The following pages include an article written by a two times BUG builder Charles Smith in conjunction with designer Roger Stollery's BUG 3 detail drawings, construction photos, foil moulding, sail making, wire bending detail and descriptions.

Building a Footy – BUG 3

The Footy is sailed all over the world and the class was created to encourage to youngsters to build boats as school projects. The free sailing version (see plan) was designed to be made for £5.00. The rules are quite simple: the boat must fit into a box 305mm long, 153mm wide and 305mm deep as you will see from the rules summary. 305 mm is a foot in imperial measurement so that is why the boat is called a Footy.

We are much indebted to Roger Stollery for permission to reproduce the Bug 3 Plans in Acquaint. The Bug 3 is an ideal introduction to the Footy class and works well in competition. Indeed, a slightly modified Bug 3 holds the current Footy speed sailing record over the Footy Internet Course. Excluding the electronics an experienced model maker would expect to build a hull in a morning, the rig in an afternoon, the electronics whilst the glue sets – and go sailing the following day! A newcomer might take three days!

Materials

Hull. The hull as specified is built from Correx sheet which is a lightweight fluted plastic widely used in the building industry. (In fact you will probably find off-cuts around any building project). It may be obtained from builders' suppliers in large sheets, sufficient for many of these boats. The material is widely used in schools as for Craft Design and Technology.

Alternatively the hull may be built using Balsa sheet, or 1/32nd (.79 mm) plywood. If you use these then be sure to cut out the side panels in the 'bendy' direction of the ply, and strengthen the transom. Plywood may be cut with scissors.

Spars. 5.5 mm carbon rod is widely available from kite shops from most serious model shops or as second hand arrow shafts. The BOTTLE boat yard fitting to which the fore and aft booms fit is obtainable by post from Peter Wiles at 01202 744101 (www.pjsails.co.uk). Alternatively you may cut down the weight of the rig by using 3mm carbon tube, reinforcing around the head with tape and the yard junction (where the main and jib booms are joined to rotate around the mast) with resin and carbon tow. When working with 3mm make up the yard junction fitting from 2mm stainless steel wire bent around a 3mm headless nail. Cut a short piece of 5.5mm tube, fit the end of the 3mm mast into it and insert into the 6mm section at the top of the foil.

Sails. Very successful sails may be made up from any suitable plastic material – usually a proprietary plastic bag! Each sail is then double thickness and the forward edges (luff) provide sleeves through which the mast or the forestay can run. They are tensioned by using small wire clips (home made) which slide on the booms and it is not necessary to build a 'curve' into the sail itself. You may also use lightweight drawing films obtainable from most makers of model sails.

The simple way of tackling sail cutting is to make up two templates at the correct sizes using cardboard or MDF. Lay the template on to the folded plastic, so that the edge of the bag forms

the luff, then cut out using a soldering iron for the leech, which will seal the trailing edges automatically. Cut the foot and head with a knife. See pages 8 and 9 for more detailed explanation.

Adhesives. With Correx use *Sticks Like S***t* which is widely used in the building industry. For plywood any two part Epoxy may be used, preferably one with a five minute setting time. (Tip: these epoxies are supplied as separate resin and hardener. When they need to be used in equal quantities (read the box) then squirt 'lines' of epoxy and hardener next to each other on to baking foil – it is easy to judge the quantity by eye – and then mix)

Miscellaneous Materials: Stainless steel wire in 1.25 mm (18swg) and 0.56mm (24 swg). A small strip of aluminium on to which the rudder is mounted. Suitable 'string' for the sheets – 6-20 kg Dyneema does the job well and can be burned at the ends to form a blob which will prevent knots pulling apart.

Electronics The design as shown uses two standard servos – for example the Futaba S3003, any two channel receiver and standard AA batteries (4). Footy rules have changed recently to allow the use of any batteries. The electronics cassette may be made up using lightweight servos which are the subject of much discussion amongst Footy skippers. Make up two washers from a thin spongy material and treat them with Teflon grease (available from Halfords). Placed over the servo shafts they will prevent any water getting into the electronics.

Foils Foils in carbon fibre may be made up using moulds which may be borrowed from Roger Stollery (01483 421801) or made up as described on the plans using ply epoxy methods and the bulb formed from lead leaves as shown, smoothed with a plastic padding material. *Warning: when working with lead and plastic padding it is essential that you wear eye shields, face mask and gloves.*

Making the Hull. Photocopy the hull plans on to A3 sheets and the others may be copied on to A4 sheets. The plans show a free sailing model and an rc model. (Full size plans are available from MYA Publicity Officer publicity-officer-08@mya-uk.org.uk) Ensure that they come up to the correct size by carefully checking the scale on each sheet. Cut out full size paper patterns of the hull bottom, transom (mark the positions of the holes for the rudder hanging) , sides, bow piece and deck. You will use these to follow round when you cut the Correx, but before you do , tape them together so that patterns for hull bottom, transom, deck and bow transom are joined along the fore and aft centreline, as in the photograph.

Now cut the Correx around the paper panels with the corrugations fore and aft. Score enough to break the outside skin along the transom/hull panel joints so that the Correx will fold here. With insulation tape, bond the side panels to the hull bottom and transom. Tape around the open corrugations of the deck edge as shown in the photograph.

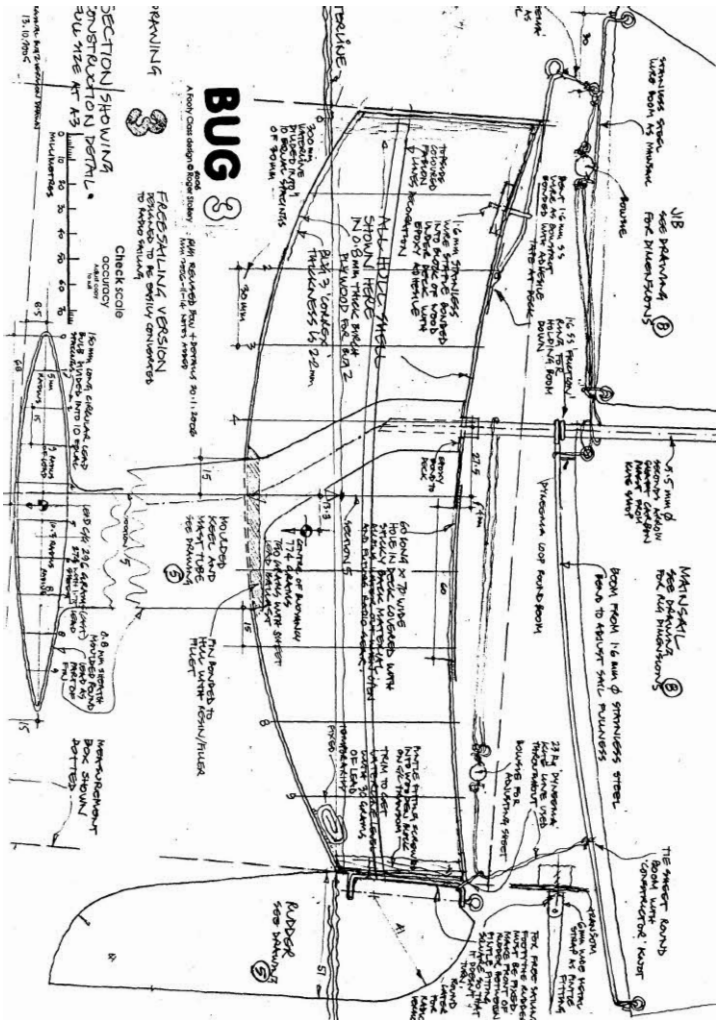
Ideally place the hull in the measurement box to compress the ends and ensure that it adopts the desired shape. If you don't have a measurement box then two 2 parallel surfaces 305mm apart will do the trick.

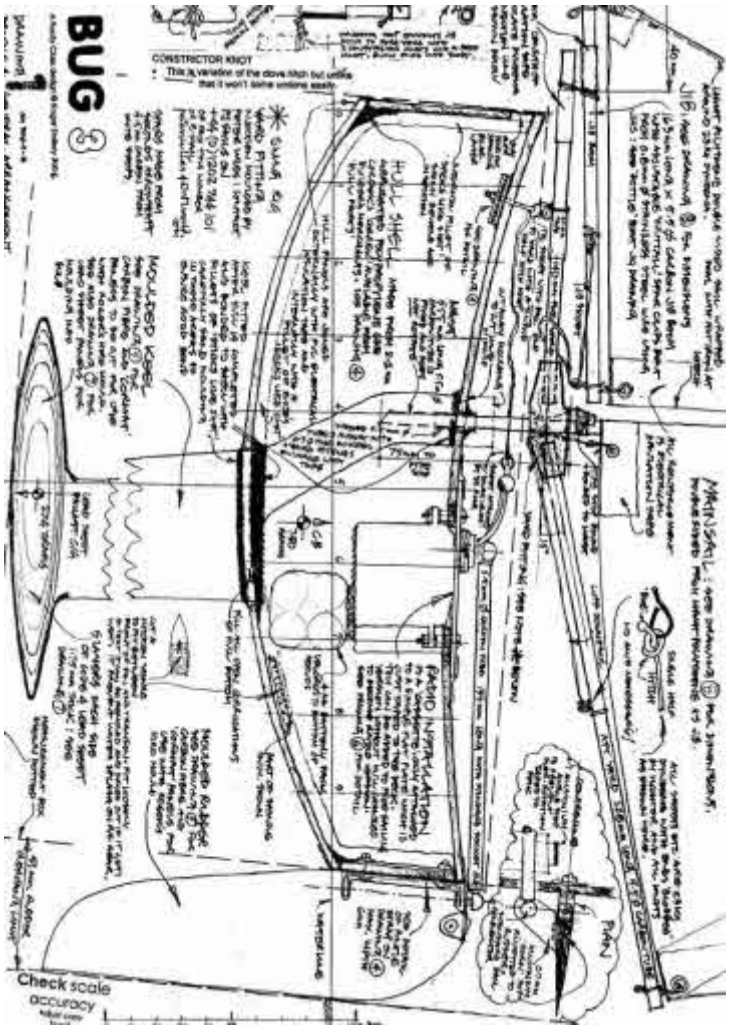
The tape should run lengthwise along the hull and be done smoothly since it will remain in place when the hull is finished. Use a line of adhesive inside the hull where the sides meet the hull bottom and at the transom. Fit the deck fitting and the rudder hanging bracket (gudgeon) using a pop rivets. Fold the deck down and tape to the hull sides once again using insulation tape. Fold the bow transom down, add adhesive around the edges and tape to the hull sides (inside).

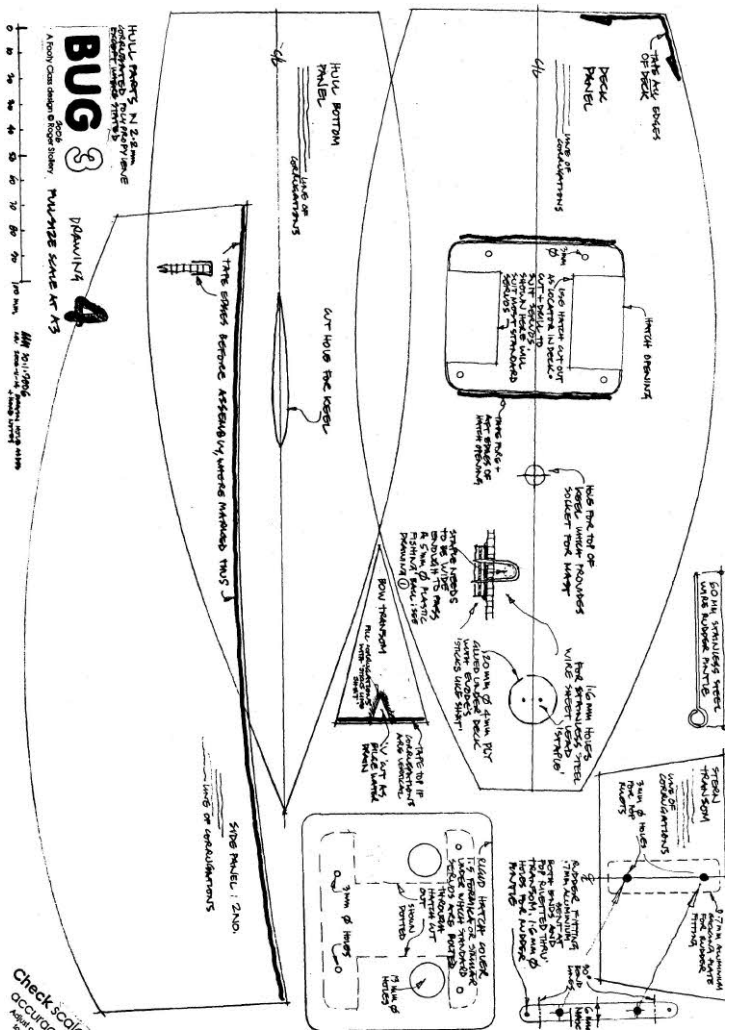
Insert the foils and hold in place with adhesive inside and out – the top of the foil projects through the deck to form the mast socket. Access to the inside is gained through the hatch.

Rules and Registration

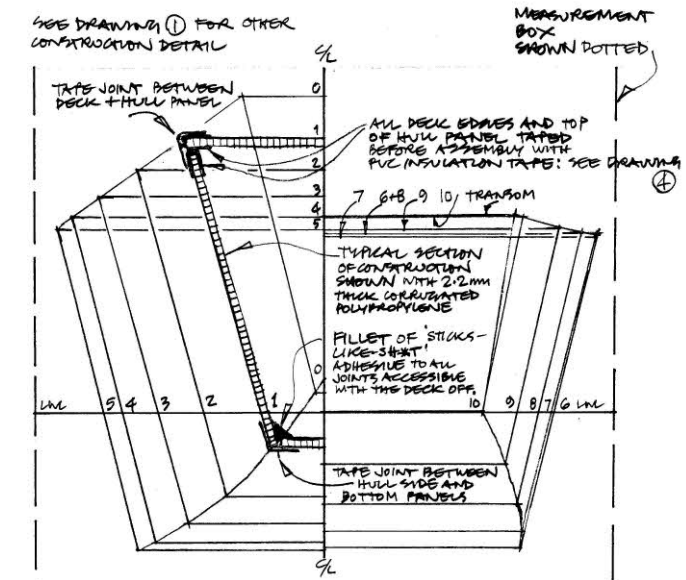
Once the boat is complete you will need to obtain a registered number before you race it. This is available free of charge by emailing the Footy Class Registrar who will send you a form – Andy Trewin email: andytrewin@googlemail.com The Footy Class Association web site may be found at http://.rcsailing.net/ and a widely used Footy forum at www.rcsailing.net

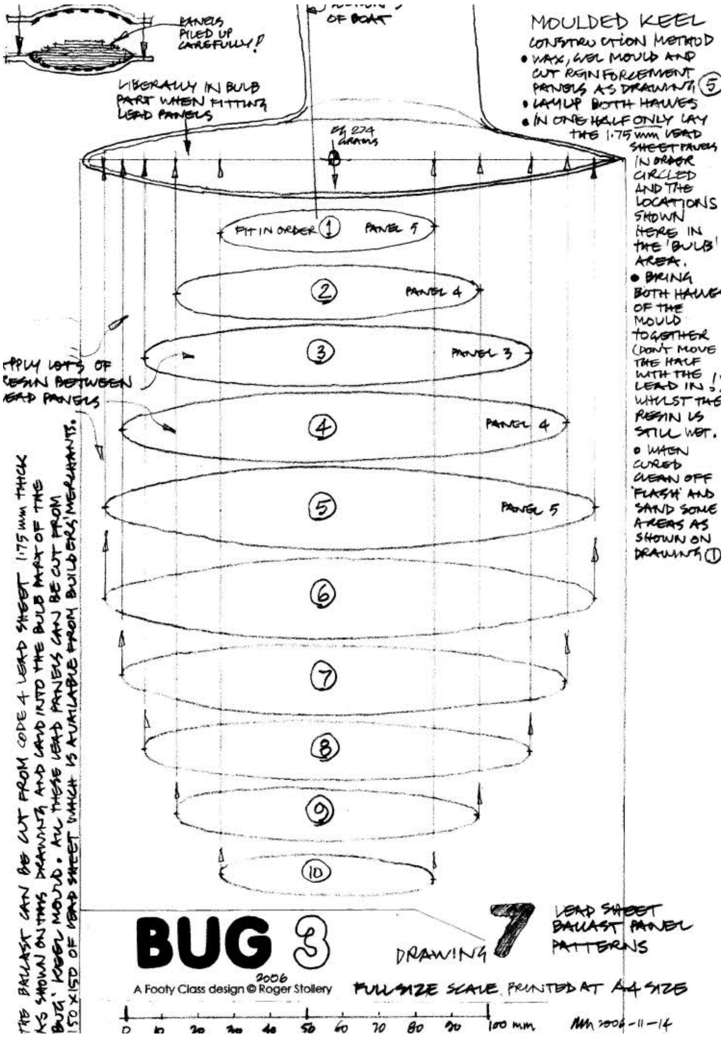


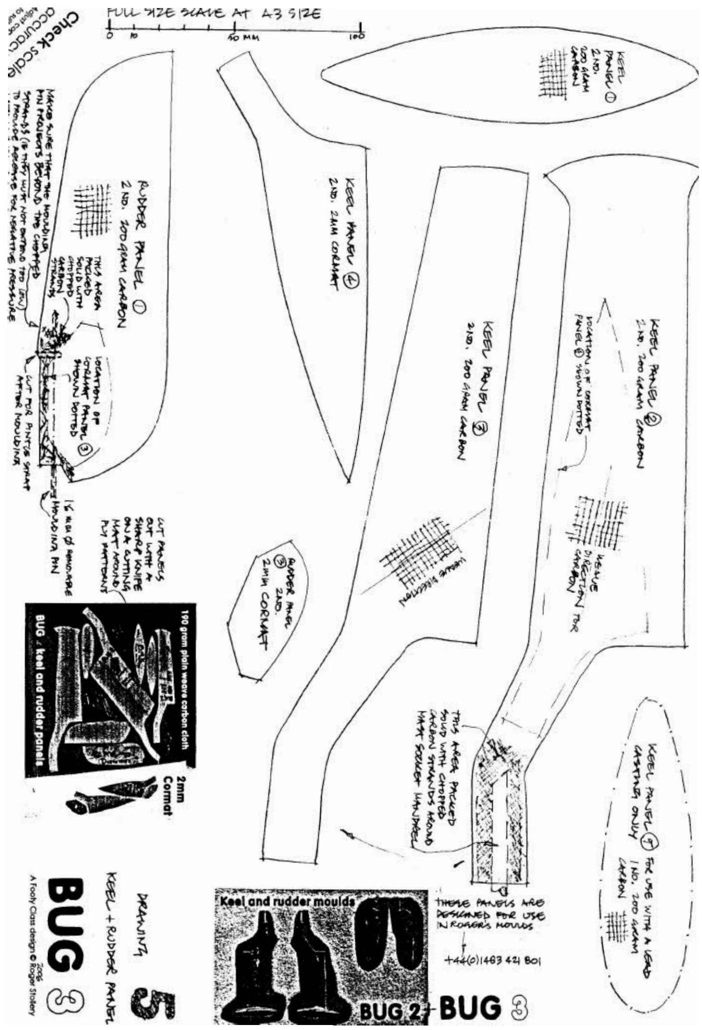


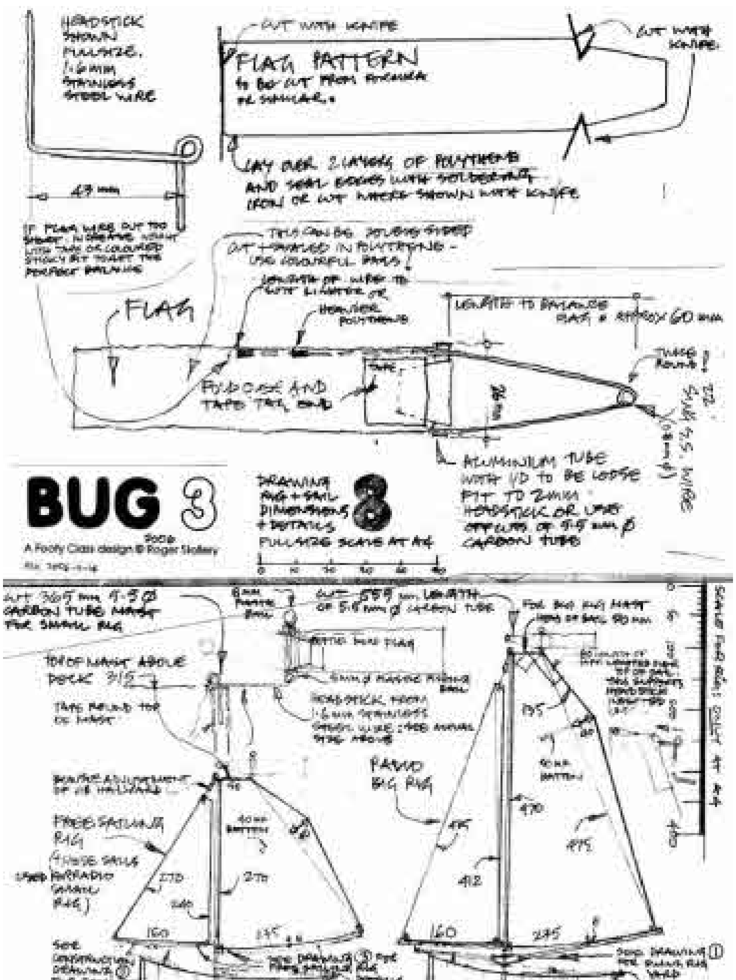


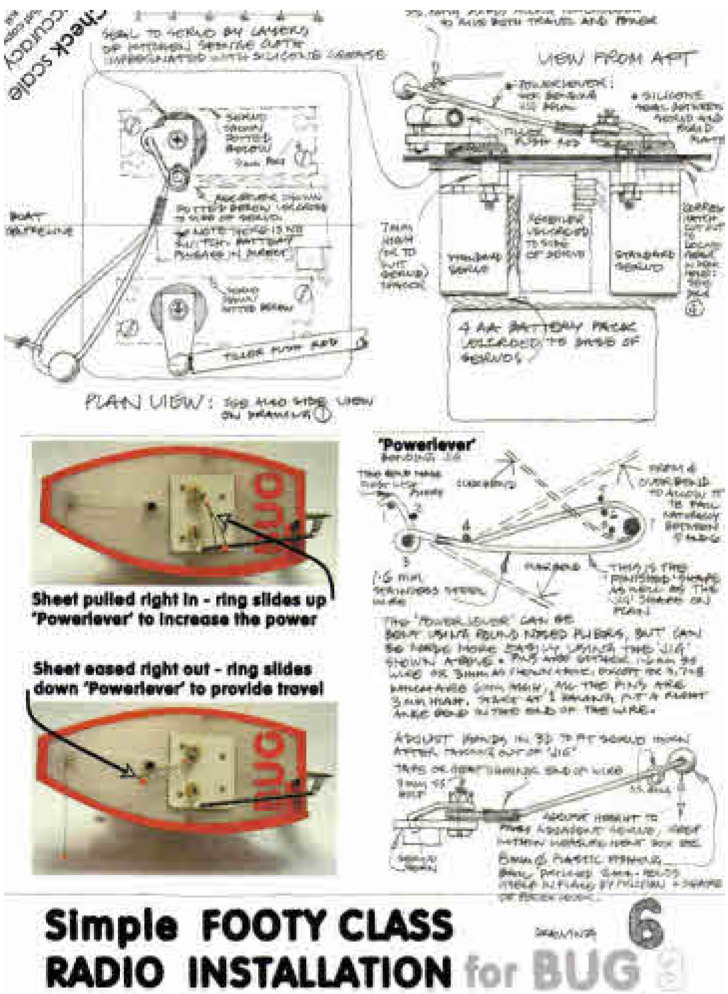
CORRUGATED POLYPROPYLENE KNOWN AS 'CORREX' IS AVAILABLE FROM BUILDERS' MERCHANTS. CONTACT MANUFACTURER 'CORDEK' ON 01403 799 600 FOR INFORMATION.




MOULDED KEEL
CONSTRUCTION METHOD
• WAX, KEEL MOULD AND CUT REINFORCEMENT PANELS AS DRAWING 5
• LAYUP BOTH HALVES
• IN ONE HALF ONLY LAY THE 1.75 mm LEAD SHEET PANELS IN ORDER CIRCLED AND THE LOCATIONS SHOWN HERE IN THE 'BULB' AREA.
• BRING BOTH HALVES OF THE MOULD TOGETHER (DON'T MOVE THE HALF WITH THE LEAD IN!) WHILST THE RESIN IS STILL WET.
• WHEN CURED CLEAN OFF 'FLASH' AND SAND SOME AREAS AS SHOWN ON DRAWING 1
PANELS PILED UP CAREFULLY!
LIBERALLY IN BULB PART WHEN FITTING LEAD PANELS
FIT IN ORDER 1 PANEL 1
PANEL 4
PANEL 3
PANEL 4
PANEL 5
APPLY LOTS OF RESIN BETWEEN LEAD PANELS
BUG 3
2006
A Footy Class design © Roger Stollery
DRAWING 7
LEAD SHEET BALLAST PANEL PATTERNS
FULLSIZE SCALE PRINTED AT A4 SIZE
0 10 20 30 40 50 60 70 80 90 100 mm
2006-11-14


FULL SIZE SCALE AT A3 SIZE
0 10 50 mm 100
Check scale accuracy
KEEL PANEL 1 2 NO. 200 GRAM CARBON
KEEL PANEL 2 2 NO. 2mm CORMAT
KEEL PANEL 3 2 NO. 200 GRAM CARBON
KEEL PANEL 2 2 NO. 200 GRAM CARBON
KEEL PANEL 4 FOR USE WITH A LEAD CASTING ONLY 1 NO. 200 GRAM CARBON
RUDDER PANEL 1 2 NO. 200 GRAM CARBON
RUDDER PANEL 2 2mm CORMAT
CUT PANELS OUT WITH A SHARP KNIFE DRAWING ON THE MAT AROUND PVC PATTERNS
100 gram plain weave carbon cloth
BUG - keel and rudder panels
2mm Cormat
Keel and rudder moulds
BUG 2 BUG 3
THESE PANELS ARE DESIGNED FOR USE IN ROGER'S MOULDS
+44(0)1463 421 801
BUG 3
A Footy Class design © Roger Stollery
DRAWING 5
KEEL + RUDDER PANEL


HEADSTICK SHOWN FULLSIZE. 1.6mm STAINLESS STEEL WIRE
CUT WITH KNIFE
FLAG PATTERN
LAY OVER 2 LAYERS OF POLYTHENE
FLAG
LENGTH TO BALANCE FLAG = APPROX 60 mm
FOLD CASE AND TAPE THE END
ALUMINIUM TUBE
BUG 3
2006
A Footy Class design © Roger Stollery
DRAWING
RIG + SAIL DIMENSIONS + DETAILS
FULLSIZE SCALE AT A4
DRAWING 8
TOP OF MAST ABOVE DECK 315
FREE SAILING RIG
RADIO BIG RIG
160
275
170
412
470


Check scale accuracy
VIEW FROM AFT
PLAN VIEW
BOAT CENTRELINE
STANDARD SERVO
4 AA BATTERY PACK
'Powerlever'
Sheet pulled right in - ring slides up 'Powerlever' to increase the power
Sheet eased right out - ring slides down 'Powerlever' to provide travel
BUG
1.6 mm STAINLESS STEEL WIRE
Simple FOOTY CLASS RADIO INSTALLATION for BUG 3
DRAWING 6

Moulding foils

Introduction

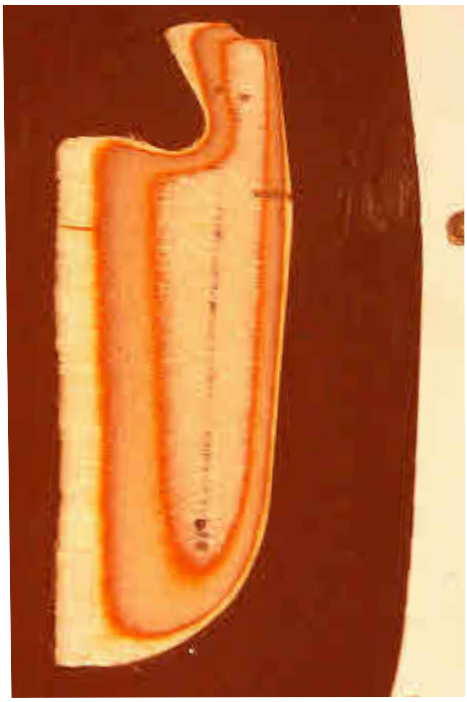
The moulding process for foils is in comparatively easy and quick compared to making a rudder out of timber. The advantage is that in just a few minutes a beautifully shaped and finished moulding that needs no painting, won't warp, delaminate and will remain close to the desired accurate cross section. This is important to reduce the drag particularly for classes with long fins. Moulding is an ideal club activity where one mould can be used over and over again and make the investment of time in making the mould very worthwhile.

Moulding a rudder

The example shown is a small transom hung rudder for a Footy. Assuming that you have made or borrowed a mould, the creation of which will be covered later, the first thing is to wax the mould with a release agent such as 'Mirror Glaze'. Mix a small quantity of polyester gelcoat resin and carefully paint onto the polished surfaces of the mould. If any resin gets onto the centre line surfaces, wipe it off with a cloth wrapped around your finger. Whilst allowing that to cure, cut two fabric panels, one for each side from the carbon reinforcing cloth and a small piece of Cormat to form a solid section at the top. When the gel coat is cured, paint the rudder surfaces with polyester laminating resin and lay in the carbon fibre, carefully aligning the cloth with the front and top of the rudder. Carefully stipple/paint the surface with the brush to bring up the resin from below and add more resin where it looks dry, painting it from the more resin rich areas if possible. Repeat on the other side. Wet up on a piece of polythene, the small Cormat panel and 'stitch in' a waxed 16 swg wire pin along the line on that pattern and lay in one half of the mould. This will form a hole for the pintle. Add a little resin all round the edges of both halves. Don't worry about resin getting onto the centreline surfaces this time because when these are carefully placed together and bolted up the resin will be squeezed out and will appear as flash to be cleaned off the edges of the moulding. This part always appears to be a bit of a messy crude process. Add a few clamps to ensure that the two halves are in good contact along the edges.

Finishing the rudder

After curing remove the rudder from the mould. Start by twisting, bending and distorting the mould with a bit of force and the cracking sounds will let you know that the moulding is being released. Opening up the mould is the most exciting and satisfying part. One 'new moulder' recently described it "as like giving birth". After this relatively crude process a beautifully light, polished product appears. Clean the flash from the edges with a pair of scissors and finally a sanding block.



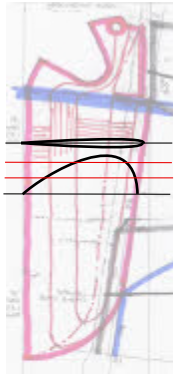
Making a mould

Design of foils

Now assume that you want a special rudder shape or cross section and need to produce your own mould. It is not difficult, but it is time consuming. The design drawing is the starting point for making a plug for the mould because this will be made of 1/16" plywood. Each ply is 0.53mm thick, so as well as the profile, the 'buttock' lines are drawn 0.53mm apart from the centreline; thin vertical section slices through the rudder as shown adjacent. Briefly, this is done by drawing a NACA 0006 section shape on a 100mm length chord, but with the vertical scale drawn 10 times the true scale giving an exaggerated curve. This is then photocopied down to the various chord lengths for suitable sections of your rudder. Over these section copies draw parallel (buttock) lines 5.3mm from the centreline. Where these cut the curve sets points that make up the buttock line shape on the profile. This can be hand drawn as shown adjacent. The maximum thickness is less than 3.2mm overall so each half can be shaped from just one layer of ply.

Making the plug

Cut the ply to the rudder profile. The grain of the centreline layer MUST be across the rudder. Repeat for the other half. Most important for later registration of the two halves is drilling two 1.5mm holes towards the ends of the maximum thickness line. Make a support block the same profile shape as the rudder and drill this too with registration holes. Use 1.6mm stainless steel wire to pin the ply down to the support block. Sand the ply until the glue lines match the buttock lines. Glue the plug halves to a flat Formica baseplate projecting about 25mm beyond the rudder profile. Make sure that the very flexible tapered ply edges are held down flat to the baseplate. Drill registration holes in the baseplates and bond them tempo- rarily to a flat melamine covered chipboard. Drill registration holes and push the pins down just below the rudder surface. Fill these 'big' holes with plastercine and finish flush. Do not worry if there are a few bits of the centreline ply missing that you cannot replicate with plastercine. Only make sure that there are NO bumps or projections. Hollows become bumps in the mould, which can easily be sanded off.



Making the mould

Wax the surfaces with an old-fashioned bees wax, like 'Simoniz wax for cars'. Spread the wax with a cloth in a circular motion to get it even and then polish it off with a clean cloth. Repeat until there are 5 applications.

Repeat the moulding process described for moulding the rudder, but with two thin polyester gel coats preferably in different colours and two layers of carbon either side of a 2mm Cormat layer. After curing remove the Formica from the melamine base, remove the pins and cut one set down in length to locate the Formica layers together. Clamp up and drill 2 bolt holes for bolts that will hold the mould parts together. Now remove the plug. This may be tricky if any resin has got under the edge of the plug. Go round the edges carefully and chip away this resin so that the whole profile of the ply is showing. Bend, twist and distort the mould and some part of the plug will release. Slide a thin flexible piece of plastic under this released bit and gently work it under the remaining parts of the plug. It won't look a good surface, but the finish is achieved by sanding with progressively finer wet and dry sandpaper up to at least 1200 grade and preferably 2000, until it is perfectly smooth with all bumps removed. Polish the surfaces with T-cut until it is a mirror finish. Patience and hard work is required, but it is worth it in the end, as all the subsequent mouldings will have this fine finish. This finishing process wants to be done as soon as possible after moulding, as the resin is much softer and less hard work.

Moulds

Some clubs have moulds that can be borrowed, so if your club has no moulding expert ask around as there is sure to be someone who can help you enjoy the pleasures of moulding.

BUG 2

A Footy class design for Kings College, Guildford

- KEEL & RUDDER PLUG DRAWING
- NOTE THIS DESIGN ALSO USED FOR 'BUG 3' AND 'ANT' DESIGNS

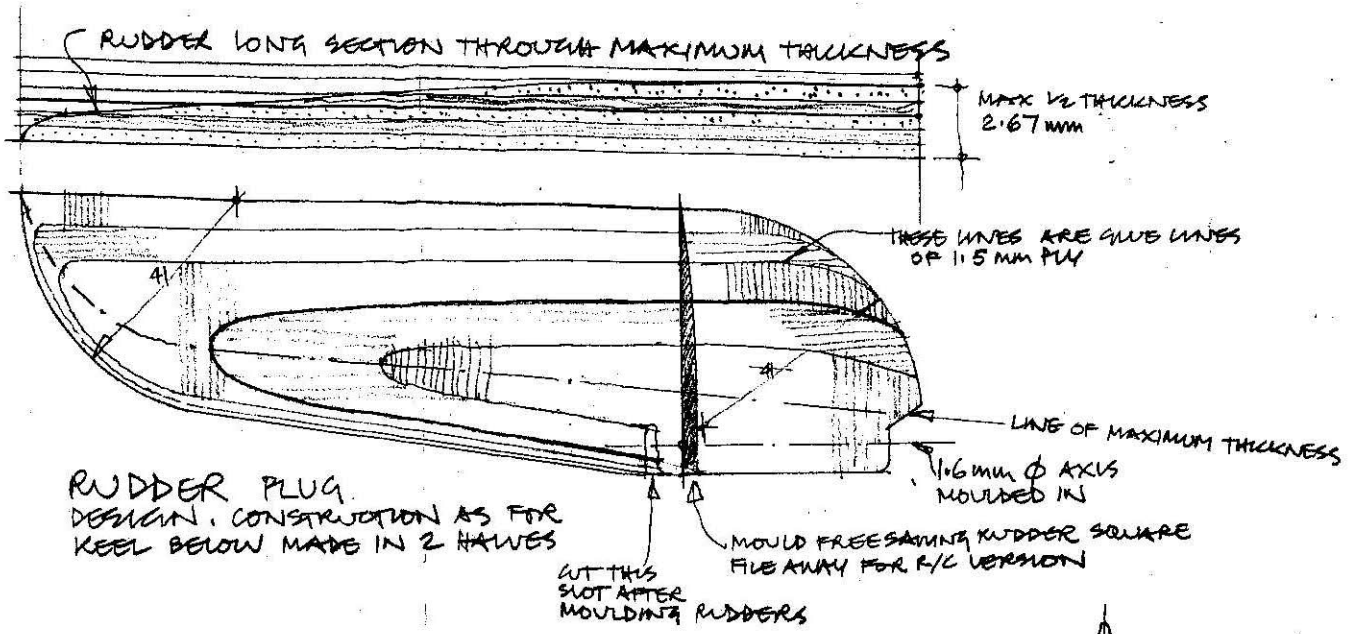
0 1 2 3 4 5 6 7 8 9

MILLIMETRES

SCALE · FULLSIZE AT A3

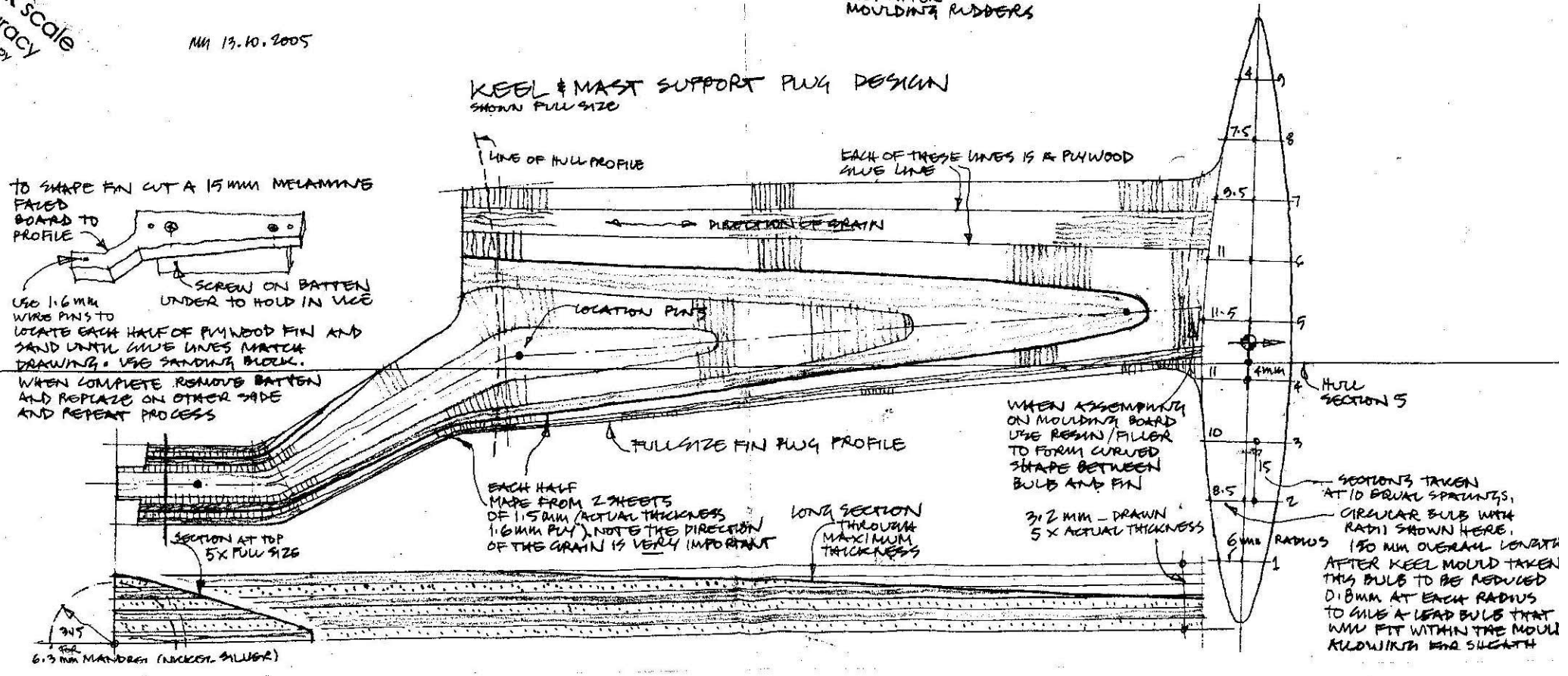
Check scale accuracy
Adjust copy to suit

MM 13.10.2005



RUDDER PLUG
DESIGN, CONSTRUCTION AS FOR KEEL BELOW MADE IN 2 HALVES

KEEL & MAST SUPPORT PLUG DESIGN
SHOWN FULL SIZE



Simple soft sails for small rigs

As an alternative to cutting panels and forming seams in drawing film, very adequate small sails can be made using soft sail material just folded over to form double sided sails. These are ideal for the smallest models like Footys up to BOTTLE boats with a sail area of 600 square inches. They can even be used for light weather jibs for 'A' boats with additional film reinforcing the leech.

Soft materials

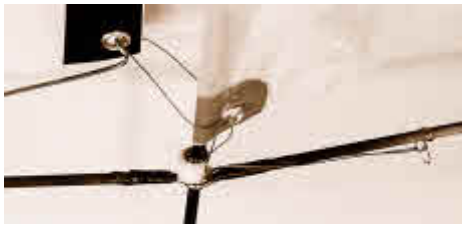
Such soft materials include any sort of thin plastic bag materials such as dry cleaner's bags, bin bags, shopping bags, freezer bags etc. The massive choice of colours allows a bit of visual fun! As this thin soft material is flexible and stretchy, it is possible to create fullness within the sail very simply without the need for panels or great DIY skills. The thin material immediately forms a slight curve where folded over and held with a bit of tension. It allows a very good 'automatic' shape to form in the luff of jibs and mainsails from just a flat sheet. However to achieve this it does need to be set up carefully as described below.

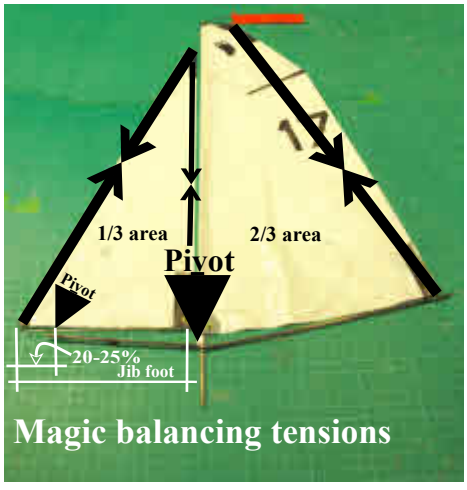
Cutting the sails

After selecting the material, fold it over with the fold to form the front edge of the sail. Place on a laminate or similar cutting surface and tape it down with only just enough tension to get rid of the major wrinkles. Either mark the plan of the sail on the material or place a pattern of the sail shape onto it with the straight luff on the fold line. This pattern can be made from cardboard or thin ply so that the material can be sealed with a hot soldering iron along the back edge. With such soft material the leech shape needs to be a series of straight lines between corners and/or battens. Cut the foot and head shapes with a sharp knife, but don't seal the two surfaces together.

Finishing the mainsail

Add reinforcement tape (e.g.electrical insulation tape) to the corners as shown in the photographs with the number of layers dependant on the forces generated from the boat. Two layers is sufficient for Footy sails. Fit eyelets to the bottom corners, making sure that the tack eyelet allows the mast to fit within the sleeve in front of it. An important part of the design is a wide head shape at right angles to the mast. Stick the tape along the top of the leech and fold it over the head and down the other side. Repeat on the other side of the sail. Battens need only be fitted to one side. Any flexible thin plastic can be fixed with double sided tape reinforced by tape to the sail at the front end and





Magic balancing tensions

Finishing the jib

Repeat sticking on corner reinforcements and fit the eyelet for the clew, but don't add the eyelets to the tack or head until the luff line is fitted to take the rig forestay tension. Use a light (6 – 20 kg) Dyneema line and make a loop at the bottom to go inside the two sail surfaces and round the tack eyelet before you close that up. Thread the line up the luff using a bodkin or thin wire loop and pull close to the luff before fitting the head eyelet. Temporarily tape the tack down, remove wrinkles in the luff and apply a bit of tension in the luff line. Tie a single overhand, figure of eight or other stopper knot in the luff line about 10mm above the head. Apply more tension to the line and tape that down. Make a loop passing through the head eyelet and with a cigarette lighter create a blob at on end. Pass this round the luff line above the stopper knot and tie a half hitch back on the loop. Carefully pull tight so that the blob and the stopper knot are together. Repeat with the other end of the loop and adjust the length of the loop such that it is only just slack when the luff line is taut. Cut about 5mm from the knot and burn the end back close to the knot. This will keep the fullness in the luff of the sail when the luff line/forestay is under tension.

Setting up the sail on the rig

The photos show a simple swing rig for a Footy where the mast is fixed and the yard rotates around it. The 3mm yard spars are simply joined with 2mm bent wire and held against the upward pressure of the sails by a small PTFE block bonded to the mast. The camber in the mainsail is fully adjustable at both top and the bottom in the normal model yachting tradition with a loose foot fixed to a boom or yard spar at the clew. There is no spar as such at the top, but a large 1.25mm diameter wire headstick rotating about the mast allows the head of the sail to be fixed at the aft corner and located along the headstick to create or remove camber at the top of the sail. The fullness here allows the mast to bend within the sleeve without creating major creases as the wind increases. The photos show connection to the headstick by the tape reinforcement mentioned above, which can be adjusted by slitting the tape or shortening the slit with more tape to get a beautiful shape of any degree of fullness all the way up the sail.

Adjusting the Swing Rig tensions

This design of Swing Rig has a magic balance of forces which only requires the adjustment of the bowsie on the jib luff line to suit different wind strengths. The design concept automatically keeps perfect tension balance between the main and jib leeches. The design principles of this rig are shown in the diagram and can be applied to a rig of any size.

The Humble Bowsie

by Roger Stollery

Up to the introduction of DYNEEMA, polyester line was used for running rigging and this had a relatively coarse texture and so did not slip through bowsies like the typical plastic ones shown in the diagram. Also polyester was relatively easy to thread, by creating a point on the end, after melting with a cigarette lighter. This is the traditional form of line adjuster as used for decades on models, tent lines etc.

When superpolyethylene came along, as DYNEEMA or SPECTRA, it was immediately favoured because for the same breaking strain it was a lot thinner and was very soft, smooth and silky, so reducing windage and going through fairleads with less friction. However this gave some problems: it slipped through traditional bowsies and cigarette lighter 'blobs' could not be sharpened to go through small holes. So something new was required to solve these problems. Also continuing the objective to reduce windage for jib halyards etc, I wanted something more aerodynamic with less drag. The result is the design shown to scale, compared to the traditional form shown below.

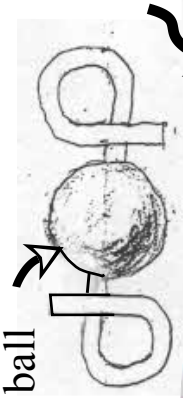
My solution was to reject plastic, even when fibre filled, because once the bowsie wears or slips, it has a reduced load capacity. The Stollery bowsie uses fishermans' knotting experience of achieving friction by going round something rather than through it. The bent wire bowsie is quick and easy to make and thread. The 'blobbed' Dyneema goes through the 'big' wire eyes easily and the line cannot wear away the bowsie. It can be made with round nosed pliers or better round the jig shown on the 'jig diagram', which is also very easy to make; just 2 stainless steel pins bonded with epoxy into a metal plate, close to its edge. A 5mm diameter plastic ball allows fingers to grip the bowsie, but not the line! The design was developed in the late 90s for the BOTTLE boat using 0.8 mm stainless steel rigging wire. This technology is now used for general applications on both bigger and smaller boats.

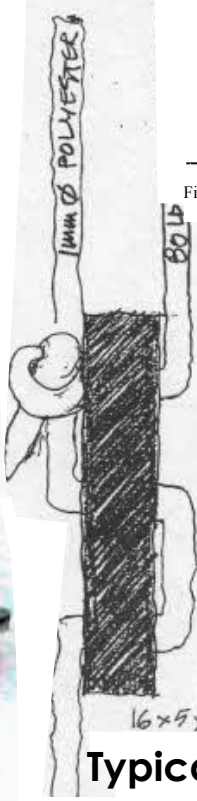
Gripping the bowsie is achieved without the ball, by the projecting ends of the eyes at right angles forming the contact with the fingers. It has great flexibility by using different wire diameters to suit the load and it can be threaded with extra turns round the wire to suit lines which need to be adjustable, but which are not continuously loaded. You can adjust the number of turns so that the line can flap around and yet not loosen.

Low drag wire bowsie

Thread bowsies carefully, always going in or coming out of the 'eyes' in the same way. Finish by tying just single half hitch and pull up against the 'blob'; no need for glue

BOTTLE boat bowsie with fishing ball as the 'grip'

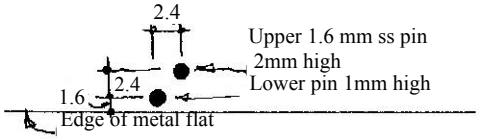




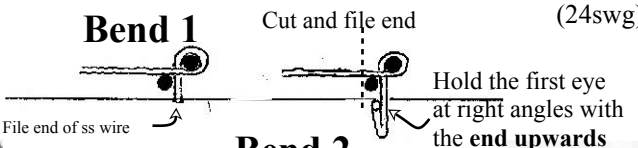
Shown here is Ron Thompson's **'Dyna Cable'** 0.38mm 36.3kg 80lbs Dyneema fishing line. There is a good range of breaking strains: the 6kg line is incredibly fine.

'Blob' formed by melting with a cigarette lighter

Wire bowsie jig

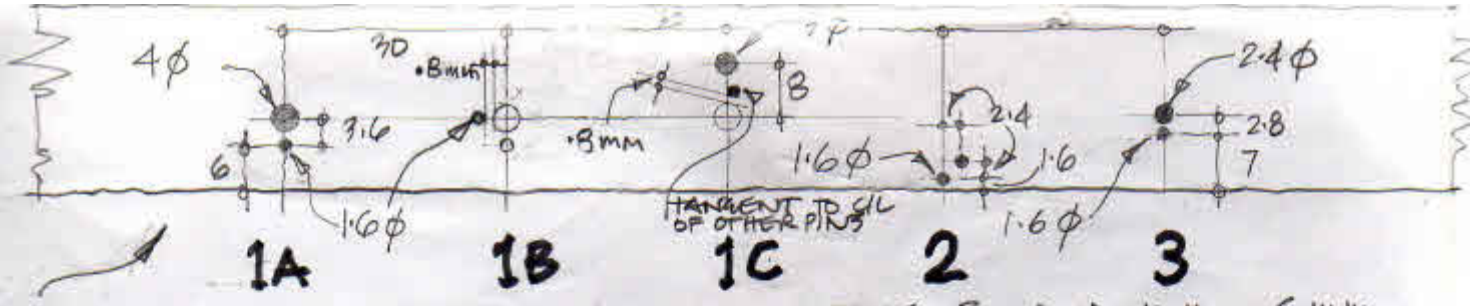


0.8mm (21swg) stainless steel wire for most models, even for high loads on Marbleheads. Use 0.56mm (24swg) for Footys etc



Bend 2

Typical plastic bowsies suitable for polyester line



SETTING OUT OF STAINLESS STEEL PINS BONDED INTO 6MM THICK ALUMINIUM BAR WITH EPOXY ADHESIVE. **HEIGHT OF PINS**

ADJUSTABLE 'NUTTALL' SPAR CLIPS 0·8 mm (22SWG) SS WIRE

1 START WITH THE END OF THE WIRE WITHIN THE TANGENT BETWEEN THE TWO PINS **1A**
2 BEND TO FORM LOOP

3 CLOSE UP LOOP WITH PLIERS

4 BRING BACK LOOP TO THE SAME PLANE AND BEND AT RIGHT ANGLES

* GENERALLY WHEN CLOSING UP PART OF A LOOP USE PLIERS TO CLOSE UP THE WIRE END TO OVERLAP SLIGHTLY. THEN WITH THE PLIERS PLACED AT RIGHT ANGLES BRING THE WIRE LOOP BACK INTO A SINGLE PLANE. THIS REMOVES THE NEED TO 'FINISH' THE CUT END OF THE WIRE LOOP.

5 BEND WIRE ROUND THE 4mm Ø PIN ANTI CLOCKWISE

LOOP WITH CUT END DOWNWARDS

6 MOVE ON TO PINS **1B** AND BEND ROUND 3RD PIN

7 MOVE ON TO PINS **1C** AND BEND ROUND THE 3MM Ø AND 1.6 MM PINS

8 CUT AND SMOOTH END TO FINISH

9 CUT SHORTER AND CLOSE UP TO FORM LOOP WITH PLIERS WHEN REQUIRED

JIGS for 0·8mm WIRE FITTINGS
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11·1·03

BOTTLE BOAT

THESE ARE THE ACTUAL FITTINGS

HOOKS AND CLOSED HOOKS

1 START WITH THE END OF THE WIRE WITHIN THE TANGENT AT RIGHT ANGLES TO THE WIRE ON PINS **1A**
2 BEND TO FORM LOOP

3 TURN THE WIRE OVER WITH END AGAINST 1.6mm Ø PIN AND BEND ROUND 4mm Ø & 1.6ϕ PINS

4 CUT AND SMOOTH END TO FINISH

5 CUT SHORT AND CLOSE UP TO FORM LOOP WITH PLIERS WHEN REQUIRED

BOWSIE

1 START WITH END OF WIRE ON EDGE OF PLATE AND BEND ROUND 6mm PINS **2**

2 REMOVE, THREAD 5mm Ø PLASTIC BALL ON LONG END AND PLACE THIS AGAINST THE EDGE OF PLATE AND REPEAT 1 ABOVE. BOTH LOOPS MUST OVERLAP THE MAIN PART ON THE SAME SIDE

SHEET LEVER RING

1 BEND WIRE 1½ TIMES ROUND 2·4mm Ø PIN **3**

2 CUT AND SMOOTH ENDS TO FINISH