THIS model is a departure from the orthodox method of construction in the fact that it is constructed mainly of thin paper. I remember a few years ago making a couple of low-wing scale type models from paper. These were intended for free flying, as pole flying was then in its infancy. The duration of these models was not high but they flew, which was all I was concerned about at the time. With the coming of the winter months last year pole flying was introduced into our club (the Doncaster and District M.F.C.) and I was prompted to build up this type of model again specifically for R.T.P. flying. This resulted in the model about to be described.

When first taken down to the club it was received rather dubiously, but when the other fellows saw it flying this cleared away any doubts they had about its capabilities and, in a short time, they had produced quite a collection of paper flying scale models, including Henschel 123, Lightning, Helldiver and Piper Cub, etc. Practically every type of aeroplane can be reproduced with paper construction. The only difference there is from the normal tissue and balsa type is the slightly angular appearance they present. This is not normally very noticeable and detracts very little (if any) from the general appearance of the machine. How much better is this though than the normal flying scale one sees with the stringers and formers, etc., prominently emphasised by taut tissue? (I am referring now to models whose prototype is covered with a stressed skin.) Where it occurs that the machine is covered with fabric the ribs and stringers, etc., can be imitated by thin lines drawn in Indian ink or black dope on the wings and tail, etc., before they are assembled. These lines can be drawn with a mapping pen, although the ideal is, of course, a draughtsman’s ruling pen. A pair of sharp scissors will be found useful for cutting out the various pieces of covering, though a razor blade will do just as well.

The author's model was covered in a smooth paper, thinner than foolscap, which can be used if desired, but the finished machine will be heavier than mine and the performance will invariably suffer. Anyway, whatever paper you use see that it has a nice smooth surface as it "handles" better. All the wood stated on the plan and as used in my machine was balsa, and the amount used is very modest. (A favourable point in these days.) If, however, this is unprocurable, hardwood will do just as well, providing the sizes are decreased slightly so as not to increase the weight unduly.

The fuselage formers are first prepared. Nos. 2, 3 and 4 being built from ¼ in. strips of 1/16 in. sheet. Nos. 1 and 5 have to be made from a slightly larger size. The wood is first cemented into "frames" the overall size of the former. The outlines are then traced on to these frames and they are then cut out. Be sure to add the little gussets in the corners where shown. Next cut out the two main longerons and lightly mark in pencil the positions of the formers. Assemble by cementing the first and fourth formers in position after cracking the longerons at former 4 so as to get the taper of the fuselage. Now cement the ends of the longerons together at the rear and add the remaining formers. Before leaving the fuselage for the present, apply several coats of cement on both sides of the longerons in the region of the motor peg. This is important, so do not forget it.

The Wings.

Procure a sheet of the paper you have decided to use, approx. 13 ins. by 8 ins., and give this a coat of thin banana oil or dope on one side and pin it down on a board. When it is dry turn it over, apply one or two coats of silver dope and then pin it down again. With dope on one side only the paper tends to curl up, so doping it on both sides helps to equalise the pull as well as stiffening the paper. Cut out the spars and ribs as shown on plan and assemble together. When the wing sheet is dry lightly draw in the wing outlines on it. This is shown in sketch or plan. Make sure that you get a port and starboard wing. Cut them out and note that the top of the tip is cut out separately and is stuck on afterwards. Now take one wing pattern and crease it along the leading edge so that the top and bottom are at 20 degrees. Lay it on a board with the inside upwards and the T.E. towards you. Smear the underside of the correct wing frame with seccotine or some similar glue. (Glue is used here as cement on contracting tends to distort the paper.)

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The Full-size Aircraft.
Then press the wing frame gently into place, put it on one side for a few minutes and repeat for the other wing.

Next take the first wing and smear the spar and ribs with glue, spreading it also along the T.E. in a strip about 1/16 in. wide. Then (now comes the tricky part) keeping the whole unit pressed flat on the board, bend the top wing half gently down on to the wing frame, working from the L.E. and finally finishing up at the T.E. 

Endeavour to get the paper stuck down to every part of the wing frame, especially along the main spar. This is the secret of the wing's strength. Note that no L.E. or T.E. is necessary. The T.E. will dry quite straight if you keep some heavy object pressed on to it until the glue has set. The strength of these wings is surprising and they compare favourably with their orthodox equivalent. Do the same with the other wing and then add the top of the tips. When everything is set, trim the wing along the T.E. and tip if necessary.

Join the two wings with the dihedral brace shown on plan. Scale dihedral is incorporated in the spar, but check this on assembly. Finish by cementing pieces of balsa at the L. and T.E. as shown on the plan, and then finally mark the ailerons on with Indian ink.

To return to the fuselage: The paper covering is cemented on in the sequence shown in plan. No patterns are given for these as the different shapes can easily be found by a little experiment. Notice that there is no post at the rear of the fuselage: the paper is simply stuck edge to edge. Cement can be used for fixing the paper as the curvature of the fuselage makes it stiff enough to resist contraction. Cement panels Nos. 1, 2 and 3 in position. Now cement the wing into position on the 1/16 in. sq. runners, and then add the two pieces of 1/16 in. sq. to complete former No. 3. You can now finish covering the fuselage. Panels Nos. 4 and 7 are cut from ordinary foils, as a bit of extra strength is needed here. Before adding panel No. 7 do not forget to add the 1/16 in. sheet on to the bottom of former No. 2. This is stuck on top of the paper panel No. 6.

Note that the cockpits should be cut out of panel No. 3 before cementing it in place. Panel No. 5 is in one piece and extends over the wing L. and T.E., where it is finally cemented down on to the incidence runners. The edge of this pattern where it passes over the wing is simply fastened down by a small fillet of cement.

The fin and tailplane are cut out from thick foils one previously silver doped on both sides in the manner described for the wings. A branching strip of a 1/64 in. hardwood or 1/32 in. balsa is cemented on the underside of the tailplane. No bracing is necessary on the fin. Mark the control lines in with Indian ink. Then fit the tailplane by carefully cutting a slot in the rear of the fuselage with a razor blade, smearing around it with cement and slide the tailplane into position. The fin is simply cemented on top of the fuselage. This may seem rather flimsy but it is quite strong enough and has given no trouble in practice.

The undercarriage can now be made and fitted. This is very simple and should give no trouble. To fit, make two pin holes in each wing, one on either side of rib 2 and gradually enlarge these to fit the legs. Then, just squeeze cement in and around the slot and push the leg into place. The wheels are two laminations of 1/8th balsa sheet cross grained, and sanded to shape. Dope black and finish by sticking two discs of paper doped silver on either wheel. (These wheels by the way, are lighter than celluloid ones and are to be preferred.) The tail wheel is made from a disc of hardwood or balsa nipped in a thin wire fork. It does not revolve and is simply cemented on to the bottom of the fuselage.

The nose block is quite orthodox and needs no explanation except that the bush is left protruding slightly to provide clearance between the prop and the air inlets. This should not be necessary, of course, on the "false" noseblock with the inlets painted off.

The propeller can be tackled next. I should like to say here that any extra time expended on this unit will be well spent. I believe that the airscrew is the most important part of any model and is the secret of long duration. Cut four blades from 1/32 in. sheet to the pattern shown on plan. Next procure a strip of sheet lead, soft brass or tin about 4 ins. by 1/4 ins., and bend a camber in this with a max. height of 1/4 in. and about 1/4 in. from one edge, forming a crude jig on which to make our airscrew. Now, hold the strip in the middle with a pair of pliers with L.E. of the jig on your right. Then, gripping the tip nearest to you with another pair of pliers, twist it in a clockwise direction until the tip is inclined at 10 to 15 degrees to the middle. Check the camber when you have done this and see that it has not got flattened out during twisting operations. Next, take two blades and coat the entire surface of one with cement, spreading it on with the finger tips. Now quickly place the other blade on top of this, then bind the whole unit on to the convex side of the jig, making sure that you get the prop tip and the jig tip together and that the prop is pressed on to the jig along the whole of its length. Cotton or wool can be used for the binding operation. Let the cement harden, remove, and do the same for the other blade. An alternative for the jig is to use a standard duration prop of about 9 to 10 ins. diameter, in which case both blades can be made at once instead of singly. The two blades can now be trimmed to shape and sanded down to an airfoil section. When sanding the convex side of the blade rest it on a bottle or some cylindrical object. This will prevent any undue pressure on the camber. Join the two blades as shown on plan and finish in the usual way. Propellers made by this method (in the smaller sizes at least) are as efficient as the carved type and are definitely superior to the steamed propeller.

The model is now complete except for minor details, and these are all shown on the plan.

Power is supplied by a 22 in. to 24 in. loop of 3/16 in. flat. This may seem excessive for the length of fuse, but it can be handled. A little care is needed, however, during winding to avoid any bad bunching. The rear motor peg is a match stick sanded round and smooth. Complete with rubber the model should balance along the main spar. No trouble should be experienced in this direction. (In fact, the author's model was slightly nose heavy.) Anyway, unless the C. of G. is very far out do not use ballast but trim by tail. On 1,200 turns the machine will consistently average 45 sec., but best time being 51.75 sec., and as such it holds the R.T.P. scale record for the club. The 1,200 turns referred to is not maximum turns, but rubber being so precious these days the author did not want to tempt any gremlins that might have been hanging about!

Seriously, though, the whole model is quite robust and the fuselage will easily withstand the effects of a broken motor. One point I forgot to mention in regard to the paper covering of the fuselage. This is cemented on in its natural state and apply two coats of silver dope after completion. I should like to point out that the original model is not yet fully tested out, and no doubt that further experiment in the right direction (i.e., prop and power) will produce durations of well over the minute.