BOAT-MAKING PROCESS – *TIPS FOR VOLUNTEERS*

STEP 1 - COLLECT

Bottles are collected in schools or in factories that produce plastic bottles but they discard the defective ones. Be sure you have enough bottles especially in the first days.

White and blue bottles (use the blue ones if available, cords are straighter and stronger – easier to weave).

BOTTLES CUTTING: remove labels and caps (keep the caps for other projects) and cut the bottom (as levelled as possible).

STEP 2 – SHRED

0.5 LITER BOTTLE = 3.5 m of PLASTIC STRINGS

1.5 l = 7 m

Always use a sharp blade (we used them for a week).

When pulling the string try to keep it horizontal so the string won't break.

When shredding the bottles divide the strings you obtain in two different bags: one for the long strings and one for the short ones.

TIPS

- For a new shredder consider to set the blade higher so the plastic string you obtain is wider and it's faster to weave.
- New shredder should be a separate tool instead of being connected with the loom so it's easier to work on both.

STEP 3 – WEAVE

Set the loom to create a plastic net (it takes about 30/40 minutes)

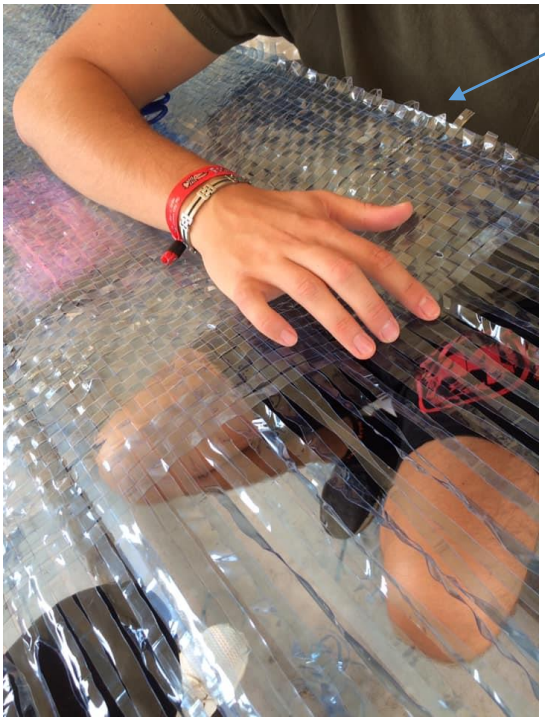
- Put the thread as tense as possible, don't use elastic ones.
- Use the long plastic cords (and possibly the straightest) to build the base of the net.

- Tie the plastic cord to the thread and then make a knot at the end of the cord and attach it with a stapler to the wood.


- Take a piece of wood that you will use to loom and staple long plastic strings between the threads. Make a knot in the end so the plastic string won't break.

Weaving

- A faster way to loom is using a long plastic string without cutting it. Use the same one every time you change the position of the wood.



Using one plastic string instead of cutting it in the edge allows the net to stay in place

- Each time you put new perpendicular string to the net try to push it in order not to leave spaces between one string and the other. It is useful to use a comb to press the strings.

- The most efficient way is to work **4 people per loom**: 1 person changes the position of the wood up and down, 1 prepares the string and put it in between two layers of the base of the plastic net and pass it to the others 2 that put the strings in place and press it.

- When you cut the strings try to select them according to their length and reuse them. In case the string is too short put it into the recycling bin.
- Plastic net should measure at least 240 cm of length.
- When the plastic net is done cut first the side where the threads are and then the other part.
- After removing the plastic net cover them with cardboard/plywood to press it.
- Remove every leftovers of plastic from the loom.

Preparing the material for the building part

- First prepare the mold with the cardboard for each side of the boat (use the old wooden boat).
- Use the cardboard molds to shape the plastic nets and cut them with scissors (leave 1 cm more from the border).

MATERIAL USED FOR 1 BOAT

- BOTTOM: 2 layers of plastic nets + 3 layers of fiber glass
- SIDES: 1 layers of plastic net + 2 layers of fiber glass
- FRONT: 1 layer of plastic net + 2 layers of fiber glass
- BACK: 1 layer of plastic net + 2 layers of fiber glass.

For the whole boat we used **7 PLASTIC NETS**. For one layer of the bottom you need two sheets of plastic net (for the bottom we used 4 plastic nets in total), 2 for the sides (one per side) and 1 for front and back.

PLYWOOD: (4 pieces - 1.5 m X 2.5 m)

- On 1 piece of plywood place the cardboard mold and draw the shape of the bottom
- On the 2nd piece place the cardboard mold of the two sides of the boat, front and back and draw the shape of those pieces.
- Wax the 4 pieces of plywood on one side where you will put the shape of the boat.
- Put the waxed plywood in the sun so it can dry faster.

STEP 4 – BUILD

1) Apply a thin layer of polyester on waxed plywood within the shapes of the boat.
2) Attach the 1st layer of fiber glass
3) Another thin layer of polyester (the fiber glass has to become totally transparent)
4) Put the plastic net on top of fiber glass
5) Another layer of polyester
6) Put the waxed plywood on top to press it and put some weight on it (could be bricks, volunteers, etc.) → IMPORTANT: THE PLYWOOD MUST BE WAXED SO YOU CAN REMOVE IT AFTER THE POLYESTER DRIES.

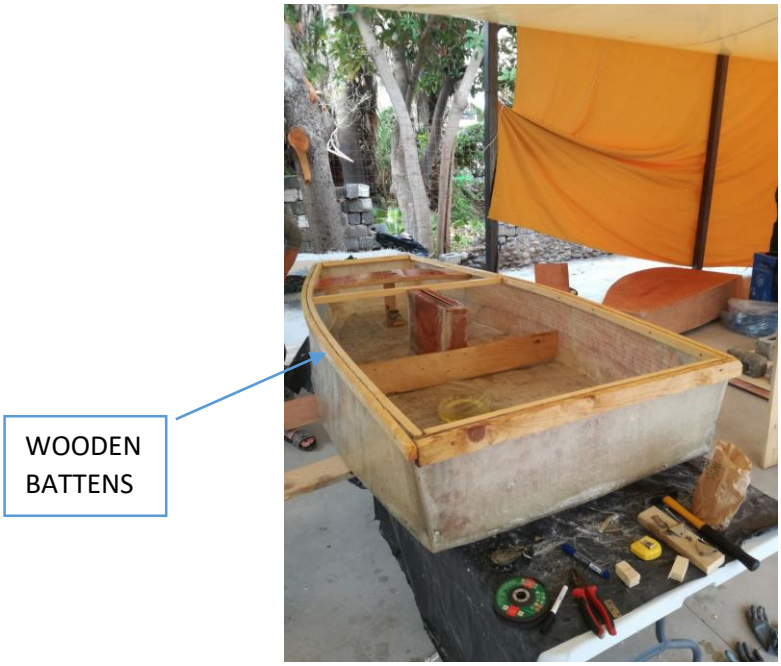
7) Put it in a dry place and avoid humid environment or contact with water. (Polyester dries depending on weather conditions and amount of hardener used. It takes at least few hours.)
8) When it's dry remove the plywood from one side.
9) For SIDES, FRONT and BACK: apply a thin layer of polyester + fiber glass + polyester
   For BOTTOM: apply a thin layer of polyester + plastic net + polyester + fiber glass + polyester
   → IMPORTANT: after using polyester, leave the brushes in acetone overnight!
10) Press it again with the plywood and let it dry (→ remember to apply a new layer of wax on the plywood before pressing).
11) After drying remove the plywood from both sides and you'll have the pieces of the boat ready.

12) Prepare the wooden mold of the boat: clean it using the sandpaper, wax it and let it dry (inside and outside).
13) Put the 2 sides, front and back inside the wooden boat and make it stable with clamps.

14) Apply epoxy resin in the corners + fiber glass + epoxy to make all the pieces stick together.
15) Let it dry. (→ drying time for epoxy depends on the type you use. It can take from 19 to 72 hours)
16) When it's dry take the skeleton of the boat out from the wooden mold. Turn the wooden mold upside-down and fit the skeleton of the boat in it. Make it stable with tapes or cable ties.

17) Put the bottom of the boat and cut it in the right shape.
18) Apply fiber glass and epoxy around the bottom to fix it with the structure of the boat.
19) When it's dry remove the wooden mold from inside and apply fiber glass and epoxy in the corners inside of the boat.
20) Grind the edges of the boat using the grinding machine.

21) Measure and cut the wooden battens in the shape of the edges of the boat (inside and outside).
22) Fix the wooden battens on each side of the edges with screws (6 pieces - 2.5 m).



23) Apply a thin layer of epoxy on the wooden parts and on the entire boat.
24) Use the sandpaper to make the surface of the boat smoother.
25) Attach the inner parts to the boat with fiber glass and epoxy (use screws if needed).

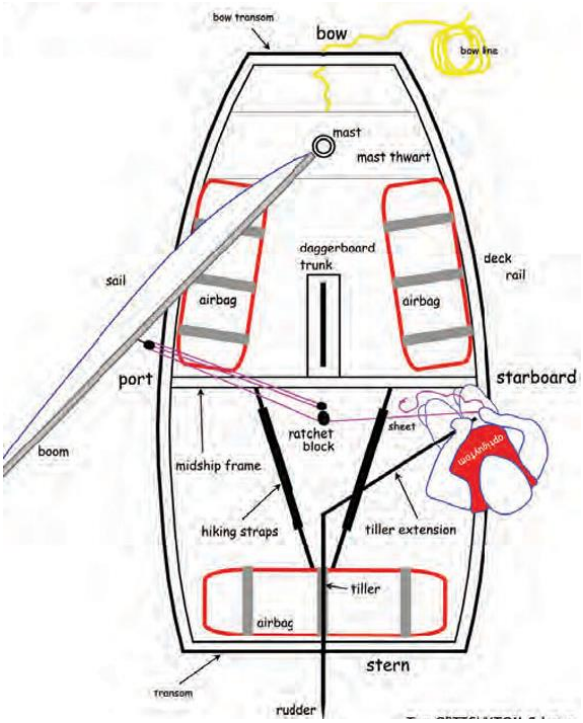
INNER PARTS OF THE BOAT (to be built)

- DAGGERBOARD TRUNK
- DAGGERBOARD
- MAST THWART
- MIDSHIP FRAME

Material needed for building these parts: plywood and screws. Take the dimensions from a sample boat. After construction put epoxy in all the wooden parts to protect them from water.

INNERS PARTS OF THE BOAT (provided by the sailing club)

- BOOMVANG
- MAST
- SAIL
- RUDDER
- WINCH



STEP 5 – SAIL

Good luck!

MATERIALS

- PLYWOOD: 5 pieces **8mm** thick (1.5 m x 2.5 m). 4 pieces to build the mold and to press it + 1 for inner parts
- WOODEN BATTEN: 6 pieces for the edges of the boat (2.5 m length)
- FIBER GLASS: 15 m^2

CHEMICALS

- Polyester + hardener
- Epoxy + Hardener (the fast one)
- Special Ink (to fasten up the drying process)
- Acetone

Work with chemicals:

- Gloves (**6-8 pcs**.)
- Masks with filters (**4-6 pcs**.)
- Rollers (**8 pcs**.) (high quality for chemical work)
- Painting brushes (**6 pcs**.) (high quality for chemical work)

Wood:

- Screws (**~200 pcs**.) (**2,5mm**; **4mm**)
- Tire-ups (**2 packs**) (**20cm** long)
- Thread (**30m**-**40m**) (depends on the number of looms)
- Sandpaper (**#60** or **#80** thickness)
- Plastic cover (in case of need)
- Tape (in case of need)

TOOLS

- Jigsaw
- Regular Saw
- Grinding machine
- Hammer
- Pliers
- Wire cutters
- Solid knife (**2 pcs.**)
- Screwdriver

- Electric screwdriver
- Clamps (**6 pcs.**)
- Cable ties
- Multi-plugs (various)
- Stapler (**2 pcs.**)
- Ruler
- Scissors

MATERIALS AND QUANTITIES for 1 BOAT (November 2019)

- PLASTIC BOTTLES: 130 x 1.5 liters
  [250 cm (length of the plastic net) x 50 (number of plastic strings in 1 loom) = 12.500 cm
  12.500 x 7 (number of plastic nets used for 1 boat) = 87.500 cm
  87.500 cm : 700 cm (length of plastic string from 1.5 liters plastic bottle) = 125 bottles > rounding up to 130 bottles]
- POLYESTER: 35/40 liters (it's possible to reduce the quantity, the flatter the plastic net is, the lesser polyester you need!)

PROPORTIONS for POLYESTER:

- DRY WEATHER (20+ °C): in 1000 ml > 2 ml ink + 10-15 ml hardener
  drying time: 15-20 min
- WET WEATHER (15-18 °C): in 1000 ml > 5 ml ink + 20-25 ml hardener
  drying time: 25-35 min