



Forward swept wing designs are coming to the fore with full size fighter aircraft. Malcolm Saunders is right up-to-date with his 'Firebrand' model. See also Model of the Month for another exciting Saunders design.



FSW-5 FIREBRAND

'40'-'60' power - 57in. wingspan - four function radio - guaranteed excitement from Malcolm Saunders brilliant new design

FIREBRAND IS THE FIFTH in a series of Forward Swept Wing models I have built and is a direct development from FSW-2 and FSW-3 which appeared in RCM&E March 1981.

The aerodynamic advantages of swept forward wings, mainly good slow flying characteristics and high wing efficiency, have been known for a long time in full size aeronautical circles but difficult to apply in practice due to the high twisting loads that can be experienced in flight, demanding a very stiff wing. However just as new materials and building techniques are permitting full size aircraft manufacturers to look again at Forward Swept Wings for use in fighter aircraft of the 1990's so the introduction of foam core wings for models has provided an easy to make and very rigid wing ideally suited to model Forward Swept Wing application.

The original Firebrand was powered by an Enya 45 which provided ample power, so any 40 two-stroke should be suitable, or if you must fit a 60 then I suggest you shorten the nose by at least 1in. to lessen the need for ballast in the tail.

Construction

As the wing is required during final stages of fuselage construction it is worth thinking about the wing first. If like me you do not fancy your chances at cutting the foam cores yourself you can take advantage of our special offer for foam wings — as advertised in the caption adjacent to the plan. Either way it is best to get the wings on order first.

The wing is a standard foam veneered covered wing with balsa leading and trailing edges, joined with epoxy and reinforced with glass fibre bandage.

Wing halves are assembled with the top surfaces flat. The ailerons are top hinged at the covering stage using Solartex or Solarfilm as the hinge. The ailerons on the original were worked via torque rods let in to the top surface of the wing, but bellcrank and pushrod operation can be used if preferred.

Fin

The fin will also be required before the fuselage can be completed so might as well be constructed next.

The fin has to carry all the flight loads exerted by the all moving tailplane so the fin must be strong. Start by cutting the mainspar and false leading edge from pine, beech or similar 'hard' wood, assemble into an 'A' frame using the balsa components as shown in the photograph. Carefully drill the hole to take the tailplane pivot rod, this should be a nice tight push fit, then fit the tailplane snake before completing the tail by fitting the $\frac{1}{16}$ th balsa sheet. Do not add the soft balsa leading edge at this stage but put the fin on one side while you build and fit the tailplane.

Tailplane

The tailplane is built as one piece and then cut in two parts when complete.

Construction starts with assembly of the brass tube and laminated balsa mainspar.

The leading and trailing edges are assembled over the plan raised up on packing carefully arranged to overlap on the inside so as to provide a ledge on which the lower rib strips can rest. Once the lower rib strips are cut and put in place, the main spar is pinned down to the building board bending the lower ribs into shape, and the whole assembly is well glued with white glue.

The top wingribs are then glued in place bending each to a suitable curve to come flush with the top surface of the leading and trailing edge and pinning while the glue dries.

Once dry the tailplane is removed from the building board and the wingtip blocks fitted. The whole structure is then carved and sanded to shape, before being divided into two halves by cutting with a razor saw or hacksaw, after which 0.5mm ply root ribs may be fitted.

Tailplane assembly

Control of the all moving tailplane is by a steel rod let into the leading edge of the tailplane, on which a short length of brass tube is free to revolve. A $\frac{1}{2}$ in. long 6BA countersunk screw is bound and soldered to the brass tube and the threaded end screwed into the end of the tailplane snake.



Mean and magnificent - ready for action!

From the plan, draw a horizontal line on the fin through the tailplane pivot point, assemble the tailplane to the fin, connect up the control snake and check that the tailplane has free movement $\frac{1}{2}$ in. either side of the horizontal line when measured at the trailing edge.

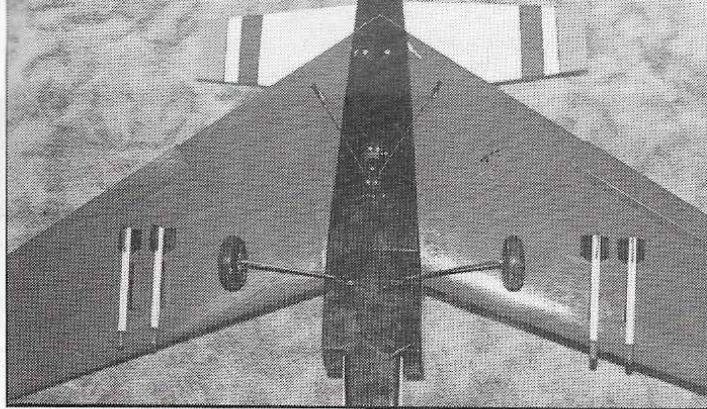
When everything is satisfactory the balsa block leading edge may be cut and glued in position on the fin, and the fin finished off ready for assembly to the fuselage. Check again for free movement of the tailplane.

Fuselage and final assembly

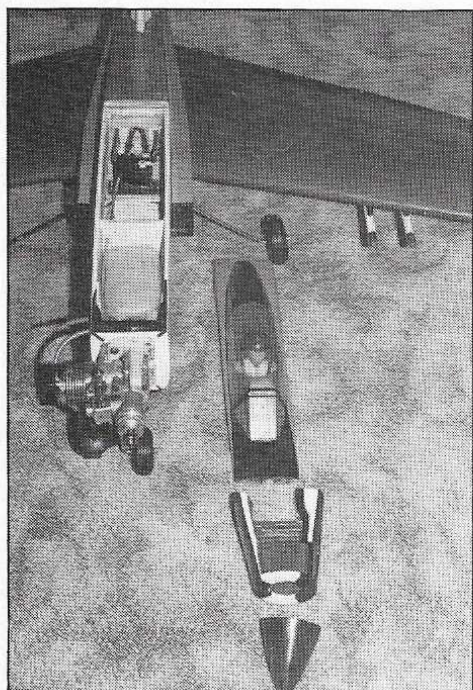
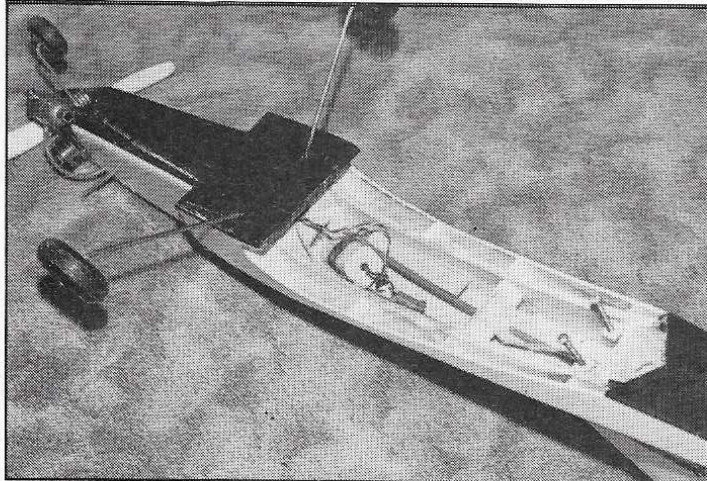
Start by cutting out fuselage sides and ply doublers and glue together.

Cut formers F1, F2, F3 and F4. Drill F1 to suit nylon or similar type engine mount of the type that can locate and clamp the front wheel nose leg.

Cut the hole in F3 to allow the control snakes and radio leads to pass through, bend the undercarriage and lightly epoxy in place on



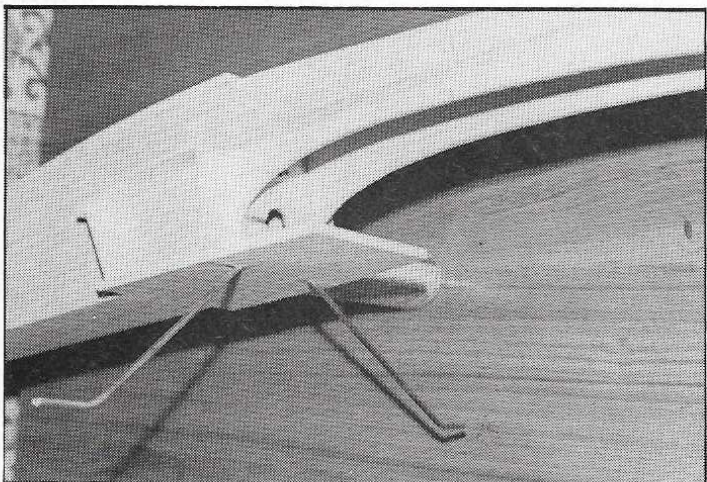
Detail of aileron torque rod operation. Wing bolts onto underside of fuselage. Rockets attached by Velcro.



Fuselage wing bay showing position of nicad, normally wrapped in foam.

Easy access to engine, fuel tank and radio. Cowl and hatch retained with woodscrews.

Fuselage ready for wing attachment to assist in fitting 'air intakes.'



F3, when the epoxy is dry it is an easy job to drill $\frac{3}{32}$ in. holes either side of the undercarriage wire and bind firmly to F3 with thread.

Assemble the fuselage sides to F1, F2, F3 and F4, cut and fit bottom sheet from F1 to the wing.

Cut and fit the top sheeting and internal supports forming the dummy air intakes. Cut out the side sheeting for the air intakes slightly oversize and offer up for final fitting and gluing to the fuselage with the wings held in position.

Before sheeting the top of the fuselage mark where the fin hardwood leading edge and main spar come in relation to the fuselage, cut suitable size $\frac{1}{4}$ in. balsa formers to fit the fuselage at the points marked, and glue the fin and balsa formers in position. Take great care to check the fin is vertical and that the horizontal line drawn earlier on the fin is parallel to the datum line of the main wing and fuselage.

Reinforce the balsa formers holding the fin with $\frac{1}{4}$ in. gussets where they attach to the fuselage.

Balsa sheet may now be glued to the top of the fuselage from F3 to the tail.

The top sheeting on the fuselage between F1 and F3 forms a removeable hatch made from two layers of quarter inch sheet glued together, the bottom layer locating inside the fuselage and the top layer overlapping the sides. In order to get the sheet to bend to the top contour it may be necessary to cut saw slots across the sheet to assist cracking the wood to a curve and then filling the saw slots before final sanding to shape after gluing the two sheets together in position on the fuselage, use a sheet of plastic cling film to protect the fuselage from glue and act as a separator between the hatch being glued and the rest of the fuselage.

The engine cowl is started by first masking off the air intake and exhaust to prevent entry of sanding dust later, then fit the engine in position on the engine mount and bolt to the front of the fuselage.

Cut a round $\frac{1}{8}$ in. ply former to the same size as the spinner to be used, cut a clearance hole in the middle to allow it to fit easily over the crankshaft of the engine, glue to a piece of $\frac{1}{8}$ in. balsa and drill a centre hole in the balsa to be a good fit on the propeller shaft. Assemble the ply and balsa assembly on the propeller shaft with the ply former nearest the engine.

Cut some $\frac{1}{4}$ in. balsa strip about $\frac{3}{8}$ in. wide and proceed to plank in the space between the round ply front former and the fuselage former F1. Cut planking to fit around the engine and needle valve assembly as required, when dry sand complete fuselage and engine cowl to final shape, carefully detach the engine cowl from F1, remove balsa former and first lamination of ply from the engine cowl former, this will give clearance to the propeller when it is fitted later.

Relocate the engine cowl and drill small screw holes through the cowl into the engine mount. Retain the engine cowl with small countersunk wood screws.

Drill holes in F1 to take the fuselage hatch locating dowels and drill holes for the hatch retaining screws in F3.

Radio installation

The throttle, elevator and rudder servos are mounted on a ply plate just in front of F3, and connector by flexible snakes to relevant controls. The receiver is located underneath the servos, while the nicad is located in the wing bay just behind F3.

The aileron servo is let into the underside of the wing and connected by exposed pushrods to torque rod ends protruding out of the bottom of the wing.

Finishing and covering

The original was given a coat of Balsarite and covered in Solatex, then painted with Humbrol Enamel and fuel proofed with Tufkote. However Firebrand lends itself to most finishes such as tissue and paint nylon, or Solarfilm whichever takes your fancy, but try to aim for an all-up flying weight of under 6lb.

Flying

If, like me, you read the introduction and then skip the building instructions to see what is said about flying, well that's all right, but please if you decide to build then do please read the instructions as some points of assembly may not take the order you might expect, enough said, on with the flying.

Check the centre of gravity is where marked on the plan for first flights, I'll have more to say about altering the centre of gravity later, but please start with it as marked.

Check tailplane movement is in the correct sense and has $\frac{1}{2}$ in. movement above and below the neutral position when measured at the trailing edge.

Rudder movement is 1.0in. either side of centre measured at the trailing edge.

Aileron movement is $\frac{1}{4}$ in. up and $\frac{3}{16}$ in. down measured at the

trailing edge.

The original had an all-up weight of 5lb 12oz and needed no ballast.

Firebrand is easy to fly requiring little aileron but some elevator to turn, rudder is not very effective but then, it is only used for stall turns which Firebrand does well.

Inside loops and inverted flight are no problem, but a hot 40 will be required to do outside loops, the Enya 45 being a bit marginal on power for this manoeuvre.

Rolls need care to keep axial as the long nose exaggerates any over control on the elevator.

The stall with the centre of gravity where shown is a non-event being very gentle and of course straight with no hint of wingtip stalling thanks to the forward swept wing. It is possible to fly Firebrand around on low throttle and full up elevator with the aeroplane just nodding its head gently as it nudges the stall while being directionally steerable using aileron.

With the centre of gravity further back, past experience would indicate that a flat spin should be possible or even a flick inside loop when the centre section of the wing stalls before the forward raked wingtips, both are interesting manoeuvres to explore by just moving the centre of gravity back about 1in., but not for the faint-hearted.

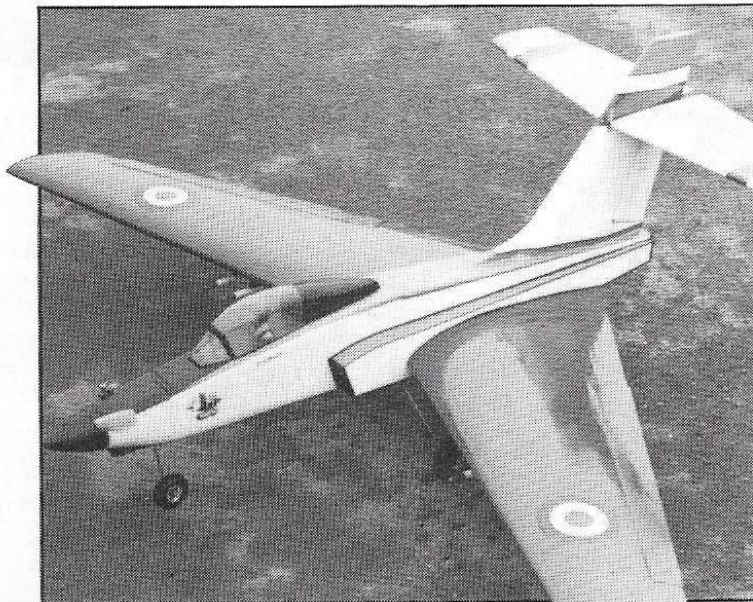
Moving the centre of gravity forward tends for nose-heaviness and less axial rolls, while the stall may be unobtainable, true spins are difficult with the centre of gravity in the forward position and usually are more of a spiral dive.

However it is when landing that Firebrand shows itself to be not just another sports aeroplane, due to the swept forward wings, aileron control for direction control is available right down to and during the stall, so landing approaches can be slow nose high affairs with no fear of tip stalling or having to change to rudder to pick up a wingtip near the stall, Firebrand can be eased back on the stick to make a main wheel landing that is a Firebrand special.

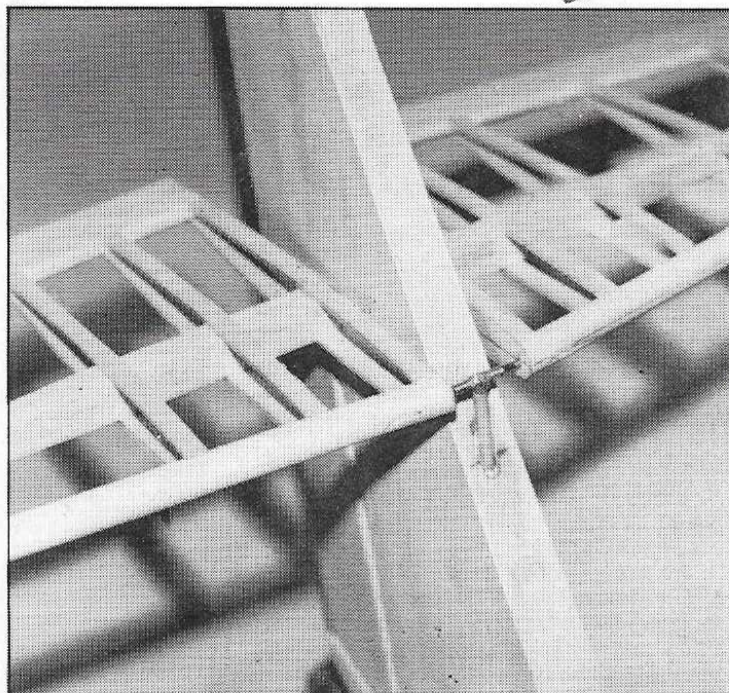
To sum up, if you can fly a low wing aileron trainer you are ready for Firebrand.

Underwing rockets

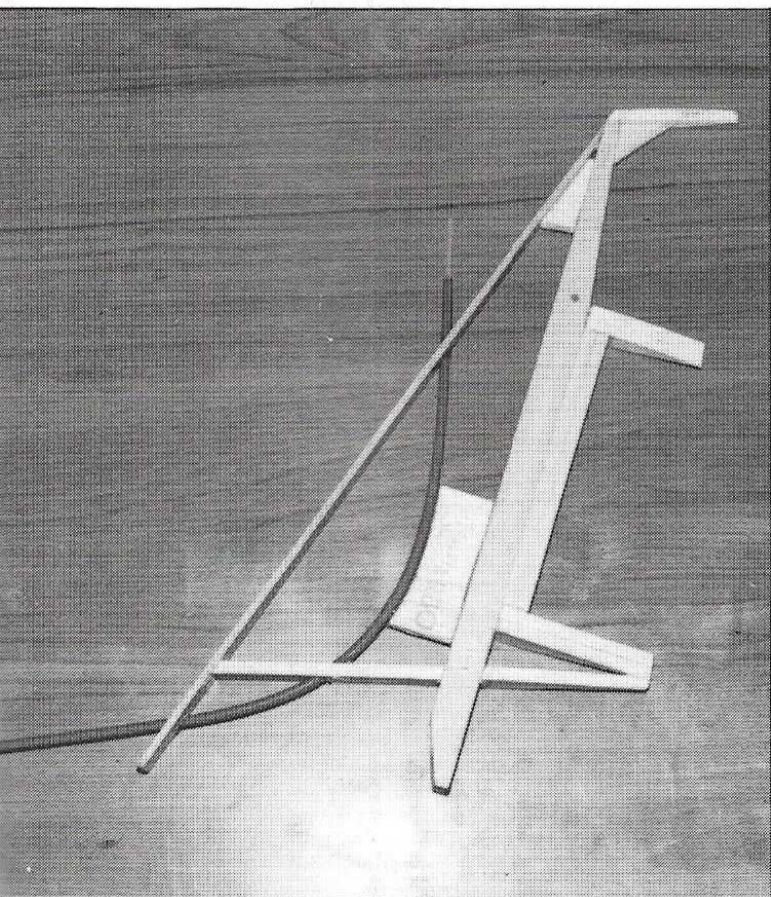
The rockets are for looks only but very simple to make from balsa dowel with 0.5mm ply or cardboard fins, the trick is to attach them to the wing using Velcro so that they can pull off without damage when knocked getting the wing in and out of the car.



Ready-to-go - a '60' engine will take the model at a frighteningly high speed.



Tailplane detail. Note: brass tube, free to rotate on steel joining pin, has 6BA screw soldered to it for 'snake' attachment.



Above: note tailplane operating snake fitted before covering with balsa sheet and hole drilled to fit tailplane pivot rod. Rudder cut free after covering with balsa. Right: packing under leading and trailing edge to allow for bend in lower rip strips which only touch the building board at the main spar location.

