

De Havilland 82A TIGER MOTH

a superbly detailed 50 in. span, one-seventh scale version of the classic biplane, designed for free-flight or radio control, using 2.5-8 cc. engines, designed by scale doyen HAROLD TOWNER

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Geoffrey de Havilland's Tiger Moth is perhaps the most well-known biplane of all time, and with so many of these machines still flying today, it seems almost unbelievable that it first saw the light of day over four decades ago.

Designed and built in 1931 as a solution to the problem of producing an efficient primary, intermediate and advanced training aeroplane which would be cheap to produce and operate, the Tiger fitted the bill perfectly. However, it rapidly found other operational roles in the Services, including formation flying, reconnaissance, bombing and photographic duties. More recently, Tigers have found favour with film companies and are featured in such aviation epics as 'The Blue Max' and 'The Red Baron' - although they are not so easily recognisable!

Virtually viceless in its flying characteristics, the 'Tiggie' gives only a gradual stall and a slow resultant spin. As a model, these features provide a most stable machine, but one fully capable of aerobatics if the control and power is available.

The design presented here is Harold Towner's latest scale model, being intended primarily for four function proportional radio control using .49 cu. in. engines, but could equally successfully be flown as either a single channel R/C model or free-flight, in which case 2.5-3.5 c.c. engines would be adequate. A glance at the plans reveals that this is no beginner's machine, but a modeller's model! All the information is provided for a really true-to-life replica (note how the fuselage longerons are to scale thickness . . .), the amount of detail included on the model, depending on the builder's ability, ingenuity and patience! Being aimed at the more experienced modeller, the following instructions do not cover every point to be encountered, but will point the less-able enthusiast on the right lines and guide him through the tricky parts! All flying surfaces are readily detachable to facilitate access and ease of transportation. R/C installation is not shown, this being dependent on the equipment used and the degree of interior detail envisaged by the constructor, but remember to keep the majority of the weight as far forward as practical to maintain the correct C.G. position.

Start work on the fuselage by building a pair of basic sides directly over the plan. Note that the longerons are from 1/4 in. square spruce, while uprights and diagonals are from 1/4 in. dia. birch dowel,

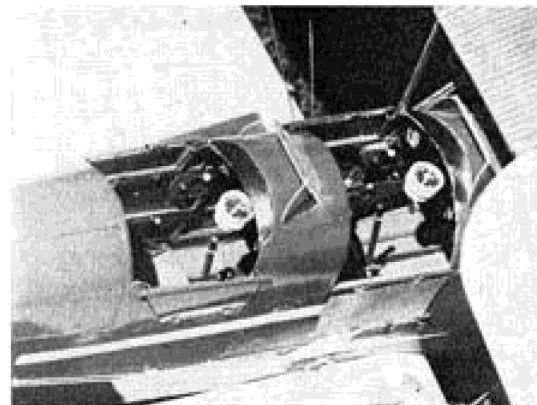
except where stated. Take care to make accurate joints and use a good quality glue. Remove from the plan, then cut out all the 1/4 in. square spruce cross braces. Reposition the plan on the building board so that the position of F1 lies approximately 1/4 in. off the edge of the board - this is to enable the fuselage frames to be inverted flat over the plan. Pin the cross braces for the top of the fuselage to the plan view, invert the fuselage frames and glue securely, checking that the sides are kept vertical. When dry, add the diagonals, followed by the bottom spars and their diagonals. Remove from plan, then draw the nose sections together, using temporary cross struts, which will be removed later.

The cabane wires are now bent from 16 s.w.g. wire, accuracy being most important. Note how the two side assemblies are connected at the top with brass tubes soldered in place in order to assist their lining-up. Bind these struts to the fuselage sides as shown, then add the 1/4 in. ply fairings. These are grooved with a saw to accept the wire and are then epoxied in position.

Cut out the 1/4 in. plywood engine mounting plate to size, then add the hardwood bearers, spaced according to the width of the engine crankcase used. Note that this bearer assembly is to be glued to the longerons, which are inclined upwards, so to restore the thrust line hardwood or dural packing pieces should be filed to shape. When satisfied, drill the engine mounting holes, remembering to incorporate the appropriate sidethrust, depending upon the direction of rotation of the crankshaft. Most people will no doubt leave their motor unmodified and so select right thrust! See plan. Harold opted for absolute realism and had his Merco 29 modified to clockwise rotation - hence the left-handed prop shown! The whole unit may now be securely epoxied into position, including the 1/4 in. ply fill-in reinforcing the longeron joints.

The 1/4 in. plywood firewall may now be epoxied in place, followed by the obechi gusset. Laminate the nose cowling from 1/4 in. sheet obechi, hollowing the laminations before gluing to ensure adequate clearance for the motor. Carve and sand to approximate shape, then glue in place. The lower part of this cowl is connected to the bottom of the firewall by a plywood plate complete with side members, and reinforced with obechi fillets.

Superb cockpit detail evident in Harold's model - note the opening cockpit access doors and full instrumentation, plus flying controls. Add as much detail as you like, but keep an eye on those scales!



No, the picture is not back to front, the prop is left-handed! Harold's Merco 49 has been modified to clockwise rotation for true scale effect. Check that the side thrust on your model is suited to the crankshaft direction of the motor to be used.

The dummy centre section tank should be made up as shown (or, for true scale fanatics, a tinplate header tank could easily be incorporated within, but this is not drawn) and attached to the cabane struts so as to position the wing at a positive angle of 4° incidence to the top longerons. Also ensure that everything is truly square - a couple of long straight balsa strips pinned temporarily to either side of the tank will clearly reveal any inaccuracies. The tank is secured at the rear by binding the trailing edge to the rear cross wire, leaving off the last inch of sheeting until this job is complete. The front is keyed into position with scrap material epoxied into the slot for this purpose. The 20 s.w.g. bracing crosswires are now bound and soldered into position and are made fast to the motor bearer plate below before the centre section wing root ribs are cemented either side of the tank, again at 4° incidence.

Formers F1-9 are then cut out and glued in position, followed by the 3/16 in. x 1/16 in. stringers before the rear decking is sheeted with 1/16 in. medium soft balsa. The section between F1 and F2, F3 and F4 may also be sheeted at this stage, cutting small grooves to fit around the wires.

The 1/4 in. ply wing tongue is glued and screwed securely to the fuselage base, cutting away the lower longerons to accommodate it. If foot pedals are to be fitted, the rudder bars should be fixed before the subframe is glued finally in place.

The next stage is to assemble the undercarriage and then to bind and epoxy it to the reinforced underside of the fuselage - the front radius rods are likewise attached. The lower portion of the cowling between the upper and lower longerons is sheeted with 1/32 in. ply, fairing it into the upper sheeting, while 1/4 in. hard sheet balsa (cross grained) is added to the fuselage floor from the firewall to just behind the rear seat.

Fitting of all detail parts, such as oil tanks, opening doors, footholds, cockpit furnishings, etc., may be added during 'waiting time' while the flying surfaces are made.

Wing construction may seem laborious at first, but it is surprising how the repetitive work becomes fascinating! Cut-out ply or metal templates for the ribs and riblets, a separate template being placed on the ribs to mark the cut-away portions, which can be filled in after the wing is assembled, if found advisable.

Each panel is built in a similar fashion - start by pinning the leading and trailing edges, together with the tip piece, over the plan with appropriate packing

View of the designer's Tiger Moth which visitors to the Model Engineer Exhibition saw on the M.A.P. stand. Much interest was shown in this highly detailed model.

the distances from the wing tips to the rudder post and adjust with small packing pieces on the wing roots until both sides are alike. The spaces left in the wing roots can be readily filled with soft balsa.

The wing boxes can now be finally fixed - slide these on to their respective tongues, offer up the wings and then when all is correct glue home, adding short lengths of 3/16 in. square balsa to buttress the boxes against the ribs.

The free-flight enthusiast is recommended to cover the model using the 'silk on tissue' technique described by Eric Coates in the September, 1971, issue of *Aeromodeller*, while R/C types would do better to employ nylon, due to its greater strength. In either case, the fuselage may be tissue covered.

All final fittings, such as opening doors, tinplate engine cowling, and sundry other details, should now

to suit the camber of the underside of the ribs. Cut out the two spars and insert the ribs upon them loosely, without any glue. Pin the spars in position, again with suitable packing underneath, then position each rib accurately before applying a PVA glue to each joint. When dry, add the riblets to the top surface (two between each rib), allow the glue to dry once more, then remove from plan and add the single riblets between each rib on the underside. Carefully hinge the ailerons if the model is to be flown radio control, but glue them securely if the machine is destined for free-flight use. Complete by adding strut anchorage points and aileron linkages.

Tailplane features conventional construction and again the elevator should be hinged only if an R/C model is contemplated. Use thick aluminium 'hinges' for F/F models, so that the elevator may be adjusted for trim. The fin/rudder are equally conventional, and are designed to bolt to the tailplane, which, in turn, is bolted to the fuselage - see details on plan.

It is advisable to rig all four wing panels in position using dummy struts, then to glue the wing root ribs in position - noting at the same time the different dihedral angles of the upper and lower wings. The correct interplane struts can now be made and bolted to the tin clips. Bracing wires are added and securely epoxied in position. Where the interplane struts and the bracing wires emerge, glue card or balsa supports for the covering.

The upper wing roots will tend to sag at the trailing edge owing to the tension of the wires, hence a small length of 1/4 in. square balsa protrudes from the centre section wing root and suitably cut away in the wing root so that the wing root rests upon this projection. This is quite sufficient to cure this problem.

Correct, accurate rigging is most important, and it is a good idea to make plywood jigs on wooden bases cut out to receive the wing tips for rigging purposes. The designer used the concrete floor of his garage to set up the rigging operation, making off in chalk the various datum lines, and using lengths of 1/4 in. square wood to check the heights, etc. Measure

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be added before the model is finally ready for decorating.

Colour schemes for the Tiger are, of course, many and varied, but the modeller would be well advised to study both the *Aeromodeller* scale drawing 2681 (price 20p) and Profile Publication No. 132 for suitable ideas.

When completed and painted, fitted with four-function proportional R/C equipment plus engine, the original model weighed around 5 lb. and required no further ballasting as the C.G. worked out to be spot on. It may be remembered that full-size Tigers were generally nose heavy, the pilot occupying the rear seat when flying solo. This is a good point for scale models, as they so often finish up tail heavy, which requires a considerable amount of unwanted ballast to correct.

For transporting, the wings are readily detachable and it is suggested that end plates of ply or hardboard with small tongues are made to fit into the wing roots to keep the wings in their natural position and thus to relieve strain on the flying wires.