Fun in the water

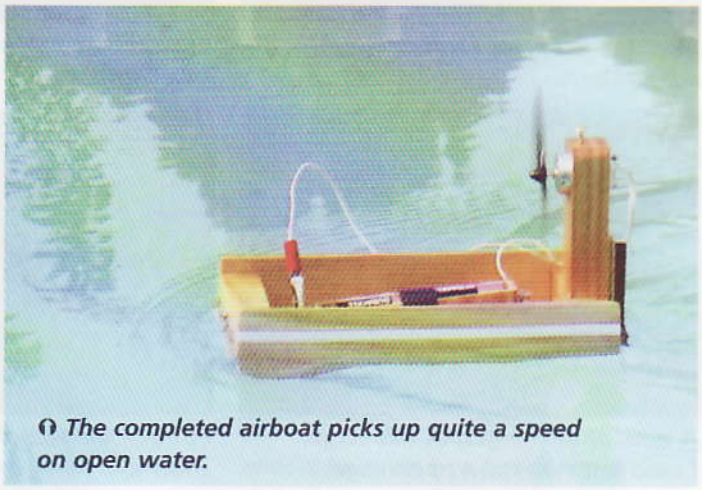
Chris Beswick offers two ideas for water toys – one a motorised airboat and the other a yacht.

Toy airboat

An airboat is defined as "a water transportation vehicle using the air as a medium for propulsion". Often airboats also use air rudders for steering, but since this design is constructed for water, a water rudder is used as it is more efficient in maintaining directional stability. Airboats are commonly used in America as leisure and work transport in Florida and other wetlands where the powerful motors and polymer bottoms of the boats allow them to cross land almost equally as well as water.

This airboat uses an electric motor – in this case an inexpensive one obtained from a model shop – which will operate between 3V and 6V. After testing it with a 3V setup, I found it adequate to propel the craft at surprisingly reasonable speeds across the water. With a motor and batteries – 2 AA type – the weight of the craft is an issue, so it is a good idea to revisit Archimedes' (Eureka) principle to consider what size the craft should be.

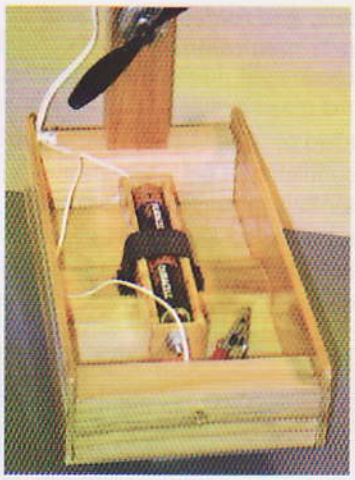
The principle states that the buoyant force on an object is equal to the weight of the fluid displaced, or in other words, things weigh less in water than air, as the density of air is to all intents and purposes 0 gram/cubic centimetre whereas pure water is one gram/cubic centimetre. As a rule of thumb, the volume of the boat in cubic centimetres must well exceed its weight in grams for it to float satisfactorily. If the volume of the boat is twice its weight it will float at a 50% draught assuming even distribution of weight.



The completed airboat picks up quite a speed on open water.

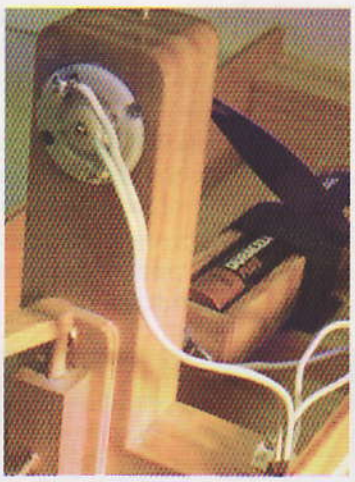
As an example of the operation of the Archimedes' principle, a cork has a density of about 0,2 grams/cubic centimetre; therefore, a 10 cubic centimetre piece of it weighs only two grams in air or minus eight in water, explaining its tendency to burst out of the water if you try to submerge it. A similar piece of aluminium at 2,7 grams/cubic centimetre will sink as its weight exceeds the weight of the water it displaces (at 10) by 17 grams (at 27).

Anyway, enough theory. The boat, complete with motor and batteries as described here weighs around 360 grams. External diameters of the airboat at 22cm x 10,5cm x 3,5cm give a volume of 808,5 cubic centimetres which is adequate for use in very calm water. Despite placing the batteries low and centrally, the motor



The construction of the hull – a small chamfer is sanded at the underneath of the front.

The motor mounting will have to be constructed bearing in mind the specific motor and propeller that you obtain.



The motor may not be marked with which terminal is positive, so determine this by trial and error.

The fixed rudder is made from hardwood and glued to a plywood plate which is attached to the stern with small brass screws.

weight at the back makes the boat draw more water at the back than the front, however, the shallow draught at the front reduces its water resistance.

The battery holder

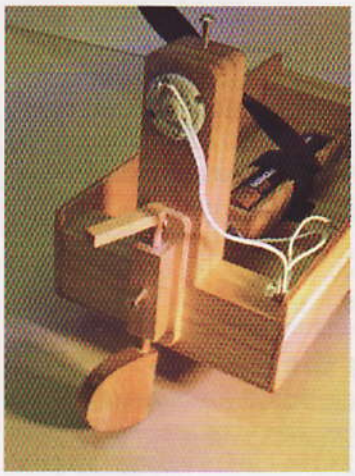
Battery holders are available from electronic supply specialists, however, I decided to make one for myself. It is constructed of 4mm ply with a 3mm bolt at one end – for the positive battery contact – and a 3mm bolt holding part of a 5mm diameter compression spring (available from hardware suppliers) at the other. The box itself measures externally 117mm x 23mm and is 16mm deep. Two strips of self-stick 'hooked' Velcro on the sides and one free 'looped' piece hold the batteries in place. The battery holder itself is held in by self-stick Velcro stuck to the central cross piece of the boat and the bottom of the battery box. The independent construction of the holder and its mounting in the boat allows it to be moved around easily if necessary.

Construction of the airboat hull

The airboat is a simple construction, with 4mm ply sides and base, and 32mm x 22mm ends with a 32mm x 12mm central spar. I found it easier to first glue and clamp one side to the cross members, allow it to dry, and then add the second side. The base is added last, marked out from the outline of the assembled shell and sanded flush. At the underneath of the front, sand a small chamfer.

The motor mounting

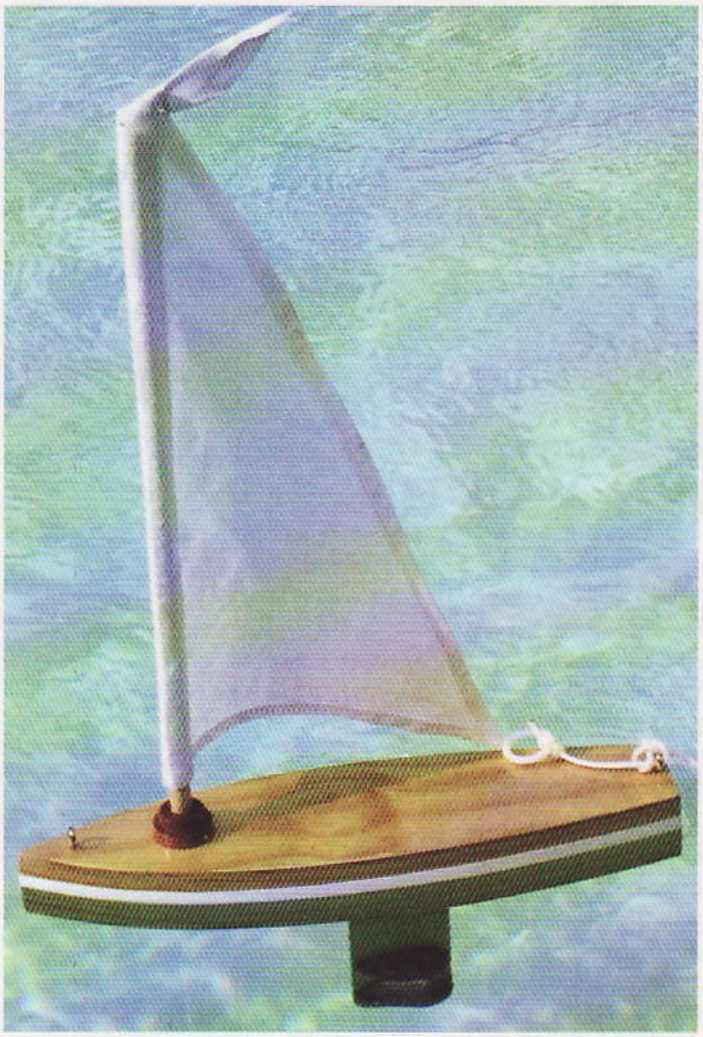
The motor mounting will have to be constructed bearing in mind the motor and propeller that you obtain. In this case it is made from a 22mm x 28mm section, 60mm long. It is simply glued to the front of the back cross member after drilling through to take the motor – here a 23mm diameter housing. A hole is also drilled from the centre of the top, where a small 3mm brass screw is inserted to hold the motor in place via one of its outside case crimping slots. This allows easy removal and replacement, perhaps for use in another project. The motor I used is 30mm in length, so the motor projects from the front of the mounting to allow clearance for the propeller. It is flush with the back of the mounting allowing easy access to the soldering tags. The standard airplane propeller I used has a 102mm blade.



The moveable rudder uses a piece of dowel as a shaft held in the chosen position by a small brass screw.

Wiring the motor

The motor may not be marked with an indication of which terminal is positive, so it is advisable to determine this by trial and error. Correctly connected, you will be able to feel the draught behind the propeller. Solder the connections to the motor using some bell wire and a round crimped tag to one of the 3mm bolt contacts on the battery box. The other wire should be terminated in a small crocodile clip, which can be clipped on to the other bolt and will act as a basic switch. To avoid the wire fouling the propeller, use a cable clip as shown in the photograph.



This toy yacht will give kids hours of fun in the water.

The rudder

The fixed version of the rudder is made from a hardwood scrap and glued to a plywood plate which is then attached with small brass screws to the stern of the airboat. It is a good idea to temporarily attach it with tape and do a few test runs to ensure that the airboat travels in a straight line. Small adjustments can be made by altering the angle at which the rudder meets the boat.

The moveable design uses a piece of dowel as a shaft held in the chosen position by a small brass screw. All of the components are varnished before assembly, and the shaft finally waxed to ensure free movement before the parts are finally glued together.

Finishing

Varnish the airboat with a good quality exterior varnish. Apply three or more coats, sanding lightly with 320 grade between coats. Decoration is a matter of personal choice: you could paint the

airboat if you wish, but it would be best to apply the varnish for reliable sealing first.

The design described above is a simple one, but the basic principles could be used to make much more sophisticated and powerful craft. I would suggest that if you are planning to use the airboat in a larger stretch of water, it would be wise to attach a fishing line to the front screw eye for retrieval purposes. Enjoy it; it's a fun project and quick to make. Get the kids involved in the making of the project, as they will be the ones who use it most. If they can get it away from you, that is.

Toy yacht

There are often toys which you remember from your childhood as being particularly significant for you. One of those was my Meccano set which provided me with many hours of enjoyment. Another was a toy yacht given to me by my parents just before a seaside holiday. I spent many happy hours sailing this in a lagoon with my father. Looking back, I'm not sure who got more fun out of it, me or my father!

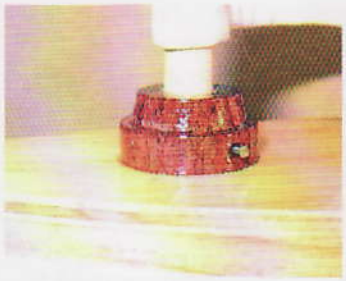
Constructing the hull

The construction of the hull is simple if somewhat unconventional since it involves cutting off the stern before you start. A blank of good quality 32mm pine measuring around 300mm x 100mm was used in this case. The outside and inside shapes of the hull are marked out using a flexible French curve to a suitable shape. A French curve is a plastic covered lead section available in several lengths, and is invaluable for marking out a smooth curved shape. It is inexpensive and can be purchased from an art shop. Once one side is marked, use the curve upside down to mark out the other side. The thickness of the hull is around 10mm and the finished length of the yacht is 260mm.

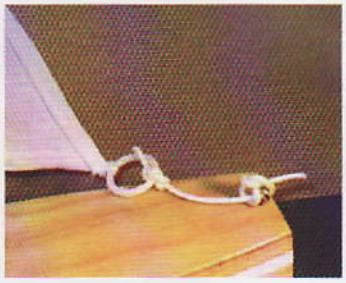
To make the hull, cut through the stern up to the bow, leaving the two sides joined at the bow. Finally cut the 10mm width of the stern from the waste piece and rejoin it to the hull, preferably using waterproof wood glue. If you use ordinary wood glue it should still seal effectively, as the hull will eventually be covered in several coats of exterior varnish.

The bottom and the deck are marked out using the cutout hull and are made from 4mm ply. Glued together and sanded flush, the hull is complete. Sand down the whole assembly to 220 grade.

The bottom of the hull and the deck are made from 4mm ply.



The mast of the yacht is a 300mm piece of 8mm dowel which sits in a socket glued to the deck.



The sail has a finished size of 280mm x 330mm x 160mm. A plastic ring is stitched to the bottom, which with a length of nylon twine, holds the sail in place.

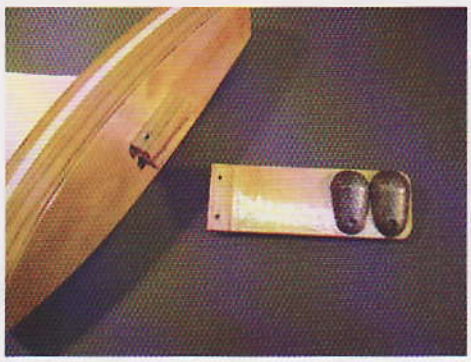
The mast and the sail

The mast is a 300mm piece of 8mm dowel. It sits in a socket glued to the deck, 65mm from the bow. I turned the socket which has a maximum diameter of 23mm from a piece of rosewood; however, it could be simply made from a 15mm slice of dowel if you do not have access to a lathe. The mast is held in place by a panel pin in a pre-drilled hole, enabling it to be easily replaced if necessary.

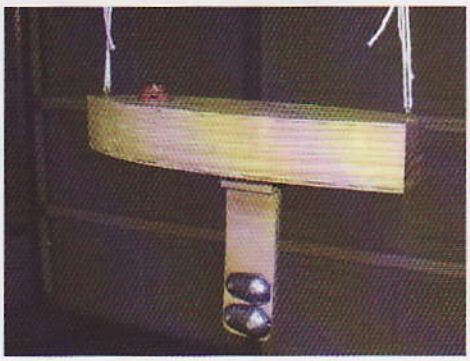
The sail has a finished size of 280mm x 330mm x 160mm and which was made for me by my wife. My sail is made from calico but you could use kite nylon or even a strong plastic. The bottom of the sail could also be stiffened by adding a suitable piece of dowel. A sleeve is made in the 280mm side to fit the mast, and the end of the triangle turned over to suggest a pennant. A plastic ring of the sort used in making blinds is stitched to the bottom which, with a length of nylon twine, holds the sail in place.

Making the keel

As can be seen from the photograph, the keel is also designed to be removable, so that the yacht could be used as a display model when it is not being used. To determine the weight of the keel required, weigh the mast and hull assembly on the kitchen scales. To remain stable in even fairly stiff breezes, the keel should weigh approximately the same.



The keel is designed to be removable so that the yacht can be used as a display model when it is not being used.



The yacht should be varnished with a good quality exterior varnish – I found it made varnishing easier if I suspended the yacht.

I found that four fishing sinkers of a No 8 spoon type, with two on each side were about the right weight. These are glued with superglue to the 4mm ply keel which is 115mm by 40mm. The keel supports (40mm x 12mm x 12mm), are glued to the bottom of the yacht and attached to the keel with two small round headed brass screws, long enough to penetrate the opposite support. They are positioned in the centre of the bottom with the front of the supports approximately 125mm from the point of the bow.

Finishing and sailing your yacht

Varnish the yacht with a good quality exterior varnish. Apply three or more coats sanding lightly with 320 grade between coats. I found it made varnishing easier if I suspended the yacht from the ceiling of the garage. Decoration is a matter of personal choice: you could paint the yacht if you wish, but it would be best to apply the varnish first. I left mine plain and simply applied some car pin-striping tape.

The yacht will sail quite happily in a swimming pool where it drifts around with the currents and the wind. Again, if you are planning to use it in a larger stretch of water, attach a fishing line to the front screw eye, enabling it to tack back to you by a yank on the line.

This is a very simple toy which has been designed to be easy to make. I hope it encourages you to attempt much more sophisticated designs. In any case, happy sailing!

Home Handyman winners!

Homemakers Fair Pretoria (June):

- Mr Erasmus from Clubview – "Vinnige en Maklike Projekte vir die Naweek Houtwerker"
- Mr N Evans from De Deur – "Build Your Own Kitchen and Built-in Cupboards"
- Miss L Fourie from Lichtenburg – Skil Router
- Mr JJ Janse van Rensburg – "Woodwork for the Garden"
- Mr M Koekemoer from Wonderboom South – "Build Your Own Braai"
- Ms D Naude from Halfway House – "In The Box"
- Mrs I Olivier from Glen Marais – Skil Jigsaw
- Ms R Stassen from Marble Hall – Skil Octo Multi Sander
- Mr A van Vuuren from Kroonstad – Skil Drill Gun

Hobby-X Cape Town (June):

- Mr AW du Plessis from Greyton – "The Patio Expert"
- Mr Q Marais from Brackenfell – Skil Router
- Mrs J Rheeder from Sanlamhof – "The Complete Book of Home Planning in South Africa"
- Mr P Roodman from Claremont – "Build Your Own Kitchen and Built-in Cupboards"
- Mr Schumann from Durbanville – Skil Jigsaw
- Mr S Tait from Constantia – Skil Drillgun
- Mr ZB van den Berg from Mowbray – "The Pond Expert"
- Mr S van Vuuren from Montague Gardens – Skil Octo Multi Sander