MEGA PLAN 1 Freebird

Sleek, sporting lines really make Freebird stand out on a busy flight line. The curvaceous fuselage is specially designed to minimise wood wastage.

Freebird was designed during a period of convalesence after a fairly major operation. My normal approach of hack away with a balsa knife and design it as you go along was not possible. The handywork of someone else with a sharp knife had seen to that. This was probably quite a good thing as it gave me much more time to think about what I wanted from this new design.

Midmounted plug in wings and a glider style all moving tail appealed for a change. With these features I decided to build in some shape to the fuselage, without having to invest in half a rain forest to achieve it.

Thus Freebird was conceived. Powered by a 0.40 two stroke, it's racey lines, spirited flight performance complement well with what has turned out to be a thoroughly practical and pleasing model to fly.

Fuselage construction

The shape of the fuselage is mainly created by bending 1/8in balsa sheet around the main formers and not by using huge section balsa block, most of which ends up on the work shop floor.

The accuracy of the fuselage starts, most importantly, with the assembly F2, F3 and doublers D1. Before the assembly is glued, I used cyno for this, sandwich the two D1's together and pre-drill the five holes. This saves a lot of aggravation later on.

Cut the fuselage sides from well matched 1/8in balsa medium sheeting, choosing pieces that will bend easily across the grain.

The fuselage sides are firmly glued to D1. When dry they can be coerced around F2 and F3, some cyno and accelerator makes this job very easy. Please note the actual shape of the fuselage side sheet is larger than the side elevation on the plan. This is because it has to bend around F1, F2, F3 and a little bit of F4. The dotted line on the plan shows approximately the extra material required.

Next add F1, again bend the fuselage side around the curved section. Sand the lower sheet to form a flat on the bottom of formers F1, F2, F3 and F4, then add the 1/4in balsa bottom sheet and carve to a pleasing round shape similar to one shown on the plan. Now laminate F1 with good quality 1/16in ply, shown as F1A on the plan.

The fuselage doublers, D2 and D3 are added next. I found that contact adhesive coped best with the curved part on the lower part of F3.

Follow this by adding formers F4-F6. The balsa immediately behind F3 won't like this too much so a little heat or steam may be necessary.

Add the 3/16sq longeron and sheet the upper turtle deck with 3/32in sheet. This is probably the hardest part as care is needed, especially around F6.

By now you should have the beginnings of a light weight, pleasingly shaped fuselage, hopefully inspiring you to push on with the model.

At this stage it's better not to add the bottom sheeting, or the block between F1-F2 as access for control runs is needed. Fuel tank and engine installation is also made much easier.

Fin and tailplane

The fin is made from a core of 1/4in balsa covered with 1/16in balsa either side.

Note the 1/4in core is two pieces of balsa, the grain direction is the same as the 1/16in sheet except for the stern post.

The all moving tail is moved by a snake embedded in the 1/4in balsa core. The best way to achieve this is to start with a 1/16in side, add the 1.4in core, epoxy in the snake outer and finish the assembly with the second 1/16in sheet.

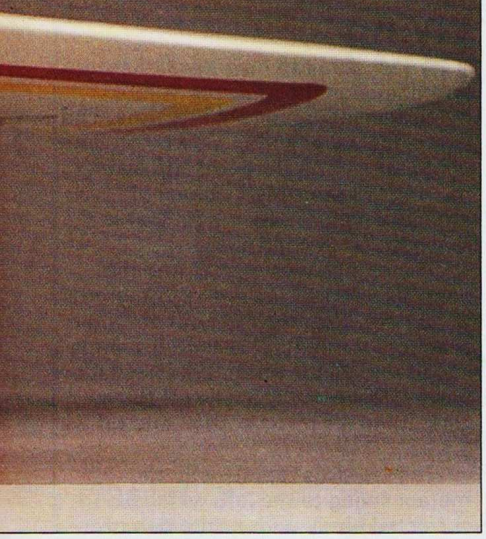
Finally inlay some 1/16in ply sheet around the pivot point and sand the complete assembly to that shown on the plan.

The rudder is made from 3/8in sheet, again sand to section on plan.

The complete fin can now be offered on to the fuselage. Some trimming of D2 is required to achieve a really snug fit. Before the fin is glued onto the fuselage suitable holes need to be drilled into F3, F4 and F5 so that the snake outer can be supported. This is important as a nice slop free elevator linkage has to be achieved.

The all moving tail plane is a very basic structure comprising 3/8in med

Brush off your building board and start building this stylish .40 size sports model from our free pull out Mega-Plan, designed by Terry Eato



balsa, faced with a 1/16in ply root rib. Epoxy the 10swg brass tube onto the 1/8in ply support. The forward 14swg brass tube is added after the ply root rib has been added. Details of how to achieve removable tailplane halves is shown on the plan. If your transport problems are not acute enough to need this feature then the tailplane halves can be epoxied in place after the finish has been applied.

Bend the main undercarriage from 8 swg piano wire. In order to get the bent wire on to F2 it will be necessary to create two small slots around the wire exit points. The piano wire is sandwiched by the two F2A formers which have to be thoroughly bonded into place with slow setting epoxy. Finally fill the slots with scrap balsa and sand to the fuselage profile.

The engine can be mounted in any position; my original had it side mounted. It could, however, have been at any angle from upright to inverted.

Whichever angle you choose, bolt the engine to an engine mount, preferably made from aluminium. Then secure the mount to the fire wall with bolts and blind nuts. This is a good time to add the fuel tank, sort the plumbing out and install the throttle linkage.

The cowl is made from 1/2in balsa sheet faced by 1/16in ply formers F1B and F1C. I find it best to install the engine minus the silencer, but with spinner and prop, blocking of any orifices that balsa dust could get into with masking tape.

Attach F1C to the spinner and down F1B to the fire wall. Now epoxy 1/2in sheet balsa between the two formers. The general idea is to form a balsa wall between the two formers; carve the outer surface to the general form shown on the plan. It may be necessary to add some internal 1/2in square block to thicken some of the thinner areas. Carve the outside to the general form shown on the plan so that the cowl can be removed. It will be necessary to hollow out the inside and make some extra cutouts for the silencer and needle valve.

Cowl retension is by two self tappers screwed into the 1/4in dowel location pins.

Removable canopy

The canopy is framed with 1/16in ply, the forward part is keyed with an 1/8in diameter dowel. The rear part of the frame extends down and has two small 16swg wires bonded so that they locate in suitable holes drilled in D1. The canopy is removed by simply squeezing the rear frame which disengages the protruding wires. This method of canopy retension is so simple and far better than rubber bands or wire locking pins. I am really quite pleased with this idea.

Wings

The plan shows details of both built-up wings or balsa/veneer covered foam wings.

Before we get onto the detail of wing building I must comment on the type of wing joiner employed. It consists of a single 12in long, 8mm diameter carbon fibre rod. Don't be put off by this as it is perfectly up to the job and both the rod and close fitting brass tube are available at a modest cost from Gliders, 81 Victoria Rd, Netherfield, Nottingham, NG4 2NN. Tel: 0602 870243.

The built-up ones first:

The wing is best built upside down. Pin the 1/8in x 1/4in spruce upper spar down, add the ribs, making sure R1 is kept perpendicular to the building board. Add the bottom spar, 1/2in leading edge sheet, the 3/16in false trailing edge, together with the 3/4in x 1/4in trailing edge.

3/32in and 1/16in webbing is added next, noting that the grain direction is vertical. Before removing from the board add the 1/16in sheet skin and capping strips, allow to dry thoroughly.

At this stage it's probably best to get the second wing panel to the same state of construction as the first.

The 8mm diameter brass wing joining tube, 1/4in location dowels and over size root facing rib need to be assembled dry onto the wing halves. The partly completed wing can now be offered on to the fuselage.

Any small inaccuracies can be tweaked out leaving you with both root ribs snugly fitting the fuselage sides. When you are happy with the alignment glue the complete assembly with slow setting epoxy, ensuring that you can still unplug the wings when the adhesive has done its job.

Finally add the webbing around the brass tube; use plenty of epoxy in this area.

Finish the wing with the 1/16in sheet top skin and cap strips. Add the 1/2in balsa tip block and sand to the shape shown on the plan. The ailerons are made from 3/4in balsa which are best tacked into place and then planed to shape. I know that 3/4in sheet is an indulgence and a good part of the material ends up on the floor, but the benefits in appearance and flying are well worth it.

Each wing half has it's own aileron servo. These are installed between ribs R4-R5 where there is plenty of room for a standard servo and no servo extension lead is required either. With the servo in this position a short and very positive linkage to the aileron is possible.

Glider style plug-in wings make Freebird easy to transport. A high strength carbon fibre wing joiner soaks up the flight loads.

DATAFILE

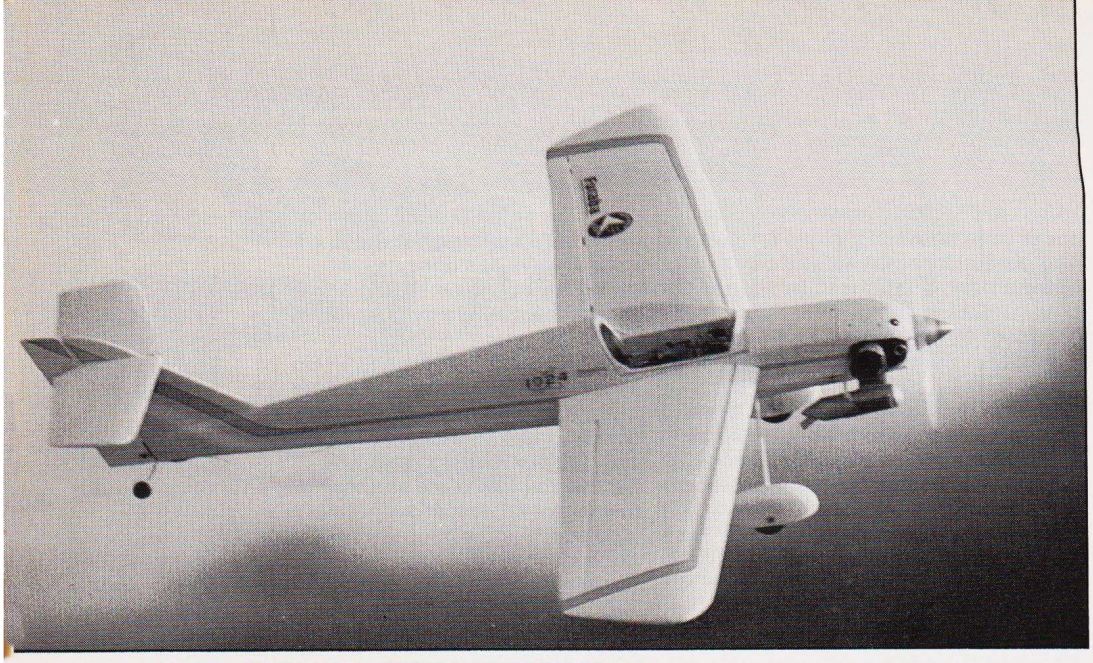
FREEBIRD

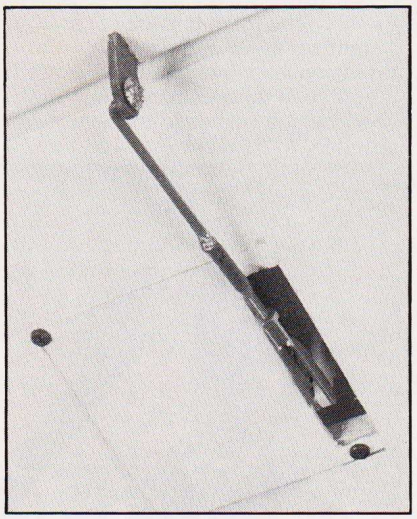
Plan Specifications

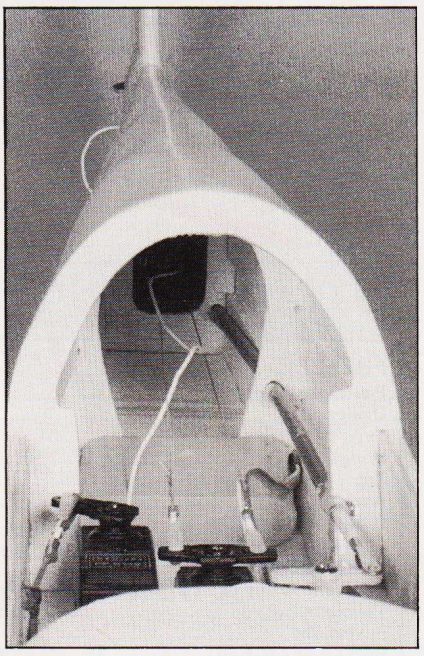
Designed By	Terry Eato
Type of Aircraft	Sport Aerobatic
Wingspan	53 inches
Total Wing Area	430 inches^2
Aerofoil	O/D symmetrical
Dihedral at each tip	None
Fuselage Length	44 inches
Tailplane Span	8.25 inches
Tailplane Area	75 inches^2
Tailplane Section	O/D semi symmetrical
Fin Height	8 inches
Rec. Engine Range	0.40-0.46 two stroke
Fuel Tank Size	8ozs
Rec No of Channels	4
Control Functions	Aileron/Elevator/Rudder/Throttle

Materials used in Construction

Fuselage	Balsa/ply
Wing	Built up or foam and veneer
Tail Surfaces	Balsa
Weight Ready to Fly	4.5-5.5lbs
Wing Loading	24-29oz. sq. ft.







Above: Freebird's attractive design is shown to good effect during a low fly-past (photo by Gary Barlow). Right: Wing mounted servos keep the ailerons slop free – makes installation easy too! Below: Interior view of fuselage shows construction details; make sure that the elevator snake is well supported.

The second option is to use foam wings for your Freebird.

If you cut your own then root and tip templates are shown on the plan. if you don't then I am sure one of the very good wing manufacturers will be able to help.

Being a 'grow your own type', I used 3/32in balsa wing skins, sanded to approximately 1/16in at the tip, to produce a very strong and lightweight wing. Normal foam veneer wings are perfectly adequate. It is, however, imperative with any foam wing that the wing joining assembly is adequately integrated into the structure.

The brass tube is first sewn onto the 1/8in ply joiner and the balsa stiffner added. Bond this assembly with slow setting epoxy.

Very carefully cut the wing joiner shape from the foam wing. It is important to achieve a really good fit as the strength of this joint is critical.

Using some masking tape, dry assemble the 1/16in ply root ribs, 1/4in location dowels and wing joiner assemblies and plug them onto the fuselage.

Again any small inaccuracies can be sorted out, the aim is to have the root ribs flat against the fuselage sides. When you are happy the wing is aligned correctly then the dry assemblies can be bonded together using slow setting epoxy. The aileron shape is the same as the built-up version. When cut out, face the edges with 1/4in balsa and sand to shape.

The aileron servos, one in each wing, are located in cutouts on the underside of the wing. The holes for the servo leads can be produced quite easily with a hot piece of piano wire.

If you have opted for veneer covered wings and intend to pull lots of those high G turns then it may be a good idea to consider a cuff of lightweight glass cloth in order to strengthen the wing joiner assembly.

The wings are retained by two cup hooks with two or three elastic bands pulling them together.

One final note about the wing method. I have been warned to watch that the ends of the brass tubes are rounded so that no scoring of the carbon rod can take place. Apparently the stress raising effect of a notch on this material can seriously reduce its strength.

Radio installation

Very conventional here, a servo tray for the elevator, rudder and throttle servos is shown on the plan. The aileron servos are wing mounted and can be driven via a Y lead or for those with more sophisticated radio sets, separate channels. There is plenty of room for the receiver and nicad pack.

Covering

The original used traditional tissue, dope and cellulose spray for the fuselage with iron on film for the rest of the model. The choice of covering type is yours. What ever you use beware of adding too much weight.

Flying

I must admit to having a little more apprehension than normal before flying this model for the first time. The two piece wing, joined only by an 8mm diameter carbon fibre rod and an all moving tail prompted visions of structural failure or a model that is a real handful to control.

The engine was started and the controls checked yet again. The model taxied out, steering very well for a tail dragger I thought. The model swings round into wind, a moments hesitation while I check that the take off run is clear, then it's throttle open and off we go.

The tail rises rapidly with the merest swing to the left, which is corrected easily with a little dab of rudder. After a short run Freebird leaves the ground and climbs quickly, the OS SF 40 hauls the model into a rock steady climb out.

The first few turns showed the model to be well balanced with the elevator and aileron response nicely harmonized, only needing a little down trim to fly straight and level.

My fears over the responsiveness or otherwise of the all moving tail were unfounded, in fact it seems very smooth, maybe because it operates above the turbulent air created by the wing.

The model is capable of the usual sport type of aerobatics. Rolls are quite axial, about one per second. Inside and outside loops are not a problem, with no tendency to screw out. With the control throws shown on the plan flick rolls and fully developed spins are a treat, stopping immediately the sticks are centred.

Inverted flight is no problem, a nice run a few feet above the middle of the runway was achieved on it's first flight.

High G turns in windy and very turbulent conditions have convinced me that the carbon fibre wing joiner is more than adequate for the job.

The model, because of it's shape, is probably a little more slippery than most. This has to be taken into consideration when landing. It helps if you throttle back early on the down wind leg, making those six foot fly bys after you have called "landing" less likely.

Enjoy building your *free* Freebird plan. It's certainly been an interesting and rewarding experience for me.