YOU HAVE CONTROL

By David Boddington

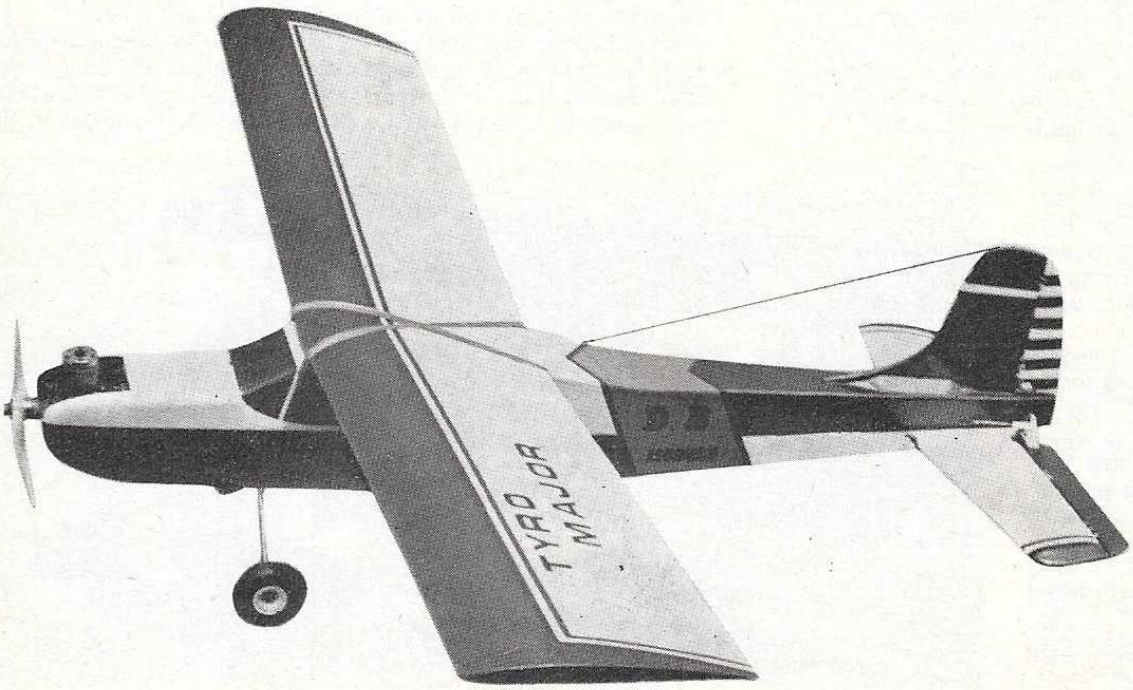
A simple ab-initio trainer for multi

TYRO MAJOR

INTRODUCTION

The 'Tyro Major' is an enlarged version of the popular 'Tyro' design originally introduced in 1966. Many Tyro's have been flown with two- and three-function radio control installed but the wing loading of some of the models tended to increase to the extent where the normally docile characteristics were affected.

With the 'Tyro Major' the additional wing area can cope easily with all modern radio control equipment and there is ample room in the fuselage to install the equipment without having to squeeze it in. By keeping the wing span to 54in. it is possible to use a one-piece wing and still have a model that is convenient to carry about; another advantage of keeping the model to a medium size is that it is economic to build and fly. A. 19 cu.in. glow plug engine is ideal for the 'Tyro Major' although engines from .15 to .30 cu.in. can be used, with the larger engines the amount of side and down thrust must be increased. The design aim was to produce a model with good stable flight characteristics suitable for a novice to have a reasonable chance of success. Construction, too, must be simple with the airframe rugged enough to stand up to most of the knocks that it is bound to get in the hands of a trainer.



Virtually any of the existing forms of radio control equipment can be used including single channel using escapements, motorised servos, magnetic actuators (double ended, high output) and proportional systems from one to four functions. It is slightly on the large size for Galloping Ghost unless it is limited to rudder and engine control only. For 'bang-bang' single channel control the area of the rudder should be reduced by using the top two inches of the rudder as a trim tab. Ailerons are not normally fitted to the Tyro Major but, if desired, strip ailerons ($\frac{5}{8}$in. x $\frac{3}{32}$in. spruce) can be incorporated on a wing with reduced dihedral (approx. 2° per panel).

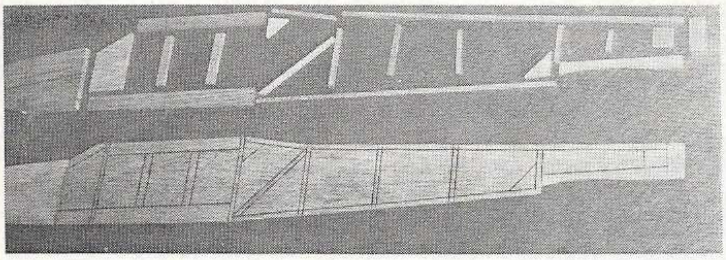
Before commencing construction, thoroughly familiarise yourself with the drawings, instructions and photo's and ensure that all stages of construction are fully understood. Cut out all sheet parts as this will save time at a later stage. For the majority of constructional work a white P.V.A. glue, such as Evostick Resin or Bostik Carpentry adhesive, is recommended. Exceptions to this are the joints between the engine bearers and the $\frac{3}{8}$in. nose doublers, the bearers and formers F1 and F2 and the plywood undercarriage plate to the underside of the fuselage. For these joints an epoxy adhesive, such as the new Bostik quick set epoxy adhesive, should be used as it has better 'gap-filling' properties, is stronger and is more resistant to fuel. Some modellers prefer to use an impact adhesive for large doubler areas, i.e. the $\frac{3}{8}$in. sheet nose doublers to the $\frac{3}{32}$in. fuselage sides, but great care must be taken when placing the two surfaces together that they are in exactly the right position. The easiest way to achieve this is to place a piece of greaseproof or waxed paper between the two glued surfaces, after the adhesive has 'dried', and gradually withdraw the paper checking that the doubler is correctly positioned before withdrawing too much of the paper. P.V.A. glue can be used for these doublers but remember that it will take a very long time for the glue to dry where the air cannot get to it; the side/doublers should be left, preferably lightly clamped together, at least overnight. Although P.V.A. glue does not dry as quickly as some other glues, i.e. balsa cement, this can be an advantage when tackling some of the slower jobs such as fixing the leading edge sheeting to the wings. In most cases the glue will be sufficiently dry to allow parts to be unpinned from the building board after about two hours.

Select the wood for the various parts of the model carefully and, in particular, try to get the quality of wood the same where they are 'paired' on the model, i.e. fuselage sides, left- and right-hand wing spars, leading edge, fuselage longerons, etc. Keep the weight to a reasonable minimum but not by using the wrong strengths of balsa wood. It is not easy to specify exactly the right type of wood by labelling it medium or hard, etc.; if you are building the Tyro Major from the plan tell your supplier what the wood is needed for and, I have no doubt, he will assist you in choosing the right grade. A last plea before we start a detailed description of the construction, the finished model will only be as 'true' as your building board, so do make sure it is absolutely flat and level. 'K' quality hardboard makes an excellent surface for building on, it takes pins just right, and if this is bonded to a flat surface, like marble, you have the perfect building board.

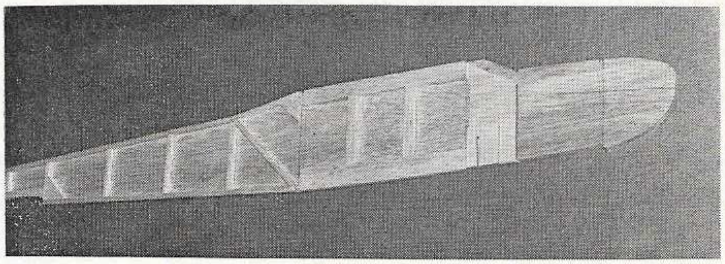
So, pin down the plan, rub over the building area with hard soap (to prevent the glue sticking to the plan) and off we go. On the basis of one picture being worth a hundred words, we will try to keep the words down and give you plenty of pictures.

Fuselage

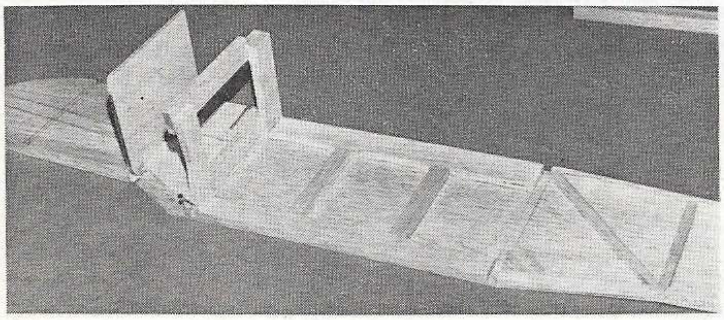
Mark on the $\frac{3}{32}$in. fuselage sides and $\frac{3}{8}$in. nose doublers the position of all the longerons, uprights, doublers, etc. If you do this by putting the balsa under the plan, together with carbon paper, and pencilling on the plan, remember to put another layer of carbon paper (face up) under the plan. This will automatically mark on the reverse of the plan ready for making the opposite side. Glue to the $\frac{3}{32}$in. sheet sides (one left and on right) the $\frac{1}{4}$in. square longerons and uprights, $\frac{3}{8}$in. nose doublers, $\frac{1}{4}$in. x $\frac{3}{4}$in. wing platform doubler sternposts and $\frac{1}{4}$in. lower fuselage doublers.



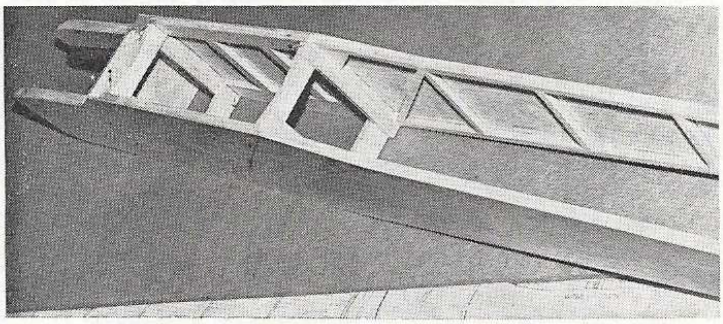
Fuselage construction, stage one. The basic fuselage side components cut out and ready to glue on to side sheet at point marked.



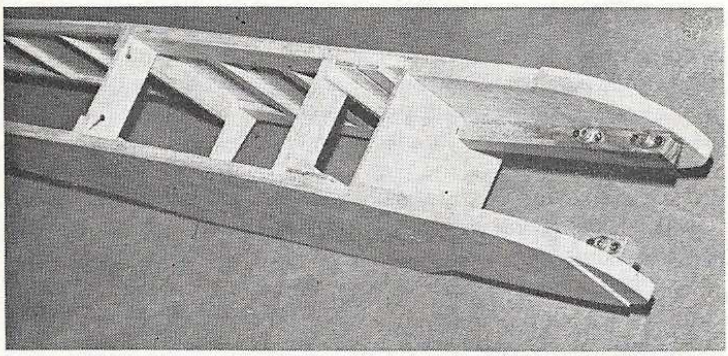
The fuselage side made up with all spacers, longerons and doublers in place. Two opposite sides required . . . be careful not to build two left sides!



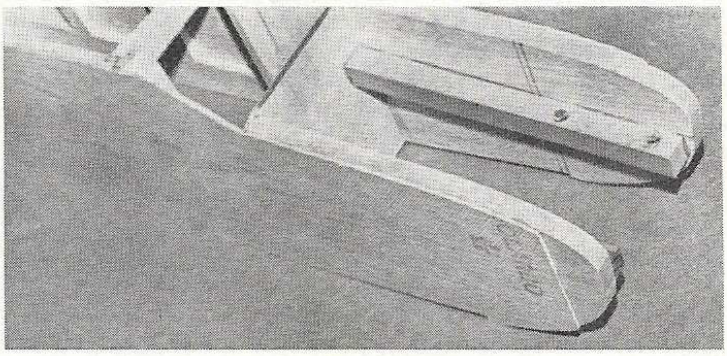
Fuselage side with first formers glued in place. Three formers, two here and a third placed at rear of radio area, used to assemble with fuselage sides.



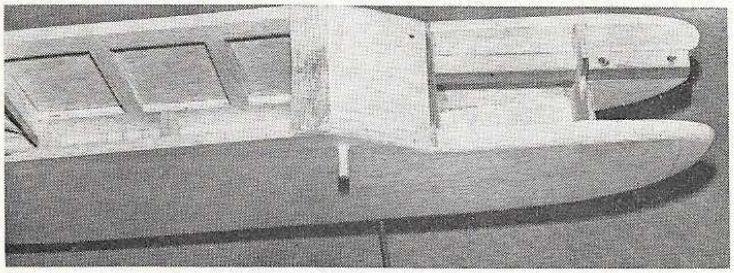
The three formers are placed together with fuselage sides. Once sides are in place and glue is dry, the rear end of the fuselage may be drawn together.



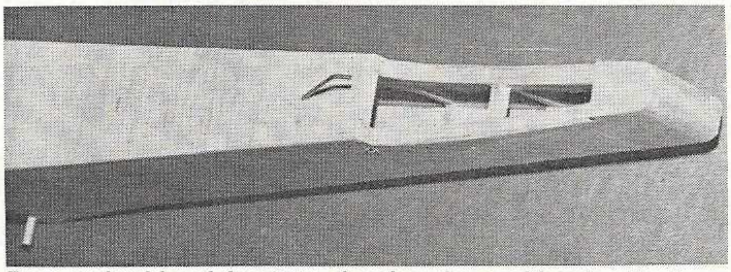
Nose section of fuselage prior to sheeting in the bottom, showing the engine bearers and the blind nuts for the engine bolts.



Top side of fuselage at cockpit area prior to building in the cockpit block and tank position.



Here we see the cockpit area of the fuselage, blocked in, together with tank compartment. Note that the bottom is also sheeted.



Rear underside of fuselage showing the position for the low-mounted tailplane. Note sheeting and tail skid.

Drill the engine bearers to receive the engine plate bolts and fix in position the anchor nuts. When the fuselage sides are thoroughly set, glue on the engine bearers. Make up the formers F3 and F4 from strip and sheet parts as shown in the plans.

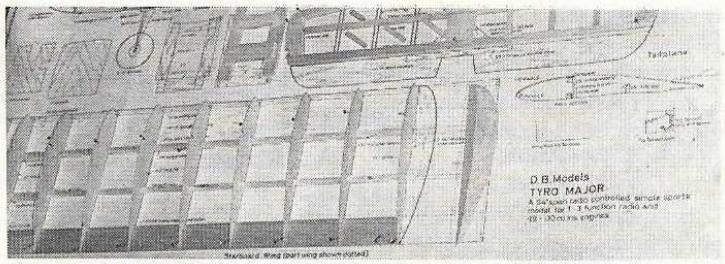
Glue the 4mm plywood undercarriage leg positioners (unless a dural undercarriage is to be used) to each fuselage side noting that the left-hand and right-hand positioners differ slightly. The plywood undercarriage plate can also be drilled at this stage, the staggered holes matching the slots in the positioners. Glue the $\frac{1}{2}$in. additional nose doublers under the engine bearers cutting them to fit over the anchor nuts.

Formers F1, 2, 3 and 4 can now be glued in position to both sides together with the full width $\frac{1}{4}$in. x 1in. cross member. Ensure that all formers are square and put the assembly aside until dry, then bring together the rear ends sanding the stern blocks until they mate accurately. Check that both sides have an equal curvature and add the remaining cross members followed, when these are dry, by the top and bottom balsa sheeting and plywood undercarriage plate. Bend the tail skid from 14 swg piano wire and sew and epoxy it to the plywood plate. This, in turn, is epoxied to the underside of the fuselage as shown on the drawing. Fit the scrap trailing edge stock to the top of the cabin area and the $\frac{1}{2}$in. sheet cabin front. Sand the whole of the fuselage thoroughly rounding off the corners especially around the nose and cabin area.

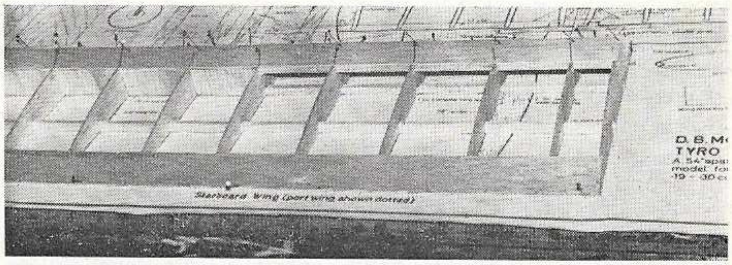
Wings

Wings are constructed in two sections and joined together with dihedral braces. Pin down a piece of $1\frac{1}{2}$in. x $\frac{1}{16}$in. trailing edge, and cut the hard lower spars to length and pin in position.

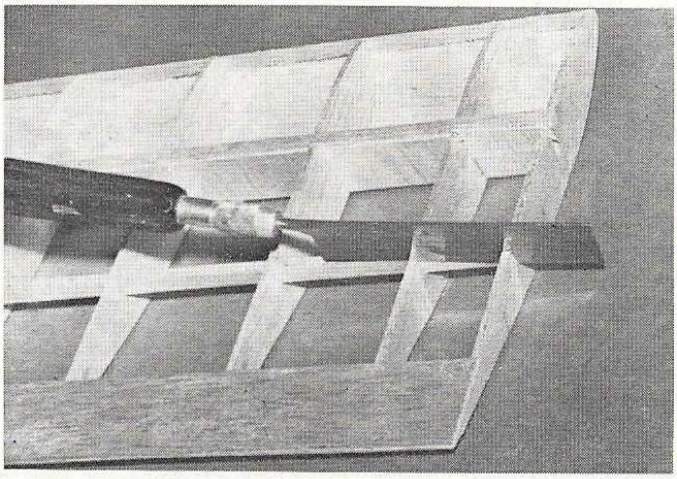
Glue $\frac{1}{8}$in. x $\frac{3}{32}$in. wing ribs in positions shown and check that all are vertical except for the root rib which should be angled from the root rib template. Glue the top spar in position. Fix the top trailing edge in position and glue the leading edge in place. Sheet in the upper surface of the wing from the top spar to the leading edge and from root rib to tip. When dry, remove from the plan and add $\frac{1}{16}$in. sheet vertical webbing from top to lower spar. Add $1\frac{1}{4}$in. soft balsa tips and sand, together with the leading edge, to smooth contour as shown on the section drawing.

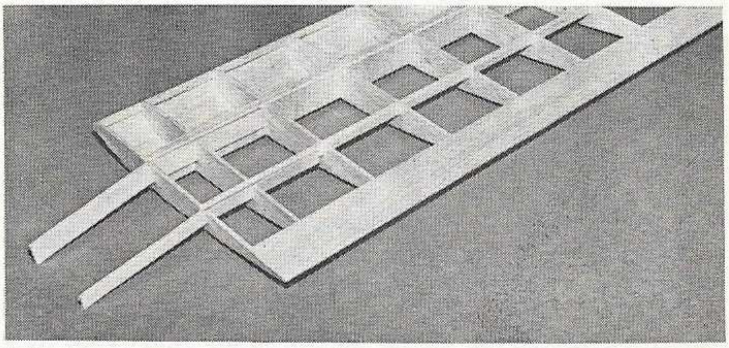


Wing construction starts by laying the bottom surface spars and trailing edge sheet over plan and adding ribs. Note also the tailplane structure.

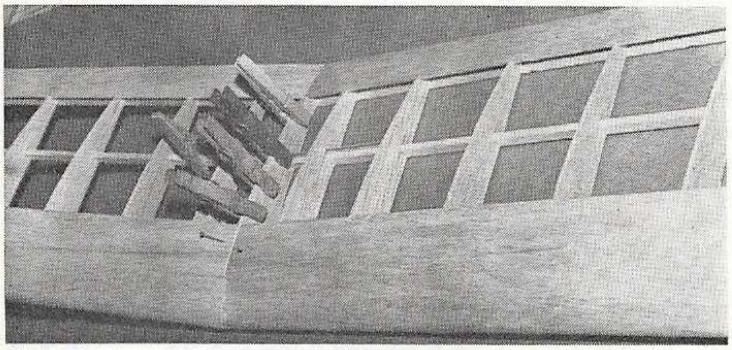


Wing construction, still on plan, has here progressed with addition of leading edge, leading edge sheet, trailing edge top sheet and top spar. Note also the main spar vertical webs.

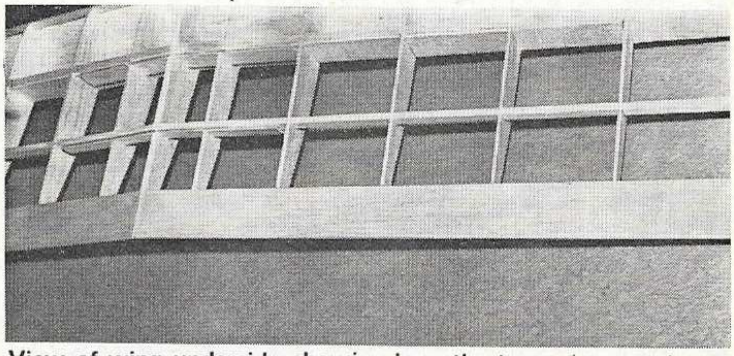




Left: the wing has now been removed from the plan after the glue dried, and saw is being used to knot bottom surface of centre section ribs to take ply dihedral braces. Both wings receive the treatment, then the braces are glued into the wing centre section as shown above.



The wing panels are then joined, gluing the dihedral braces across the spars and using clothes pegs to butt the two centre section ribs together.



View of wing underside showing how the two wing panels are joined with the two plywood dihedral braces. Trim off the braces flush with the spars.

Construct the second opposite side panel in a similar manner. When both panels are set, cut slots with a razor saw in the first three root ribs to receive the dihedral braces. Check these for accurate fit and then glue into position on one wing panel. When dry, add the second wing panel to the projecting dihedral brace, glue thoroughly and pin down. Prop up the opposite wing tip to 5½in. to obtain the correct dihedral angle. Hold firmly in position until dry, pinning the two root ribs together. Sand completely and prepare for covering and glue trailing edge stock reinforcement.

Tailplane and Elevators

Construct the basic frame from ⅛in. x ¼in. and ¼in. x ½in. strips as shown on plan. When dry remove from plane and add $\frac{3}{16}$in. square to rib positions. Sand the tailplane to a symmetrical section and round off the leading edges. Join the elevators with the ⅜in. x ¼in. spruce strip and, when dry, sand the elevators to the section shown on the drawing.

Fin and Rudder

These are straightforward construction of ¼in. strip and ¼in. sheet parts. The leading edges of the Fin should be rounded off; the rudder is from ¼in. sheet.

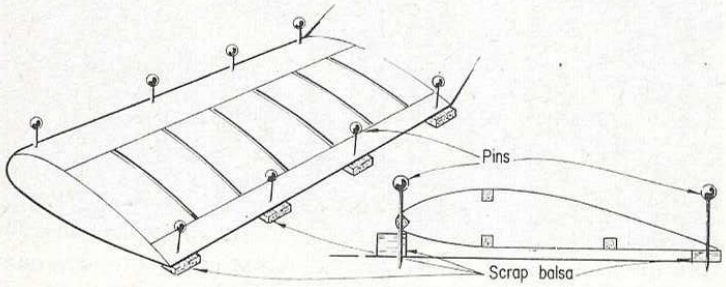
Covering and Finishing

The model may be covered in heavyweight tissue Solar film or Kwik Cote or lightweight nylon although the latter is to be preferred for maximum strength. When tissue or nylon covering is used, the balsa framework should be brushed with sanding sealer and sanded between coats until a perfectly smooth finish is obtained. Coloured doper or enamels should be kept to a minimum as this represents wasted weight, the model, however, should be thoroughly fuel proofed to avoid fuel seeping into the structure, particularly in the fuel bay.

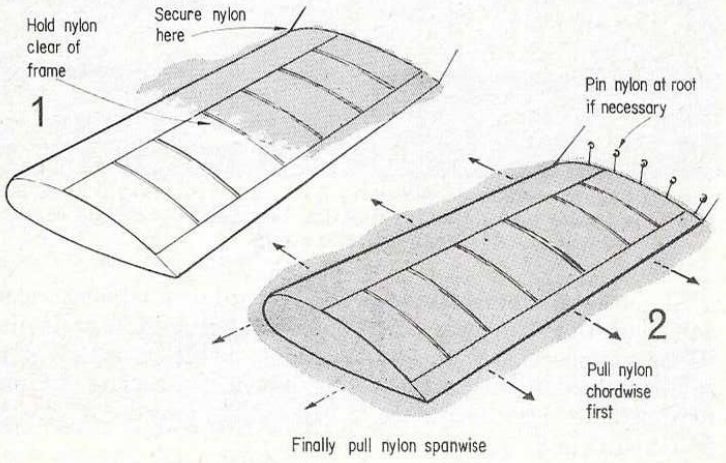
Covering a model can be one of the trickiest parts of the construction although modern materials have made the process as simple as possible. Covering with Solarfilm or Kwik Cote and similar heat-activated plastic sheet covering materials are not explained in this article as full instructions are included with the material.

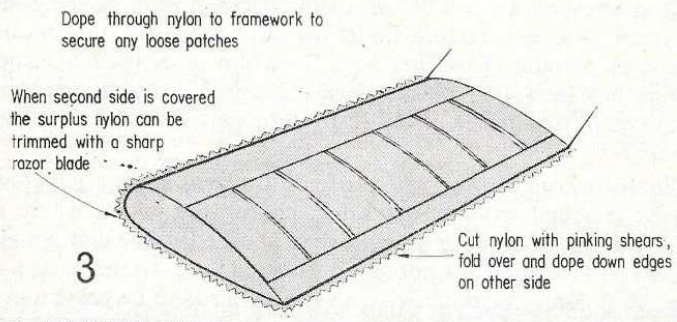
The secret of covering *with tissue* is to use as large a panel as can be attached without wrinkling, ending the panels where a definite break of contour appears (e.g. at dihedral breaks). Small pieces must be used for compound curves, (e.g. round fuselage nose, etc.). Only the outer edge all round needs to be pasted, except where concave surfaces occur, when the covering must be stuck to each individual member (e.g. each rib on the underside of an undercambered wing). The procedure is: 1) Cut a panel of tissue to the shape of the part, allowing 1in. extra all round. 2) Apply paste (or cement) to the framework, edges only except as above. 3) Lay the tissue lightly in place, press the centre of one end down and stretch along the length and press the centre of the other end down. 4) Stretch the tissue to the full width at the centre of the sides and press down, then work from this point to each end, adjusting the tissue so that all wrinkles are worked out.

5) Trim off to within $\frac{1}{8}$in. of the edge and paste the edge down. Completely cover a frame before shrinking, and always cover all woodwork, even sheeting. If water-shrinking is to be used, spray the water on with a Flit gun or similar, and allow to dry naturally over a period of 24 hours. Heavyweight tissue will require about three coats of slightly thinned dope to fill all the pores of the tissue and the colour dope or enamel trim colour and fuel proofer can be applied. It is more important to pin down the wings during the doping period to help prevent warping (twisting) of the wing panels. Because of pinning down, only one wing panel can be doped at a time but always the top *and* bottom of any panel or tailplane should be doped. Pinning down a wing panel is carried out by using small packing pieces at the pinning points, the wing need not be pinned down until the dope is just 'touch' dry, but it should then be left pinned to the board for at least six hours.



Lightweight nylon covering is applied in a similar manner to tissue but dope is more often used as the adhesive and the nylon is applied damp. Cut the nylon out, allowing an overlap of about $\frac{1}{2}$in., with the warp and weft running in line, or at 90°, with the wing span, fuselage datum, etc. Thoroughly wet the nylon and squeeze out the excess moisture in your hand and then spread the nylon out on some old newspapers. Apply plenty of dope to the framework to be covered and start applying the nylon at one end.





All parts that have been covered with nylon should be left for 24 hours before shrinking dope is applied. The first coat should be a heavy one with subsequent coats progressively getting thinner. Three or four coats will be needed or until all the 'pinholes' in the nylon are filled in. When the nylon is being applied to the fully sheeted surface of the fuselage it should be started in the centre of the fuselage and worked outwards, with the aid of a wad of Kleenex tissues. I would suggest that for a first-ever attempt at covering the tailplane, fin, rudder and elevators are covered first, followed by the fuselage and wing.

Finished, hinges and radio installations will be dealt with in Part 3 next month, so do take your time and make the basic constructions of the 'Tyro Major'. This is far more important than the decorative finishes.

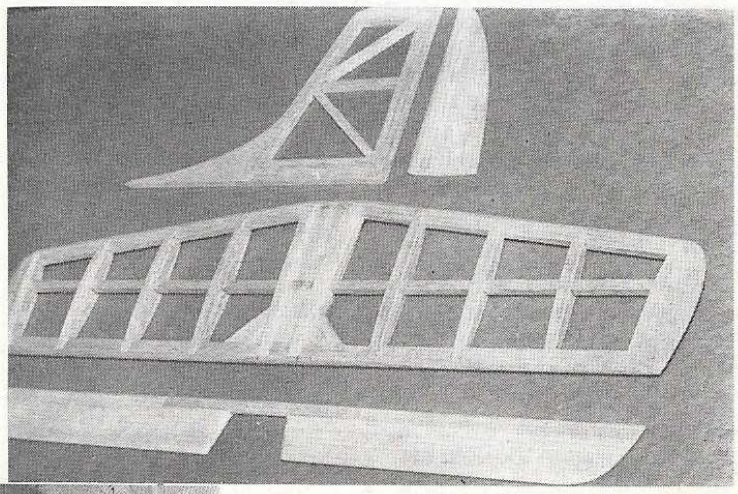
Parts List

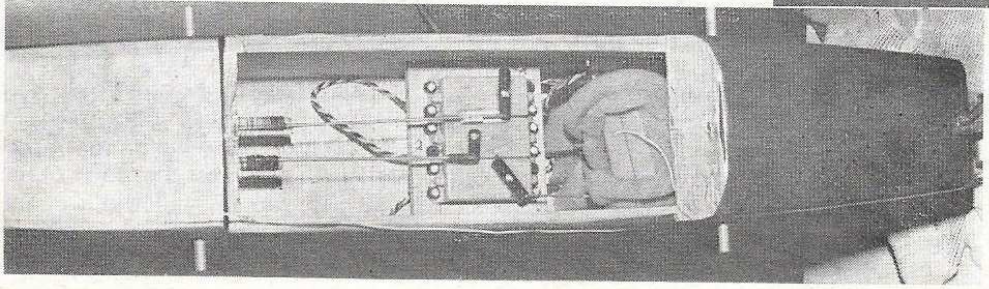
1 sheet $\frac{3}{8}$in. x 4in. x 36in.
1 sheet $\frac{1}{2}$in. x 4in. x 12in.
1 sheet $\frac{1}{2}$in. x 4in. x 36in.
1 sheet $\frac{3}{16}$in. x 3in. x 36in.
2 sheets $\frac{1}{8}$in. x 3in. x 36in.
2 sheets $\frac{3}{32}$in. x 6in. x 48in.
5 sheets $\frac{1}{16}$in. x 3in. x 36in.
1 sheet 12in. x 6in. x 4mm plywood
1 sheet 12in. x 6in. x 3mm plywood
1 length $1\frac{1}{4}$in. x $1\frac{1}{4}$in. Triangular
1 length $\frac{3}{8}$in. x $\frac{3}{8}$in. ,,
1 length 1in. x $\frac{1}{4}$in. ,,
12 lengths $\frac{1}{4}$in. x $\frac{1}{4}$in. x 36in.
2 lengths $\frac{3}{16}$in x $\frac{3}{8}$in. x 36in.
2 lengths $\frac{1}{4}$in. x $\frac{3}{4}$in. x 36in
3 lengths $\frac{1}{4}$in. x $\frac{1}{2}$in. x 36in.
3 lengths $\frac{3}{16}$in. x $\frac{3}{16}$in. x 36in.
1 length $\frac{1}{4}$in. x $\frac{3}{8}$in. spruce
1 length $\frac{1}{2}$in. sq. x 18 in. beech
1 length $\frac{1}{4}$in. beech dowel
Scrap $\frac{3}{4}$in. x 7in. & $\frac{1}{4}$in. x 1in. strip

Accessories Required

4oz. Fuel Bottle
2 No. Nylon Saddles
1 No. Paxolin engine plate (2$\frac{3}{4}$in. x 2$\frac{3}{4}$in.)
4 No. Engine Bearer bolts and anchor nuts
4 No. Screws for saddles
8 No. Screws for anchor nuts
2 No. 2$\frac{1}{2}$in. wheels
4 No. Washers
2 No. U/C legs, 9g. piano wire, 9in. long
1 No. 14g. wire x 6in. for tail skid
2 No. Nylon horns
3 No. Nylon clevises
3 No. Clevis spokes
3 No. Quick Keepers

For modellers not wishing to build the 'Tyro Major' from a kit but with problems of purchasing the 'bits and pieces' I can offer a full accessory pack as listed, including air wheels (total retail value well over £2) for £1.90 and also wing rib sets with ribs die-cut for 60p. from D. B. Models, 22 New Street, Irchester, Northants NN9 7AQ. Full kits are available from your local stockists at £8.99.





Above: the uncovered structure of the fin, with sheet rudder and the tailplane with sheet elevators. Note the hardwood elevator joiner. Left: the radio installation showing the three side-by-side servo arrangement for rudder, elevator and throttle controls.