Introduction

This model was designed specifically for Jessica Nash to build as a 'larger' contest model after a lot of flying and some success with John O'Donnell's 'Delinquent' (APS D/923). With this she won the Women's Cup three times but never made three 'maximums.' Not because the model was not capable of high scores but Jessica, as a beginner, was not quite capable of getting the best out of the model. It was decided that a model was required which when flown a little below its best would make the required flight times. The size of a rubber model is only limited by the size of the motor that can be wound comfortably. Jessica found that she could handle a motor of 14 strands of 6mm x 1mm rubber and this fitted nicely with a model of 'Wakefield' area.

The general shape and proportions of the 'Delinquent' were retained together with the freewheeling propeller which is easier to make than a folder, is lighter and makes trimming easier. The model was built, flown in the Women's Cup in 1983, made three three-minute maximums fairly easily and a good fly-off flight of 4:06 to win.

The model had a motor of 55 grams, 14 strands of 6mm x 1mm Pirelli about 43in. long and wound to 800 turns. This motor was used for ease of handling. The model will take a similar motor of 120 grams, about 56in. long which requires more careful

Fig. 1 although not covered in the text, using a simple jig will simplify the building of the fuselage. (a) basic jig, (b) first stage, building two sides one above the other, (c) and (d) second stage using the jig whilst positioning top and bottom spacers.
handling and will take over 1,000 turns and give flights in excess of five minutes.

The model is about as simple as a rubber model can be. It is therefore quite suitable for anyone to build as say a second contest model. Or for the more confident, even their first contest model.

Construction notes follow, not because they are necessary for this model but more to provide tips which may be useful to anyone not too familiar with construction of this type.

The general principle is to cut oversize and trim down to fit where it has to.

Materials selection

Don't imagine that the model will be a failure if the balsa chosen is not perfect. Providing the model is not unduly warped, it will almost certainly fly.

Generally, all the wood chosen should be light in colour, not white but tending towards a pale fawn. It should be cleanly sanded with no saw marks and with an even grain pattern.

For everything except wing ribs, the grain must be long and straight. All the wood should feel stiff and when pressed between finger and thumb (do not use thumb nail) should feel hard and unyielding. For wing ribs, the wood should be particularly stiff and with the 'speckly' grain pattern commonly referred to as 'quarter grain.' Although stiff, quarter grain should not be used for longerons, wing leading and trailing edges or spars as it tends to snap straight across, rather than bend when subject to shocks.

Do not however, choose wood purely for its weight. The model must be fairly strong but do not think that heavy wood necessarily has strength, the two do not always come together!

Some modellers prefer to cut their own strip from sheet but unless you have done this before it would be better to buy ready cut strip. This allows the final weight, accuracy of cross section, straightness and grain pattern to be better assessed. Any wood with a natural curve to it should not be used as it will almost certainly cause the model to warp.

Fuselage

The fuselage is longer than the standard 36in. Get 48in. strip if you can, otherwise join two pieces together. Select four lengths of 1/16in. for the longerons making sure they are identical in grain pattern and weight. Splice join, by cutting diagonally across the extreme ends of the main longerons and cutting the ends of the make-up lengths to match. It may take several goes before you get the joint to fit, therefore cut the make-up pieces well over length. Test the fit of the two pieces against a straight edge Fig. 2. When satisfied, glue together by double gluing. Apply balsa cement to both pieces, allow to dry, then apply more glue and join together, keeping straight and preferably under pressure until dry.

The fuselage sides can now be built by the usual method of building one on top of the other, over the plan (note, on the plan provided you must build the wings first as the plan has to be cut to provide a full fuselage profile... or trace the missing front end!... Ed.). An alternative method using a simple jig is shown in Fig. 1.

When cutting out the spacers for the sides, use them as a measure and cut out an extra pair of slightly overlength spacers for the top and bottom (noting where they are to fit). This will save time later. Do not try to put in the nose and motor peg sheeting while the sides are pinned down, it is much easier with the fuselage off the board. Leave longerons overlength until later.

When all spacers are glued in position and dry, remove the sides from the board.

Lightly sand and then separate the two sides. The curve on the top and bottom of the fuselage should be the same but if the longerons were wildly dissimilar in grain or density, there is a chance that the top and bottom will have a different curve! One advantage of a 'square section' fuselage over a 'diamond' is that this sort of distortion can be 'lived with'... if not too bad!

Now the sides can be pinned vertically to the board over the plan but only at the wing mount position where they touch the board.

Approximately 1/8in. packing pieces can be placed under the nose and motor peg position, the packing pinned to the board and the fuselage sides to the packing. The previously cut spacers can now be trimmed to exact length required. Put in only the bottom spacers at this stage. When in place and dry, turn it over and the top spacers can be cut and fitted.

When complete, the tail ends can be joined together by pinning one piece of scrap balsa about 1/32in. thick between the two ends, adjusting until the fuselage is straight, then cutting the two 1/32in. spacers.

Now all the remaining diagonal spacers can be cut and fitted but leave out those pieces at the top around the fin.

Cut pieces of 1/16in. sheet to fill the first bay at the nose and glue in place.

Make the pieces to take the motor peg. These are 1mm ply on the inside and 1/32in. balsa on the outside. Cut the balsa so that it fits in place, then use as a template to cut the ply. Make the hole in the ply for the motor peg, glue to the 1/32in. balsa then glue the two in place Fig. 3.

Before the fuselage is finished, build the fin. This can then be used as a guide for the parts in the fuselage that fit round it.

There is nothing complicated about the fin. The leading edge, trailing edge and top piece with gussets should be glued together pinned to the board, I prefer to build the rest of the fin off the board.

While the outline is drying on the board, cut out the ribs. These are easiest if rectangles 3/16in. wide are cut to length then cut to the shape of a rib. Make a template of the rib curve. Mark the leading and trailing edge thicknesses in the rectangles and cut out the ribs using the template Fig. 4. Glue in the bottom rib first, making sure the fin is not twisted. When dry, glue in the other ribs. Cut the notches for the spars using the spar itself as a guide, pinned onto the fin in the correct place.

When complete, sand the leading edge, top and trailing edge to shape but leave the parts that extend inside the fuselage square. Pin the fin in position in the fuselage, cut and glue the lengths of 3/16in. x 1/32in. that fit round it and the short spacers. When dry, remove the fin.

Lightly sand the fuselage all over just enough to make it all flush and smooth. Now you find the spacers that were not properly glued! One or two will probably get knocked out, don't curse, look on it as a blessing that you have found the loose ones before covering! Cut off the surplus lengths of longeron, sand the tail end round and fit the DT hook Fig. 5. The fuselage and fin are now ready for covering. The wing mount is left until the wing is built.

Wing

Some people have trouble with laminated tips but these are really very easy to make providing you first have a decent template.

A very suitable template can be made from scraps of 1/32in. balsa. Join enough pieces together to cover the curve of the tip with about an inch to spare each end, place under the plan, mark the inside of the curve by pin pricking through the plan and then cut out the template following the pin pricks Fig. 6. Get the edges of the template as square as you can. Thoroughly grease the edges with a candle to stop the glue sticking
Cut out ten strips of \( \frac{3}{8} \text{in.} \times \frac{1}{4} \text{in.} \) approximately 12 in. long (five for each tip). Using a white PVA, glue five strips together using plenty of glue to make sure the wood is well soaked. Making sure they are nicely in line, pin one end of the strips to the template and put a rubber band round it. Fig. 7. Bend the stack of strips round the template, pulling them as much as you can to ensure that they are tight against each other and the template. Pin them to the template at the other end, slip the rubber band over the whole lot and leave to dry for at least 24 hours Fig. 8.

Make a thin plywood template for the ribs and cut them out. Cut the notches for the spar at this point but leave those for the doubler until the wing is built. Cut ribs a bit overlength at the trailing edge so they can be trimmed to fit. Use pre-formed trailing edge if you can get it, otherwise cut from \( \frac{3}{8} \text{in.} \) sheet. Trailing edge section is not easy to shape. Sandpaper smooth, sanding must be done across the grain or in small circles. Do not press hard or sand along the length, or the wood will curl upwards.

I find it easier to work with short lengths of wood and therefore cut the strip into lengths for each panel but leaving a generous overlap. The lengths of trailing edge can now be laid on the plan, the rib positions marked and notches cut to take the ribs. These notches should only be \( \frac{3}{8} \text{in.} \) deep. Now cut the trailing edge to length but leave overlength at the tips, pin to the board, not forgetting to pack up the front, \( \frac{3}{8} \text{in.} \). This is best done with a strip of \( \frac{3}{8} \text{in.} \times \frac{3}{8} \text{in.} \) under the front of the TE Fig. 9a. If by now the laminated tip is dry, take it off the template and make the other tip ... Roughly shape the leading edge Fig. 9b. At this stage, join the tip to the leading edge. Cut off where it has to join the leading edge and cut to match Fig. 10. When satisfied, glue the tip to the leading edge, again double gluing and make sure they fit together when laid flat on the board.

When the joint is dry, pin down the leading edge with the tip laid over the trailing edge. Cut off the rear end of the tip and cut the trailing edge using the tip as a pattern Fig. 11. Double glue to the trailing edge and pin down. When the tip, trailing edge and leading edge are all nicely pinned in place trim off the leading edge to length.

Treat the other tip and outer panel similarly then cut the centre panel leading edges to exact length and pin in place. You then have the complete wing outline pinned down and can check that the chord of the various panels is the same throughout.

For best flying trim, the left hand wing must be slightly ‘washed-out’ (less incidence) relative to the right hand wing. The warps can be steamed in when the wing is finished but it is better if built in. The left tip should have \( \frac{3}{8} \text{in.} \) wash-out and although it is logical to raise the end of the trailing edge.

When dry, take the tip panels off the board but leave the centre panels pinned down and make the outer dihedral joints.

Use a piece of packing to support the tip to the height required, offer up the tip to the centre panel and you will see where the trailing and leading edges need to be cut. Cut about half the amount required off the pieces pinned to the board, then cut the corresponding tip pieces until they match Fig. 14. When the leading and trailing edges fit each other nicely, glue together, again double gluing and leaving the spar overlapping. Do not pin the outer panel in any way, as you may by pinning the leading and trailing edges at slightly different angles and cause a warp.

When the two panels are firmly glued together, the overlapping spars can be cut straight through together and then glued. Fig. 15. This needs a nice fine cut and I still prefer the old-fashioned double edge razor blade. When dry, take the assembled inner...
and outer panels off the board and cut and fit the plywood braces Fig. 16.
Then cut the \( \frac{3}{16} \) in. rib to length (not notched to TE) enlarge the spar notch to accommodate the ply brace, glue into position and add the trailing edge gussets.

Treat the other outer panel similarly and then shape the laminated tips Fig. 17 before joining the centre panels. Join the centre panels together, add the ply braces but leave out the rib at this stage. Cut out the spar doublers, notch the ribs to take them and glue in position, note that they fit on top of the ply brace which then becomes hidden from the top. Cut out the \( \frac{3}{16} \) in. \( \times \frac{1}{16} \) in. wing rest, notch the bottom ribs to take it and glue in position, then add the \( \frac{3}{16} \) in. infill between the spar and the wing rest Fig. 18.

Finish off the tip spar by gluing a piece of \( \frac{1}{16} \) in. sheet to join the spar to the tip and cutting the whole to shape Fig. 19.
Finally cut the \( \frac{3}{16} \) in. rib in half, trim to fit and glue in position. The wing structure is now complete and requires only light sanding to finish.

Avoid sanding the ribs as far as possible or they will easily lose shape. Don’t forget to sand the trailing edge across the grain. Sanding with the grain will still tend to make it curl.

**Tailplane**
This is as simple as can be and needs no comment; just follow the general principles of the wing. Cover both the tailplane and tip fins before gluing the fins in position. Fit the DT hook to the tailplane before covering.

**Wing pylon**
You may think this is unnecessarily complicated and if so it can be replaced with a simple \( \frac{3}{16} \) in. sheet mount Fig. 20. However, the pylon shown is attractive in appearance, interesting to build as well as being lighter.

Start by making the central frame pinned to the board. The frame is then taken off the board and built on a piece of balsa sheet \( \frac{1}{16} \) in. thick or so. Pin the frame upright with the bottom cross strip in position Fig. 21. Then add the wing rest and two main side uprights. Try the wing in position on these and adjust heights and angles until wing sits square without wobbling.

The basic pylon is now complete Fig. 22 and the rest is more streamlining than anything, although it does make the whole structure more rigid. However, even if you make a mistake, it will not affect the basic wing mounting.

Cut out one curved rib for the front and one for the back, use these as templates to make six of each. Cut a little over length where they meet the central upright and do not cut the notches for the \( \frac{3}{16} \) in. square uprights. Trim the lengths and adjust angles at ends if necessary and glue all the ribs in position. Note that the top ones follow the dihedral angle.

At this stage push a couple of pins into the leading and trailing edge where the hooks will go and lightly rubber band the wing in position. It will be seen that the top pylon ribs can now be pushed upwards gently to meet the undercamber of the wing ribs (it is easier if the wing is covered when doing this). Take the wing off and cut the notches in the pylon ribs to take the \( \frac{3}{16} \) in. square uprights.

With the wing back in position, cut uprights to a length that will force the top pylon ribs against the wing undercamber. Now cut and fit pieces of \( \frac{3}{16} \) in. sheet between the uprights and under the top rib to hold it in position. The pylon structure is now finished and can be sanded smooth. Bend and fix the rubber band hooks and it is ready for covering. Cover the pylon before fixing to the fuselage, but do not shrink the tissue until it is fixed.

**Covering**
The whole model must be covered in a lightweight tissue. By lightweight of course is meant the finished weight including dope and not just the tissue! The most common lightweight tissue available is ‘Modellspan’ or similar. This is actually lighter than ‘Japanese’ tissue but absorbs more dope, thus being heavier when finished. Japanese tissue is readily available from some model shops and private individuals who often advertise in Aeromodeller.

Having chosen the tissue, you now need something with which to stick it to the airframe. Although some people have their favourite variety of paste, the real choice is between clear dope and specially made ‘tissue paste’ — the white runny variety like watered down PVA.

There is no doubt that dope gives the neatest and lightest job but not everyone finds it easy to use. The paste is much easier to use, it can be spread over the whole surface to be covered and the tissue applied fairly leisurely. Furthermore if you make a bad mistake, it allows the whole panel of tissue to be lifted off which dope will not.

Therefore, if you are good at it, or would like to try, use dope. If you are like most of us and often make a mess of covering, you will get a better job with tissue paste with the \( \frac{3}{16} \) in. ribs, make sure the tissue is stuck well to both edges. The top surface of the rounded tips from the last rib outwards can only be satisfactorily covered by using a separate piece of tissue.

The bottom of the fuselage from the motor peg to the tail should be left uncovered until the fin is fixed in position. The top of the fuselage is covered first, then the fin covered and glued in position. The small gussets that secure the fin to the bottom of the fuselage can then be added followed by the covering. The wing pylon (un-doped) should be glued in position after the fuselage has been doped.

Water shrink by brushing on water till damp and then leave to dry. Do not pin down surfaces while water or dope is drying. If they are going to warp it is better to find out at this stage. Dope with very thin dope. 30 per cent dope/70 per cent thinners, if it is too thin, you can always apply more coats but just try getting it off! Two coats should be sufficient for everything except the fuselage which should have an extra coat as protection against the rubber lubricant. Bear in mind that the purpose of the dope is to render the tissue airtight, the fact that it helps to make it water resistant is only a happy side effect.

You should never put so much dope on that you end up with a glossy finish. If you find that it is too sticky, thin it off far too much in damp conditions then thin it further with more dope. However, having the tissue slacken is preferable to having the model warp in hot, dry conditions which will almost certainly happen if too much dope is used. Providing the tissue is not being used to hold the structure together, the trim of the model will not be affected by the tension of the wings. This is why it is extremely bad to stretch the tissue into place when covering and cause unequal stresses in the structure.

The finished weights of Jessica’s model are:
- Fuselage, fin and pylon 27 grams
- Propeller and assembly 22 grams
- Wing 26 grams
- Tailplane and tip fins 12 grams

The propeller assembly and trimming will be covered next month.