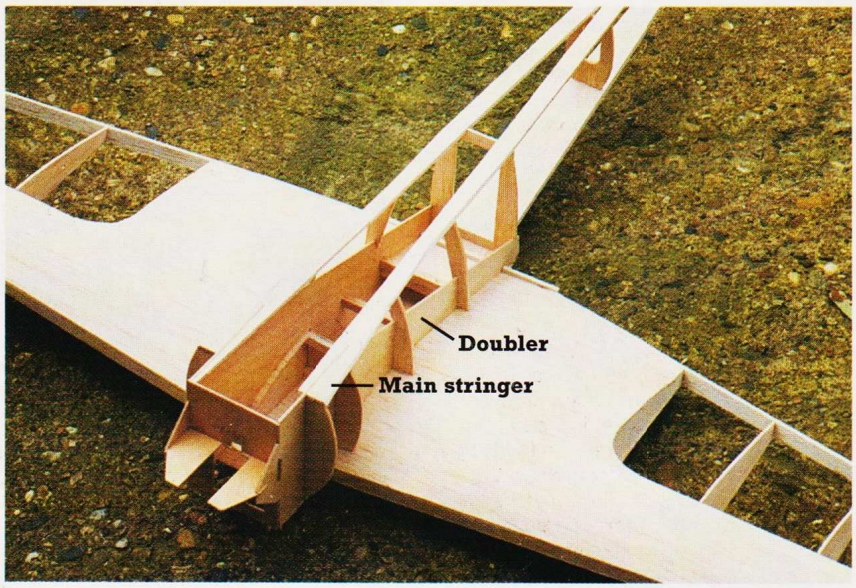
ROBIN FOWLER TALKS US THROUGH THE DESIGN AND CONSTRUCTION OF HIS P36 FOR ELECTRIC 540 POWER

CURTISS HAWK

Wings are built-up with the rear outer sections left unsheeted



The Hawk is monolithic in design with the fuselage attached to the wings.

When looking for a new aircraft to model my main requirements are that I have sufficient information on the chosen subject and that it's of a lesser known aircraft. Okay so I've probably made more Spitfires than most (I'm on my 8th at present) and I've also done the usual Hurricane, Typhoon, ME 109, FW 190 and so on, (you'll gather I'm rather keen on scale subjects - preferably WW2) but there comes a time when you don't want to get stuck in the same old rut. Taking up electric power seemed to act as a spur somehow, so there I was hunting through my reference books. Have you noticed how hard it is to get books from your local book shop which illustrate anything more than the usual front line high profile jobs?

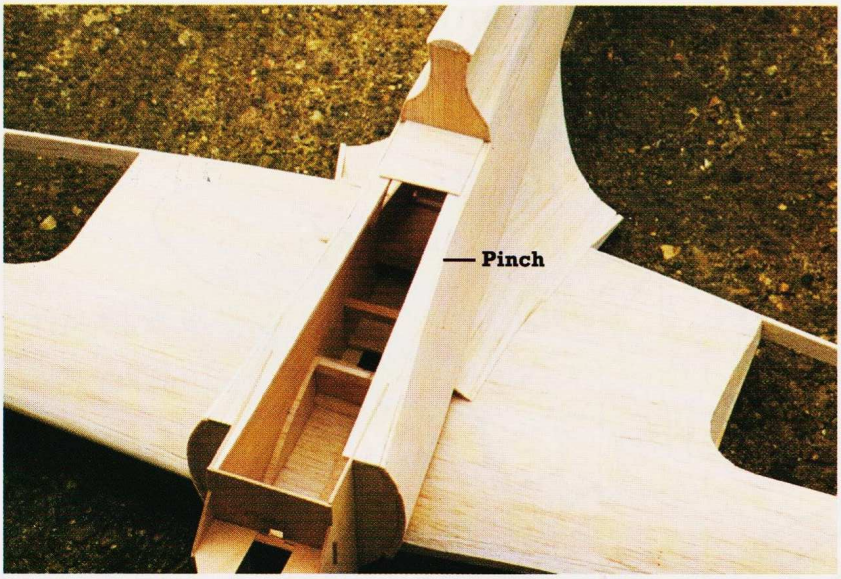
I eventually settled on the P36 because it was one I had never seen a model of and I had already drawn up and built the Kittyhawk for a .25 glow motor. Being roughly the right size for a 540 with gearbox I thought I might only have to modify the front end and all would be well. Wrong! On checking the 3-views I found that there were actually quite extensive alterations made during the development from Hawk to Tomahawk and then to Kittyhawk, although many concepts ran through all. It just goes to show that you can't judge the whole plane by things like wing planform or the fact that it looks similar in certain respects. For example, that characteristic rear to the cockpit. In the end, of course, I ended up redrawing the whole thing, but at least much of the basic structure was already there from the Kittyhawk drawing. Several days later the outlines were all down on paper and the structure sketched in.

THE REALITY

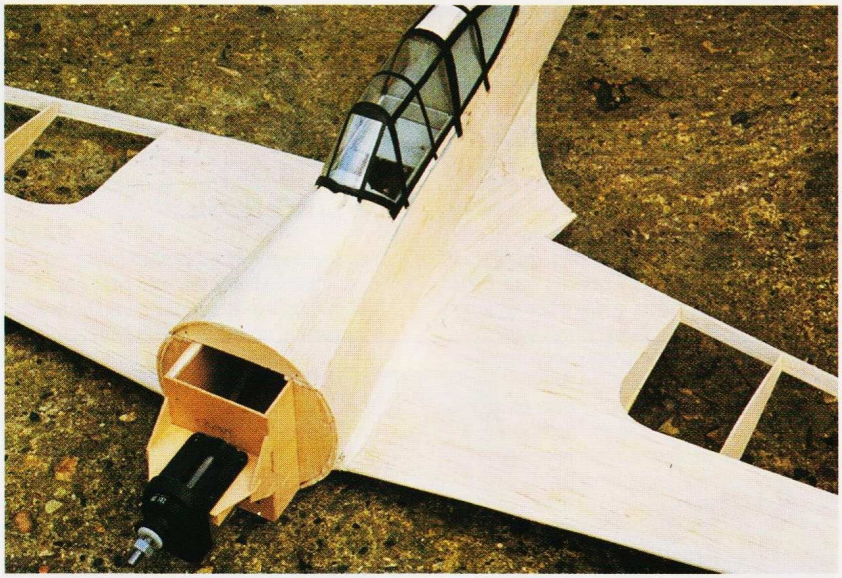
The Hawk first flew in April 1935 and went on over the next few years to equip an impressive number of air forces. It was considered something of a watershed as it entered service but in Europe it found itself outclassed within two years of joining front line squadrons. Those undelivered to France at the time of its capitulation were taken over by the RAF under the name of Mohawk. It was apparently a pleasant aircraft to fly, with excellent manoeuvrability and light and well harmonised controls, but lacked speed especially in climb and dive which made it no match for the BF109. It is of course a matter of British pride that the Americans didn't have a fighter worth a bean in the European theatre until the Merlin powered Mustang came along. Nevertheless, the Curtiss Hawk fought on in Burma, India and the middle east until early in 1944.

THE MODEL DESIGN

I decided to construct the prototype model using built-up wings with the outer rear sections unsheeted. The fuselage would be built onto the



The basic airframe with fuselage sides sheeted and wing root fairing in place. Note the fuselage sides 'pinched in' forward of the cockpit area.



The leading edges are added at a very late stage in construction. The canopy is produced using Robin's highly effective pop bottle method (see text).

completed wing structure. I had used this system on my 52" FW 190 A-8 (although with a foam wing) and it had resulted in a very light and strong airframe which performed beautifully right down to low speed using a .35 glow motor and three function radio (until I tried a reversal too low and found someone had jacked the field up a couple of feet!). I keep wondering whether to give it a new lease of life especially if I could gear up a couple of 540s to power it - it was only the cowling I damaged.

I made only one design decision on the Curtiss which erred from a full scale model, and that was to use full span ailerons. I had done this on my Jet Provost to great effect, producing a very impressive (if not frightening) rate of roll, and knew as a result that only small control movements would be required. I also designed for differential throw on the ailerons. In the event, my decision for full span ailerons resulted in another minor departure from scale in that I was unable to find a trailing edge section of sufficient depth in one inch chord, and had to accept a one and a quarter inch section with the inevitable result that the wing chord grew by a quarter of an inch over the whole span.

RIB SANDWICH

I tried the sandwich method for cutting the wing ribs but with such a highly tapered wing it turned out to be more trouble than it was worth and I ended up doing so much adjustment by eye (even after the wing panels were constructed) that it would have been quicker to visit the print shop in town and have the root template reduced by the required percentages. This would have given the remaining rib shapes (suitably modified for washout) which could then be cut individually. Next time!

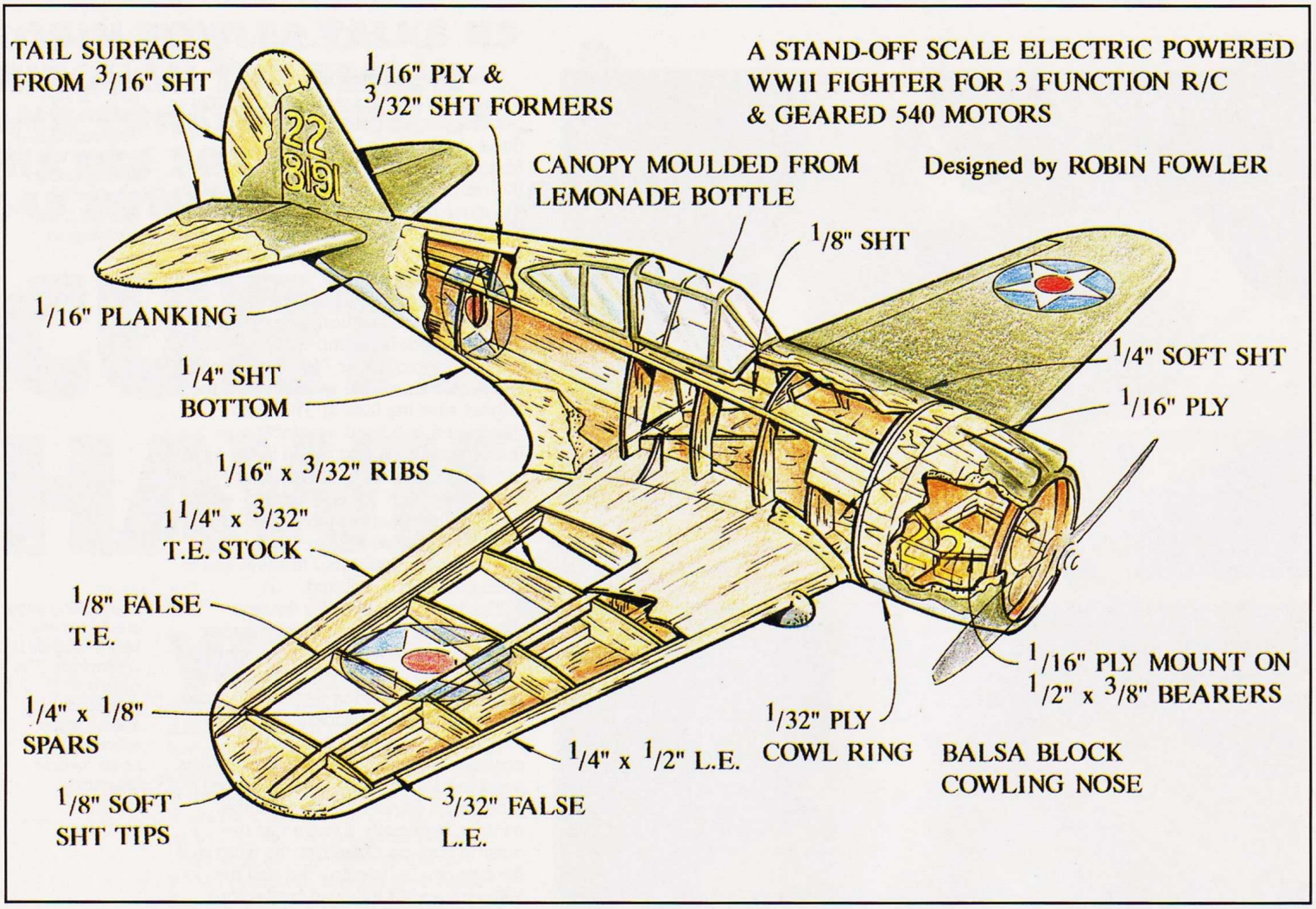
I sheeted both top and bottom of the wings forward of the main spars before joining the two halves together and sheeting the rear part in one piece. The centre section sheeting went to one third span but could be cut back a bay if going for lightness.

The wings are joined using a plywood brace connecting all the spars, but the wing leading edges are not fitted at this stage. The plywood fuselage doublers were then cut to fit the wings and glued to the insides of the innermost ribs where the servo well had been left. A cut-out had been left in the underside of the wing immediately aft of the spars with the thought that it might serve as both a hand launch facility and a ventilation air exhaust. Now the model is complete I think the former impractical as I left insufficient space to ensure safe withdrawal of the fingers after the launch. The motor mount and bulkhead assembly was then constructed and glued to the front of the doublers and the fuselage formers cut and added, together with the rear underside of fuselage. The two main stringers were then attached to the top of the doublers / formers and to each other at the tail end.

The basic structure for the rear fuselage can now be added together with the sheeted sides, although before the sides went on I fitted some 3mm sheet over the section F4 to F5 so there would be plenty of thickness to allow shaping immediately behind the cowling. The 'medium hard' sheet sides need moderate care in fitting but will pinch in as required forward of the cockpit, especially if wetted on the outside surface. Once dry the wing root fairings can be constructed and the tailplane added followed by the top rear fuselage and the fin. I used 4.5mm balsa sheet for both tailplane and fin and consequently thought it better not to try my normal linking method for the two elevators i.e. through the fin. Instead, I used a 'Y' shaped push rod with a snap link clevis attached to each elevator. This would also give me a slightly bigger ventilation for cooling air via the two push rod exit guides - every little helps. The Leading edges are added at this stage.

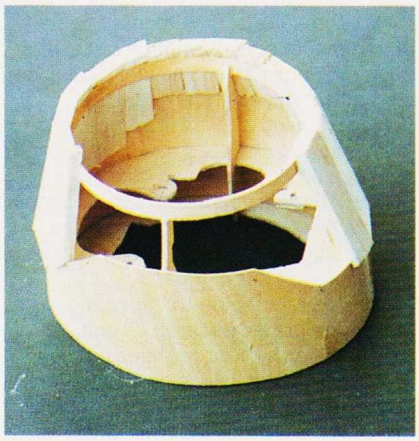
There is very little worth noting about the upper decking / hatch construction except perhaps a reference to my article on how I mould my canopies from empty pop bottles. It's quick, it's easy, and best of all it's CHEAP! I reckon I'm probably an Olympic standard in skinflinting! *(Robin's article will be reproduced in the next issue of RCM&E, by which time you should just about be looking to mould your Hawk canopy! Get drinking that pop - Ed).*

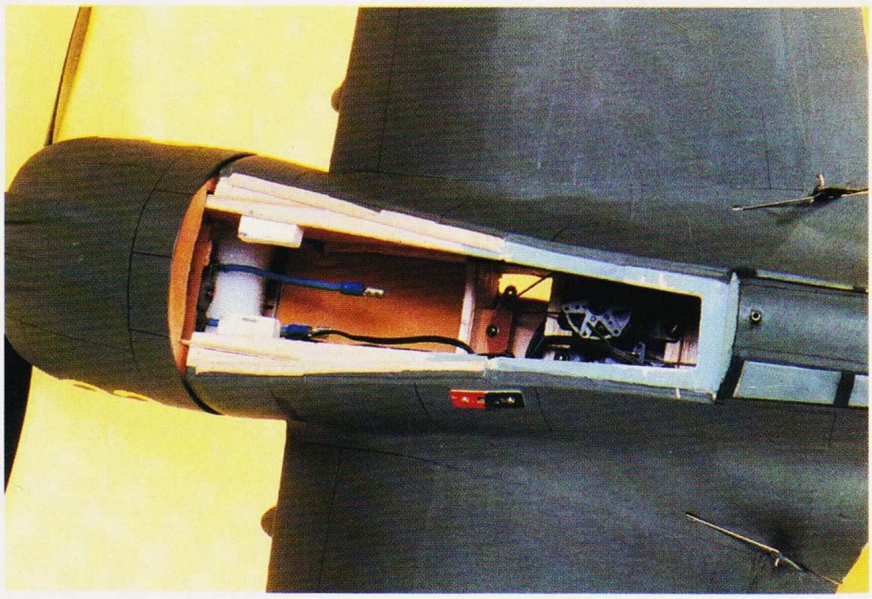
The cowling for the prototype was a bit of a suck it and see job. Firstly, I drew out and cut formers at positions slightly forward of F1 and F4 and spaced them apart at the required distance. In the event I had a bit of a false start here as I tried using ply that was too thick and refused to let me hold it in place to dry in any other way than by hand - which can be a pretty boring pastime. This was duly thrown away in favour of the thinnest ply I'd got, but at least I emerged with my



The cowling is fabricated from thin ply, laminated obechi rings and balsa planking.

All control surfaces are hinged with film to increase efficiency. The Aileron pushrods exit through the wing fairings. Note the paxolin bell-crank mounted in the fuselage.

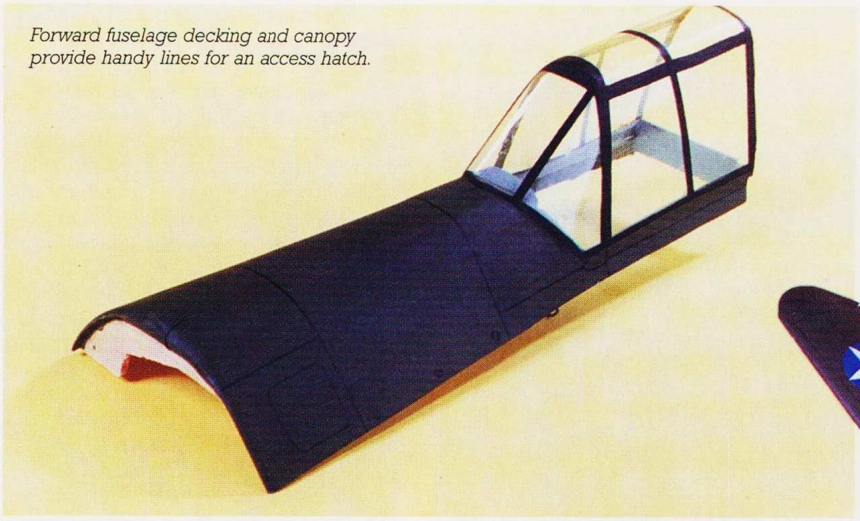




sanity. Assertions to the contrary are vicious lies! The ring for the inside leading edge of the cowling can be constructed by laminating three strips of 6mm wide obechi veneer around a tin lid - if you can find one the right size that is! Personally I really couldn't be bothered to search for one so I used a circle cut from thin ply - the cut-out from the inside of F4a in fact. When dry it can be added to the cowling using spacers. Once the glue is dry the balsa planking can be fitted, waiting for the glue to dry before sanding to shape. With the two gun housings added to the top it looked pretty good and after trimming a couple of places on the formers to fit it to the fuselage, I could get on with the covering.

FINISHING

I have to admit to going off at half cock on this as I really hadn't decided which colour scheme to finish the model in. Not only that, I wasn't sure if I would be able to get Solartex in any of the colours I wanted for a French scheme. I therefore set about covering the wings with the well tried and tested (although heavy) doped nylon. This would ensure plenty of strength which would assist in resisting the rigours of constant belly landings. In the event, on my next visit to the local model shop I was unable to find any of the little Humbrol spray cans in the colours I needed and found myself changing horses in mid stream as it were. I ordered a couple of metres of dark green Solartex and decided to finish it as an American machine, which meant adding the Solartex to the upper surface of the already covered wings. Heavy upon heavy! As things turned out, the completed model in full flying trim weighed under three pounds. As I had already tested my motor and



Forward fuselage decking and canopy provide handy lines for an access hatch.

(ABOVE) Robin's colour scheme is just one of the many variants that can be modelled.

gearbox with an 11 x 7.5" prop on eight cells giving 1.5 pounds of static thrust and a five and a half minute run flat out from a 1700 SCRC pack, it did not unduly worry me. I also knew I could save a couple of ounces of weight on a second prototype - if it ever came to that - so no great problem.

All the control surfaces are hinged with the covering material so there is no air leakage along hinge lines.

GEAR

I fitted my standard Sanwa receiver and two standard size servos as I had intended, linked to the elevator with a pushrod and to the full span ailerons via a paxolin bell-crank and wire exiting through the wing fairings to 1/16" ply horns above the wings. This has been changed on the drawing so that the aileron servo is in line with and in front of the elevator servo allowing rods to pass directly to the ailerons by the same route. Don't forget to allow for the differential on the output disc.

Fine - but what was I going to do for a speed controller / flight switch? I tried one that I had in the workshop and blew the mosfet output stage after a motor run of about five seconds (those rumours of my not having retained my sanity are probably true after all!). The speed controller I burned out was one built for me from a published design by an electric flying friend (Maurice Hancock) in the Hertford Model Aero Club. It had a single mosfet output sufficient to cope with two speed 400 motors although it did get warm in the effort. Repaired and equipped with two mosfets it stood up well to the task - thanks Maurice!

FLIGHT

The first was made on Thursday 30th May '96, notable for being one of those isolated summer days in the midst of grot. The morning had not actually come up with the promised 15 mph winds, and I drove the five minutes to the local club field to give it a quick one. Aren't I a lucky chap? Twenty minutes later I was back home again checking the model out, and the motor was still warm! Well, there have to be some advantages to being self-unemployed!

A light breeze was coming off the rubbish tip and onto the strip which is in a thirty foot deep depression. As I stood with model in right hand and transmitter in left I hoped the wind wasn't strong enough to create undue turbulence. It was swinging a bit within about a 90 degree arc - a sure sign of thermal activity. It could be a bit of a bumpy ride. I prepared myself and switched on, then checked for the last time that control surfaces were moving in the correct sense - all okay. A little up trim for luck, throttle up, check that I'm facing into wind, and heave....

I was soon sorry about that bit of up trim. Why don't I trust myself more? I held the nose down with the stick until I had forty feet or so under the model, then eased the trim back to central when the aeroplane seemed happy. It was climbing well, with a bit less airspeed than I had expected and by the time it had reached about a hundred feet I had the distinct impression that there was more than adequate power available and turned left. It was very well behaved, responding positively and staying where it was put. No worries there. I decided to try a loop from level flight. It fell off the top a little tightly, but I was amazed that it got over at all. The ailerons seemed very responsive even set-up as they were with a quarter of an inch of up and an eighth of an inch down, and I brought it overhead again with a 360 degree circuit. A shallow dive to build a little speed and I pulled back into a much nicer loop. Very satisfactory - what about a roll? Ah! Quite a scalish barrel roll. Throttling back to see how slow it would fly I banked downwind again, pulled too hard on the elevator and suddenly the outside wing broke away and instead of levelling out of a left hand bank I found myself recovering from an unexpected right hand dive. Plenty of height though, so no sweat. This was cured by allowing myself a little less elevator movement on later flights. I stooged it around at half power for a couple of minutes getting used to the model's turning and roll rate. I hadn't checked the time when I launched so didn't know how much battery power was left. It's always better to be on the safe side so I cut the motor and the nose dropped, but not a great

DATA FILE

Name:	**Curtiss Hawk 75A (P38)**
Designed by:	**Robin Fowler**
Aircraft type:	**WWII fighter**
Wingspan	**42"**
Fuselage length (inc prop):	**31"**
Wing area:	**315 sq.ins. (2.19 sq.ft)**
All up weight:	**21b.13oz (*2lb 5oz with 7, 800AR cells)**
Wing loading:	**20oz./sq.ft. (*14.4oz/sq.ft.)**
Motor:	**Geared 540.**
Req. number of channels:	**Two plus speed control**
Control functions:	**Aileron, elevator, speed controller**
BUILD MATERIALS	
Fuselage:	**Balsa and ply**
Wing:	**Balsa and ply**
Tail surfaces:	**Balsa**
Canopy:	**Pop bottle**

The cowling showing 540 motor and gearbox. The scuffed nose ring is the result of a whole year of belly landings. All in all a robust little model.

Robin adds scale to his Hawk - an attractive little model and a cracking flyer.

deal. Feeding in a little up trim I steered the model downwind. Turning towards the strip I realised that it was still at about seventy feet. A bank right and left to spill some height didn't pay off and I quite obviously wasn't going to make the strip! The Hawk sailed over my head with twenty feet to go. Ah well, long grass isn't such a bad thing. Crump!... Ooo-err, that sounded a bit naughty. Putting the transmitter aerial down as I walked and picked the model up from its green eiderdown I soon realised that there was nothing to worry about, just a couple of green marks on the underside of the cowling. The whipping grass on the open framework of the wing structure had made a noise like cracking balsa wood. I ran the motor as I walked back and found I could have stayed aloft for another twenty seconds!

The verdict after that first flight was to fly with elevator rates on next time, which would have the plane flying in a more scale manner. I do tend to haul them round rather tightly - especially when nervous! Also, the prop could perhaps be changed to advantage. Something like an 10 x 8 might give a little longer flight time.

On the second flight a few days later, I was able to enjoy throwing the model about a bit and did a few rolls, with and without a jab of down while inverted. Surprising perhaps is the fact that loops are possible during which the model seems to lose little speed over the top. It definitely has enough power, needing only a shallow dive before pulling up. The odd thing is that the airspeed doesn't seem to differ appreciably for differing throttle settings.

The Nexus Scale Day at Old Warden was the site of the fourth and fifth flights. The wind varied from calm to light gusts depending on the current thermal activity, and the afternoon became more generally windy. Lighter models could be seen rising and falling in level flight due to the bumpiness of the air. The Curtiss was the first to launch in the slot and was almost first to 'land' as well - before anyone else got into the air. I found later that I had inadvertently knocked the elevator rate switch out, but to the accompaniment of a gasp or two from the crowd, it gained height and a perfectly good flight was made. In the event I think I landed third. Many thanks to all of you who expressed interest in the model. It is always nice to have the encouragement of a few compliments.

As you will have guessed from the asterisked details given earlier, I subsequently tried a pack of 7, 800AR cells. I was somewhat surprised that it flew, but it climbed away without trim changes, albeit slower than with the 1700 SCRC pack. Everything else was the same, prop and all and the motor ran for the same time on the bench. The first flight with the 800 mAh pack was short as the plane dropped a wing at thirty feet and the nose dropped suddenly. I thought it better to shut down early and go for a recharge before trying again. The second flight on a full battery went better. Speed was definitely down from the 1700 pack but rolls and loops were still possible after a dive. Limiting the elevator throw gave the model a gentle performance and in flight it looked every bit the scale article, but the motor power was falling off early and I landed after about four minutes. The verdict on the 7 cell 800 pack is that if you can build nice and light (say about 2lb all up) it would probably be a nice flyer, but over that it's just a bit too close to marginal for anyone who isn't an experienced pilot. On an 8 cell 1700 pack it has plenty of go. Any flyer could fly it, and I have had no repetition of the wing dropping problem from the first flight since cutting down the elevator throws to about three eighths of an inch both ways. In stall tests it still drops a wing slightly, but it all feels so benign and it'll land with quite a nose high attitude.

The Hawk is quite a distinctive shape in the air and seems to pull quite a bit of interest. Four flights at the electric flight meet at Old Warden last year had me doing more talking about the Curtiss than flying it even though my charger was going as fast as it ought! Fancy one? There are so many possible colours in which to finish a Curtiss Hawk that you could quite easily have one of a kind. To mention only one source book, 'Flying Colours' by William Green and Gordon Swanborough gives examples from America, the Nationalist Chinese Air Force, France, Norway, the Netherlands (East Indies) and Sweden, so there is lots of scope.●