Light Fighter

Dave's 'Light Fighter' squadron now includes twin, float and biplane versions. Our plan is for the single engine glow and electric versions, as well as a slope soaring glider.

Here's details of a versatile little 40" sporster that can be built in a variety of different configurations. Dave Philpotts explains what's different about his multi-mode design...

My interest in electric flight began some seven or eight years ago when I decided to take up aero-modelling again after a break of about twenty five years. In those days most of my models were 'fly-by-wire' (lightweight Laystrate!) so radio control was to be a new experience.

Not being able to fly didn't prevent me from buying a Humming Bird 20 motor, which the man in the model shop said was equivalent to a .20 size glow motor (I was naive enough to believe him). So armed with a motor, a handful of the wrong sort of nicads, some balsa sticks and a few feet of covering, I built myself something which looked like a Blackburn Monoplane.

I never got more than an extended glide from that model - nor did anyone who could fly either! After about two years of messing about, I decided to do the sensible thing and join a club. I went through the protracted experience of learning to fly (and land) using a variety of slope soarers, plus a Tinker Biplane with an 0S 10 bolted to what might arguably be called the sharp end.

I would never claim to have mastered the art of flying R/C models, but I felt sufficiently confident to believe I was ready for another crack at electric power.

P is for Prototype

By now I was reading the model magazines and seeing what everyone else was doing. I couldn't help but be impressed by what was happening in the scale world, four-engined heavies and the like, but my interest was now leaning towards aerobatics and this type of model, by contrast, seemed to be not nearly so advanced.

Most models of this type seemed to follow the same basic layout. They would have fairly high aspect ratio wings, a flat bottomed aerofoil section and a rather simple angular shaped fuselage. The reasons for this were pretty obvious - everything was done to build a lightweight model that would be efficient enough lug a heavy battery around on very limited power.

Whether models had to follow this format, or not, was impossible to determine - such fundamental information as weight and duration was rarely given, even in specialised articles.

Faced with a desire to design my own model, I had but two choices:

1. To follow established practice and design a model that I could be sure would fly, or...

2. To do my own thing and to design a model which I couldn't be sure wouldn't fly!

I decided to go the second route and set myself three targets:

a) The model should look something like a real aeroplane.
b) It should have a symmetrical wing section which would allow negative manoeuvres.
c) It should be capable of taking off from grass

The model was called 'Polar Bird', an appropriate sounding name borrowed from a racehorse. Polar Bird did fly and, up to a point, did what it was supposed to do, but with a weight of 48 ozs and 330 sq. ins. of wing, the wing loading was such that it needed to fly fast to fly at all, and if it were turned too tightly or fell out of manoeuvre, stability would only be regained after it had hit the ground.

An assessment of the situation suggested that a lighter version was not only desirable, but possible, so it was back to the drawing board for a second attempt. I also decided that the new design would be capable of being adapted for glow power and also slope soaring.

E is for Electric

The new design had the same wing area as 'Polar Bird', but the section was thinner to reduce drag, increase speed and therefore increase the lift. The rudder area was increased to enable stall turns to be performed and the ailerons were enlarged to improve the roll rate when slope soaring. An Astro 035 cobalt motor replaced the Kyosho 360PT and the power for the avionics was tapped from the flight battery. The latter two modifications, plus numerous changes in construction techniques, were to reduce the weight to 38 ozs.

The complete airframe, fully covered and ready for all the hardware, weighed just 10 ozs, so light compared to its size that it seemed to float upwards of its own accord when I put my hand underneath to lift it.

The light weight, in conjunction with its fighter-like appearance, made the name 'Lightfighter' an obvious choice.

It would have been nice to say that the new model was an instant success, but it would not have been the truth. The problem was that the club's flying site is not smooth and the Astro's armature shaft is not hardened. I won't dwell on this matter, but one of them had to go and flying sites are hard to come by!

What to replace it with? The 360PT used in Polar Bird had more than sufficient power, but being a 550 size motor the greater weight would have pushed the G.G. too far forward. The question then became which of the enormous selection of 540 motors would be sufficiently light and powerful to fly Lightfighter in the manner intended.

I would like to say that I carefully analysed all the technical information on 540 size motors and made my decision accordingly. What technical information? Reading through one manufacturer's catalogue, the descriptive text suggested that any of their range of motors would be absolutely ideal for any application I might have in mind!

I had a lucky break. A clubmate (Christchurch & District M.F.C.) offered me a Ripmax 'Spirit 600' to try. This motor had originally been bought for use in a rather angular looking kit-built model, with high aspect ratio, flat-bottomed wings and subsequently rejected on the grounds of insufficient umph. However, I was using an extra (7th) cell and it would have been rude to refuse the offer, so I accepted.

I discovered two things. Firstly, that at 5.5 ozs the Spirit was only 0.25 ozs heavier than the Astro - I had expected a bigger difference. Secondly, that if you screw a Spirit 600 onto the front of a Lightfighter and then open the throttle, the prop will cut the tops off the bumps on the runway, mow the occasional clump of grass and still have enough power in reserve to haul the model into the air!

Once airborne, the Lightfighter showed itself to be capable of performing loops, bunts, horizontal eights, cuban eights, stall turns, in fact almost any manoeuvre not requiring brute power, e.g. vertical eights and square loops.

The running time was surprisingly long at 6 minutes using a 7 cell pack of Sanyo 1200's. The propeller used was a Graupner 7x4 power prop and the static thrust 17 ozs. You can buy a Spirit 600 from around £10, which is about one fifth the price of a cobalt motor.

Finally, no article about electric models would ever be complete without some mention of the receiver battery. I don't use one! I use an F.E.T. throttle unit with a low voltage cut-out in conjunction with a B.E.C. chip and wouldn't dream of doing it any other way on this type of model.

It took a while to get things properly sorted out, but eventually the decision to do my own thing was justified by the result. Lightfighter can be regarded first and foremost as an acrobatic model, which just happens to be electric powered.

G is for Glow power

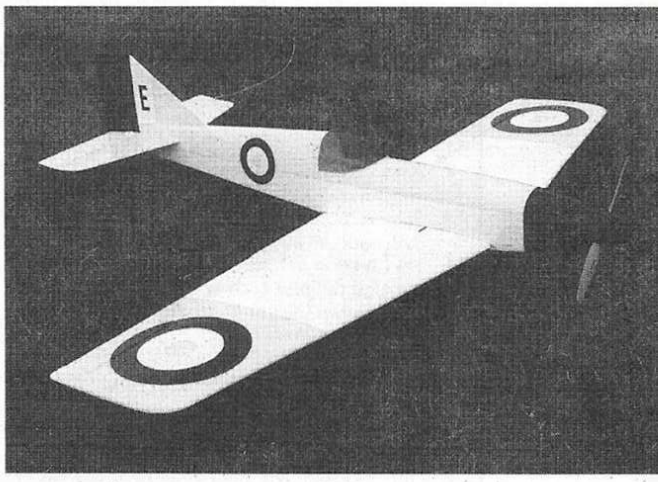
The development work on this model was easy - just a matter of changing the prop from 7x4 to 7x5, or 7x6, and that was it.

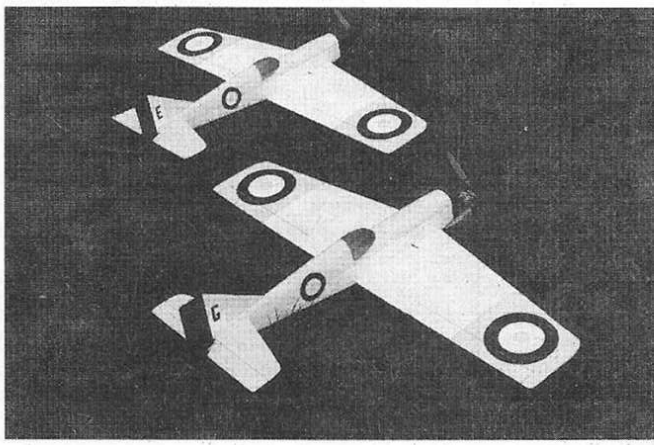
As far as performance goes, it takes over from where the electric variant left off. The weight of only 25ozs and a static thrust of something in excess of that figure means that vertical eights, square loops and knife-edge flight are all possible, although the latter manoeuvre is not within my personal repertoire - yet!

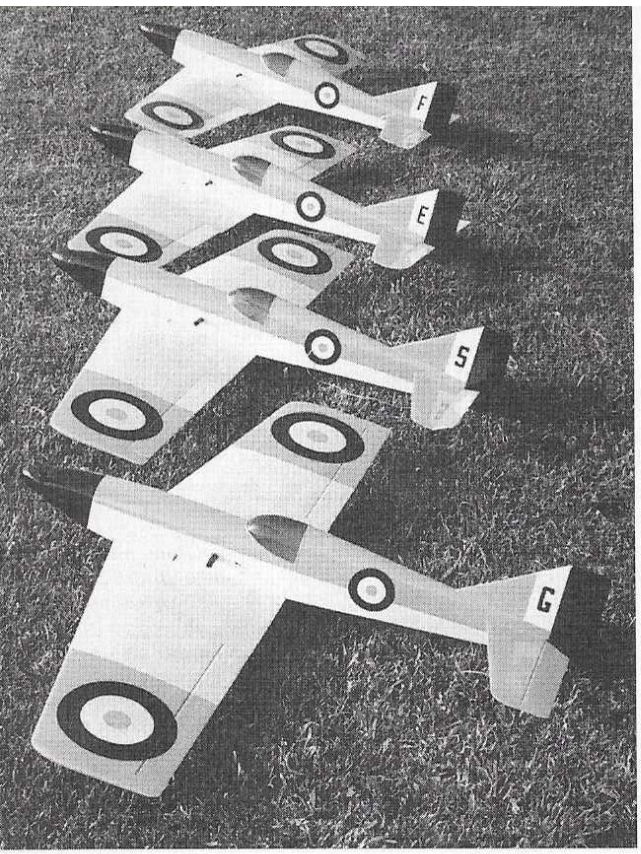
The model is very fast, but, fortunately, is also very stable, so whilst you'll never be able to relax when flying it flat out, it won't turn you into a nervous wreck. Of course, you don't have to fly with the tap wide open all the time - you can throttle back until the model is flying so slowly that you'll wonder what is keeping it up and still have sufficient aileron authority to perform rolls.

One of my favourite manoeuvres is to climb the model until its just a spec in the sky and then push both sticks forward and outward. What happens then, I'm not sure, but when it reappears into full view it will be seen to be performing inverted spins at a quite ridiculous rate - almost as fast as it rolls, which, with its slope-soarer size ailerons is very fast indeed. Recovery, however, is almost instant upon command.

On the ground the model is a real pussycat. Just hold full up elevator until the speed has built up (doesn't take very long!) and then ease the stick forward to its neutral position. Once the tail is up you can forget all about the rudder as Lightfighter will







Here's 'Lightfighter' in its electric, glow and glider forms. Note the 'floater' and 'slope' versions of the latter.

DATAFILE

Plan Specifications

Name	Light Fighter
Designed By	Dave Philpotts
Aircraft Type	Multi-mode sport
Wingspan	40"
Wing Chord	10" root, 6.1/2" tip
Wing Area	330 sq.ins.
Aerofoil	Laminar flow 8.75% symmetrical
Dihedral At Each Tip	Built in via bottom taper
Fuselage Length	32"
Tailplane Span	13.3/8"
Tailplane Section	Flat plate
Fin Height	5.3/4"
Engine Range	.10 cu.in or 540 electric on 7 cells
Fuel Tank	2 ozs.
Rec. Number of Channels	Four
Control Functions	Aileron, elevator, rudder (+throttle)
C.G. (from L.E.)	3.1/2"

Materials Used in Construction

Fuselage	Balsa, ply
Wing	Balsa or veneered foam
Tail Surfaces	Balsa sheet
Weight, Ready to Fly	Electric - 38 ozs. Glow - 28 ozs. Slope - 22 ozs.

forward sweep of the undercarriage legs provides a simple, but very effective suspension system. Any bouncing on landing is definitely down to pilot error!

All this with an OS10!

However, it should be appreciated that having a thrust/weight ratio in excess of unity does not necessarily mean that a vertical climb can be held indefinitely- the degree of excess is important. If vertical performance is really important to you then an OS15, which is only a fraction bigger and a shade heavier than its little brother, would almost certainly have the extra power to keep you vertically upwardly mobile.

track straight and true without any interference from the pilot and, provided that the trim has been set for a shallow climb under full throttle, it will take off in its own good time.

It doesn't have you be that way, however! If your flying field is as uncooperative as ours, especially during the winter months, you may prefer simply to hold full "up" elevator and clear the danger area as quickly as possible.

Landings are also very easy, as the

Building the built-up wing

1. Prepare tapered strip to support rear of ribs.
2. Assemble ribs and spars on one wing, all ribs to be vertical.
3. Skin section ahead of spar with slightly over-size panel. (NB. sand all skins before assembly).
4. Skin section behind spar with panel cut to exact shape, but slightly long each end.
5. Skin aileron including rib. Butt inboard end of skin against wing skin and tape to ensure alignment.
6. Repeat steps 1 to 5 for other wing.
7. Reflect on how much easier it would have been had you chosen the foam wing option.
8. Join wings together flat on building board with skinned sides (actually the undersides) uppermost.
9. Fit pre assembled main dihedral brace/undercarriage mount.
10. Fit rear dihedral brace, blocks and anti-crush tube.
11. Fit aileron tubes and supports, also ply doublers on centre ribs.
12. Fit aileron end ribs, being careful to maintain aerofoil section and blocks for torque rod anchorage.
13. Bevel trailing edge of bottom skins, then skin tops of wings, being careful to avoid warps.
14. Have a coffee. You've earned it!
15. Prepare wings for fitting of leading edges by rubbing wings over a piece of sandpaper which is flat on building board. Fit leading edges.
16. Fit tip blocks, sand tips and leading edge to shape.
17. Separate ailerons from wings, tidy up rib ends and fit wing trailing edge and aileron leading edge strips.
18. Just the finishing touches now. Now sand wings and ailerons. Cut holes in top skins for access to torque arms. Cut slot in bottom wing skin for undercart cross-member.
19. Drill leading edge for wing dowel. Bevel and dry hinge ailerons.
20. Cover wing in film (or tissue and paint if you prefer).Finally fit torque rods and hinge ailerons. Solder levers to torque rods. Fit wing dowel.

S is for Slope

Small models, with their attendant high roll rate, can be great fun, but if twinkle rolls are all that they can do then the novelty soon wears off. Lightfighter, with its symmetrical wing section, has an aerobatic capability of which you are unlikely to tire. With an all up weight of only 22 ozs (20 sans u/c) this model can be flown in any but the lightest winds and, surprisingly, even without ballast in very high winds as well. I quite frequently fly mine in the sort of winds that rock the car or even blow the coffee out of your cup! Another surprise was the ease with which the model manages to perform horizontal eights. Pitch plane

manoeuvres are equally the forte of high aspect ratio models, but Lightfighter can perform this particular manoeuvre more easily than many "serious" aerobatic machines.

F is for Floater

This variant of Lightfighter has a flat bottomed wing section and is what I fly when the "S" 'version won't stay up. I find scratching around with this model more interesting than watching a thermal soarer, but then, each to his own. Fitted with a tow hook (and on one occasion with wheels as well), I've also bungy-launched it from a flat field. In the not too distant future, I have every intention of fitting a servo release and trying my hand at aerotowing using the glow powered model as a tug. This variant is not shown on the plan, so I'll say no more about it.

C is for Construction

There's nothing complicated about the construction of a Lightfighter, so I'll keep this bit short. The wing was designed to be built using a foam core which is partially sheeted using 1mm thick balsa. If, however, you wish to build either the glow or slope version, where weight saving is not so important, then the conventional foam/obechi type of construction could be employed. Using the same templates, the wing will then be a shade thinner, but don't worry about that.

For those who don't like foam wings, the plan also shows a balsa built-up version. Construction's similar to that used on the prototype, but using strips instead of full sheeting to save weight.

Start the fuselage assembly with formers F4 and F6 as they are the same width. Glue the sides together at the tail and fit the remainder of the formers, finishing with F3 and its reinforcing angles. Now you're ready to rediscover the ancient art of planking. Don't worry about it - just do it. Use balsa cement - it dries quickly, sands easily and the smell is pure nostalgia. Sanding is best done with a helical motion. From now on, you're on your own!

P.S. is for Post Script - of course!

With four variants already built, are there any more in the pipeline? Possibly. I have a fascination for biplanes and a Lightfighter with a pair of narrow-chord wings - the top one swept back - might look quite nice. A twin-engined version powered by a pair of 380 size motors is also a distinct possibility. (Both now built, see pic - K.C.)

The glow version has already taken to the water fairly successfully with a pair of floats. Three attempts at taking off were rewarded by two flights. Of the consequent two landings, one was good enough to keep the engine running and to taxi to the shore. Whether the failures were due to inadequacies in the design of the floats, or through pilot error, has yet to be established. So, the Lightfighter in its various forms has given me a great deal of amusement and continues to do so.

Perhaps it could do the same for you?●