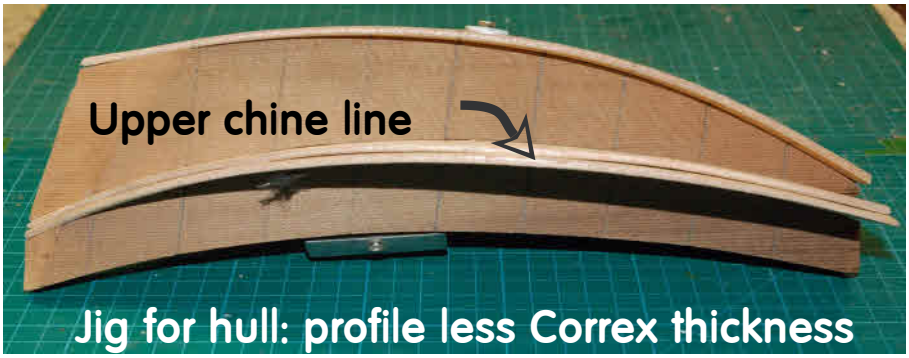
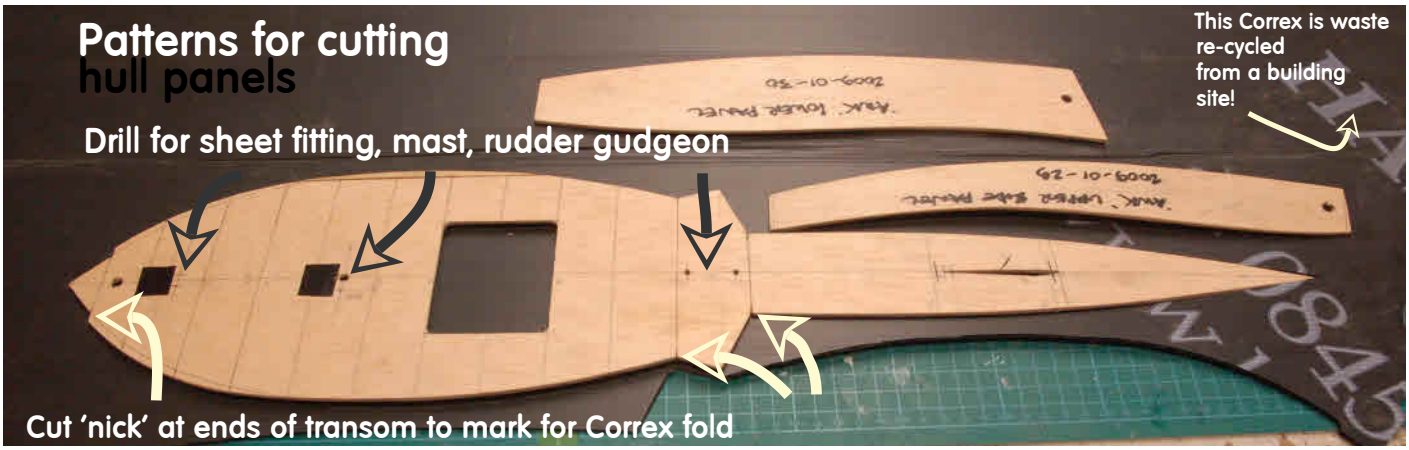
AWK

A Footy design by Roger Stollery

Design drawings, hull panels, hull former parts and foils illustrated with photos and references to the BUG 3 design.

A 500 gram development of the ANT design with less displacement and freeboard, new foils, but still made with Correx corrugated poly-propylene stuck together with insulation tape and powered by Stollery Swing Rigs using recycled plastic bags. Please note that AWK has been redesigned several times and the design lines shown here are the 'as built' drawings with bits crossed out.

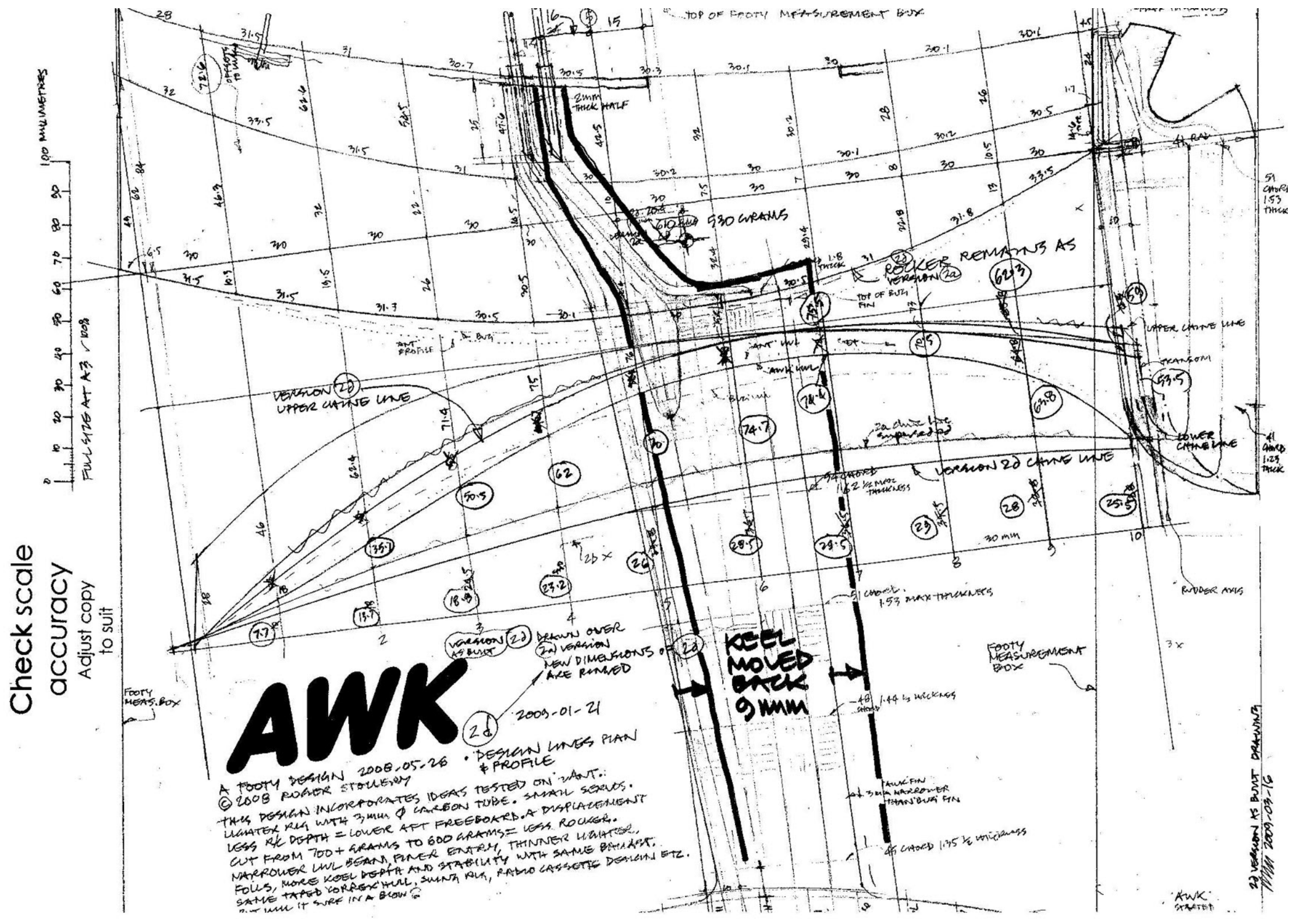




Jig & Correx panels

Fitting panels to jig

Ant and *Awk* 5 plank hull construction method


Check scale accuracy
Adjust copy to suit
100 MILLIMETRES
FULL SIZE AT A3 / 100%
AWK
2d
2009-01-21
DESIGN LINES PLAN & PROFILE
A FOOTY DESIGN 2008-05-26
©2008 ROGER STOLLERY
THIS DESIGN INCORPORATES IDEAS TESTED ON 'AWT'.
LIGHTER RIG WITH 3 MM Ø CARBON TUBE. SMALL SERIES.
LESS RK DEPTH = LOWER AFT FREEBOARD. A DISPLACEMENT
CUT FROM 700+ GRAMS TO 600 GRAMS = LESS ROCKER.
NARROWER LWL BEAM, FINER ENTRY, THINNER LIGHTER,
FOILS, MORE KEEL DEPTH AND STABILITY WITH SAME BALLAST.
SAME TAPED 'CORREX' HULL, SWING RIG, RADIO CASSETTE DESIGN ETC.
PUT HULL IT SURF IN A BLOW
KEEL MOVED BACK 9 MM
ROCKER REMAINS AS VERSION 2a
VERSION 2d AS BUILT
DRAWN OVER 2a VERSION
NEW DIMENSIONS OF 2d ARE RINGED
VERSION 2d CAINE LINE
UPPER CAINE LINE
LOWER CAINE LINE
TRANSOM
RUDDER AXIS
FOOTY MEASUREMENT BOX
TOP OF FOOTY MEASUREMENT BOX
2mm THICK HALF
530 GRAMS
610 GRAMS
2a CHINE LINE SUPERSEDED
30 mm
AWK FIN
AWK STARTED
2d VERSION AS BUILT DRAWING 2009-03-15

AWK

VERSION 2d (2a) 2009-01-2

A FOOTY DESIGN 2008-05-26

DESIGN LINES, SECTIONS DRAWN OVER 'AWK' VERSION 2a SECTIONS

SAME PLAN VIEW AS TRANSOM

53.5

IN MIDDLE SAILING ON 2C

530 GMS ~~GALVANIZED~~

6,7

100 MILLIMETRES

FULL AT 26 AT A4

Check scale accuracy

Adjust copy to suit

SCALE FOR RIGS ONLY AT A4

0 50 100 200 300 400

TOP OF MAST ABOVE DECK 315

TAPE ROUND TOP OF MAST

BOTTLE DOME FLAG

HEADSTICK FROM 1.6 MM STAINLESS STEEL WIRE

BOWSIE ADJUSTMENT OF JIB HALYARD

FREE SAILING RIG (ALSO USED AS RADIO SAILING RIG)

50

90 MM BATTEN

40

270

270

240

160

235

B

SEE CONSTRUCTION DRAWING FOR BOOM DETAILS ETC

RADIO BIG RIG

50

135

40

90 MM BATTEN

470

435

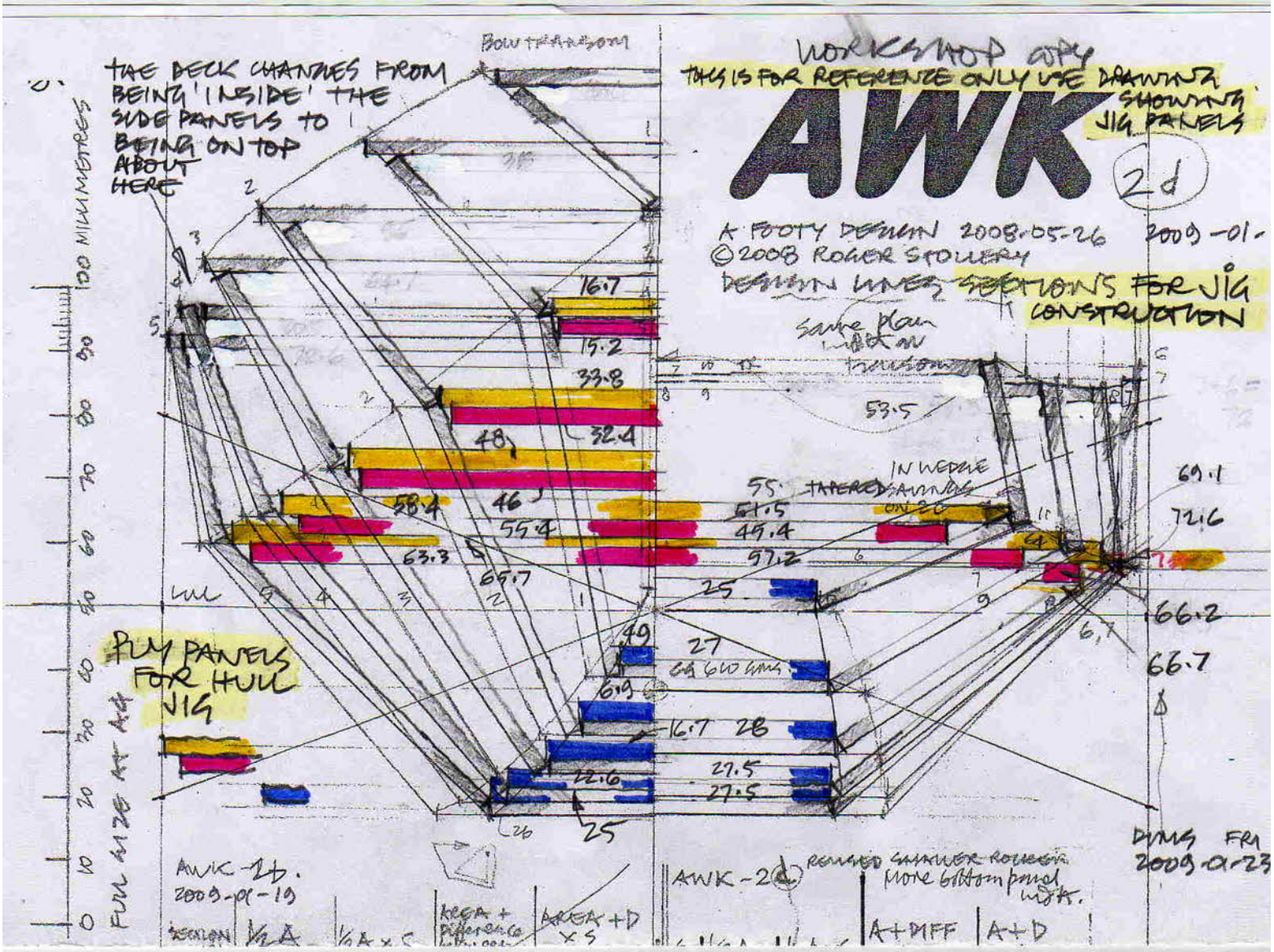
475

412

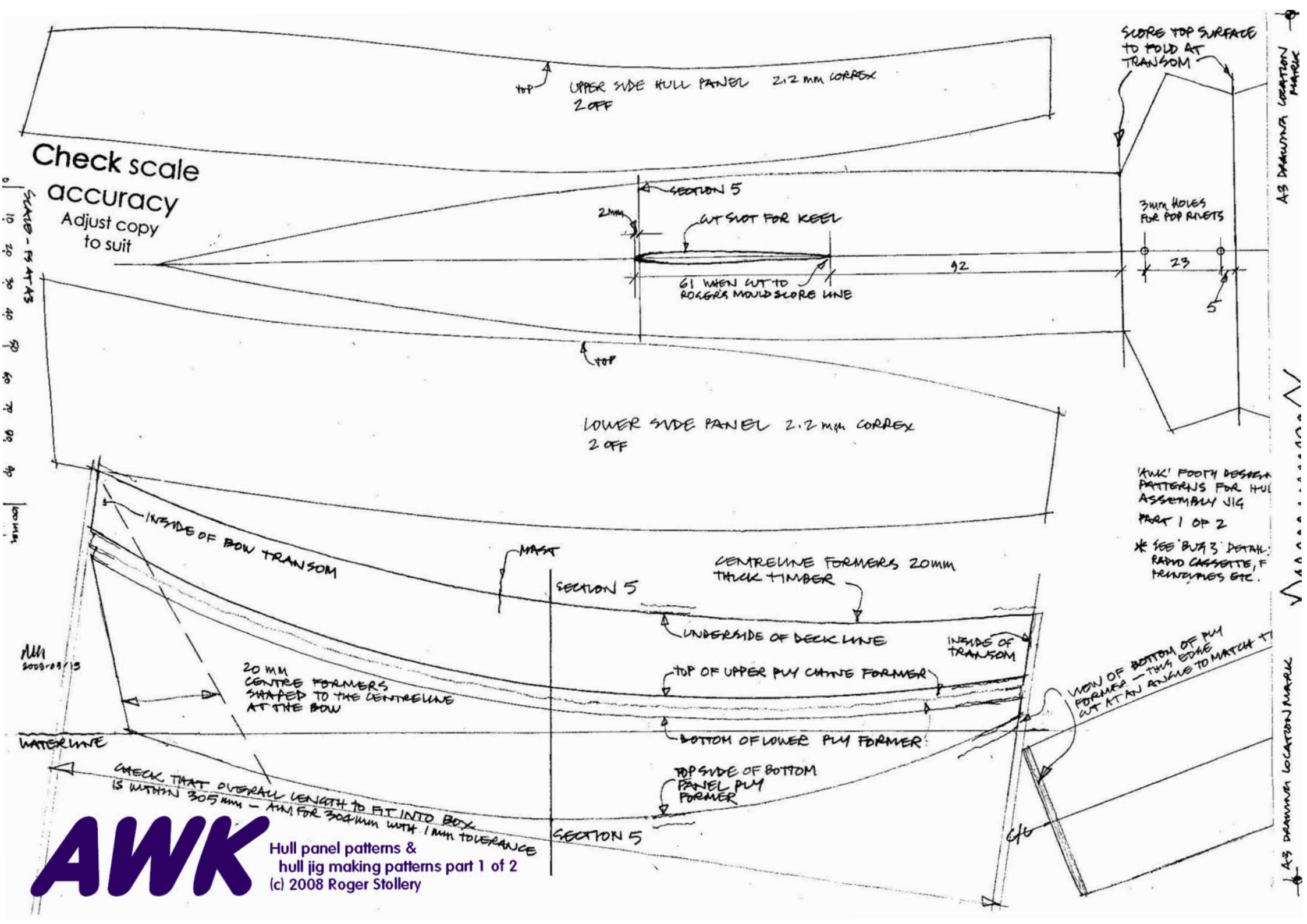
160

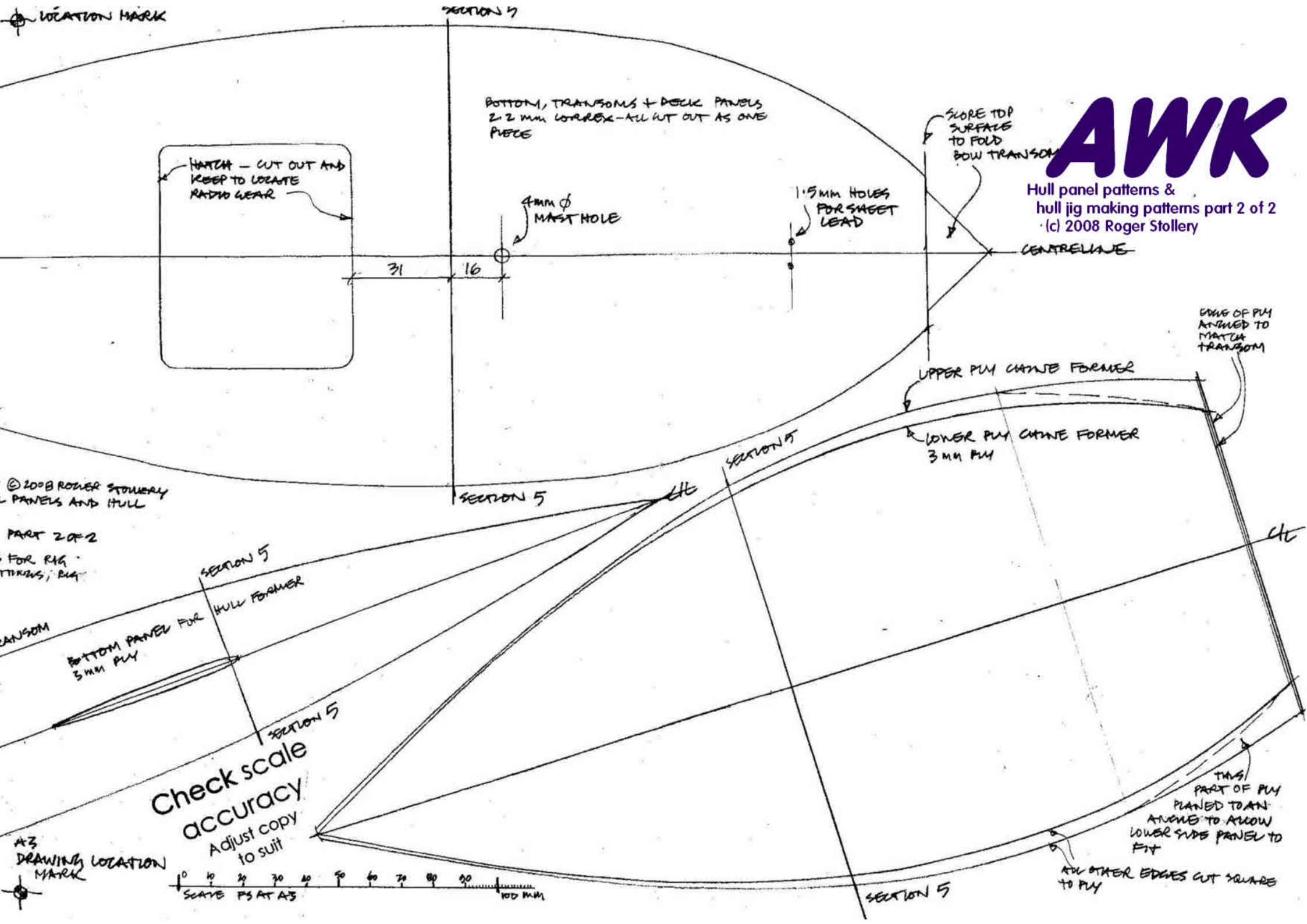
235

B



Please note that this is for reference and to explain the construction of the hull jig.
The hull jig panel patterns shown on the other drawing are 'as built' and should be followed in preference to any dimension on these sections.


Check scale accuracy
Adjust copy to suit
SCALED - FIT AT A3
TOP
UPPER SIDE HULL PANEL 2.2 mm CORREX
2 OFF
SCORE TOP SURFACE TO FOLD AT TRANSOM
SECTION 5
2mm
CUT SLOT FOR KEEL
61 WHEN CUT TO ROGERS MOULD SCORE LINE
92
3 MM HOLES FOR POP RIVETS
23
5
TOP
LOWER SIDE PANEL 2.2 mm CORREX
2 OFF
'AWK' FOOTY DESIGN PATTERNS FOR HULL ASSEMBLY JIG
PART 1 OF 2
* SEE 'BUG 3' DETAIL: RADIO CASSETTE, F PRINCIPLES ETC.
INSIDE OF BOW TRANSOM
MAST
SECTION 5
CENTRELINE FORMERS 20mm THICK TIMBER
UNDERSIDE OF DECK LINE
INSIDE OF TRANSOM
TOP OF UPPER PLY CHINE FORMER
20 MM CENTRE FORMERS SHAPED TO THE CENTRELINE AT THE BOW
WATERLINE
BOTTOM OF LOWER PLY FORMER
TOP SIDE OF BOTTOM PANEL PLY FORMER
CHECK THAT OVERALL LENGTH TO FIT INTO BOX IS WITHIN 305 mm - AM FOR 304 mm WITH 1 mm TOLERANCE
SECTION 5
61
A3 DRAWING LOCATION MARK
A3 DRAWING LOCATION MARK
AWK
Hull panel patterns &
hull jig making patterns part 1 of 2
(c) 2008 Roger Stollery



AWK

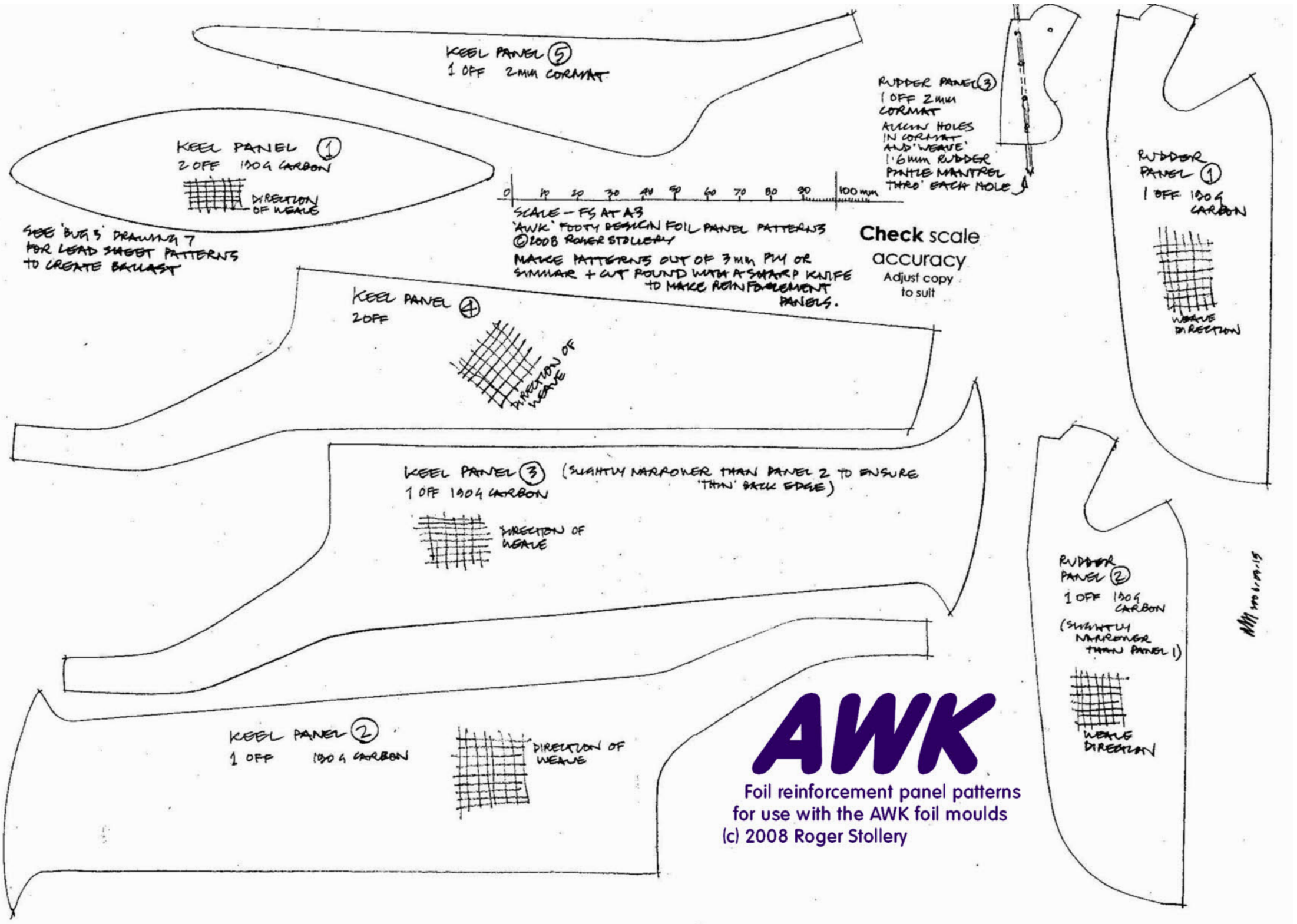
Hull panel patterns &
hull jig making patterns part 2 of 2

PANELS AND HULL

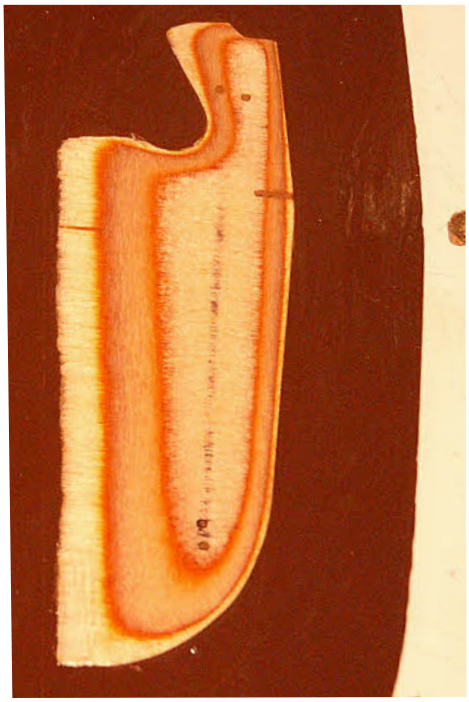
PART 2 OF 2

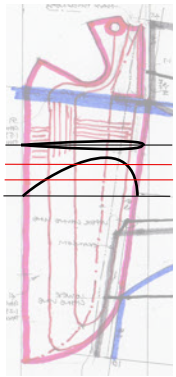
FOR RIG
TTINGS, RIG

RANSOM


KEEL PANEL (5)
1 OFF 2MM CORMAT
KEEL PANEL (1)
2 OFF 190G CARBON
DIRECTION OF WEAVE
SEE 'BUG 3' DRAWING 7
FOR LEAD SHEET PATTERNS
TO CREATE BALLAST
RUDDER PANEL (3)
1 OFF 2MM CORMAT
ALIGN HOLES IN CORMAT AND 'WEAVE'
1.6MM RUDDER PINTLE MANDREL THRO' EACH HOLE
0 10 20 30 40 50 60 70 80 90 100 MM
SCALE – FS AT A3
'AWK' FOOTY DESIGN FOIL PANEL PATTERNS
©2008 ROGER STOLLERY
MAKE PATTERNS OUT OF 3MM PLY OR SIMILAR + CUT ROUND WITH A SHARP KNIFE TO MAKE REINFORCEMENT PANELS.
Check scale accuracy
Adjust copy to suit
RUDDER PANEL (1)
1 OFF 190G CARBON
WEAVE DIRECTION
KEEL PANEL (4)
2 OFF
DIRECTION OF WEAVE
KEEL PANEL (3) (SLIGHTLY NARROWER THAN PANEL 2 TO ENSURE 'THIN' BACK EDGE)
1 OFF 190G CARBON
DIRECTION OF WEAVE
RUDDER PANEL (2)
1 OFF 190G CARBON
(SLIGHTLY NARROWER THAN PANEL 1)
WEAVE DIRECTION
KEEL PANEL (2)
1 OFF 190G CARBON
DIRECTION OF WEAVE
AWK
Foil reinforcement panel patterns
for use with the AWK foil moulds
(c) 2008 Roger Stollery

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 temporarily 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.

This rig detail is out of order. It supercedes/adds to the information on rigs on page 4.

AWK

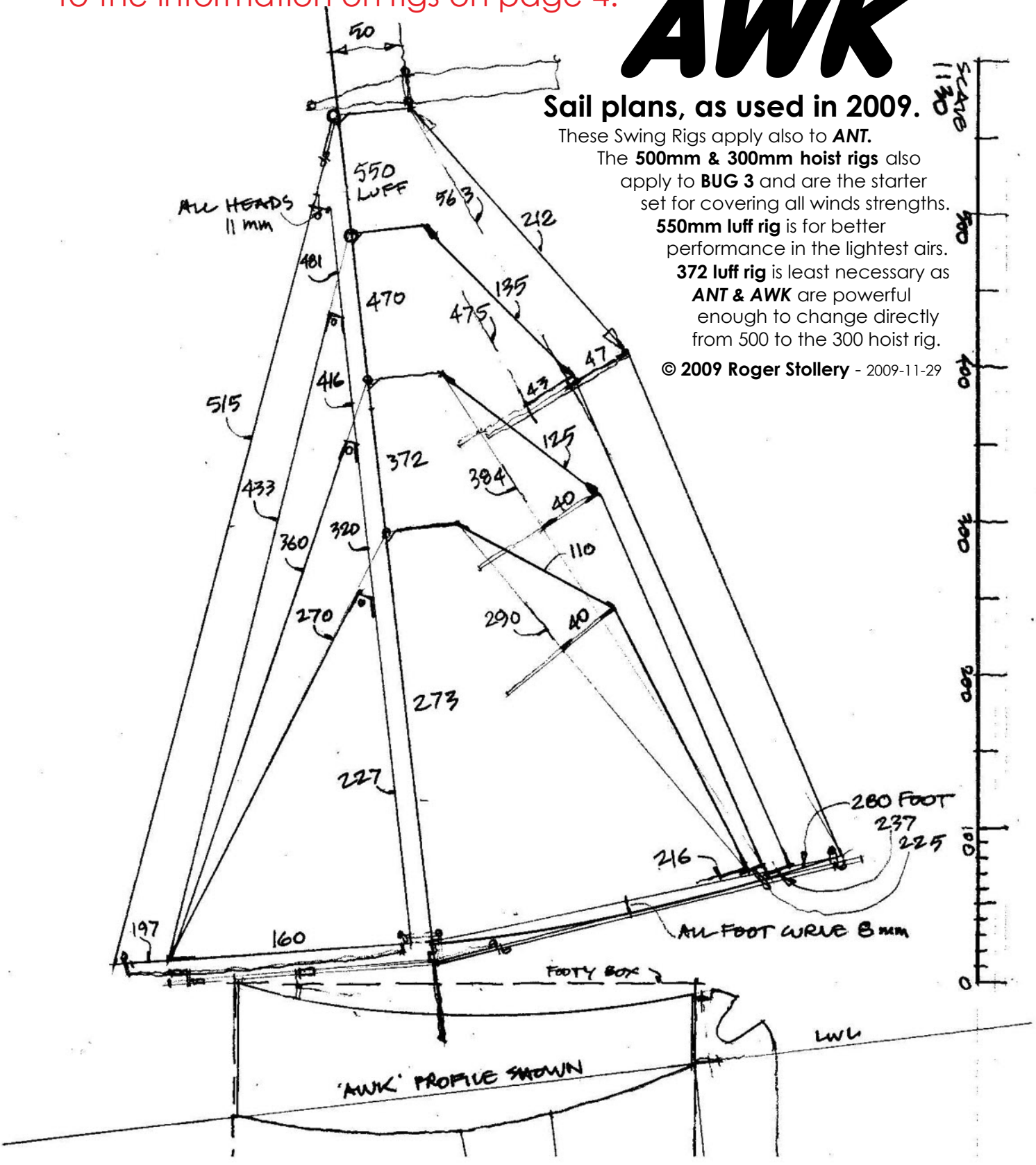
Sail plans, as used in 2009.

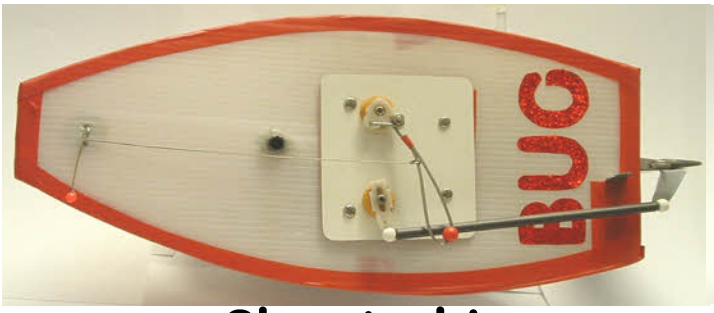
These Swing Rigs apply also to ***ANT.***

The **500mm & 300mm hoist rigs** also apply to **BUG 3** and are the starter set for covering all winds strengths.

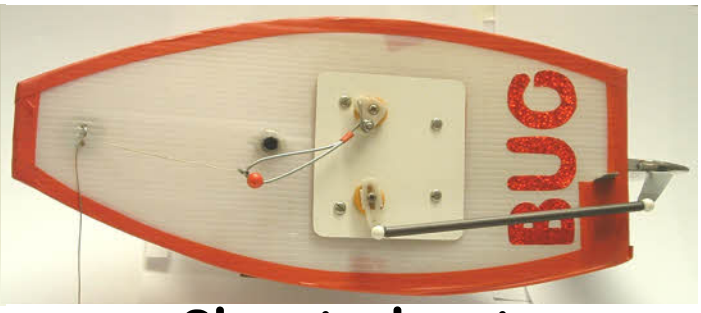
550mm luff rig is for better performance in the lightest airs.

372 luff rig is least necessary as ***ANT & AWK*** are powerful enough to change directly from 500 to the 300 hoist rig.





Sheeted in

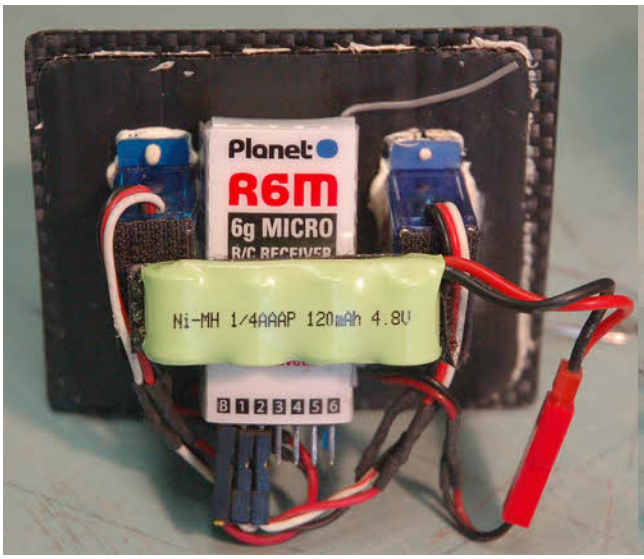


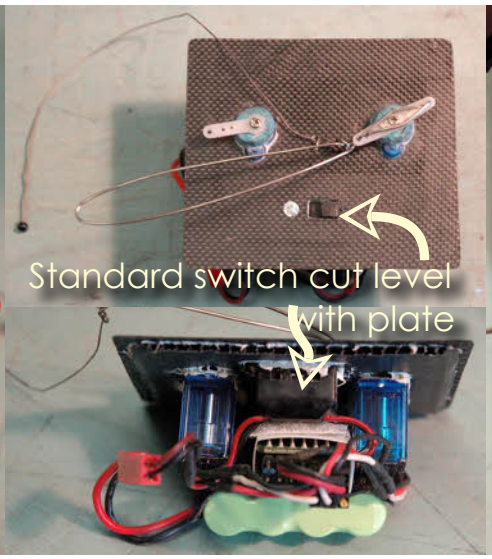
Sheeted out

Cassette Radio Installation

The principle shown here is that the radio gear is not fixed to the boat, but to a thin flat plate just bigger than the 70 x 60 mm long hatch shape and taped to the deck. The servos are mounted by bolting to the underside of the plate, which is located in the deck by the Correx piece cut out for the hatch. The servos operate through the plate and are waterproofed by a silicone grease laden kitchen sponge washer under the horn. The sheet is operated by a Powerlever, which is shown operating on the BUG above. The sheet is attached to a ring which slides on the Powerlever: when sheeting out, it travels to the full extent of the lever to give the travel for the running trim and sheeting in, the ring is pulled towards the servo so increasing power on the sheet without strain on the servo. In the BUG cassette there are two basic servos pulling 2.5kg/cm or so.

With this design principle and the balance of forces in the Swing Rig it is possible to use much smaller and lighter servos . The later ANT, AWK & ICE hulls use the cassette design below in the same 70 x 60mm deck hole, with two HD1800A 8 gram servos with a stall load of 1.3 kg/cm available from Howes Models. See servo details on www.chd.hk. These are just bonded to the underside of the plate with 'Sticks Like Sh*t' as used to seal the inside of the Correx hull chines. A standard switch has the switch projection cut level with the top of the plate. It is also stuck to the underside, operated through a slot in the plate and covered with tape to waterproof it. There is no readable detail drawing available to date, but the photos below show the general arrangement used on the later designs. The Powerlever is 0.8mm or 21 swg stainless steel wire. The RX shown is used with the Planet T5 TX also from Howes Models. The 4.8v Ni-MH 120mAh 15 gram rechargeable battery pack from The Component Shop is Velcroed to the bottom of the servos. In light conditions the charge will last about an hour.





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 on which this idea was developed. They have even be used for light weather jibs for Marblehead and 'A' boats with additional film reinforcing the leech.

Soft materials

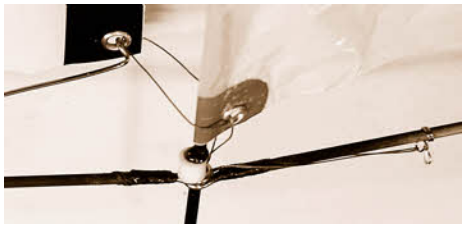
Such soft materials include any sort of thin plastic bag materials such as dry cleaner's bags, bin bags, shopping bags, freezer bags etc. The massive choice of colours allows a bit of fun! As this thin soft material is flexible and stretchy, it is possible to create fullness within the sail very simply 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.

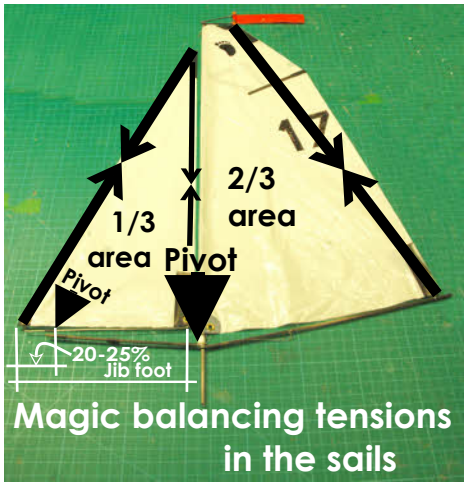
Cutting the sails

After selecting the material, fold it over with the fold forming the front edge of the sail. Place on a hard 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 along these lines.

Finishing the mainsail

Add reinforcement tape, such as 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. They can made from any flexible thin plastic fixed with double sided tape and reinforced by tape to the sail at the front end and around the aft end of sail.





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 one 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 the end of the loop line about 4mm 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 with a simple bent wire adjuster. 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 in a suitable location along the headstick to create or remove camber at the top of the sail. The fullness created 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.

As an alternative to the ball for gripping the bowsie it can be achieved more simply and with even less drag, by bending **projecting ends of the eyes at right angles** forming the contact with the fingers. This idea has great flexibility by using different wire diameters to suit loads. 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 not loosen.

Low drag wire bowsie

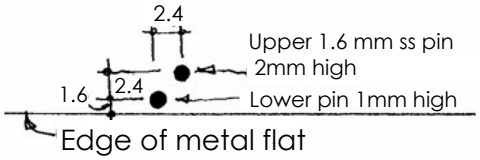
Thread bowsies carefully, always going in or coming out of the 'eyes' in the same way. Finish by tying just single half hitch and pull up against the 'blob'; no need for glue

BOTTLE boat bowsie with fishing ball as the 'grip'

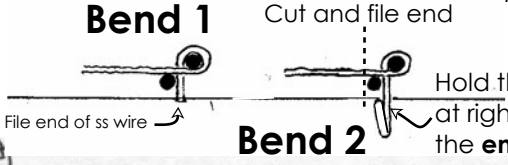
Shown here is Ron Thompson's **'Dyna Cable'** 0.38mm 36.3kg 80lbs Dyneema fishing line. There is a good range of breaking strains: the 6kg line is incredibly fine.

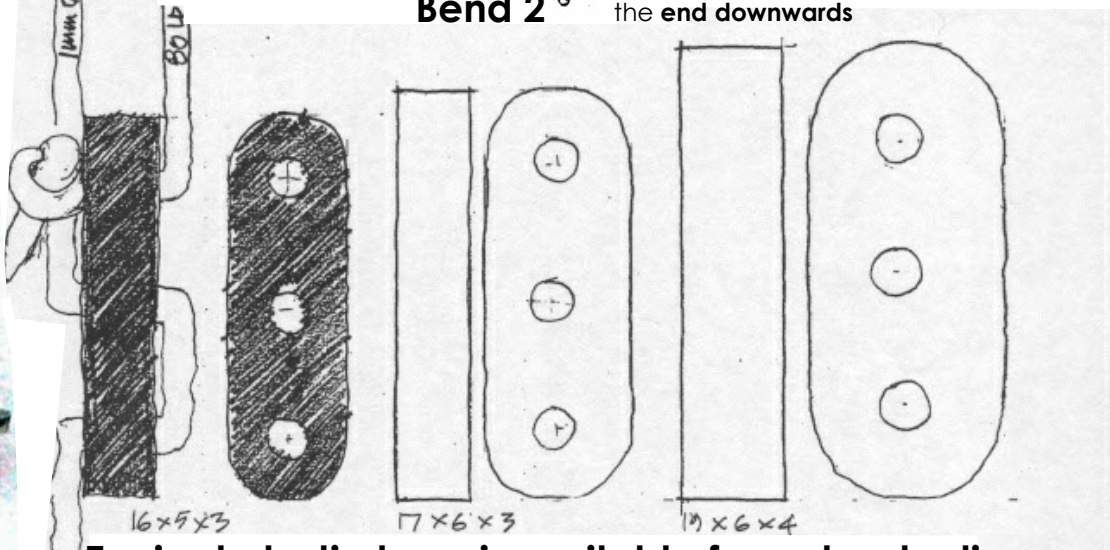
'Blob' formed by melting with a cigarette lighter

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





Typical plastic bowsies suitable for polyester line