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28

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ON THE COVER

Twice a Bipe, more than a Tripe; that's how Alex Whittaker sums up the Armstrong Whitterworth FK 10 Quadruplane, modelled in quarter-scale by Tim Hooper and reviewed in this issue.

DECEMBER 2015 NO.193

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CONTACT

Although by no means pre-planned, this month's issue of FSM is very much a concentration of the obscure, quirky and downright outlandish!

Take Peter Rake's construction feature in this issue. Peter makes no secret of his attraction to the more obscure aircraft types, usually from the early days of aviation. He is also drawn to micro-R/C scale using the airborne 'brick' packs robbed from various micro ARF models that are in so plentiful supply nowadays. His scale subject this time is the Martin MO-1.

What yer say? Never 'erd of it! Well neither had we, and it took a *Wikipedia* look-up to discover that it's a 1920s-era observation aircraft that served with the U.S.Navy. With shoulder mounted wing and slab-side fuselage, it's a nice, simple 'build' and Pete's techniques for construction of such a lightweight are well worth a read.

Then there's Alex Whittaker's review of Tim Hooper's quarter-scale Armstrong Whitworth FK 10 Quadruplane - never 'erd of that one either, eh! Well, hardly surprising really because only eleven examples of this four-wing WW1 fighter type were built. During that period, what constituted the 'ideal' fighter aircraft layout was by no means firmly established, although the importance of climb-rate and field of vision were already understood by those 'at the front', doing the fighting. A stack of four wings seemed to possibly improve on the biplane configuration and also the triplane, but the FK 10 did not fulfil the theoretical promise and quickly faded into oblivion. Tim's model is, nevertheless an achievement and one that grabs attention at any of the scale events where it is flown.

Then, finally we have the Blohm und Voss Bv 141 - and one look at this says it all!

But despite the utterly unconventional departure from the 'norm' of aircraft layout, it was in fact an entirely workable and very effective answer to a particular military aviation combat requirement. That it did not achieve front line combat service in any numbers was the result of circumstances unconnected with it's fitness for purpose.

Ken Sheppard has spent most of the last decade making entirely workable scale models of this aircraft, initially with a 1/11th scale .40-size example and then more recently with a 108" span 1:5.5 scale version, which is the subject of one of our construction features in this issue. But it did not all end here - the final version Ken produced was a full quarter-scale model. All three proved entirely workable, after working out a few snags that had nothing to do with the actual aerodynamic layout and the flyability of each model.

Ken recounts the whole fascinating story - well worth a read!

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RYAN PT-22

PART 2: Concluding the construction of an electric powered, 52" span sport scale model designed by Peter Rake and built by Pat Lynch.

Okay then, we're finally on the home stretch with this model. The final plan sheet is included in this issue and we need to get the construction finished before we can get to the interesting stuff - like flying the model. Since about the only actual building left to be done is the tail surfaces, let's dive straight into that.

FIN & RUDDER

I'll deal with this separately, simply because of the modifications Pat made. If you're building the 'as drawn' version, most of the construction will remain the same but there will be a little less of it.

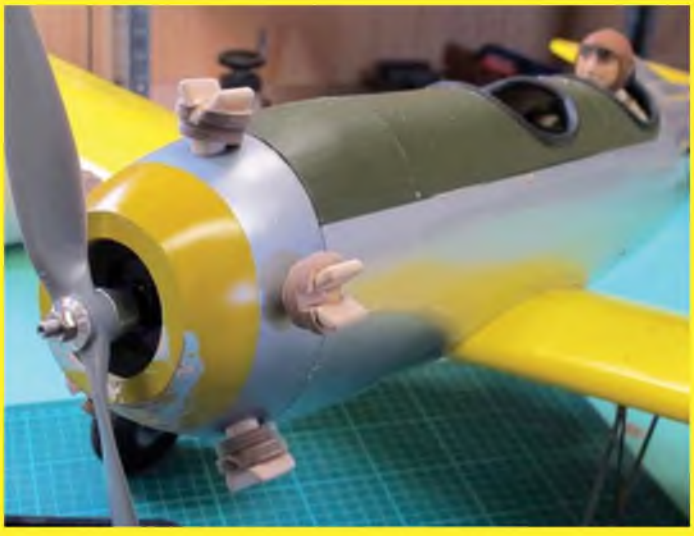
The hardest part of building this section is likely to be laminating the outline. When attempting this task I always choose medium grade strip and soak it well before starting. A former is cut from Depron, to the inner line, and the edge rubbed with a candle to wax it so that the

> "Before any actual building is done I strongly recommend that you read through this and do a dry run of the assembly"

Pat runs up the motor in preparation for another flight.

EDITOR'S NOTE:
Due to the manner in which the three plan sheets of the Ryan PT-22 had to be laid out, the tailplane, undercarriage etc., comes in this issue (Part 3), part 1 (October 15) carried the front fuselage and one of the wings and the rear fuselage and the opposite wing panel was in Part 2 (last issue).

The humble beginnings of the dummy cylinders, a multitude of ply discs.



With a bit of modification, some balsa dowel and a few scraps the cylinders begin to take shape. Note the scuffed nose from an earlier 'landing'.

laminations don't stick to the former. At the same time I wax a selection of pieces of scrap balsa that will be used to hold the laminated strips snugly against the former.

Pin the former securely to the building board (with some film between board and former) and glue the thoroughly soggy strips of balsa together. Use one of the waxed pieces of scrap to secure the strips at one end of the run and PULL them around the former, securing as required with further pieces of scrap, until the whole outline is in place. I stressed the part about pulling the laminations around the former because this keeps the strips under tension and helps prevent any cracking on the tighter curves.

Many people use a 'fence' of pins to form laminated shapes around, but I don't like this practice. You can't get the required tension on the strips and the pins actually increase the risk of cracking the inner lamination because it tries to take a straight line between the pins.

How ever you do it, allow the laminated outline to dry thoroughly before removing it from the former. As an aside, I know Pat usually shapes his laminated strips without glue. Allowing them to dry to shape and then gluing them up as he builds the structure, so that's another option for you to consider.

Pin the outline in place over the plan and glue in place all the strip and cut parts before allowing to dry. I like to sand and shape the fin and rudder while they are still joined since I feel this is a better way to get them to match once separated.

As to the modifications Pat made, this simply involves studying the full size aircraft and building out each side of the lower rudder to blend in with the wider tail. If you aren't modifying the fuselage shape then you don't need to do that.

TAILPLANE & ELEVATORS

Building these pretty much follows the same process as used for the fin and rudder. However, there is a little 'wrinkle' that can be used to ensure that, once the elevators are joined, they will still align correctly with the tailplane tips. It's very simple really and involves nothing more technical than making the elevator leading edge a continuous piece across both elevators.

Now, once the parts are shaped, the tailplane separated from the still conjoined elevators and the joiner shaped, you can drill holes to match the joiner and then separate the two elevator halves. Now you know that when you glue the elevators to the joiner they will still be the same distance apart as they were when you built them.

COVERING & FINISHING

As mentioned at the start of this construction article, Pat was originally building this model purely for his own use, rather than as a proper prototype build. As such, he wanted a relatively simple finish for what was intended pretty much as a 'hack' model. That being the case, the obvious choice of covering was film with the markings applied as vinyl decals. No attempt was made, at this stage, to reproduce the dummy engine or add extra details. The model was flown in this condition; flown, pranged, repaired, re-motored and flown again until Pat had something he was happy with. Then, of course, I stepped in and asked if I could use his model for the article.

As you can probably imagine, by this stage Pat's PT-22 was looking a little worn around the edges and was still quite basic looking. So, whilst still not wanting a full blown detailing job, Pat made up some basic dummy cylinders from ply discs, added struts and rigging and finally produced a glassed foam spinner for his model. A little tarting up of the 'worn' areas (mostly around the lower nose from less than perfect landings), a few tweaks here and there and the model you see in the photos was the result.

Part of the beauty of this type of model is that it's entirely up to the builder how much time he wants to put into finishing his model. Pat's is, by his standards, pretty basic, but as long as you don't add huge amounts of weight (especially at the front of this rather long nosed type) the sky literally is the limit as regards how realistic you can make your model appear.

Even if you choose not to modify the rear fuselage shape, careful application of scale details will still result in a stunning looking model. As I said, Pat didn't want to go to great lengths with the detailing and his fairly basic rendition still looks pretty good to me. Just imagine what he could have done with it if he'd really set his mind to it.

ASSEMBLY

Well, since the model has removable wings, quite obviously the details such as struts and rigging need to be equally easily removed. On this model that really isn't too much of a problem. Because the undercarriage is (we hope) attached to the wings with saddle clamps (or simple brass straps), and the lower rigging only attaches to the wing and u/c, it's only the struts and upper rigging we need concern

Here you see Pat's thickened lower rudder which matches his modified rear fuselage.

The turned foam, spinner has had a layer of glass cloth smoothed into place with resin and is being allowed to cure.

If this shot doesn't show just how long the nose is, nothing will. The model cruises smoothly overhead.

ourselves with. Since neither are vital to the integrity of the model (they're purely cosmetic) that isn't too daunting a task. You've already built in (you have, haven't you?) the brass tubes that the strut ends plug into and the small wire loops on the access hatch for the rigging to attach to so assembly is pretty straightforward.

Bolt the wing loosely in position and fit the struts, springing the ends into their brass tubes, before fully tightening the wing bolts.

As mentioned, retain the u/c legs in their grooves with either plastic (commercial) straps, or straps cut from brass strip and fully rig the lower surface using elastic thread. The thread should go from each u/c leg, through the wing rigging block and around the hatch retaining hook before returning through the other wing block to the u/c. Get the rigging tight, but not so tight that there is no stretch left in it. Remember the photo last month showing how the hatch can be accessed without the need to unhook the rigging.

So, you bolt on the wing, make any minor adjustments to achieve correct alignment, fitting the struts as you go and then hook up the rigging. If you really take your time about it, it might take all of five minutes before you are looking at a ready to fly PT-22. Talking of which....

Filled, sanded, primed and painted the finished spinner has a ply back plate and is cut away to clear the prop.

FLYING

You may have noticed that I have kept mentioning the long nose of this model. This is because, initially, it gave Pat problems. Using far more motor than required only added to the problem. He had deliberately kept the tail light and this, combined with the oversize motor, long nose and sweep-back on the wings, meant he had to move the batteries and servos back in the fuselage. Replacing the motor with a smaller, lighter one meant he could move the batteries forward a bit and wasn't plagued with the problem of a model that needed up elevator to maintain level flight, but that climbed like a lunatic if more power was applied.

Initially, Pat tried flying his model using a E-Flite Power 25 and 3,600 mAh, 3S pack and the model was both nose heavy and well over-powered. Later flights were made using an O.S. 3815-1000 (roughly on a par with a Power 10/15 size motor), a 2,600 mAh pack and APC 11x8 e-prop which was a much better arrangement. This resulted in a model capable of hands-off flight (after trimming), but still having ample power for loops and rolls.

Although the model can be flown using a larger motor, Pat feels his flying skills aren't really up to that style of flying, either the power available or the landing speeds involved. His final set-up, however, is something he is far happier with and is probably more likely to result in scale like flight.

After a few adjustments Pat finds the model to fly well hands-off, but still be capable of mild aerobatics.

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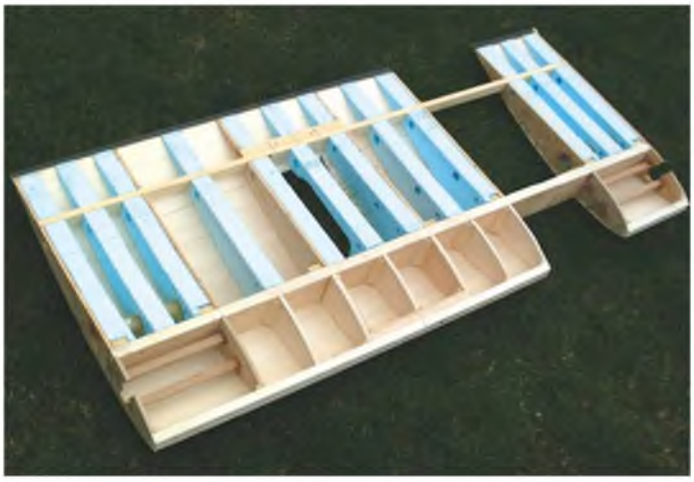
The BLOHM AND VOSS 141B

A 1:5.5 scale, 108" span asymmetrical model of a unique Luftwaffe WW2 aircraft, for 40-50cc petrol power. A satisfying and unusual 'large scale' project designed by KEN SHEPPARD

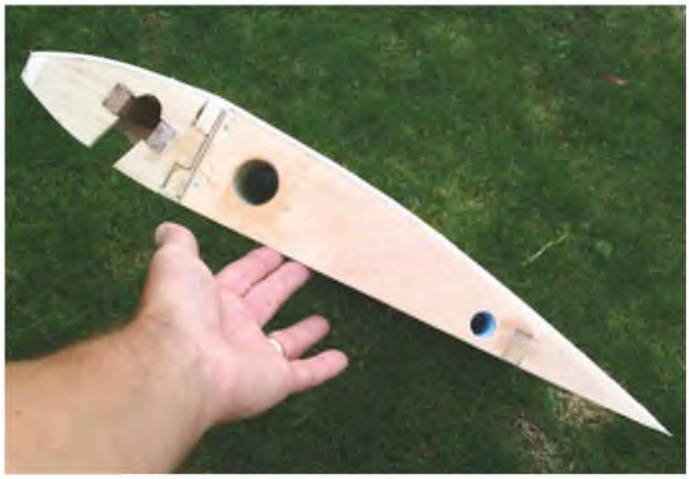
The Blohm and Voss Bv 141 was one of the more unusual aircraft to have been built and flown during WW2. Although unsuccessful in it's attempt to secure mass production as a reconnaissance/light bomber (the order went to the Focke Wulf 189), a couple of dozen were built and (repudely) flown in action, mainly on the Eastern Front, although there is some debate whether this was true.

To my knowledge, none survived the war, but there is more than enough documentation available to build a reasonably scale flying R/C model of the type (see source information at end of article) and I began my fascination with the type about two decades ago when I designed (and had published) a .40 sized glow version (54" span) of the Bv141, which featured a blue foam wing, a foam-clad balsa box fuselage, all-sheet tail surfaces and a carved

It looks as though it shouldn't, but it does, fly – and fly very well, too! The unique planform really shows in banked passes and figure eights!



The underside of the wing centre section showing the blue foam ribs, the I beam spar and the balsa sheet 'D' box ribs and retract mounting rails.



One of the centre section end ribs, showing the spar construction, retract beam geometry, and the 'D' box rib.

The front section of the two-part fuselage, showing the original S/T 3000 glow motor fitted (retrospectively fitted with a 45cc petrol engine).

Underside view of the front fuselage, showing the staggered joint line build.

The two sections temporarily joined to allow the four bolt/blind nuts that hold the two parts together to be drilled and fitted.

foam crew pod. It flew amazingly well - once the balance issues had been sorted - and the desire to build a larger version became a 'must-do-sometime' project.

Over the years, my model designs have become larger and larger, but my attraction to the unusual has remained, such that when considering my next project about eight years ago, specifically to be suitable for demonstration at LMA meetings and shows (it's easier to get flying slots with an unusual model and this one has a remarkable presence in the air!).

Whilst this 'larger' model isn't huge by LMA standards, it seemed a perfect choice. So how to start?

Determining size

The start point was what engine to use. Initially I was going to use a Super Tigre 3000 glow and actually started the build with that intention, but I have been wanting to get into petrol engines and larger models for some time and had purchased a Zenoah 38 for just that purpose. So, having seen quite a few Warbirds flown using this very size of motor, at a span of about 9ft, I decided to change ship in favour of the heavier, slightly larger capacity petrol engine. *(Note: during its second season, the Zenoah was replaced with Thor 45cc petrol engine, which turned out to be a perfect combination, that remained until the model's demise back in 2011).*

A nine foot span model was also exactly twice the size of my earlier .40 powered design, so it was an easy matter to blow up the original plan to 200% to give a starting point for the larger one. At that size also, the engine would fit nicely in the radial cowl, with just the top of the head and sparkplug showing - AND the glassfibre *Seagull Models* Hawker Sea Fury ARTF cowl would fit perfectly! (Cowls are available from *J. Perkins Distribution*).

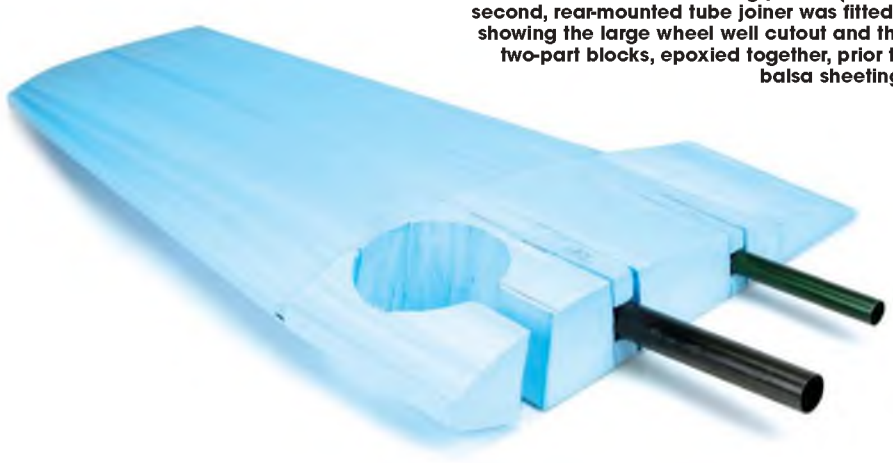
The other main design consideration was that the model had to break down into chunks that would fit my Volvo estate car (no dedicated trailer needed here, thank you!). I decided that it would have a three-piece wing, a two-part fuselage and a removable crew pod and tailplane - so, starting from just the outline of the doubled-up original plan (I knew the outlines were accurate because I had taken the original plan from an official three-view), I started to consider how the beast could best be built.

The heart of the matter...

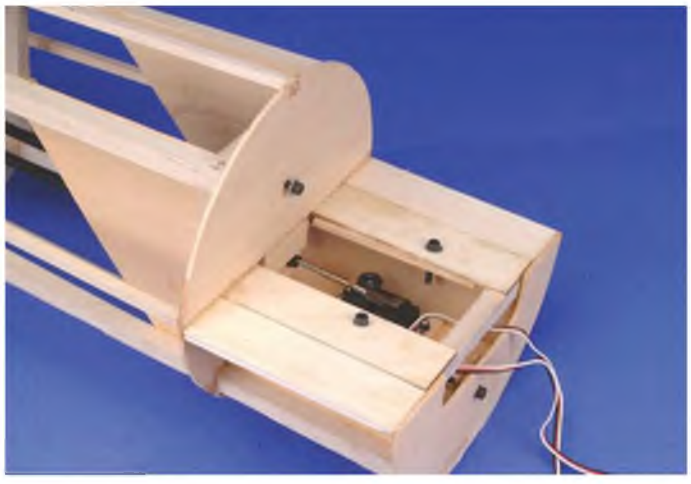
I decided from the outset that it would not be a superscale job, but rather an accurate stand-off scale one that had all the character of the original (if I was lucky), without the hassle of too much detailing and finishing. So, after selecting the engine, the retract undercarriage system geometry became a high priority - the first step in finalising the wing centre section design.

The wing section would fully house a scale size wheel, and the position of the wide track main legs were quite outboard of the wing centre line, with the legs retracting outwards into the wing tip panels. To take the landing loads - and then some more - would need a main spar across the full span of the centre section that would be strong enough to absorb the bending forces and stiff enough to take the torsional loads that would be applied to it by those long legs.

One of the blue foam outer wing panels (before second, rear-mounted tube joiner was fitted), showing the large wheel well cutout and the two-part blocks, epoxied together, prior to balsa sheeting.

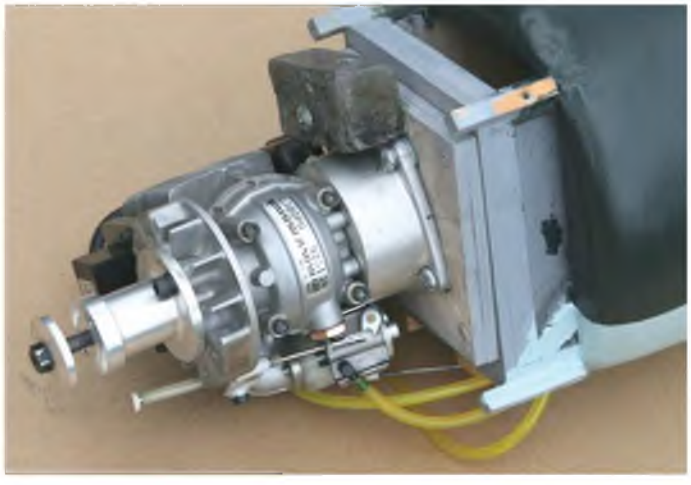


Close-up of the rear for the wing seat, showing the wing mounting bolts and the staggered joint build.



The inverted rear fuselage section, showing the staggered joint, four mounting bolts and the rudder/elevator servos.

The first engine fitted was a Zenoah 38. Note the throttle servo mounted on the bottom of the motor box and the large lump of lead needed to balance the model.



Another view of the Zenoah installation, showing cowl mounting blocks.

A full depth box spar was the answer, made from sections of 1/2" square spruce strip top and bottom, faced with 1/8" birch ply sheet, front and back. The undercarriage units (*Eurokit Giant pneumatic*) were mounted on hardwood blocks set into 1/4" birch ply rib nose pieces that were themselves inset into the box spar before the front ply spar facings were epoxied in place.

The remaining balsa nose ribs and leading edge were added to make up a wing 'D' box, with a leading edge reinforcing piece to mount the fuselage mounting dowels (steel bolts). Also incorporated at this stage is the 'gap' where the crew pod/module/gondola will fit - to allow a lower fuselage floor to be fitted later to allow some internal detailing.

With the wing D-box built, thought was given to the rest of the centre section - and the outer wing panels. The latter were cut from blue foam, each in two pieces because the wing features a two-stage dihedral form outboard of the undercarriage legs - a parallel-ßchord root section and a tapering tip section. The latter was hot-wire cut with some washout built in, because in planform,ß the tip has both leading and trailing edge taper.

The parallel root section would carry the mounting tubes - one large diameter at the front, just behind the spar box and a smaller diameter tube in the rear section of the wing section - and also incorporate the wheel well for the outward retracting legs. The two foam blocks were simply epoxied together after carefully sanding the mating faces to a flat surface and the correct dihedral angle. To close the wheel well on the top surface a disc of soft 1/2" balsa was inserted, glued in place and sanded flush with the foam on the top surface.

The photographs show a tip panel and the build of the wing centre section although, as with any scratth-built design, when making it up as one goes along, the two units don't tie up exactly! So I decided to add the second wing tube AFTER building the rear of the wing centre section. The rear spar is also spruce strip, as is the wing bolt mounting block, inset into birch ply ribs at the fuselage positions - and the tip root joint.

The centre section was sheeted in 3/32" balsa, but the tips were cut full depth, so the surface is sanded foam. The whole airframe was then covered in lightweight glasscloth applied with water-based acrylic varnish (*Ronseal*).

Ailerons and rudder are built up on a balsa core and 'tex-covered (to show rib surfaces) and top-hinged, with the *Robart* hinges standing above the top wing surface, with the rudder and elevator centre-hinged, as per the full-size (well, approximately!).

Tailplane

The offset tailplane is built from 1/2" sheet strip edging and trailing edge, with a thin strip of epoxy glasscloth sheet (available from *Free Flight Supplies*) epoxied all along the trailing edge, before skinning with 1/16" balsa sheet. The tailplane is retained by two nylon wing bolts which pass through the tailplane into the fin tail seat, where two blind nuts are fitted under two ply insets.

Due to the offset, the strut on the underside is fully functional, made from 1/2" x 3/16" spruce strip. The ends are chamfered to match the fuselage side and lower tail surface, where ply plates inserted into the fuselage side and tail lower surface pick up self-tapper screws through holes drilled in the end of the strut - primitive maybe, but also effective!

Fuselage

With the wing pretty well built, it was time to consider the fuselage. The model differs slightly from scale in that on the full-size, the wing is almost centrally mounted in the fuselage, but to allow the model wing centre section to be removable, I raised the fuselage above the wing top surface to give strength to the basic box section, which is the heart of the fuselage build. During the life of the model, no-one ever noticed - like I said at the beginning, I never intended it to be museum standard scale!)

Regarding the position of the fuselage joint, the weight of the motor and support systems meant that the joint needed to

be aft of the rear mounting bolts, but still be accessible from the wing cut-out, so that the joint fixing bolts were internal, rather than external - again, the photos show my solution better than I can describe, being four bolts into blind nuts, accessed from the wing seat cut-out. So far, the joint, has proved to be excellent and at just a few paces distance tends to disappear.

The basic fuselage box is from 1/2" square balsa strip, with lite-ply doublers in the front half and extending just beyond the wing seat in the rear section. The rear section also carries the tail seat structure and, to give strength to the vertical fin, I cyano'd some carbon sheet strips into the fin post on either side (I did the same during the tailplane build) before final sheeting. The rear section also carries the elevator and rudder servos (as far forward as possible, for weight and access considerations).

Because the tailwheel position is way in front of the rudder line, I opted for a castoring tailwheel - wrong! Ground handling was appalling until speed builds up to give the rudder authority, so after the initial couple of flights, I did a retro mod to externally link the leg to the rudder, via pushrod and horn (not at all scale, of course), which cured that problem!

The flat section tailplane is held in position by two bolts through the tail into the tail seat, but whilst quite rigid, the asymmetric tail does need the supporting strut and so ply mounting plates were built into the tail lower surface and fuselage side - the strut is spruce strip with rounded edges.

The cowl

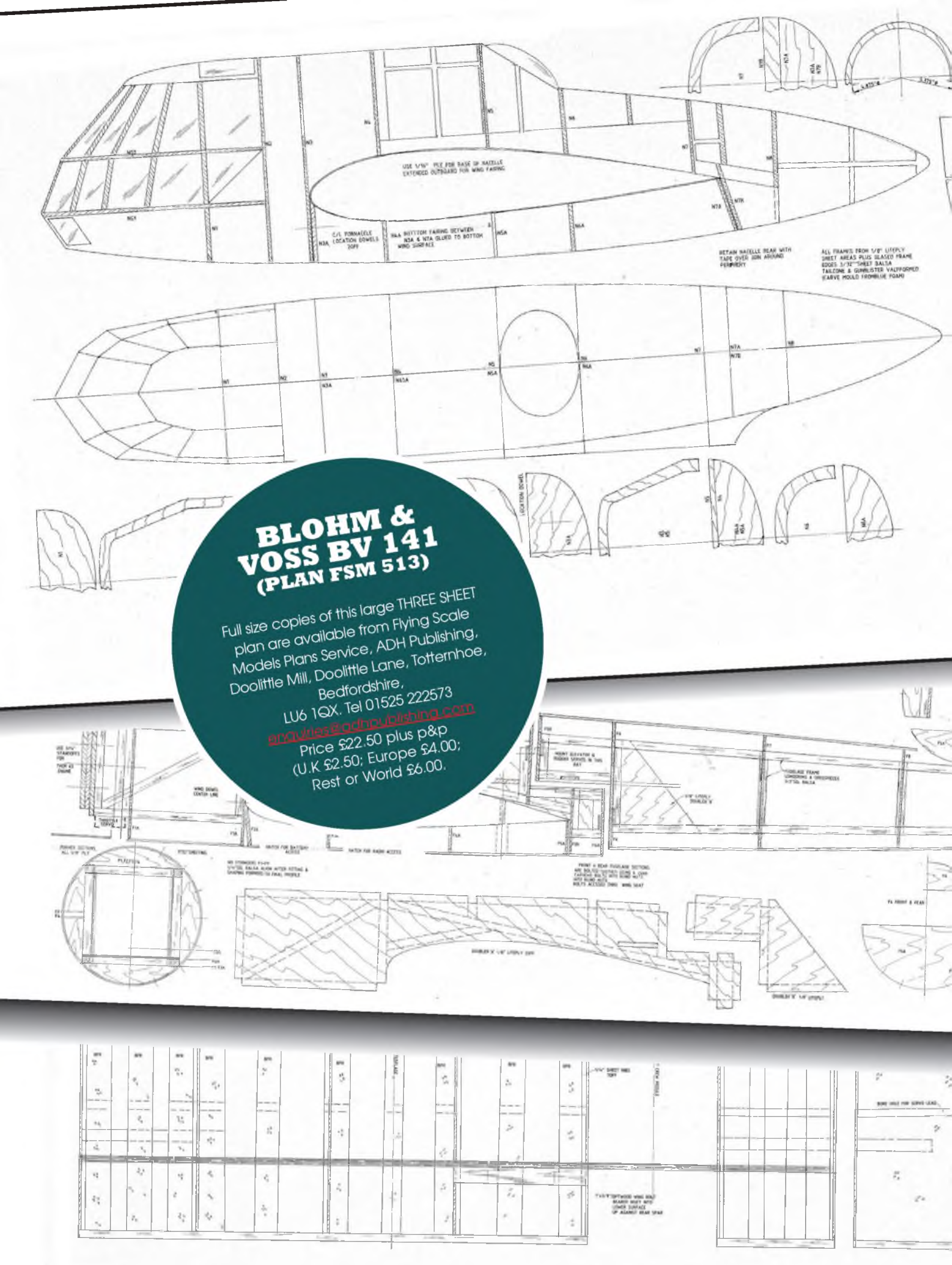
I've already mentioned the suitability of the *Seagull Models* Hawker Sea Fury cowl, but it is just as easy - and perhaps more satisfying to make your own - or, in the words of the old cigarette ad' - roll your own!

The cowls I have made for other radial models were a laminate of two layers of 1/8", 3/32" or 1/16" balsa sheet (depending on the overall diameter), with a layer of carbon sheet between. This was moulded round a mandrel made from three rings of MDF, spaced apart with 16 x 1/4" x 1/2" balsa strips (see photo of these main assemblies). The 1/8" balsa sheet was cut into cowl lengths, edge-joined with cyano, thoroughly soaked in water (in the bath), then wrapped tightly around the cylinder mould and finally strapped up with wide sticky packaging tape, and allowed to thoroughly dry out (two days in the airing cupboard).

When dry, both layers were removed and a piece of polythene sheet (an old ARTF kit bag) taped around the mould to prevent the balsa cowl sticking to the mould. The balsa sheet was then re-wrapped around the mould and the edge trimmed for a good edge fit. The balsa was then held in place with strips of tape and cyano was wicked into the joint line to hold the balsa in a perfect circular cylinder on the mould.

The carbon sheet (supplied in 6" width from *www.freeflightsupplies.co.uk*) was then cut to length and the pieces taped together so that it fitted all the way round the balsa layer on the mould. Epoxy resin was mixed up sufficient to coat the surface of the balsa and duly brushed on. The carbon sheet was then wrapped

> "To my knowledge, none survived the war, but there is more than enough documentation available to build a reasonably scale flying R/C model"



BLOHM & VOSS BV 141 (PLAN FSM 513)

Full size copies of this large THREE SHEET plan are available from Flying Scale Models Plans Service, ADH Publishing, Doolittle Mill, Doolittle Lane, Totternhoe, Bedfordshire, LU6 1QX. Tel 01525 222573
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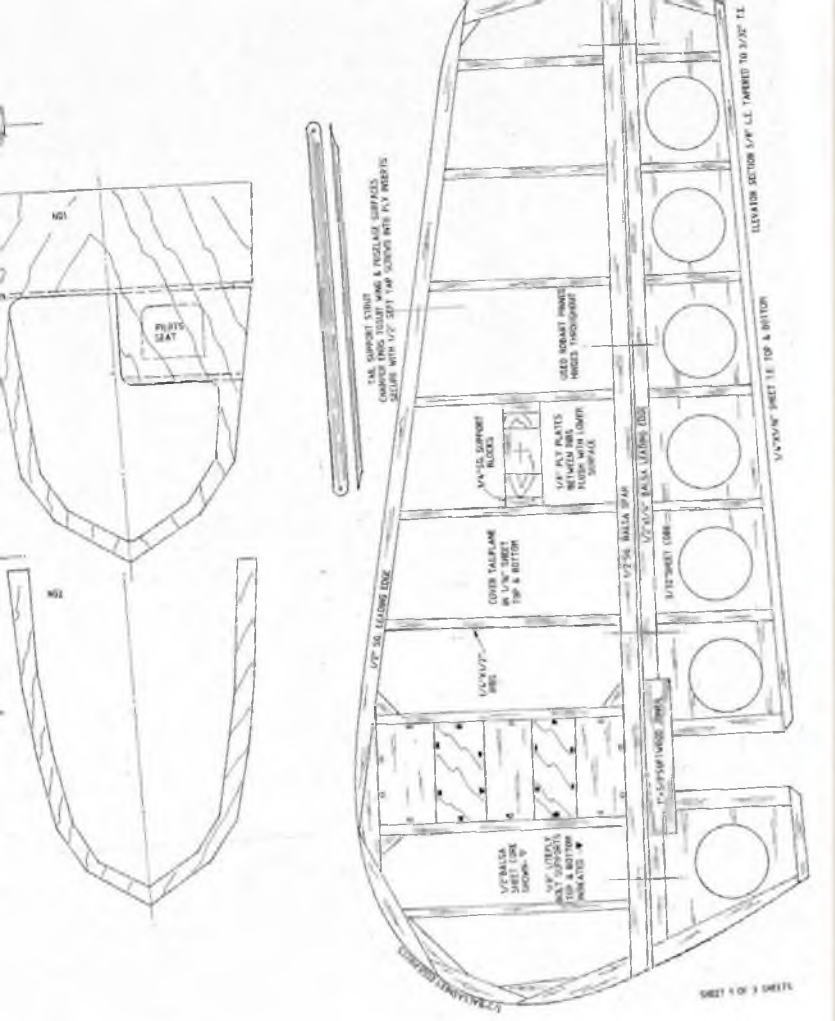

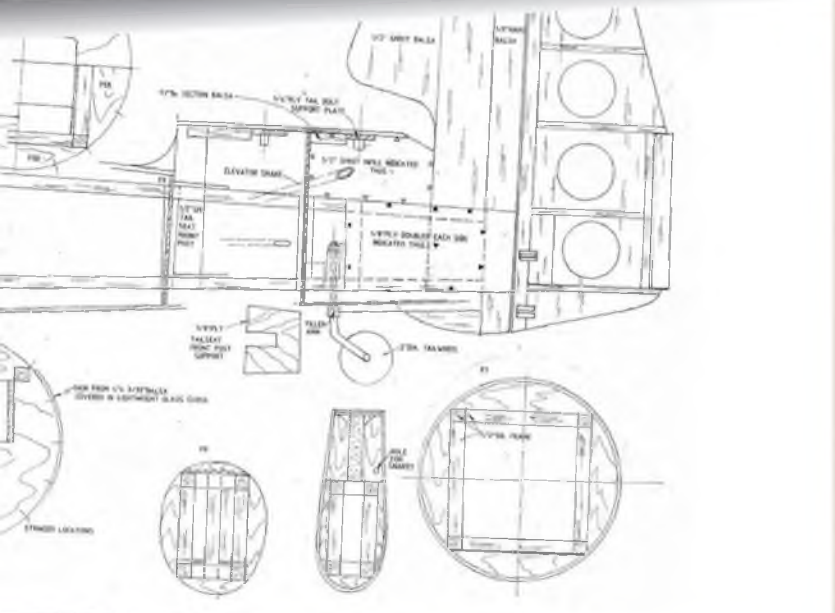

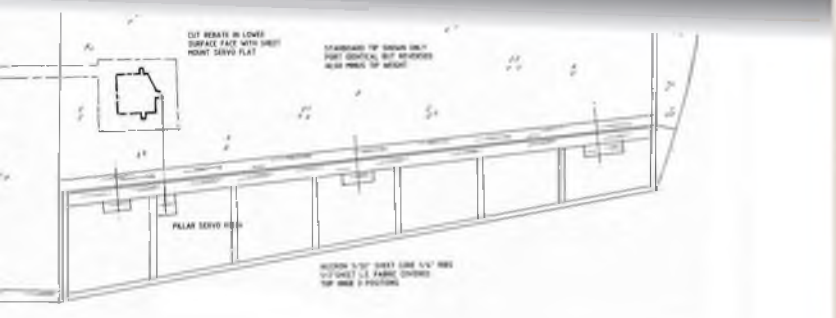

CUT PARTS SET FOR THE

BLOHM & VOSS BV 141

Get straight down to construction without delay! This month's full size free plan feature is supported by a laser-cut set of ready-to-use balsa and plywood components.

THIS PARTS SET PROVIDES: formers, doublers, wood wing ribs, blue foam wing ribs, blue foam wing panels (not veneered) and tips, elevator and rudder core sheet.

IT DOES NOT INCLUDE STRIP AND SHEET MATERIAL OR SHAPED WIRE PARTS

Price £155.00
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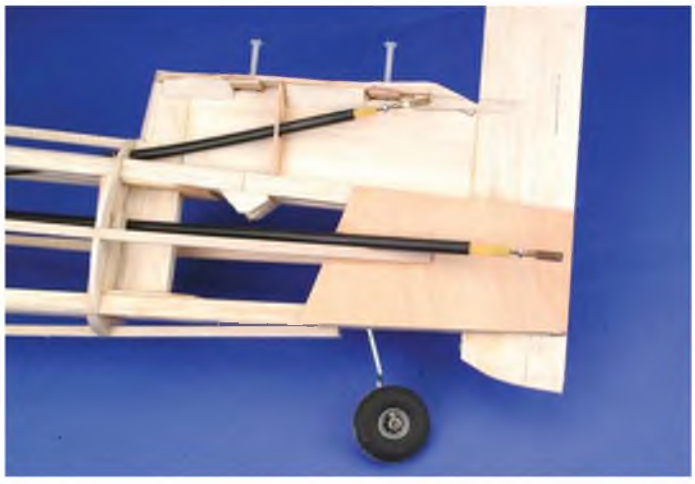
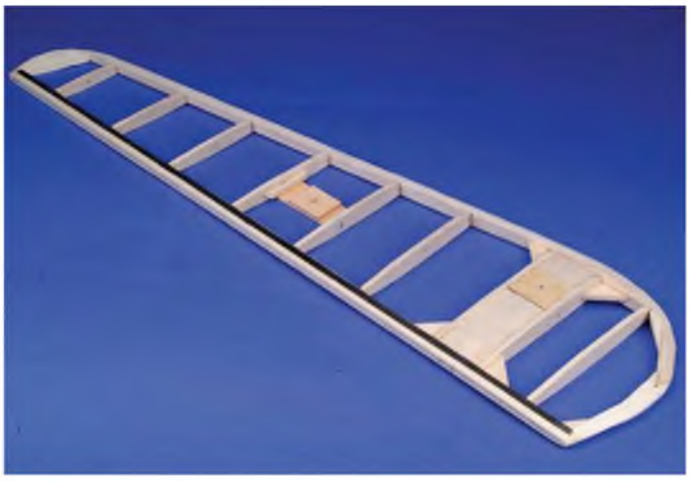


Detail of the tail seat build, showing 1/2" sheet core to the seat pylon and the fin sternpost. Note the two tail bolt mounting plates and blind nits inst into the tail seat.



The tailplane, ready for final sheeting. Note the inset ply plates for the tail mounting bolts and the strut end fixing.

Making your own cowl. In this case, for the bigger, 12ft span Bv. The nosering in this case is moulded plastic, but a simpler, carved balsa, ring on the front of the laminated balsa tube is easy.

Looks difficult? Well, it was a challenge, but the plan shows the final outlines, which simplifies it greatly! Study the photos of the full-size for interior detail, gun troughs, pilot seating, etc.

around the mould as tightly as possible and held in place with the ubiquitous tape (good old B&Q 4" clear) until the resin had completely set.

Remove the tape and repeat the process with the second balsa layer, making sure the edge joint is good - I used the old *Radio Modeller* method - overlap the ends of the sheet and make a single cut through both layers of balsa, making sure you don't cut into the carbon sheet underneath, remove the off-cut underneath the top balsa sheet edge - and voilà - a perfect fitting edge. Re-tape and leave to cure.

After about 24 hours, you can slide the whole cowl laminated tube off the mould. Remove the plastic sheeting and tape and you have your lightweight, but very strong cowl tube!

The nose ring is made up from three layers of 1/2" balsa sheet cut out in three sections per ring on a scroll saw. The first layer fits inside the front cowl edge, the second and third (1/4" larger outside diameter) butts up against the inner ring. When the glue has dried, the nose radius can be carved and sanded to shape.

I chamfered the rear edge of the cowl to increase the air exit area around the firewall and this has proved sufficient to prevent overheating.

Crew pod

I left the worst bit until last! Right up until I had to start on the crew pod, I had no idea how I was going to build it. I was not confident of my three-dimensional drawing abilities to work out accurate final shapes to allow the vertical and horizontal glazing frames to slot together (as I would have preferred) and there was no way I wanted the hassle of making a mould and laying it up in glassfibre, then cutting out all the glazing windows. So it had to be a bit Heath-Robinson - but it worked!

I was so pleased with the way it progressed and the speed at which it went together that I forgot to take any photos of the build steps. But I did draw round the frames when I was happy with the fit, so I had a record of the final shapes!

So in brief, the rear part of the pod was built onto the wing, using thin ply wrapped and taped over the top surface to make the mounting face/fairing fillets. The lite-ply vertical frames were fretted out of sheet using the excellent Dremel Scroll Station and glues in place on the ply, using cyano and number one eyeball to line them up.

Temporary strip spacers were fitted to hold the frames the right distance apart above the ply and the full wing chord lower sheet sides fitted to form the carcass base. The former at the wing leading and trailing edge carried the full fuselage depth profile, so that the completed pod lifts off vertically from the wing in one piece - but not yet!

A long sanding bar was used to ensure the external edges of the frames lined up in smooth sweeping curves and then the inner edge of the frames were sanded to a parallel section (they were cut wider on the inner edge to facilitate this final adjustment) and then the permanent horizontal spacing strips fitted individually and cyano'd in place. Remove the temporary holding strips - and low and behold, the wing part of the crew pod could be lifted off the wing - fantastic! That left the REALLY worst part to last! The front part of the pod was built in the hand - no jigs, just using the Mk.1 eyeball method. Admittedly, I had managed to plot the horizontal glazing frames and these were cut, fitted and adjusted as per the rear frames, but needed quite a bit of extra trimming and sanding to achieve the multi-faceted, but flat glazing panels, including the edges of the sheet balsa cabin front top. When all the glazing bars were fitted and sanded to give

acceptably in-line and flat mounting surfaces (I've forgotten to mention the two machine gun troughs on which the pilot sits, and the instrument console), it was time to consider how to attach the glazing panels.

At just 1/8" thick, the lite-ply frames were too thin to mount the clear plastic sheet panels, so I fitted 1/4" wide 1/16" balsa strips (grain vertical, to the frames) externally to each frame to provide a gluing surface and again sanded in the various angled faces using a smaller flat sanding block.

Before attempting to fit the 'glass' panels, the whole of the inside of the pod was painted using *Humbrol* cockpit green - no pre-treatment was needed as I had used so much cyano in the frame build that the surfaces were pretty well sealed!

Come the dreaded 'it's-now-or-never' point for fitting the glazing, it turned out a lot easier than I had anticipated. The individual panels were marked out on the structure, then cut out on a cutting mat using a steel rule and a sharp blade. These were glued in position using 'Canopy glue' (fantastic stuff) and strips of tape to hold the edges in position. I soon realised that I could fit quite a few at a time, spacing them out and then after leaving them overnight to cure (the white Canopy glue becomes completely transparent), the remaining panels can be glued and taped - literally just a couple of evenings work!

Finally, strips of sticky-backed aluminium tape (from B & Q) were stuck over the joints (two layers) to complete the 'external' frame pieces - I have to say that at this point, I was pretty chuffed!

Radio set-up

As stated earlier, the rudder and elevator servos are in the fuselage, together with the throttle and retract switch servos, so extension leads were routed through the wing to under the crew pod area - together with the two aileron servo leads - and radio boxes were built in the under-fuselage fairing, housing the receiver (*Spektrum*), battery and switch/charging point. Heavy-duty servos were used throughout and a 1,800mAh 6v battery powers it all - a visible onboard battery level indicator is a good idea, too (I intended to position one at the engineers station in the pod).

Asymmetric balancing

The experiences of flying the smaller 54" span version all those years earlier gave me confidence that balancing the larger version to the same parameters would give a good starting point, so after painting (using *Warbird* authentic Luftwaffe colours), a sling was rigged up from the roof of the workshop in order to set the pitch and roll balance points.

The former was set at 25% of wing chord back from the wing leading edge and it needed a full kilo of lead epoxied and bolted to the firewall to achieve the desired fore/aft balance point (despite the heavier engine being used).

The offset fuselage and tailplane dictated that quite a bit of lead was also needed to achieve the correct latteral balance and require about 0.5 kg, fitted in a box cut in the starboard wingtip lower surface - in line with the fore/after balance position - the balance point being the centreline of the wing, which happens to line up with the starboard side of the motor fuselage. The undercarriage leg geometry is such that in the 'locked down' position, the legs are canted forward - so all balancing should be done with the wheels up.

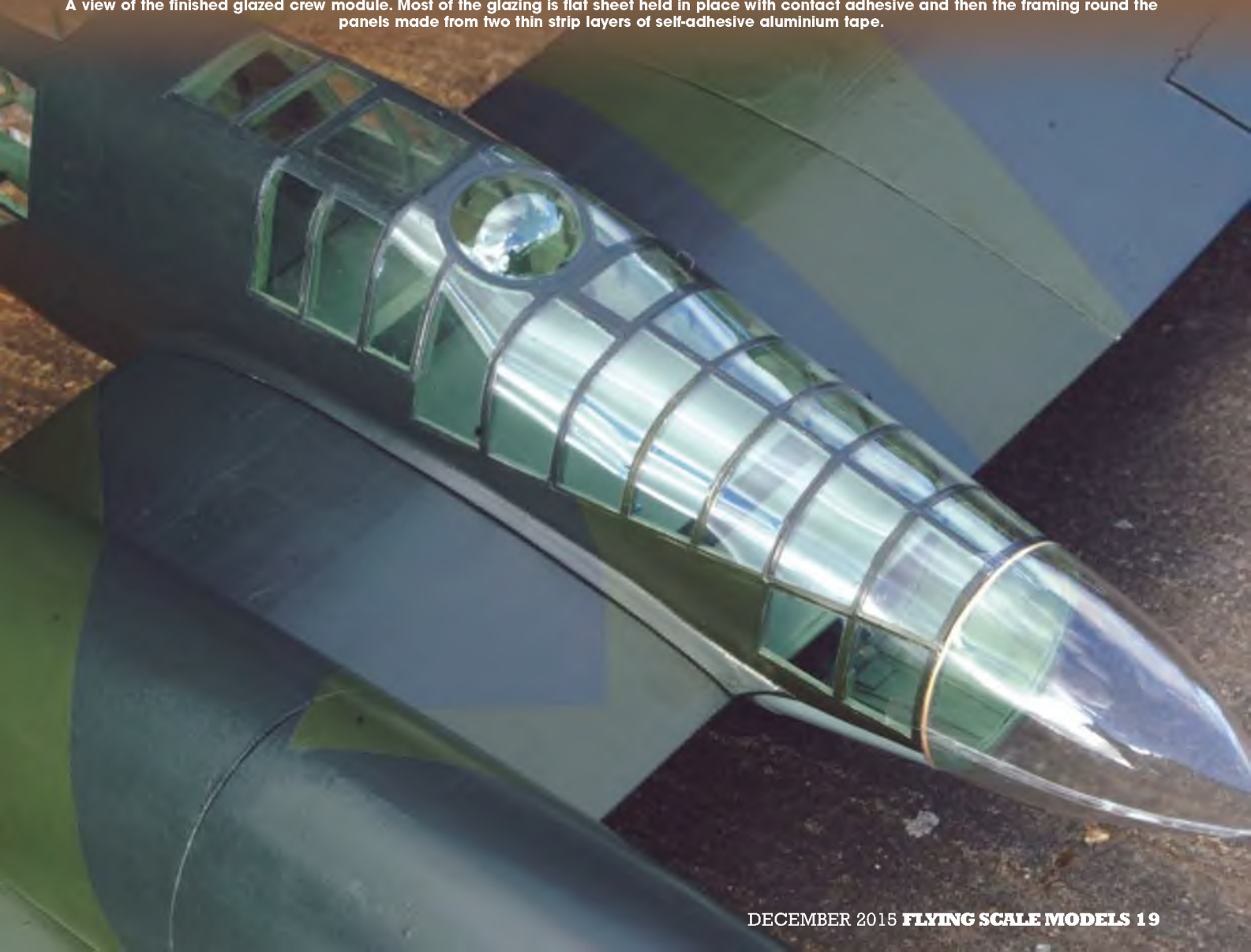
Flying

I approached the first flight with quite a bit of trepidation, it was my first really big model after all; not a conventional layout, either - and the fact that the weather wouldn't allow test flying before the first LMA fly-in of 2007 (although I had managed to set-up and tune the engine), meant that I had quite a large audience for that important first flight.

After suffering all the expected friendly jokes like *"...was there a crease in the plan, then..?"* and *" ...you sure you've put it together right ..?"*, the tank was filled, the motor started and after the usual ground checks, the Bv141 was wheeled out onto the flightline.

This is where I found the castoring

A view of the finished glazed crew module. Most of the glazing is flat sheet held in place with contact adhesive and then the framing round the panels made from two thin strip layers of self-adhesive aluminium tape.



Two hatched in the belly of the motor boom give access to the receiver and flight batteries.

That offset tail which helps give the Bv the asymmetry. The support strut is functional, so needs to be securely fitted.

tailwheel to be a big mistake. Advancing the throttle gently caused the model to swing to the right and, with no rudder authority, getting it back on line was impossible. So the throttle was closed and the model pulled back and realigned into wind. This time I opened the throttle to full power - the model jumped forward and started to swing right again, but this time the propwash gave the rudder some purchase and I straightened her up easily as she accelerated away, with the tail coming up after just a few metres.

I let the speed build up and then eased in a little up elevator - and saw daylight under the wheels! I left the wheels down for the first flight, just wanting to concentrate on how she handled, but she soon turned out to be a pussycat - rock steady, with smoothly responsive turns and none of the partly anticipated yaw due to the asymmetric layout. The climb-out felt a little dampened (I had built in some downthrust - since removed), but I felt completely at ease with the model - elated, in fact!

I can remember hearing a great cheer from the assembled throng, but most of all, I remember feeling that this really is as good as it gets - after the months of building, the partial worries raised by balancing the unusual layout, the technical problems of building a reasonable facsimile - and there she was, in her element and looking really elegant.

Looking back now, over the scores of flights I made with her, I'm really pleased with a project that turned out so well. She didn't win any prizes for scale fidelity, but she flew like a dream - what else could one ask for?

As already mentioned, I subsequently fitted a steering link from the rudder to the tailwheel, so that ground handling was completely controllable. In fact, I've been so busy flying her at every oportunity, I never did complete the crew pod detailing; time is too short when you're having fun!)

Summary

Big models definitely fly better - it's true! This project has really got me back into the thrill if designing, building and flying an original and unique scale model aircraft. After such a successful conclusion, already I'm looking for a similarly demanding 'next project', searching through my reference books for something that grabs me like the Bv 141 has - onwards and upwards!

PS - Even bigger!

Three years ago, after having built and flown several unusual and in the main, successful types, I came back to the Bv141 - and built an even bigger one! At 12ft span it was 1/3 bigger than the one described here which, on reflection, is a massive increase. It was built under the LMA 'Over 20kg' build-scheme (it finally weighed in at 28kg!) and is, as far as I am concerned, the end of the line for my love affair with this type.

But, despite its size, weight and additional complexity, it flies every bit as well as the previous models. Everyone asks *"...is it difficult to fly with this unusual layout...?"* If I were a bit more canny, I would reply *"...yes, it's a real pig!"* But it's not; get the model balanced right and it's a big pussycat.

One final word, regarding aerobatics; I don't suppose the full-size was rolled or looped, so scale-like flight doesn't necessitate these manoeuvres, but yes, the model is definitely capable of both, keeping plenty of height for the former and a nice large radius for the latter! Chandelles and steeply banked Eights really show off the type's asymmetric layout really well and demonstrate what a truly unique and practical design the Bv141 really was. ■

SPECIFICATIONS:

Span:	108"
Weight:	24lb
Power:	38-45cc petrol used on prototype
Functions:	5 channel (no flaps fitted, although are a practical option)
Servos:	4 off high torque (ail/elev/rudd) 2 off standard (thrott/retracts)

RECOMMENDED SOURCES:

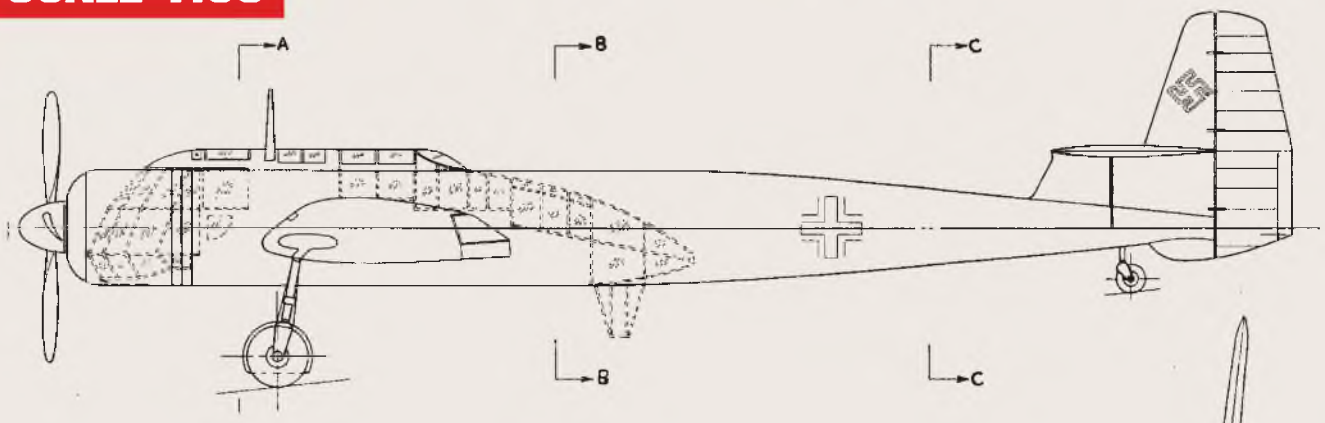
'Blohm and Voss Bv141 - *Planes of the Third Reich Series'* by David Myhra, published by Schiffer 0-7643-1397-5 (obtained from Amazon)

'The Blohm and Voss Bv141 - *A Technical Guide*- by Richard A Franks, published by Valiant Wings (obtained from ADH Publishing)

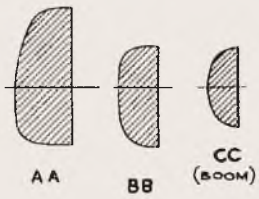
Bv141 1/72 scale plastic kit from Airfix - code A03014

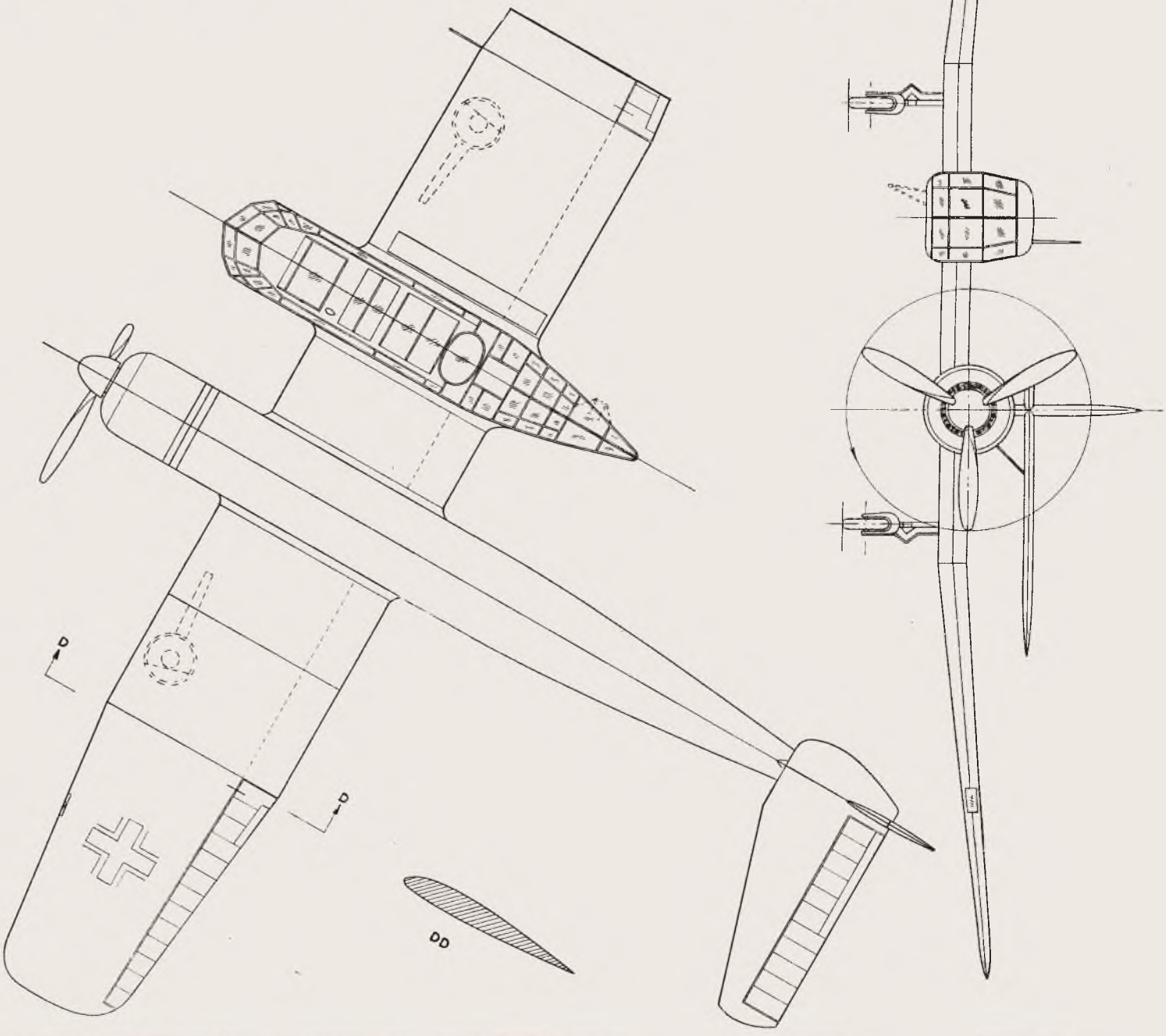
A great source of indo for building and finishing the BV - the Valiant Wings book is packed with photos, technical sketches and photos of plastic kits giving valuable detailing info - available from ADH Publishing.

SCALE 1:80



BLOHM und Voss
Bv 141





SEEING IS BELIEVI

An aeronautical
Sheppard really mad
picture here show, it fle

NG!

oddity it certainly is, but Ken
e it work as a model. As the
w perfectly at model size - a
great achievement!

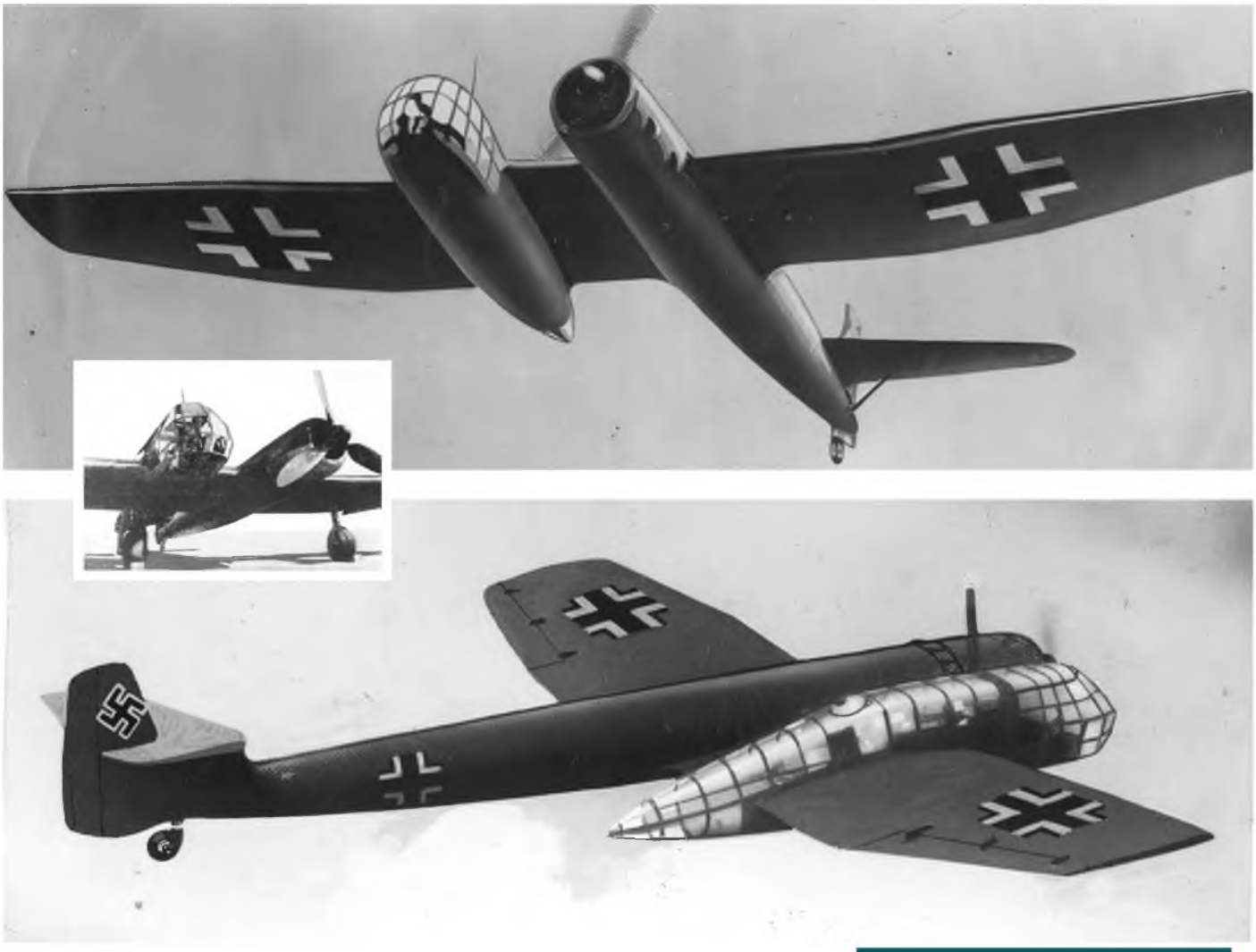
The BLOHM UND VOSS Bv 141

Totally odd looking, it was in fact an entirely workable answer to the task for which it was designed. Only the unavailability of the specified engine prevented its introduction into service.

Although there is a temptation to regard the Blohm und Voss Bv 141 as a bit of a joke and just the whim of an aircraft designer attempting to satisfy aeronautical design curiosity, Dr.-ing Richard Vogt's unique design was a thoughtful and serious attempt to satisfy the German Reichluftfahrtministerium's (RLM) requirement, set out in 1937 by General Ernst Udet (then director of the technical office of the RLM), for a battlefield reconnaissance and ground attack aircraft, capable of accommodating a crew of three, for tasks which would also include light bombing, and emergency smoke-screen laying in support of German armyforces.

Competitor proposals were the Arado Ar 198 and Focke Wulf 189, both of which featured entirely conventional symmetrical layouts.

As written, the RLM's outline specification implied single engine power although, in 'conventional' layout, the position of the single engine, up front, would entail a serious and obvious restriction of the observer's view from the aircraft, whereas



These three pictures of the Bv 141 serve to illustrate the wide field of vision from the crew gondola. whichwaswhat the unique design layout was all about.While the pilot sat in the obvious posion up front, the other two crew members mannd gun, one placed in the barbette half way back and operated from a standing position, while at the rear, a second gunner operated a gun from a prime position. Both faced aft.

a far less restricted field of view would be much more easily achieved with a twin engine layout.

Vogt's theoretical answer, maintaining the single engine requirement, was to place a full 'fuselage' incorporating the engine and tailcone, offset to the port side of the wing centreline and place the crew of three in an almost entirely glazed gondola, in a position offset to starboard of the centreline, which would provide a first class observation position. But would the resultant force set-up work?

Vogt reasoned that a symmetrically configured aircraft does not actually behave symmetrically in flight, due to the rotating propeller wash over the fuselage behind the engine and over the fin and rudder, which constantly tends to divert the aircraft from its intended course (which is why high-powered piston engine fighter aircraft have the fin/rudder assembly offset by a few degrees). Vogt reasoned that such a force could be used to balance the asymmetric aerodynamic layout he conceived.

Vogt was personally acquainted with Ernst Udet and, having drawn up the layout, visited Udet in Berlin, to present his proposal. Udet, for his part, understood the theory and authorised the construction of three prototypes. The first of these flew on February 25th 1938 under the designation *Hamburger Ha 141-0,* reflecting the original Company name of *Hamburger Flugzeugbau*, before the name change to *Blohm und Voss* in 1940.

Initial flight tests proved the concept and Ernst Udet went to Hamburg to appraise the new aircraft first hand. He found that the asymmetry of the layout, with offet crew gondola, perfectly counteracted the take-off power of the BMW engine's torque during take-off and proceeded to roll and loop the machine. Thoroughly convinced, Udet immediately had the aircraft refuelled and flew it directly to Berlin to demonstrate the aircraft to Fieldmarshal Erhard Milch and Herman Goring, which may be considered as testimony to Udet's impression of the aircraft, resulting in an order for 500 examples.

Once accustomed to the unique airframe layout, one appreciates the aerodynamically clean shape of the Bv 141. BMW 801 is closely cowled.

Three of the total of 20 Bv 141's built. These may be the three prorotypes.

The Bv 141's retracting main undercarrige faetured widely spaced legs that retracted outwards. The wide spacing would have been good for rough field operations as would have been the likely case on the Eastern Front.

However, there was one fundermental problem facing the program in that the specified engine, the BMW 801A was also required for other, more important aircraft, including the Dornier 217 twin engine bomber and the FW 190 fighter, the latter then at prototype stage. Thus, hard choices had to be made and the requirement for front-line combat aircraft inevitably took precedence, resulting in the cancellation of Bv 141 production in April 1940. In any case, much of the Blohm und Voss production capacity had already been applied to the four-engine Focke Wulf Fw 200 'Condor'.

By the time of production cancellation, just 20 Bv 141s had been built and these were supposedly issued to a specially designated *'Special Squadron-Bv 141'* for planned action on the Eastern Front in 1942. However, it may well be that this formation was nothing more than a figment of the imagination of Dr. Josef Goebbels' propaganda machine in overdrive, for it seems there was little evidence of this unit ever going into action.

Such then was the Blohm und Voss Bv 141, a seemingly impractical, quirky aircraft that actually proved entirely practical, only to be defeated by other practical considerations unconnected with the capability of the aircraft.

Aviation history is littered with such situations! ■

This heavily retouched wartime photo well illustrates the crew gondola and reveals the upper, rearwards firing gun barbette.

Avios

1200mm Hawker Sea Fury FB11 EPO Warbird

Avios brings you a exemplary example of the legendary Hawker Sea Fury, the last propeller driven airplane to serve in the Royal Navy. A brilliant no-glue design arrives with all electronics pre-installed, all your require os a battery and radio system to complete. The outline is that of the FB11 version, which served well into the 1950s and was used during the Korean War. Modelled in the livery of Commander Peter "Hoagy" Carmichael, the only British pilot to in a piston engine aircraft to down a jet driven airplane during that conflict. The all EPO molded foam replica features functional flaps, retracts with gear doors, LED lights, scale 5-blade propeller, wing mounted rockets, and remotely activated drop tanks. The Avios brand is focused on premium quality design features, with no detail being spared. The Avios 1200mm Hawker Sea Fury is no exception.

ESC
60amp Brushless
Speed Control

Motor
Brushless Motor 3648
Out runner KV600

Length - 1100mm

Wingspan - 1200mm

Weight - 2100g

Armstrong Whitworth FK 01 Quadruplane

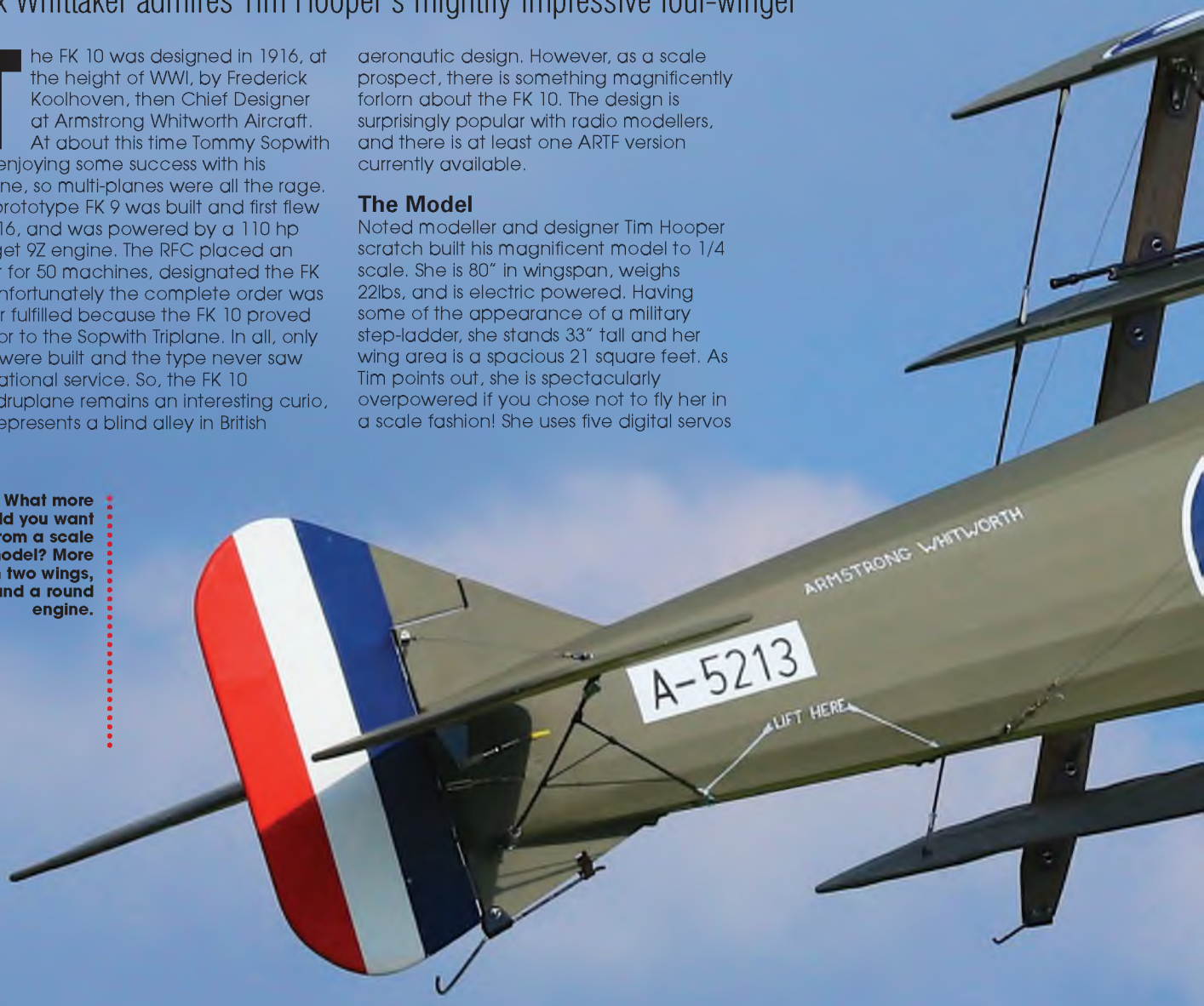
TWICE A BIPE, MORE THAN A TRIPE

Alex Whittaker admires Tim Hooper's mightily impressive four-winger

The FK 10 was designed in 1916, at the height of WWI, by Frederick Koolhoven, then Chief Designer at Armstrong Whitworth Aircraft. At about this time Tommy Sopwith was enjoying some success with his Triplane, so multi-planes were all the rage. The prototype FK 9 was built and first flew in 1916, and was powered by a 110 hp Clerget 9Z engine. The RFC placed an order for 50 machines, designated the FK 10. Unfortunately the complete order was never fulfilled because the FK 10 proved inferior to the Sopwith Triplane. In all, only nine were built and the type never saw operational service. So, the FK 10 Quadruplane remains an interesting curio, but represents a blind alley in British aeronautic design. However, as a scale prospect, there is something magnificently forlorn about the FK 10. The design is surprisingly popular with radio modellers, and there is at least one ARTF version currently available.

The Model

Noted modeller and designer Tim Hooper scratch built his magnificent model to 1/4 scale. She is 80" in wingspan, weighs 22lbs, and is electric powered. Having some of the appearance of a military step-ladder, she stands 33" tall and her wing area is a spacious 21 square feet. As Tim points out, she is spectacularly overpowered if you chose not to fly her in a scale fashion! She uses five digital servos



What more could you want from a scale model? More than two wings, and a round engine.

“The FK 10 Quadruplane remains an interesting curio, but represents a blind alley in British aeronautic design”

1: Bellicose pilot came from *www.realmodelpilots.com*
2: Netty, Tim's fiancé (and also a scale pilot and builder) made this leather cockpit edging.
3: Despite its ambitious nature, Tim has designed a practical scale model.

and has a complex 'redundant' control system which separates radio control from power requirements.

Plan

Enthused by our own Peter Rake's Sopwith Triplane, Tim's own plan was distantly based on an original three-view sourced from the internet. In fact, Tim has built two FK 10s, in different scales, the first much smaller, at 34", and weighing in at 34 ounces. It was electric powered, and flew well. However, some years later Tim decided to build a much bigger version, which we feature here.

Construction

The model follows balsa and ply construction, with some hardwood for high stress areas. Sadly, we do not have enough room to fully describe the building and the rigging of such an ambitious project, but traditional techniques were used throughout.

Wings

Tim remarks that you will be an expert by the time you have built all eight wing panels. He reckons that he rattled through a wing panels in two nights. Accurate alignment of the wing panels is vital, so Tim used a simple ladder frame to jig the panels correctly at the assembly stage. Incidentally Tim used Tufnol to attach the panels to the sturdy hardwood interplane struts.

Fuselage

Also traditional, which begins life as box fuselage followed by much embellishment. Tim has incorporated an engine / battery box at the nose to support the motor.

Tailplane

Again traditional, but it is an all-flying unit, which required brass control tags to protrude both above and below the surfaces.

Rigging

Tim used 200 lbs fishing trace and turnbuckles for the landing wires, but also used 16swg piano wire for the main flying wires. The drag wires from the front of the fuselage to the top of the outer struts are from 75lb trace. Their opposing anti-drag wires, made off to brass tabs on the lower rear fuselage, are also 75 lbs trace.

Undercarriage

Tim wished to reproduce the authentic

Tim's FK 10 is 33" high.

4: As per the full-size example, Tim's FK 10 has an all-flying tailplane. 5: Model is covered in Solartex. Four metres of linen and six metres of green. 6: Tim used white marker pens to legend his model. 7: Anti-drag wires (fishing trace, nylon coated) terminate in the rear lower fuselage.

undercarriage system as far as practicable for a flying model. The main structural elements are made from 6 swg piano wire with a lower spreader. The legs and spreader are soldered together. Brass sheet fairings are used to reinforce the joints. Tim used cheap plywood mock-ups to get it all fitting and travelling correctly. These sheets have slots to allow for undercarriage travel. There are also lugs for the rigging wires. The assembly is simply, but necessarily, sprung with bungee cord. The undercarriage is fitted to the fuselage hard points with brass saddle clamps.

Cowl

Tim used a DB Models metal 1/4 scale Pup cowl. Unfortunately, this was delivered with a metal turned finish, so Tim had to polish it with increasingly fine grades of wet and dry paper, ending up with 2000 grit. The final "labour-intensive" finish was produced with humble Brasso.

Cowling

The bright metal cowling panels were produced with a layer of tissue and dope on the fuselage, topped off with a layer of Flair Aluclad. Brass tube was pressed into the Aluclad to suggest rivets. Tim then wiped it all over with black marker pen and then wiped most of it off with a with rag dipped in solvent. This really to picked out the rivets.

Dummy Engine

Tim's very impressive 9-cylinder radial engine was conjured up from a yoghurt pot crankcase and convoluted caravan sink tubing for the cylinders. Plus, of course, a good dollop of imagination, creativity, and low craft cunning!

Motor

Tim is a confirmed electric modeller, and used a Turnigy G160 Outrunner Motor.

Electronic Speed Controller

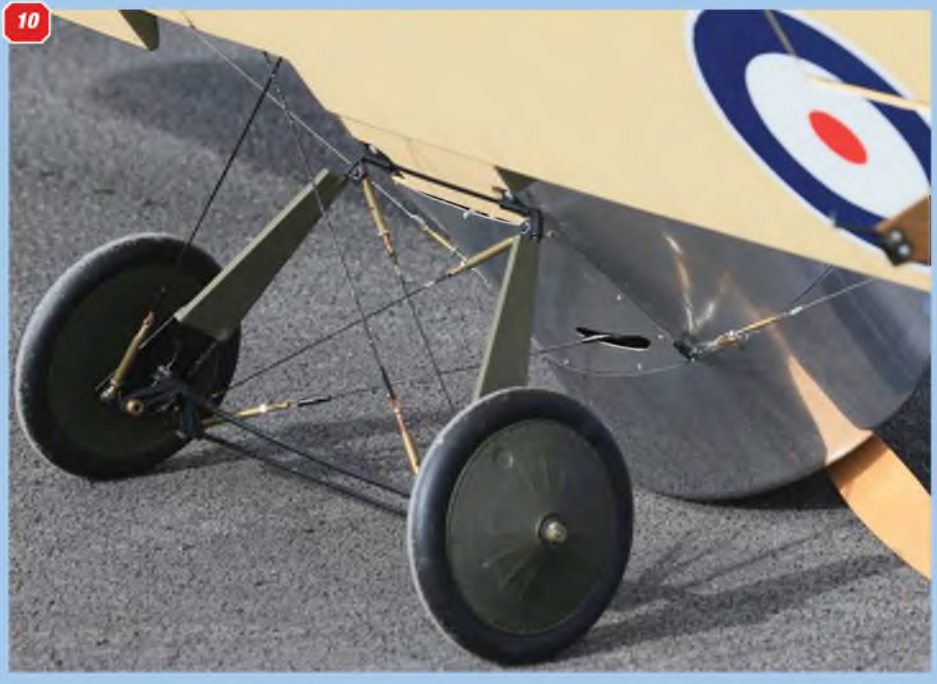
Tim used an HV 80 Amp speed controller.

Battery Pack

The FH 02 uses a 10s 5000 mAh Li-Po pack.

Control Systems

Tim has prudently separated motor control functions from the radio control functions. This means that any emergency in the motor control or battery department does not result in a lost radio control and a crashed model. This moderately complicated wiring involves 2 UBECs, an SM Services Battery Backer, and a Turnigy power distribution board. In addition, Tim has dispensed with all power



switches, and all servos are substantial digital types. The model uses a single rudder servo, two elevator servos, and two aileron servos, plus of course, an ESC for the motor. To maintain a forward cg Tim sited the battery, elevator servo, and twin elevator servos right at the front of the model in the combined motor/battery box. This box positions the motor exactly where required by the cowl.

Covering

The olive drab and linen scheme lent itself well to *Solartex* covering. Four metres of linen and six metres of green were required.

Rib Tapes

Tim used ripped strips of *Solartex* to simulate the many, many rib tapes.

8: Busy tail area with sprung skid, and triangulated tailplane strut with M3 clevises. 9: Neat metal strap to anchor the anti-drag wires on the lower rear fuselage. 10: Undercarriage arrangement is scale-like and practical.

SPECIFICATIONS:

Armstrong Whitworth FK10 Quadruplane

Plan:	Tim Hooper
Wingspan:	80"
Wing Area:	21 sq. feet / 1.9 sq. metres
Fuselage length:	64"
Height:	33"
Controls:	Rudder servos, Two Elevator servos, Aileron servo , ESC.
Weight:	22lbs
Motor:	Turnigy G160 Outrunner
ESC:	80A HV
Prop:	22"x6"
Battery:	10s 5000 Ah Li-Po pack

Unique and bags of character.

Legending
Roundels are cut from white Solartex, and then brush-finished with Flair enamels. White stencilling on the rear fuselage was done with a steady hand and a white marker pen.

Pilot and Observer / Gunner
These really are impressive and came from www.realmodelpilots.com

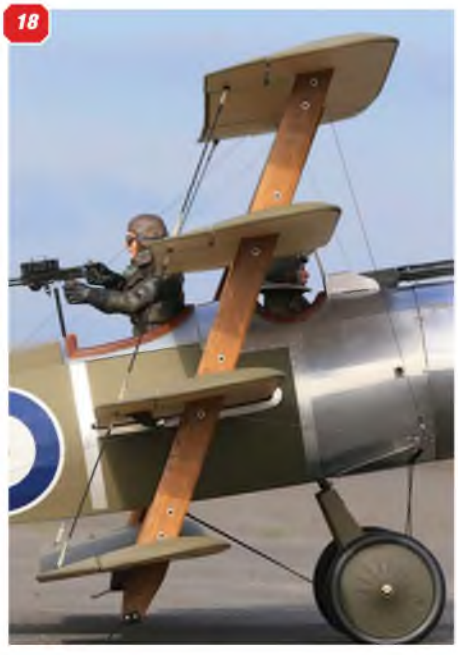
Guns
The Vickers gun was made from balsa, cardboard, and a dash of inspiration. The Lewis gun came from a wooden kit available from balsa USA.

Windscreen Surround
This was fretted out from aluminium sheet.

Tail Skid
Made from 12swg wire soldered into a brass U-clip. The skid articulates about an M3 bolt, and is sprung with heavy-duty hair bands.

Flying Notes
As might be expected from all that area - and a generously over-specced power train - the FK 10 sweeps into the air with great authority. Tim reports that she flies very predictably. I have seen her flying in quite stiff autumn winds with no problems whatsoever. She looks uncannily stable, and from the ground she really does seem to lean into the turns. On low passes her manic rear gunner looks utterly intimidating. Overall, she is the nearest you and I will ever get to observing the real thing. ■

11: DB Models Pup cowl, which Tim polished. Cowling panels from Flair Aluclad. 12: Plastic convoluted hose cylinders, a yoghurt pot crankcase, and inspiration. 13: This part of the cowl and panelling looks very crisp, Note turnbuckles and cable terminations. 14: Non-nonsense ailerons and pushrods! Note rib tapes from ripped Solarfilm. 15: The control pushrod arrangement on the aileron suite. 16: The struts have their own tiny skids. 17: Cable terminations on struts. 18: This view exemplifies the strength of the jig-built hardwood strut arrangement.



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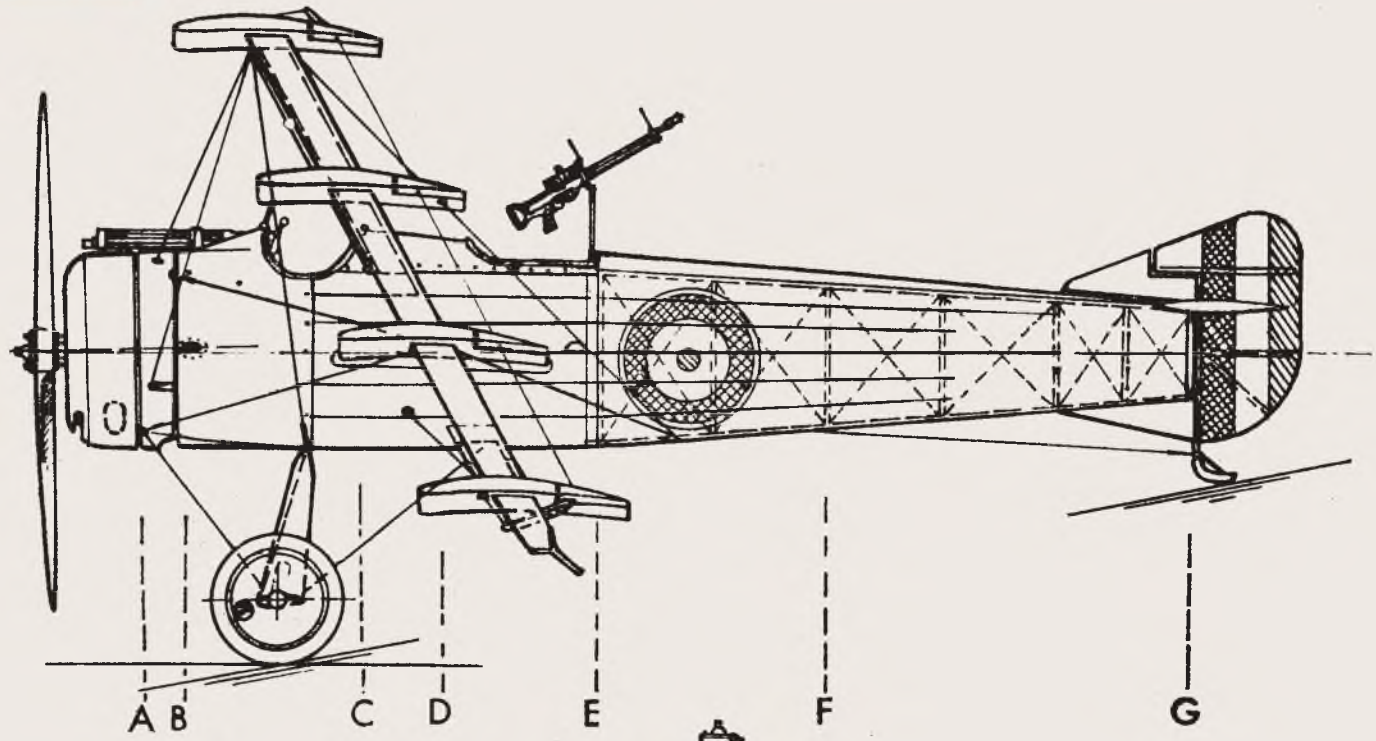
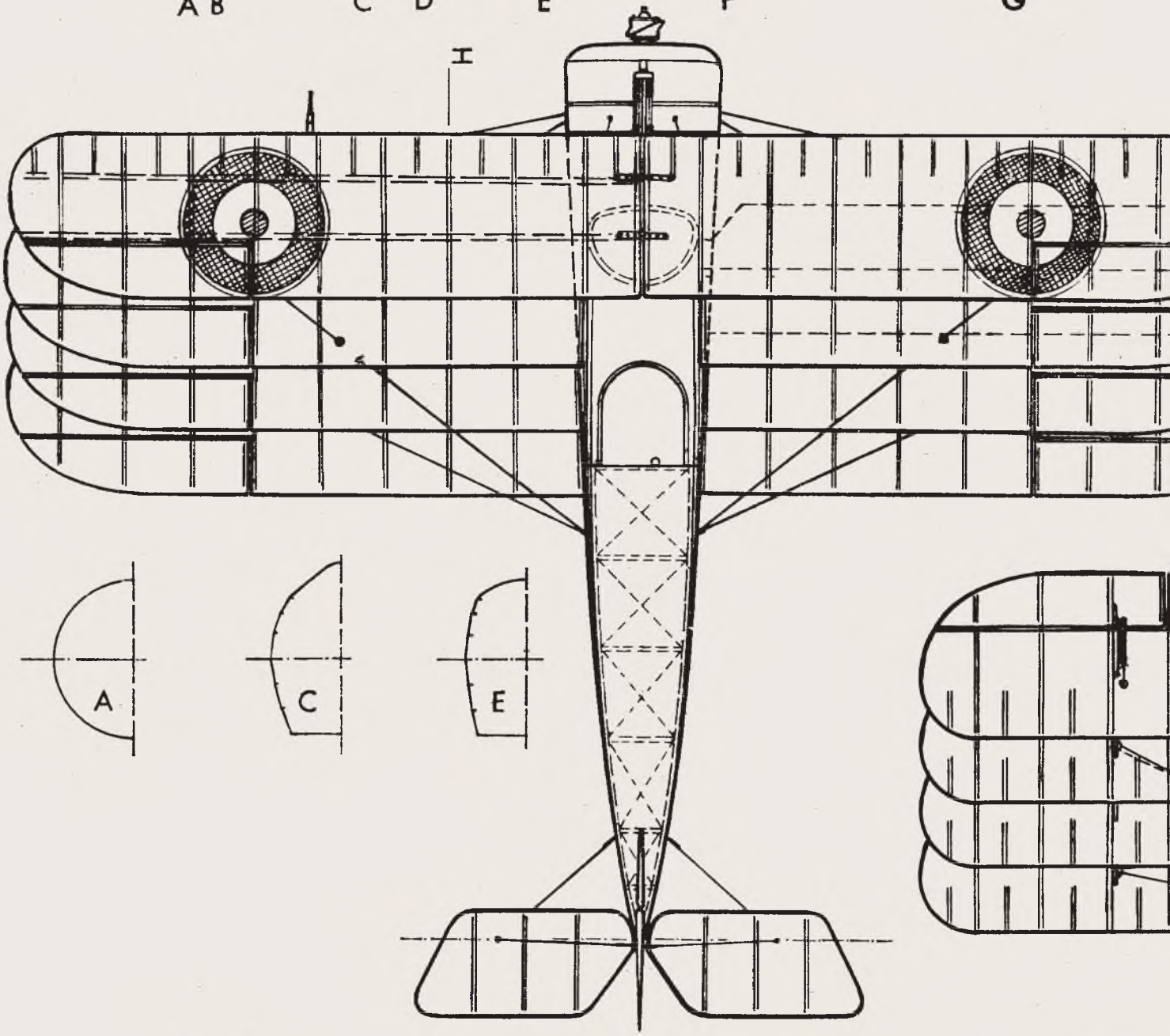
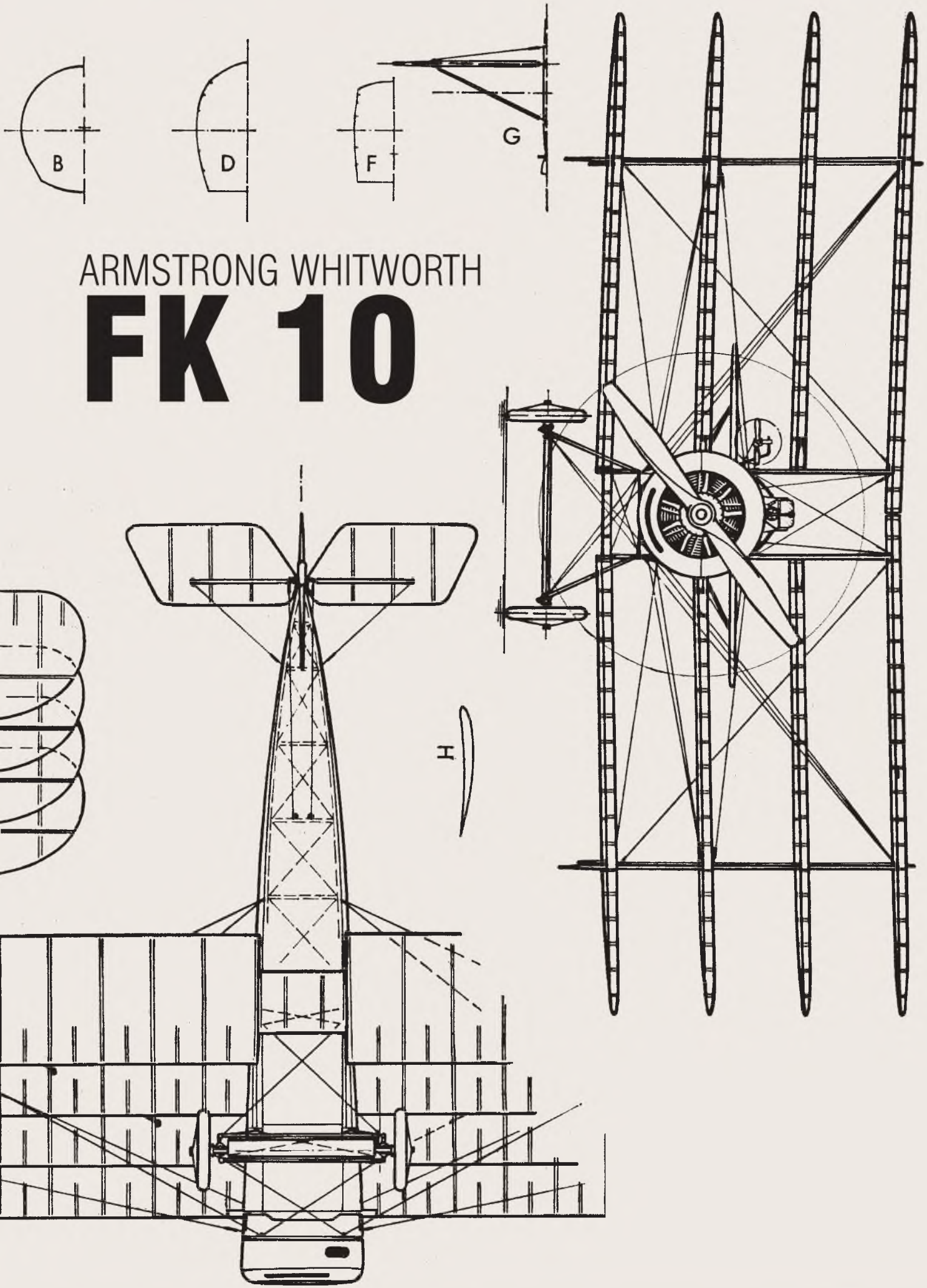






ARMSTRONG WHITWORTH

FK 10

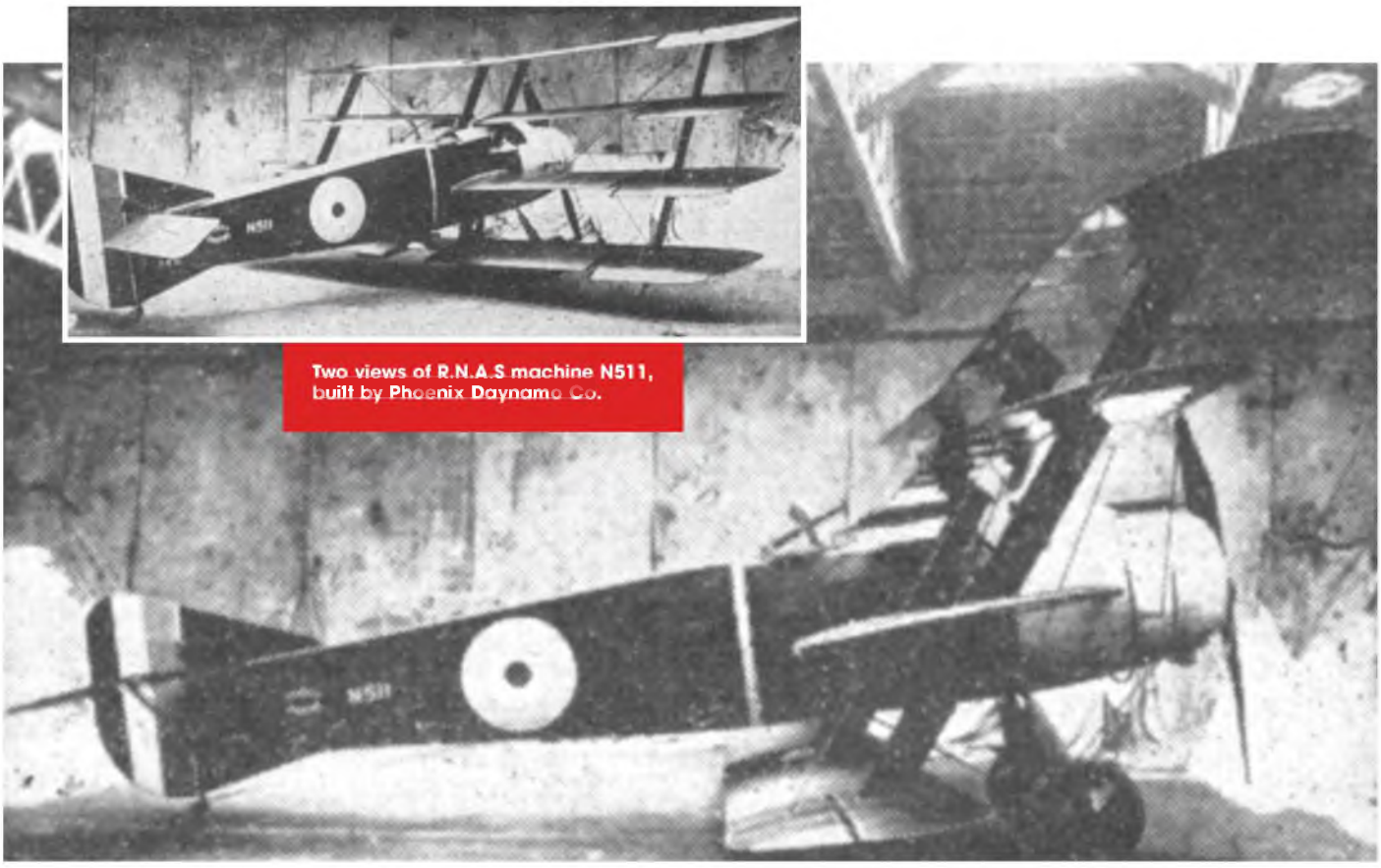
ARMSTRONG WHITWORTH FK 10

A look at one of the most extreme examples of the constant attempts, during the WW1 period, to provide aircrew with a fighter that gave the practical parameters they needed in combat - but which was an extreme too far

Although at most, only 11 airframes were constructed, the F.K.IO Quadruplane achieved unique fame as one of the most unusual aeroplanes of the First World War. The four, narrow-chord identical wings were primarily intended to produce good manoeuvreability, especially with a total of eight ailerons; compact design with high rate of climb; and perhaps most important, good crew visibility.

Located either side (forward and aft) of the wing structure, the pilot and observer/gunner had an excellent field of view in almost every direction. Armament of a fixed Vickers gun synchronised to fire through the airscrew disc ahead of the pilot, plus a pillar mounted lightweight Lewis for the observer would have made it a machine capable of defending itself, but in actual fact records indicate that none of the examples built actually left Great Britain.

One of the Armstrong Whitworth examples of the FK 10, showing the sturdy nature of the wing strutting. Note the fully rounder metal engine cowl, without the cut-out in the lower part of the cowl ring. The manufacturer's name is written along the rear fuselage upper side longeron.



Two views of R.N.A.S machine N511, built by Phoenix Daynamo Co.

They were flown by the Royal Flying Corps at Gosport and the Royal Naval Air Service at Manston. Three constructors were involved; the Phoenix Dynamo Manufacturing Co. made N.5II and N.512 for the R.N.A.S. and these had cowlings with cut-away bottoms, no windscreen for the pilot and sundry detail differences from the Armstrong Whitworth constructed aircraft A5212, A5213, and A5214.

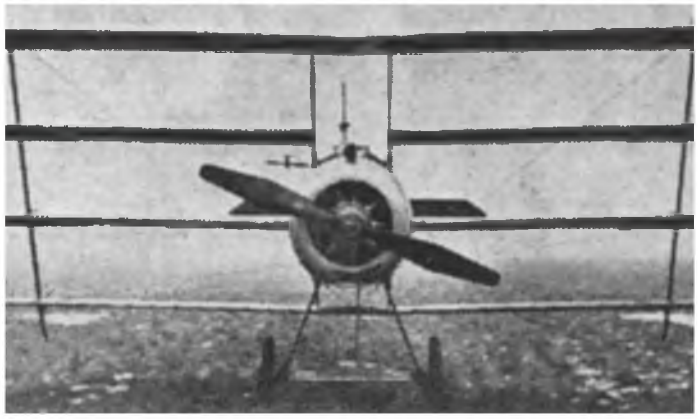
Both the 110 h.p. Le Rhone and 130 h.p. Clerget were fitted but in either case, performance was disappointing, with a maximum speed recorded of 94 m.p.h. at 6,500 ft. and 23 minutes to climb to its ceiling of 10,000 ft. These figures were with the 110 h.p. Le Rhone.

The design, by Frederick Koolhoven (hence the F.K. in the type designation), first used a conventional rigid tailplane, but production examples used the Morane-Saulnier balanced all-moving elevator of only 16 sq. ft. against 390 sq. ft. of wing area. For this reason alone, the F.K.IO is hardly presentable as a subject for free flight scale modelling!

Koolhoven produced a wide range of particularly original designs for the Armstrong-Whitworth Company, which was then located at Gosforth, Newcastle-on-Tyne. To follow the F.K.IO, he had a project with no less than 15 narrow chord wings, heavily staggered and mounted close together, using an F.K.IO fuselage and given the project number F.K.II. It was not completed.

After their short and uneventful service career, the F.K.IO's were scrapped during 1917, but their fame lingers on as the best known of the World War I Quadruplanes. ■

Front view here shows the relief in the lower section of the engine cowl as applied to some of the few FK 10s produced.



Head-on view reveals the lack of centre section panel on the 3rd (one down from the top) wing to allow space for the pilot's head and shoulders.

FEATHER NUMBERR TWO!

PART 1: GOING BEYOND A SINGLE ENGINE SCALE SUBJECT CAN BE A LEAP IN THE DARK. GORDON WHITEHEAD DESCRIBES THE TECHNIQUE TO SURVIVE AN ENGINE-OUT EMERGENCY ON A MULTI-ENGINE SCALE MODEL

So who would want to fly a twin-engined machine on one engine? Well there are those who would want to do it because it presents a challenge. And there are those who might want to use it as a point-scoring demo in a scale competition (especially if they could restart the dead engine in mid-air!).

I can't think of any other group of modellers who would be so inclined and my own experiments were performed purely because I was fed up with throttling back to land every time one engine on one of my twins cut prematurely. I also wanted to see if aerobatics were possible with one engine dead.

The emergence of electric power has done wonders or the twin-engined aeroplane enthusiast. Electric fly-ins feature a far larger proportion of twin and multi-engined models than are seen at events where IC power is the mainstream. Furthermore, at any fly-in where electric and IC fly side-by-side, the six or eight engined machine is bound to be electric-powered; the risk of asymmetric failure of one's powerplants is eliminated by connecting all the electric motors in series or parallel across one electronic speed controller (esc).

But there is an upper limit to the amount of power you can extract from one battery and esc to feed several motors. As larger electric models become ever more popular, it will becomes more common for twin-engined ones to feature a separate esc and battery for each motor. Whilst the chance of one of a pair of electric motors cutting out unexpectedly is minimal compared to IC power, there are bound to be a few adventurous souls out there who will want to experiment with engine-out situations by purposely stopping one motor, spurred on by their complete confidence that the dead motor will be guaranteed to re-start in flight.

So, for the reason just stated, this article is

The De Havilland DH88 Comet has the engines relatively close to the centreline of the aircraft, which is an advantage in dealing with an assymmetric power situation, but the sharply tapered wings work against that advantage. This one is half full size.

Even the full size Martin B-26 Marauder had a reputation for being a handful! As a model, the lack of dihedral imparts no inbuilt stability, so pre-fight preparation to ensure engine reliabily is a wise precaution.

Twin engine type with twin fins. like this Beech C-45 have the advantage that propeller wash over the fin and rudder on the 'live side' can be useful in counteracting and controlling power asymmetry.

One engine out on a four-engine type has less adverse effect that for a twin, particularly if the dead 'un is one of the inners. Although it looks here as though it's a completely dead-stick landing, it's the port outer that died - the others are as idle for landing and the speed of the camera setting appears to have stopped the lot!

relevant to those folks, as well as the IC exponents! The main problem regarding twins concerns how to control the model on asymmetric power when one engine stops.The hazards of engine failure have not been overstated in the past and I don't intend to underplay them, as I have spent more than enough time repairing twin-engined models as a result of overstepping the mark. However, a failed engine situation on a twin is readily controllable with practise, as this article will show.

Some initial points

The first thing to note is that, provided both engines keep going, your twin will fly just like its single engined brethren, except that it will sound nicer, be more unusual, look fantastic, maybe raise your aeromodelling stature just a little ... and stop saying I'm prejudiced.

The second point to note is that, unlike a full size aeroplane, your model does not spend much time flying in straight lines.

You will fly racetrack patterns, or Figure Eights, perhaps with the odd aerobatic manoeuvre. At the very least you will, perforce, have to turn a corner every 15 or 20 seconds and will need to carry on doing so if you propose to keep your twin in the air even with one engine out. If you are a left-hand-turn-only exponent and aspire to flying a twin, then you had better start learning to turn your model the other way. Start tomorrow, and try not to do a left-hand turn for a month!

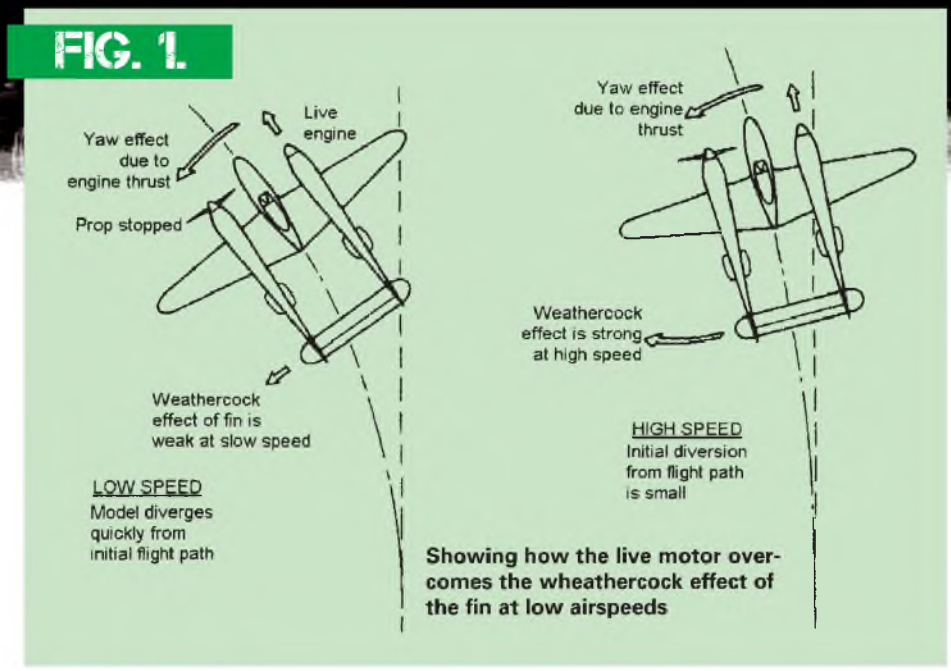
The third point to take on board is that controlling an engine-out situation on a twin will require familiarity with your rudder stick. Handling an engine failure with a twin is essentially a more extreme version of applying co-ordinated rudder and aileron in an adverse yaw situation.

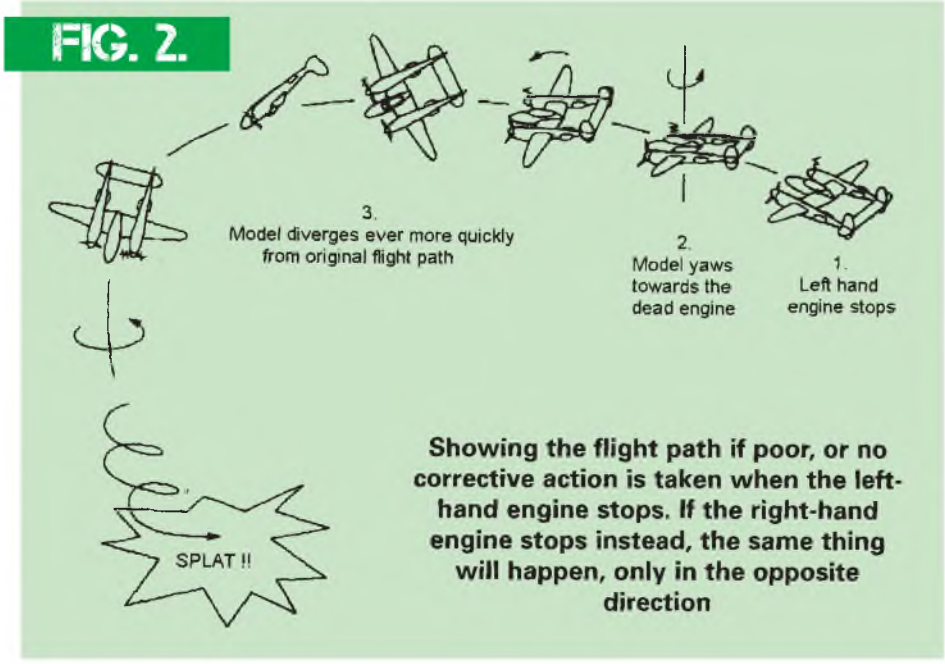
Pre-Twin Preparation

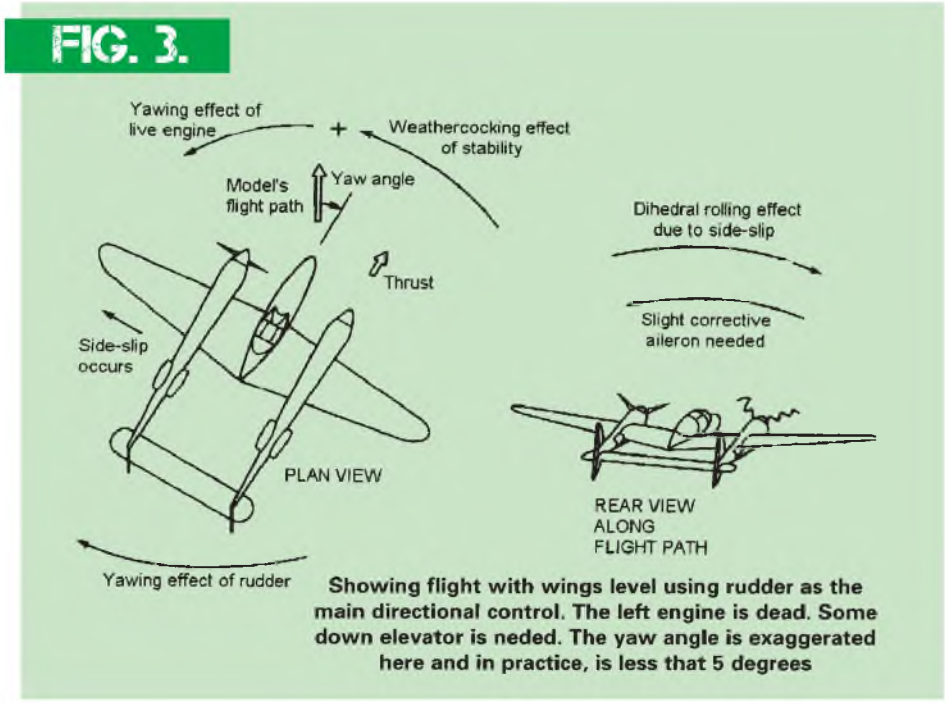
If you're a sport aerobatic flier who can handle the odd bout of knife-edge flight, then you're home and dry. If you are not at this level of competence or don't go in for aerobatics, don't despair. Just practise using that rudder stick during turns using your everyday favourite single-engined model.

During every turn you perform, move the rudder stick over in the same direction as the aileron stick. If the rudder input is too powerful, desensitise it by reducing its throw rate. You must get that rudder thumb freed up and ready for action.

Next, further your experiments by moving the rudder in the wrong direction during a banked turn, firstly to satisfy your curiosity, secondly to see what adverse yaw looks like and thirdly to make the model feel funny. Then, to make your sport model feel really odd, get it to a good height and offset the rudder trim a little one way; fly the model around with your rudder thumb biasing the rudder stick to re-balance the flight path. Try this experiment with the trim offset the other way and note that you







might find it easier, or more difficult, to fly the model with this direction of offset.

This difference in perception could be caused by model characteristics, or by the ergonomic arrangement of your transmitter. Be prepared for a twin with an engine out to have handling characteristics that differ depending on which engine died. That is, apart from the obvious left or right bias when an engine conks, don't expect the model to behave in a symmetrical fashion irrespective of which engine fails.

Exercising your rudder thumb has to be the main prerequisite to flying a twin successfully with one engine out.

Triple Jeopardy

When one of your twin engines stops in flight, there are three things to look out for:-

(1) The model loses half of its power. So it slows down, the controls lose some effectiveness and the model will not climb as strongly, if at all.

(2) The good engine yaws the model towards the dead one.

The yaw is opposed by the directional stability of the aeroplane and at high speed, this stability will be high due to good airflow over the fin. So at high speed, the model will not diverge from its initial flight-path very quickly.

At low speed, however, the corrective effect of the fin will be small and asymmetric thrust will turn the model much more rapidly. **See Fig 1**.

(3) The model will roll towards the dead engine. The reduced propeller slipstream over the wing behind the dead engine reduces that wing's lift and it will drop. This is normally not a strong effect and needs only a small aileron deflection to correct it. However, there could be a significant roll effect if the wing flaps are deployed. Additionally, if the model has a lot of dihedral, it will roll strongly into the turn due to the yaw mentioned at **(2)** above.

If you don't take appropriate corrective action when one engine fails, the first thing you will notice is that the model will yaw towards the dead engine. The effect will be the same as if you had applied a rudder deflection in the same direction and the advancing wing will have its lift increased, mainly due to dihedral effect, causing the whole model to roll in the direction of the dead engine. If you allow the situation to proceed, the angle of bank will continue to increase and the nose will begin to drop. The yaw and roll effects will then begin to increase rapidly and create large drag forces, slowing the model down, decreasing any residual control effectiveness to irretrievably small proportions and precipitating the model into a violent spin, the like of which you will never have experienced before. **See Fig 2**.

The most important thing to realise, is that it is the yawing effect which is the root cause of the problem although, when you see the model flip almost onto its back whilst the drama described in the

foregoing paragraph unfolds, it might tend to make you think it was a roll problem.

Basic corrective action

When you detect that an engine has stopped, your first corrective action has to be to oppose the yawing effect of the live motor, either by applying a good helping of rudder, or by throttling back on the live engine, or a combination of both. A spot of aileron will be needed eventually and we'll come to that, but you should not rely upon aileron as your primary means of attacking the problem.

When you think carefully about it, you will see that the aileron input needed for rolling away from the dead engine could cause adverse yaw towards that engine and it is just that direction of yaw we're trying to avoid.

Whilst we can throttle back the live engine to reduce its yawing effect on the model, at this stage of the description let's leave the good engine running well for now and concentrate on stick and rudder deflections to create the necessary effects for keeping things under control. We are at the stage where we have had one engine cut and have reacted quickly in the first instance with an appropriate rudder throw. We now need to find, and hold in, some sustained control deflections to keep the aeroplane on an even keel. We need to move fast because, as mentioned earlier, we will have to turn the model within a few seconds to keep it in view and we will not want to mess things up on this first turn.

To keep things simple and to help us to place the problem in an easier perspective, let's suppose that we don't have to turn just yet and that we can keep going straight for a while.

We will find that we have the choice of a large number of aileron and rudder settings with which to maintain a straight flight path. At one extreme, we could try to hold the aeroplane with its wings level, using mainly rudder deflection to counteract the asymmetric engine thrust; at the other extreme, we could use aileron alone to try to balance out the asymmetric effects of the engine using a steep banking attitude.

Somewhere in between these extremes lies a combination of control inputs which is the best choice. We'll now examine these choices one at once.

Asymmetric Flight with Wings Level

At this extreme, we aim to keep the wings level. Look at **Fig 3**. The yawing effect caused by the good engine is opposed by the yawing moment generated by the deflected rudder. Besides the pure yawing effects due to rudder and engine, there are some other complicating factors, which we'll look at in the simplest terms.

The rudder side force generates a sideslip towards the dead engine and this sideslip creates a dihedral-induced rolling effect which has to be cancelled out with some aileron deflection. Depending on the amount of wing dihedral, you could finish up in this instance by flying with crossed controls. Another factor is the weathercock effect of the fin, which, in trying to straighten up the model, actually opposes the rudder deflection. So, the rudder has to work pretty hard here, by having to oppose both the engine and its own fin.

That's enough extra complications for our purposes! To keep things simple and to the point, I have taken the liberty of missing off some forces and turning moments and the force diagram does violate Newton's 3rd Law.

The drag of the aeroplane in this configuration is high, due to the sideslip involved, which obviously disturbs the airflow. Our model, which is already only on half-power, could therefore slow down somewhat and struggle to maintain height. The reduction in speed will reduce the rudder's effectiveness, so that a greater deflection will be needed to maintain its control power. It is possible for the aeroplane to slow down so much that the rudder reaches full travel. Then with no more deflection available, the rudder becomes unable to oppose the yaw caused by the live engine and the result is a terminal power spin. When you sense that this eventuality is about to occur, throttle back immediately and push the nose down, using gravity to help increase the model's speed.

Another problem with this wings-level set-up arises when you want to turn the model, which you will have to do fairly frequently. Some aeroplanes will be reasonably happy when controlled thus, but others much less so. With one of the latter, even a gentle turn towards the live engine could use up a significant proportion of the remaining rudder travel, leaving you with insufficient travel available for corrective inputs which may be required to steady the turn.

A turn towards the dead engine, once initiated, might well be unstoppable due to

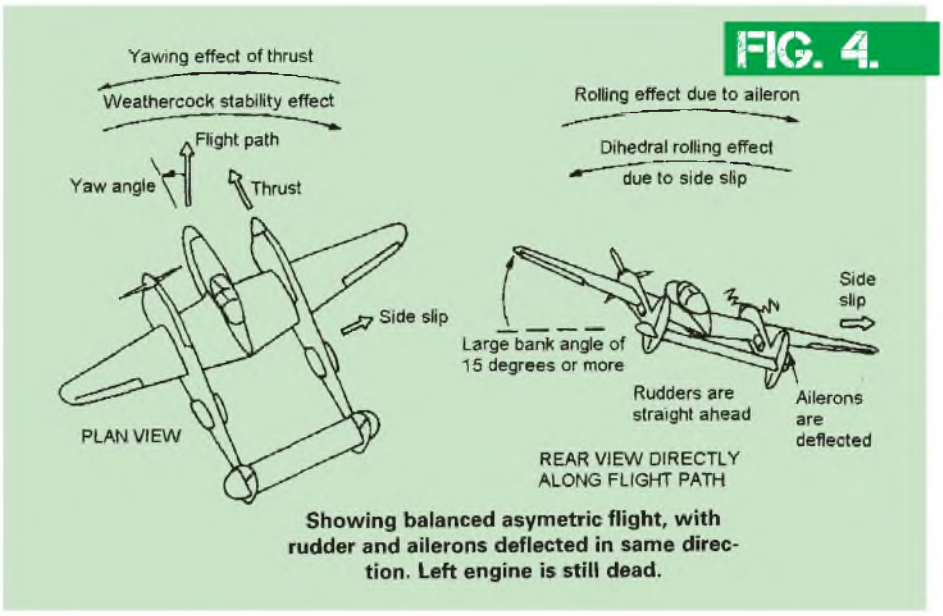
The Westland Whirlwind is not often modeller, although the author succesfully tackled it!

An even more obscure twin type is the Bristol Brigand. John Menhennett may be the only scale modeller to have modelled it

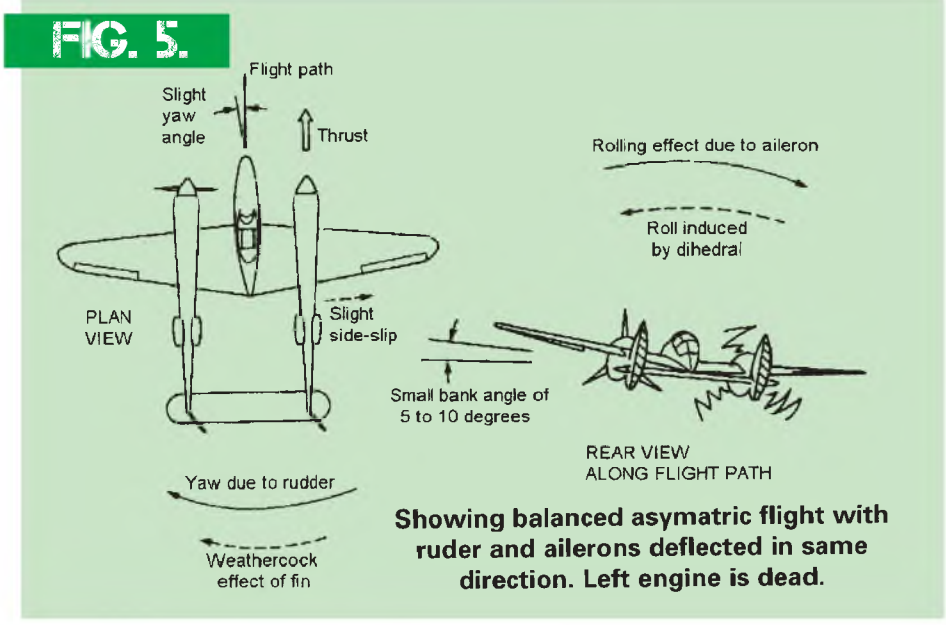
De Havilland Devon has engines particularly close to the centreline, but those narrow wing tips invite a tip stall.

Vickers Armstrong Wellington also offers a relatively safe and contollable twin layout.

Among four-engine scale model subjects the Boeing B-17 is among the most popular and offers plenty of wing area coupled with useful dihedral that imparts useful natural stability - very handy when coping with an engine-out situation.



Showing balanced asymetric flight, with rudder and ailerons deflected in same direction. Left engine is still dead.



Showing balanced asymatric flight with ruder and ailerons deflected in same direction. Left engine is dead.

insufficient rudder travel to bring the model out of the turn. In fact, holding the model in the wings-level attitude as just described is not the best solution, because the draggy flying attitude markedly reduces performance and makes turning manoeuvres harder to perform than necessary. So, let's press on and examine the other extreme control combination available to us.

Asymmetric flight with steep bank angle

It may be possible to control the aeroplane in asymmetric flight by introducing a large bank angle towards the live engine and leaving the rudder central. **See Fig 4.**

What happens here is that the model banks steeply and the aeroplane is made to sideslip towards the live engine. As a result of this sideslip, the weathercock stability of the model yaws the model towards the live engine. Because of dihedral effect, the sideslip does cause the model to roll away from the live engine, so extra aileron is required to counteract this unwanted roll. Furthermore, the direction of aileron input tends to generate adverse aileron yaw towards the dead engine, thereby requiring more aileron input to increase the sideslip and hence favourable weathercocking effect, towards the live engine.

When balanced flight is achieved, the model is at a large angle of bank, pointing in a direction quite different from the way it is moving. It looks, and is, ungainly. It is also harder to control than when using the wings-level technique. As with the wings-level technique, the success or otherwise of the 'steep bank' method depends on which engine remains running and is again due to those 'propeller effects'.

Once more, the set-up is very draggy and should not be used on its own except as a very instructive experiment. You can run out of aileron deflection, and get the you-know-what all the way to mother earth.; spectacular, perhaps, but not rewarding.

If you settle on the Grumman F-7F Tigercat, you might well find yourself with a tiger by the tail!

Something at lot more sedate; the Cutiss B-2

Balanced asymmetric flight

Looking again at **Figs 3** and **4**, we note that with one engine dead, rudder correction yaws the model one way, whereas aileron correction yaws it the other way. In each case, the applied control input is towards the live engine. Therefore if you apply rudder and aileron together in the same direction and towards the live engine, the opposing yaw effects should cancel out, and the model should straighten up. In practice, this is exactly what happens.

Fig 5 illustrates this happy medium. The flying attitude you require is achieved with a fair amount of rudder deflection towards the live engine, with aileron generating between 5 and 10 degrees of bank in the same direction. The banked attitude of the model produces a sideways tilted lift vector which slips the model towards the live engine, and enables weathercock stability to assist the rudder. With this combination of control inputs, you minimise all the disadvantages of the previous two set-ups. The model actually points almost exactly the way it is going, and its drag is low. Low drag means that your engine power is used more efficiently, and height can be maintained more easily.

Furthermore, the amount by which the control surfaces are deflected is less than with either of the two previous examples, since aileron helps rudder and vice-versa. This means that you have more spare movement in reserve for emergencies. ■

NEXT MONTH...

The foregoing theory of flying a twin sounds OK - but what happens for real? Gordon will be back in the next issue to detail some actual experiments he performed to see how the theory stacked up in the real world!

All photos from the Richard Riding aviation photo archive

AUSTER J-5 AUTOCAR

In the immediate post-WW2 years and into the mid-1950s, 'Auster' was the almost universal collective term used for the British light and private flying machine. This one is, perhaps, the most attractive of the line

"If you can see a white star marking then it's got to be a Piper L-4 Cub; but if it's got R.AF roundels, then it's an army Auster!" In Britain by the summer of 1943, few Servicemen would have wished to question such a comfortingly simplistic generalisation of aircraft recognition. If it was slow, small, and with a braced high-mounted wing, then none but the elite of aircraft recognition in the Royal Observer Corps, and the industrial raid spotters would have tut-tutted otherwise.

The name Auster was born in war and survived into the difficult immediate post-war years. 'Auster', the 'south wind', eventually vanished into the Beagle Company, which, in turn, has long since ceased to exist. Yet there are those who have banded together to ensure that the brave endeavour of Auster Aircraft Ltd. lives on - to 'keep 'em flying!' in the form of the International Auster Pilot Club (I.A.P.C).

The experimental clipped-wing Autocar J-5E G-AJYS was fitted with a 155 hp Blackburn Cirrus Major 1 and flown by Auster's chief test pilot Ranald Porteous in the Daily Express Race. Run from Hurn to Herne Bay, in September 1950, 'YS was retired unable to complete the course due to a dodgy thrust bearing. The most interesting and largest competitor in the race was the Handley Page Halifax C. Mk 8 G-AKEC seen in the background. G-AJYS was dismantled at Rearsby and the fuselage later modified to a standard J-5B specification and sold as a spare airframe.

The unique Auster J-5V Autocar G-APUW, the ultimate version of the breed, was powered by a 160 hp Lycoming 0-320 and first flown in 1960. It became a development prototype for the D-series of Austers/Beagles. Note the glass fibre wheel spats.

While the members of I.A.P.C. quite happily know their way around the variety of Austers (from Taylorcrafts to Beagles), the family tree of Austers is more like the Hampton Court Maze for the innocent and unwary.

Initially, the designs were those of the American parent Taylor Airplane Corp., of Alliance, Ohio. The earliest high-wing two-seaters were known as the Taylorcraft Models A-D series. It was the 11th airframe, of June 1939, and with a 90-hp. Blackburn Cirrus Srs.I in line, which became the R.A.F.'s first Auster Mk.I (serial T9120). In civil guise, this British-powered tandem-seater became known as the Taylorcraft Plus (Models C.2 and D) and despite the total 'Britishisation' of the company during WW2, it was not until March 1946 that the name changed to Auster Aircraft Ltd., and the Britannia Works at Thurmaston was finally phased out and production concentrated at Rearsby.

The first Auster model 'J' was the army's Auster A.O.P, (Air Observation Post) Mk.5 (130-hp Lycoming 0-290-3), of which some 790 were built between 1944-46. But there are other J/5s which, like the J/1s, were further developed into J/5 'Autocrat' (for the Australian market renamed 'Adventurer'), the J/5F, J/5K and J/5L 'Aiglet' trainers, plus the J/5Q and J/5R 'Alpines'; in all, a wide variation on a theme!

Other routes in the maze could take in the J/1 as the 'Autocrat', 'Aiglet,' 'Alpha' and 'Workmaster', as well as the J/2 'Arrow', and the aptly-named 1947 one-off J/3 'Atom' and the J/4 'Archer'. What all the model 'J' types have in common is the braced, high-wing monoplane look and fixed main and tailwheel 'alighting gear'. Structurally, they differ here and there, but essentially a fabric skin covers a mixed wood and metal (light alloys and steel) skeleton of the type honed to perfection in the 1930s. Whereas others, especially in the U.S.A. began to satisfy the customer-demand for all-metal light planes, Auster Aircraft remained loyal to a long-proven formula - and paid the price of standing still.

After WW2, it was not until 7 March, 1946 that the Company name was changed to Auster Aircraft Ltd.

The J/5 Autocar variants

It is perhaps as well to try and grasp the nettle here, in order to arrive at the launch of the AusterJ/5B Autocar on its first flight in August, 1949.

The J/5B bit in Auster nomenclature is sorted out best by reading it from right to left. Thus, 'B' indicates that this is the second version of the fifth ('5') variant of the basic 'J' design.

Although Auster Aircraft had dabbled with four seaters before, the Autocar can

The short-lived Auster Autocar J-5B prototype G-AJYK, powered by a 130 hp D.H.Gipsy Major 1 engine, was first flown in August 1949 and followed by 80 production aircraft. After it was sold to Airviews Ltd and based at Barton, Manchester, G-AJYK was destroyed in a crash near Leicester on 18 September 1950.

Two views of J-5P Autocar G-AOGM fitted with a 145 hp D.H. Gipsy Major 10 engine and equipped for aerial - see camera port on the starboard side aft of the cabin. The aircraft was based for a while at Elstree, where this photograph was taken in the early 1960s.

rightly claim to have been their first genuine production four seater. The concensus of opinion is such as to accord the Autocar the compliment of being the best-looking representative of the whole Auster Family. Yet curiously, the accolade results from uncharacteristic deepening of the rear fuselage to accommodate a domed cabin roof.

However, what Chief Designer Ronals E. Brid gained on the fuselage, he lost on the engine cowling, or rather the external exhaust system hanging out in the breeze, at a time when contemporary lightplanes from other manufacturers had enclosed such ugly devices inside their engine cowls.

The prototype J/5 Autocar (registered G-AJYK), appeared just in time for the 1949 S.B.A.C. Display at Farnborough, at which point the company had been in existence for only 11 years.

What makes individual surviving examples of the Autocar so different from one another is partially due to the swapping of old, worn, parts for rescued better bits, because spares for the remaining Auster airframes and engines are becoming more scarce each year.

But the variations across surviving examples is also due to the fact that initial purchase was ex-works 'pretty basic' - enough only for VMC (Visual Met. Conditions) - and everything else was an 'extra', duly recorded on the planning card for each aircraft and added on the assembly line. Navigation lights, wing-mounted generator and additional instruments were all customer-specified.

The wheel spats that subsequently appeared on some were Auster-designed, but are an 'extra' from a later period. So don't count on any two surviving Autocars being 'lookalikes', either externally or internally.

A total of 82 built from 1949 to1957, with enlarged, horn-balanced rudder in December 1949 replacing prototype G-AJYK's original mass-balanced control surface. ■

AUSTER J/5B GENERAL CHARACTERISTICS

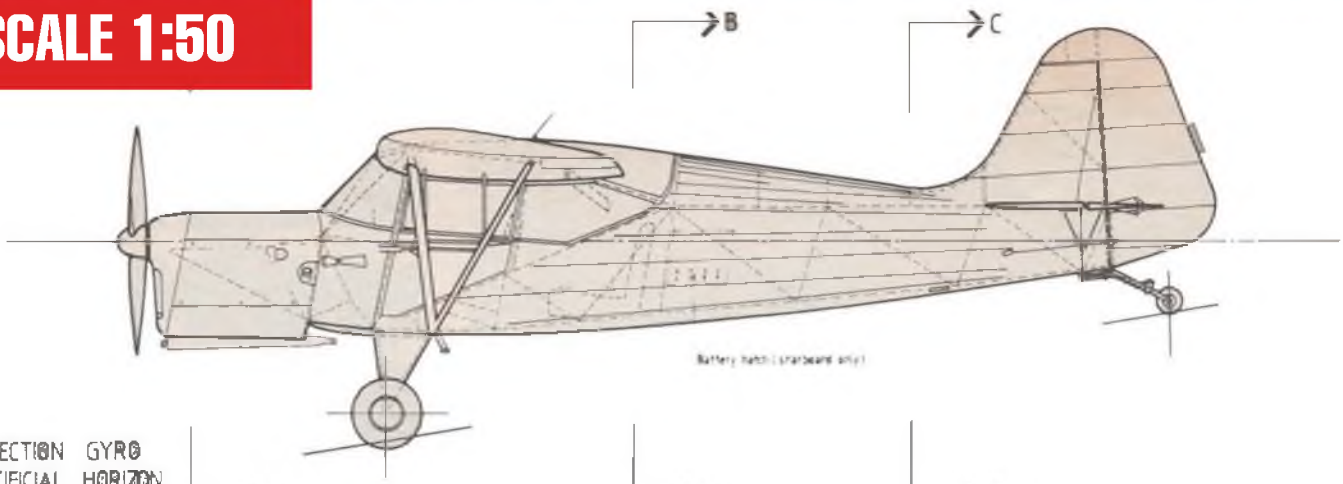
Crew: 3
Length: 23 ft 4 in (7.11 m)
Wingspan: 36 ft (10.97 m)
Height: 6 ft 6 in (1.98 m)
Wing area: 185 sq.ft. (17.19 m.sq.)
Powerplant: de Havilland Gipsy

Performance
Maximum speed: 117 mph (188 km/h)
Range: 260 miles (418 km)
Service ceiling: 11,000 ft (3,355 m)

LEFT & MAIN IMAGE: Two views of the Autocar J-5G G-AMZV pictured on the Solent in 1958 undergoing trials fitted with an experimental Sunders-Roe hydro-ski undercarriage. Although equipped with wing-tip buoyancy tanks, just in case, the aircraft could remain almost stationary on the water. Fitted with a conventional undercarriage 'ZV was later flown from Southport sands with Giro Aviation Ltd and eventually destroyed in a crash in August 1966.

Auster J-5G Cirrus Autocar G-ARUG, originally an an unsold airframe was eventually sold to the Portsmouth Aero Club in 1962 and is still airworthy in private ownership.

SCALE 1:50



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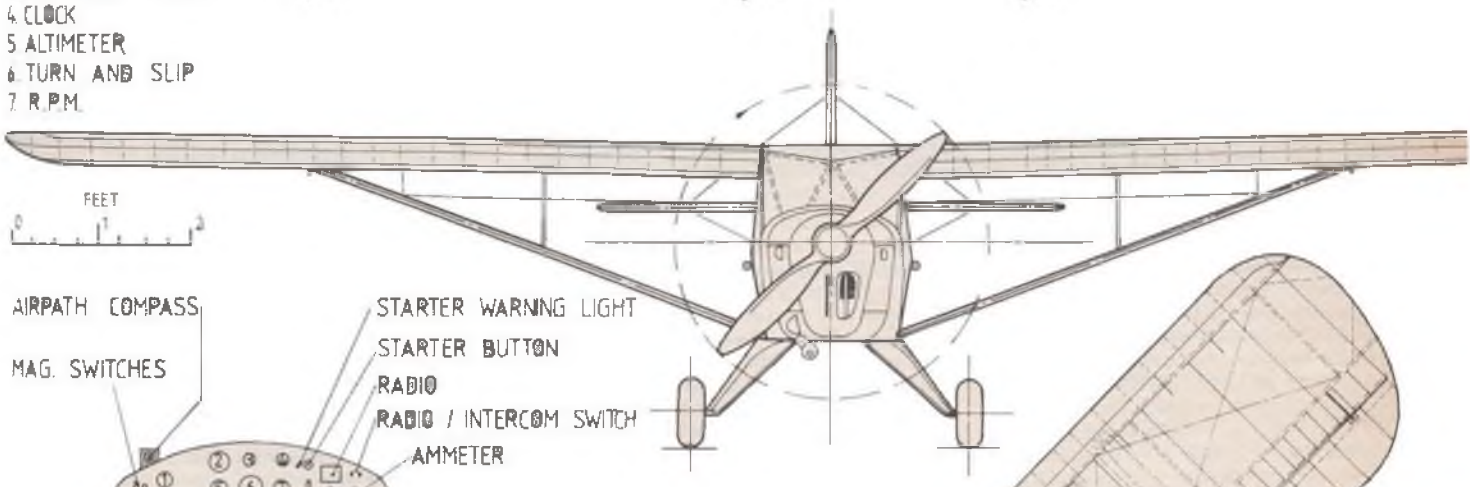

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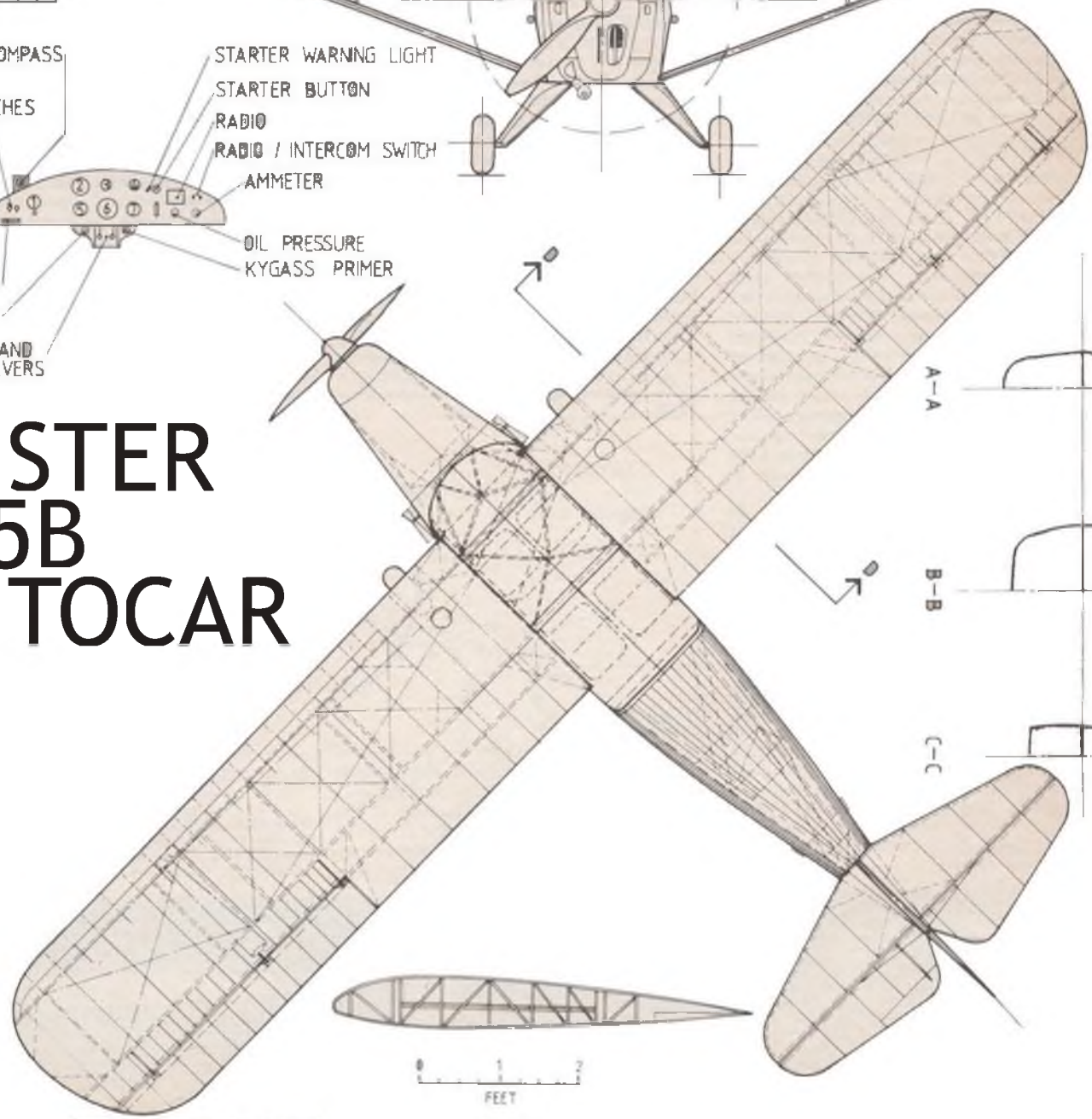

AUSTER J/5B AUTOCAR

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COUNTERWISE

NEW FROM MAXFORD USA

The **Maxford** line of R/C scale model kits is notable, and commendable, for the interesting aircraft types that it chooses to replicate as models. Even so, it was particularly nice to see the introduction of their **Curtiss Model D Pushe**r of 1911 vintage, which those who favour the real 'old timers' will certainly welcome.

The kit features basic all- balse/ply airframe construction and is supplied in ARTF format. RRP: £195.95

The model has a wingspan of 50" (1270 mm), which is approx. 1/9th scale and requires a minimum of 400W brushless motor power.

Equally individualistic in choice of subject is their **Hughes H-1** Racer which, although the name implies, was never actually raced, but was used by the legendary Howard Hughes to set a world speed record and was indeed the very last privately owned type to ever hold such an outright world record.

Maxted's model spans 50" (1270mm) and is supplied in ARTF format for electric power, with retracting undercarriage included in the kit. RRP: £219.95.

Both from MacGregor Industries stockists.

A FLYING LIFE

An enthusiast's photographic record of British aviation in the 1930s; a Biography of E.J. 'Eddie' Riding

BY RICHARD RIDING

ISBN 978-1-78155-087-8

Foothill Media Ltd.
£16.99

Any aeromodeller with a committed interest in free flight will know the name of Eddie Riding, whose designs were regularly published in AeroModeller magazine as construction feature, with plans, during the post-1945 period. Indeed, until the demise, just a couple of years ago, of the annual Woodvale Rally, the range of E.J.Riding free flight scale designs was celebrated with a regular competition class for F/F scale models built from his plans.

Bourne in 1916, Eddie interests were drawn to aviation from an early age, first (after schoolboy motorcar and train spotting), to aircraft, and then to aviation photography which formed a part of his life thereafter, until his death, in an air accident in 1950 at age just 34.

In the intervening years, 'E.J.R.' travelled widely in his Austin Seven 'June Bug', photographing a vast variety of aircraft of the 1930s decade and amassing a huge archive of aircraft photo studies, no less than 350 of which appear in this 250-plus page story, written as first-hand knowledge by Eddie's son Richard who was the launch editor of Aeroplane Monthly magazine.

UP, DOWN, FLYING AROUND...

Attempts at providing an aircraft that combines the vertical take-off/landing capability of a helicopter with the payload performance and speed of a fixed-wing aircraft has been one of the aeronautical challenges of the past decade.

One of the experimental types involved in this aero-engineering quest has been the **Canadair CL-84,** which has been instrumental in proving some of the concepts that led to greater understanding of the V/STOL technology that was eventually incorporated into the Boeing V-22 Osprey.

First announce at the Nuremberg Toy & Hobby Fair back in January this year, **Hobbico** have now introduced their 950mm wing span (37.5") model of the type that features a control system just like the full size, in which a tail-mounted motor controls fore/aft pitch and left/right yaw. The model features an on-board electronics system incorporating a built-in three-axis gyro that steadies the aircraft throughout the flight envelope through the whole vertical-to-horizontal flight transition, providing full stability.

The fully assembled mechanism for the 90 degree wing-tilt transition is built into the model as it comes in the box (fully adjusted) with three associated three brushless motors and three brushless ESCs also fitted.

The basic airframe components are made of injection moulded foam and the model features R/C control functions for ailerons elevator, motor, steerable nosewheel, wing tilt, fore/aft pitch, roll and yaw, driven from a 4S 2,200mAh power pack. A six-function R/C system is required.

Price is expected to be £276.99.

SCALE FROM SCRATCH

WANT TO TAKE A STEP BEYOND KITS AND ARTFS? KEN SHEPPARD CONTINUES HIS SERIES TO ENCOURAGE OWN-DESIGN SCALE MODELS

PART 10: FLYING THE BEAST

Last month saw the model completed, with scale detail added and surface finish achieved ready for flight preparation, combined engine runs to check the throttle management, ground checks to check range and interference, a final check of CG position control surface throws and directions - and commitment to the blue yonder. No more excuses, it's time to try her out!

Maiden flight nerves

The immediate disappointment at the field was that the undercarriage which had worked perfectly at home on the bench, refused to retract. Never mind, most first flights with full-size prototype aircraft are done with the wheels fixed down, so the Do335 would have to do the same! The strip had been freshly cut and rolled and, despite the sky being overcast, there was very little wind - in other words, perfect weather for test flying. So, despite not being able to lift the wheels, I decided to go for it. Using an eight-cell pack to check out the electric motor circuit whilst warming up the RCV 58CD four-stroke, the 'Arrow' was carried out to the flight line and at two clicks above tickover on the throttle stick, a fully charged ten-cell pack was substituted in place of the 'systems check' pack - and connected up. For the first take off, I elected not to use the flaps - just to see how long the take off run would be. Blip the throttle to check both motors fired up smoothly and, check the nose was directly into what little wind there was - and off we go!

The nosewheel steering was very sensitive and initial oversticking had the nose wagging from side to side as the speed built up, so just the rudder trim slider was used to straighten it up. As expected, the take off run was long and I held off from feeding in 'up' elevator until I felt that the speed was sufficient for a gentle climb out and, just like that, she was up and away! The gyro on elevator was set at max gain (I could switch it out if necessary) and she felt as smooth as silk. The first turn was kept flat and wide, with good aileron response - and boy, didn't she look good! On the into-wind leg of the first circuit as I flew her past me for my clubmate Jeff to get a picture, we noticed that the starboard undercarriage leg was hanging in the breeze, retained only by the plastic pneumatic tubing! The long, bumpy take off run had loosened the wire leg. So decision time!

Fortunately, the adjacent sloping field had only just been sown and the rain of the previous weeks had ensured that the earth was soft, so I opted to land in the field, as flat as I could. Just then, banking to the right into the last circuit turn to line up with the field (the model was at 90

The very unusual side profile - in the air on a fast pass she looks like a flying torpedo!

1: Just one shot of her flying! The very first flight - you can see the starboard uc leg hanging off, starting the curse of the retracts saga! She looks good, handles well, is very fast - and sounds great! 2: The dolly - after several retract failures, this seemed the right way to go when flying off of less than billiard table grass!

degrees to the aerial), there was a severe glitch on the ailerons, causing the model to drop the port wing momentarily, before levelling out again - interference - just what I need during an emergency landing. So I decided to keep it level without any further aileron input and ease off the throttle for a level descent along the slope of the field. The 'arrival' was near enough flat, but the soft ground grabbed the wheels and pulled the remaining two legs off - but she was down and pretty well in one piece!

Damage was minimal and I have to say that I was pleased as punch as I carried the model back to the pits - forget the U/C, she had flown and what's more, she had felt very smooth - joy!

If I could summarise everything that this series has been about, it's that feeling you get when the first flight is under your belt (or even during the first flight, if it lasts long enough!) - your own design baby has flown! Nothing like it in the world, believe me - spiritual, emotional and downright joyous!

Analyse and rectify

Time to analyse what happened. On the positive side, the handling felt very comfortable, so aerodynamically, everything was OK. The RCV 58CD performed faultlessly, as did the Twister 19 electric motor - I had no opportunity to time the duration of the useful electric power, but the thrust of the combo certainly push/pulled the 'Arrow' at a respectable rate of knots. The gyro successfully damped out any of the anticipated 'porpoising' (future flights would see the gyro gain reduced progressively to see the effect) - so overall, a great success.

On the down side, the retract failure was traced to a leaking joint. The loose leg was rectified by filing a bigger flat' on the leg, so that the grub screw engaged the leg completely and the screws refitted using threadlock compound.

The glitching of the aileron was a bit of a head-scratcher. Two possible causes came to mind, first, the servo leads to the ailerons are about two feet long (610mm) each. This has not been a problem for me in other models of the same sort of size, but it is generally recommended to fit a 'flux' ring near the Rx, on any lead over about 18"(460mm) long - so this was done, wrapping the lead several times through the ring, positioning it about 6" (150mm) from the Rx connector.

The other possible source of interference was the electric motor harness that runs down the centre of the fuselage from the cockpit to the tail. I have been told that the three heavy-duty cables can induce a 'field' around them when the motor is running. I had strapped them together to minimise this phenomena, but the aerial ran parallel to them and could possible get 'blanked' by the harness. Now I normally advise that 'changing one thing at a time' is the right way to go, but in this case, I opted for re-routing the aerial out of the top of the fuselage to the tip of the fin, hoping that any 'blanking' would be minimal - as well as fitting the flux rings.

The second flight the following day (yes, two days of good weather!) was much better; the retracts worked, there were no glitches and the handling proved every bit as comfortable as before - I even tried a loop and a roll and a couple of low passes at speed - she really motors.

This time I flew about a half dozen circuits, before deciding that I should bring her in for her first proper landing. I kept the approach on the fast side, but nice and flat, letting her fly herself in. The landing proved the models weakness, however because, on settling down on the noseleg oleo, the nosewheel leg collapsed, causing one of the mains to be pulled out again - this was becoming monotonous - and annoying!

On returning home, a close examination of the main legs showed that if I loosened the four screws securing each of the main leg *Robart* units to the mounting beams, they operated perfectly. Tighten up the screws and the legs refused to budge! It suddenly occurred to me that the main body of the retract unit was some sort of glass reinforced plastic, or something similar. It would appear that unless the mounting holes lined up exactly with the csk holes in the mounting case, the flange of the case would distort when the screws were tightened, causing the case sides to grip the retract fitting. This increased resistance being enough to overcome the pressure in the operating cylinders. The other factor being that despite the grass being short, the small diameter of the nosewheel probably caused it to dig in to the softish, bumpy, ground,

Three reds again - and again!

Being a sucker for punishment, the U/C leg mounting was repaired and I flew her again, as soon as I could. This time the take off run was straight, the undercarriage retracted on climbout and

3: I'm not the only one who is fascinated by the Do335! Way back in the early fifties, my hero, Doug McHard, modelled the 335 (solid wood) and was awarded second prize in the annual RAF Champs. 4: Going for it! Warming up the RCV 58CD ready for the first off. As you can see the model needs some restraining! Note also that the grass is already grabbing at the undercarriage - bigger wheels should have been a major design consideration! 5: The RCV58CD with its unique low profile cylinder fits completely inside the small diameter cowl and the power output and running reliability is first class. 6: One of the first of the new generation electric outrunner motors commercially available, the Twister range gave equal performance potential to normal IC engines - this Twister 19 claimed to be equal to a .40 glow - and I believe it!

the flight was perfect - and fast. With the wheels up she was noticeably faster and, mindful of the need to conserve battery power for a decent duration flight, after just a couple of high speed diving passes just to see how fast she'd go (impressive, well, I thought so, anyway), most of the flight was done at three quarter throttle. At a bit of height, I lowered the flaps and with no noticeable pitch change (no trim adjust needed), she slowed down significantly - excellent! I have to say, the outline of the model in the air is very distinctive and despite that second canopy, as she flashes past, she looks more like an airborne torpedo than an aircraft!

All went well until I decided to land and hit the 'retract down' switch - zilch! Nothing. For the second time, it had to be a landing on the field - a true belly landing. This time I came in with full flap, keeping the power on for elevator authority, but letting the gyro keep her level. This time the earth grabbed the main leg doors and bent the legs! Retracts - who'd have them?

Talking to the guys at the club during the afternoon, someone suggested using a dolly for grass strips - using the retracts only for tarmac. Now opportunities for the latter are few and far between, but after having to repair the U/C after every flight on grass so far, the dolly 'idea' was an attractive solution.

Dolly mixture

I toyed with an all-wire assembly that would look scale-ish, with U/C doors etc, but soon realised that a lot of accurate wire bending would be needed, so I settled for a more agricultural version, using 1" square hardwood strip and a bit if 1/4" ply. A redundant pair of ali U/C legs from the spares box gave the necessary height, when fitted with large diameter wheels and a noseleg from another dead aircraft proved perfect for the noseleg. I didn't bother with steering, although a second Rx battery and servo would be easy to locate on the dolly, if it decides to wander.

A wire cradle holds the nose in place and a vertical piece of piano wire hold the wing at each panel leading edge. To stop the aircraft sliding from side to side, a short wire pin on the dolly centre line engages in a larger diameter piece of tube fitted in the wing belly fairing. It's a guess how long to make it as you don't want it too short and the aircraft may bounce off the dolly during the take off run - too long and the pin may bind in the tube so that the dolly takes off with the aircraft!

NEXT MONTH...

The very last part will complete the flight testing - despite a major setback - look back over the objectives and consider whether they have been met, and give a summary of the lessons learnt - that will be considered when contemplating the next project. It's addictive, you know, this OD scale!

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PURE SCALE!

THE BMFA FREE FLIGHT SCALE NATS 2015

Alex Whittaker enjoys two bonus evenings of FF fun at the August Nats

Many had mixed feelings at this year's BMFA Nats at Barkston Heath. Some felt that this might be the last time that we would see Free Flight Scale comps at the Barkston. I prefer to wait and see. The weather was less than co-operative during the day, but abated almost miraculously for the evening F/F comps. In fact, we had two bonus flying evenings, though the first began a little wet, and rather dull.

The second evening was much better early on, but late-August Barkston does not normally provide many long, late, sunny spells. Never mind, we had a whale of a time, with a broad range of scale subjects, and a refreshing variety of types of propulsion.

The thick of it

Numbers were down on last year. I counted 16 entries that turned in a score. It is quite hard to make sense of such busy

Bernie Nicholl's Piper L-4 Grasshopper flying into the westering sun divesting herself of all encumbrances.

Mike Hadland admires Peter Fardell's rubber powered Bristol M1c. This is the in-line engine version.

Peterborough Flyers', Gareth Tilston and his electric powered DH 60 Moth.

Phil Worth and his electric powered Me 163 Komet.

Richard Granger launches his large rubber powered Lacey M10, not long before dark!

Splendour In The Grass: Andy Hewitt's Morane Type N, rubber powered.

Derek Knight stepping up to the oche with his rubber powered Avro 560.

outdoor F/F comps when you are in the thick of it with your camera. There is no Start Line, public address, or any clear linear sequence.

Often there are two or three sets of Judges tracking entrants who contrive to fly off simultaneously, all over the shop. You can be waiting patiently for one pilot to dope the wind, whilst another makes a spectacular, but misse launch behind your head. Very frustrating; in fact, it is usually the next day when I receive the Official Results, before I get a grasp of the significance of the some of the flights! Of course, the spectating crowd know exactly what is going on.

Scale Power

Andy Hewitt was suffering a bit with both engine and trim problems on his very impressive Oliver Tiger Cub powered Halberstadt C.1 IV. As a F/F design, it looks a tricky customer, since it doesn't appear to have much dihedral, or a very long tail moment. Sadly, Andy's 'Ollie' was certainly not starting first flick. However, he persevered, and placed 3rd. This is quite a large diesel powered model, with bags of area, so lift was not the problem, though she did make one or two spectacularly abrupt arrivals on the tarmac.

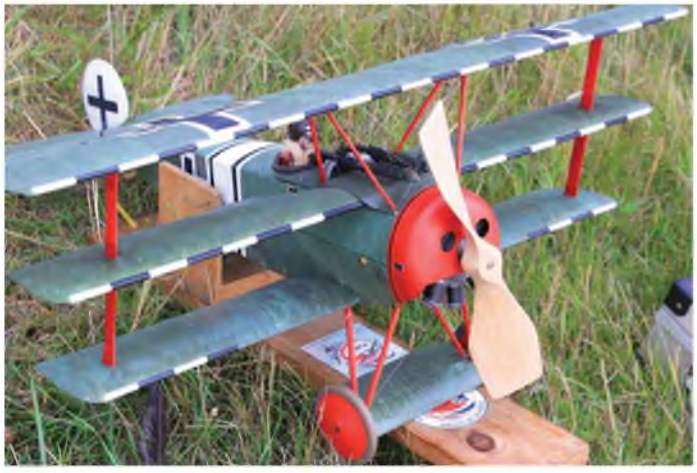
The scale detailing, as we have come to expect from young Hewitt, was very good indeed. I loved the dummy engine, the radiator, and of course, the lozenge covering. Her static score was a very good 1401.

Runner-Up in this class was Mike Smith with his newly re-engined and lightened Sopwith Cuckoo. This was very crisply detailed, and was given a good static score or 1399. To my untutored eyes she looked to be flying a bit slower and more predictably this time. She first flew on an AM 15 diesel, now de-selected by Mike in favour of an AM 10. Two flights drew zero score so he did well in the others to place 2nd.

Top Podium went to Bill Dennis with his nicely presented 'Harry Tate', or RE8. I loved the detailing around the engine, and trade mark upright exhaust stacks, that smartly hide the diesel engine. The RE8 has bags of character, and this one attracted an excellent static score of 1,599. Most importantly she flew very consistently. A very worthy winner.

Scale Rubber

A goodly number of entries made this a



Richard Moore's rubber powered Fokker Triplane D1.

Richard Moore's Fokker triplane leaves his hand in the gloaming.

SAM 35 Chairman Ian Lever and his Miles Magister. Rubber powered.

Bill Dennis checks the engine run on his Mills 1.3 diesel powered RE8.

Backed by the large crowd, Steve Glass awaiting his slot with his Saab J-29 Tunnan.

Textbook launch from Ian Lever of his rubber powered Miles Magister.

Smashing engine detailing on Bill Dennis's "Harry Tate" - RE8. Diesel just visible.

Steve Glass gives a good heave-ho to his Saab J-29 Tunnan

closely contested class. SAM Chairman, Ian Lever flew his Miles Magister. He dropped a couple of flights but recovered and then also scored well in static to place 3rd.

Ivan Taylor's ambitious and pretty rubber powered Supermarine S5 floatplane put in two good flights, plus an excellent static score, and was Runner Up. This was all the more remarkable when you consider Ivan suffered a cataclysmic winding failure while the model was on the 'stooge' during the first evening. This knocked the tail clean off the model, but he repaired it for the Sunday evening's flying Incidentally, Ivan was awarded the Eric Coates Trophy.

Top Podium went to Andy Hewitt with his nicely detailed Morane N. An excellent static score coupled with two very good 'best' flights sealed the deal.

Co2 / Electric

Steven Glass flew his Saab J-29 Tunnan 'flying barrel'. This was an electric ducted fan (EDF) model, which looked very convincing in the air. Steven told me he is building a bigger one over the winter. He clocked up a static score of 2,306, and capped it off with six highly consistent flights. This was enough to grab Third Place.

Next up was Bernie Nicholls with his Piper L-4 Grasshopper. She shed a few scale details on climbout, but nevertheless, she flew on and managed to turn in a score in five of her six flights. A worthy Runner-Up.

However, she was pipped at the post by a newly invigorated Gareth Tilston with his immaculate DH 60. This was his own electric conversion of a rubber kit.

Models I liked

A number of the models that did not quite make the podium tickled my fancy. I loved Derek Knight's elegant, high aspect ratio/silver dope finished Avro 560, while

Mike Smith's re-engined Sopwith Cuckoo flies by in the gathering gloom.

Terry Aydon's Sopwith Triplane climbing out on her Frog 150 diesel.

Terry Aydon with his new Sopwith Triplane Black Maria. Frog 150 diesel power.

Boing! Terry's Sopwith Triplane demonstrates her clever crash-proof construction.

BMFA FREE FLIGHT SCALE NATIONALS

Podium Places

FREE FLIGHT POWER

1.	Bill Dennis	RE8.
2.	Mike Smith	Sopwith Cuckoo.
3.	Andy Hewitt	Halberstadt C.1 VI

FREE FLIGHT RUBBER

1.	Andy Hewitt	Morane N
2.	Ivan Taylor	Supermarine s5
3.	Ian Lever	Miles Magister

FREE FLIGHT CO2 / ELECTRIC

1.	Gareth Tilston	DH 60
2.	Bernie Nicholls	Piper L4 Grasshopper
3.	Steve Glass	Saab J-29 Tunnan

Richard Moore's rubber powered Fokker Dr.1 Triplane was a delight, as was Phil Worth's tiny electric powered Messerschmitt Me 163 Komet. (I note that Komets have come back big in all scales this summer).

I enjoyed watching Richard Granger's rather large rubber powered Lacey M.10 in its aerial navigations, and Peter Fardell's rubber powered Bristol M.1c fascinated me. This is a model of the Lucifer engined version, not the usual big Le Rhone radial.

However, my favourite model was Terry Aydon's beautifully crafted Sopwith Triplane. Terry modified the old *AeroModeller* plan and applied an amazingly detailed cockpit. In flight she was bit wayward, including a crash into the tarmac, and a few sallies forth through a delighted crowd. She'll be utterly superb when she is sorted, but I suppose this year's poor weather has given too few opportunities for consistent free flight scale trimming sessions.

The Verdict

Against all the odds, of sometimes very inclement daytime weather, we had a superb Free Flight Scale event. The two fine evenings in a row was a superb bonus after a two full days of R/Cscale. F/F scale is a subtle and lasting pleasure. It is so different from radio, but every bit as absorbing.

Andy Hewitt and his impressively large diesel powered Halberstadt.

Radiator detail on Andy Hewitt's Halberstadt.

Ivan Taylor with his ambitious rubber power Supermarine S5.

Andy Hewitt's fine Halberstadt C1 VI climbing out over the heath. Decent wing area.

Dummy engine detail on Andy Hewitt's Halberstadt. Love the valve springs, rocker boxes, and manifold.

All hands to the motor: Ivan Taylor piling on the turns on his Supermarine S5.

THE QUIET ZONE

R/C SCALE ELECTRICS WITH PETER RAKE

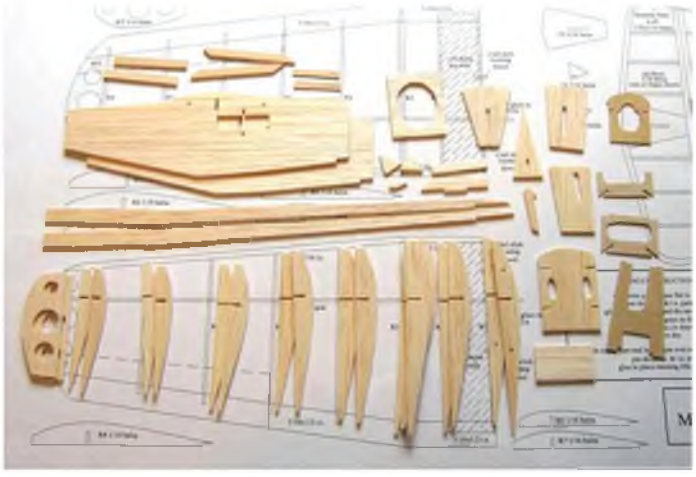
OUR COLUMNIST OFFERS AN UNUSUAL, EASILY CONSTRUCTED MICRO-MODEL OF A 1920S-ERA U.S.NAVY OBSERVATION AIRCRAFT - WITH FULL SIZE FREE PLANS

Yes, here we go yet again, more electric flight rambling. However, there isn't actually going to be too much rambling this time because I have a fair bit to fit in. Over the last few months we've taken a look at some of the techniques involved with building small models, without actually getting as far as building one. Well, it had to happen sooner or later, so this time around we have an actual construction article for just such a model.

Since I'm on something of a small model crusade myself, it seemed a good idea to offer some fresh designs for prototyping by other builders - after all, I can't draw models and build them at the same time, so other poor souls often get press-ganged into doing the actual building.

In this instance it was Larry Nagel who stepped up to the mark to build the 20 inch (or thereabouts) span Martin MO-1 that I'm presenting here as a construction feature. So, my thanks go out to Larry for all the hard work he put into this model,

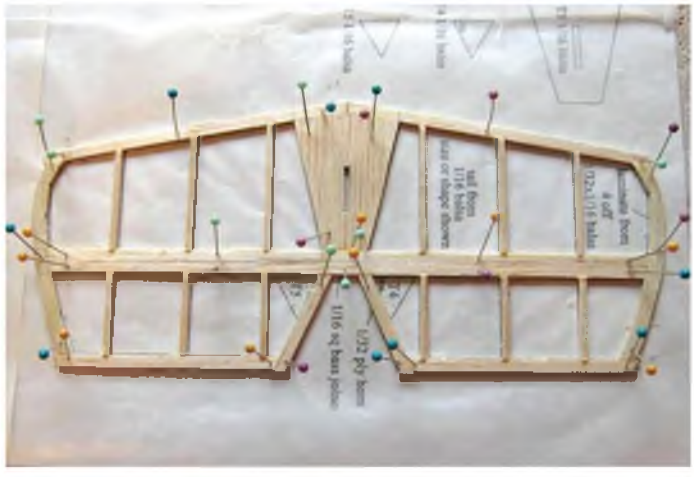
Sweeping in for a banking pass the model has proved to be an excellent flyer. Note how Larry installed his battery for easy access and to aid balance.



As you see, not too many parts to cut out if you don't have the laser cut items.

The basic forward fuselage box all assembled and ready to have the rear end fitted.

Working over the plan helps ensure a straight fuselage once the front and rear sections are joined.



Absolutely nothing in the least difficult about the tail surfaces. Fin and rudder are very similar.

and the excellent end result, indeed, a really great result because poor old Larry had been enduring some problems with the previous one of my small models he'd built, the 18" span DH6.

It's not that there was anything wrong with the design, which has been built and flown very successfully by another builder. No, the problems Larry was having were that his particular example is actually slightly lighter than the successful one, and showed a distinct lack of urge.

The probable cause is either a duff prop, or excessive drag from the extra detail he added. It doesn't, if the results of the Martin are anything to go by, appear to be that his flying site is around 5,000 feet above sea level. Undaunted, he pressed on with the little Martin, made a really nice job of the model AND ended up with a fine flying addition to his fleet.

EQUIPMENT

As you can see from the plan, the bulk of the equipment used in the model is of *Parkzone* origin. The motor and prop used are available as spare parts for their P-51 Mustang RTF and the receiver 'brick' is the three-channel version as used in the Vapor or Ember.

That said, there are Vapor bricks and Vapor bricks. The one I used to draw up the plans is the older, 'green spot' brick which is slightly shorter than the bricks currently available as spares. The only issue this caused Larry is that he had to cut away some of F2 to allow the brick to fit.

Similarly, there are props and props. Whilst the P-51 works fine and provides ample power for Larry's sub-50 gram model, it doesn't seem to be working as well on his almost 70 gram DH6. Tom, the other DH6 builder, used an adapter and GWS 5x3 prop on his model and has no problems at all as regards to power with his 72 gram model.

As regards batteries, this is another area where there are choices. Part of the reason Tom's model is more successful may, and I do stress may, be down to the battery he's using. Instead of the usual 1S type supplied with the *Parkzone* models, he uses a battery from one of the small quadcopters that proliferate. Of higher capacity and consequently heavier, it is able to cope more easily with the current draw imposed by the more effective prop. Although wider, it is quite a bit shorter than the 'standard' batteries, making it ideally suited where space is a bit in short supply.

If you must go with the standard style of battery, opt for the after-market high C rated cells such as those offered by *Turnigy*. You may not be pulling 45C, but it means that you are highly unlikely to find your battery 'strangling' your motor by being unable to supply the current it requires.

THE MODEL

Having already designed two other sizes of this particular prototype, both of which flew extremely well, it seemed a logical choice for scaling down to 'micro' size. Like my original 30" version (I did actually build that one myself), it uses rudder, elevator and throttle control and has been deliberately kept simple in construction. 'Simple' usually equates with light, and I do a very good line in simple! You may have noticed that if you are a regular reader of this column.

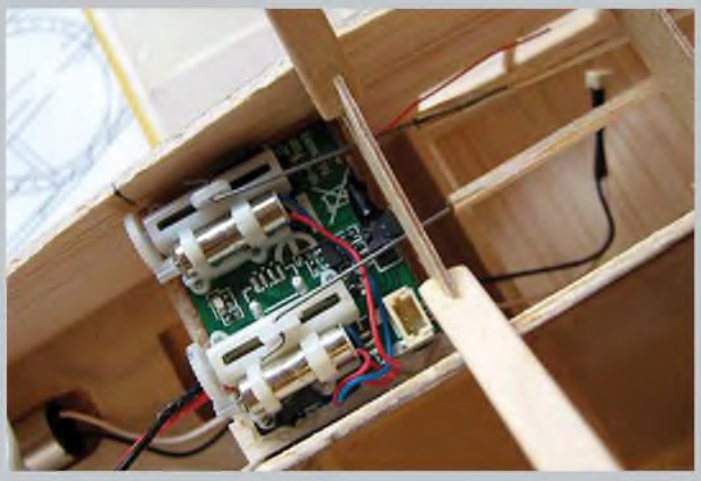
Very much 'sport' scale, or what I like to think of as 'character' scale, it is a simplified version of the original, but still retains all the essential character of the full size aircraft. Although some consider the Martin MO-1 to be something of an ugly duckling, I think it is just quirky enough to be interesting as a subject for modelling. Don't tell me, having drawn up three different sizes of the type you'd already worked that out for yourself.

Think of it in terms of a 'Dime Scale' rubber power model on steroids. Bearing that in mind, the obvious choice of covering material is lightweight tissue, in this case, printed Esaki, so all the markings go on at the same time as the covering. You could, of course, use very light film covering but you'd have to exercise extreme caution not to warp the 1/16" thick tail surfaces.

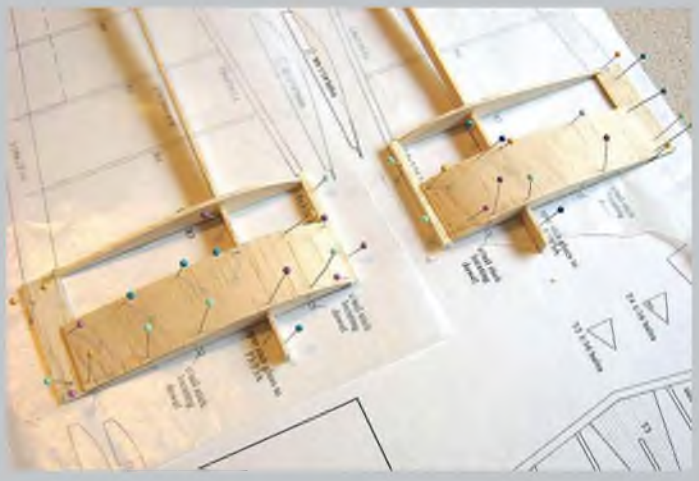
So, with the preamble out of the way, let's start attacking balsa.

FUSELAGE

Although the publisher is certainly making laser cut parts available for those who want them, Larry didn't avail himself of the



Here you see how Larry modified F2 to allow for his slightly longer receiver.



This is how the wings begin, with the flat centre panels built first. The spar is then lowered over the drawing to complete the wing panels.

opportunity to use them. Since there are only four small sheets of parts, all of which are shown on the plan, it's a simple enough task to cut your own kit of parts.

The first thing to note about the fuselage is that it is built as two sections, front and rear, which are joined before the 1/32" sheeting is fitted between the sides.

Starting with the front section, once you have the former positions marked onto both 1/16" balsa sides, score and crack inwards both sides at the nose. Please make sure you do actually end up with a left and right side. Two the same will result in a strange looking fuselage and a part 'M' that won't fit.

Laminate formers F3 and F3A and assemble F1, M (making sure you end up with right thrust), F2, RT and UC1 over the plan so that you get all the angles correct and then glue that assembly to one fuselage side. Next add UC2 and F4 to the same side, checking that they truly are at ninety degrees to the sheet side

Taking care to ensure accurate alignment and a straight, square structure, glue on the other fuselage side. Pull in and glue the front onto F1 and M. Part M ensures that the sides pull in evenly and that F1 actually ends up centred once all the gluing is done.

Now that you have both sides joined, fit the F3/F3A assembly so it aligns with the spar slots in both sides. It's important to get the fuselage square and F3/F3A accurately positioned because those formers will set the dihedral on the wing panels once they are glued in place. I know I keep stressing accuracy but whilst a small amount off on a larger model isn't that important, it can make quite a difference once you get down to these tiddlers. Oh, they'll probably still fly with minor inaccuracies, but they'll be a lot more enjoyable to fly without them.

Although the top sheeting has yet to be added, this shot shows off the simple nature of the model.

The rear fuselage structure is built in the time honoured manner of assembling sticks over the plan to produce two identical side frames. Score and crack in the rear of each as shown on the drawings and then, working over the plan, join the two frames with cross braces and part TS. Since the top longerons are completely straight, this is easiest done with the fuselage inverted over the plan. Just ensure you keep everything square while the glue dries.

Now, still working over the plan, join the front and rear assemblies and trim the longeron stubs flush with the sheet sides. Fit the 1/32" sheet between the upper sides, but not the lower sheet until the undercarriage is in place. Sand lightly, to achieve a nice smooth transition between sides and sheeting and then add the forward 1/32" balsa decking. Make up and fit the hollowed nose block and you are looking at an almost completed fuselage.

Temporarily fit the unercarriage assemblies, but don't glue them. Now use these as a guide for trimming the lower piece of 1/32" balsa sheet. The u/c doesn't get fitted permanently until after the fuselage is covered. Your fuselage can now be finish-sanded overall and prepared for installation of the equipment.

When it comes to fitting the equipment, you have choices. Personally, I like to get all but the lower rear fuselage covered and doped before fitting anything. That way there is no risk of sticking up anything with a wayward drop of dope.

The motor unit is easy to fit through the open lower nose, and may either be glued in place, or retained with a couple of small (very small) screws. The drawings allow for the battery to either be installed vertically immediately in front of F2, or horizontally to the inside of the fuselage between F1 and F2.

As you can see, Larry chose a third option. Being a little conscious of inducing drag (as a result of his DH6 experiences) he decided to seal in his motor and provide a partially concealed, external mounting for his battery. The choice is yours, but will depend to some extent on the size of the battery you use.

As regards fitting the receiver brick and pushrods, I have a specific way I like to go about that. I've tried fitting the receiver with exact length pushrods attached and found it to be a process fraught with peril for the covering tissue. While you're busy trying to get one pushrod through its exit plate, the other one is busy piercing holes in the covering. I like Z-bends in my pushrod ends, and that means they must be fitted to the receiver brick's servos before it is fitted into the fuselage. So, to avoid holing the tissue I only fit the wire ends to the receiver end of the pushrod and leave the other ends well over length - one much longer than the other.

Now, the very long pushrod can be slipped into position without the other one coming anywhere near the tissue, guided into place without risk of puncturing the covering. Then it's a simple task to position the receiver and glue it in position with a couple of small spots of *UHU Por* or canopy glue. Once set, the long ends of the pushrods can be trimmed (those little nail clippers work well for this) and the remaining wire ends fitted.

For those of you unused to models this small, although Larry made pretty conventional pushrods using balsa and wire, I prefer 1 mm carbon rod with 0.020" wire ends, the latter secured to the carbon with heat shrink tube and a tiny spot of CA glue. This means that you can adjust the final length slightly, once the horns are glued into the control surfaces, before finally adding that tiny spot of CA to fix the pushrod length.

I know that little exercise took us a little off course, but it was relevant to the fuselage assembly. Now, all you have to do is cover the lower rear section and permanently fit the undercarriage to end up with a finished fuselage that is all ready to have the remaining parts added to it.

WINGS

I won't bother telling you how to build the tail surfaces; if you can't make a few simple laminations and glue a few parts together you'll already have given up trying to build this model. Therefore, we'll move straight on to building the wings.

The spars, as I'm sure you'll have noticed, are ready shaped and made from Bass. They're Bass because once plugged into the fuselage and glued to F3/F3A, they are all that prevent the wings breaking off the first time you try to loop the model. Very hard balsa will probably do the job, but I can't guarantee that's actually what will be used for the laser cut parts, so show them as bass. It's the one point on the entire model where it's far better to play it safe and pay the minor weight penalty of the harder material.

Actually building the wings is pretty straightforward, you just have to do it in the correct order. That means building the flat centre panels first and then lowering the spar onto the

All set to commit aviation, the models shows off its' printed tissue finish nicely.

remaining panel to build that. This will result in a wing with minimal non-scale dihedral already built in and all taper on the lower surface acting as additional dihedral. A little leading and trailing edge shaping, some overall sanding and the addition of the locating dowels will see your wings ready to cover.

Don't rely on those locating dowels for strength, that's not what they're there for. All they do is ensure that your wing panels go onto the fuselage at the correct incidence angle, and that both wings go on at the same angle.

ASSEMBLY

With all the individual assemblies covered using whichever method you prefer, and the control surfaces hinged, it's time to glue it all together. The fuselage slots, F3/F3A and locating dowels should mean that all you have to do is remove a little covering from where the root ribs fit against the fuselage sides and epoxy the wing panels in place. The locating dowels will ensure both are at the same incidence and the F3A former makes sure they both go on at the correct dihedral. Now just use that assembly as a guide for gluing the tail surfaces in place.

Make up the rear ends of the pushrods, slip on the control horns and glue them into the control surfaces. Make any final adjustments to pushrod length, Spot the wire/heat shrink tube with CA and stand back to admire you miniature Martin MO-1.

FLYING

I won't bore you with how the model should fly. Instead I'll just quote what Larry had to say about his model.

"0100 hrs Zulu, Moab, Utah - The Martin MO-1 has flown and all I can say is, WOW!"

I know I'm supposed to get some static shots and fake flight shots before I commit any new airplane to flight, but after the trials and tribulations I had with my DH-6 I just had to find out how the Martin was going to fly. Besides, I figured if the Martin didn't fly the photos would be for naught anyway.

So this evening just before the sun went down behind the rim on the west side of the Moab valley I went out into the field beside my house, applied full throttle and gave the Martin a gentle toss. It immediately gained speed and climbed out with authority. It responds very well to the elevator and rudder controls and cruises effortlessly at half throttle. Slow flight is stable at a bit less than half throttle. All in all it was an enjoyable maiden flight.

I didn't do anything fancy, just cruised around in circles in different directions and at different altitudes. I flew it with the rudder at 100% rate and the elevator at 50% rate. The rudder was a bit sensitive but easily controllable. Next time I'll try it at 80% just to see how that feels. At 50% rate the elevator was Goldilocks, just right. I would recommend extending the length of the elevator control horn by at least 50% if not doubling its length. That way the transmitter can be set at a higher rate that will give better elevator resolution.

Pete, you've got a winning design here." ■

Larry's model climbs gently away for another smooth flight. Sewn hinges make for very smooth operating controls.

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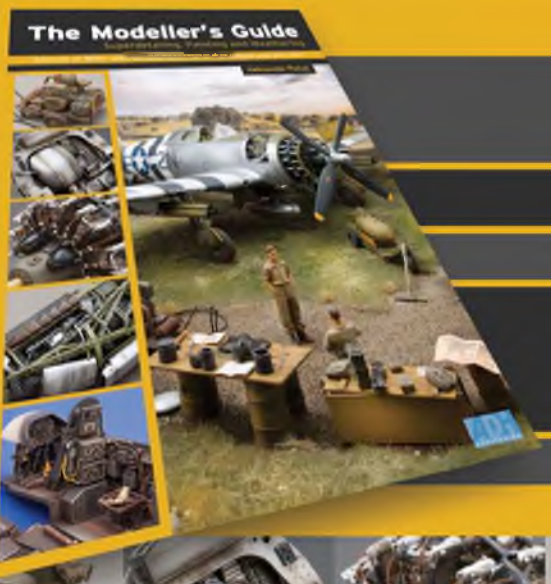

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