De Havilland HORNET: 80" (2023mm) wingspan for .45-58 size engines

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Motor:	15-size, 950Kv BL outrunner (installed)
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ON THE COVER

All shot up! Distressed Boeing B-17G on finals at the Large Model Association's big 'do' at Cosford, flown by Andy Johnson. Full report in this issue.

Photo: Alex Whittaker

OCTOBER 2012 NO.155


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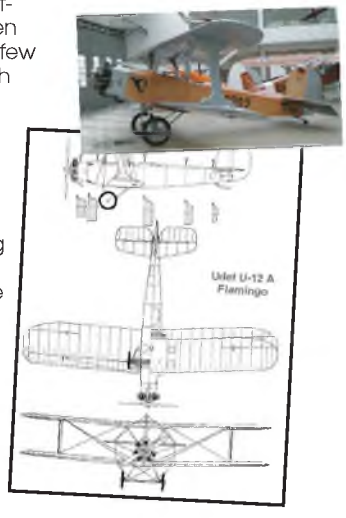
CONTACT

One of the tragedies of British Aviation in the immediate post-WW2 era has been the general disinterest in preserving examples of significant military aircraft for posterity. Yes, not all types became totally extinct at the hands of the Scrapper, but some very fine and outstanding ones certainly did.

In some cases it has taken the skill and determination of preservation groups and commercial organisations to piece back together or even totally replicate historic aircraft of that period.

One very regrettable extinction has to be the De Havilland 103 Hornet. This super-sleek example of the 'final generation' of piston engine fighter aircraft had the distinction of being the highest performance fighter aircraft of all time, capable of being looped with both of its Rolls Royce Type 130/131 engines fully throttle back and propellers feathered.

Circumstances were, perhaps, the expedient reason for the Hornet's total extinction. Many were used in Malaya during the early 1950s, where the hot-and-humid weather played havoc with the bonded wood/metal airframes, leading to the type being 'struck-off-charge', robbed of all usable items and then burned. But surely there must have been a few examples that remained in UK, one of which would have been worth preserving.



So I hope that this month's construction feature for Bob Hart's 80" wingspan DH Hornet Mk.3 will be enough to inspire those with a liking for this outstanding fighter aircraft. As we've said elsewhere in this issue, those super-slim engine cowls are just crying out for electric power.

As presented, the plans show a one-piece wing that bolts to the fuselage, but an alternative to consider might be a major airframe component incorporating the fuselage and wing centre section to just outboard of the engine nacelles - with slot-on, detachable outer wing panels.

Given the comment above about the preservation of historic aircraft, it's worth mentioning here the achievements of the aircraft preservation organisations whose recreations are the backbone of the full size summer air show circuit and where better to find a statement of their achievements than in the annual *Flying Legends* Air Show reported in this issue.

Another 'gone-but-not-forgotten type from an earlier aviation area is the Udet Flamingo from the mid-1920s. Some 300 examples of this aerobatic trainer were built, but only a single modern replica now exists - at the Deutsches Museum in Munich. So I hope all who follow Peter Rake's series of R/C electric designs will be attracted to this month's full size Free Plan feature - see, I told you that the freebie plans were not going to disappear from FSM!

Editor
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FLYING LEGENDS 2012

The annual Flying Legends Air Show traditionally straddles the first weekend in July and this year's event was held over June 30th/July 1st.

Organised by the Duxford-based *'The Fighter Collection'*, in conjunction with the *Imperial War Museum*, the 'Legends' show can always be relied upon to bring aviation enthusiasts

something more that just a bit 'different'.

This year's event brought back much of what had been previously seen, including Duxford's resident types held at *'The Fighter Collection'*, but there were also some spectacular 'Legends' debuts, and none more eagerly awaited than TFC's Republic P-47G-10-CU Thunderbolt, making its first public air show appearance in the air,after a six-year restoration and was the first time a 'razorback' P-47 had flown in UK since Republic Aviation's P-47D example had visited UK during a Eurpean tour in the late 1960s.

Equally momentous in achievement, was the bringing-together of three Supermarine Spitfire Mk.1s, the *Aircraft Restoration Company's* Mk.1, plus Mk.1As of *Spitfire the One Ltd* and Dan & Tom Friedkin, in a formation display that surely had not been seen since the 1940-41 period.

Seven other Spitfires from Mk.Vs to Mk.XIX were among the plethora of 'heavy-metal' WW2 warbirds seen in action.

Something 'really different' was the appearance of Tom Schrade's

LEFT: A sight not seen since 1940-41 - three Battle of Britain era Spitfire Mk.1s in close aerobatic formation. A remarkable and imaginative 'coup' for the organisers.

ABOVE: Last year it sat on the display flight line looking good, but nevertheless far from flyable. This year's most eagerly awaited flying air show debut was The Fighter Collection's Republic P-47G, a magnificent sight.

RIGHT: Red Bull's Lockheed P-38L Lightning seen here with 'verything down. Fine polished finish replicates Lockheed's prorotype.

1: 'Razorback at rest. TFC's superb six-year restoration is now complete. **2:** Dainty is the only word to describe the Spitfire Mk.1, in comparison to later more muscular versions. **3:** John Day's Fokker Dr.1 replica appears to have correct length nose, unlike other modern repros with lngthier snouts for balance considerations. **4:** Gordon Brander's Sopwith Triplane was also part of the WW1 era presentation, together with Robert Gauld-Galliers/ M.Larscombe's Nieuport 17 repro as seen in pic **5. 6:** Red Bull's P-38L Lightning features the earlier engine cowls, without the 'chin' intacks. **7:** We can expect to seen a number of P-47 Thunderbolt models finished in the striking 'Snafu' livery of TFC's razorback 'G' variant.

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8 & 9: Tom Schrade's Sikorsky S-38 'Osa's Ark', a remarkable sight in the air.

10: Hawker Nimrods of The Fighter Collection and the Historic Aircraft Collection awaiting their turn in the air.

11: Air combat during WW1 got that close.

12: The two Hawker Nimrods reprented Royal Navy aviation of the 1930s period.

Sikorsky S-38 twin-boom flying boat, which gracefully handled strong winds, and then there were the Hawker Nimrods of *The Fighter Collection* and *Historic Aircraft Collection* - a sight last seen prior to WW2.

As always - a memorable display of classic aviation in action. ■

12

"It hard to think of an aircraft with quite as much character as the Blackburn."

Blackburn BLACKBURN

Alex Whittaker takes a walk around Terry Manley's amazing carrier-borne aircraft

There are some prototypes that defy the rules of aesthetics, yet still manage to deliver a fascinating aircraft. The Blackburn R-1 is one such type. It is a miasma of rigging, portholes, double struttery, tanks, louvres, and grills. Yet, overall, the effect is magnificently individual.

Blackburn R-1

The Blackburn R-1 'Blackburn' was conceived in 1922 as a carrier-based reconnaissance aircraft for both fleet spotting and gun spotting duties. Blackburns entered service at Gosport in April 1923. It was loosely based on the earlier Blackburn Dart; it spanned 45 feet 6 inches (13.87m), weighed 3,929 lbs (1786 kg) and was fitted with Napier Lion engine. Designed for a crew of three comprising pilot, navigator and rear gunner, the pilot's high seat was on top of the wing. The navigator sat inside the fuselage, with the gunner firing from the rear of the fuselage cabin.

The pilot's position was so high that landing must have been exceptionally difficult, even though portholes were provided. The two-bay wings folded for storage on the carrier.

Defensive armament constisted of a single forward firing Vickers machine gun positioned to the left of the pilot, while the rear gunner had a Lewis gun in a WWI Scarff ring.

Some Blackburns were converted to training aircraft and later marques were fitted with the Napier Lion V engine. In all, 44 aircraft were built and the Blackburn remained in service until 1931.

The model

Terry Manley is one of most distinguished scale modellers, undoubtedly one of 'The Lords of Scale'. Terry is currently working his way through the Blackburn canon. He designs and scratch-builds all his own models. He used existing scale three-views, augmented with specific data supplied by BAE Systems at Brough in Yorkshire to devise his own model plan.

Fuselage

The fuselage is of conventional construction with ply and balsa formers with spruce stringers. The forward fuselage is sheeted in balsa, and the double curvature around the the cowl is home-moulded in glass fibre.

Wings

Conventional construction with two hard balsa spars and 3/32" balsa ribs. The wing section is T64.

Tail

1/16th balsa sheet core with half ribs top and bottom. Three laminations of 1/16th balsa strip were wrapped round the outside edge of the core and then sanded to section to represent the tubular steel tube outline. Fin and rudder were built using the same method.

1 2

3

1: Note the interesting split line for rudder. Note also two tail struts.

2: Terry does all his own legending. Note stitching and convincing surface finish of fabric.

3: Lots of louvres, vents, fasteners, and panel lines to keep the scale modeller busy.

4: Stainless steel working oleos have compression springs. 1/4" stainless tubing was used for the legs.

5: Beyond the need gravity feeding, and perhaps to improve downwards sight for the crew, why are these tanks on the top of the wing?

Engine

The dummy Napier Lyon Engine was carved from balsa block with dural tubes to represent exhaust stubs.

Prop

The scale prop is 23" diameter and is carved from balsa. Flying prop is 18x8.

Exhaust

Standard Laser silencer with a 3" long steel tube extension to take the exhaust gases to the cowl outlet.

Undercarriage

The undercarriage oleos were made from stainless steel tubing with 1" long x 7/16th dia. compression springs incorporated to absorb the landing loads. 1/4" dia. stainless steel tubing was used to make up the undercarriage legs.

Covering

The model is covered with lightweight tissue and given one coat of shrinking dope. It was then covered again with silk using wallpaper paste as an adhesive over which three coats of shrinking dope was then applied.

Painting

The model was sprayed overall with cellulose grey primer, followed by two coats of silver cellulose. After all markings were applied, the model was fuel proofed with epoxy matt fuel proofer.

Legending and Decals

The Roundels were applied directly onto the model. After masking off, they were sprayed with cellulose paint. All the letterings were painted onto water slide transfer paper. They were then cut out and applied to the model in the appropriate positions.

Scale detail

The cowl louvres were made from thin alloy sheet, while control wires are made from nylon covered stainless steel fishing line (trace). Rigging wires and end fittings were supplied by Mick Reeves Models.

"The simple silver scheme, set off by the red white and blue, is very satisfying."

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Flying notes

For such a large and impressive model, the Blackburn flies much like a trainer. Initially Terry had concerns as to whether the Laser 180 would deliver suitable flying performance but as it has turned out, she requires only about 80% power to get airborne, and tootles about the circuit on half power. Terry set the fire/aft balance point at 25" from the wing leading edge and the ailerons have 50% differential. The model flew with no trim changes.

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Model Specification

Scale:	1:5.6
Wingspan:	96"
Weight:	13 kgs
Engine:	Laser 180
Prop:	18x8

The idiosyncratic Blackburn Blackburn looks like no other aeroplane.

6: Neatly executed engine cooling louvres. Flying prop is an 18"x8" XOAR. **7:** Pilot looks suitably wild-eyed. **8:** The Blackburn designers seemed to like double-struttery. Note also the nautical port holes. **9:** Model is covered in light weight tissue, then covered again in silk, using wallpaper paste. **10:** Rear gunner's Scarff Ring. **11:** All of the details on Terry's models are wonderfully crisp. Note riblets, rib tapes, control runs, and beautifully executed roundel.


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PLANS and PARTS

BE READY TO START BUILDING AS SOON AS YOU UNFOLD THE PLANS WITH THESE LASER-CUT PARTS SETS

ELECTRIC CANBERRA B(I)8
Plan price £29.50 Plan No.262
Component Pack £175.00
From the building board of electric ducted fan scale expert Chris Golds, this 84" (2,134mm) span model is the 'Interdictor' version of the famous jet bomber. Prototype used two Hacker B50-16L motors and two ten-cell 3300 NiMH power packs. Four sheet plan shows retracts and flaps. Plans are supplied complete with step-by-step written construction sequence.

PIPER SUPER CUB
Plan price £16.50 Plan No.146
Component Pack £95.00
G/F Cowl price £17.50
A great first-time scale model for novices and sport fliers who want real scale accuracy. 79 ins span 1:5.33 scale model suits a range of engines .40-.60. Two sheet plan. Glass fibre cowl available.

CORBEN SUPER ACE
PLAN PRICE £19.50 PLAN NO.275
COMPONENT PACK £65.00
A 50" (1270mm) wing span sport-scale model of the delightful American homebuilt aircraft, this design is an excellent introduction to the world of radio control scale modelling, featuring simple airframe structure that will result in a scale replica ideally suited to regular club-field flying on a regular week-upon-week basis. 1/6th scale replica suits .26-.30 four stroke engines, or .20-.25 cu.in. two strokes. Four function radio systems required.

HEINKEL HE 51
PLAN PRICE £17.50 PLAN NO.80
COMPONENT PACK £125.00
A 68" (1727mm) wingspan 1:6.4 scale model of the pre-WW2 German biplane fighter for 4-function radio control and .70-.90 cu.in. four-stroke motors. Can be built without recourse to glass fibre mouldings for items like engine cowl and wheel spats.
Two sheet plan.

RUMPLER C.IV TAUBE
PLAN PRICE: £19.50
PLAN NO. 269
COMPONENT PACK: £110.00
A 1/7th scale 80" (2032mm) wing span sport-scale model of the early German WW1 aircraft designed for .60 cu.in. size four stroke engines and four function radio control operating rudder, elevators, ailerons and throttle.

De HAVILLAND DH 82a TIGER MOTH
PLAN PRICE £26.50 PLAN NO.051.
COMPONENT PACK £115.00
An 80 inch (2032mm.) wingspan, 1:4.33 scale model for 1.20 cu.in. motors and four function radio control systems. No moulded cowl required - all wood construction. Three sheet plan.

FE8
PLAN PRICE £19.50
PLAN NO.267
COMPONENT PACK £88.00
Accurate 1/5th scale 75.6" (1920mm) wing span replica of the British early WW1 pusher fighter. Requires .78-.91 four stroke engines and four function radio control system. Excellent for electric conversion.

FELIXSTOWE F2A
PLAN PRICE £19.50 PLAN NO.276
COMPONENT PACK £110.00
An amazing 1/6th scale fully flyable replica of the British WW1 maritime patrol flying boat. Model spans 100.5" (2553mm) and suits two .25-.30 cu.in. two stroke engines. Can be flown from water, or from land using a take-off dolly to safely landing on its hull. Prototype model won "Best of Show" at the prestigious Toledo R/C Expo in USA. All the detail is there on the plans for an impressive model.

FOKKER D.VII

1/4 PLAN NO.241, 1/5 PLAN NO.242
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COMPONENT PACK 1/4 £125.00
COMPONENT PACK 1/5 £120.00

1/4 scale spans 82.5" (2095mm) for 30cc (1.8 cu.in.) two stroke engines. 1/5th scale spans 65.7/8" (1673mm) and suits 15.cc (.90 cu.in.) four stroke engines. BE SURE TO QUOTE SCALE REQUIRED WHEN ORDERING!

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PLAN PRICE £17.50 PLAN NO.091
COMPONENT PACK £125.00

A 1/6th scale replica of the RAF's most elegant 1930's biplane fighter 60" (1524mm) wing span model requires four function R/C gear and .60 cu.in. motor.

D.H. 103 HORNET

PLAN PRICE £22.50 PLAN NO.052
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80" wingspan sport-scale replica of the hottest production piston engined fighter ever. Suits engines .40-.53. Original retracting undercarriage unit included with the plans.

BOEING PT-13 STEARMAN

PLAN PRICE £19.50 PLAN NO.243
COMPONENT PACK £99.50

A 58" (1473mm) wingspan replica of the famous bi-plane radical engined trainer aircraft of the WW2 era. Designed for 700 size electric motors, but with option of i.c.engine power using a .52-.60 four stroke engine, with modifications shown on a separate plan sheet. (Ready-cut wing ribs and fuselage formers available - see below) Three sheet plan.

TIPSY JUNIOR

PLAN PRICE £19.50 PLAN NO.286
COMPONENT PACK £95.00

A 1:3.44 scale, 79" (2006mm) wingspan replica of the late 1940s Belgian light aircraft, designed to suit .90-1.20 cu.in engines. Designed by Philip S.Kent, the model features all built-up balsa/ply construction throughout and makes an excellent entry into R/C scale modelling. Rudder, elevator, aileron and throttle controls.

AVRO AVIAN MONOPLANE

PLAN PRICE £19.50 PLAN NO.278
COMPONENT PACK £110.00

Designed by respected R/C scale expert Philip S.Kent, this quarter scale replica of the radial engined version of the 1930s air racer spans 96" (2438mm) is an ideal/introduction to the world of large scale. The model suits 1.50 cu. in. size four stroke engines and requires four function radio control operating the basic control functions of rudder, elevator, ailerons and throttle. Conventional wood airframe structure throughout.

SOPWITH CAMEL

PLAN PRICE £14.50 PLAN NO.188
COMPONENT PACK £79.50

1/6th scale replica of the famous RFC WW1 fighter biplane, for .24-40 size motors and four function R/C. 56"(1422mm) wing span.

SOPWITH PUP

PLAN PRICE £16.50 G/F COWL PRICE £17.50
PLAN NO.177 COMPONENT PACK £135.00

Superb, true-to-scale 1/5th scale replica, features accurate outlines and rib-for-rib reproduction of the full size wing structure.63 ins. (1600mm) span model is of manageable size for transport and offers realistic flight performance.For.60size motors and 4 function radio. Glass fibre engine cowl available.

BUCKER BU180 STUDENT

PLAN PRICE £26.50 PLAN NO.015
COMPONENT PACK £120.00

The R.A.F. maritime recce/ anti-submarine patrol aircraft, modelled by renowned electric scale expert Chris Golds. 86" (2185mm) span model flies on four Speed 400 electric motors, driving pusher props. Full step-by-step written building instructions.

050/12

WHAT DO THE CUT-PARTS SETS CONTAIN?

The components, in balsa and ply that you would otherwise have to trace off the plan onto the wood and then tediously cut out prior to commencing building! Basic strip and sheet wood not included. Be ready to start building as soon as you unfold the plans!

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De Havilland 103 HORNET

It was the fastest piston engined fighter ever to enter squadron service. It could be looped with both engines shut down and props feathered! BOB HART presents a fine model of this classic, elegant warbird, that has great flight characteristics

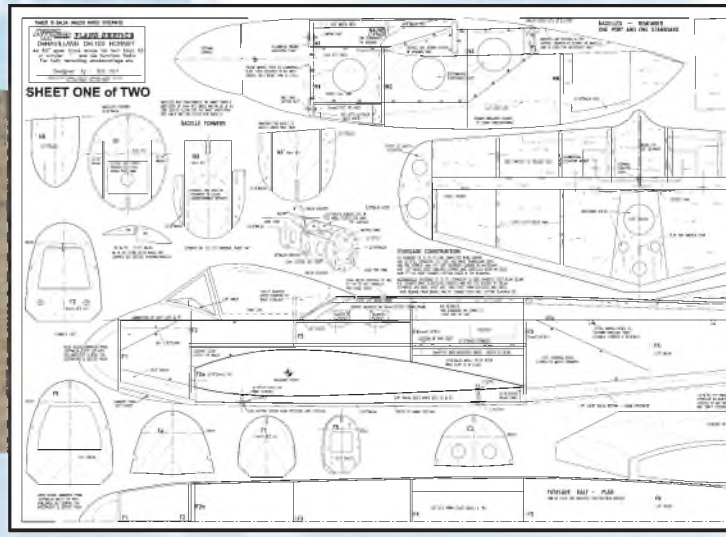
My interest in the De Havilland 103 Hornet started when I was a teenager doing control line aeromodelling. My father had a 1955 edition of *'The Aircraft of the World'* and I spent many hours looking through it. On page 110 was a small three-view and an equally small back and white photo of, what to me, was the most beautiful plane in the book. It was the DH Hornet F. Mk. 3. Later, in my twenties and stationed in Germany with the R.A.F. and still flying control line, I drew up plans and built

two models of it, each with about a 40 inch wing span and powered by two O.S. 30s. The first was very much a semi-scale effort, but the second was a good attempt at true scale. It was over-complicated by my own-design retracting undercarriage which never worked when it should and did when it shouldn't have!

Time moved on, I got into radio control and, having modlled a fair number of single-engined scale fighters I decided to try a twin. My first was a Douglas A-26C Invader, since sold, which, with its tricycle undercarriage and shoulder wing, made a good introduction into the delights of twins, but my aim was always to build the Hornet for R/C.

So here it is then. I have not been disappointed after all these years and I hope you won't be either. It really looks the business on the ground and in the air. Best of all though, it flies as if on rails.

If you've bought the plan then I'm assuming you know what you are doing, so I will not labour over the obvious parts. The main thing to keep in mind all the time is the weight, especially the tail end. My prototype came out at 13lbs finished and I then had to add 1lb. of lead in the nose to arrive at the fore/aft balance point shown.



1: Stage 1 of the wing construction is the mainspar, around which the rest of that structure is assembled. 2: Basic wing panel. Ribs have been slotted into the mainspar, rear spar stringers added, together with trailing edge sheet. 3: Here the wing panels ae mated and surface skins applied. Basic engine nacelle structures have been added and main undercarriage units have been trial-installed. 4: The engine mounts are here installed. Metal mounts are receommended. 5: Further detail of on one the engine nacelles, showing the Enya 53 on its mount ahead of the firewall. 6: Here, one of the engine ncelles has been surface skinned. 7: The basic fin structure, with long dorsal fillet that was a feature of the later Hornet Mk.3. 8: Wing centre section as the fuselage upper decking begiuns to take shape. 9: The basic tailplane, skinned only on one surface. 10: Finished tailplane and elevator assembly.

Wings first

I would suggest you start with the wings. You will find it easier to build the fuselage by bolting that onto the wing during the construction of the wing seating etc. The wings use fairly conventional construction techniques.

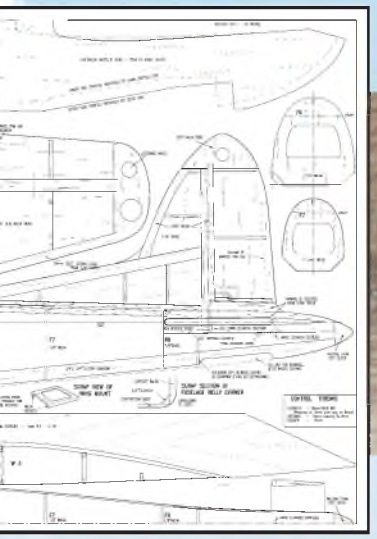
The heart of the structure is the front mainspar. Built as shown around the mainspar. It has proven to be very strong and it needs to be, to carry the engines, undercarriage loads etc.

Mark the positions of the ribs onto the finished spar. One side at a time, slide the ribs to their positions and, keeping them true to the plan, then glue into position. Add the outer 5mm balsa spar extensions and in-fill the top of the mainspar between the ribs also with 5mm balsa. Then glue in the remainder of the ribs.

Add the rear spar as shown and thereafter the leading edges and wing dowel mountings, followed by the wing bolt mounting plate.

Using a sheet of 48 inch long balsa, mark the positions along the trailing edge for the flaps and ailerons, also the rib positions. This becomes the lower trailing edge and wing skin. Position the sheet on the plan and glue the ribs and rear spar where it makes contact.

When you come to add the top skin, you should jig up the trailing edge to get two degrees of washout. Add the aileron and flap hinge spars, also the aileron leading edge by half slotting both the ribs and spars as necessary.



DH HORNET

Full size copies of the two sheet plan for the De Havilland Hornet are available from Flying Scale Models Plans Service, ADH Publishing, Doolittle Mill, Doolittle Lane, Totternhoe, Bedfordshire, LU6 1QX.
Tel 01525 222573
enquires@adhpublishing.com
Price £22.50 plus p&p
(U.K £2.50; Europe £4.00;
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Please quote plan
no. FSM 52

Add the aileron ends. At this point, cut through between the hinge spar and aileron leading edge, but not fully, so that it still remains a part of the wing until you have skinned it completely. Following the part-cut lines, you can then free the ailerons from the wing. You can do the same for the flaps.

The next step is to decide how you are to operate the flaps and ailerons and insert the necessary controls as required. On my model, I used one slim servo on each aileron and one good quality servo driving the flaps from the wing centre, with locating joiners from the inboard to outboard flap panels. Add the spar webs between the ribs as indicated, then sheet the top of the wing along the trailing edge. Remove the lower skin from the wing where the flaps will be and box off the ends. Remove rib material in the flap bay area so you can sheet the top of the bay.

You should also now consider how you are to operate the two throttles. Originally, I had one servo in the centre of the wing driving via bellcranks to the motors. This method took a lot of balancing to get the motors to open and close at the same rate, which is important for ground handling and I have now converted it to two servos linked via my transmitter which makes it instantly adjustable.

The top of the wing can now be skinned.

Engine nacelles

The engine nacelles are formed round a ply crutch that locates onto the front mainspar. The lightening holes shown will not take out too much strength. Remember, we are still thinking light! To get the sides accurately parallel to each other, lay them flat on your building board bottom to bottom. Mark out the former positions and glue your triangular balsa gussets in one piece. Hopefully, the picture will demonstrate what I mean. When set, cut to separate. You should notice that that one crutch side is taller than the other. The short side is inboard. This is so that the nacelle will hang vertical, allowing for the wing dihedral.

Start thinking about your retracting

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undercarriage now. Having decided what system to use and having applied any necessary modifications to the structure to suit your choice of system, then build up the crutch.

Accurately attach to the wing at the main spar, reinforcing with the triangular balsa gusset as shown. Watch for the centre line of your nacelles. The thrust line is parallel the centre line of the fuselage.

You can now skin the remainder of the bottom of the wings. Take the sheet inside the confines of the nacelles. Now skin the nacelles and then cut out the undercarriage doors area.

The engine and fuel tank mounting method works well. The hole in the bulkhead just allows a Kavan 8oz. tank to pass through. A hole in the aluminium mounting plate should be made large enough to just let the nozzle part of the tank protrude forward, which makes for easy connecting up. I used Enya 53 engines.

The first engine mountings I used were made of plastic and as it heated up in the cowls, the effect was to introduced up-thrust; Interesting I can tell you! I suggest aluminium mountings as the best

11: Basic rear fuselage, with sheet sides assembled around the formers. 12: Basic front fuselage, around the wing-seat area. 13: Wing underside detail showing the aileron horn and adjustable link to the aileron servo inside the wing panel. 14: Designer Bob Hart used the Robart P-51D Mustang retracting tailwheel unit as the basis of the tailwheel retracting mechanism of his DH Hornet. 15: Close-up of the dummy exhaust stack on the lower side of one of the the engine nacelles.

option. I set up both engines with two degrees of right thrust and then made the cowls by tacking a lump of blue foam onto the built-up nacelle, shaping and covering in two layers of 200 gr. carbon fibre and epoxy. When cured, remove the foam and finished off as required. I made the undercarriage doors the same way incidentally.

Body language

The fuselage is initially built up around the wing fixing areas. Cut out the ply formers, use the wing dowels to locate former No. 2, arrange Nos. 3 4 and 5 along the top of the wing in their relevant positions and then add the side 5mm balsa spars and top keel. Glue the wing bolt mounting plate to the side spars and lightly bolt through the wing into the seat as it will be when finished. Check all the alignments.

Cut the ply fuselage doubler and the balsa sides. As the fuselage is longer than most sheets of balsa, make the join in the middle of the doubler. The sides have a curve to follow on the formers and it is a good idea to try and set a curve into the side panels where the ply is placed before attempting to position on the formers. Making sure not to glue the assembly to the wings, glue the sides to the frame so far built.

When set, remove from the wings and continue to build up from the plan. I found it necessary to put in 5mm square balsa strip across the balsa sides between the formers as shown, to stop the sides bulging. At some point, you have to decide on the tail wheel to be used. I used a *Robart* plastic mechanical retracting unit. This was perfect as the wheel doesn't fully retract, which is all the movement available. I don't know how it is supposed to work on a Mustang, for which it was designed. Anyway, you will have to add a suitable mounting point for your choice.

Fit your chosen type of snakes or push rods to the rear before planking the top and bottom.

The ply plate for the servos can be fitted at any time, as it is easy to get at. Finally, there is the belly pan to make, build up from sheet and triangular balsa as shown. Glue ply fixing points to the underside of the wing and make suitable holes in the pan to screw through. Make these fixings as unobtrusive as possible and then, with the wing fixing bolts under the pan, you 'can't see the join' as they say.

Back end

The tailplane, fin and rudder are self-explanatory and are quickly built. Note the lightening holes again. I let in some scrap balsa where the trim tabs are so they could be removed to add scale detail.

Finish

Finishing any scale model is probably


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16: Prototype model used two Enya 53 four-stroke engines for power. Hole in the cowl underside keeps the engine cool. 17: Fine detail on the prototype model, showing one of the wing leading edge radiators. 18: Cockpit detail - dummy pilot in place.

19: Designer Bob Hart finished his prototype model in Royal Navy Fleet Air Arm colour scheme, hence the dummy arrestor hook on the rear fuselage underside. 20: Detail of one of the engine nacelles, showing the main undercarriage leg and the undercarriage doors, moulded in glass fibre. 21: The business end of the De Havilland Hornet - four 20mm cannon in the fuselage nose underside.

the most important part. You can cover up all the building bodges for a start. Remember the 'Keep-it-light' rule. I epoxy/glassed the wing assembly and fuselage using 19 gr. cloth and tissue/doped the tail feathers.

There are quite a few colour schemes to chose from. A good choice can be found in *'Warpaint Series No.19'* and *'The Hornet File'* by Lewis G. Cooper from An *Air-Britain* publication, not to mention lots of scale details. I sprayed my model using *Humbrol* enamel matt paints and fuel proofed with a mix of 50/50 matt and gloss *Aerocote*. The mixing of the two types gives a semi-matt finish, which I think is more original and, on the practical side, is less prone to show oil stains from handling than a full matt finish.

I find *Aerocote* will mix with a little enamel thinners enabling it to be sprayed and without the risk of damage which cellulose can cause to enamels.

Fly-by ...

Flying, the best bit! Lots of time was spent balancing the two Enya 53s. In my experience it is better to get the engines well synchronised from idle up to the mid range. This is particularly important for ground handling with ground loops the order of the day if the engines are out of sync. The top end can be around 100 R.P.M. different without any noticeable difference in the air, but ideally, the engines should open up and close down at the same rate.

Cooling is another consideration. I opened up a large hole in each cowling where the cylinder head is and also put some holes on the inboard sides.

Control movements as follows:-
Elevator: 18mm, rates reducing to 12mm.
Ailerons: 10mm to 8mm.
Rudder: 45mm.

The large movement for rudder is mainly for ground handling and in anticipation of a possible engine out in flight.

With range checks completed and with the engines running to your complete satisfaction, get on the strip. Last minute

full power checks, all main controls moving the correct way, line up on the runway.

Open up progressively and catch any pull to the left with rudder. Don't overdo the movement, as it is very effective from quite low speed. Get the tail up and in short order, ease back on elevator. Keep the climb-out steady; no verti-

Ground crew's view of the DH Hornet from the rear, reveals the twin-panel split flaps on each wing.


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22 & 23: Two views of cockpit detail. Note the dummy cockpit canopy rails for the rearward openning canopy.

24: Dummy Pilot head on the left wing leading edge.

25: Neatly fitting main undercarriage doors on the prototype model.

26: Inner wing panel split flap in the deployed position.

cal climbs here.

At lower speeds a little touch of rudder in the turn will make it tidier. I programmed in rudder-to-aileron coupling to make things easy. Once up to flying speed the Hornet is smooth and agile to fly. Landings are no problem, tending to float on a bit. You should allow a long approach until you've a few landings under your belt. The flaps are effective on calmer days and not used on strong windy days.

Build and enjoy. I look forward to seeing Hornets flying everywhere. Now what about another Invader?

Main uncarriage

Full construction details of the scale-action main undercarriage used on the prototype will be featured in the next issue of Flying Scale Models. ■


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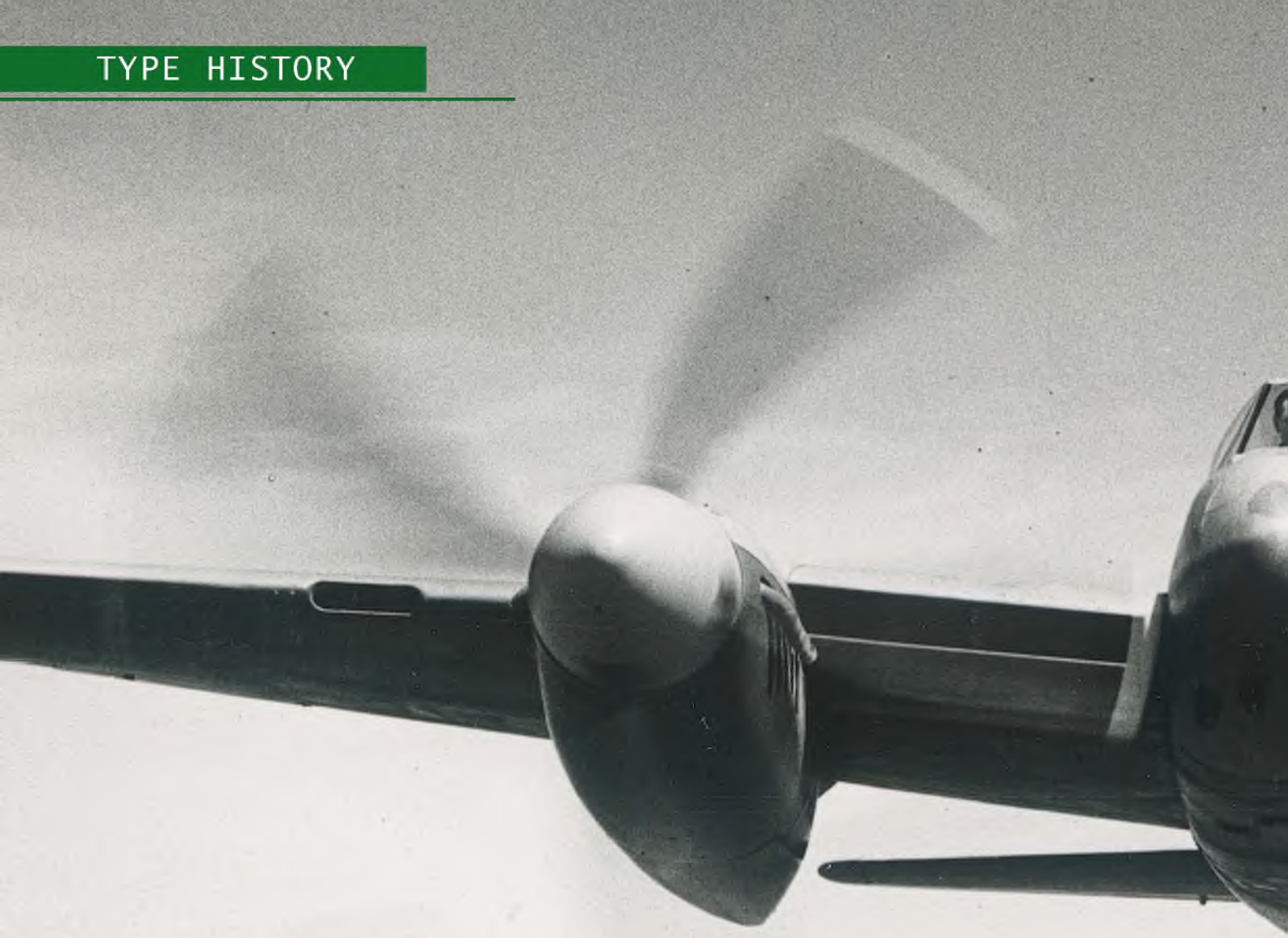


De Havilland 103 HORNET

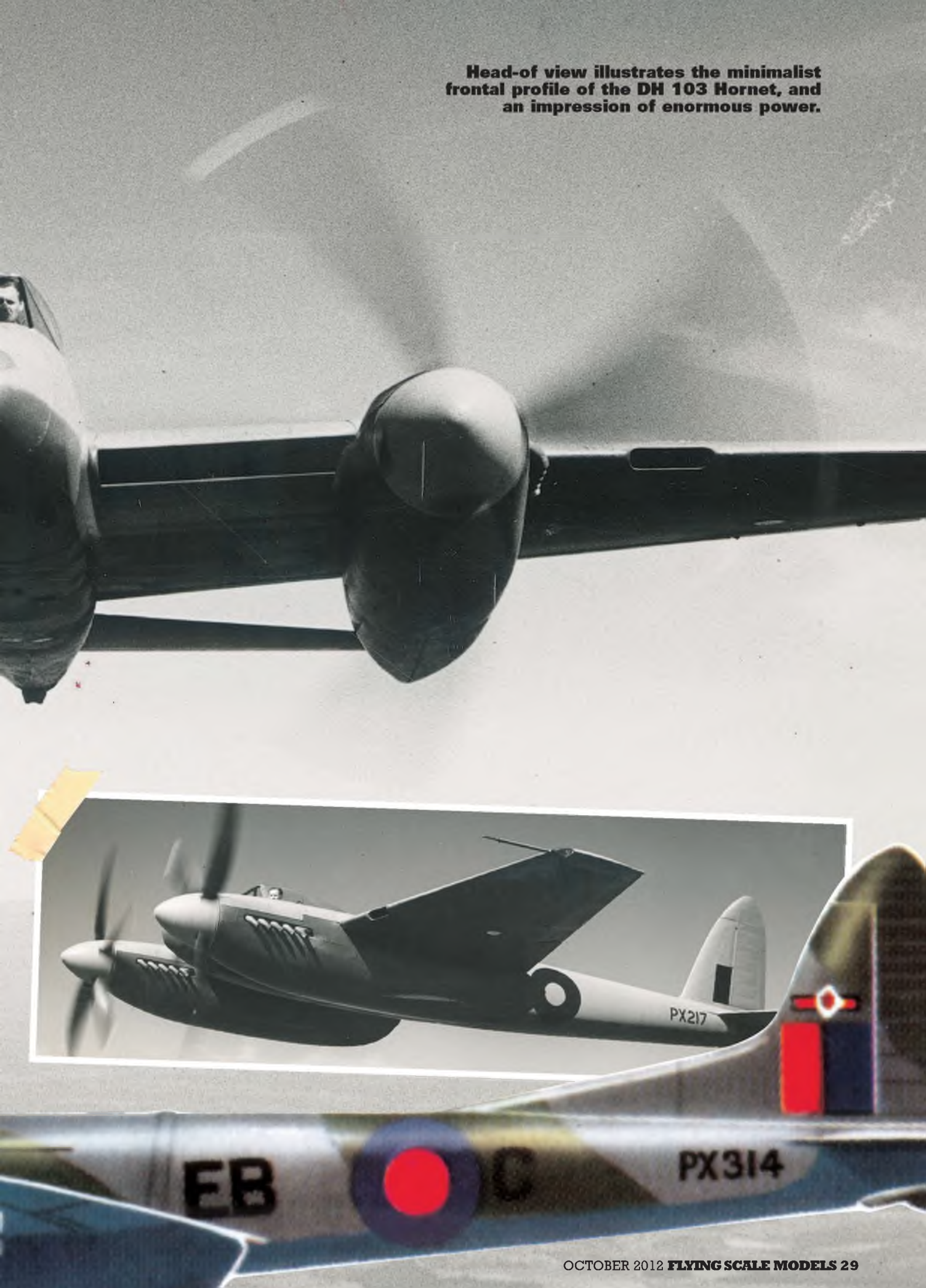
A study in slim elegance, the Hornet was the pinnacle of fighter aircraft performance during the twilight years of the piston-engine fighter type. For modelling purposes, those slim-line coels cry out for electric power.

If ever there was a hot rod twin piston engined aircraft, then the DH 103 Hornet was it. Like most of the 'final generation' of piston engined fighters, initiated during the mid-to-latter stages of the WW2 period, the Hornet never saw action in the war for which it was originally intended and suffered the inevitable curtailment of service use and longevity of operation due to the overlap with the beginning of the jet age.

Although there is obvious lineage with the earlier DH Mosquito, the Hornet was a totally new aeroplane, envisage, in 1942, as a long range fighter for the Pacific war theatre, capable of meeting Japanese single engined machines.

Like the Mosquito, the Hornet made extensive use

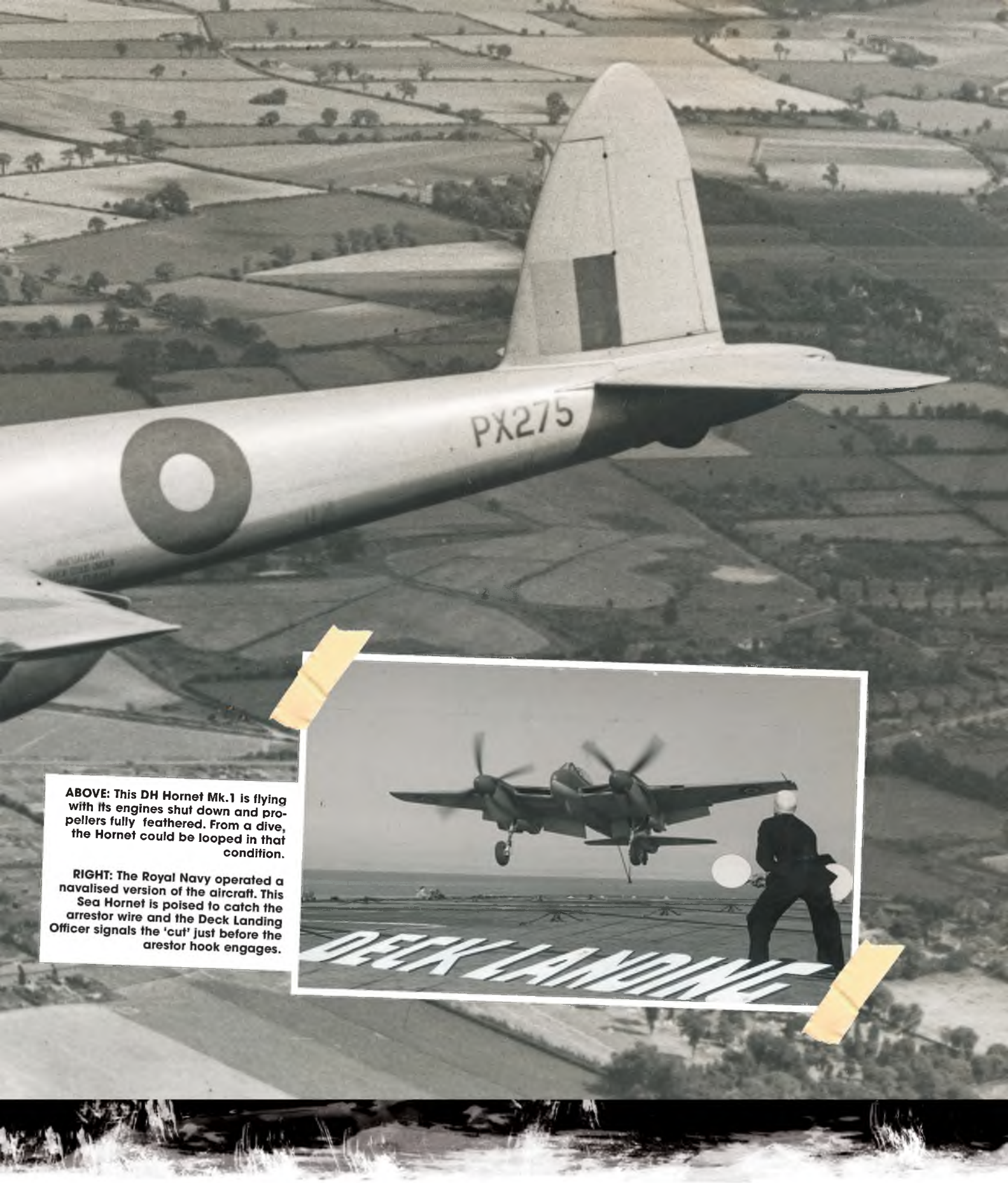
Head-of view illustrates the minimalist frontal profile of the DH 103 Hornet, and an impression of enormous power.



of wooden and wood-bonded-to metal techniques developed by the De Havilland company. The specification to which the Hornet was developed demanded a maximum speed close to 500 mph, climb rate of 4,400 ft/min, up to 22,000 ft. and range of about 1,200 miles.

One of the vital ingredients in achieving this performance was the No.61 series Rolls Royce Merlin engine, a variant specially developed to provide an absolute minimum frontal area, allowing the engine to be enclosed within an extremely slim, low drag cowl.

However, in spite of this performance promise, the 'paper aircraft' on offer from the De Havilland did not, initially draw official enthusiasm for production and it was not until mid-1943 that a re-assessment of the design's potential



ABOVE: This DH Hornet Mk.1 is flying with its engines shut down and propellers fully feathered. From a dive, the Hornet could be looped in that condition.

RIGHT: The Royal Navy operated a navalised version of the aircraft. This Sea Hornet is poised to catch the arrestor wire and the Deck Landing Officer signals the 'cut' just before the arestor hook engages.

drew a request for prototype development, the first prototype taking the air at the end of July 1944.

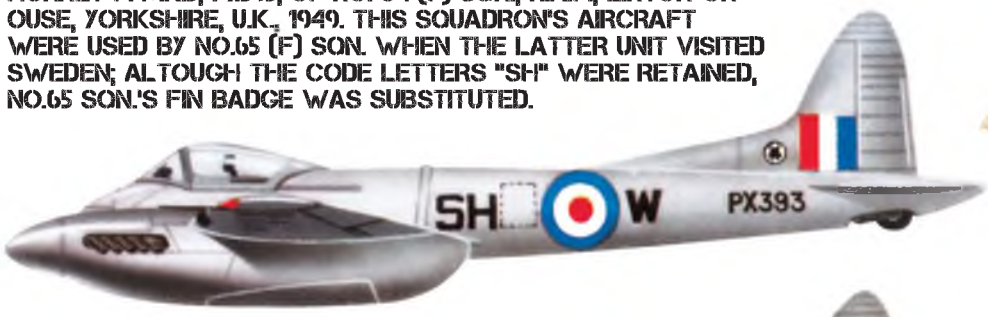
Within a month it had established a maximum level speed performance of just over 490 mph, a speed bettered only by the Supermarine Spiteful and, latterly, in the present day era of Unlimitted air racing 'specials in USA.

The engine now used was the Merlin 130, which developed the low frontal area theme of the Merlin 61 and came in 'handed' opposite rotation 130 and 131 variants.

Hornet Mk.1s entered R.A.F. squadron service in early 1946 when No.64 Squadron began trading up from its North American P-51D (Mk.IV in RAF service) Mustangs. Four Squadrons eventually converted to Hornet Mk.1.

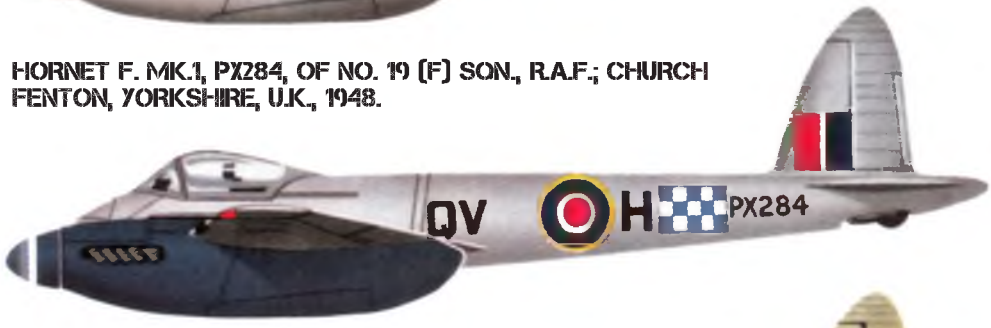
Hornet Mk.3 versions began to trickle

HORNET F. MK.3, PX393, OF NO. 64 (F) SQN., R.A.F.; LINTON-ON-OUSE, YORKSHIRE, U.K., 1949. THIS SQUADRON'S AIRCRAFT WERE USED BY NO.65 (F) SQN. WHEN THE LATTER UNIT VISITED SWEDEN; ALTOUGH THE CODE LETTERS "SH" WERE RETAINED, NO.65 SQN.'S FIN BADGE WAS SUBSTITUTED.



HORNET F. MK.1, PX252, FLOWN BY SQN. LDR. C. HAW, COMMANDING OFFICER OF NO. 65 (F) SQN., R.A.F.; LINTON-ON-OUSE, YORKSHIRE, U.K., 1948.

HORNET F. MK.1, PX284, OF NO. 19 (F) SQN., R.A.F.; CHURCH FENTON, YORKSHIRE, U.K., 1948.



SEA HORNET N.F. MK.21, VX250, OF NO. 809 SQN., FLEET AIR ARM; R.N.A.S. CULDROSE, CORNWALL, U.K. 1951.

SEA HORNET F. MK.20, TT206, OF AIR FIGHTING DEVELOPMENT UNIT; R.N.A.S. FORD, SUSSEX, U.K., C.1949.

HORNET F. MK.4, WF977, OF NO.80 (F) SQN., R.A.F.; KAI TAK, HONG KONG, 1953.

HORNET F. MK.3, WB898, OF NO.45 (F) SQN., R.A.F.; TENGAH, SINGAPORE, 1952.

through during 1948, these with a revised tailplane shape and distinctive dorsal fin strake which is the most immediately discernible difference between the two Marks.

Far East Action

As the RAF's home based Fighter squadrons transferred to the jet powered Gloster Meteor and D.H. Vampire, the Hornet's eclipse began, at least as far as U.K. air defense was concerned. However, as that door closed, another immediately opened, in Far Eastern Malaya where the Hornet's long range and excellent ground attack performance became invaluable in the campaign against Communist terrorists, where Hornet operations with bombs, rockets and 20mm cannon fire commencing in early 1952. Here it became a solid workhorse of the air campaign.

In the end however the real enemy of the Hornet was the Malayan climate, which had an insidious effect on the wooden construction of the aircraft, first revealed in mid 1954 when plywood skin detached from a Malayan based Hornet during flight. Glue joint failure quickly became a feature of Hornet airframe inspection and by mid-1955, it was decided to scrap the entire Hornet fleet, most of the airframes being unceremoniously bulldozed and burned, after removal of usable equipment. Typical of the attitude of the day, long before the aircraft preservation movement ever took hold, no single Hornet escaped the scrappers attention, the only remaining reminder of this highly elegant aircraft being a front fuselage section in the custody of the *Mosquito Aircraft Museum* at Salisbury Hall, Hertfordshire. ■

CG RANGE QU
IN AP 2864C&
VOL1 SECT2 C

PLYWOOD STRESSED SKIN RUNS FROM ROOT TO TIP, BETWEEN FRONT AND REAR SPARS ON UPPER SURFACE ONLY.

FUSELAGE STRUCTURE IS PLYWOOD/BALSA LAMINATE. ENGINE NACELLES AND TAIL SURFACES ARE ALL METAL. COMPOSITE WOOD/METAL W STRUCTURE AS NOTED.

METAL LEADING & TRAILING EDGES

HYDRAULIC JACK

FOLDING LINK IN U/C DOWN POSITION

MOVEMENT OF UNDERCARRIAGE
at SCALE 1:50

WING RIB

U/C SUPPORT STRUCTURE

U/C UP LOCK MECHANISM

FOLDING LINK IN U/C RETRACTED POSITION

U/C UP AND LOCKED

A B C

CROSS-SECTIONS AT FUSELAGE BULKHEADS

D E F

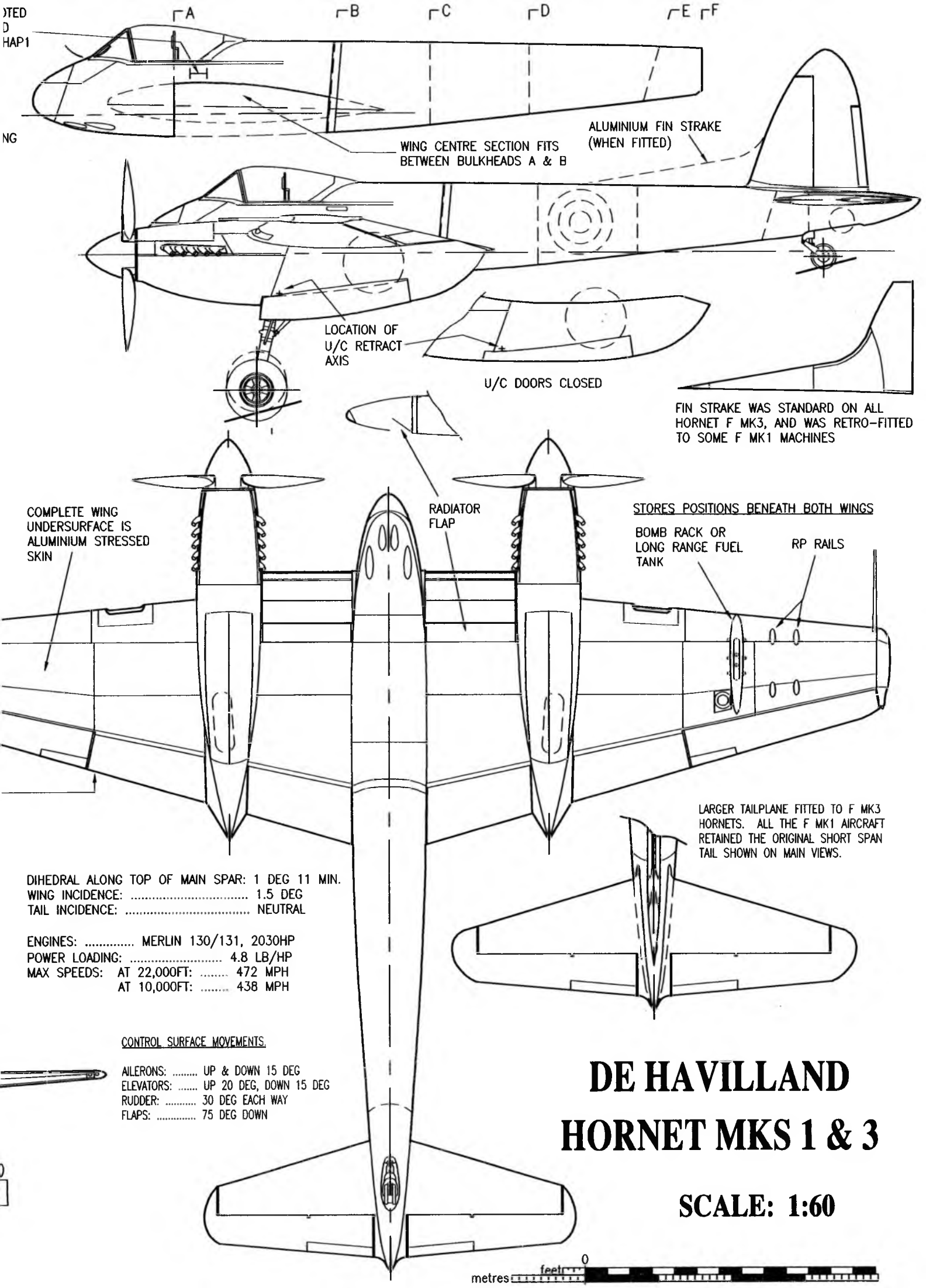
TYPICAL WING SECTION

LEADING PARTICULARS.

WING SPAN: 45FT
LENGTH OVERALL: 37FT 6IN
WING AREA: ..... 361SQ FT
CG POSITION: ..... 8.5IN TO 18.5IN AFT OF DATUM.
DATUM POINT IS FRONT SPAR ATTACHMENT.

BOMBS, ROCKETS AND LONG RANGE TANKS ON HORNET F MK3; THE F MKI WAS A PURE FIGHTER.

LOCATION OF U/C RETRACT AXIS



DIHEDRAL ALONG TOP OF MAIN SPAR: 1 DEG 11 MIN.
WING INCIDENCE: ..... 1.5 DEG
TAIL INCIDENCE: ..... NEUTRAL

ENGINES: ..... MERLIN 130/131, 2030HP
POWER LOADING: ..... 4.8 LB/HP
MAX SPEEDS: AT 22,000FT: ..... 472 MPH
AT 10,000FT: ..... 438 MPH

CONTROL SURFACE MOVEMENTS.

AILERONS: ..... UP & DOWN 15 DEG
ELEVATORS: ..... UP 20 DEG, DOWN 15 DEG
RUDDER: ..... 30 DEG EACH WAY
FLAPS: ..... 75 DEG DOWN

DE HAVILLAND HORNET MKS 1 & 3

SCALE: 1:60

metres feet 0

PX293, flown by commanding officer of No. 19 (F) Squadron, R.A.F.; Church Fenton, Yorkshire, U.K., July 1950.

DE HAVIL

LAND HORNET F. Mk.1

Cosford Victorius

Whittaker takes his camera to a buoyant LMA scale show blessed with a healthy Trade presence

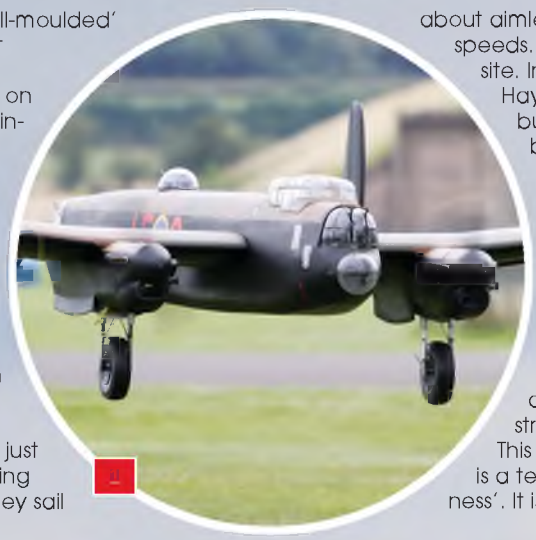
Andy Johnson piloted this Boeing B-17G. Note ëshot-upí undercarriage.

Maybe it was a predictable reaction to the economic gloom, the disappointing 'summer' weather, and a general downturn in our flying opportunities, but Cosford 2012 was a great success. Punters(like me) turned out in force, with a bellyful of enthusiasm and the brave model-money jangling in our pockets. The crowds were deep along the flight line all day, and the stalls were thronged with eager buyers all weekend. Indeed, for a whole weekend, it was like the Good Old Days.

Scale, everywhere

First and foremost, Cosford is about flying large scale models. It is also one of the last places where the builders' art is still greatly revered. Of course, you can find ARTFs and their 'all-moulded' affluent cousins at Cosford, but the emphasis remains on celebrating the winter achievements of a lad in his shed.

This year there was a definite trend towards humungous models, with 60% scale not being uncommon on the flight line. Nor were these models made big just for the sake of being big. Neither did they sail about aimlessly at low speeds. Quite the opposite. In fact Greg Hayfield's scratch-built Pitts Python was built to 89% scale and was fully aerobatic. This model might as well be full size. The only thing to indicate it was a model was the non-transparent cockpit, which I assumed was for structural integrity. This impressive model is a testament to 'shedliness'. It is mostly conven-



tionally built, supplemented with glass fibre mouldings. At first glance, I thought the Pitts was covered with the full-size fabric, Cecconite. In fact, the Python is covered in Stitts PolyFiber fabric.

The Python weighs 140 kgs, and is powered by a Hirth 650cc / 65 bhp microlight engine. The prop is a mighty 68" in diameter, and it is a triple-blader too. Interestingly, this carbon prop has variable pitch. This is the model's first year of display. She took five years to complete, sandwiched between Greg's other commitments and features electric on-board starting. Another interesting 'full size' feature is on-board battery charging. Futaba radio is used to control the model.

As far as I could see, she looked, sounded, and performed just like the 100% version. The Python looks to have the appropriate 'mass' in the air, though being picky, I would have liked to see her sporting a transparent bubble canopy to complete the illusion. I noted that on the top of the rudder, there was a poignant statement for all true modellers. In said:

"In Memory Of Curtis Pitts 1915-2005".

Amen to that.

Hanriot

We first saw Ian Turney-White's Hanriot HD-1 at the LMA Symposium two years ago. She looked truly enormous indoors. Outdoors, at twenty paces, she looks full size. She is built to 2/3rds scale, and fitted with a JPX 425cc petrol engine. When models get to this sort of scale they often exhibit handling similar to their full-size partners. Also, comparatively lightly loaded, moderately powered, WWI biplanes were

1: 'Tony Hooper's superb Lancaster bomber. 2: EE Lightning on short finals. 3: Ian Turney-White's Hanriot HD-1 takes quite a bit of restraint on run-up. 4: Steve Carr (left) warms up his 60% Extra 260. 5: Ted Allison stares into the bowels of his EE Lightning, as pilot Dave Johnson looks on. 6: Greg Hayfield and his 87% Pitts Python. Big, innit?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always a handful for their pilots in any sort of cross wind. At Cosford 2012 the fickle wind was backing and veering all day, making take-offs and landings tricky to say the least. Ian tried twice to get the Hanriot off, but had to taxi back, and try again. He is an excellent pilot, so he persevered and eventually prevailed. In fact his Hanriot becomes airborne at something around walking pace, with only a tiny roll-out.

Ian flies this majestic model very thoughtfully, and you are effectively as close to seeing a real Hanriot HD-1 as you are likely to be in waking life. Soon, Ian had to land in the same awkward crosswind. She sailed in on one wheel, balanced for what seemed like an age, then settled down nicely. Wow! However, despite the nifty airmanship, there had been the beginnings of a problem with the engine. In the Hanriot's next slot there were power delivery issues and he had to abort the next take-off due to a lack of urge.

Soon though, Ian and his army of cloth-capped, Fred Dibnah lookalike pals had stripped down the cylinder heads. The bits were laid out carefully on the Cosford grass and early diagnosis seemed to indicate piston clearance problems. The Hanriot's engine clearly needed some shed time, and didn't fly again that day. This hardly troubled Ian. He turned to his

7: Massive Miles Magister by John Townsend is a familiar performer at the LMA shows.
8: Pitts Python coming in over the turfed hangar.
9: Robbie Skipton's YAK 54 on a low pass.
10: Trevor Wood's lovely 1/4 scale Hawker Sea Fury from US scale maestro Jerry Bates' plan. Moki 250 power.
11: Fine Fournier RF-4 from Ted Allison.
12: Ian Turney-White's Sopwith Tabloid. King 200cc engine, weighs 85lbs.
13: Superbly finished North American P-51D Twilight Tear part of the CJD Models WWII Display Team.

Flaps down, John Masonís Thunderbolt on final approach.

well-known, but always entertaining, Sopwith Tabloid. One of my favourite models on the UK circuit.

Big Extra

Top Display pilot Steve Carr flew his beautifully prepared 60% Extra 260. She has a 560cc 3W flat-four power plant. For displays Steve has fitted a smoke system and jettisonable wing streamers. Steve always gives an excellent display, set to carefully chosen music, and the Cosford crowd loved it. When the Extra 260 did her aerobatic display with smoke-on and those long streamers crossing, you knew Carr was The Star.

EE Lightning

LMA Head Honcho Dave Johnstone was deputed to fly Ted Allison's English Electric Lightning which looks utterly spectacular in the air and many older heads in the crowd nodded knowingly as she flashed past. I thought she looked amazingly convincing coming in low over Cosford's historic turfed hangars.

Ted's model is powered by two 120 turbines, and weighs 44 kgs. She is covered in *Proskin* 0.44 mm aluminium sheet, and finished with a satin matt fuel proofer. Ted is a handy lad around the lathe and milling machine, and manufactured his own retracts.

De Havilland Comet

When Steve Rickett wheeled out his

Comet 4B, a hush fell over the crowd as yet another British icon was about to fly.

Steve's enormous Comet 4B had all her jet turbines serviced for the new season, so she sounded stunningly spritely. I was born in the beginning of the Comet era. I still think that those jet turbines, so suttley blended into the wing, are in a class of their own. Steve is a full size airline pilot, so he flies the Comet accordingly smoothly. She whispered around the circuit looking utterly convincing at every turn. The sight of her landing into the westering sun really was romantic, even for an anorak like me.

Thunderbolt

Built to a smaller size, but still very impressive, was John Mason's new 1/4 scale Republic P-47 Thunderbolt. She is powered by an exquisite a Moki five-cylinder 250cc radial. John (of TJD Models fame) flew the 'Jug' inappropriately aggressive style. There were lots of oohs and aaahs as she beat up the strip. In a rough straw poll, I suspect she was the Pilot's Choice of the day. I did get some more static and flying shots of this fabulous beast, so we will return to her in due course.

Trade talk

Mid-day, I made a full tour of all the trade stalls, and there were over sixty. If you needed to stock up on scale-orientated items, LMA Cosford was very good indeed. Also, there was a slew of CNC

Ian Turney-White had an army of Fred Dibnah lookalikes to assist him with his dodgy engine.

14: Just in front of the famed SLEC tent, Sharon Stiles about to retrieve Steve Hollands' Bronco from the pits. **15:** Rockwell Bronco OV-10 up close and personal. Designed and built by 'Tony Nijhuis, and now owned and flown by Steve Holland. **16:** Stunning quarter scale / Moki five-cylinder radial engine powered Thunderbolt from John Mason.

Steve Rickettís elegant Comet airliner caused a hush to descend over the crowd.

17: Didn't see this nifty Sav-Air twin in the air, or mentioned on the PA, so unfortunately no details forthcoming, but I liked it. **18:** 'Tony Hooper's Lancaster in the pits. You may just be able to make out 'Tony and Our Em seated behind.

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concerns eager to turn your paper or computer plans into woodwork. Large engines, plus engines and exhaust accessories suitable for scale applications were available in some numbers, so LMA Cosford was very 'scale-friendly'.

The Verdict

Cosford 2012 was a much needed tonic. Where I live fly in the North West, we have developed webbed feet with all this rain, so a full-on summer show, mostly in the sunshine, gave us all a lift. The crowds turned out in huge numbers, and the traders were literally having a field day. Just what the Doctor ordered!

By the way, at the light-hearted end of the scale market, I was delighted to note that *Cambrian Models* are back in production. So, the fabled *FunFighter* range lives on!

FULL SIZE FREE PLAN

Udet Flamingo

A 38" (965mm) wingspan electric powered scale model designed by Peter Rake, built and described by Reuben Kinghorn

Showing off how much the spoked wheels and dummy engine add to the model's appearance.

While searching for my next build and, after a couple of messages to Mr Rake I decided to have a go at building one of his models, the 38" Udet Flamingo.

After a short search on the Internet I became really interested in this aircraft.

I had settled on an actual plane that I wished to reproduce and while I waited for the laser cut parts to arrive, I decided to make myself some spoked wheels to simulate those of the original aircraft in question.

I used 70mm pvc drainpipe for the rims, with copper rivets soldered together to make the hubs. Fishing line is used for the spokes, which are actually laced onto the wheels.

While waiting for the cut parts to begin the build, I also ordered a graphics kit from *Callie Graphics* and after a short wait, it arrived and is exactly what I wanted.

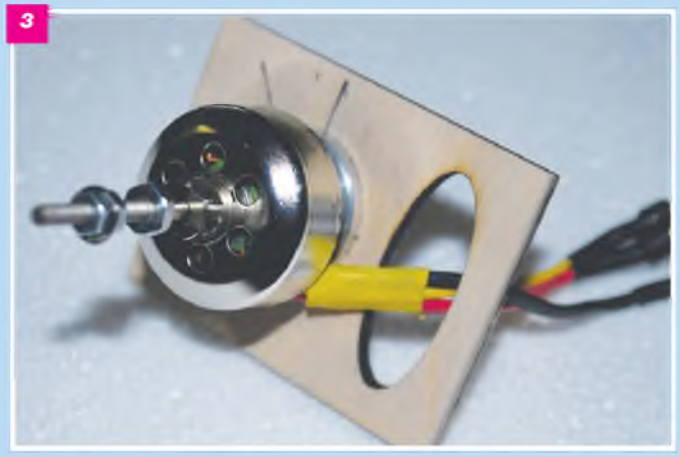
Fuselage

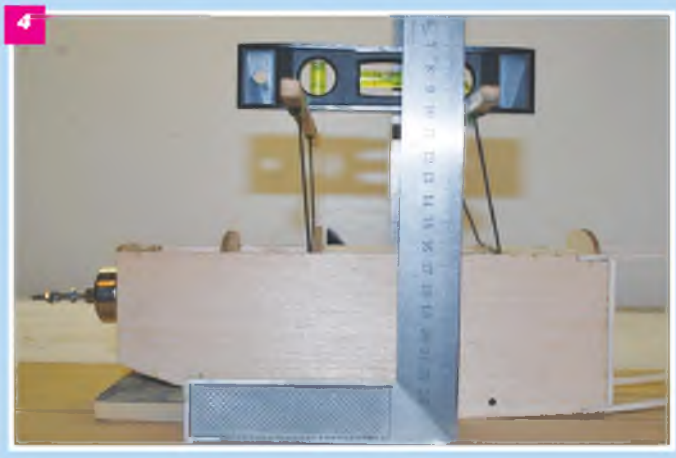
After studying the plans for a couple of evenings and reading a couple of Pat Lynch's build threads on the internet to familiarize myself with Pete's designs, I felt confident to start stripping some 1/8" x 1/8" stock for the fuselage sides. *(Personally, I dislike stripping balsa for longerons. They need to be quite hard and it's difficult to find balsa sheet that provides hard enough strip. If it is hard enough, it's virtually impossible to strip accurately. PR)*

The rear fuselage sides were soon framed up over the plan and joined using cross-braces cut as pairs. Note how the longerons are scored and cracked in at the tail. The pushrod exits and part TS were also fitted at this point. Be careful to keep the whole structure square.

While the glue was drying, I marked and drilled the liteply F3 with a 1.5mm drill bit for when I would later bind the landing gear and centre section struts in place. This would be hard to do after the F3 had been epoxied in to the fuselage. *(Hopefully, future builders working from laser cut parts won't have to drill F3, and I'm not altogether sure why Reuben did, because the holes should all be included on the cut part. PR).* Since I wanted to make completely sure the glue on the rear frame was totally set, I started to build the front fuselage box section making sure to keep everything square.

This is a pretty straightforward process, once you have sanded the required bevels onto the indicated formers. Join the sheet





1: Using the sheet side to ensure accurate spacing of the longerons is a good idea - just make sure they don't stick to each other. 2: Joining the front sides with these formers allows you to get it square, before pulling in the nose. 3: Getting the motor mount sorted out before gluing it in place is never a bad idea. 4: The very simple jig used to ensure the c/s struts align properly before the bindings are glued. 5: Wing construction doesn't get much simpler than this. 6: Not a big model, but one with ample space for the radio gear. Note the pushrod tubes ready for their wire inners.

sides with formers F3 and F4, fit the MP parts and then add the 1/16" balsa cockpit floor. Including the floor at this stage will help prevent the sides bowing as the nose is pulled in onto F1 and M. The exact size and location of M may need to be adjusted if using a motor that is much different to the 'bell' style one shown on the plan. Drill M for your chosen motor mount and fit the mount before installing M in the fuselage. Pack the mount for two degrees down and right thrust.

With the front and rear basic structures complete the sections should be joined over the plan. F1 needs to overhang the edge of the board, but the rest can fit nice and flat to ensure a straight, square fuselage. While all is secured to the board, fit the fuselage underside 1/8" balsa fill-pieces.

At this point, you may notice that it is impossible to bind the front undercarriage leg in place, but there is a reason for that. It could be bound to F3 much earlier, but you would then have to cover around it. It results in a much neater finish if it can be bound in place after the lower fuselage is covered. To enable this, drill through the front MP and the 1/8" balsa immediately in front of F3, keeping the holes close against F3 and in line with the holes in F3. Finish-sand the area and then cover the areas where the wires need to go before binding them in place. It is a task made much easier if done now, rather than after the upper decking is in place. Alternatively, you could do as I did, use P-clips to retain the undercarriage wires, with the screws also retaining the radio hatch.

Now fit the decking formers F2-F7 and the shaped piece of 1/16" x1/8" balsa and carefully glue in place the 1/16" balsa decking.

I chose to do a little detailing at this stage. I sprayed the inner cockpit area matt black as it is easier to do at this stage than after the upper fuselage is sheeted and while the paint was drying, I cut the upper fuselage sheeting from 1/16" soft balsa sheet. I decided to use three separate pieces, a front/middle and rear, these were sprayed with warm water on the outside surface and then taped around a spare spray can to help form them to the fuse shape, after drying overnight, these components were test fitted to the fuselage and rough sanded to size. I then made a template for cutting the cockpit holes, the template being useable for both cockpits and allowed them to be identical.

All three sheets were then glued using white glue, taped in place while they dried, and then sanded to shape.

Next, I added the 1/32" ply battery and servo hatches to the lower fuselage. The servo hatch is retained by four small screws, which are used to mount the landing gear. These are screwed in to the lower mounting plates.

The battery hatch has a magnet at the rear and a small balsa tongue at the front. I then added balsa servo rails to hold the elevator and rudder servos.

Next came the part I had been dreading; shaping the 16swg wire for the upper wing struts. I warmed up by bending and soldering the landing gear. This was done in stages and checked over the plans to ensure the angles were correct.

I then used Spiderwire (braided fishing line) to bind the front and rear upper wing strut wires to F3 and the upper rear mounting plate. After making a jig to check the alignment, I then used epoxy to fix them in place.

There is 1-degree positive incidence on both upper and lower wings. That is measured from the datum, which is parallel to the top edge of the fuselage sides and is measured along the flat bottom of the wing. Also, taper the longerons at the tailplane seat, to provide a similar amount of positive incidence on the tailplane this is also shown on the plans.

This completed the main fuselage structure, which I put safely to one side and studied the separate wing plan.

Wings

I removed all the wing ribs for one lower wing panel and labelled them as R1B and R2B are slightly thinner to allow for the upper sheeting. All the ribs and wing tips are laser cut and I only had to supply the 1/8" x 1/4" bass spars, I used a straight edge to ensure the wing panels were nice and straight. Using white wood glue for the assembly, I found it gave me plenty of time to align everything and after an hour or so I had a completed wing panel. Over the next few evenings I completed the other three panels and the upper centre section. Angle the root ribs for dihedral by packing up the panels to the required dihedral before fitting these ribs.

The upper centre section has 1/8" ply panels to which to mount the wing struts. R4 and R4B have cut outs into which the outer

wing struts will slot. These need small balsa plates glued to the outside of both edges to form a box for the struts to fit into and these need to be sanded to the rib profile.

Join the upper wing panels to the centre section, ensuring these have the correct dihedral and clamp and glue the 1/32" brace to the spars. The struts will ensure the lower panels have the correct dihedral and the locating dowels will make sure they are fitted at the correct incidence.

Tail surfaces

The tail surfaces are simplicity itself. They simply need the edges rounded off, the elevators joined and finish-sanding before being covered.

Finishing & assembly

This completed the main structure of the plane; so now I had to add the push-rod tubes and glue/paint/detail the dummy motor. (A vac-formed item is available from *Parkflier Plastics*). The motor is retained via a couple of magnets and located using two small dowels.

Covering the model is a mix of document laminating film lam and silver *Solarfilm*. The laminating film was sprayed desert yellow and after the graphics were added I used a fine tip black pen to add the panel lines. This was then sealed with a light coat of semi-gloss spray.

The side cowl panels on the fuselage are styrene sheet that has been heated to contour to the shape of the fuselage and the rivet details are canopy glue. This procedure was also used on the wing struts and both were then sprayed silver.

The cane landing skid was made from a garden stake that I split lengthwise and soaked in a glass of water. After 30 seconds in the microwave it was easy to bend to shape, I used a form to hold it to shape while it dried. (Heating the bamboo over a flame is another method of inducing a curve. Hold *the curve until the bamboo cools and the curve is fixed. PR)*

Windscreens and cockpit combing were added along with a pilot and then it was time to assemble the model.

Thanks to the simple jig used to set up the centre section struts I knew that once the wing was fitted, it would be at the correct incidence. All I had to do was make sure it was accurately aligned with the fuselage. With ready-drilled P-clips on the strut ends the fuselage was carefully aligned over the top wing and the screw positions marked onto the centre section. I drilled the screw positions and screwed the wing in place. The lower wing panels were then glued to the fuselage sides (having removed the covering from the glue area) and gluing in the interplane struts set the dihedral. Now it was a simple task to glue the tail surfaces in place, hook up the control linkages and check that the model balanced at the point shown on the plans. ■

Flying

I won't go into great detail here; the model performed well enough that it isn't warranted. It is a simple-to-build model that flies very well indeed. That being so, here's what I found.

After waiting for a suitably calm morning, it was time for the first test flight. I lined up the model into the slight breeze, took a deep breath and advanced the throttle. The take-off run was nice and straight and the take-off was performed at a walking pace. The model gently rose into the air with very little effort and, once airborne, she handled the almost still air very nicely and was very stable.

Landings were comfortable, only requiring the model to be lined up and throttle gradually reduced to allow the model to sink onto the strip. Since this 'strip' is actually a soccer pitch, the landing ended with the customary nose over, but I was more than satisfied with the flight.

I can definitely see this model becoming my favourite calm air flier, it looks right floating by at a walking pace and I found no vices at all. A relaxing flier that has the potential for more spirited flying when the mood takes you.

Drifting gently overhead the model has proved a stable, vice-free flier.

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Guild of Aviation Artists

Aviation Paintings of the Year

Preferences in Art are a matter of personal taste. What appeals to one person, may be total anathema to another - and with all shades of divergence of preference in between.

For many whose interests centre on aircraft, aviation art grips the imagination in a very special manner. So many of us have pictures of aviation scenes hanging at home and a dramatic depiction of an aircraft can certainly stir the imagination, particularly among Scale modellers.

Go to any of the major air shows around the country and there will be aviation art on display for sale, some originals, but mostly prints and limited editions. Many, maybe most, of these will be the original works of members of The Guild of Aviation Artists whose Annual Exhibition took

1: 'FREE FOR ALL'. Handley Page Hampden harbour attack by Anthony Cowland. 2: 'FALL OUT'. FE2b observation balloon attack, also by Anthony Cowland. 3: 'FOXY LADY'. De Havelland Sea Vixen on finals for landing on HMS Eagle by Philip E. West. 4: 'WINTER OF '40', another entry from Philip E West depicts snowbound Hawker Hurricane. 5: 'A, B and C'. Bristol F2b in stormy skies by Anthony Cowland.

6: 'ADSTANTES (STAND BY)'. E.E. Lightning F.3 at readiness, by Paul Thurston. 7: 'OBSOLETE BUT EAGER TO FIGHT'. Vickers Wellesleys over sub-Saharan Africa, by Roger H. Middlebrook. 8: 'BIG E's FLYING BARRELLS. Grumman F3Fs over USS Enterprise by James Field.

place as in previous years at The Mall Galleries, London, over the period July 16th to 22nd.

This year's showing displayed a range of close to 450 exhibits by 149 artists, from all era of aviation, depicting some imaginative aviation related scenes and vying for some substantial prizes in 21 categories. Most works were and remain for sale;

9: 'LATE ARRIVAL' Short S23 C Class flying boat on dusk arrival, by David Ellwood. 10: 'FREEFALL'. Superb three-dimensional perspective in Chris West's depiction of tail gunner escaping crippled and burning Avro Lancaster. 11: 'QUICK REACTION ALERT'. Tornado F.3 scramble, by Wilfred Hardy. 12: 'AT THE GOING DOEWN OF THE SUN'. Lancaster crew at dispersal, by Michael Turner. 13: 'SCENTIFIC MISSION". Lockheed Super Constallation in Antarctica, by Ken Rush.

some, sold during the day-one preview for up to £1200.

As we said at the beginning, Art is very much a case of personal taste, so rather than dwell on what the Judges thought, here are a selection of really outstanding examples that caught the Editor's eye.

Look it all up at: www.gaga.org.uk

14: 'DISASTER AT FITZROY 1982'. Royal Navy helicopters assist in rescue, by David R. Hardstaff. 15: 'M2 RECOVERING THE PETO'. Submarine and Parnall Peto by Michael Daley. 16: 'BON VOYAGE'. Passengers board Handley Page H.P. 42. 17: 'A LOT OF HOT AIR'. Lockheed Martin F-35B Lightning II by Roy Huxley. 18: 'DESPERATE MEASURES' Messerschmitt Me 163 breaks of attack on Boeing B-17s, by Michael Turner. 19: 'THE VETERAN'. Avro Lancasters prepare to depart, by John M Boyd.

19

SCALE RETRACTING UNDERCARRIAGE for the Bristol Beaufighter

Andy Ward reveals the work that went into the development of the retracting main undercarriage of his Beaufighter

The full size Beaufighter featured a robust twin braced oleo leg main undercarriage that retracted rearwards and upwards into the nacelle through 115 degrees of travel. Operation was through the use of hydraulics.

As previously mentioned, having extended the leg lengths of a *Unitract* Avro Lancaster system to suit my Bristol Beaufighter, I discovered that I could not adddapt these to the Beaufighter after all. However, I could of course, use the *Unitract* air rams, reservoir and selector valve as a basis for my own homemade retract units. I had discounted the use of a commercial air retract unit in which the travel was limited to 90 degrees, because that would have left the wheels hanging below the nacelle when retracted.

There was no alternative but to copy the full size geometry and use scale pivot points.

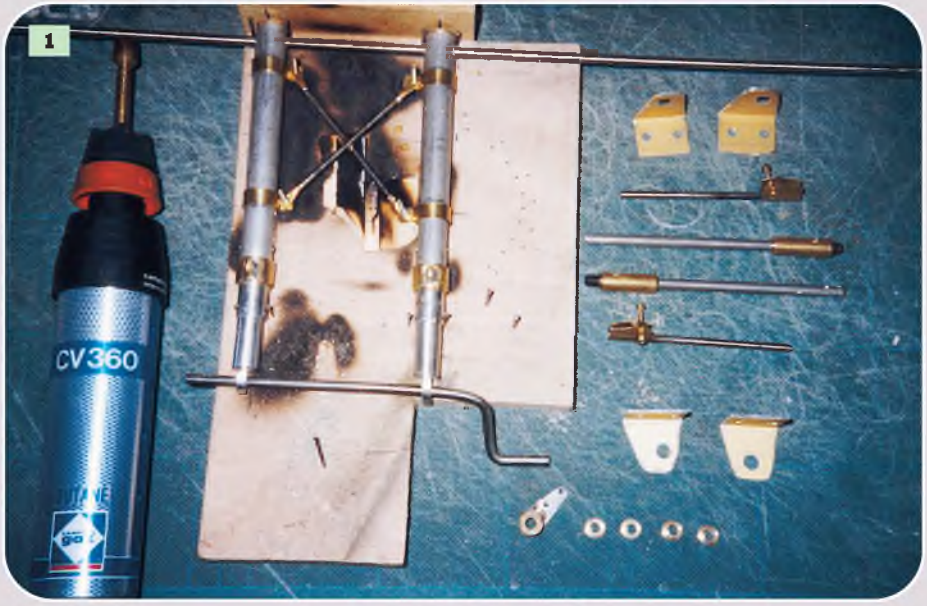
Following a chat with Brian Taylor , he kindly sent me a copy of the original factory blueprints, which I soon reduced to the appropriate model size using a photocopier.

I then had a great time with some cord strips and drawing pin, simulating the retract movements over the blueprints. The system worked very well, of course, as it had on the full size and I reckoned I would be able to conceal the *Unitract* air ram within the depth of the wing ribs.

At this point I realised that I needed help to advise me on the actual design and materials to be used. I had several unsolved problems, such as how to make the free joints in the radius rods and also how to construct the sprung oleos easily?

A visit to my long-time friend (and ex school metalwork teacher) John Davies resulted in much lively discussion on the merits of various metals. John is an engineer of the highest calibre and his expertise with classic motorcycles, cars and tractors is without question. He rose to the challenge of helping me with great keenness, being an

These two pictures reveal the main undercarriage of the Bristol Beaufighter Mk.10 that has been a long-time resident in The Fighter Collection's hangar at IWM Duxford. There is much internal structure and detail to be seen in the aircraft's present state of long-term restoration.



ex-aeromodeller as well, and I owe him a great debt of gratitude.

One option we discussed was to use electric motors and worm gears to lift the legs, ensuing positive locks in the up and down positions due to the meshing of the gears. The motors were to be switched by microswitches at the end of their travel. This system would undoubtedly work, but would have been too heavy, with the additional NiCad pack and weight of the motors - so pneumatic it had to be!

John and I were able to resolve all the problem areas and came up with ways of building the units that were easy for a relative beginner to lathe work (i.e. me!). It turned out to be a rewarding challenge.

I was soon busy on the lathe and produced the first leg of the retract pair in about two weeks (the second was much quicker). Installing them in a wooden test rig, I was elated to find the mechanism worked as it should when actuated manually. Spring assistance was mandatory to help raise the legs and was arranged so that, when the springs were relaxed, the legs were held around halfway up, thus using the same effort to raise them as to lower them.

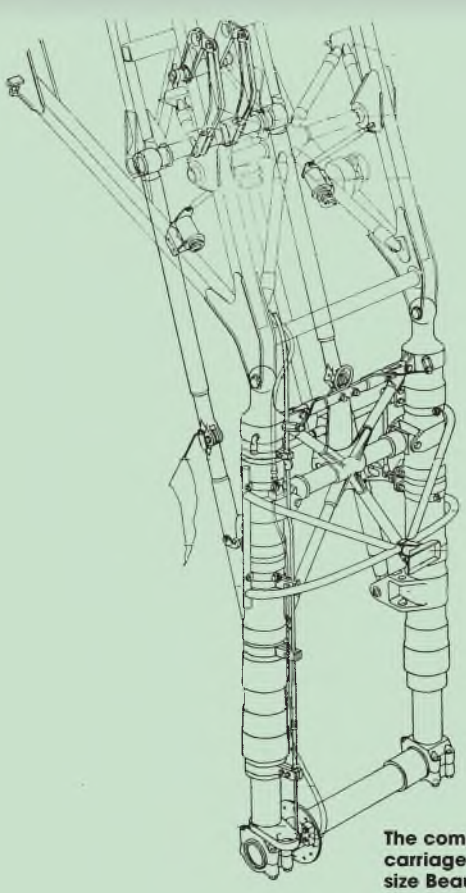
Having tried several positions for the operating arm linked to the air ram, the best place was found to be under the radius arm top pivot rod. Small 5mm grub screws hold the 8swg piano wire pivot, to which the arm is attached and provide adjustment also. The best the system can achieve is a movement of 105 degrees because of leverage limitations but this is enough to lift the wheels well into the nacelles. I reckon that the use of an intermediate crank, more movement could possibly be attained, but I'm happy as they are!

I don't propose to relate how to build the retracts in a step-by-step way as: -

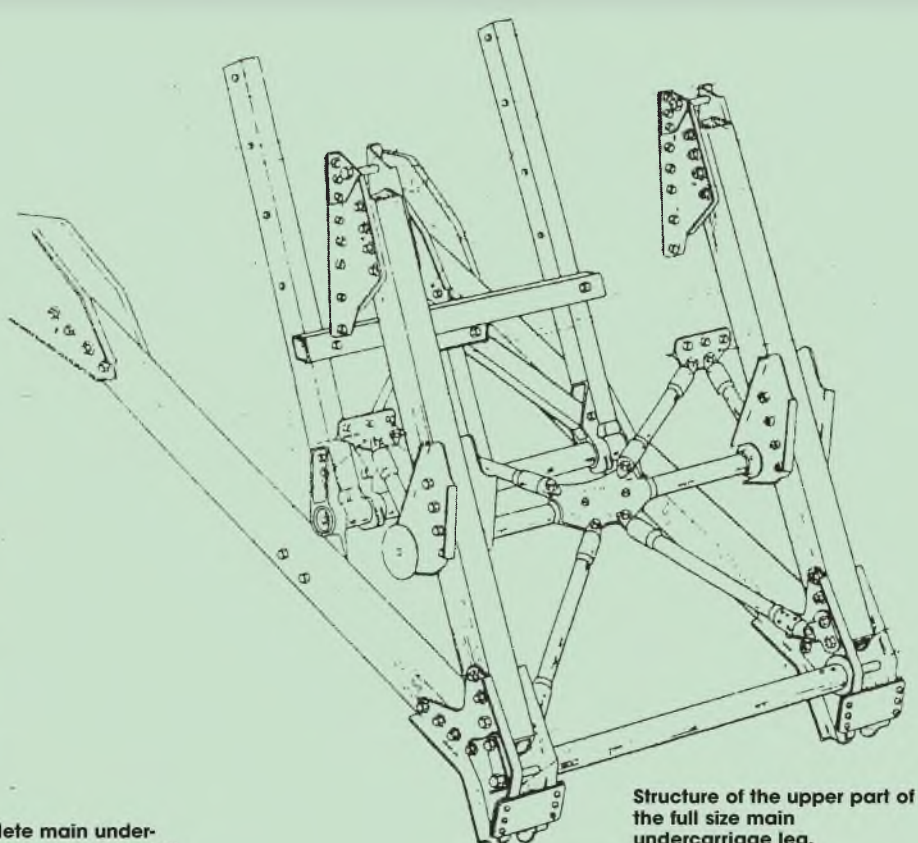
a) It would take too long

b) Hopefully the photographs and drawings should make construction self-evident.

If you think you can improve on them, please go ahead - just maintain the overall



The complete main undercarriage assembly of the full size Beaufighter.



Structure of the upper part of the full size main undercarriage leg.

geometry. I was able to just use soft solder and epoxy apart from silver soldering the steel air ram operating arm onto a brass 8swg wheel collet. All the metal materials used were from *K&S* range except the brass needed for the radius arm to oleo leg pivots and bushes.

The top of the legs and radius arms use 8g piano wire pivots in small brass bushes and all nuts and bolts are 8BA, Loctited for security. The idea for the radius arm knuckle joint may seem under-engineered, but it works and is easy to make. The springs in the main oleos were purchased from Waltons. The wheel door springs were home wound on my lathe, but ballpoint pen springs would probably suffice here.

The doors are opened by the legs pushing them open and a thin pain wire guard runs down the outside of each oleo, which the doors run against. This is a scale-like system, preventing the doors fouling on the various pairs of the legs.

I hope you take the plunge and have a go at making your own legs, as I did. It is very satisfying and relatively cheap. The materials for mine cost no more than £25, except for the air rams, of course, and the finished product looks very scale-like and above all, proved to be reliable in operation.

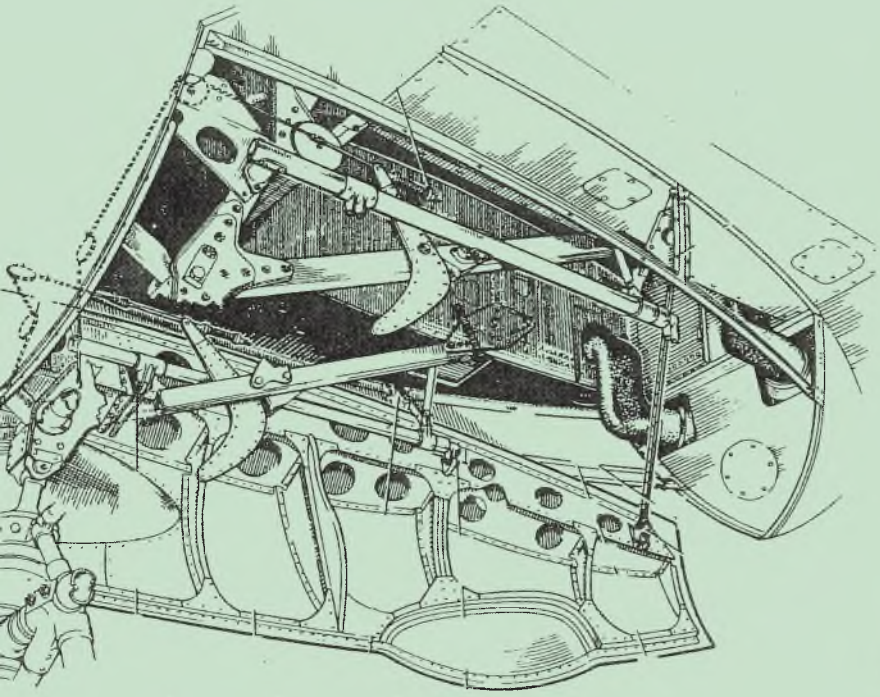
My thanks go to John Davies for his help on this part of my Beaufighter model. ■

1: The components of one of the two scale retracting mechanisms build by Andy Ward for his Bristol Beaufighter, seen here ready for assembly. Note brazing torch. Use of fire bricks for supporting the components furing brazing operations minimises risk of in-workshop fires!

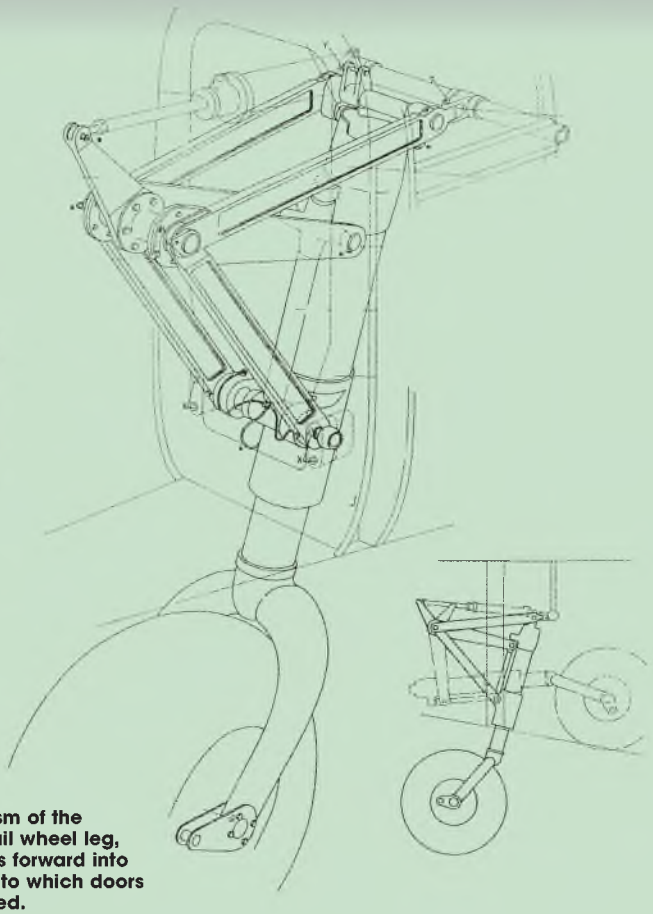
2: The mechism in retracted position, showing the air driven actuation ram by the side.

3 & 4: Two views of the retracting mecchanism in the undercarriage-down position.

5: Engine nacelle with the undercarriage leg snuggly tucked away and faired over with the undercarriage doors.



Detail of the main undercarriage doors on the full size aircraft.



The mechanism of the retractable tail wheel leg, which retracts forward into an open well to which doors are not applied.

Simulated wing rib stitching

Simulated Stitching without too many tears (of boredom)

- a real rib tickler from Don Harvey

Having tried more than one method of applying simulated rib stitching, I rapidly came to the conclusion that it was not the most exciting part of building a scale model. It did however, give the finished authentic look, which made the effort seem worthwhile, if still a bit of a yawn. I cannot claim this system as my idea. It's something I picked up some time ago and have been using it ever since. It has certainly made that particular part of detailing, which, let's face it is rather repetitive, a good bit easier. So what is it?

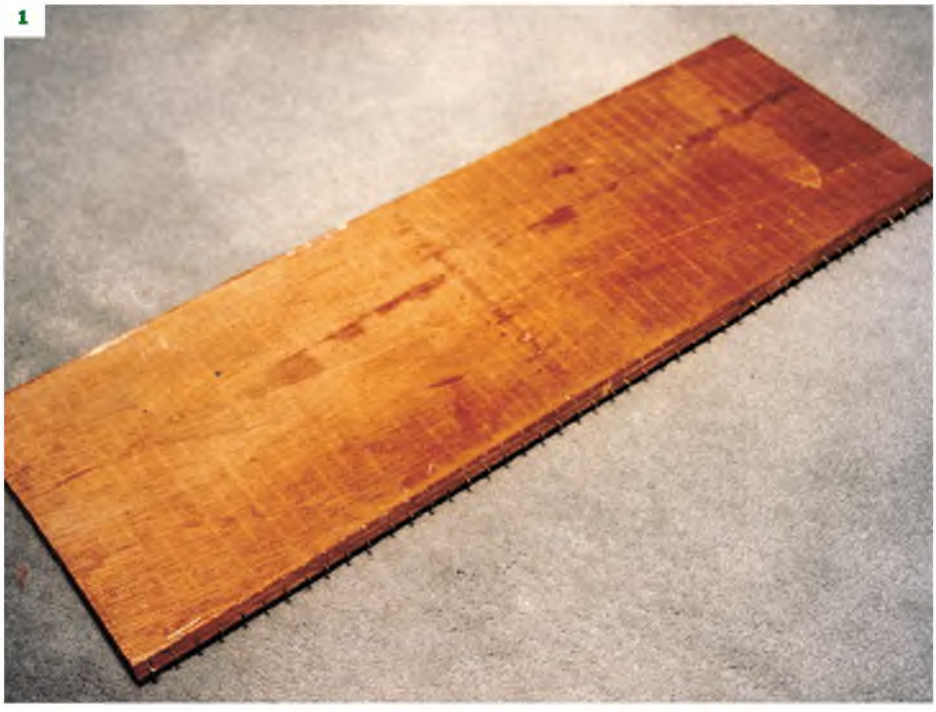
Quite simple really, all you need are the following: -

- One piece of approximately 1/2in thick timber
- Some sheets of lightweight paper. The continuous stuff that's used on computers is ideal
- A goodly number of small nails
- Sewing cotton
- One Brush
- A quantity of watered down PVA glue
- Sharp bladed scalpel
- Steel Rule

Sounds a bit like a cooking recipe eh! You will also need a small hammer and a pencil. Nothing beyond the average model maker.

Method

The piece of timber only needs to be anything from a 1/4in upwards in thickness to give it some rigidity. You will be knocking little nails into the edge so a piece of ply is fine. The length should be an inch or so greater than the maximum cord of the wing to receive treatment, 10in cord would mean around 11in of timber. The width is totally uncritical, the wider it is, the more rib stitching strips you can



1: Base board, with small tacks along the edges.

2: The base board faced with the paper and with the cotton glued to it ready for slicing off the tape strips.

3: Sharp blade scalpe; and steel ruler for parting the rib-tape strips. Note the slight wrinkling.

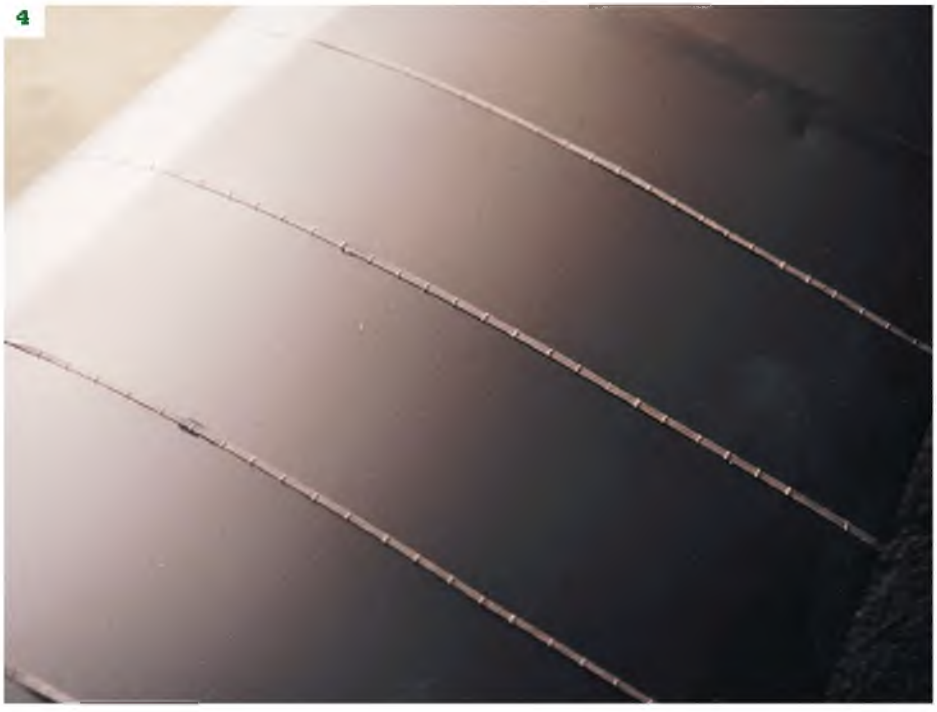
Finished - complete with rib tapes 'Moth' fin and rudder.

produce. Ideally the width would match the width of the sheet of paper you are using.

With the timber now cut to size, it's time to decide on the distance between 'stitches'. As an example, if the full size has the stitches at something like 2 in. intervals, or thereabouts (it's never that consistent) and your model is a quarter scale replica, then the model's stitches would be at 1/2in intervals. Now draw parallel lines across the width of the timber at half-inch intervals (assuming that you want your stitches spaced at half inch intervals) right down its length.

3

'Hey, Presto' a length of rib stitching ready to be cyano'd on top of the wing covering.
- sounds a bit like a cooking recipe.



4: Strips of 'ribs being laid on wing (Moth). 5: Finished wing showing rib stitching of tapes. 6: Strips with 'stitches' glued in place.

Grab a handful of the little nails; half-inch long are just right and knock these partially in, leaving something like half their length exposed, all along each side of the timber, in line with your pencil lines. You will now have a lethal looking piece of timber with loads of little studs sticking out of the sides.

Now for the paper

Continuous computer paper is handy; you are not governed by length, provided you don't tear the perforations that separate the sheets. Trim the paper to fit the width of timber, then stretch the paper along the timber - (not too tight to tear those perfs) - by wrapping it over the ends and taping it to the back with sticky tape. Once this is done, it is time for...

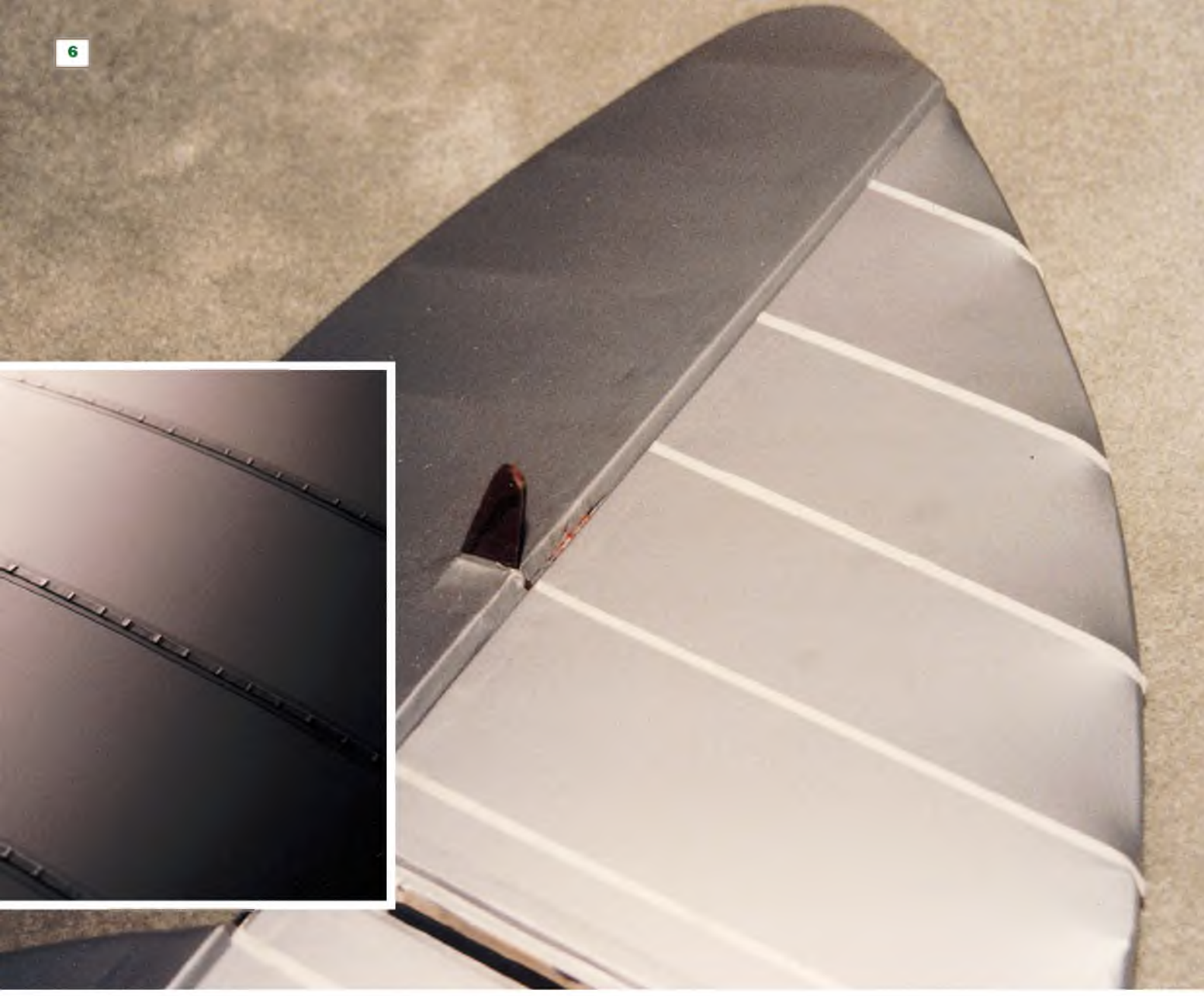
The sewing cotton

Start by tying the end of the cotton to the top left nail, run it across the paper face to the opposite, top right nail, hook under and then down to the next nail (second right), then hook under again and run across to nail no.2 on the left, hook under and down to nail no.3 and then back across to nail no.3 on the right, and so on until you get to the end of the board ... reads like a knitting pattern, eh!

Once you get to the last nail, tie the cotton off and you should have what looks like some sort of odd musical instrument. Believe me, this is a lot easier to do than to try and describe in writing.

PVA Glue and brush

Watered-down PVA (50/50) is fine; so is *BalsaLoc*, which can also be watered down. Both take well to being heat-sealed. Now, proceed to apply the watered down PVA over the cotton thread and paper. The idea is for the thread to soak up the adhesive and adhere to the paper. It's OK to use fairly well loaded brush loads to make sure everything gets covered. If necessary use two coats, just make sure that the cotton sits proud on the paper surface and is not 'buried' by the glue. Once everything is dried, the cotton thread should be well stuck down to the paper. Occasionally the paper will wrinkle causing the cotton to lift off as things



dry. That usually means the cotton was too tight, but unless the gaps are huge, there should be nothing to worry about. It is best to use real cotton, which absorbs the PVA somewhat more than the synthetic variety and will adhere better to the paper.

Sharp blade and steel rule

Measure the thickness of the ribs used on the wings of the model. Usually something like 1/8 in. or 3/32 in. thick. Once all is well and truly dry, take your steel rule and proceed to cut strips to the same width as the ribs along the length, across the cotton, and 'Hey, Presto' a length of rib stitching ready to be cyano'd on top of the wing, covering over the designated ribs. It is only necessary to use three drops of cyano per strip, one at each end, and one in the middle. Just make sure it's good and straight and that they look parallel to each other. Once again easier to do than say!

If you have used one of the 'Tex coverings, the final bit could not be easier. In that case, make rib stitch tape from the 'Tex used to cover the wings and, again using a sharp blade, approximately double the width of the stitching. With a little care, iron the tapes over the stitches, keeping things straight and making sure to iron down the 'Tex material firmly between, and right up to the base of the stitches, so that they really show.

The wing tape will take well to the coat of PVA and become 'part' of the wing covering. Also, being wider than the strip of stitches, shrinkage will be taken care of and everything will be permanently stuck down. Some purists might say that the edges of the rib tape should be 'pinked' for the full effect. This can be achieved, with some perseverance, by tearing the fabric along the edge of a hacksaw blade. However, I think it's true to say, that not all full-size rib taping is 'pinked'. I once saw a beautifully finished, full-size, Pitts Special that needed very close inspection to actually see the rib tapes, they were almost feathered in! So that bit is up to you.

You will find that the finished result is very convincing with, for all intents and purposes, what really looks like genuine 'rib stitching... and very much easier to apply than the PVA blob system and others. Happy stitching ■

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THE QUIET ZONE

R/C SCALE ELECTRICS BY PETER RAKE

Yes, I'm back again, with more fascinating information for you. Well, in this particular instance it is likely to only be of interest to some of you - those new to electric flight. Now, don't all you experienced electrophiles go blaming me, it isn't entirely my fault. After last months' look at electric basics, our beloved editor (He Who Must Be Obeyed) said he liked what I'd done (now there's a first) and that more along similar lines would be good. So, that's what you'll be getting this time around.

Now, much as I'd like to submit precisely the same, I doubt that I'd get away with it. Therefore, just as soon as I finish checking what I did actually write about, I'll continue from where I left off last time. The 'firsts' are coming thick and fast this month. Not only do I get editorial approval, there's actually going to be a logical progression to things. For those loyal readers finding this hard to believe, fear not, normal service will be resumed very shortly.

Right, I've read through what I wrote last time, so know what I have to get done this time. Beginning with.....

OOPS

As I was reading through what I had to say about speed controllers I spotted a glaring error. Sorry if this comes too late (and you've already fried your ESC) but that will teach you to wait until you have all the information before plunging ahead. You just knew it wasn't going to be my fault, didn't you? Obviously all this sticking to schedules is making me too predictable by half.

Anyway, the error in question involves jumper plugs and cell counts. For some strange reason (and most things about this column are fairly strange) I got a little confused (again nothing new). Although we had been talking about two or three cell set-ups, I said the jumper lead was used to set up the ESC for three or four cell packs. Sorry about that, it should, of course have said that the jumper lead is used, or not used, depending upon whether you have TWO or THREE cells in your battery pack. However, my mistake shouldn't have caused you too much grief because your ESC instructions should have explained it correctly. I know only too well that we all always thoroughly study the instructions before doing anything else. Don't we?

MORE ON CONTROLLERS

Just briefly, last month I mentioned programmable ESCs. By and large, this isn't anything like as complicated as it may sound. At the level we are looking at they are simply speed controllers that use the

GETTING THIS 30 INCH SPAN MARTIN MO-1 DOWN TO AROUND 10 OUNCES WOULD BE MUCH HARDER USING A NIMH PACK. LIPOS PROVED THEIR WORTH.

A selection of batteries. L to R - 800 mAh, 7.4 volt LiPo, 11.1 volt LiPo, a tiny single cell LiPo for indoor models and a 300mAh, 7 cell NiMh which weighs more than any of the others.

The dreaded table eating model, the authors Ponnier racer sits on the table it later tried to devour.

transmitter to set up their parameters. The instructions that come with your particular ESC will give you all the details, but it is simply a case of using the transmitter stick, and counting bleeps, to set such factors as cell count (cut-off voltage), soft start, motor brake, etc.

For scale models we can pretty much ignore the brake part, other than to ensure it is set for OFF. That feature is really aimed at models that use folding propellers, which won't fold properly if allowed to freewheel. It's more the realm of glider models rather than scale models.

Soft start, however, is quite a good feature to have because it 'eases' the motor into operation. Not vital, but not something that will cause problems if you have it engaged, especially if you are using a large, scale size propeller. As you can perhaps imagine, suddenly trying to spin such a lump can put quite a strain on motor mounts, so anything that eases the strain can't be an altogether bad thing. 'Normal' start is also perfectly acceptable.

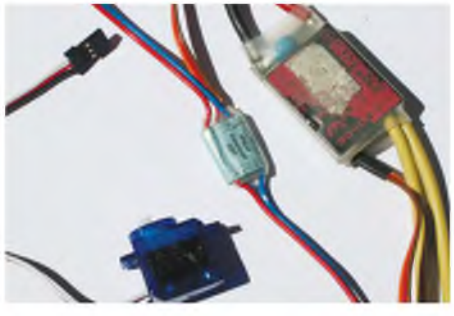
I suppose, since we're talking about an ESC to fit into a scale model of a fixed wing aircraft, please make sure that is the type of speed controller you buy. I know it only adds to the confusion, but there are brushless speed controllers specifically aimed at model cars and boats too. They look a little different, and are heavier, but there is one important feature they have that you most definitely DON'T want - reverse. So, unless you specifically want your model to come hurtling towards you tail first and at full throttle, make sure you have actually purchased an AIRCRAFT speed controller!!!!

How this unfortunate set of circumstances could take place involves how we 'arm' our speed controllers. If it's an even halfway decent controller it will incorporate a 'safety' arming system. Don't panic, that isn't anything like as technical as it sounds. Basically, all it means is that the ESC won't work until you have closed the throttle. So, no matter where you left the throttle stick when you plugged in the flight battery, nothing will happen until you close the throttle. Some ESCs, (and your instructions will tell you if this is the case), require the throttle to be fully closed, fully opened and fully closed again before they arm. The idea behind this appears to be that the ESC can then 'see' the entire throttle range and calibrate itself accordingly.

One word of warning however; not all ESCs are created equal. I once bought a reasonably cheap ESC (I'm known for my meanness) that worked a bit differently - the perils of buying cheap I suppose. This ESC was fitted to a severely over powered model, although I didn't realise that at the time, and I forgot to close the throttle before plugging in the battery pack. Not worrying too much, because I 'knew' I had to close the throttle to arm the ESC, I closed the throttle and prepared for take-off. My wife was all set with the camera, to get some take-off shots and I proceeded to ease the throttle open. Surprise, surprise, nothing happened. Thinking the ESC must be the type that requires the closed, open, closed form of arming I moved the stick towards full throttle, before closing it again and trying for those take-off shots again. You can probably imagine my surprise when, upon reaching the stick position at which I'd plugged in the battery, the motor burst into life at that throttle setting and the model literally leapt into the air. The one photo the wife did get time to take showed just the rudder disappearing

All's well that ends well. The author's smile tells all about how the maiden flight went.

Sizes of brushless speed controllers may vary but they all work much the same.



As you see, only two motor wires on a brushed motor speed controller.

What would have been an ambitious 600 size model, the AIR-1 of Pat Lynch is a simple model to power using a brushless motor and two-cell LiPo pack.

off the edge of the shot, with the model already three feet in the air. This particular ESC had chosen to totally ignore anything below the setting it had been at when the battery was plugged in and I was basically left with two speeds - ballistic and BL**DY H*LL.

So, whatever else you may do, ALWAYS try to remember to shut the throttle before plugging in the battery until you are fully aware of how your ESC will behave. Whilst carrying out these checks, it's a very good idea if you haven't got a flesh mincing machine attached to your motor while you do it. Don't fit a prop until you are completely sure you have things right.

Since I'm recounting experiences, this last point is important if you are running up the motor at home. Some transmitter/ESC combinations require that the throttle channel be reversed at the transmitter. Having more than one transmitter, of differing brands, I forgot which way the throttle reversing was supposed to be while testing a set-up on the dining table. Once again falling into the closed, open, closed trap (some people take a while to learn these things), even though I had remembered to close the throttle before plugging in the battery, I 'opened' the throttle and went to close it again. Well, that would have been fine IF it had actually been that sort of ESC and IF I hadn't been supposed to reverse the throttle. As it turned out, neither was the case and, as soon as I whipped the throttle stick back down to the closed position I suddenly found myself with a model that was trying to jump off the dining table and chew lumps out of the dining room wall. Yes, I was just a little fraught at this point and it was fortunate that I had actually been holding onto the model at the time. I can tell you there were a few frantic moments, with me desperately clinging onto the model and the prop gouging the dining table, before I was able to work out what had happened and remedy the situation.

IT ISN'T THAT BAD

Honestly, it really isn't as complicated as it may sound. Buy a decent ESC in the first place and test the set-up without a prop attached and you can't go too far wrong. As you buy them, most ESCs have default setting of gradual start and no brake; all you might need to set is the low voltage cut off point. They really are plug and play and I only recounted those tales of woe to emphasise that you should be

THE MODEL THAT PUT THE WIND UP THE AUTHOR WHEN THE ESC DIDN'T WORK QUITE THE WAY HE EXPECTED IT TO. ALMOST 100 WATTS/L3. IS SOMEWHAT MORE POWER THAN NEEDED.

aware of the simple precautions that allow easy, safe operation. In my case, it was a matter of familiarity breeding contempt. I'd used similar items so often that I forgot to take the precautions I'm advocating here. In it's most basic terms, ensure you have the correct cut-off voltage setting so that you don't put your power pack at risk. Try to always remember to shut the throttle before plugging in the battery pack and carry out testing minus a prop. Then, even if your throttle is reversed, or not reversed when it should be, nothing untoward will happen. Absolutely the worst that can happen is that you suddenly find yourself with a motor screaming its' little heart out.

PROGRAMMING CARDS

To simplify setting up your ESC there are programming cards available that allow you to easily see what the settings are, and alter them without having to listen to and count the number of bleeps. I personally don't own one and have never found the need for one, but they are a good idea if you have any doubts about your ability to use the transmitter to do the setting up. However, as with seemingly everything related to brushless motors, they are all different and will usually only work with their own brand of ESC. Hopefully, given another twenty years or so, manufacturers will finally realise that they sell more products if the system is standardised and interchangeable. Unfortunately, until that state of Nirvana arrives, we're stuck with making sure WE choose matching equipment.

MOVING BACK

No, not in time you fool, even I haven't managed that yet, despite those claims that I'm stuck in some kind of time warp. I mean, of course, moving back along our power train. That, since we have a prop, motor and ESC (suitably programmed), means that the next thing we'll be looking at is batteries.

Getting this 60" Waco YMF to fly would require LOTS of NiMhs, whereas just a four-cell pack of LiPos works admirably.

As things stand at the moment there are two main options, NiMhs or LiPos. By and large, except in the realms of the fly straight from the box type models, NiMhs (Nickel Metal Hydride) are heading the way of the dinosaur. They are okay, but are heavy and lack the capabilities of LiPo (Lithium Polymer) cells. What they do have going for them, and probably why the ARTF models still supply them, is that they are simple and safe to use. What they lack is a useful weight/capacity ratio.

A NiMh is very easy to recognise because it looks just like you'd expect a battery to look. It has a tubular metal case, with a terminal at each end (usually in the form of tags that can be soldered together to make up a pack). However, I'm quite sure you don't want to get involved with all that nonsense, so we'll stick with ready made packs for the purpose of this article.

Just to prove the point, this AW FK1 did actually destroy itself when the NiMh pack kept on going in a heavy landing.

NiMhs are quoted as being 1.1 volts per cell, so to make up a flight pack for the average model you need to be looking at an eight cell pack - 8.8 volts. They are available in a variety of capacities and were the staple power source for electric models for several years. I never liked them much, preferring Ni-Cads, but since they were banned (because of the Cadmium) had no choice until the advent of the LiPo.

Bear in mind that all model aircraft fly better if they weigh less and NiMhs or Ni-Cads are heavy for their capacity. The greater the capacity, the more they weigh. Back in the good old days (?), it wasn't at all unusual for an already marginally powered 600 size model to have to lug upwards of 12 ounces of battery pack skywards. That wasn't too bad, but 12 ounces has a lot of potential inertia when it comes time to land said marginally powered model. In the event of a heavy landing, or catching an unseen obstruction, the model tended to stop about five feet before the battery pack did so the nose of the model needed to be fairly substantial - or risk not surviving the landing.

These days things are a lot better. Since a LiPo cell weighs no more (often less) than a comparable capacity NiMh, but is over twice the voltage, we are instantly able to halve the weight our model is expected to haul aloft. Since less weight equals less potential inertia (damage), our models can also be built that much more lightly and still survive the occasional 'rough' landing. In fact, the situation has improved to such an extent that I tend towards feeling that if a landing is hard enough to dislodge the battery, the damage that causes will be the least of your worries. The model is already likely to be in need of extensive repairs - or simply throwing in the bin.

Oh yes, the advent of the LiPo cell represented a great leap forward in terms of what we can expect from our models. However, nothing comes without its' price, and just such is the case with LiPo batteries. Don't get me wrong, I'm not talking about financial cost. LiPos are very often cheaper than equivalent NiMh packs. No, I'm referring to the care needed to get the best from them - without incinerating anything.

Having done my usual stunt, had far more to say than there was space available for, I'll have to carry this over to the next issue. Then, with any luck, I might actually be able to complete the article and get back to my usual rambling.

In the meantime, should you want to contact me for any reason (except abuse), You'll find me at PETERRAKE@aol.com ■

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Price: £250.
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01923 243467.

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Contact: john.seacombe@wanadoo.fr
0033 545 29 03 56.

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Price: £35 plus £1.95 p&p
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Yorkshire.

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Price: £19.50
Contact: 01733 553745
marriottsolent@talktalk.net

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Weight - [illegible]g	Size (mm) 21 x 11.5 x 20
Torque 4.8V/6.0V (kg/cm)	[illegible]
Speed 4.8V/6.0V (sec/60deg)	0.12 / 0.11

AAS-[illegible]BB
SRP £[illegible].99

Weight - 6.2g	Size (mm) [illegible]
Torque 4.8V/6.0V (kg/cm)	[illegible]
Speed 4.8V/6.0V (sec/60deg)	0.13 / 0.12

AAS-309BB
SRP £10.99

Weight - 9.6g	Size (mm) 23.5 x 12.5 x 22.5
Torque 4.8V/6.0V (kg/cm)	[illegible]
Speed 4.8V/6.0V (sec/60deg)	0.12 / 0.10

AAS-3[illegible]1MG
SRP £14.99

Weight [illegible]1g	Size (mm) 23.5 x 12.5 x 22.5
Torque 4.8V/6.0V (kg/cm)	[illegible]
Speed 4.8V/6.0V (sec/60deg)	0.12 / 0.10

AAS-31[illegible]MG
SRP £14.[illegible]

Weight - 16g	Size (mm) 29.5 x 13 x 30
Torque [illegible]	[illegible]
Speed 4.8V/6.0V (sec/60deg)	0.15 / 0.12

AAS-[illegible]LMG
SRP £24.99

Weight - 34g	Size (mm) 42 x 20 x 22
Torque [illegible]	[illegible]
Speed 4.8V/6.0V (sec/60deg)	0.31 / 0.26

AAS-[illegible]LMG
SRP £21.99

Weight - 34g	Size (mm) 42 x 20 x 22
Torque 4.8V/6.0V (kg/cm)	7.7 / 9.0
Speed 4.8V/6.0V (sec/60deg)	0.14 / 0.11

AAS-750MG
SRP £18.99

Weight - 41g	Size (mm) [illegible]
Torque [illegible]	[illegible]
Speed 4.8V/6.0V (sec/60deg)	0.14 / 0.12

AAS-752MG
SRP £18.99

Weight - 40g	Size (mm) [illegible]
Torque [illegible]	[illegible]
Speed 4.8V/6.0V (sec/60deg)	0.11 / 0.09

ABDS-[illegible]HTG
SRP £59.99

Weight - 45g	Size (mm) [illegible]
Torque 6.0V/7.4V (kg/cm)	8.8 / 10.1
Speed 6.0V/7.4V (sec/60deg)	0.10 / 0.08

ABDS-[illegible]HTG
SRP £59.99

Weight - 56g	Size (mm) [illegible]
Torque 6.0V/7.4V (kg/cm)	11.6 / 15.8
Speed 6.0V/7.4V (sec/60deg)	0.13 / 0.11

ABDS-[illegible]HTG
SRP £59.99

Weight - 56g	Size (mm) [illegible]
Torque 6.0V/7.4V (kg/cm)	25.8 / 30.6
Speed 6.0V/7.4V (sec/60deg)	0.16 / 0.14

ABDS-[illegible]HTG
SRP £59.99

Weight - 56g	Size (mm) [illegible]
Torque 6.0V/7.4V (kg/cm)	[illegible]
Speed 6.0V/7.4V (sec/60deg)	[illegible]

ADS-[illegible]HTG
SRP £29.99

Weight - 22.1g	Size (mm) [illegible]
Torque 4.8V/6.0V (kg/cm)	4.7 / 5.6
Speed 4.8V/6.0V (sec/60deg)	[illegible]

ADS-[illegible]HTG
SRP £29.99

Weight - [illegible]g	Size (mm) [illegible]
Torque 4.8V/6.0V (kg/cm)	4.1 / 4.6
Speed 4.8V/6.0V (sec/60deg)	0.09 / 0.07

ADS-[illegible]LTG
SRP £39.99

Weight - [illegible]g	Size (mm) 42 x 20 x 22
Torque 4.8V/6.0V (kg/cm)	7.0 / 9.0
Speed 4.8V/6.0V (sec/60deg)	0.14 / 0.11

ADS-660LTG
SRP £[illegible].99

Weight - 34g	Size (mm) 42 x 20 x 22
Torque 4.8V/6.0V (kg/cm)	7.6 / 9.1
Speed 4.8V/6.0V (sec/60deg)	0.11 / 0.09

ADS-[illegible]HMG
SRP £34.99

Weight - 102g	Size (mm) 59 x 30 x 58
Torque 4.8V/6.0V (kg/cm)	19.8 / 24.3
Speed 4.8V/6.0V (sec/60deg)	0.16 / 0.13

ADS-940HMG
S[illegible]

Torque 4.8V/6.0V (kg/cm)	8.2 / 9.7
Speed 4.8V/6.0V (sec/60deg)	0.14 / 0.12

ADS-942HMG

Torque 4.8V/6.0V (kg/cm)	[illegible]
Speed 4.8V/6.0V (sec/60deg)	0.11 / 0.09

ADS-[illegible]HTG
SRP £39.99

Weight - 49g	Size (mm) 39 x 19 x 38
Torque 4.8V/6.0V (kg/cm)	16.6 / 21.0
Speed 4.8V/6.0V (sec/60deg)	0.19 / 0.16

ADS-[illegible]HTG
SRP £39.99

Weight - 49g	Size (mm) [illegible]
Torque 4.8V/6.0V (kg/cm)	7.8 / 10.1
Speed 4.8V/6.0V (sec/60deg)	0.10 / 0.07

ADS-[illegible]HTG
SRP £49.99

Weight - [illegible]g	Size (mm) [illegible]
Torque 6.0V/7.4V (kg/cm)	11.2 / 15.2
Speed 6.0V/7.4V (sec/60deg)	0.11 / 0.09

ADS-[illegible]HTG
SRP £49.99

Weight - 56g	Size (mm) 39 x 19 x [illegible]
Torque 6.0V/7.4V (kg/cm)	19.4 / 22.1
Speed 6.0V/7.4V (sec/60deg)	0.16 / 0.13

ADS-[illegible]HTG
[illegible]

Weight - 56g	Size (mm) 39 x 19 x 38
Torque 6.0V/7.4V (kg/cm)	8.8 / 10.6
Speed 6.0V/7.4V (sec/60deg)	0.08 / 0.06

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