Francis Plessier

introduces you to . . .

R/C WATERPLANE DESIGN

and presents

DONALD

an ideal introduction to multi R/C R.O.W. flying

ALL the full-size seaplanes, and by lack of imagination, all our models have a V-shaped hull and often a complex design rather difficult to build (Fig. 1).

Before copying the full-scale shape, one has to ask why this shape? Is it only an effort to represent the full-size navy type boat hull . . . stability? What stability? Perhaps for a hull type of sea boat, but surely not necessary for a twin float seaplane, sitting firmly on her two floats? Why not a simple, flat-bottomed hull, that would slide nicely on the water like a water ski?

The only reason for this intricate shape is to soften the 'landing' on the water. The hull comes in contact with the water in a progressive manner, first the edge of the V, then the sides and this acts like a shock absorber. With a flat bottom, a full-size seaplane would not survive a normal water 'touch down'. Structural damage would take place at every landing (actually it is the same with a full-size land plane which could not land without shock absorbers).

Happily, our models are much, much stronger than full-size airplanes. They can survive severe punishment, cartwheeling, and so on, that would bend a full-size plane. It is the same with a model seaplane which can undergo a severe 'splash' without damage – so why bother with a V-shaped hull, let us try a flat-bottomed one – many advantages.

1. Building is so, so much easier.
2. Such a hull is much more efficient on the water. It will slide on the water with very little drag while a normal V-type hull will painfully plough its way through the water.

Of course, there are other reasons for a V-hull. It will have a better directional stability, and will be less prone to bounce and ricochet. We will be obliged to add small fins on our hull, and to prevent bouncing; we have only to come for landing without excessive speed flaring gently (simple isn't it . . .).

Building a pair of floats

Floats are easy to build in conventional structure but it is much better to cut them in styrofoam, since waterproofing is not a problem.

Such flat bottom floats are very easy to build (see 'Donald' plan) they are cut in a block of styrofoam with two pairs of templates (Fig. 2).

A first pair of templates are used for the side view but it is difficult to cut the step with a hot wire, it is better to cut it after with a sharp metal blade.

Keeping the two parts of the styrofoam block, a second cut is made with the two other templates (front view) and after disassembling the parts, a beautiful float shows up (photograph is right).

Using contact cement, the styrofoam is covered with balsa, or thin plywood or veneer, beginning by the upper surface. Before covering the underside, cut the styro foam, insert and glue the plywood tabs used for mounting on the landing gear. Use $\frac{1}{8}$ in. 5-ply plywood, and they must be long enough to be flush with the underside planking (Fig. 3).

Glue in place the underside planking, balsa or thin plywood, then reinforce with fibreglass cloth and fibre, especially the lip, the plywood tabs and the step.

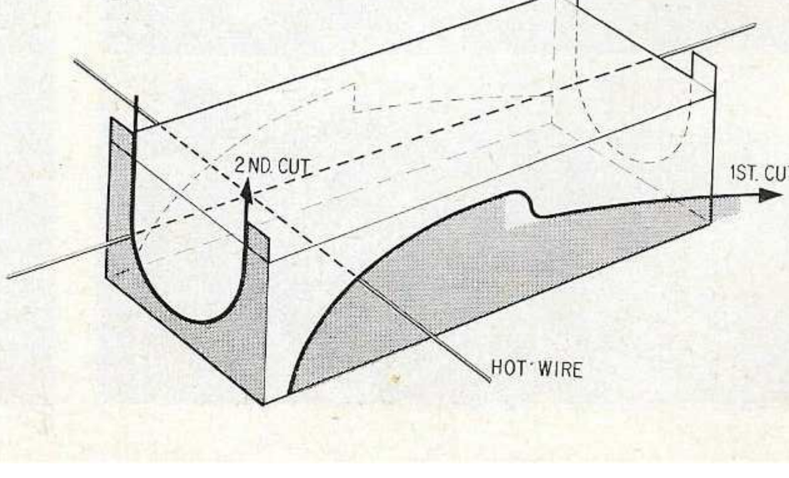
The whole floats are then covered with silk or tissue, and then triangular 'fins' are added for a better directional stability.

The two floats are held by a piano wire undercarriage, bolted to the plywood tabs, and held by rubber bands or bolted to the fuselage. A dural landing gear can be used but it will break the plywood tabs in a crash.

Building a Hull

A hull type of seaplane can be built easily with the flat bottom. Building will be conventional or in styrofoam planked with balsa. If a conventional structure is used it will be smart to fill it with polyurethane foam epoxy to fuel-proof it completely.

Fig.2



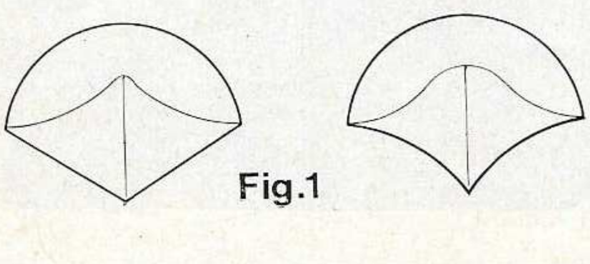
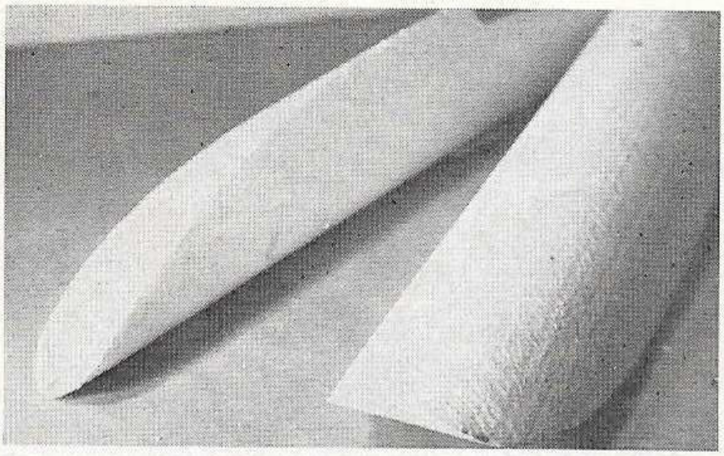
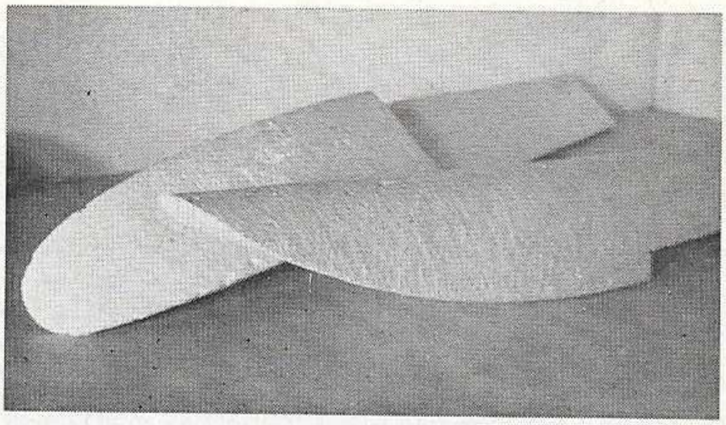
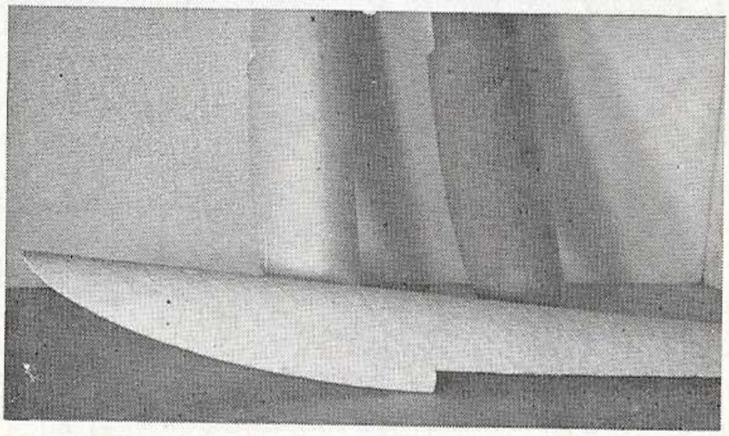


Fig.1







These floats were cut from expanded polystyrene foam by the author. Flat bottom shape considerably simplifies cutting operation and still provides efficient shape. Cores are covered in either balsa or thin ply.

A step is necessary to decrease drag, but such a hull requires much less power to get airborne than the usual V-shaped hull.

A problem with these big Seaplanes is the stability on the water. They are very sensitive to cross winds, and if the C.G. is high over the water you have to *use opposite rudder to raise a low wing* (exactly like the big flying boats). If in taxi-ing on the water, the left wing drops, and you apply right rudder as normal, the model will turn to the right but the centrifugal force will bank the model still more to the left – as on a big one, when one wing is low, you have to give rudder on the side on the low wing to lift the wing, then neutralise . . . not simple.

The best answer is to keep the C.G. very low, and also the wing which will give you a small side area in cross wind.

Drawing 5 shows the usual configuration, which is not very good. The C.G. is high above the water, the plane has a tendency to bank while taxi-ing and the low wing is very difficult to raise again, especially on cross wind, besides, the usual shape of hull gives a high drag and you need a lot of power to come up on the step.

Fig. 6 shows a much better configuration, much simpler to build; the hull is a simple rectangular box flat bottomed. The wing and the C.G. are low on the water and take-off is very easy. The small floats under each wing are also flat bottomed, giving just lift and no drag when 'waterski-ing' on the water. Any drag would give a cartwheeling tendency. Such a plane taxies very well on the water with the lower part of the rudder immersed. It flies O.K. with rudder and elevators.

Fig. 7 shows another configuration, with nearly the same hull, but biplane, with constant chord wings which have no dihedral. The high wing gives enough rudder induced roll to fly rudder only. One of my models using this configuration had only 40 in. wingspan (it is the length of balsa sheets here) with wings made of a single sheet of balsa giving a cambered airfoil (no waterproofing necessary). Fuselage length was 55 in., 6 channel Grundig radio was used and take-off was long but really progressive and beautiful with a simple OS 19. Weight, I might add, was more than five pounds! . . . To be able to get airborne with that weight and power is the proof of the good design and low drag of the hull. It flies now with an ST 23.

High performance acrobatic seaplane

If you want to have a seaplane with high performance, fully aerobatic and capable of flying from rather rough waters. I do not think it is possible to use a hull type seaplane. Configuration 5 is not good enough, and 6 and 7 cannot be used on rough waters, the waves will come over the wing.

You have to come back to the twin float configuration, very stable on the water, with rather big and long floats, giving good buoyancy and stability. It will give a lot of drag, and you will need a good engine, but any modern .60 is sufficient.

High wing or low wing? The low wing configuration would give the best flight and taxi characteristics, but it is rather difficult to attach the floats to a low wing. I prefer the shoulder wing, which gives you an easier way to water-

Fig.4

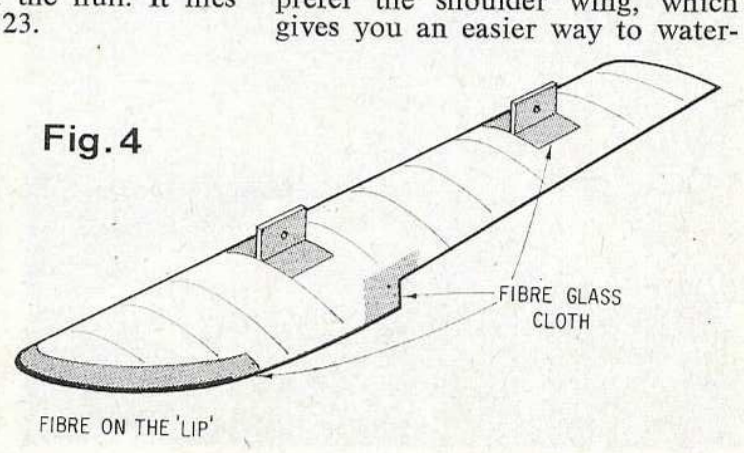
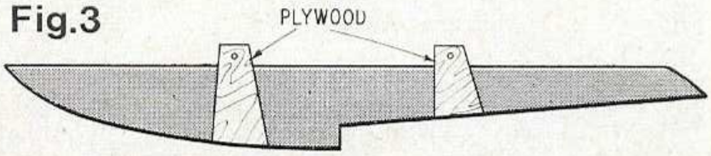
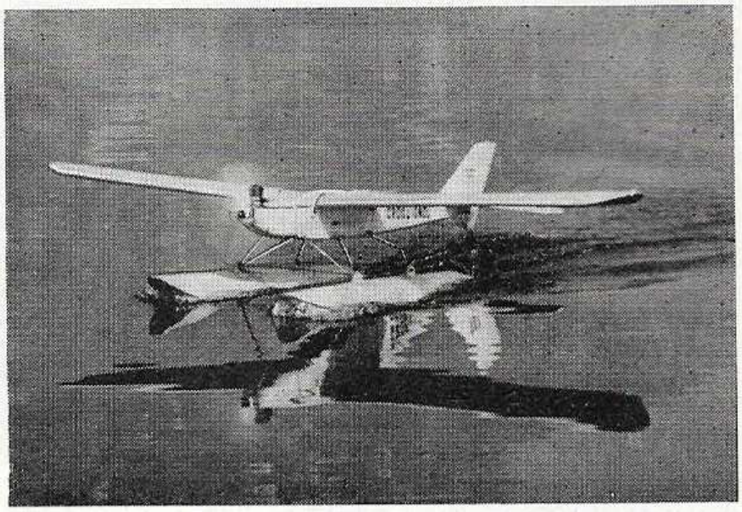


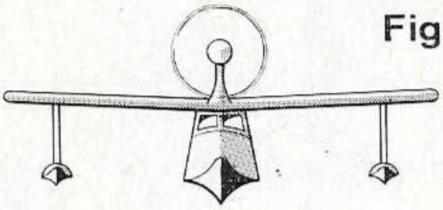
Fig.3





Some of Francis Plessier's R/C float-plane designs. His experiments lead him to the conclusion that the shoulder wing is the most practical layout for an aerobatic design.

Fig 5



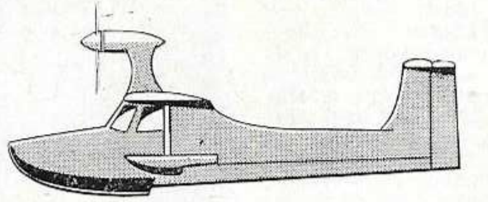
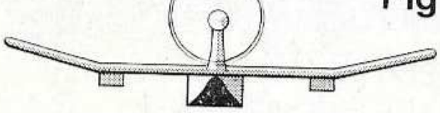


Fig 6



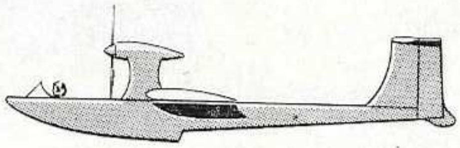
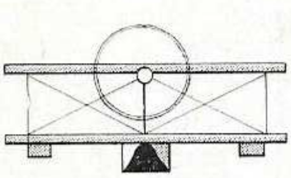
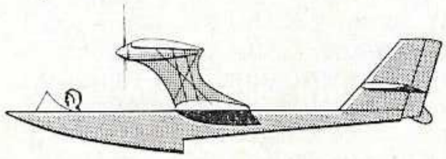


Fig 7





proof the radio bay under the wing.

A biconvex semi-symmetrical airfoil is the obvious choice, and the wing will be completely planked in balsa, in classical structure or styrofoam and very little dihedral, if any, is required. Ailerons will be used with just enough dihedral so that the wings do not seem to hang woefully, which is the case when there is no dihedral.

Taxi-ing on the water is difficult with this configuration, and you need a water rudder. It is difficult to install it at the stern of the floats and the best way is to have a small water rudder made of brass sheet, solder to a piano wire epoxied on the main rudder. Unhappily it is not very pretty, but very efficient. Incidence settings are easy. Zero everywhere is a good idea to begin with, but a little downthrust will help. A little more than usual fin area will also be necessary because the big floats are somewhat de-stabilising.

The C.G. just above the step is a good compromise, and angular decalage between floats and fuselage shall be adjusted later; for instance if the model rides very fast on the water without tendency to take off, some negative incidence will be given to the floats, which will give positive incidence to the wing. Too much decalage is dangerous on landing because the bow could hit the water first if the flare is not sufficient with risks of tumbling. For landing, it is better to slow down as much as possible and flare the model so that the stern hits the water first: the model will tilt forward with a big splash, without any chance to bounce off again.

Good splash and goes . . .

Two more Plessier R/C waterplane designs. At left is a hull type design following the layout of Fig. 6 (above right), while below is the DONALD, the subject of the plan shown on the page opposite.