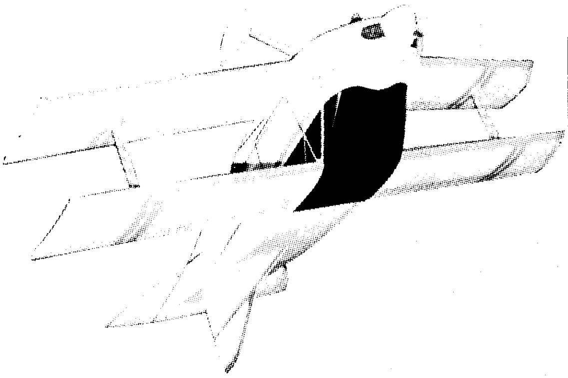
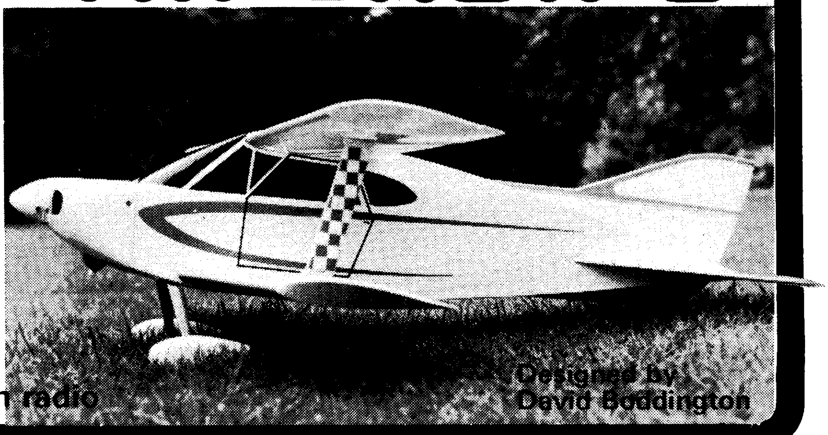
THE SORRELL SN7 HIPERBIPE





A 1/8th scale model for .20-.25cu.in engines and 4 function radio

Designed by David Boddington

IT IS SELDOM that a full size cabin biplane is designed with a full aerobatic capability as part of its specification but, the *Sorrell* 'Hiperbipe' (HIgh PERformance BIPlane) fulfils this requirement. Aircraft designed to perform flick manoeuvres, vertical rolls, lomecevaks and other advanced aerobatics, tend to be utilitarian, with the overall comfort of the pilot being a secondary consideration. Not so with the 'Hiperbipe'. The interior of the cabin is extremely well appointed with more than generous seating space for the pilot and his passenger, afforded by the extra wide fuselage. With a touring speed of 150mph, a stall speed below 50mph and ample power from the 180hp *Lycoming* engine for short take off's, this biplane really does combine the virtues of a high speed tourer and a sporting aerobatic aeroplane.

To achieve the high standard of specification, set by himself, the designer, Hobie Sorrell, introduced a number of features that, if not exactly unique, are not to be found on the average club aircraft. The fuselage was designed as a lifting body, hence the constant width, aerodynamically shaped, fuselage.

Negative stagger wing style, used so successfully on the *Beech* series of biplanes, assists in the upwards vision and the straight leading edge of the top wing gives a good reference for aerobatic manoeuvres. All four wings are fitted with full length 'flaperons' ie ailerons that are capable of being drooped to give flap effect, whilst retaining their use as ailerons. To incorporate so many unusual features, in such a unique design, would be outstanding in any circumstances, when one considers that this is also a genuine 'home build' aircraft the achievement become all the more amazing. There is no doubt that many 'Hiperbipes' will be constructed in the near future and this should offer the modeller more scope with regard to colour schemes. For modellers requiring additional information on this delightful little biplane — it only has a wing span of 22ft 10in — plan packs are available from the Aeromodeller Plans Service, PO Box 35, Bridge Street, Hemel Hempstead, Herts price 35p plus 10p postage. Quote Plan Pack No. 2990.

I must admit that, despite the obvious attractions of the 'Hiperbipe', the aircraft was not high on my list of priorities for modelling. The list was, as always, quite extensive and it was only through the continuous prompting of my son, Andrew, that I set to and started drawing. As there had already been .40 and .60 powered models of the aircraft designed I opted for a smaller, one eighth scale, design suitable for the popular .20cu.ins. engines. The hotter versions of this range of engines should give the model a sprightly performance in keeping with the prototype. No problems were encountered during the drawing up stage, but it was fairly obvious that the fuel tank and radio equipment would have to be positioned well forward to maintain the correct balance point. All up weight and wing loading — the same difference — is important with small models.

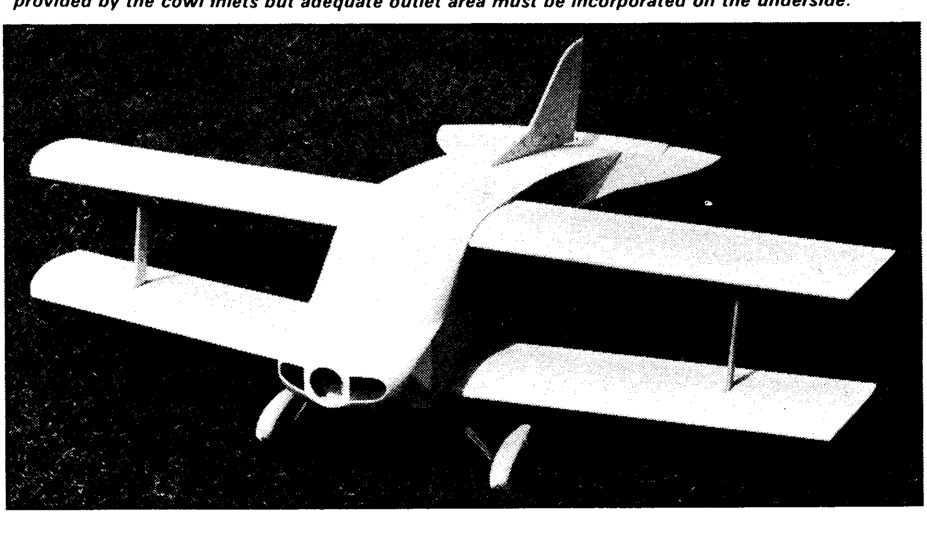
Ironically, the smaller a scale model becomes, the slower it must fly to give a *scale* impression. Conversely, the smaller the scale of the model, the harder it is to achieve the low wing loading necessary for good slow flight characteristics. The weight of the radio control equipment remains as a constant and the weight of the power unit is not proportional to its capacity. We must, therefore, keep a close eye on the construction of the model — selecting balsa wood densities with care — and the finishes. It is very tempting to go 'overboard' with the finishes on a model of the *Hiperbipe* type but restraint is necessary. The prototype model was covered with heat shrink white film and trimmed with *'Fablon'* turquoise self-adhesive plastic. Total weight less fuel, was 3lb 5oz.

Wing construction features a built-up, fully sheeted, structure and, because of the narrow chord, no main spar is included. Ailerons are only fitted on the top wing to simplify the control installation and the flaperon feature of the original aircraft is not reproduced. It would be possible to use foam wings but, if you decide to use this method, keep them as light as possible by using balsawood skinning. Wing interplane struts are housed into semi-circular cut-outs in wing ribs and require no other fixing, they will 'knock out' in the event of a hard landing. Windows to the cabin area are not glazed but painted black, or covered with black plastic. Glazing the windscreen and cabin windows may be feasible, as the fuselage sides are reinforced with .8mm plywood, but, you are on your own if you decide to do this — it will need some modifications to former F3 and the top wing fixing. A glass fibre cowl was used on the original model, formed from a balsa plug and female glass fibre mould. For modellers not wishing to produce their own glass fibre, or balsawood and plywood, cowl a stout vacuum formed plastic cowl can be supplied for a cost of 90p plus 35p post and packing. Available from *D.B. Models,* 3 East Street, Irchester, Northants NN9 7BG.

With the small ground clearance, when wheel spats are fitted, the model is more suitable for operation from tarmac or paved strips, unless hand launches are attempted. For the average club flying field conditions, it would be wise to dispense with the spats (no doubt some of the full size aircraft will do likewise), but this does detract from the sleek appearance of the model.

Ideally, the spats should be formed from glass fibre and a method of producing these, using silicone rubber moulds will be described in part two of the constructional article. Before you commence construction of the model, you should work out the radio equipment installation and the engine and

Fully sheeted construction of the Hiperbipe is well illustrated here, careful selection of balsawood is necessary to keep the overall weight of the model down to a reasonable level. Ample engine cooling is provided by the cowl inlets but adequate outlet area must be incorporated on the underside.



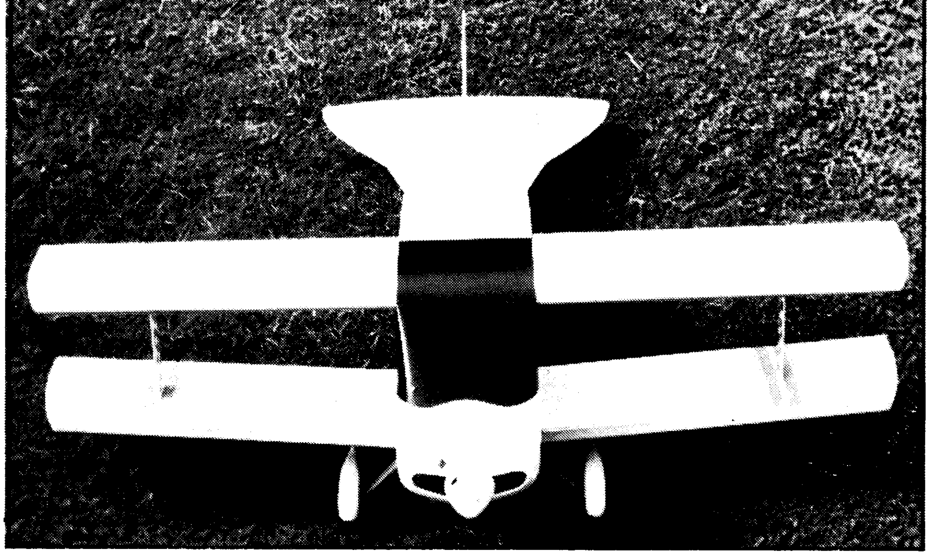
silencer arrangements. The servo and battery positions are suggested on the plans, the spacing is for *Futaba 16M* servos, but there is ample room for the installation of any modern radio equipment. Access through the wing housings is sufficient, but the bearers for the servos should be pre-drilled before fitting. You may have to fit the fuel tank (*Sullivan* 4oz used) before gluing the front bearer in position, although it should be possible to slip the tank in afterwards. Do a dry run with the bearer temporarily positioned to check. An *O.P.S. 21* R/C front induction motor was used originally, and the bearer spacings are shown for this engine, you may have to adjust the bearers to suit your choice of engine. There is insufficient room in the cowl to fit a standard 'torpedo' silencer and a 'dumpy' silencer must be fitted if scale appearances are to be maintained. Whether this is mounted direct to the engine or, via an exhaust manifold, to a remote mounted silencer will depend on the type of engine and silencer used. (*K & C* '20' size dumpy silencer and manifold used on ours). The area under the fuel tank, between formers F1 and F2, could be used as part of the space for the silencer if this is advantageous.

Construction

Building will be much more pleasureable if all the balsawood and plywood parts are cut out before commencing building. There is nothing more frustrating than reaching an interesting stage of construction only to have to break off to cut some additional parts. Be precise with your cutting and assembly will be quick and painless. If you cut accurately and the parts still don't fit, blame the draughtsman! Apart from contact adhesive for the doublers, PVA glue was used for nearly all construction, but the model is small enough to consider the use of cyanoacrylate adhesives — particularly the slightly thicker types with a marginally slower setting time.

Fuselage

Join the two sheets of medium grade (reasonably light but 'stringy') 3/32in x 3in balsawood; a 24in length is just sufficient if this is available. Cut to the shape indicated by the arrows on the drawing, note that there is *no* cut out for the tailplane, the tailplane halves are butt jointed to the fuselage sides. Glue the 0.8mm doublers to the fuselage outsides noting that the doublers do not extend quite to the front of the sides. This is to allow for housing the cowl. Add the internal 3/32in and 3/16in balsawood doublers and the 4mm plywood undercarriage leg, and plate doublers. There is an additional 1/8in balsa vertical support, glued to the lower engine



Wheel spats can be fabricated from balsawood and plywood or from glassfibre. Ailerons are fitted to the top wing only although the full size aircraft uses 'flaperons' on both wings.

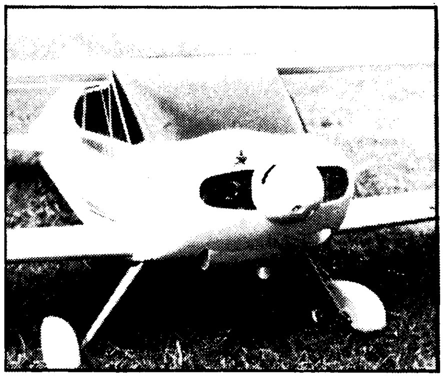
bearer and F1, but this is not fitted until the bearers are in place. The 1/16in square balsawood vertical stiffeners are also added, together with the 1/8in x 3/8in servo bearer supports. Make up former F6 from 3/16 x 1/2in hard balsa strip and chamfer the edges to contour with the fuselage sides. Join the fuselage sides by gluing formers F1 to F6 in their respective positions plus the 3/8in square horizontal stern piece. A slow drying glue is recommended for this operation to allow ample time to get the assembly square. Hold in position with pins and masking tape until thoroughly set. Epoxy (slow drying) the engine bearers in position and, when set, position and drill for the engine mounting bolts. The prototype full size aircraft had a reasonable gap between the spinner and the front of the cowl so we do not have to think in terms of a 'five thou' clearance in this instance. Construction of the remainder of the fuselage is straightforward but the following points should be borne in mind:

a. It will be easier to locate the position of the wing retaining dowels if these are marked onto the wing through the holes in formers F3 and F4 ie the wings should be constructed and temporarily positioned *before* the windscreen block and fuselage rear underside sheeting are fitted.

b. The lower wing fixing bolt bracket is a shortened version of the standard Micro Mold bracket.

c. The 1/16in sq. side stringers are glued to the basic sides and sanded down to the 0.8mm plywood doubler at the front and to fair in with the fuselage at the rear.

d. Don't sand the 1in block windscreen to

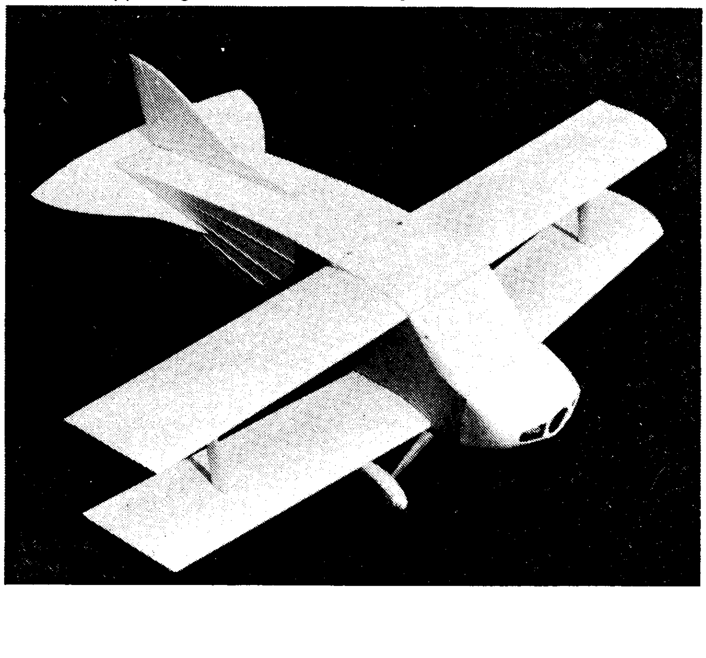


shape until the cowl is fitted, so that the compound curvature of the top of the cowl can be matched by the windscreen. Protect the cowl with masking tape during shaping.

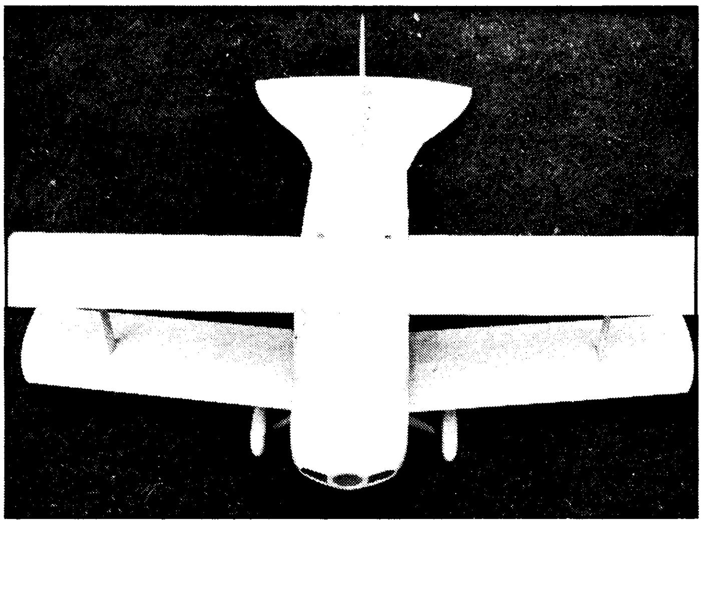
e. Fuel proof the interior of the fuel bay area with glass fibre resin — fuel tanks have been known to leak before now!

The method of fitting the cowl to the front of the fuselage was well described in David Vaughan's article on his P51 Mustang in the December 1979 issue of R.C.M.&E. (Page 1167) so I won't bother to repeat it. Although the air inlets are quite adequate in the cowl, don't forget to allow ample cooling air outlet area on the underside of the cowl. It may be necessary to incorporate a baffle in the cowl to direct the air over the cylinder; and prevent it routing direct from the inlet to outlet positions.

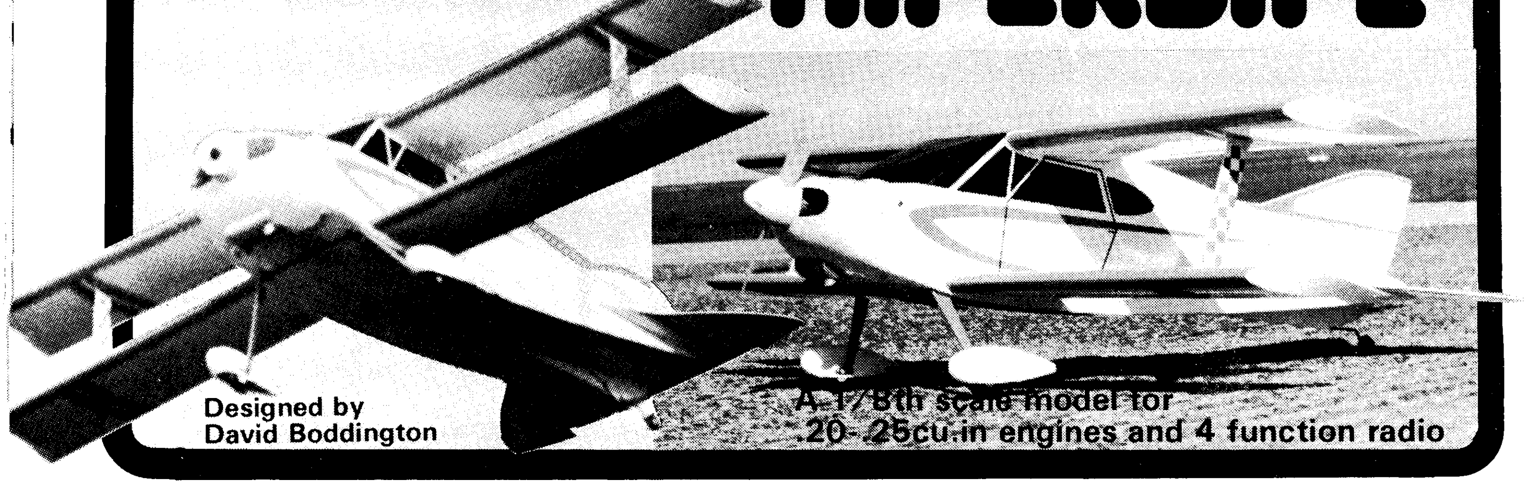
In the next part we will deal with the construction of the wings, tail surfaces radio installation, finishing and flying. By all means cut the fuselage parts out, and join the sides, but I would suggest waiting for the second part of the plan and instructions before proceeding further — don't worry there will be plenty of good flying days left.



Note that the .8mm plywood doublers are positioned on the outside of the fuselage and the 1/16in.sq. stringers are faired into them, and the fuselage sides at the rear.



THE SORRELL SNS7 HIPERBIPE



Designed by David Boddington

A 1/8th scale model for .20-.25cu.in engines and 4 function radio

CUT THE WING RIBS to the shapes shown on the plan, using the sandwich method or by cutting around a template. Note that ribs for the top wing centre section include the top fuselage fairing. The fairing below the centre section of the lower wing is added after construction of the wing (to allow the wing to be constructed flat on the building board). Pack up the $\frac{1}{4} \times \frac{1}{2}$in. leading edge by $\frac{5}{16}$in. off the building board, the $\frac{3}{32}$in.sq. sub leading edge — for location of the ribs — should be first glued to the LE. The $\frac{1}{8} \times \frac{5}{16}$in. rear spar is pinned direct to the board but the rear end of the ribs are packed up by $\frac{1}{16}$in. Construction of the lower and top wings is in three sections although the top wing features a continuous leading edge and rear spar for increased strength. Butt joint the lower wing sections together, blocking up the tips by $\frac{5}{16}$in. to give the correct dihedral angle.

Reinforce the butt joints with $\frac{5}{8}$in. wide bandage epoxied in position — $\frac{1}{16} \times 4$in. balsa sheet, medium grade, is used to cover the top and lower surfaces of the wings.

On the lower surface of the wing the $\frac{1}{16}$in. sheeting stops at the tip rib and the underside of the top sheeting is reinforced with .4mm plywood. The covering will then follow the same line from the underside of the tip rib to the wing tip as featured on the original aircraft. Construct the aileron horns from threaded rods (bicycle spokes) fitting a clevis, with one arm removed, to act as the horn. Space the bearers fitted to the underside of the top wing centre section to suit the servo used.

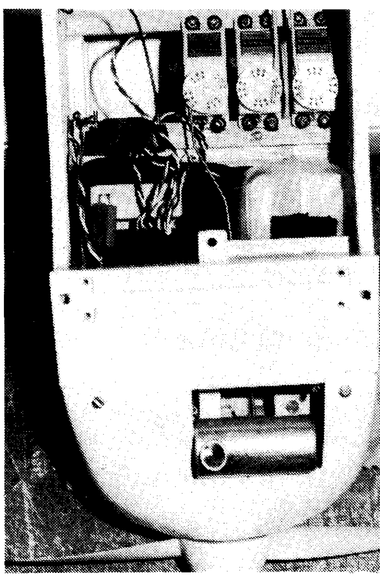
The ailerons and lower wing trailing edge can be from $\frac{1}{4} \times \frac{3}{4}$in. trailing edge stock or rectangular stock planed down. Cut away the $\frac{1}{16}$in. sheeting on the top centre above R3 and the lower centre below R4, to expose the interplane strut housings.

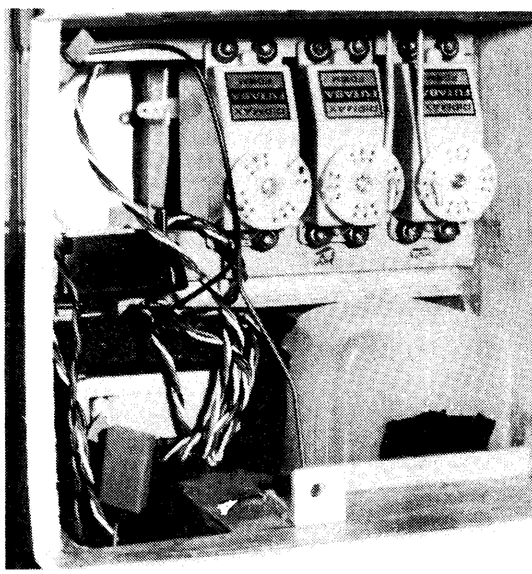
It is advisable to mark, with a soft pencil — not ballpoint pen, the alignment of ribs, R3 and R4 onto the leading and trailing edges before the sheeting is fixed. When the wings have been completed and sanded, position them on the fuselage and mark for the position of the wing dowels. $\frac{1}{8}$in. dia. aluminium alloy rod is the best material to use for the dowels but birch dowel will suffice if it is strengthened by applying cyanocrylate adhesive. Reinforcement is also required at the wing fixing bolt positions, the rear lower sheeting to the top wing is 1.5mm plywood.

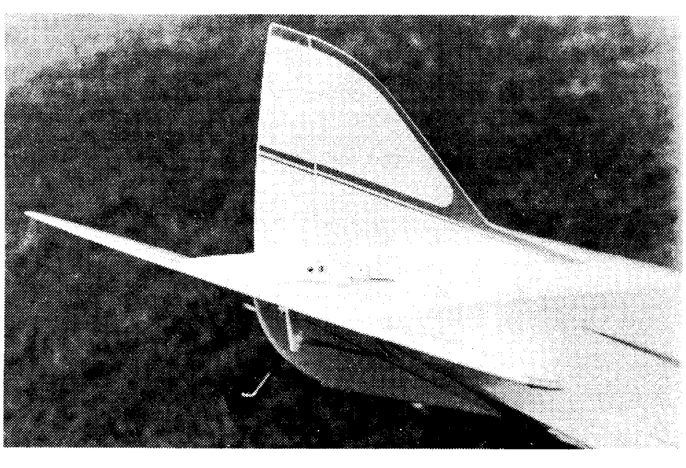
Tail surfaces

These are all cut from medium grade $\frac{3}{16} \times 4$in. balsawood with the leading edges rounded and the trailing edges of the rudder, elevator and tailplane tapered to about $\frac{1}{32}$in. thickness. Construction of the sub fin is from a central core of $\frac{1}{8}$in. balsawood, cut to house the tailwheel leg, with .8mm plywood facing on each side.

Glue the $\frac{3}{16}$in. long pieces of 18g aluminium tube to the fin and tailplane for the bracing wires. Cover the tail surfaces and fit hinges before gluing to the fuselage — this should also be covered first. Where heat shrink film is used for covering, the film must be removed over the contact area of the tail surfaces to the fuselage to obtain a good glue joint. Pin and support the tail surfaces during the glue setting period and check, from all angles, that the surfaces are all square. When the glue has set, the bracing wires (nylon covered fishing trace line) can be applied. Correctly tensioned, the bracing will add considerably to the rigidity of the tail structure. Secure one end, by a knot, through a hole adjacent to the tailwheel leg; take the line up through the tubing in the tailplane, up to the fin, down to the opposite side of the tailplane and back to be secured through the hole in the sub fin. As you tension the line ensure that it is not pulling the tail surfaces out of square and, when you are satisfied that the alignment is correct, secure the rigging at all points with a touch of cyanoa-crylate adhesive.







There is ample room in the spacious fuselage of the "Hiperbipe" to neatly install all of the radio equipment, as shown in the photographs above. Switch and charging sockets positions are a matter of choice, select to be as unobstrusive as possible. Tail surface control linkages, on the photograph left, are easiest when using pushrods - the rudder connection should incorporate a ball link.

Undercarriage

Fixing the undercarriage to the fuselage is by the well established system of locating slots in plywood doublers, and metal saddles screwed to the underside plywood plate. You may have to make up the saddles from sheet metal, although it should be possible to modify commercial items to suit. U/C leg fairings have a habit of coming adrift after a few landings and this can be prevented by wrapping the fairings, and piano wire leg, with nylon for better security.

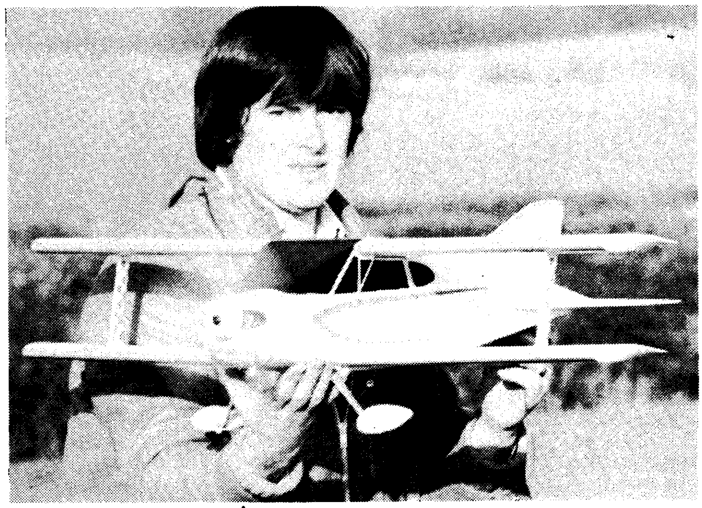
As promised in the last article I will describe a simple method of making moulds for the wheels spats. Carve a plug for the spat from two, lengthwise, pieces of hard balsawood, spot cemented together, to the thickness required to house the wheel to be used. Obtain a good finish to the surface by doping, filling and sanding — it does not have to be a perfect mirror finish. Split the plug carefully and glue the halves to a piece of *Formica*, or similar, about 7 × 6in. size. Form a 'barrier' around the perimeter of the *Formica* with ⅛ × 1in. timber, glued to the surface. Treat the exposed surface of the plug halves with a dry silicone spray, if this is available, or a PVA release agent. Squeeze silicone rubber (the type used as bath sealants etc.) over the plugs and build up a thickness of about ⅛in. When this has cured, the surrounding *Formica* is greased with petroleum jelly and the 'box' is filled with plaster; shaking the box after the plaster has been poured in to remove any air bubbles. Remove the base and plugs from the plaster, when it has set, and your mould will be ready for use. Because of the 'non-stick' properties of silicone, the moulds may be easily removed from the plaster backing and there should be no problems with the GRP moulding adhering to the mould. I will not describe the methods of laying up the GRP moulding as this has been covered previously but, the spats are small and, therefore, do not require the use of heavy materials. This method can be used for producing moulds of any reasonably sized GRP item and the plaster backing gives the advantage of stability during the moulding process. *Slight* undercuts can be incorporated, providing the silicone is built up to a thickness to eliminate the undercut on the outside surface. The silicone mould, and GRP moulding, can then be removed from the plaster and the silicone 'peeled' away from the mould.

Attachments of the spats, whether GRP or wood, is by a metal plate soldered (silver soldering preferred) to the U/C leg. Small self-tapping screws are fixed through the mounting holes to the spat — reinforce the interior for GRP spats.

Covering

Because the 'Hiperbipe' is a relatively small model the weight of the covering and finish must be kept within reasonable bounds. Tissue covering, doping and a light sprayed finish would be acceptable but, heat shrink plastic film would seem to be an obvious material use for this model. I have no doubt that most builders of this model will have their own 'pet' finishing methods so I will not labour the point.

If you use 'Fablon' or 'Contact' self-adhesive plastic for the windows you will probably encounter some difficulties in covering the compound curvature of the front screen. It will be necessary to slit the material, overlap it, cut through the centre of the overlap, peel away the excess pieces and join the edges again, to give a neat joint. Do *not* attempt this operation until the material has been fitted for a week or two as some natural shrinkage will take place, and you don't want gaps forming between the joints.



David Toyer prepares to hand launch the "Hiperbipe" on its first test flight, always an anxious moment for the builder, designer and launcher. As can be seen from the photographs on this page, the spinner nose section flew off just prior to the initial flights - spoils the appearance but the photo' session had to take priority.

Radio installation

Servo positions have been arranged to allow for virtually straight runs of the elevator and rudder positions, and the throttle linkage. Use pushrods, in preference to 'snakes,' as these will give neater linkages to the tail surfaces. A ball link connector is used at the rudder horn, to cope with the sweep back of the rudder hinge line. Mount the switch remotely, on former F2 or F3, using double sided servo tape to secure it to the face of the former. A piece of thin piano wire, protruding through the fuselage side and bent at a right angle, actuates the switch.

Finding a position for the charging socket is the only problem! If it is externally mounted and moulded in black plastic, the cabin glazed area is probably the least obstrusive position.

Flying

All the normal warnings apply i.e. C/G position, warps, suitable weather, radio operation, proficient pilot etc., etc. The prototype balanced slightly nose heavy — supported at the leading edge of the top wing it was a little nose down. With no suitable take off area available on the mornings of the test flight (fine for a change!) we had no option but to handlaunch the 'Hiperbipe.' There is always that nagging feeling that the model may climb excessively from the launch, stall, and drop a wing so. I was not perturbed by the forward C/G. I think the most nervous member of the party was Andrew — having spent many hours making the model — but he was given the camera, to make a pictorial record of whatever might happen. We need not have worried, as the diminutive biplane went away smoothly and, apart from a fair amount of 'up' required, straight. The rate at which it climbed up and away, at less than full throttle, quickly proved the *OPS 21* to be more than amply powerful. Later in the flight this view was reinforced by putting the model through a few vertical manoeuvres.

Roll rate is high *providing* the speed is maintained, ailerons become less effective at slower speeds. Trim the model out correctly for ailerons and rudder — I was doing corkscrew loops initially because of incorrect trimming. A good speed range is possible with the 'Hiperbipe' and there is no sign of a wing tip stall as the model is slowed down for landing. Control responses are positive and carrying out slow, low passes for the camera were in no way fraught with misgivings. For normal sports flying any reasonable .19 or suitable but, to emulate the full size prototype, select a hot '20' or '21.' A 9 × 4in. nylon propeller was used for test flights — the spinner nose flew off just before launch!

Control movements, measured at the trailing edges, were as follows:

Rudder, 0.5in. each way; ailerons, 0.2in. each way and elevator 0.4in. each way.

The latter movement could probably be reduced, with the balance point as indicated on the plan. That only leaves me to wish you all success with the 'Hiperbipe' and to remind you that we should be interested in seeing some photographs of *your* model.