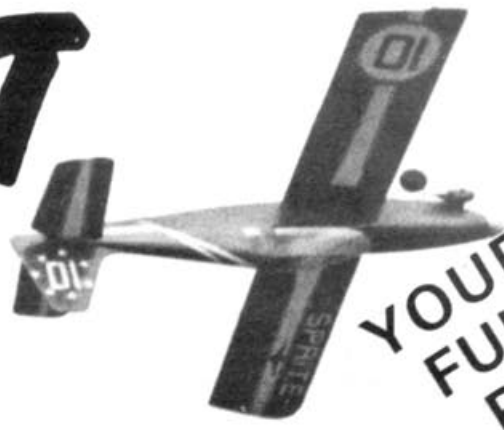
SPIRIT



YOUR SUMMER FULL-SIZE PLAN MODEL

A COMPACT SPORT AEROBATIC MODEL FOR .19 to .25 cu.in. MOTORS

BY RICHARD SPREADBURY

THE SPIRIT IS THE RESULT of a set of requirements that I drew up early last year, for a model of (or less than) 42in. span, easy and cheap to build, capable of being powered by an *HB* .25 and have a good aerobatic performance.

Being a painfully slow, intermittent builder, the prototype took nearly a month to complete. When I had flown and trimmed it, I set about exploring its flying characteristics. To say the least, I was pleased. It did everything I expected it to, and more.

The prototype, however was fairly short lived as, on its 76th flight (I log the lot!) it collided almost head on with another powered model, the result being the most spectacular explosion of balsa and *Solarfilm* I've ever seen! Anyway, I was impressed enough by that model to build another. This one took me three weeks. It's still flying, some seven months later, and it's this model that this feature is based upon.

Construction

I always start the process by getting together a kit of parts including obtaining the spinner, canopy, horns, hinges, etc., etc., and by cutting all the parts possible, like ribs, fuselage sides, doublers, u/c blocks, tail surfaces, etc., and I find this method much easier than obtaining and cutting according to demand.

To get to the part that matters — starting with the fuselage, take the two basic sides of ⅛in. sheet and bond the front and rear doublers to them, making one left and one right side. Mark the positions of F2 to 5 on both sides and glue F2 and 3 to one of them. When dry, position the other side and glue at points F2 and 3, ensuring symmetry with the other side. Allow this assembly to dry well before bringing the tail together to join at its extreme. Fit F4 and 5 making sure that the fuselage remains straight. If a steerable noseleg is to be fitted it would be best to drill F1 to suit at this stage, as it would be to mark the centre lines and drill for the engine mount. Next, glue in F1 with epoxy adhesive, again being careful to maintain the straightness of the assembly. The action of drawing the sides together for fitment of this former will give the fuselage its smooth curved shape. If a steerable leg mounted on the back of F1 is to be used, bolt it on now, then sheet the tank bay floor, finally adding the triangular section fillets. (It's very important to make a firm job of the fillet between the sides and the back of F1.) The remainder of the construction is pretty basic; add the deckings, tail surfaces and fillets and sand to shape. Remember to make the tank bay hatch removable. Bolt the engine and mount in position on F1, complete with the prop. and spinner, and glue the three pieces of ⅜in. soft sheet, which, when carved and sanded, form the cowl. The bottom rear fuselage sheeting is left off until the control system has been installed so all that remains is to bolt on the wing bolt anchor nuts, paint or *Solarfilm* the interior of the cockpit area, mount the pilot (he is *essential* to the good appearance of any model) and bond the canopy in place.

Wing Construction

Construction is really self explanatory but these few pointers may help.

The wing panels are built inverted over the plan, the flatness and squareness of the ribs being ensured by the ¼in. sq. 'jig strip' and a square. Don't forget to angle the root rib, *of one panel only* to 3° and remember that the panel is inverted when you do this. Use medium grade sheet over the leading edge portion and medium to hard for the trailing edge section. The ailerons are cut from the basic wing structure, the L.E. webs being added when the ailerons have been cut to suit. The wings are joined using epoxy glue and, after the dowel has been put in and servo area cut out, reinforce the centre section with fibreglass. (I use two layers of medium grade fibreglass tissue, top and bottom.) Be careful when mounting the ailerons to ensure the gap between them and the wing is kept to an absolute minimum, that the aerofoil section is maintained and that the centre line of the horn holes corresponds with that of the hinge line. I mounted the aileron servo on its side, lying in the centre section of the wing, and I used snakes to the bellcranks and 16swg rods to the aileron horns. Add the tip blocks and carve them to shape, add the capping strips and finally sand everything smooth ready for covering.

Radio Installation

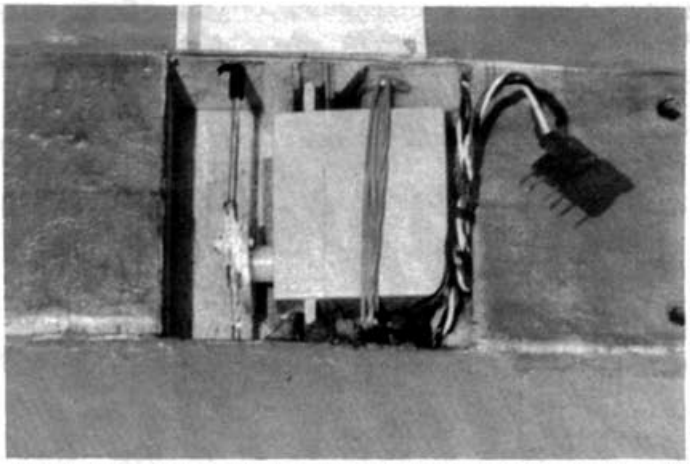
With a bit of forethought and careful organisation there can be a lot of room in the centre of the fuselage for the radio gear. The main problem for me was where to stow the deac and I got round that problem by utilising my 'made up' 500mAH flat pack which sits snugly on top of the fuel tank — foam packed to give it a smooth ride! This arrangement also helps out with the CG location. The receiver sits in a foam 'cell' just behind F2 with the three servos and switch mounted aft of that on a duralumin tray. I used *Bowden* cable snakes throughout with metal clevises on all points except for the steerable noseleg (both ends) and the throttle arm on the engine, these three being small 'snap links' which, incidentally, act as servo savers on the noseleg, shearing off instead of damaging the servo.

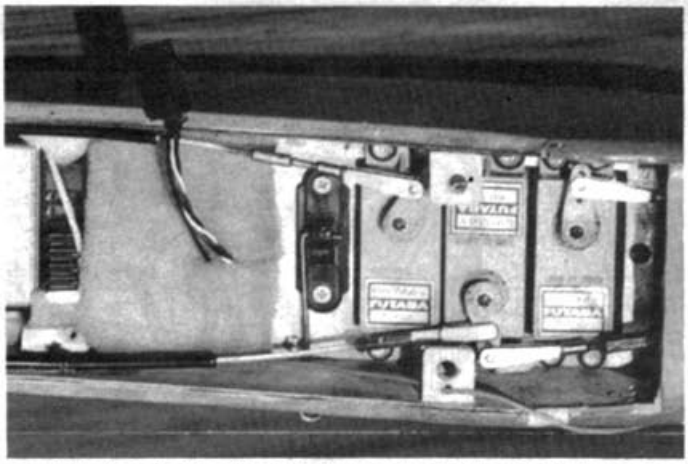
To start with, I would recommend that the control throws be set up as per plan. I think it worth noting at this point that continued reliability of the control system, therefore the consistent reliability of accurate controlled flight, is very heavily dependant on how the control system is initially installed and periodically maintained, and it's with this in mind that I take extra care over controls — at all stages in the model's life.

Hints and Tips

The fuel tank bay is short and to get a tank of sufficient capacity means mods to that tank and what I did was to buy a *SLEC* 4oz. clear plastic (round) tank and cut the blank end clean off, about ¼in. up the actual 'tube'. My method of ensuring a square cut was to mark ¼in. up the tank at four equal spaces, then wind a length of 1in. masking tape round the tank, the edges corresponding to the marks. This gives a straight line to cut to, and, by pure coincidence, I found that the best amount to cut out of the length of the tank was about 1in. so a clean, straight cut was made the other side of the tape, this portion being discarded. The blank end was then placed back on the end of the tank and 'tacked on' in four places, with the soldering iron, then, each segment was sealed carefully with the, not too hot, iron. Over the join and for about 1in. up the tank length I smeared a thin layer of silicone bath tub sealant. When this had dried all day, I filled it with fuel and left it overnight. It didn't leak and it hasn't since. The reduction in length by 1in. reduces the capacity to about 3oz. — this, with my *HB* .25 gives about 7mins. of air time.

I would recommend the use of tip skids on the wings — pieces of ⅛in. ply wood are adequate for this task. It saves scuffing the wing on an awkward landing.





Above left; aileron servo held in cradle by rubber band. **Bowden** *cables used from servo to bellcranks, then piano wire links to ailerons. Above right; three servos mounted on dural tray above wing fixing brackets. Servo on left operates throttle, centre servo rudder and steerable nosewheel, right servo works elevator.* **Bowden** *cables used throughout.*

Utilising heat shrink film covering, I found it beneficial to cover the tail surfaces and hinge them completely before I attached them to the model.

Don't be tempted to leave the tail skid off, it is used a fair bit!

Finishing Off

This is a matter of personal choice and mine was to use heat shrink film on both my models, adhering the trim with solvent and fuel proofing over the edges to seal them. When I covered the mainplane I made a point of covering the gap between the ailerons and mainplane, thereby, in effect, eliminating it altogether.

Models of this sort deserve a colour scheme complimentary to their nature and this gives rise to justified flamboyancy, as suited to our tastes, although we mustn't overdo it!

I find, when finishing a model, that it's the little things that either make it look good, or just like another model. Things like accurate lettering, dead straight trim lines, transfers mounted accurately and squarely, acceptible colour combinations for the trim, and a host of other seemingly obscure details which, when combined, make or break the appearance of the model.

Flying (the interesting bit!)

With the CG checked and positioned as shown and with the control deflections as shown, commence the air test:

Air testing both my own examples was an uneventful performance in as much that the models both flew 'comfortably' and with only minimal changes to the trim. In both cases the model accelerated down the runway like a rocket, a touch of right rudder was needed to maintain a straight track and a touch of elevator saw it airborne. On both my models, lateral trim to the right was needed and a little down elevator to maintain straight and level flight.(A consistent fault with either my building or my building board!) The stall, with the engine idling is announced by a gentle drop of the nose. Control response at all speeds (except when on the stall) is good. I like my aileron response to be a touch slower than most other flyers in my club, so the deflection shown on the plan may be insufficient for other flyers" needs. The elevator and rudder response with the deflections shown is very positive. Because of its streamlined shape the rate of speed decay 'deadstick' is very slow — it keeps coming!

I suppose I'm naturally biased but I think it an easy plane to fly, with no apparent vices.

Aerobatics

Aerobatics are virtually unlimited with this little machine. Inverted flight needs a little constant down elevator and spin recovery, upright or inverted, sometimes needs opposite rudder. Snaps are fast and with the rudder being so effective, the exit attitude of the model can be judged with a fair degree of accuracy. Really slow rolls are no trouble and vertical manoeuvres are quite easy to perform due to the low rate of speed decay and adequate power available with the '25'. However, the manoeuvre that I like to perform most of all with this model is knife edge flight, which it does perfectly. To many onlookers this manoeuvre is unspectacular but to me, it's pure magic. If performed directly into, or down wind, the model needs virtually no correction to maintain a dead straight track with its nose held high! It knifes best when banked right — the engine helping it out.

With the high power available and the streamlined shape of this model, there can be no excuse for flying it in any other than the smooth manner that it's capable of. It will fly on a .20, with a corresponding drop in performance. A fellow club member who built an *HB* .20 powered version (admittedly the engine was 'tired') assures me that it was like flying a low wing trainer type. (He flies model so I couldn't try it for myself). He did however have the CG well forward and a small amount of washout in the wing. (I don't consider that washout on this mainplane would be of any advantage as neither of my examples have shown any wing dropping tendencies.)

Summary

Besides my own, there are three examples of this aircraft currently flying, their owners, all experienced fliers, seem very satisfied with them. I have enjoyed flying both my own examples, they've helped me learn a fair bit about aerobatics and, indeed, flying in general. It's 'comfortable' to fly, at the same time precise, It's cheap to build and run, I think it looks good and it fits into my *Fiesta* completely rigged ready for flight. In other words, it fits in with my requirements — does it fit in with any of yours?

Below left; motor installation showing **HB** *25 used in original. Note external steering arm for noseleg. Below, right; Richard poses with the second prototype, and shows compact size of the model.*