

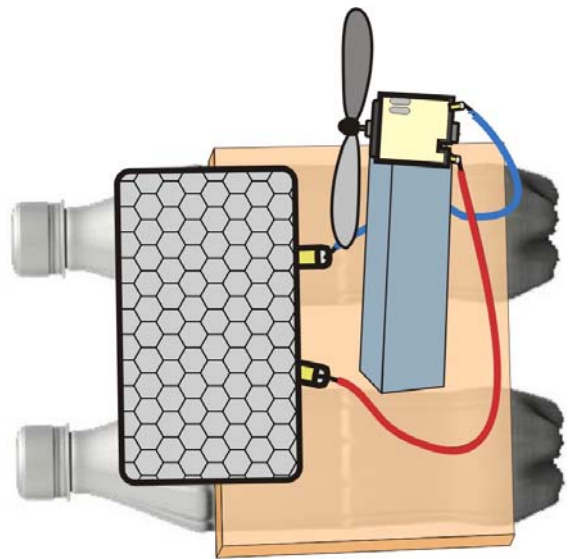
Constructing a solar catamaran with a photovoltaic cell and a motor

The construction of a solar catamaran appears to be rather simple, easy and amusing. It can be used to introduce a set of constructions based on the idea of two floaters connected with a piece of balsa, thin plywood, foam paper board, plastic, Plexiglas or any other kind of material one can imagine and find readily available. The solar motor is fixed on top of a sort of tower, at some height from the connecting board of the floaters and that is needed in order to create some space for the helix to rotate freely without obstacles. Again, this tower can be easily constructed with a piece of dense polystyrene (Styrofoam) or any other sort of rather light and easy to handle material (cf. CAT, 2001). Furthermore, the suitable kind of solar cells should be used for each construction to be functional (Komp, 2001).



Materials

- ✓ 2 plastic bottles with their tops, water or refreshment bottles, 500 or 750 ml are fine, to construct the floaters of the catamaran
- ✓ a piece of plywood, balsa or corrugated cardboard or even Plexiglas, or a piece of foam paper board for the connection of the two floaters
- ✓ a low friction solar motor
- ✓ a helix with two or three blades
- ✓ a piece of dense polystyrene (Styrofoam)
- ✓ one or two proper photovoltaic cells, even low efficiency ones of 0,5 Volt will work fine
- ✓ a couple of pieces of wire with crocodile clips
- ✓ silicon glue and glue gun
- ✓ scissors, cutter, or a small saw
- ✓ ruler, pen or pencil



Let's put it together

- 1** Find two plastic water and/or refreshment bottles with their tops. It is better to be of the same kind in order to have symmetry and balance in your construction.

Choose either 0,5 or 0,75 litre plastic bottles, transparent or coloured is up to you. Make sure they are in good shape and they do not have any holes. You do not want your solar catamaran to sink after all ...



- 2** You will need a connecting piece of material to connect the two bottles together, which will then become the two floaters of the catamaran.

That piece of material can be plywood, balsa plastic or corrugated cardboard or even Plexiglas, or a piece of foam paper board etc.

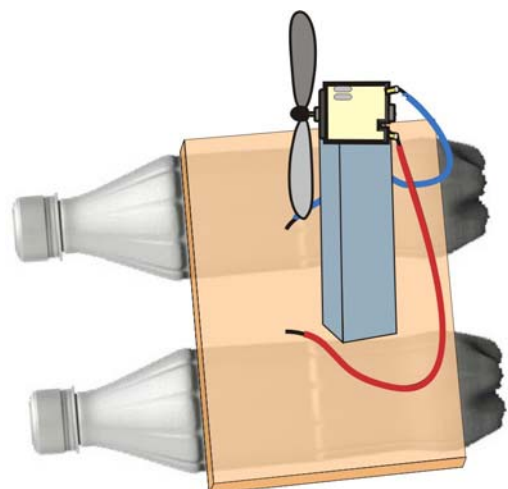
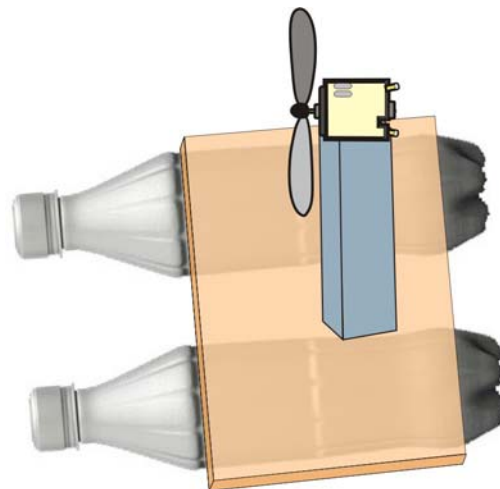
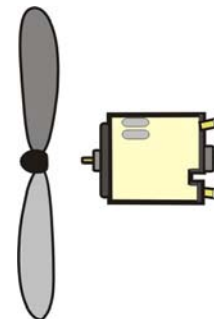
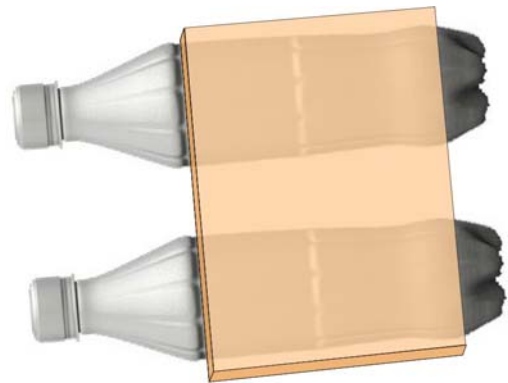
Depending on the choice of material you make, you will need an appropriate kind of glue to fix it together with the bottles. That can be silicone, a glue gun, super glue or whatever, provided that you do not destroy or melt your materials. Ask for adult advice if you have doubts what kind of glue to use.

- 3** The shaft of the solar motor has to be attached to the helix of 2 or 3 blades. Usually, the diameter of the motor shaft is 2-3 mm and the hole of the helix is of the same size, so they match together. If not, minor adjustments need to be done for the helix to be fixed firmly on the motor shaft. It is better not to use any glue, just in case you want to change the helix and put another one at later instance.

- 4** The motor with the helix needs to be placed on top of a "tower", which can be easily constructed out of a dense polystyrene (Styrofoam) column and then glued on the deck of the catamaran. It should be centered and slightly moved to the back of the deck of the catamaran, in order to leave some space for the photovoltaic cell to be placed in the front part of the deck later (*see drawing aside*). The reason that the motor with the helix is placed high up is to enable the helix to move freely, without hitting the deck or the photovoltaic cell. Moreover, it appears to be "catching" the air more effectively.

- 5** Two pieces of wire, most preferably with crocodile clips, are needed to connect the motor with the photovoltaic cell to be placed at the front part of the catamaran deck (*see drawing*).

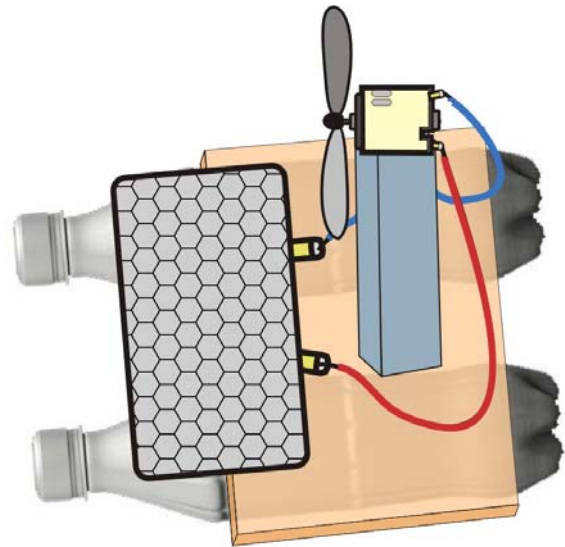
Alternatively, the wires can be twisted around the motor contacts and the photovoltaic cell contacts and/or be soldered with adult help.



- 6** Place the photovoltaic cell at the front part of the catamaran deck and raise it slightly from the back side, to be more effective against the Sun rays. Then, connect it to the wires coming from the motor. If you have any trouble, experiment a bit or ask for adult assistance.

The solar catamaran is now ready to go! Harness the solar energy and power this toy, having hours of fun. No use of batteries needed, just let the Sun beams do the job!

The motor will rotate using the energy from the Sun and the helix will move around pushing the air backwards and the solar catamaran will move forward in a pond or small pool.



Solar catamarans constructed by children for science fairs ...

The solar catamarans are easy to construct, even by children who are not very experienced in handling every day materials and simple tools. They are simple to put together and children can have immediate fun with their construction (*see photos below*).

<p>Photo a: A solar catamaran made out of two water bottles (500 ml), a piece of foam paper board connecting the two floater bottles. The tower for the motor is built out of pieces of thin foam paper board and the helix used has 3 fins. Two cheap and easy to find photovoltaic cells of 0,45 Volts are used as solar energy converters to power the electric motor.</p>	<p>Photo b: A solar boat made out of two floaters of dense polystyrene (Styrofoam), which have been sandpapered to get a hydrodynamic shape in order “save energy” and/or to prevent otherwise energy degradation due to “water friction”. The connecting pieces of the floaters and the tower are also built out of Styrofoam, whereas the helix has 2 blades in this case.</p>



Photo c: Another model of solar catamaran also built out of Styrofoam floaters with a connecting piece out of thin plywood used as deck. Notice the decoration and the cartoon figure at the back.



Photo d: This is an idea of a solar river boat with two floaters out of Styrofoam and a deck of thin plywood. The interesting piece in this construction is the water wheel made out of a big gear with plastic fins attached to it, cut out of a plastic soda bottle.

During the school science fairs all solar boats and solar catamaran constructions were exhibited to the local community in a small wooden pool at the school garden. The visitors as well as pupils amused themselves by examining the constructions and playing with them (see photo below).



References & Resources

- Centre for Alternative Technology (CAT)** (2001) *Teacher's Guide to Solar Electricity Projects*, Devon: Southgate Publishers Ltd.
- Komp, R.** (2001) (3rd Edition) *Practical Photovoltaics: Electricity from Solar Cells*, Michigan: AATEC publications.