FOKKER Dr.1 TRIPLANE
1/6TH SCALE FOR ELECTRIC: PART 2

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Fleet Fighter version of the Hawker Fury biplane

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PZL WILGA
- *Scale drawings*
- *Type History*

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Richard Scarborough's Spit from the Mick Reeves kit

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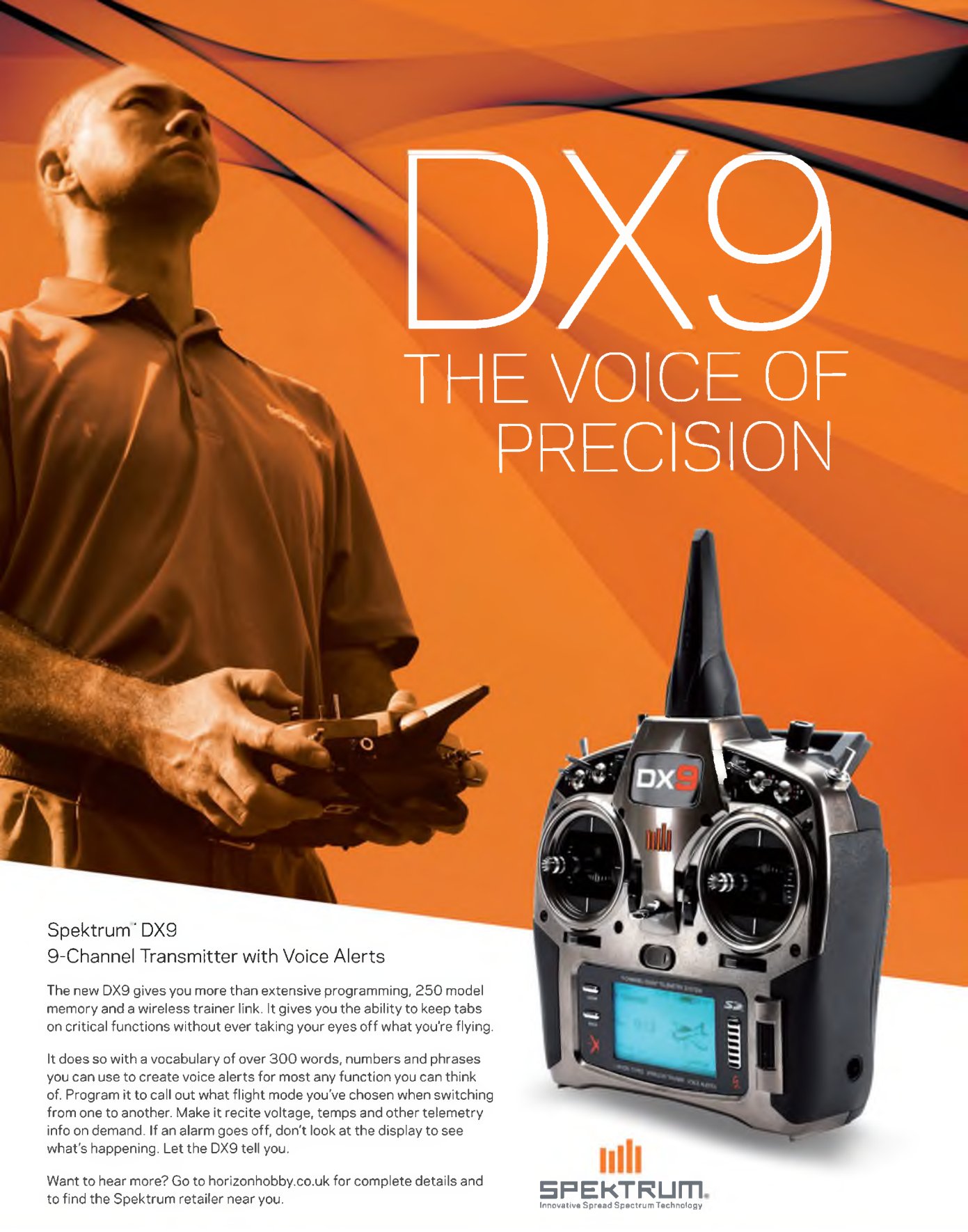

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FORMATION...

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ON THE COVER

Richard Scarborough's Supermarine Spitfire Mk.IX displays all the classic elegance of that elliptical wing as it flies past Alex Whittaker's camera. Built from the Mick Reeves kit, this 1/4-scale model is reviewed in this issue.

JANUARY 2014 NO.170

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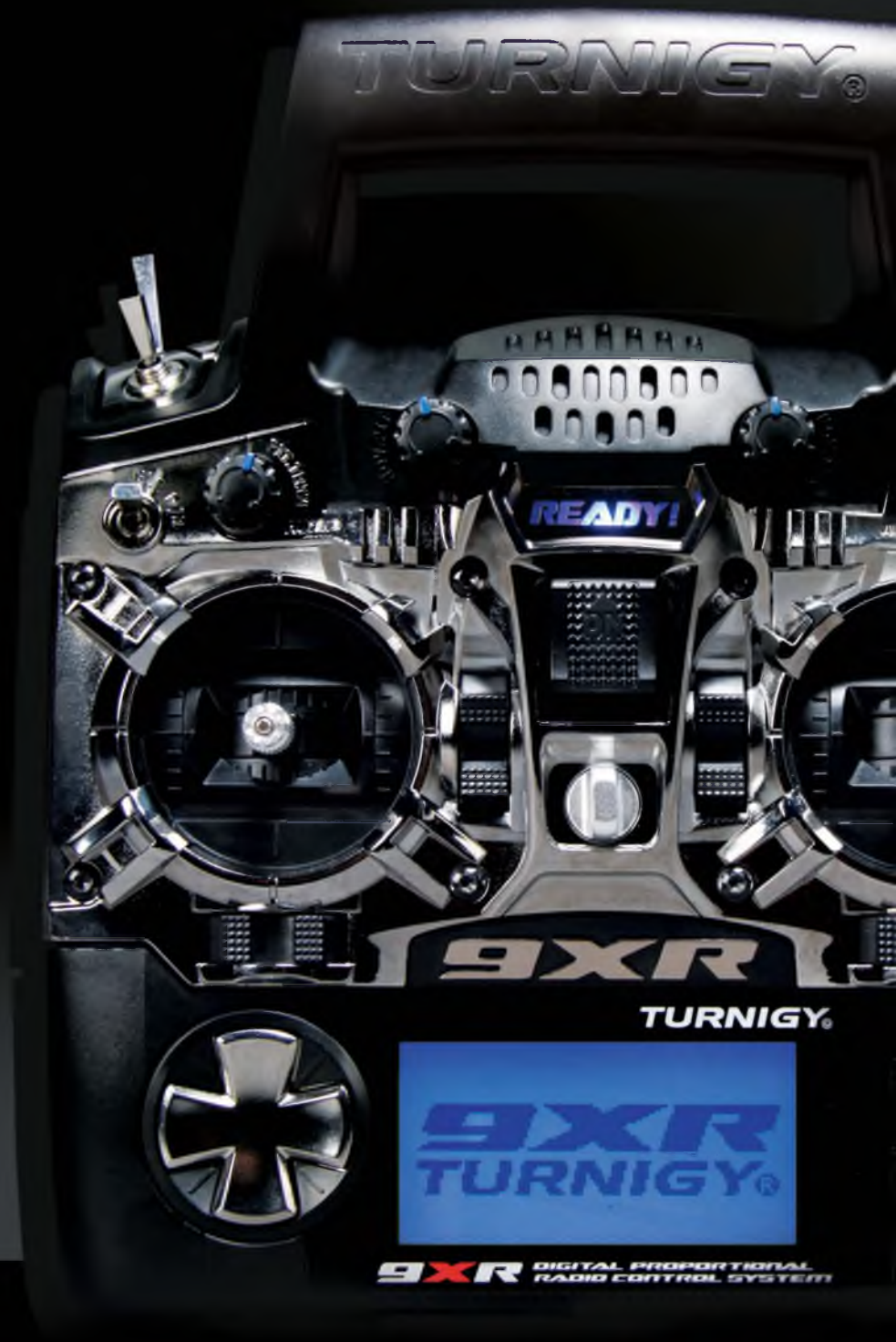

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CONTACT

INDOOR SUCCESS

Congratulations to BMFA's Scale Technical Committee, for the success of their Indoor Scale event recently held at RAF Shawbury, near Shrewsbury, Shropshire. They flew free flight in several classes, but the innovation was the inclusion of R/C Scale that inevitably requires much more space. The hangar at Shawbury had previously been used to store four-engine Avro Shackleton maritime reconnaissance aircraft - which gives some impression of the space available as the picture above shows.

And the R/C Indoor Scale innovators really did rise to the occasion with a fascinating variation of aircraft types modelled, as Alex Whittaker's photo report in this issue reveals.

Modern ultra-light R/C equipment has reached such a level of lightness, compactness and practicality and has opened up such tremendous possibilities for Indoor flying. Long may it continue and congratulations to all involved, who made it all possible.

FSM has a couple of Indoor R/C scale full size centre-spread pull-out plan features lined up. One is an 18" White Monoplane from Peter Rake, and Richard Crossley will be presenting his 22" span Piper Tri-Pacer.

CALLING ALL AEROMODELLER READERS! CAN YOU HELP US?

Here at the ADH Publications office, we receive many calls and letters concerning the older issues of AeroModeller. Unfortunately, due to the previous transfers of ownership of the magazine, we do not have a full set of old AeroModeller magazines - but we want to start collecting a set!

We thought you, our readers, might be able to help. We often hear tales of lofts full of old magazines and sadly how many are thrown away because of lack or room, or when relatives are left to dispose of a modeller's possessions.

So, if you have any old AeroModellers surplus to requirement that you would consider donating to the AeroModeller office, we would like to hear from you - we would, of course, collect the magazines and you would be playing your part in the future of the magazine - and hopefully helping new modellers to our hobby!

You can call us on 01525 222573, email: alan@adhpublishing.com or write to us at Doolittle Mill, Doolittle Lane, Totternhoe, Beds LU6 1QX.

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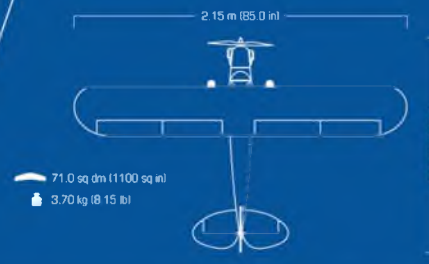

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SETTING THE PACE!

The Piper PA-20 Pacer was one of a generation of American light aircraft for private flying, produced during the 1950s/early 1960s. It was a shapely little tail dragger aeroplane with its own distinctive style that was a logical follow-on from Piper's universally known J-3 Cub/L-4 'Grasshopper'. It came from the era when light aircraft types were still largely fabric covered, before the modern era of pressed metal skinned 'span-cans'.

Now, **Horizon Hobbies** have chosen this very attractive type as an addition to their popular **E-flite** ARTF range. As such, it is not a slot-together foamie, but features an all-built-up conventional balsa-and-ply airframe, *UltraCote* covered to final finish and with moulded glass fibre cowl. It also comes with scale cockpit and instrument panel installed and also features optional wing flaps.

Intended for the power of the E-flite Power 10 brushless outrunner motor, it uses a 3S 11.1v 1800-2200 mAH lipo battery accessible through a spring-loaded hatch in the lower fuselage which also allows access to the receiver and servos.

With a wingspan of 1300mm (51.2") the E-flite Piper PA20 Pacer is to a scale of just over 1/7th (1:6.86 actually) and is priced at £131.99.

NEW AIRCRAFT REFERENCE SOURCES FROM ADH PUBLISHING

Between prototype first flight in 1936 and the end of 1945, the Supermarine Spitfire went through no less than 24 production versions - then there were the experimentals and the Seafire series too.

Most commonly, the type is associated with the Rolls Royce Merlin engine and the latest in the well known **Squadron/Signal** reference series covers the Mks 1, Vb and IXc Merlin powered versions. This new work provides extensive external and internal details in 80 pages of detailed line drawings, with 210 photos - all the stuff that scale modellers seek.

It's available is both paperback (£11.99) and hardback (13.99 formats direct from ADH Publishing.

Equally associated with the Merlin engine is the North American Mustang, for which there is now available a new reference work in the **Airframe & Miniature** series, covering all the early versions before the introduction of the P-51D buddle canopy type including the initial Allison powered A-36, P-51 and P-51A, plus Merlin powered B, and C versions.

Produced by Richard Franks, this 144 page work provides :-

40+ pages of technical information
20+ pages of walk-around images and technical diagrams
5+ pages of camouflage and markings
25+ pages of model builds and modelling information
200+ photographs including wartime images
Colour side views and four-views by Richard J. Caruana
3D isometric views of all variants by Jacek Jackiewicz
A real bonus for the modeller will be a set of fold-out 1/48th scale plans

RRP will be only be £17.95 direct from ADH Publishing.

CUSTOM DECALS

When it comes to the final surface finish on a scale model - which is really all you see anyway - the effect we are all striving to achieve is nothing more than skin-deep. In many respects, it's the little things that make the difference to authenticity and among those are the little annotations, warning notes etc. strategically placed on the airframe surfaces - the more complex the aircraft type, the more there are - particularly on warbird types which tend to be festooned with the stuff.

Adding those little details in crisp authentic type can be a tricky task, and here's a service you can use by enlisting the aid of Phil Paine at **Model Bus Transfers**. Phil's primary service has been for modelmakers who are into model busses and model railways, but the service he offers can be just and easily be extrapolated to scale model aircraft. Some example of what Model Bus Transfers can produce are here show.

Phil can produce anything you like, to the scale needed from digital or hard copy artwork in the form of waterslide transfers. The format he needs for the job is shown below and Phil can be contacts on 02380 739694 or email p.paine@talktalk.net

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SPITFIRE OF THE SILVER S

ALEX WHITTAKER ADMIRES RICHARD SCARBOROUGH'S SPIT

SCREEN

MK. IX FROM THE MICK REEVES KIT

The Spitfire Mk IX is considered by many scale modellers as the definitive Spitfire, perhaps because its particular upgrades and modifications were forged in the heat of battle. The truth is that by mid-1942 the formidable Focke Wulf Fw 190 was gaining the upper hand in air superiority in the West, outclassing the Spitfire Mk.V. Something had to be done.

The outcome was the Spitfire MK IX, employing the two-stage superchargers of the Spitfire Vb, plus a strengthened airframe specifically designed to benefit the introduction of the new Rolls Royce erlin 60 and 70 engines in a lengthened nose section. In fact, these airframe improvements proved so successful that they paved the way for the later Griffon engines variants. The Mk IX (Vickers Supermarine Type 361) proved to have a quantum leap in performance with its adoption of the Merlin 60, originally developed for the Wellington bomber, providing a top speed of 403 mph at 27,400 feet, and a climb to 30,000 feet in ten minutes.

The RAF set up a High Altitude Flight at RAF Northolt to capitalise on this impressive performance, especially to counter the threat of the four engine Junkers Ju86R, adapted from bomber to high altitude reconnaissance configuration used by the Luftwaffe.

Some late Mk IXs had bulged upper engine cowlings to incorporate the modified intercooler of the Amercian-made Packard Merlin, while other Merlin 61 powered Spitfires were stripped of all armament, painted pale blue, and designated Photo Reconnaissance or PR types. In fact, one intercepted a Ju 86R at 40,000 feet.

Showbiz Star

A fair number of Spitfires IXs survived WW2 in guises from Gate Guardian duty at RAF Airfields, to post-war service with foreign air forces, and from the late 1960s onwards as the aircraft restoration movement gathered pace, many of the survivors have been gathered up from the most unlikely 'last resting places' worldwide and restored to full airworthy condition. These days, a fully restored airworthy Spitfire Mk.IX commands a £1.5M price tag.

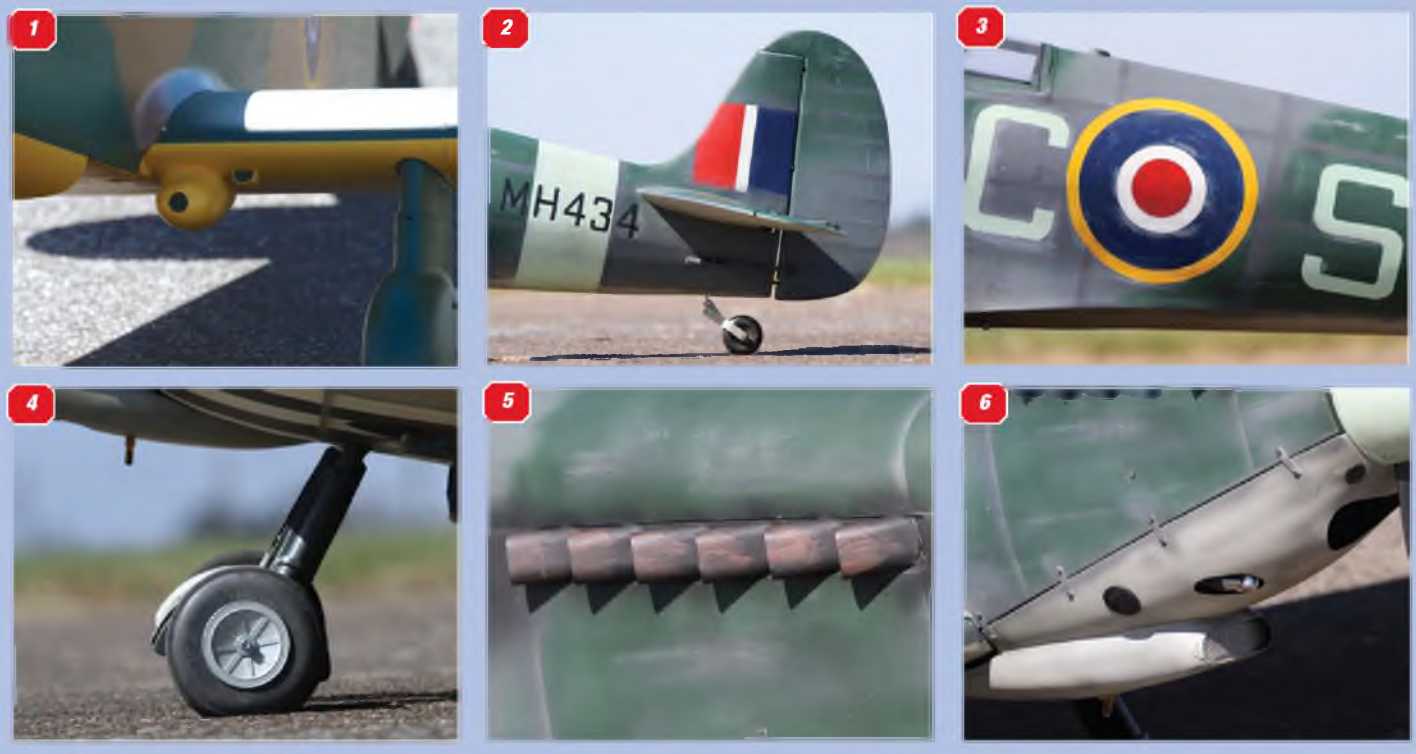
No self respecting major air show these days can get away without a Spitfire appearance and there has been a demand to the type for 'period' Movies and TV series.

One Spit Mk.IX in particular is Spitfire MH434. In November 1967 she joined the motion picture airforce of *Spitfire Productions Ltd.* This British company had been set up by Group Captain Hamish Mahaddie for the film *Battle of Britain*. At the end of the movie in 1968, MH434 was sold again. The new owner, Sir Adrian Swire, then Chairman of Cathay Pacific Airways, had the Spitfire painted in a 1944 camouflage colour scheme, with his own initials AC-S, as squadron codes. There followed several film and television appearances during this period, including the film *A Bridge Too Far*. Spitfire MH 434 is now resting between engagements, and may be viewed at the Imperial War Museum Duxford.

The model

Show stars on the modelling show and Warbird circuit such as this particular model Spitfire IX often have interesting past lives. In fact, this flying model Spitfire was originally built and finished by ace scale man Ivan Jordan in 2000.

After Richard acquired the model, he made



1: Even the smallest scale detail is present. 2: Distinctive slender rear fuselage and characteristic tail. Note crisp legending. 3: Painstaking finishing avoids that "vinyl sticker" look. 4: Scale wheels, doors, and working oleos build up the authenticity. 5: Finely moulded and nicely finished exhaust stubs. 6: Only the spark-plug cap gives the petrol engine away!

his own changes to the airframe that had been built from the plan and all-wood kit produced by celebrated ex-World Scale Champion Mick Reeves plan so scale accuracy is assured. The kit, plan, and cowl are still available from Mick Reeves who now also offers a fully moulded fuselage.

Documentation

The model is based on the Duxford-based example, which is very well documented and of course, still extant.

Construction

The whole model is of traditional construction, with an all built-up, balsa and plywood structure. The fuselage is

"ACS" HAMMERING IN OVER THE BOUNDARY.

MODEL SPECIFICATION

MICK REEVES SPITFIRE MK IX

Scale:	1/4 scale
Wingspan:	112 inches (2845mm)
Weight:	33lbs (15 Kg.)
Engine:	3W 75 cc
Prop:	Menz 24x10

traditional balsa and plywood with the addition of a Mick Reeves fibreglass cowl. The all built-up wing is a one piece item, although later versions of the Mick Reeves kit have two piece plug-in wings.

Tailplane is all built-up, with one central servo in the fuselage.

Engine

3W 75 cc rear induction petrol engine. It is worth noting that Mick Reeves reckons that Zenoah 62 petrol engines are the most popular power plant for this model world wide. The model draws fuel from a 32 oz tank, hauled around by a Menz 24"x10" wood and noise abatement is applied via home made box silencer.

Undercarriage / Retract

Heavy duty Eurokit, with hand made Oleos. Air up / spring down for safety.

Covering and finishing

The completed model was covered in glass cloth and resin and overpainted using Humbrol paints were used throughout.

Pilot's Notes

Besides his normal weekend warbirding, Richard has flown the Spitfire at the BMFA Nationals and The Showline.

He reports that:

"She handles superbly and is really easy to fly, although she is tricky to land in windy conditions, due to being so light and having such a big wing".

Richard said that he thought about putting about 5 pounds of lead on the C.G, but has decided only to fly her on better days. ■

7: Handsome nose and spinner. Love the scale flat finish to the spinner paint. 8: Meticulous rivet and fastener detail around the cockpit. 9: Flaps and blisters all present and correct. 10: Those exhaust stubs really are well modelled! 11: Finely executed pushrods, horns and trim tabs. 12: Sturdy and practical tailwheel assembly.

PART 2:

THE TRIPLANE LAYOUT MAKES THIS APPEAR A QUITE COMPACT MODEL, BUT AT 1/6TH SCALE, IT REQUIRES THREE DOUBLE SIDE FULL SIZE PLAN SHEETS TO COMPLETE, SO THIS FEATURE WILL RUN OVER THREE PARTS

Although still to have its' weathering added the model shows off just how realistic it can be made to look.

Cruising by Darrin's model looks every inch like the real thing.

So, last time we left our model with a top wing and some tail surfaces - and you deciding if you wanted a one-piece model or not. Well, you've had plenty of time to make up your mind about that, and think up various ways of making parts removable if that's the way you want to go. That being the case, I'll carry on describing the build of a one-piece model and leave you to introduce your own modifications as required. So let's get building....

Centre wings

Well, if removable is what you want, there aren't too many modifications required here. The centre wing panels are already arranged to plug onto wire dowels running through tubes installed in the fuselage. Making the interplane struts a permanent part of these wing panels is probably a good idea, so they go back in exactly the same place every time.

Anyway, there's nothing complicated about building the centre wing panels, just bear in mind all the points made while discussing building the top wing and you won't go too far wrong.

One point of particular note is the way the root ribs are cut away to clear the centre section struts. This isn't a botch simply to allow things to fit; the root ribs on the full-size machine actually had a sort of Z-shaped section for this exact purpose. Since putting a kink in the actual root rib didn't sound the strongest, or easiest, way to go about things I opted for laminated root ribs allowing the cutaway to be made without weakening the overall assembly. Ultimately, if you go to the extremes Darrin opted for, the whole thing will be enclosed by the litho plate fairings. However, if super-scale isn't what you're after, then the balsa sheet decking will blend around the area quite nicely.

The litho plate adds that extra dimension of realism, but isn't essential to a perfectly functional model. I knew what Darrin had in mind when I drew up the plan, but also

FOKKER Dr.1

Continuing the construction of the 1/6 scale, electric powered model designed by Peter Rake and built by Darrin Covington.

realised that we mere mortals might need an option that didn't involve even more metalwork than is absolutely essential.

Bottom wing

Bearing in mind the level of authenticity that Darrin required for his model, the bottom wing follows pretty closely to full-size practice. The spars run full span (or will do if you are using joined spars, but 1 metre long wood is sufficient to make them one piece) and seat in a cut-out in the lower fuselage. Just remember this when you cover the fuselage, because the natural 'lay' of the covering has to be disrupted to fit the wing. However, this is also a feature of the original aircraft so you do end up with a scale detail for no extra effort.

Once again the root rib is a laminated affair so that you can make that 'interesting' Z shaped section to fit around the undercarriage leg. Yes, that too is as per the original.

Other than making sure your fuselage will actually fit between the root ribs, the bottom wing is probably the easiest of the three to build. There are no tubes or ailerons to complicate things, so it really is pretty straightforward. Once again, and this applies to all three wings, do take particular care to get the strut fixing rib totally upright.

Aileron servo mounting and mock-up cables to aid positioning exit guides.

How the litho plate Darrin used fairs in the centre wing panels and rear c/s struts.

Remember that the interplane strut has to pass straight through the middle wing, so accurate attachment points on the centre, top and bottom wings will ensure you don't end up with bowed struts.

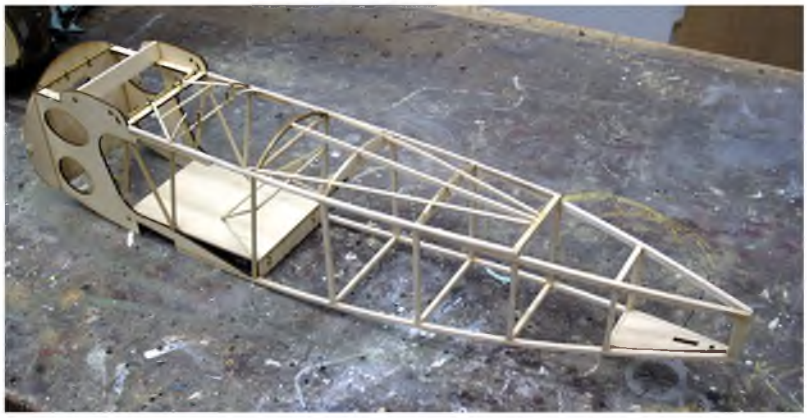
Fuselage

Since I mentioned ensuring your bottom wing fits the fuselage width, that seems like a logical next building task. Joining the two relevant sheets of the plan, to give you a complete side view is the first task. *(Unfortunaely, the size of the drawing is such that the rear half of the fuz. will have to wait until Part 3 next month).* Since the upright at F7 is shown on both parts, that is as good a place for the join as any. At least you have nice, straight lines to butt against each other.

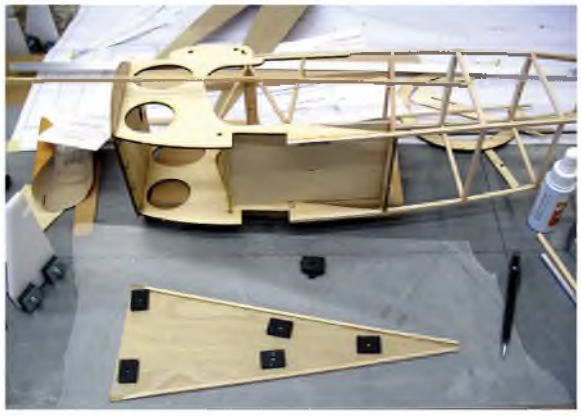
Because this is hardly the sort of model suited to novice builders I won't go into huge detail about sticking one bit of balsa to another - I'm quite sure you're perfectly able to sort out how you want to build your model, so will just draw attention to areas that might catch you out if you aren't aware of them beforehand.

A quick look at the photos will reveal that Darrin rounded off the longerons in the cockpit area (to better represent the tubular structure of the real aircraft) and replaced some of the formers in that region with tube creations. The plans show (and the cut parts set contains) the formers as drawn. If you want to add the level of cockpit detail that Darrin did the option is there. So, let's start building that fuselage.

The basic fuselage construction follows



The basic fuselage with the outside of the longerons rounded to better represent tube.



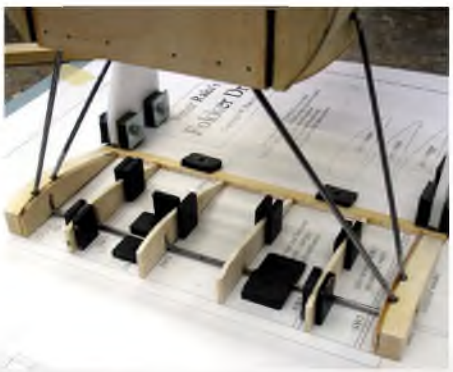
The centre stringer provides the shape for the ply side panels while the stringers glued to them provide secure fixing to the fuselage sides.

the time honoured practice of building two side frames and joining them with formers and cross braces. This will include the cockpit floor and strut plate SP. Having these parts firmly glued in place will help prevent the forward sides bowing as the tail is pulled in and joined. Fit the wing, strut and undercarriage tubes, making sure they are firmly epoxied in place.

Now, while you still have plenty of open spaces to work though, is probably as good a point as any to work out your radio installation. It can be done later, but is easier while you can still get at things to ensure the closed loop cables will actually run as they are intended to. Just a mock-up, with servos permanently fitted, but substituting thread for the cables works fine. The real cables aren't that difficult to fit once the bulk of the fuselage is complete - although it's an idea not to cover the lower fuselage until they are in place.

The centre section struts and undercarriage (u/c) legs can all be fitted after the fuselage is pretty much complete. I don't know about you, but I hate having to sand and cover around bits of wire sticking out from the item I'm trying to work on.

Don't worry that some of the rear decking formers appear slightly strange. This is so they don't (hopefully) show through the covering as it transitions from the ply fairing to the longerons.



An option with the axle wing is to do as Darrin did and actually build it around the undercarriage legs.

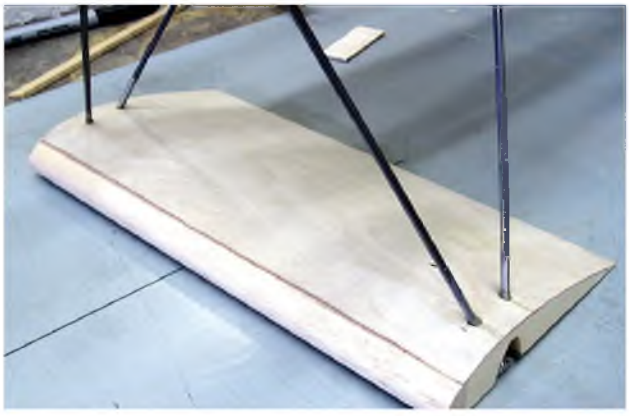
Centre section struts

Now this is where things start to get a little complicated. You can't actually set these up until you've got a complete fuselage and at least a top and pair of middle wings to work with. It's even better if you also have the lower wing and interplane struts to hand as well. You'll also need the guide parts shown on the plan to aid accurate alignment during this stage. It helps if at this point all assemblies are still bare of covering. There's going to be a fair bit of soldering going on and it would be a shame to have to patch the covering because you dropped a blob of solder on it.

Fit the lower wing into its location and secure it temporarily in place. Similarly fit the interplane struts into the centre wing panels and slip them onto the dowels. Clamp this assembly into accurate alignment before continuing. These two wing assemblies should be self-aligning, so you can move onto the next step without the guides in place. Slip the centre section (c/s) strut wires into their tubes before sliding home the centre wing panels or you may not be able to get the rear one in place. Slip on the brass strip pieces and then bind wires C in place and lightly tack solder them to A and B. Check that the top wing fits correctly (the A, B and C assembly fitting into the slots and the interplane struts aligning correctly), before removing the wing to finish soldering the strut wires.

Now, fit the guides to ensure accurate alignment of the top wing, turn the whole thing over and with the brass strip fitting securely against the wing surface, solder it to the wire parts. This should now mean that the top wing cannot go on at anything other than the correct incidence angle when you finally glue it in place. All you have to check is that it seats properly on the

Darrin uses the vac formed cowl to assist with aligning the side fairings while they are glued in place.



Once sheeted and sanded the appearance of the axle wing is very tidy. Make absolutely sure it can't move.

brass strips - and use the guides to make sure it stays there as the glue sets.

Cowl

Darrin cheated slightly with his cowl. Having already built a model that used an aluminium cowl, he used that as a pattern for vac-forming the cowl for this model. Without that luxury, you can use the built-up cowl shown on the plans. There's nothing complicated about the cowl, just a lot of sanding, filling, priming and painting involved once you have the basic components assembled. Of course, none of which is to say you can't use the built up cowl as a former for vac-forming your own cowl.

How you secure the cowl in place is up to you. Darrin, being Darrin, simulated the scale fixing by having a cable run in a groove near the rear of the cowl. Most people, however, will be happy enough with using screws to retain their cowl.

Landing gear

Build the axle wing, but DO NOT sheet the lower surface until it is firmly glued to the u/c wires. Since once this assembly is in place on the fuselage it's there for good I suggest waiting until you have the fuselage covered.

With the basic axle wing built, but before parts SW1 are fitted, fit your u/c wires and solder them up as shown on the plan. Tease the axle wing into place and glue it securely at 0 degrees incidence. The precise angle isn't that important as long as it isn't far out. What is vitally important is that it can't move from that angle. A model you have to re-trim every flight soon becomes more trouble than it's worth.

Once securely mounted, you can fit the lower sheeting and the SW1 parts, suitably grooved to fit around the wire parts. There is enough space, as long as you are careful, to fit the elastic cord binding after parts SW1 are in place and sanded to match the axle wing. However, they could always be fitted before SW1 parts are in the way if you have trouble working in small spaces. You could just solder the axle, but it won't help with those slightly less than perfect landings because there will be no give in the assembly.

Okay, you should now have a pretty much completed build on your hands. Next month we'll finish of the saga by dealing with covering, finishing and assembling the model.

If it wasn't for the size of those bricks in the background this could almost be a factory shot of an assembled Dr1.

Line-up of Jasta 26 Fokker Dr.1s - neatly placed with all propellers similarly aligned - maybe in preparation for an offical inspection?

FOKKER Dr.1

Forever linked to Germany's most famous WW1 fighter pilot, Fokker's Triplane was a classic example of an aircraft with a great capability within its limitations

Individual aircraft types sometimes gain notoriety out of all proportion to their actual performance or special achievement. In terms of performance, the Fokker Dr.1 Triplane, although notable for its rate of climb and manoeuvrability, was nothing particularly special. It was slower than its best biplane adversaries and was also slower in a dive - which is rather bad news for its pilots when attempting to disengage from a combat situation that was not particularly going their way!

But on April 21st, 1918, Imperial Germany's highest scoring fighter pilot, the legendary Manfred von Richthofen crashed into the British lines on the French Western Front, fatally injured. Much has been written over the years between then and now as to whether Richthofen fell to the guns of Captain Arthur Roy Brown's red-nosed Sopwith Camel, or to ground-fire. At the time, Richthofen was very low over the ground and modern-day examination of the action tends to suggest that it was ground fire that got him. He has scored his final, 80th 'kill' the day before.

Richthofen had first flown the Dr. 1. in September 1917, and on the 2nd he shot down an R.E. 8 for his 60th victory.

A more spectacular exponent of the Dr.1 was Werner Voss, who 'downed' some 48 Allied aircraft during his fighting career. The story of his death is an epic in W.W. I literature; when alone on September 23rd, 1917, he ran across a flight of six S.E. 5s from 56 Squadron led by the famous Capt. 'Jimmy' McCudden, and managed to shoot holes into all of them before falling to the guns of Lieut. Rhys Davis, a young Welshman still in his teens. Another colourful triplane pilot was Heinrich Gontermann, whose speciality was balloon busting; he died on October 31st, 1917, when a Dr. I in which he was on a test flight, broke up.

Design and development

In February 1917, the British Sopwith Triplane began to appear over the Western Front. Despite armament of just a single Vickers machine gun, the Sopwith swiftly proved itself superior to the more heavily armed twin-gun Albatros fighters then in use on the German side and in responce to a demand to match the performance and characteristics of the Sopwith fighter, the Fokker organisation converting an unfinished

First of the line, the Fokker V.3 that served as the initial prototype. Lack of aerodynamic balanced to the ailerons and elevators make the controls very heavy - not exacly what was wanted for the ultimate dog-fighter. Modifications quickly followed.

And here is the result - Fokker Dr.1 serial 141/17, the subject of official performance trials. The horn balance on the aileron can be clearly seen. Note also the protective wing tip skids

REPLICA Dr.1

ABOVE & BELOW: This accurate Dr.1 replica has been demonstrated at the annual Flying Legends air show on a number of occasions.

biplane prototype into their V.4, a small, rotary-powered triplane with a steel tube fuselage and thick cantilever wings, first developed during Fokker's government-mandated collaboration with Hugo Junkers. Initial tests revealed that the V.4 had unacceptably high control forces resulting from the use of unbalanced ailerons and elevators. To eradicate such shortcomings Fokker quickly revised the V.4 into the V.5. the most notable changes being the introduction of horn-balanced ailerons and elevators, as well as longer-span wings. The V.5 also featured interplane struts, which were not necessary from a structural standpoint, but which minimized wing flexing.

The result found favour with authorities with a confirmed order for 20 pre-production examples in July 1917.

When designing this machine, Anthony Fokker's aim was to produce an aircraft expressly for fighter-to-fighter combat and so manoeuvrable that it couldn't be hit. That he succeeded cannot be denied. Another attribute of the Dr. I was its phenomenal (for-the-period climb-rate), its initial rate enabling it to get upstairs at nearly 2,000 ft. per minute.

The wings, which were fully cantilever, were built on a single spar which was actually two box-spars, joined together top and bottom with three-ply, to form a single unit of constant cross-section throughout its length. Ribs were of three-ply with large circular lightening holes; the leading edge was sheeted, and the trailing edge simply a wire, which formed a scalloped profile when the fabric was doped. Ailerons were of welded

Another view of the line-up of Jasta 26 Fokker Dr.1s. This picture must have been taken sometime after the change of national insignia from the 'Cross Patee' to the squared-off 'Latin Cross' in April 1918.

steel tube and there was some variation as to the taper commencing from the first or second (inboard) rib.

Fuselage and tail assembly were of welded steel tube construction streamlined steel tube; the interplane struts were simply wooden ties no more than half-an-inch thick.

A near circular metal cowling housed the 110 h.p. Oberursel engine, the front face being fretted with round cooling holes but some Dr.Is had open front cowls similar to those fitted to French Nieuport scouts.

Others were fitted with 110 h.p. Le Rhone engines. These were Swedish-built Thulin engines, which had been manufactured to the order for the German Government under licence from the French Le Rhone firm.

Operational History

The first production example were sent to Jastas 10 and 11 for combat evaluation, arriving at Markebeeke, Belgium on 28 August 1917.

Von Richthofen first flew one on 1st September 1917 and shot down two enemy aircraft in the next two days, reporting that these initial Dr.1 F.I examples were superior to the Sopwith Triplane and recommending that fighter squadrons be re-equipped with the new aircraft as soon as possible.

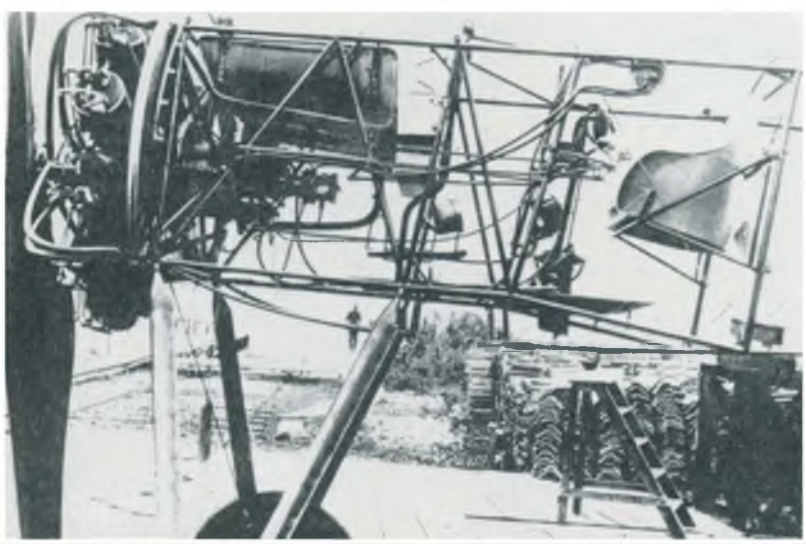
But the combat evaluation came to an abrupt cessation when Oberleutnant Kurt Wolff, leader of Jasta 11, was shot down in 102/17 on 15 September, and Leutnant Werner Voss, leader of Jasta 10, was killed on 23 September.

The remaining pre-production aircraft, designated Dr.I, were delivered to Jasta 11. Nevertheless, an initial production order for 100 triplanes, was followed by an order for 200 in November. Apart from minor modifications, these aircraft were almost identical to the initial F.I, the primary distinguishing feature being the addition of wingtip skids, which proved necessary because the aircraft was tricky to land and prone to ground looping.

Compared to the Albatros and Pfalz fighters, the Dr.I offered exceptional manoeuvrability. Though the ailerons were not very effective, the rudder and elevator controls were light and powerful. Rapid turns, especially to the right, were facilitated by the triplane's marked directional instability.

But the Dr.I was considerably slower than contemporary Allied fighters in level flight and in a dive and although initial rate of climb was excellent, performance fell off dramatically at higher altitudes because of

Just how vulnerable WW1 pilots were duringcombat can be gauged by this view of the forward fuselage framework of a Fokker Dr.1. Apart from the minimalist tubular frame, there would be nothing but a bit of doped fabric and incoming machine-gun fire!



One of the attempts to improve performance of the Dr.1 was the V.7 with Siemens-Halske Sh.III rotary engine and four-blade propeller.

the low compression of the Oberursel Ur.II, which was cloned from the Le Rhône 9J rotary engine.(As the war continued, chronic shortages of castor oil made rotary engine operation increasingly difficult. The poor quality of German ersatz lubricant resulted in many engine failures, particularly during the summer of 1918

The Dr.I suffered other deficiencies. The pilot's view was poor during takeoff and landing, while the cockpit was cramped and furnished with materials of inferior quality. Furthermore, the proximity of the gun butts to the cockpit, combined with inadequate crash padding, left the pilot vulnerable to serious head injury in the event of a crash landing.

Wing failures

The first incident occurred in October 1917, when a Jasta 15 pilot was performing aerobatics. The Triplane broke up and the pilot was fatally injured in the ensuing crash landing. Two days later, a Jasta 11 pilot was killed when his Dr.1 broke up in level flight. It did not take long for Inspection of the wrecked aircraft to reveal that the wings had been poorly constructed.

Examination of other Dr.1s with substantial accumulated flying hours confirmed these findings and all remaining Dr.1s were grounded pending an inquiry which concluded that poor construction and lack of waterproofing had allowed moisture to damage the wing structure. This accumulated moisture ingress caused the wing ribs to disintegrate and the ailerons to break away in flight.

Not for the last time were Fokker's manufacturing and quality control found lacking. The remedy was to varnish the wing spars and ribs, to combat moisture. Fokker also strengthened the rib structures and the attachment of the auxiliary spars to the ribs. Existing triplanes were repaired and modified at Fokker's expense. After testing, production resumed in early December and by January 1918, Jastas 6 and 11 were fully equipped with the triplane.

However, no more than 14 squadrons used the Dr.I as their primary equipment and frontline inventory peaked in late April 1918, with 171 aircraft in service on the Western Front

Despite corrective measures, the Dr.I continued to suffer from wing failures while being flown by notable combat pilots including Leutnant Hans Joachim Wolff of Jasta 11 who successfully landed after suffering a failure of the upper wing leading edge and ribs. On 18 March 1918, Lothar von Richthofen, brother of Manfred, suffered a failure of the upper wing leading edge during combat and was seriously injured in the ensuing crash landing.

Postwar research revealed that poor workmanship was not the only cause of the triplane's structural failures. In 1929, the American National Advisory Committee for Aeronautics (NACA) investigations found that the upper wing carried a higher lift coefficient than the lower wing - at high speeds it could be 2.55 times as much.

The triplane's chronic structural problems destroyed any prospect of large-scale orders and Production eventually ended in May 1918, by which time only 320 had been manufactured. The Dr.I was withdrawn from frontline service as the Fokker D.VII entered widespread service in June and July. ■

Aileron shape underwind some revision during the life of the Dr.1. production runs as part of airframe revisions intended to cure structural deficiences that were revealed in early service.This example reveals late-type aileron.

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On Silent Wings by Chris Williams

SCALE SOARING

It was surely a miracle indeed, that the advent of the last of the Ghost Squadron's events at Middle Wallop for the year should coincide with an unusually decent weather forecast. The warm sunshine and light winds bought a out a fair crowd and there was much to see and at which to marvel. Perhaps the attendee with the most miles on the clock was Noel Rumers, who had made the trip from Holland, bringing with him his electrified version of much-modelled K14 motor glider, as well as his venerable 1/3rd scale C-Falke, fitted with the Fema on-board starter for its Z38 powerplant.

In honour of the occasion, my pal Motley and I had brought along a few motorgliders of our own, so the line-up on the tarmac was an impressive one. Noel, as I have had occasion to mention before, is (was, like me he is now retired) a college lecturer in engineering, and in his time was not above involving his students in his aeronautical engineering projects. One noteworthy accoutrement on the K14 was the addition of an automatically feathering prop, the details of which were explained to me, but which I'm afraid went right over my head!

The K14 is a fine performer and put in several flights over the weekend. Kevin Beale's electric Moni, in it's second year of attendance was very unfortunate to become the victim of a mid-air whilst loitering in apparently lightly loaded airspace, in an attempt to avoid the more crowded parts of the sky elsewhere. (This in itself goes to show how well attended this weekend was.)

Andy Anderson brought along his Horten 3F from the old (very old!) Gordon Waite plan. The Horten range of flying wings are notable for the ascending order of their aspect ratios, as the Horten brothers pushed the boundaries of flying wing performance.

The later high-aspect ratio versions have proved to be quite problematic to model, defying even the powers of the likes of Cliff Charlesworth to successfully fly, but the 3F has proved to be an excellent performer on the slope, despite the use of drag spoilers on the wing tips to make up for the loss of a rudder, saying much for Gordon's design skills all that time ago.

To date, no one had seen one of these aerotowed, so it was with considerable interest that we saw Andy prepare so to do. On a similar principle to the V1 of WWII fame, he had made up a collapsible ramp from which to launch the model. This it did successfully, time after time, and the Horten proved to be an excellent soaring machine, with quite a few duration flights to its credit. (A closer examination of my burst-shooting photography later showed that the model jumped off the ramp each time and hit the ground before flying off, so maybe the ramp wasn't necessary after all).

Darren Maple's impressive nr half-scale Orlik puts some impressive strain on Pat Marsden's Greenley tug (Both models designed by John Greenfield).

It's hard to understand why anyone would want to fly a glider from water, but there have been many examples produced during aviation's history. On such is the Jacht 71, the original sporting the Lufthansa logo on the fuselage, although anything more unlike a people carrier than a water-borne single-seat glider is hard to imagine. Ian Davis has made a fine representation of the Yacht, and this was flying in a spirited fashion and the even, with the wingtip floats removed for launching from the grass. For those who might be interested, you can see historic footage of the full-size in action on the scale soaring UK website, in the vintage glider/documentation section. *(www.scalesoaring.co.uk)*

Talking of grass; much was made of the length of same, as just like last year, it was considerably longer than that to which we had been accustomed. This inevitably leads to the usual rash of take-off incidents, whereby a glider's wingtip catches in the grass and whips the model upside down before the hapless pilot can even think the words 'laundry van'. This especially applies to models with no wheel, long wings and little in the way of dihedral, thus putting the wingtips in close proximity to the ground before the tug pilot even fires up his motor. A couple of pilots had brought along a variety of wheeled take-off dollies, and generously offered their use to anyone who might need them. This offer was taken up quite enthusiastically by some, and proved to be a godsend, drastically reducing the number of take-off upsets.

Large models once again showed an increase in popularity, the line -up this time consisting of: two Orliks, one Slingsby Falcon, a Penrose Pegasus, one up-and-go DG1000 and an up-and-go ASH 25, all of which were half, or near to half scale.

Due to space restrictions, this can only be a snapshot of all that went on that

Andy Anderson preps his Horten 3F for it's maiden aerotow.

The Horten in distinctive action.

Chris Garrod's ASH 25 on a fly-by at Middle Wallop.

Line up of motorgliders at Middle Wallop event (Front to back: C-Falke, Moni, K14, T61E, K11, C-Falke).

Noel Rumers made the trip from Holland with his electric K13 with a feathering prop.

Patience required in the glider queue...!

wondrous weekend, but for those that were there, it will be a memory to cherish over the long winter months. Thanks as ever must go to event organiser John Greenfield and the members of the Ghost Squadron; Pat, Jane, Tony and Ivan, as well as Dave Pullenger for handling the booking-in and registration. We can only hope for something of a similar nature in 2014...

Projects, projects, projects...

After the successful conclusion of my K11 motorglider, it was time to look around for some further inspiration. My thoughts fell to my Bergfalke 1, a 1/4 scale two-seater, which is the first model I reach for when the prospect of flying in light conditions on the slope presents itself. The same Scheibe concern produced the Spatz series of single seat gliders, and you could describe the Spatz as a single-seat Bergfalke. Ideal, then, and if scaled up to 1:3.5, would produce a model with similar capabilities. The 'L' Spatz has been extensively modelled, but the earlier 'A' & 'B' versions much less so, therefore that's where I decided to go.

The metal tube construction of the full-size can be reasonably reproduced in wood, as very little of it is seen, and in the construction of the fuselage I came with a slightly new wheeze. The central core of the fuselage was designed to go together in a modular fashion which, once assembled, allowed the rest of the longerons to be attached to it with a good degree of accuracy. The jigging former supports were drawn in such a way as to allow the fuselage to be easily removed at any stage of the construction process, thus allowing access to areas that would only be accessible after the fuselage was permanently removed from a more conventional jig. Thanks to the benefits that accrue from being freshly retired, the Spatz rapidly came to a conclusion and was soon ready for its maiden flight. This went without undue excitement, the Spatz proving to be a very nice performer, stable and completely vice-free. Its first aerotow went smoothly too, at least to start with. Then, whilst gently performing thermal turns some distance away, she went into a vertical dive and vanished from view, shedding parts on the way down. As a salutary warning to others, the air crash investigation team (me, that is) came to the conclusion that the receiver went into failsafe for reasons that cannot be established, and because I hadn't up-dated the failsafe settings, the small amount of down elevator that was the result established the model into its dive. The model was fitted with the new wing joiner blade from Aeronaut, being flat steel blade of 15mm in depth in contrast to the Graupner 14mm types we have been using for many a year now. In a stark

Ian Davis' unusual flying boat glider the Yacht 71.

The Yacht in action.


The modular centre part of the Spatz fuselage.


The fuselage in the simple jig.


The fuselage removed to reveal the jig.

demonstration that control surface forces increase with the square of the airspeed, the bar was bent back upon itself, as well as the brass tube that housed it! This is only the third time in a long career that a new model has been lost in this way, and it was some three weeks later that the Spatz MkII, with a new fuselage and one new wing, was once again gracing the skies of Dorset. I'm glad to say she still flies as well as she did before.

That was then, and this is now, or as near now as magazine publishing schedules will allow. Once again the Williams workshop has been obscured from view by a mushroom cloud of dust. This time around it's another motorglider, a Fournier RF5b at 1/4 scale, but more of that another time...

Life imitates art

Many years ago I designed and built a model of the Slingsby type 13 Petrel, many examples of which have been built in the intervening years. I was working from the well-known Martin Simons drawing from his excellent book on Slingsby sailplanes, and I had the devil of a time working out how to build in the curve on the top of the fuselage behind the canopy. Recently, enthusiastic glider historian Vince Cockett has been updating the Petrel page in the documentation section of the Scale Soaring UK website. During this process he had obtained some of the original Slingsby drawings and noticed that the same small curved section had two lines in place, one of which was straight. (Most gliders of this type have a straight backed fuselage). This seemed to confirm that the extant drawings of the Petrel were in fact incorrect in this particular detail. Here's the good bit... When the current owner of the full-size Red Petrel went through the process of renovating his pride and joy, he went to some considerable trouble to reproduce the curve behind the canopy. When I recently built my version of the red Petrel, I too went to considerable trouble to replicate the same thing. If there was such a thing as a scale glider competition any more, one can't help but wonder what the judges would make of it all. ■


The Spatz in action before its reincarnation.


Author's version of the full-size Red Petrel, complete with curved fuselage.

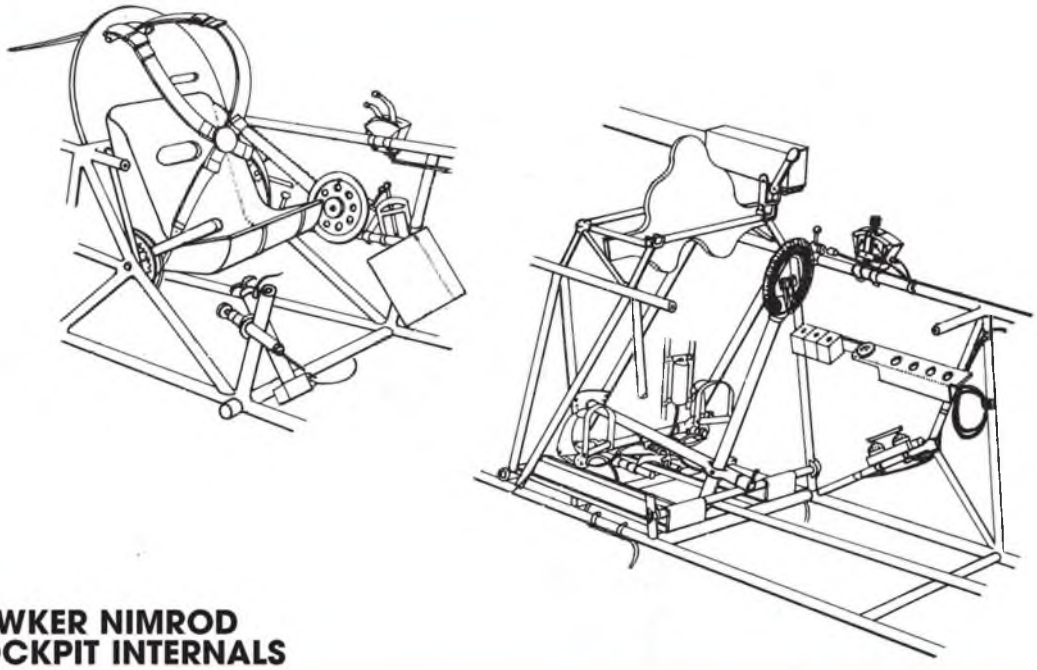

DUNLOP

NOT JUST A NAVALISED HAWKER FURY, THE NIMROD OFFERS SCALE MODELLERS SLEAK BIPLANE ELEGANCE COUPLED WITH THE COLOURFUL DECOR OF PRE-WW2 CARRIER BASED FIGHTER UNITS

HAWKER NIMROD

It is an entirely understandable first impression, that the Hawker Nimrod was simply a navalised version of the Hawker Fury (biplane), merely a Fury with some extra items added. In fact, despite the family resemblance the two machines differed in detail quite substantially and had distinctly separate origins.

In 1926 the standard fleet fighter was the Fairey Flycatcher, then in its fourth year of service, but by the time it was replaced by the Nimrod in 1932, the Flycatcher had become so obsolete in terms of its speed that RAF pilots who flew it often joked that a sprightly fly might actually give the aircraft a run for its money! (At that time, prior to the re-organisation of British naval aviation as the Fleet Air Arm, aircrew for naval aviation tasks were supplied by the



HAWKER NIMROD COCKPIT INTERNALS

Royal Air Force).

Recognition of the need for a Flycatcher replacement resulted in the drafting of Specification N.21/26, but none of the aircraft designed to this specification were selected for production after trials in 1928, but the radial engined Hawker Hoopoe, not actually designed to N.21/26, was considered promising enough to be further developed.

In common with the US Navy, the Royal Navy at that time had a traditional preference for radial engines, but Hawker's designer Sydney Camm was convinced by his experience with the landplane Hawker Fury that the future for shipborne aircraft also lay with inline engines and he began such a design, powered by a Rolls-Royce Kestrel. Before it was completed, Air Ministry specification 16/30 was written around it, first flown under the initial name 'Norn' early in 1930, received a production contract and was renamed Nimrod.

The Nimrod was structurally similar to the Fury with the typically straight wings and considerable stagger, giving the pilot a good field of vision. The forward part of the fuselage was metal covered whilst the remainder and the flying surfaces were

Rear view of TFC's Nimod Mk.1 provides fuselage panel detailing and tailcone hinges.

The Fighter Collection's Nimrod Mk.1 hammers past the crowd line at Duxford. Colourful finish has definite 'Subjevts for Scale' appeal!

fabric covered. Marine gear included flotation bags in the rear fuselage and flotation boxes in the upper wing panels. The power unit was the excellent Rolls-Royce F-XI MS engine, later better known as the Kestrel II MS, delivering 477 hp.

The prototype H.N. 1 was shipped out to Buenos Aires in March 1931 in HMS Eagle to take part in a British Empire Trade Exhibition and was flown there at the El Palomar display by Flying Officer C. P. Barker. On return to the U.K. and a period of Service Evaluation, a production order for a total of thirty-five machines was placed with the Hawker Company.

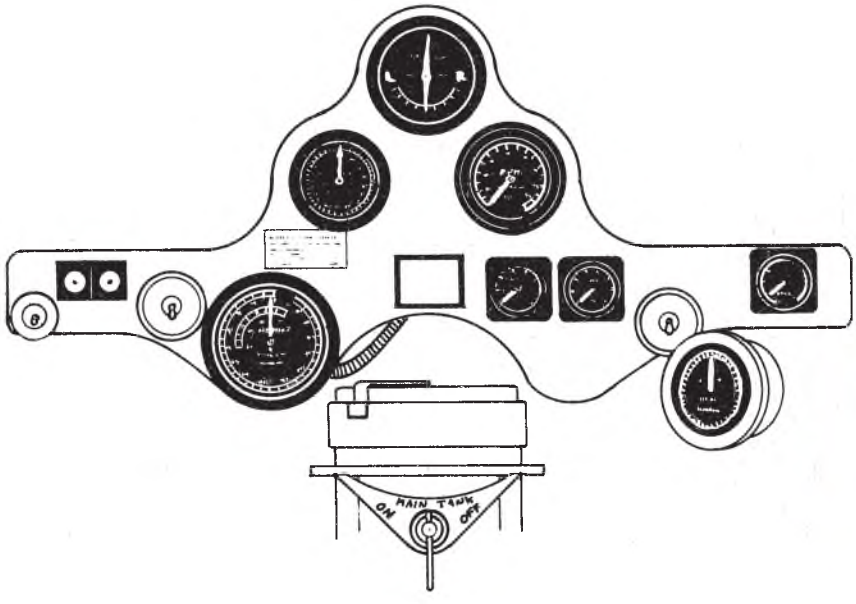
The first production Nimrod, S 1577, (H.N.I. after modification to 16/30 standard) was flown on 14th October 1931 and aircraft serial S1578 followed on 31st. These two machines were then shipped out to Japan for demonstration flights, returning in early 1932, by which time the initial production batch of Nimrods had been completed.

Airframe S1577 was delivered to the RAF Martlesham Heath, Suffolk test centre, for performance and handling trials, whilst S1578 was fitted with floats for water handling tests. Deck landing tests were carried out on HMS Eagle in April 1932 and Service clearance was achieved in June with the result that the Nimrods began to replace the aged Flycatchers.

Prior to the re-organisation of the Fleet Air Arm in 1933, the fighter units were arranged in Flights. The first Nimrods were delivered to No. 408 Flight aboard HMS Glorious and shortly afterwards, No. 402 Flight on board HMS Eagle received the new machines, replacing their Flycatchers. In September 1932, a new Flight was formed, No. 409 with Nimrods, and these embarked on HMS Glorius.

In 1933 the various Flights were emerged to form four new squadrons, nos. 800, 801,802, and 803, each Squadron consisting of a mixture of Nimrods and Hawker Ospreys (which bore the same relation to the RAF Hawker Hart bomber as the Nimrod bore to the Fury). NO. 800 Squadron, formed from Nos. 402 and 404 Flights, consisted of nine Nimrods and three Ospreys; No. 801 Squadron, formed from a re-equipped No. 401 Flight consisted of six Nimrods and three Ospreys; No. 802 Squadron was formed from Nos. 408 and 409 Flights had the full twelve machines whilst No. 803 was an Osprey-equipped squadron with only one Nimrod attached at one time. Other Nimrods were allocated to training units and some were used for various experiments with catapults and deck landing arrangements.

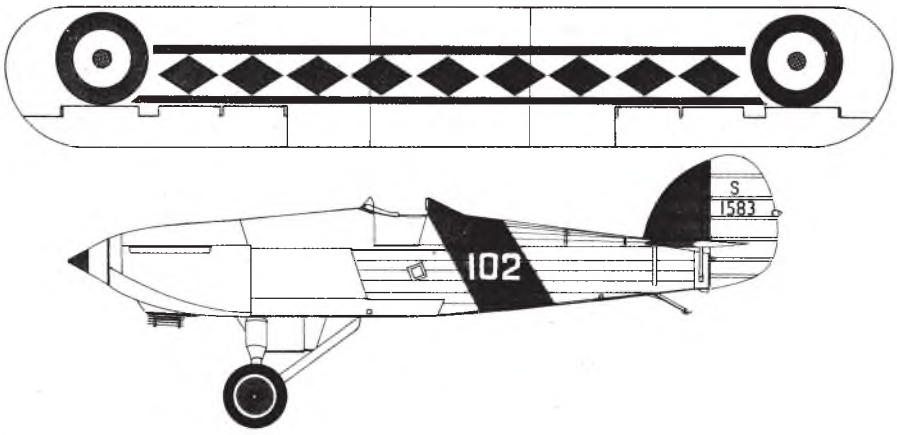
The Nimrod was developed as tests continued and additions included the pilot's headrest (necessary for catapult launching) a modified sling on the upper wing and arrester gear and hook, the latter being fitted as a production feature from K 2823 onwards. Like most naval aircraft of the period, the Nimrod was supposed to be able to be employed for more than one purpose. Whilst it was basically a fleet fighter it had provision for bombs to be carried under the lower starboard wing and dive bombing

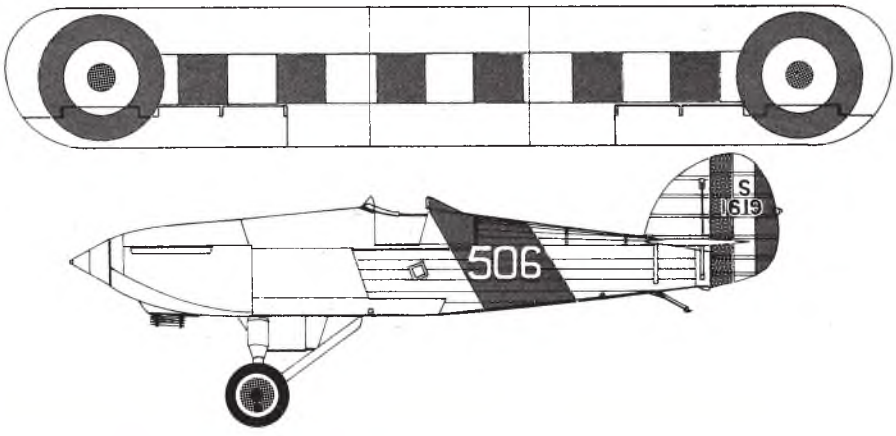


NIMROD INSTRUMENT PANEL

A sight not seen since 1942, when the last Hawker Nimrods were struck off charge (and probably a few years earlier than that) - two examples in close formation, the Historic Aircraft Collection's (HAC) Nimrod Mk.II and The Fighter Collection's (TFC) Mk.1. seen in action at the Flying Legends Air Show, Duxford.

SOME NIMROD COLOURS





ABOVE:
Nimrod Mk.1, Flight Leader's aircraft of No.800 Squadron, Fleet Air Arm circa 1935. Overal base finish is silver dope. Upper wing decoration, mid-fuselage sash, fin and tailplane are all mid-blue. Individual aircraft numeral imposed on fuselage sash is white. Wheel discs and propeller spinner are dark blue.

LEFT:
Another No.800 Squadron Nimrod as embarked on HMS Courageous in 1934. Upper wing chequers are white and blue, fuselage sash in mid blue, with white numeral imposed. Wheels disc are red. Overal base finish is silver dope

frequently featured in Squadron exercises.

The Hawker Company retained K 2823 and fitted it with swept-back wings. This machine, known as the Nimrod (Intermediate) paved the way for the Nimrod II, production of which began in September 1933.

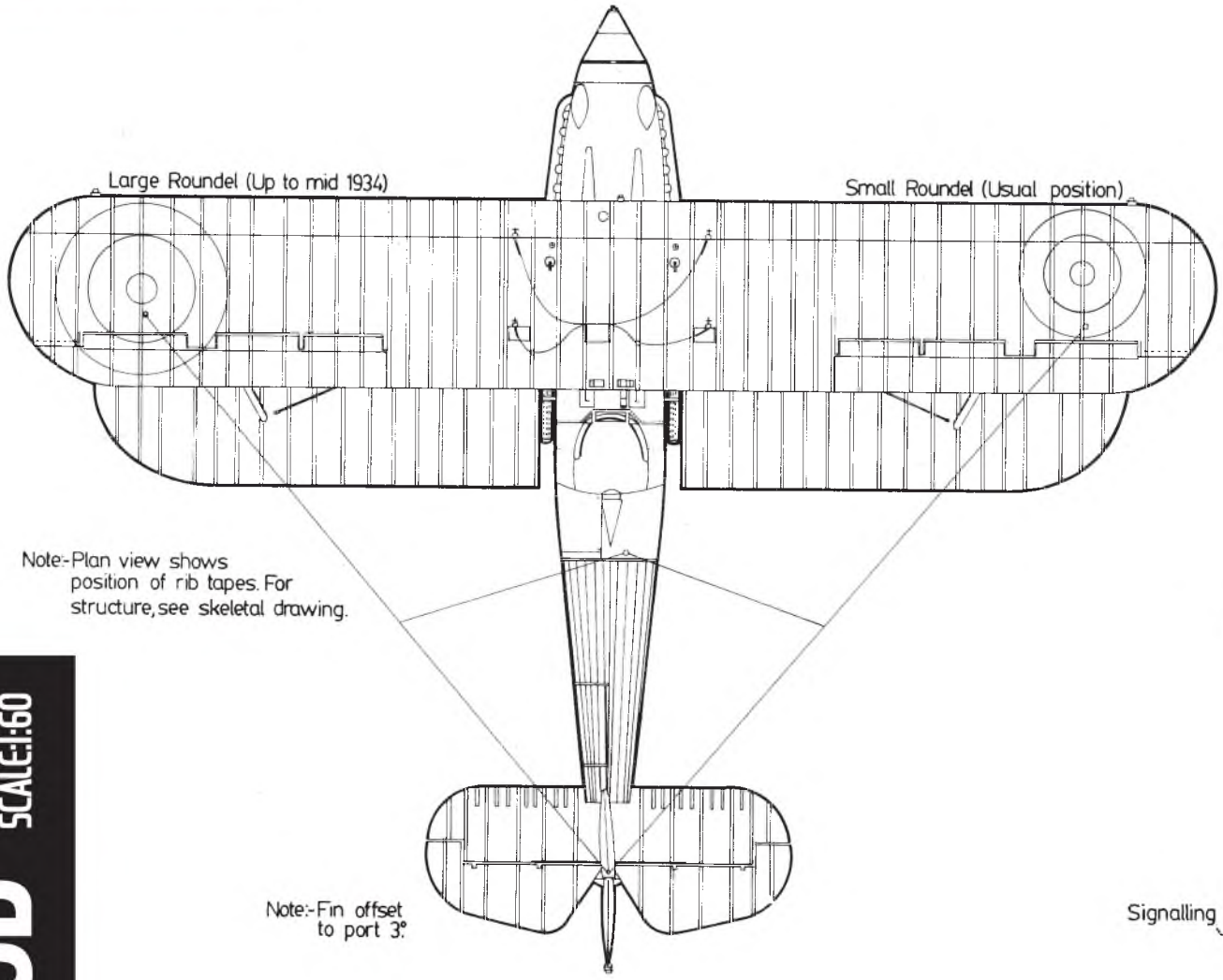
Apart from being a most handsome aircraft, the Nimrod was one of the most colourful in service and provided most valuable training for the Naval Air Service, which was to make such a memorable contribution to the war at sea. The last of the Mark I Nimrods phased out in early 1939, the last ones to serve being with No. 802 Squadron on HMS Glorious which were replaced by Sea Gladiators.

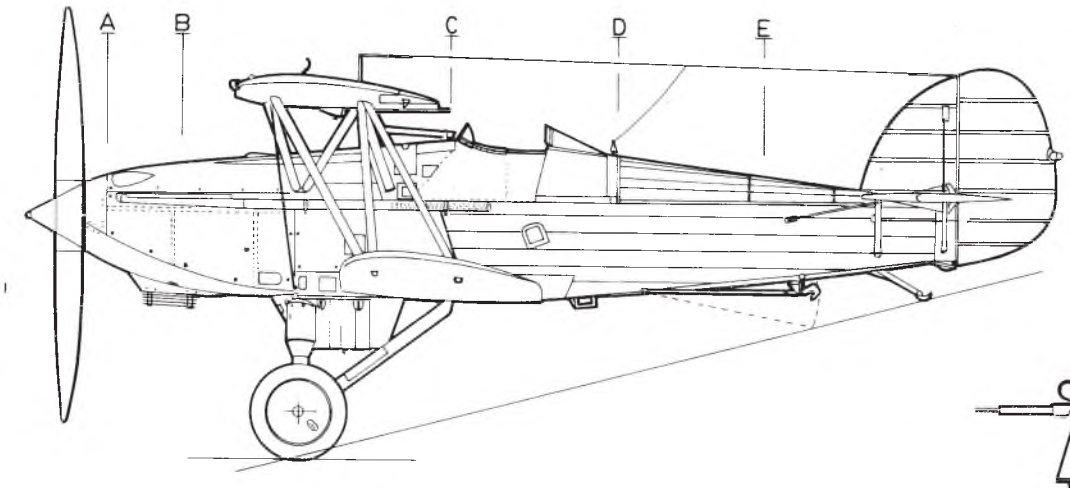
The Nimrod along with the Osprey was officiallv declared obsolete in July 1941, those being left were either consigned to scrap status or used as ground airframes for training. ■

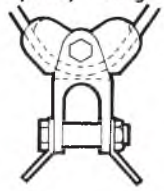
SCALE DRAWING

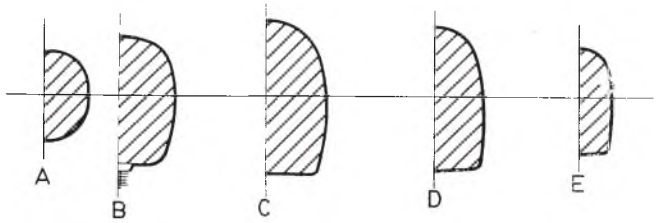
HAWKER NIMROD

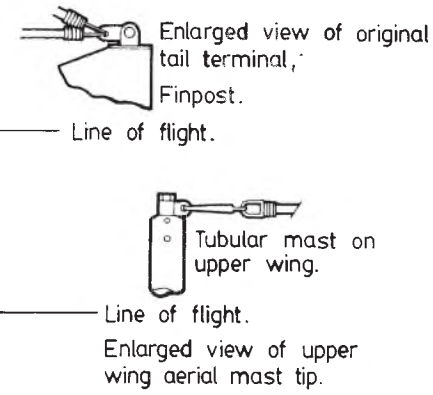
SCALE:1:60

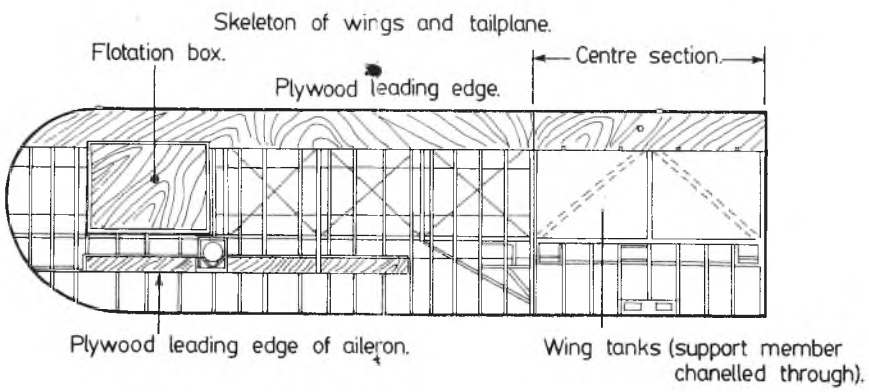


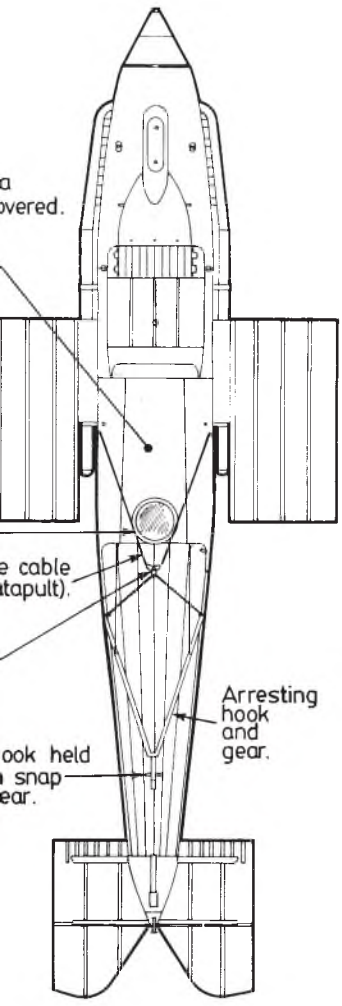


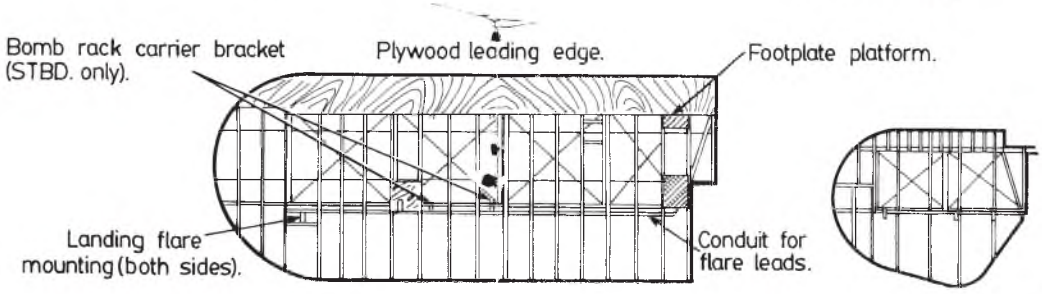


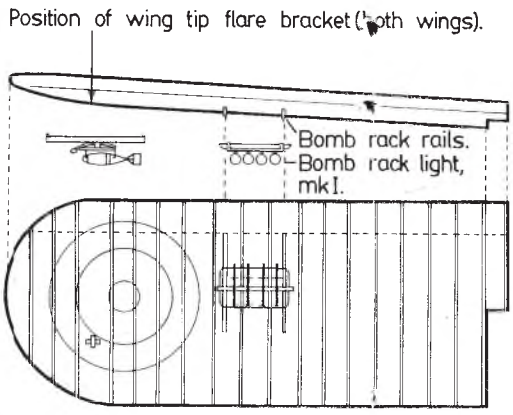




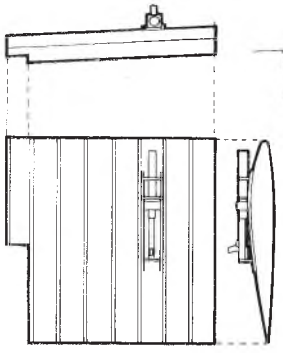




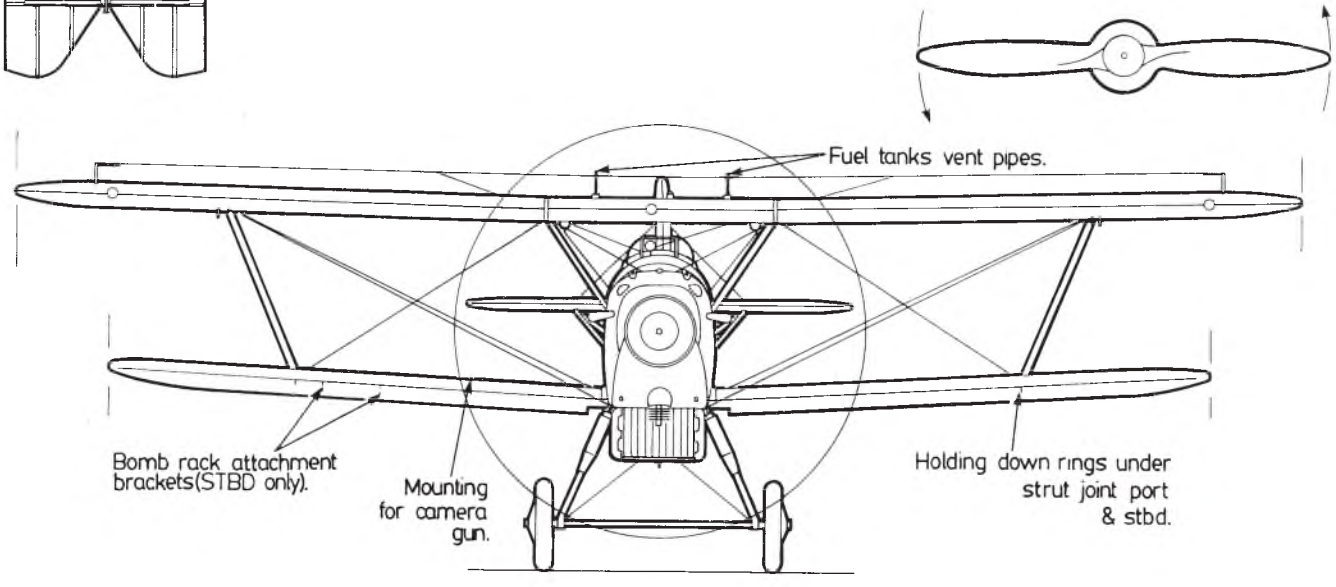




Bombs:-White, red band around nose two blue bands around body.
Starboard lower wing undersurface.

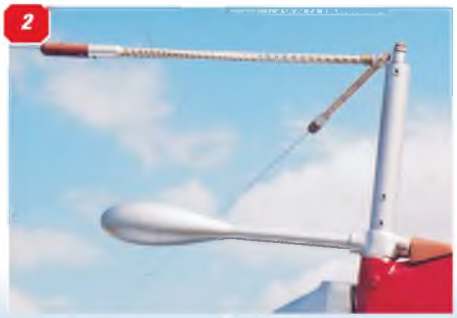


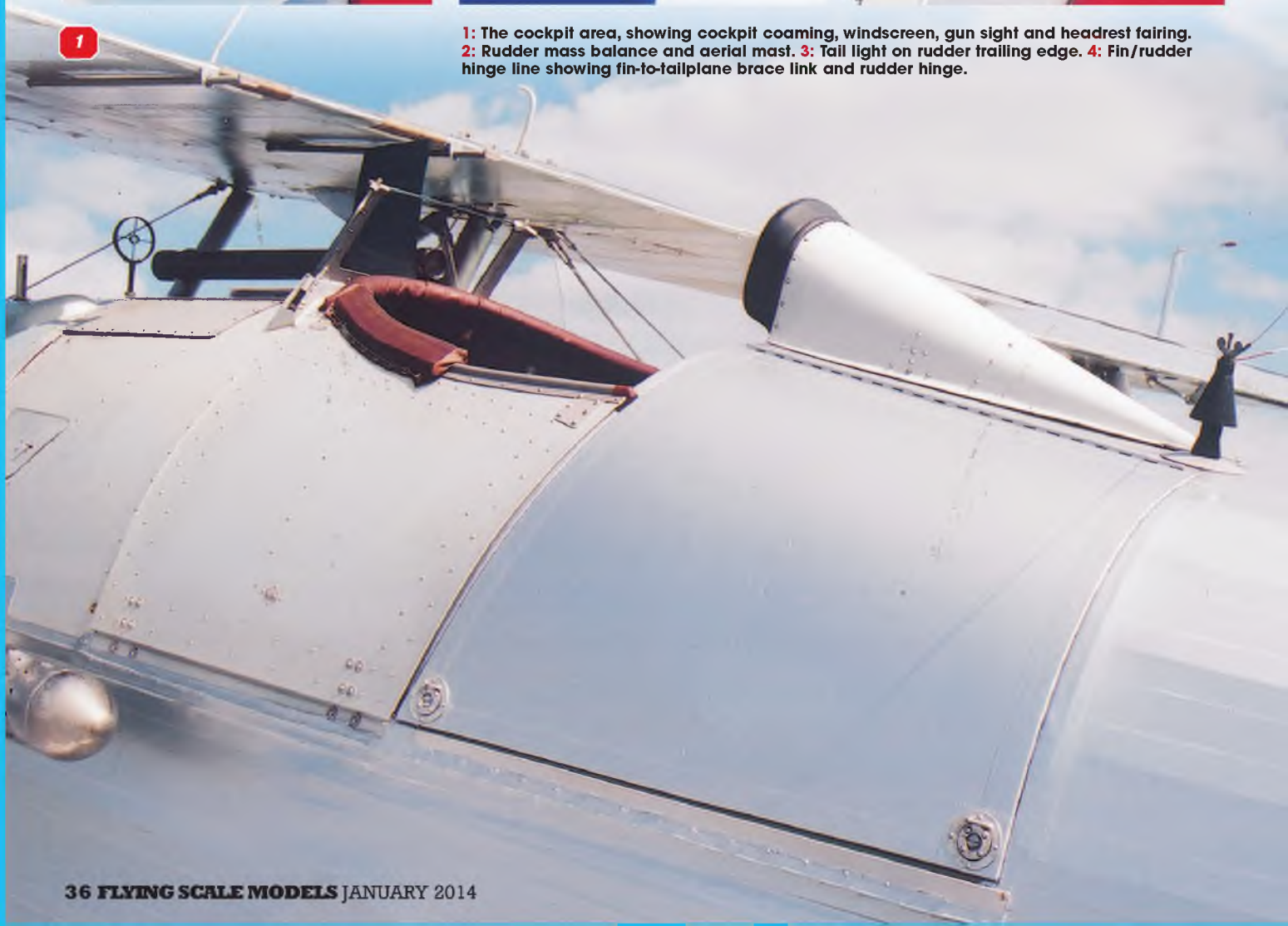
Inner section starboard lower wing- upper surface.



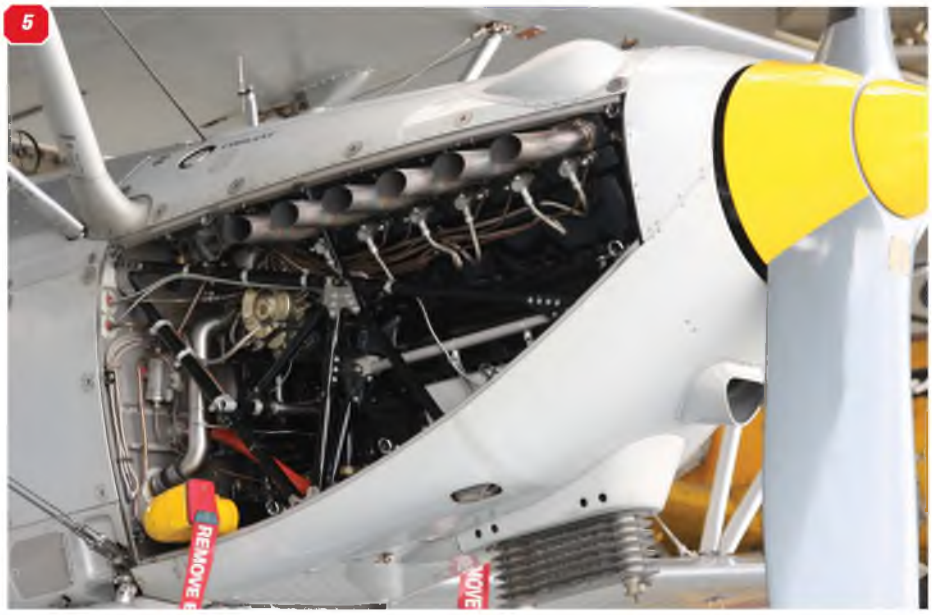
HAWKER NIMROD

CLOSE-UP SURFACE DETAIL IS WHAT MAKES A MODEL SPECIAL





1: The cockpit area, showing cockpit coaming, windscreen, gun sight and headrest fairing. **2:** Rudder mass balance and aerial mast. **3:** Tail light on rudder trailing edge. **4:** Fin/rudder hinge line showing fin-to-tailplane brace link and rudder hinge.



5: Engine cowl side panel removed to reveal Rolls Royce Kestrel engine. 6: The proverbial 'full-frontal', showing the nose profile, radiator, oil cooler. 7: Further view of the underside radiator and the undercarriage leg oleo. 8: Another view of the spinner and small air scoop. 9: Propeller spinner close-up showing the link for an external starter.

10: Detail of the oil cooler mounted on the engine colw underside. 11: Exhaust stack along the fuselage side, and cabane struts. 12: Another view along the upper fuselage from rear to front, showing surface panel detail around the cockpit. 13: The arrestor hook. 14: Rear fuselage, showing the tailskid and tailplane bracing struts.

15: Another view of the cabane strut arrangement. Note the cuffs on the front strut. **16 & 17:** Front and rear interplane struts on the right hand wing showing anchor points on upper wing underside and pitot head. **18 & 19:** Two views of the interplane strut anchor points on the upper surface of the lower wing. **20:** Further view of the interplane strut anchor points. **21:** the complete cabane strut arrangement. **22 - 24:** The study main undercarriage, designed to absorb the rigors of carrier deck operations. **25:** Inner face of the main undercarraige wheel and axle.

26: Unlike the right-hand side cabane struts, the left hand side struts have no cuff fairings. **27:** Wing leading edge light close to the wing tip on top wing. **28:** Cockpit mounting stirrup, left fuselage side behind wing trailing edge. **29 & 30:** Details of lower wing root. **31:** Tailplane/elevator, showing hinge line, hinge and control horn.

To STOL... or not to STALL!

PZL 104 WILGA C

Gary Protheroe's 84" (2134mm) span creation for .90 -1.20 size four-stroke engines

Are you looking for a scale model with few or no vices, lovely aerodynamic shape and elegant? Well, this one will probably get your fellow club colleagues asking why did you spend so much effort building such an ugly aeroplane!

Yes, to some the radial engined PZL Wilga 35 is not aesthetically the cleanest-looking aircraft, but it was designed for specific purposes and fulfils it in every respect. However, I am talking about the Wilga 104C, which was the prototype, the full-size having a nice aerodynamic oval cowl with a flat-six

If you like slow-flying models that handle in a true scale fashion, then this Wilga C is the answer. Model is viceless and a joy to fly.

engine installed.

If you build this model at 84" span with flaps and fixed stall slots and keep the weight under 11.5 lbs. then you will find it almost impossible to tip stall or fall prey to any other violent manoeuvre. Being a poor pilot, I can vouch for its friendliness as a 'flying scale model'. The only scary situation I encountered was with a dead engine and I forgot that I had flaps deployed. I lined up for the approach and descent, but at the bottom of the flare path it didn't flare! I have analysed it (like you do) and came up with four possible reasons: dead engine and no prop-draft over the tailplane; deployed flaps causing masking of the tailplane; insufficient elevator throw (now increased), and *"...the ground was too high!"*. However, there was not much damage - only a little to the undercarriage.

Since that event, having increased the elevator throw,I have refrained from tempting fate with a further dead-stick landing. (Perhaps I should explain that the reason for the engine failure was my problem and not the engine's).

Some commercial model Wilgas have,

The basic fuselage structure, with the rear fuselage skinned.

Fuselage nose section, showing the ply side plates, formers and engine bearers for sidewinder mounted engine.

A lot of wing ribs there, but at lease they're all one size on this constant chord wing!

Here the fuselage is fully skinned and the instrument panel is in place. Important to add such detail in such a fully visible cockpit.

The basic airframe complete, with undercarriage in place.

Trailing edge flaps and leading edge slats are very much a part of the character of this aircraft.

A model this size and with such a prominent 'glasshouse' of a cockpit demands a decent model pilot.

The mounting stirrups, for left and right side cockpit access are a prominent detail that should be replicated.

Cockpit close-up showing the rear bench seat.

Distinctive Wilga rivet detail seen here on wing underside. PVA glue and talc delivered via hypodermic needle was the technique used.

The 'knee-bend' undercarriage of the prototpe model uses J.Perkins oleo units.

Wing tip, showing dummy light and strengthener flutes.

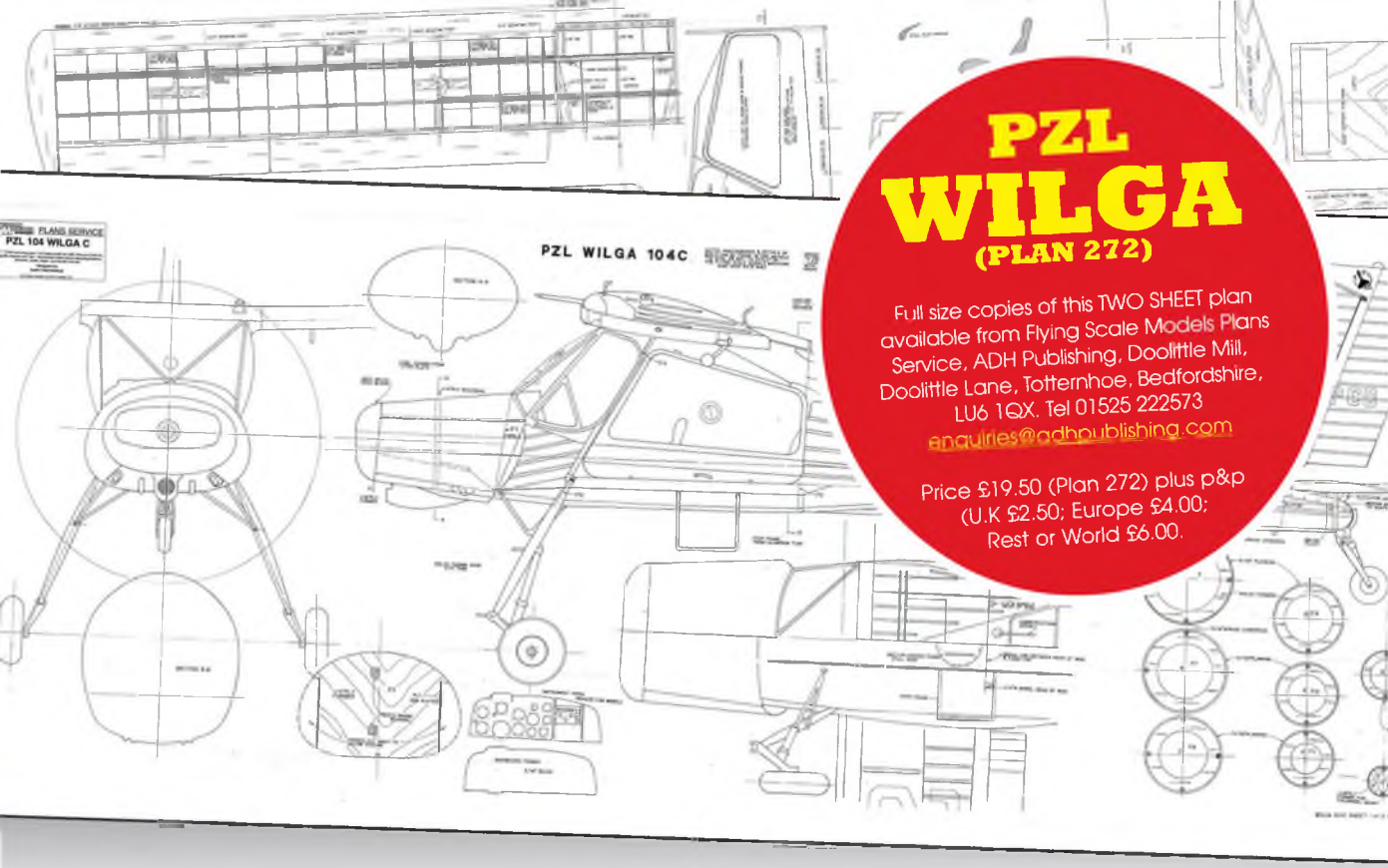
I believe, wrongly omitted from the wing both the full-length stall slot and the Omega Gates. These features are a fundamental contribution to its excellent flying characteristics. Although these items take time to make and fit, they will reward you when the finished model is flying. In a steady breeze this Wilga with flaps deployed is capable of flying at walking pace and looks so realistic in the air.

Construction - wing

The wing is a one-piece unit of a standard build, all the ribs being of the same profile. It is quick and easy to cut them and sand to shape against an aluminium template. Spruce spars are used top and bottom. This being a one-piece wing, it is advisable that all splices should be arranged to the outer part of the wing where the loads are reduced. Thin ply webs join the spars to create a strong box section. The centre section has 1/16" ply web plates to give strength and provide a mounting point to attach to the top of the fuselage.

The whole wing is 1/16" balsa sheeted with tissue/dope covering. The flaps and ailerons were constructed on 1/16" balsa sheet with leading edge balsa half ribs both sides and then 1/16" balsa sheeted. The hinges on this model were cut from phenolic board, but standard hinges could be used. The stall slats are full-span, constructed using trailing edge standard stock and strip balsa sanded to the aerofoil section. The stall slot is part of the rib aerofoil section with a wider gap at the bottom entry tapering to the top exit in order to accelerate the air over the top surface of the wing. The stall slats on this model were attached with aluminium formers, but simple ply attachments could be used. The Omega Gates and the laminar corrugations were made out of strips of balsa cut to shape and size, sanded, and glued on.

Rivet detail is fairly straightforward. I drew the rivet lines with a marker pen then with PVA glue slightly stiffened with talc in a hypodermic (prior tested for shrinkage when dry), I piped the rivets at equal appropriate spacing. I can assure you this procedure is extremely quick and simple.



PZL WILGA (PLAN 272)

Full size copies of this TWO SHEET plan available from Flying Scale Models Plans Service, ADH Publishing, Doolittle Mill, Doolittle Lane, Totternhoe, Bedfordshire, LU6 1QX. Tel 01525 222573 enquiries@adhpublishing.com

Price £19.50 (Plan 272) plus p&p (U.K £2.50; Europe £4.00; Rest or World £6.00.

Fin and tailplane

The fin and tailplane are a similar structure to the flap and ailerons, i.e. centre 1/16" balsa plate with half ribs either side of the fin with leading edge and sternposts. The tailplane is of similar construction with a thin spruce spar. These surfaces are covered as per the wing with 1/16" balsa sheet, tissue and doped then rivet detail applied.

Fuselage

The fuselage is of a monocoque construction. There are only a small number of formers linked with spruce stringers with the rear cone shape of the fuselage covered in balsa. The cabin aluminium tube is part of the structure strength and should therefore be bolted to the formers. The top of the cabin is a ply plate to support the one-piece wing and provide the two bolt securing. The rear of the wing slides back on the ply plate and is secured into a rear ply plate with dowel pegs.

The cabin area is skinned with thin ply and 1/16" balsa covering. You can either simulate by outline painting the side access doors, or cut them out and hinge them as per this model. The fuselage corrugations are made out of balsa strips sanded to shape and glued on. The cabin and doors are glazed with celluloid.

The advantages of the 104C over the Wilga 35 is that the nose is so much longer for housing the engine and fuel tank, and obviously getting the C of G in the right place. The cowl was constructed from lithoplate, drilled and screwed on.

I constructed cardboard templates prior to

Stearable tailwheel unit.

Fuselage underside detail.

Rear of the engine cowl showing air exit.

View of the cockpit rear screen. Note the X-shape braces.

Detail of the rear fuselage, showing the dummy surface strengthener strakes that must be applied to capture the character of the aircraft.

A futher good view of wing surface detail.

Detail showing the replication of the stiffener flutes pressed into the skin of the rudder, fin, tailplane and elevator. The 'snake' push rod to the rudder is actually quite accurate to full size, but really needs a lick of paint to replicate the metal of the full size machine.

cutting the lithoplate. The nose is made of carved soft balsa on a ply backing. The undercarriage is made of steel wire and steel tube, silver soldered together with a simple small oleo from *J.Perkins Dist.*

Flying

I have previously mentioned that the Wilga is a joy to fly. I am by nature an apprehensive flyer, but I do enjoy flying the Wilga 104C. I am sure that if you embark on this project and you like slow, scale flying, then this is the model for you! The Laser 90 performs well in this model and, as the Wilga is slow-flying, I am using an SPC 16 x 4 propeller. The Laser enjoys the fly-wheel effect of the 16" diameter and responds qyuckly with the fine 4" pitch. ■

Engine cowl underside showing dummy air intake fairing

Engine cowl close-up, showing neat Laser 90 four-stroke installation.

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PZL Wilga

Looking something like a giant bumble bee, the PZL Wilga has been a useful little aerial workhorse for more that 50 years and has found a particular niche for aerotow work

This unique high-wing general purpose monoplane was designed by R. Orlowski, B. Zurakowski and A. Frydrychewicz, and manufactured by Panstwowe Zaklady Lotnicza (Polish National Aircraft Factory) in Warsaw. It evolved from the experimental PZL-104 Wilga 1, which first flew on April 24, 1962 and a modified Wilga 2, powered by the Polish engine WN6RB2 of 185 h.p., and was supplied to Polish aero-clubs. The Wilga 2 first flew on August 1, 1963 and the subsequent Wilga C on November 30, 1963. The Wilga C was basically similar to earlier models, but was powered by the 225 h.p. Continental 0-470-13A engine with an all metal McCauley 2A34C-50-90A2 propeller.

Further versions included the Wilga CS ambulance, CA glider tug, CR agricultural aircraft, and CP general purpose four-seater.

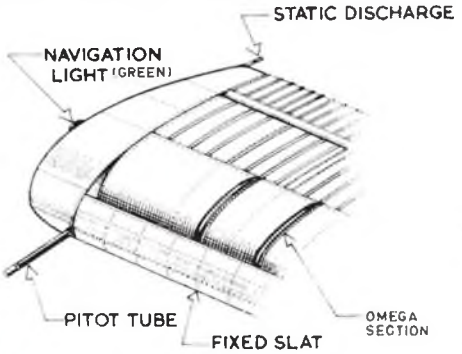
The aircraft is of all metal semi-monocoque construction and the cabin design is readily convertible for the cargo or ambulance roles. The wing is mounted high on the top of the fuselage which permits the latter to be close to the ground with consequent easy loading for passengers and freight. Wing is of single spar structure utilising NACA 2415 section. One of the unusual features of the Wilga C is the wing construction. In place of the usual complicated structure of spars and ribs, Wilga C has a stressed skin of corrugated Duralumin over five basic ribs. The wing is fitted with slotted flaps which are manually operated and has full-span fixed slats to provide good control at low speed. Ailerons and flaps are all constructed with a corrugated skin. The tail unit is of similar construction to the wing and has a symmetrical NACA 0012 M section. The fuselage is of semi-monocoque structure in stressed skin Dural.

Wilga C has a fixed undercarriage, with two semi-cantilever struts. All three undercarriage shock absorbers are of the air-oil type.

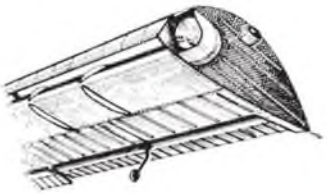
Wilga 32 & 35

Success of the Wilga C led to development of the 'Wilga 32' and 'Wilga 35'. In December 1965 the 'Wilga 3' was flown for the first time, being basically similar to the earlier '2' model, but powered by the 260 h.p. A1-14R Russian radial engine, built under licence in Poland. The first example of the 'Wilga- 35' aircraft had its maiden flight on 29th June, 1967. This aircraft was developed from the 'Wilga-3', but featured a widened undercarriage with streamlined fairing on the struts.

TIP OF THE RIGHT WING

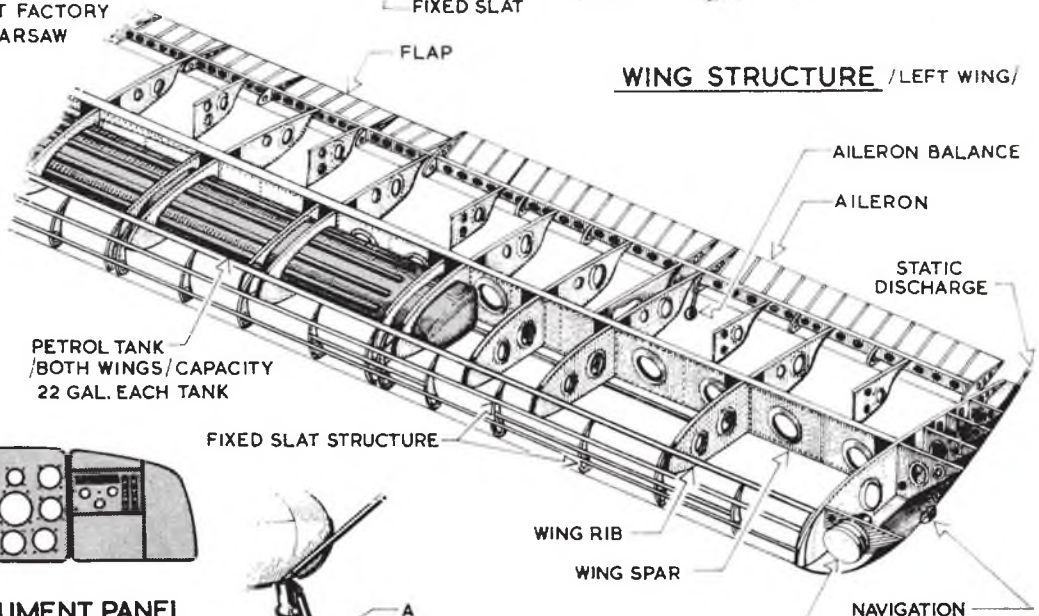


LEFT WING WITH LANDING AND POSITION LIGHT



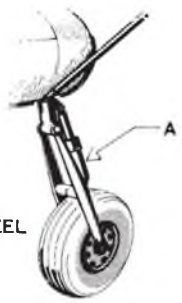
FACTORY MARKING /BLACK/
POLISH NATIONAL
AIRCRAFT FACTORY
IN WARSAW

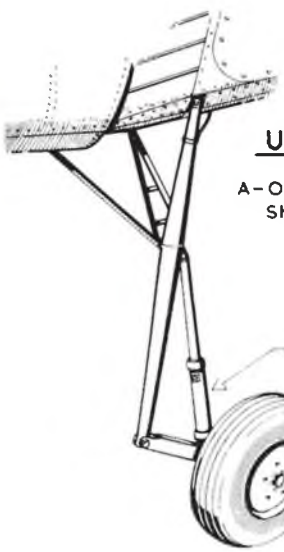
WING STRUCTURE /LEFT WING/



INSTRUMENT PANEL

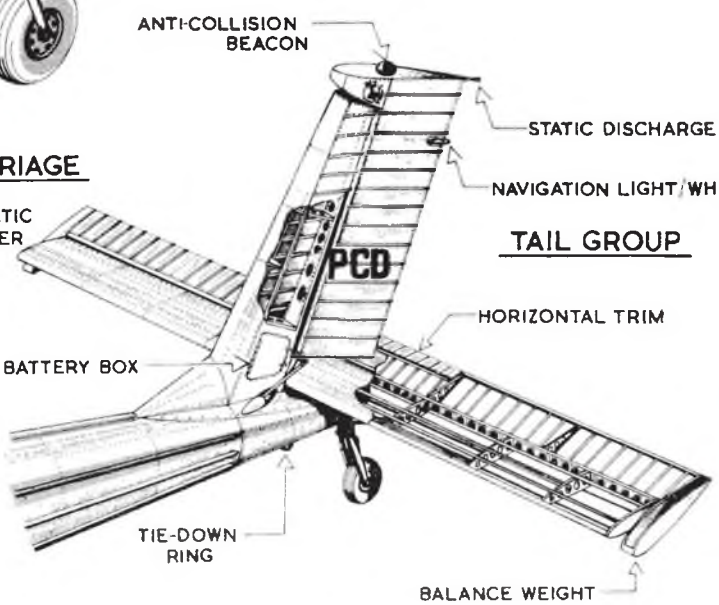
DARK GREEN





UNDERCARRIAGE

A – OLEO-PNEUMATIC SHOCK ABSORBER



TAIL GROUP

PZL-104 "WILGA-C"

DRAWN BY F. PAWLOWICZ

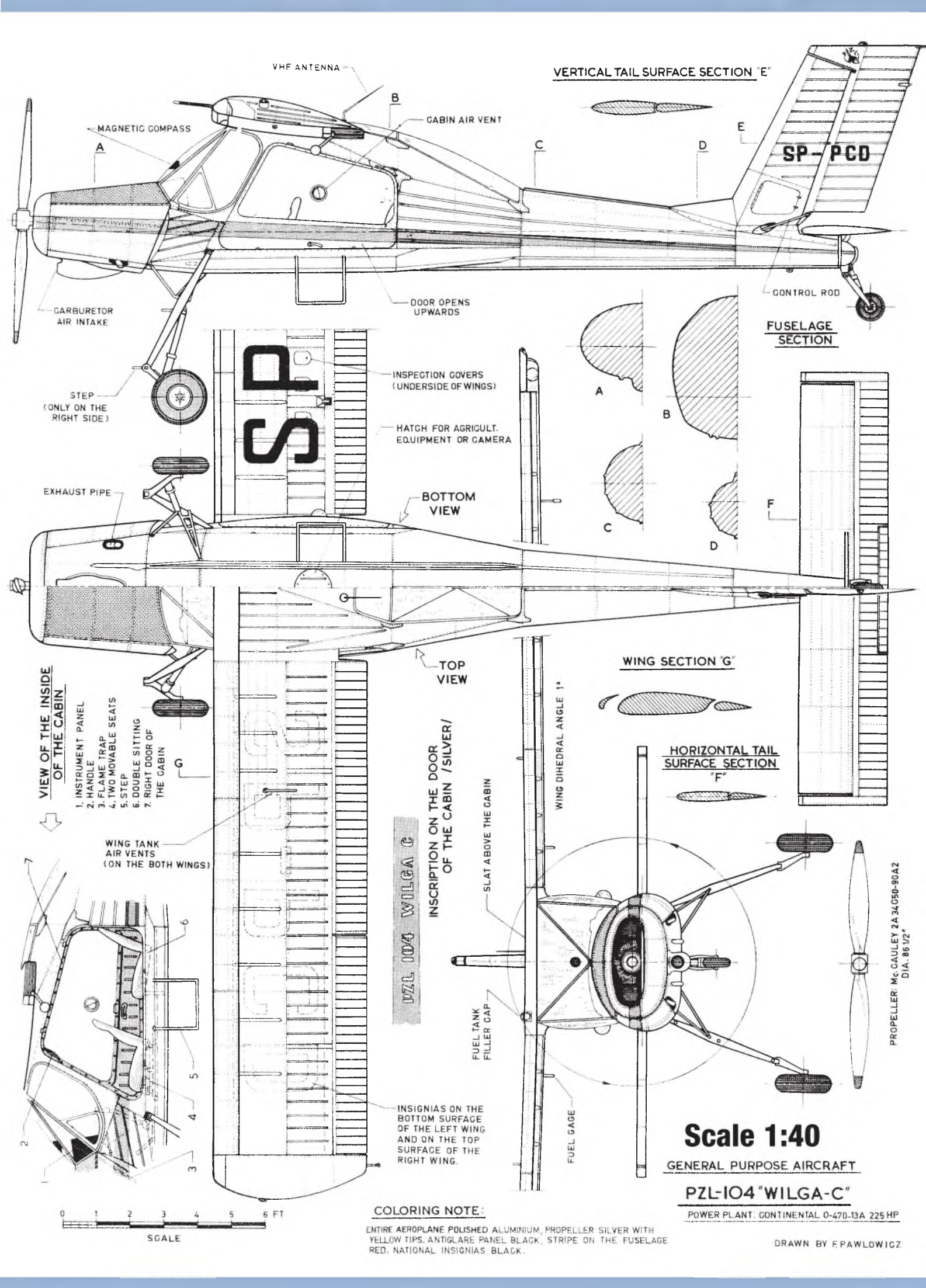
A PZL 104 Wilga C with Continental 225 hp 0-470-13A four cylinder horizontally opposed engine. The nose is longer than the later radial engined version which is more widely known.

An export version known as 'Wilga-32' was powered by a Continental 0-470L engine developing a maximum of 230 h.p., and is fitted with a McCauley constant speed propeller. Due to the smaller diameter of this propeller, a much shorter undercarriage was made feasible and this version began flight testing on the 27th September, 1967. Subsequently, over the years, many examples of the radial engined Wilga 35 have found their way to countries outside the country of origin and the radial engined machine is now much more prevalent than the Contenental engined version, to the extent that it tends to be regarded as the definitive version of the Wilga.

The fixed leading edge slot extending over the full span, including the cabin area combines with the large, hand operated (seven position) flaps to provide excellent control at low speeds - enabling the aircraft to fly at as little as 40 m.p.h. Both the flaps and the Frieze type ailerons are constructed with an externally fluted skin. The four fuel tanks are housed within the wing torsion box, being filled via two separate filler caps, either side of the centre-section.

The rear fuselage has a semi-monocoque type of structure, whilst the cabin section features a combination of girder construction with bracing tubes and stressed skin. In the interests of comfort the 'Wilga 3' bench rear seat has been replaced by two separate ones, situated further rearward, and the front seats are mounted on rails to provide fore and aft adjustment similar to any modern

Two views showing the undercarriage of the Wilga 35. This arrangement permits operation from rough field sites.



Scale 1:40

GENERAL PURPOSE AIRCRAFT

PZL-104 "WILGA-C"

POWER PLANT: CONTINENTAL O-470-13A 225 HP

COLORING NOTE:

ENTIRE AEROPLANE POLISHED ALUMINIUM, PROPELLER SILVER WITH YELLOW TIPS, ANTIGLARE PANEL BLACK, STRIPE ON THE FUSELAGE RED, NATIONAL INSIGNIAS BLACK.

DRAWN BY F.PAWLOWICZ

ABOVE: Wilga C tailcone showing the rivet lining and the fluted skin on the elevator.

LEFT: Side window removed here, reveals the seating arrangement and some of the cockit internals. Big windows provide excellent external vision.

car. The rear seats are removable to provide greater carrying capacity if required.

The distinctive undercarriage legs with knee-action oleo-pneumatic shock absorbers, have remained a feature throughout the development of the Wilga line. Wheel brakes are operated via toe-pedals on the rudder bar. A steerable tailwheel, also fitted with a towing hook, is mounted on a long, steel leaf spring.

The tailplane of the both '32' and '35' differs from earlier versions, with an inverted fixed slot mounted on the leading edge of the elevator balance areas.

Due to their high rate of climb when towing and their economy of operation, both the 'Wilga 35' and '32' have been popular with gliding clubs, being first adopted by the Polish Aeroclub back in 1968 and since then, the Wilga has been recognised as a particularly useful aircraft for aerotowing work.

As a flying scale project, the Wilga has also found favour as an aerotow machine, adding a nice additional 'Scale' touch at R/C scale aerotow meetings. It presents difficulties in representing the various corrugated surfaces and the wing mounting, but its proportions, especially the long legged undercarriage make it ideal for rubber power, while for free-flight power scale it allows inclusion of detail which would make it a perfect contest subject. ■

Two views of a Wilga 35, showing the pressed metal strengtheners on the rear fuselage. Note also the kicking plate on the right hand side boaring step. The tailwheel extends far further rearward than on the Wilga C.

PZL-104

Wilga-35 & Wilga-32

POLISH GENERAL PURPOSE AIRCRAFTS WITH STOL PERFORMANCE. WILGA-35 VERSION POWERED BY RUSSIAN 260 HP AI-14 R NINE-CYLINDER RADIAL AIRCOOLED ENGINE, BUILT UNDER LICENCE IN POLAND.

WILGA-32 VERSION FITTED WITH 225 HP CONTINENTAL O-470L SIX-CYLINDER ENGINE.

ON MAY 8 1964 ETABLISHED POLISH NATIONAL HEIGHT RECORD FOR ITS CLASS OF 22,488 FT.

THE WILGA-35A (AEROCLUB VERSION) SHOWN IN A DRAWING MADE ITS FIRST FLIGHT ON 29 JUNE 1967. THE WILGA-32 WITH THE CONTINENTAL ENGINE AND WITH LOWERED UNDERCARRIAGE HAS BEEN FLIGHT TEST ON 27 SEPTEMBER 1967. IN JUNE 1968 WILGA-35 AIRCRAFTS WERE USED FOR SAILPLANES TOWING AT GLIDING WORLD COMPETITION IN POLAND.

WILGA-32

CONSTANT SPEED PROPELLER MC. CAULEY 2A34C50 90A2 86 1/2" DIA.

BLACK

SHUTTER FOR AIR COOLING OUTLET

INSIDE OF THE CABIN

PROPELLER PITCH CONTROL LEVER (L.H. SIDE)

OPERATING FLAP LEVER

HANDLE

BAGGAGE COMPTMENT BEHIND REAR SEATS

THROTTLE LEVER (L.H. SIDE)

MAGNETIC COMPASS

INSTRUMENT PANEL

CONTROL COLUMN

TWO FRONT SEATS RUN ON RAILS AND ADJUSTABLE OVER A RANGE OF 7 1/4 IN

REMOVABLE REAR SEATS

DOOR ON THE R.H. SIDE

NAVIGATION LIGHT

SP-EAE

RED

BLACK

LAMINATED WOOD BLADE

PITOT STATIC TUBE

AI-14R

PZL-104 WILGA-35

DOORS ON BOTH SIDES OPEN UPWARD

RED, SILVER LETTERING ON THE STRIP

LAMINATED STEEL SPRING

STEERABLE TAILWHEEL

TOWING HOOK

FUSELAGE SECTION

OIL COOLER

HYDRAULIC SHOCK ABSORBER

SCREENED CARBURATOR AIR SCOOP

SECTION P

SECTION O-O

M-M

SECTIONS:

N-N

SPECIFICATION:	WILGA-35	WILGA-32
SPAN	36 FT 6 IN	36 FT 6 IN
LENGTH	26 FT 2 1/4 IN	25 FT 9 IN
HEIGHT	9 FT 6 1/2 IN	8 FT 5 IN
WING AREA	186·84 SQ. FT	186·84 SQ. FT
WEIGHT EMPTY	1818·81 LB	1531 LB
WEIGHT LOADED	2711·68 LB	2712 LB
MAX. SPEED	125 MPH	127·38 MPH
CRUISING SPEED	107·5 MPH	93·21 MPH
SERVICE CEILING	20500 FT	15 500 FT
RANGE	422·5 MILES	377 MILES
MIN. SPEED	40·38 MPH	40 MPH
TAKE OFF TO CLEAR 50 FT	770 FT	621 FT
LANDING OVER 50 FT	1072 FT	780 FT

TWO FUEL TANK FILL

STEP

VARIABLE PITCH PROPELLER US-122 104" DIA.

CABIN SECTION — COMBINATION OF GIRDER CONSTRUCTION, BRACING TUBE AND STRESSED SKIN

SIMPLE STIFFENED CONE SHAPED MONOCOQUE STRUCTURE

FIXED SLAT FITTED INVERTED ON THE LEADING EDGE OF THE ELEVATOR HORN

PITOT STATIC TUBE

NAVIGATION LIGHT

PILOT CONTROLED TAB

WING DIHEDRAL 1°

FUEL INDICATOR

ENTIRE AIRCRAFT SILVER, - NATURAL DURAL.

RED

SLAT BRACKET

SECTION A-A

SLOTTED FLAPS (SEVEN POSITIONS, INCLUDING FULL UP AND FULL DOWN)

FIXED SLAT

FUEL TANK VENT

SECTION B-B

AILERON HINGE BRACKET

MASS BALLANCE

SLOTTED FRIZE TYPE AILERONS

THE WING IS A SINGLE MONOSPAR STRUCTURE IN WHICH THE FOUR FUEL TANKS ARE HOUSED WITHIN THE WING TORSION BOX.

WING LEADING EDGE

LANDING LIGHT

POSITION LIGHT

RED

SECTION E

1. OPERATING FLAP LEVER
2. ARTIFICAL HORIZON & BANK AND TURN INDICATOR
3. AIRSPEED INDICATOR
4. LOW SPEED WARNING LIGHT
5. ALTIMETER
6. THROTTLE LEVER AND PROPELLER SPEED REGULATOR
7. MIXTURE THERMOMETER
8. CONTROL STICK
9. RATE OF CLIMB INDICATOR
10. MANOMETER
11. MAGNETIC COMPASS
12. TACHOMETER
13. RADIO SET
14. ENGINE THERMOMETER
15. ENGINE GAUGE UNIT
16. FRONT SEATS
17. ELECTRICAL CONTROL UNIT

SECTION C-C

SLAT BRACKET

SCALE

0 1/2 1 2 3 4 5 6 FT

DRAWN BY F. PAWLOWICZ, MELBOURNE

Scale 1:50

Techno Scale

Mike Evatt che

MicroInvent is a young Slovakian company whose intention is to perform a fundamental shift in the limit of miniaturisation of R/C model aircraft. Check out their web presence at www.microinvent.com to get a hint of what they mean. The dream of owning a miniature flying aircraft model, with which it is possible to fly everywhere, which is not demanding as far as space is concerned, and which thanks to its appearance may serve also as the decoration in a display case, may be fulfilled by Micro Invent.

Smart Fly at www.smart-fly.com market a range of items intended to make the life of a large scale flyer a little easier. Their SuperSwitch is a DSC style switch designed for the demands of large scale aircraft. The standard switches with their 22 gauge wires, are just not sufficient for 1/3 scale aircraft and up. Even with dual receivers in the 40% and larger planes the current draw from the battery through the switch can be substantial during manoeuvres. The company have measured a digital servo, unloaded, drawing 0.6 Amp when kept in continuous motion. Imagine what the same servo is drawing under load and then multiply that by the six to eleven servos you have in the plane. The unique features of this switch is the 18 gauge wire on the battery side with high-quality Deans connectors and the dual leads on the receiver side. This wire and connector combination allows you to mount your battery anywhere you want and you don't have to worry about voltage drops in long wire runs.

Gerhard Bruckmann's website may be found at www.modellbau-bruckmann.at The present content of these pages is not a catalogue but only to an overview of all models produced by him. Gerhard produces models only to order. The listed prices are base prices for a complete construction kit in standard form. The screen-shot shows the Macka, a vintage sailplane which is to a scale of 1: 2.2, flying weight of circa 14 kg and a Wingspan of 5m.

Scale Sailplane Kits by marcslasershop.com offers laser cut wood short kits in 1:3, 1:3.5 and 1:4 scale from top scale sailplane glider enthusiast and designer, Chris Williams. They also offer select kits from scale designers John Watkins, Jim Owen and David Smith. Their latest design from top scale glider enthusiast, Chris Williams is the Scheibe - Loravia SF-27 Topaze. This 1:3.5 scale sailplane uses 6 mm half round ramin hardwood mouldings to replicate the tubular metal fuselage of the original glider. Construction is aided by the use of building jigs. They also specialize in custom laser cutting for Radio Controlled Sailplanes. Check them out at www.scalesailplanekits.com

ADAG design Ltd. hosts a web presence at www.rottweil.fwrw.de/adagdesign Here you can buy plans and CNC precision milled parts for their model aircraft. However a great number of Arno Diemer's plans are available for free download. Plans and graphic layouts for an astonishing array of aircraft are available along with numerous photographs like those of the Emeraude Cap10 shown in the screen-shot.

Cajun R/C Specialties at www.cajunrc.com in their **Life Like Scale**

MicroInvent of Slovakia intend to push the boundaries of miniaturisation.

SuperSwitch from Smart Fly.

A Macka vintage sailplane to a scale of 1:2.2 by Gerhard Bruckmann.

Chris Williams' designed Scheibe - Loravia SF-27 Topaze from Scale Sailplane Kits.

Plans and graphic layouts for an array of aircraft are available from ADAG design Ltd.

A plethora of pilots from Cajun R/C Specialties.

cks the cybersurf for more TechnoScale Topics...

R/C Pilots range, offer Military Female Scale Masters and many more in a range of sizes from 25% to 50% scale. Theses are well worth a look as are their vinyl graphics on a sister website.

Aeroworks at http://aero-works.net is proud to add the New 50cc P-51B and P-51C Mustangs to their line of Quick Build Series Aircraft. The P-51B Mustang is arguably one of the most recognized and celebrated airplanes that emerged from World War Two. The full scale Mustang was known for its versatility and proved it could perform well in any number of missions. Now you too can own this incredible airplane in 50cc form. Featuring a distinct canopy and turtle deck the P-51B is a welcome change to the P-51D variant seen at many R/C Fields today. This 50cc representation of the P-51B Mustang features a true to scale outline that will impress even the most critical warbird enthusiasts.

The P-51C 'Kitten' was flown by Tuskeegee Airman Colonel Charles McGee in 1944. Col. Charles E. McGee, one of the famed 'Tuskegee Airmen", served as a fighter pilot during World War II, Korea, and Vietnam.

Introducing the 1/3 scale **Turbo Raven**. This kit was designed by Bob Francis and is now being produced by David Mosher, the owner of **Airasys Models Inc.** at www.airasys.com The Turbo Raven has a 102 inch wing span and is 87 inches in length. This model is currently powered by a MacMinarelli 85 Twin but most similar power plant designs will work. Currently they are looking into available Turbo prop designs and plan to offer this option in the future. Current weight is 24lbs but with serious effort a flying weight of 20lbs is attainable. Currently this is only available as a short kit but eventually it is hoped that a Deluxe Raven will become a reality.

Century Helicopter Products was established in 1987 to provide the radio control market with high quality R/C helicopters, high quality accessories, and performance upgrades. They are an all American company based in San Jose, California. They design, develop, and manufacture R/C helicopter products in the USA and overseas. They have grown to become a world class manufacturer, leading the market in R/C helicopters. Their scale Airwolf model is a 620 Size Electric Scale RC Helicopter ARF Kit features their acclaimed Swift NX ARF electric R/C helicopter mechanics. Take a peek at www.centuryheli.com

Wild Hare Hobbies at www.wildharerc.com they have recognized the need for model aircraft that are less expensive to build and fly. Therefore they are happy to announce availability of the Steinbach in the quarter-scale size. This new 30cc size Sbach is designed to be as light as is possible while maintaining a strong airframe that can survive for years without losing its structural integrity, Flying weight is 10-11 pounds with a DLE-30 gas engine making these some of the lightest planes in its class.

And Finally! It is always difficult to find items such a very small rivets. Look no further than www.sapphireproducts.co.uk **Sapphire Products Ltd** Incorporating The Rivet Supply Company is one of the few sources for tiny alloy rivets which are available in many head styles and start at just 1mm diameter! ■

The P-51C "Kitten" - a superb replica by Aeroworks.

Introducing the 1/3 scale Turbo Raven.

Century Helicopter Products market a superb scale Airwolf in 620 size electric.

This new 30cc size Sbach is as light as is possible while maintaining a strong airframe.

Sapphire Products Ltd is one of the few sources for tiny alloy rivets.

That's all there is time for from me this month so light up the screen and if you find something out there of interest that might be good to share, email me at:

mikeevatt@hotmail.com

Surviving Free-flight

Part 8 - Getting airbourne... the competition winning model has to take off from the ground - not as easy as you might think!

The first major hurdle for a free flight scale model is the take-off, for without it, you stand little chance of a gong in a competition. If your model's take-off is unpredictable and erratic - swinging with the torque, or taking too long to get airborne - then you stand every chance of your pride and joy biting someone. Your take-off needs to be accurate and predictable, so that you can position your model for a safe flight every time. Having a consistent take-off will also permit you to position your model for the best effect in front of the flight judges, either to obtain maximum points, or conversely, hide the curved take-off from their eyes!

Some times you can get away with a curved take-off run - but generally when the wind is low. Here Mike Kelsey's Be2c turns a few degrees to port, but manages to keep the inside wing up - lucky!

Biting the owner

A common fault is the swing on take-off, this can range from a mild curved take off, to the model completely turning round and biting its owner. The geometry of the model has a big influence in the take off behaviour. The ground angle of a Sopwith Camel, for example, has its nose pointed well into the air, which accentuates the gyrocouple effect as the tail is raised during the initial acceleration.

The Camel also has its wheels set a considerable distance in front of the centre of gravity, such that the raising of the tail requires more effort, so the poor thing does not know it has a tail for several seconds before the tail is raised!

These characteristics tend to impart a skittish behaviour, unlike subjects with a lower ground angle such as the Avro 504 or the DH4, which would give a far more predictable take off performance. However, with careful attention to the causes and effects, good accurate take offs can be achieved regardless of the aircraft type.

Reduce the swing

Aircraft with noses and undercarriages far in front of the centre of gravity, will benefit if the centre of gravity is moved as far forward as possible, to even 20% of the total wing chord. As well as making the model more stable (you effectively increase the moment arm), you are moving the centre of gravity closer to the u/c - hence, less effort is required to raise the tail, which now pops up much quicker, so reducing the swing tendency.

Tricks

Alterations to the thrust line can also reduce the swing. Right thrust will reduce the gyrocouple effect of the whirling propeller. Another trick is to increase the airflow over the tail areas to let the model know where it should be going. This can be achieved with a larger propeller, more power, or a finer-pitched propeller. The finer pitch propeller solution is my favourite, since it gives greater acceleration to lift the tail sooner. Another idea is to arrange to have some toe-in to the wheel alignment, such that the wheels fight the swing and so keep the model straight.

A better solution, if it can be arranged, is to have both wheels soldered to the axle and have the axle run in a tube, so that both wheels are turning together. A combination of some, or all, of the above will give a much better take-off performance.

...But when the Gods look kindly on you, even the most prickly of types can behave perfectly!

Real concentration from author Andrew Hewitt as he lets go of his Camel - a most unpredictable subject (see text)...

t Scale by Andrew Hewitt

When it goes right, nothing gives more satisfaction than a straight scale like take-off. Here Bill Dennis's Avro 504K gets away realistically off of the Barkston tarmac.

The problem with a curved take-off run is that it allows the wind to get under the wing - Mike Smith's Martinsyde Elephant about to do an about turn!

Getting the right flying speed

Many scale models suffer from much too high a flying speed and a variable power source - often the rubber powered models will leap into the air and charge around at supersonic scale speeds, with only the last half of the flight at a scale speed. The problem is also apparent in the CO2 models, but not so much in the Electric models, where the power source is more constant.

For the rubber models, solutions to that initial power burst are to use a much longer rubber motor, so that a longer cruise pattern is generated and the power for take off is not a maximum. The only problem will be fitting the longer motor into the fuselage.

A better solution for both CO2 and rubber is to use a larger, finer pitch propeller. Finer pitch propellers give greater acceleration as described earlier, but also limit the forward flying speed. The greater the pitch, the greater the torque, and also they will permit a faster flying speed. So the finer pitch propellers reduce the effects of several gremlins. The small propellers used in indoor models take little time to carve from balsa, and so an optimum can be found quickly. Most flyers use the commercial plastic propellers of fearsome pitch, great for efficiency and duration - but we want SCALE flying characteristics.

Watch your down thrust

Another common problem can be to have too much down thrust, which takes some experience to spot. It is usually characterised by a lightly-loaded model flying what appears to be far too quickly and, in more extreme cases, will refuse to climb on maximum power, preferring to saunter up after the initial burst. If you do notice such activity, try reducing the down thrust with small increments until a more buoyant flight pattern is achieved. You will find that less power is required for flight and also that the airspeed has dropped. Flight times will also be increased, since the model can climb higher at a more leisurely pace.

Next month:

Andrew concluded his free flight scale opus by practising what he preaches. As a Christmas gift, we are offering a FREE full-size plan of Andrew's free flight scale AVIA BH3, a 37.5" low wing monoplane for 0.5 - 1cc IC engines or geared Speed 400 electric motors. ■

A long rubber motor and a large diameter fine-pitch prop give more a more consistent scale speed flight.

RC Indoor SCALE!

Alex Whittaker attends the first RAF Shawbury Indoor R/C Scale Meeting

When Andy Sephton sent me details of this new winter season Indoor R/C Scale event, I was utterly delighted. You see, the BMFA Scale Technical Committee is currently on something of a roll, and its new scale initiatives have proved successful, both indoors and out. We could see clearly see that the Committee was prosecuting its advantage, building on last year's successful new Birmingham Indoor R/C Scale Meeting, and working towards the goal of a full winter indoor R/C plus F/F scale flying season.
Great stuff, says I!

Semi-subterranean

The chosen indoor flying venue was a very interesting one. Imagine a WWII-era RAF hangar buried deep in the woods, that apparently used to house four-engine Avro Shackletons. Imagine said hangar having no windows, and being lit mostly by mercury lamps, that took a short while to heat up. Imagine, also, part of said interior being segregated with badminton nets and floored with Astro Turf. (Ideal for Indoor free flight models). Imagine the even larger residual open space remaining, and overall, a good height for indoor flying. Now I have been attending outdoor R/C scale events at RAF Shawbury for years, but I knew nothing of this indoor facility. In fact, this hangar is not actually on the modern base. It is tucked away beyond a residential area, well outside the camp gates. If canny CD Andy Sephton had not supplied Sat-Nav co-ordinates, I think its location would have eluded me.

Two disciplines; two competitions

I was pleased that the resourceful BMFA Scale Tech Committee followed its usual formula of keeping all the various Tribes of Scale, both R/C and F/F, under one roof. So, there were the usual Peanut and Pistachio, Bostonian, and Lo-Cal F/F classes, as well as the brand new indoor R/C scale comp.

However, moving with the times, Andy Sephton had also made provision for two distinct R/C Scale Comps. The first, Scale R/C RTF, was one for all scale model types, including Ready-to-Fly. The second comp, Scratch Built, was exclusively for those

Stunning Curtiss Jenny from Richard Crossley. Scale genius this lad.

Chris Chapman's superb all-sheet Peanut / rubber powered Spanish Hawker Fury.

Peter Smart's cute float plane, which I think is an Albatros, but I stand to be corrected.

Another view of what I hope is an Albatros from Peter Smart. I reckon that looks like am accurate model of a Mercedes engine.

who had BUILT their scale models. In each competition there was no requirement for either Documentation or Scale Judging. which led to simple rules, readily understood. Of course, these rules were expressly designed to encourage new pilots to enter, and fresh punters to come and spectate.

As at Birmingham last winter, at Shawbury Andy clearly got it right first time. Fifty-three of us were assembled in the hangar before ten o'clock.

Winds of change

The light in this windowless space was such that R/C pilots could fly without difficulty, but there were not enough lumens for any sort of flying action photography - sorry folks!. However, there were lots of models to see and a number of technical innovations of interest to the flying scale pilot. The thing that struck me as soon as the R/C events got underway, was how many of the F/F indoor scale aristocracy had so effortlessly taken to indoor radio control. Their exquisite models now had full radio systems secreted about their fuselages.

If we take just two well known F/F scalistas as examples, Richard Crossley and Peter Smart, we are now seeing many of their stunning high-quality indoor models flying the R/C indoor schedule. This really is nothing short of spectacular, since these tiny models are the pinnacle of the scale builders art. I was hugely impressed, and it has all happened so quickly.

Radio systems

Naturally, the ARTF event was populated by off-the-shelf commercial designs with intergral radios. This class had two Tiger Moths, an Albatros, and a Cessna. Whilst the bright yellow all-foam Tiger Moths had been modified with *Deltang* receivers and *Falcon* 8gram servos, the other models were 'stock' items. Indeed, one ARTF-entrant, Andy Bowman showed up with a model that he had bought only the day before, at *Steve Webb Models* in Frodsham. Andy says that he only popped into Webbies for fuel, remembered that this event was on the morrow, and came out with an Aeronca! Naturally, many, if not all of the scratch-built models re-used radio gubbins from such commercial systems, so there was synergy there.

Some models of note

Eric Strefford brought along his amazing all-foam electric Avro Lancaster, while fellow Liverpool Clubmate Graham Green was flying his Halifax, built in a similar fashion from foam. Both these models flew

Beautifully airbrushed tissue / mock-geodetic finish on Peter Smart's Vickers Wellesley.

ABOVE: Richard Crossley and his R/C Nieuport 27. LEFT: Placed 3rd in Scratch Built: Richard Crossley's electric powered Nieuport 27.

exceptionally well. Graham Smith was present again, with his lovely slow flying Edwardian masterpiece, his R/C Voisin. This wafted along at less than walking pace - it was just mesmerising to watch.

Peter Smart flew in all disciplines all day, but entered his superb Be2c in the 'Scratch' class. To my eyes this model really is in a class of its own. If this were not enough, his Vickers Wellesley and his Vickers Virginia were lovely models of scandalously under-explored scale prototypes. The Virginia looks like the lovechild of a Vickers Vimy and a Handley Page Heyford: just magic. To cap it all Peter also had a tiny WWI German Albatros W.4 floatplane. I was expecting a cupped spinner, but perhaps it was omitted for the flying prop. Yet another lovely model from our Peter.

American classics

Previously mentioned Richard Crossley's new red Piper Tripacer looked very convincing, and yet has all technology hidden on board. His Curtiss Jenny, in barnstorming colours from the James Stewart *'Spirit Of Saint Louis'* film, was just perfect. It is hard to put across just how high a quality this young chap routinely achieves. Even allowing for the intrusive effects of harsh, high-magnification flash photography, his Tripacer and Jenny are beautifully crafted flying model aircraft.

Indoor F/F scale glider towing

Indoor F/F glider towing is now well established. On the day, we saw a goodly number in the air. I was astounded to see these models being hand-winched to height, then - sans radio - avoiding the ceiling and walls on the way down. F/F trimming really is a black art!

GossamerAlbatross

Peter Smart also brought along his stunning model of the full-size Gossamer Albatross man-powered aircraft. It is little known fact of aviation achievement that this full-size man-powered marvel was pedled the 22.2 miles across the English Channel (La Manche to our Gallic friends) in 1979, taking just 2 hours 39 minutes. Its average flying altitude was just five feet over the waves.

Laurence Marks' fine Whitman Tailwind.

Laurence Marks' neat Kit Scale class PA-15 Piper Vagabond.

Have electric kettle will travel: Mike Hadland's Stampe SV4.

Andy Bowman only went into the model shop to buy fuel, came away with this Aeronca, and entered the R/C scale comp next day!

Peter Fardell, Scion of the Famed Fardell Scale Dynasty, with his most unusual Lilienthal Glider.

Andy Sephton mid-briefing. Andy has brought energy and imagination to his post within the already booming Scale Tech Committee.

ABOVE: Victor Ludorum. Graham Green won both R/C events. This is is his superb Halifax bomber. RIGHT: Graham Smith's all foam electric scratch built Halifax bomber. Winner of Scratch Built Trophy.

How Peter cuts the balsa wood this tiny and yet so tough is well beyond me.

Micro Ducted Fan

Free Flight Scale maestro Derek Knight has designed and prototyped a new EDF (Electric Ducted Fan) unit of just 18mm diameter. For the Shawbury event, This was fitted in a slightly modified *Keil Kraft* F-86 Sabre which Derek had finished in blue tissue to look like the US Navy FJ-3 Fury variant. He has arranged the tiny EDF unit in a sculpted-out cleft in the bottom of the fuselage. A minimalist and efficient solution.

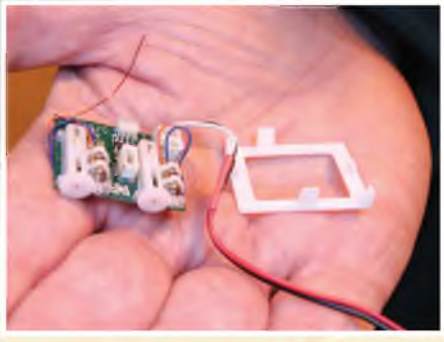
This electric powered EDF unit is not quite ready for sale yet, but I will conjure up more photographs for you as soon as Derek lets me have one. I have always been a great admirer of all things Keil Kraft, despite their often quite obvious shortcomings. However, I was struck by the simplicity of line of this classic KK Sabre kit. It is a work of art in its own right. I never built one as a kid, but always admired the box in the model shop. Apparently, for guaranteed performance with these old KK designs, the trick is to replace all the supplied wood with much lighter stuff.

3D Printing for scale

The idea of 3D printing is greatly appealing to many scale modellers. High street electronics retailers Maplins are already offering a 3D printer, so it is no longer a purely geek preserve. Now, whilst I appreciate that we are still some way from downloading and printing a Mick Reeves Spitfire, for many of the smaller plastic scale items we need, 3D printing from the internet will soon provide a useful delivery mechanism.

Scale pilot Eric Stefford, renowned for his all-foam indoor multis is now into 3D printing. He has gone even further and has designed a 3-D printed clip-on radio tray. This is for those popular radio 'gubbins' which we all salvage from our crashed commercial *Parkzone* style ARTF models. It makes mounting these combined servo/receiver units so much easier. The enclosed shot should give you the idea. Eric will be making a few available soon, so watch this space.

Charlie Newman fettles his Slingsby. Indoor Free Flight gliders are in the ascendant!

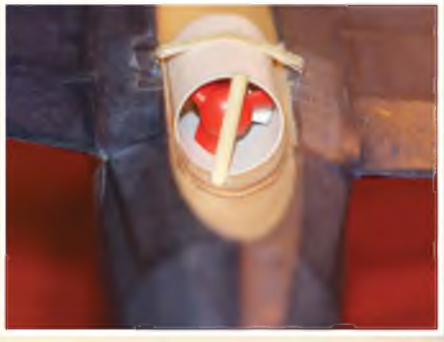


3D-printed radio clip. Secure your commercial radio gubbins to your scratch built model with one of these from Eric Strefford.

Man-powered flight. Peter Smart's Gossamer Albatross in her transport case.

Derek Knight's Keil Kraft Sabre, decked out in blue tissue as a US Fury.

Derek Knight's new prototype 18mm Electric Ducted Fan unit.



Derek Knight's new EDF unit fitted to a KK Sabre, with a sculpted-out bottom fuselage. Minimalist and efficient.

Eric Strefford's all-foam electric scratch built AVRO Lancaster. Superb performer.

BMFA Official Results

Shawbury Indoor Scale October 2103

Radio Control Indoor Scale RTF

1. Graham Green
Tiger Moth
2. Alan Glover
Albatros
3. Eric Strefford
Tiger Moth
4. Andy Bowman
Aeronca Champion
5. Dave Whitehouse
Cessna

Radio Control Indoor Scale Scratch Built

1. Graham Green
Halifax
2. Graham Smith
Voisin
3. Richard Crossley
Nieuport
4. Peter Smart
Be2c
5. Eric Strefford
Lancaster

Free Flight

Naturally there were F/F models everywhere, and it was a bonus to examine them between bouts. Certainly there were too many fine F/F models to note here, but Chris Chapman's beautifully executed Peanut (rubber powered) sheet-balsa Hawker Spanish Fury demands a mention in despatches. To many, the Hawker Fury represents the pinnacle of the biplane designer's art and was the first RAF fighter to exceed 200mph.

I often confuse it with the equally lovely Hawker Hart bomber. It is a further little known fact of aviation trivia that three such Spanish Furies were sent out to Spain in 1935, thus 'The Spanish Furies'.

Lilienthal Glider

The great Otto Lilienthal pioneered gliding, and almost in passing, created the whole modern ultra-light genre. His elegant gliders have a distinctly organic bird-like look, as if his early sketches were influenced by fossils. Anyhow, noted F/F scale man Peter Fardell brought along his own lovely scratch built Lillienthal glider, and I was utterly fascinated by its structure. We don't see enough historical scale gliders, which is a pity.

The Lad did well

Watching the various events was great fun certainly worth my 6am rise. The full Official Results are appended below for your scrutiny. However, I must mention


Another Albatros from Peter Smart, this time a D.X1, rubber powered.

ABOVE & RIGHT: Two views of Richard Crossley's immaculate, scratch-built Piper Tripacer, will be a full size centre-pull-out plan feature in FSM soon.

Geared electric motor in Richard Crossley's Piper Tripacer.

To my eyes, the Vickers Virginia looks a bit like a WW1 era Vickers Vimy, as well as a touch of the Handley Page Heyford. Another achievement by Peter Smart.

Graham Green of the Liverpool Club, who went on to win both R/C events.

Indeed, he won the Scratch Built R/C Event in some style, with his stunning Halifax multi-engined / all foam / electric powered bomber.

The verdict

This inaugural Shawbury R/C Indoor Scale event was a great success. Of course, this success did not just happen. It was deliberately built on a studied choice of date, careful marketing, and the canny selection a central venue. Besides the pilots from Oxfordshire and points Darn Sarf, I heard Scots, Welsh, Yorkshire, Lancashire, and Bristolian lilts. Attendance was very good indeed. We now have the makings of a full BMFA F/F+R/C Indoor Scale Winter Calendar. All I will say is this: may the inspired BMFA Scale Tech Committee Panjandrum roll on to even greater things!

Acknoledgements

Special thanks to Event Organiser John Minchell and CD Andrew Sephton for making it all happen. Thanks also to the army of Judges and Officials in all classes without whom we would have no comp. Grateful thanks once again to indefatigable Gordon Warburton FSMAE for his prompt BMFA Official Results Service.

LEFT: Graham Smith's lovely scratch built R/C Voisin. The pilot has a lovely suit and real cats whiskers for his moustache. ABOVE: Graham Smith with his engaging R/C Voisin. Flies suitably slowly.

THE QUIET ZONE

R/C SCALE ELECTRICS BY PETER RAKE

Yes, you lucky people, it's time for another exciting instalment of your favourite electric flight column. I know you're all champing at the bit for me to continue with Jonathan Rider's description of how he did the details on his Sopwith Camel model, so that's what I'll give you. If that's not what you were hoping for, well - this is what you're getting. Don't worry, I have another little plan item lined up so you'll get something different eventually. However, in the meantime I know many of you are enjoying following along with Jon. It's a hard old life writing a column; so many reader (two or three at any rate) all wanting something different. Working on the principle that you can't please all the people, all the time, I'll just carry on doing what I usually do - try to get someone else to write the column for me.

Right then, we left Jon describing the rear end of his model (the tail of his Camel you fool, not some attractive lady's posterior), so that's where I'll hand you back to him.

Still at the back

As we wrap up the fuselage, on the tail end, I wanted to make a fully scale operating tail skid. Okay, operating tail skids on a WW1 aircraft does sound a bit strange, but let's get into the details a little and see why they had them, and why we may want to consider building one.

Since the beginning of man-made transportation, there has always been a need to make the ride smoother, from leaf springs on buggies and wagons to shock absorbers and inflatable rubber wheels on automobiles. There is a basic need for general passenger comfort and ultimately the need to reduce impact and add longevity of the vehicle. So, what about a WW1 aeroplane smashing and dashing its way across unimproved landing fields during it's whole life? I would guess the toll it took on the fuselage was tremendous and the engineers had to find any way possible to absorb the impact and rough travelling to save the components on the aircraft.

The tail of the aircraft takes a lot of beating, not only dragging across the ground in the landing and takeoff events on the 'improved fields' but also in general handling of the aircraft on the ground. One great example is when running up an engine. You also want that

DOING WHAT IT WAS MADE FOR. JON'S STUNNING CAMEL MAKES A LOW PASS FOR THE CAMERA.

tail planted as tight to the ground as possible, and crewmembers sat on the horizontal stabiliser (or sprowled across the rear fuselage), adding needed additional weight to the tail, a flexible skid allowed the fuselage to lower even more, and reduce the risk of a 'full throttle' nose-over.

Most tail skids used some sort of bungee cord set-up, either outside, like the German Albatros series, or internal like the Sopwith and Fokker. If you also take a look at the Airco DH1 or the DH2 *(and more recent types like the Bristol F2B. PR)*, you can see a wonderful example of a 'visible' tail skid shock absorbing system.

On the camel, I made the skid out of very hard wood, with a brass tube as a bearing, drilled through the middle pivoting around piano wire. I added the elastic cord and put tension on both the top and bottom, this way, the skid stays in the centre when not under pressure. When I make my traditional hard landing, either on grass or a harder surface, the tail impact will be absorbed by the bungee cord. You can get the elastic cord at any local sewing or fabric store, I purchased about 20 metres of it in different sizes, it may take me a few years to use it all, but I know I won't run out of it!

Up front

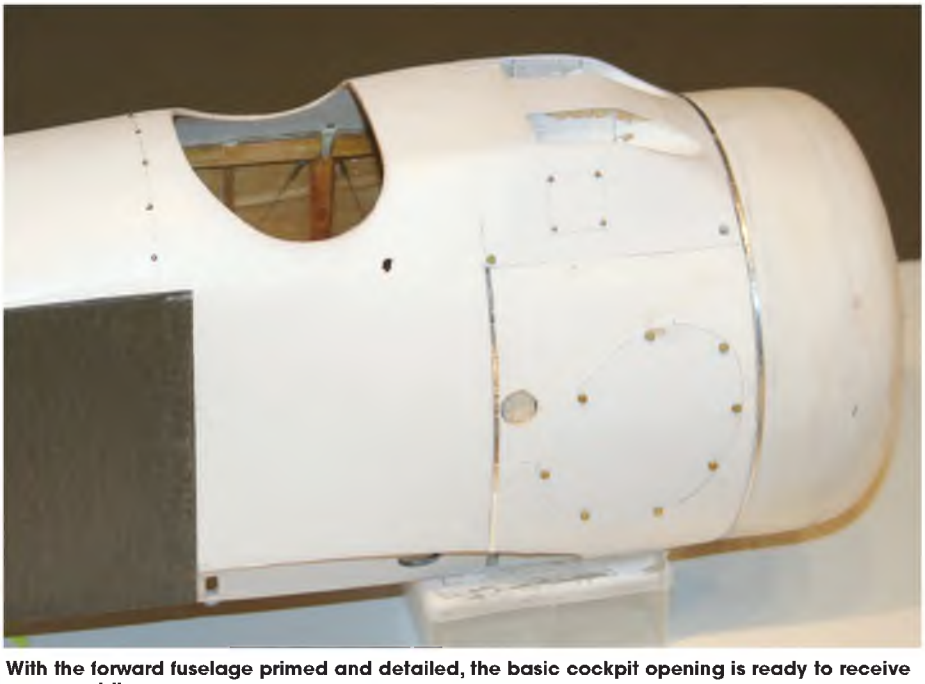
The forward half of the fuselage is sheeted with thin balsa. Because the front of the fuselage is painted, take your time, use smaller pieces of sheeting as you can always fill in the gaps with light wood filler. When you finish the sheeting, sand it smooth with 150 grit paper. After sanding, I always put two coats of white primer on the surface, and sand again with 400 grit sandpaper. I do this for a few reasons. One, I can see the high and low spots, fill them or sand them as needed, and when I paint the final colour, everything is an even shade underneath. There is nothing worse than seeing dark green filler putty under a white paint scheme. Have you ever painted a light colour over a dark one? - You can almost always see right through the lighter colour to the under shade. When painting real aircraft, autos and boats, they normally use a similar coloured primer, then mostly a light-based under colour, then the final coat. Candy Red can have a silver or a gold under colour, and the results are very different. Take your time here, sand, fill, sand, fill and make it right, time in the preparation work makes for a much better paint job.

Before final paint, I add my details. This is where we, as scale modellers, get into a lot of trouble. The question is where do you start, and when do you end? You can create so many scale items on an aircraft, the weight will double, and 99.9% of the people looking at it will never see the smallest of items that you spend so much time making. So balance your desire to add detail and keeping the aircraft light, clean looking and practical. As a side note, I also build ship models, and I spend years making scale cannons and decking, just to cover 100% of it with another deck. For a museum ship model, great, for a flying scale model, that's weight and time mostly wasted.

When adding detail, I put on the larger 'base' items first, then the smaller details. The inspection covers, the hatches, and

A nice hardwood skid and plenty of elastic cord suspension take the strain.

Once all the gubbins is hidden it looks very convincing.



With the forward fuselage primed and detailed, the basic cockpit opening is ready to receive some padding.

A piece of wire, some vinyl and a bit of thread results in a very realistic representation of the leather coaming used on the original.

A closer look at the stitching. The wood grain on the rear decking is actually supposed to be there; it was ply on the full-size Camel.

Weathered paintwork, filler caps and screw heads all add to the realism.

the panel lines go on first. Then the items like rivets, bolt-ends and the like. I normally use plastic sheet to replicate anything that was metal on the real plane. Inspection covers, cowl pieces, guns, or plates. The plastic is smooth, light and paints very well, and it looks like metal when properly finished. Using your plans, or download images from the web to help you size and place your fuselage details. If you really don't have good accurate measurements, make a paper cut out and position it on to the fuselage to see how it looks, keep trying and trimming, and once you are fully satisfied, then trace around the paper on your light plastic sheet. This way, the more costly plastic is not wasted, and you can make more than one plastic piece using your template. Many times, the right side has most of the same details as the left. So making a template assists you in duplicating parts quite easily.

The engine inspection plate on the camel is one of its most distinguishing feature, so I thought I would add not only the plate, but little bolt heads around it as well. I added 0.5mm brass bolts to the plastic cover, attaching them with thin CA. Look on the model railroad web sites as well as the *'Micro Parts'* sites for bulk offerings of small bolts, nuts, screw heads and washers. The little 18" wingspan aircraft *(the Pup and D.VIII see in previous editions. PR)* are too small to use them as detail, but this Camel, or anything larger than say 1/9 scale, you can do a lot with these little parts. Remember, less is more, you do not have to add thousands of bolts just because the real one had them, as you just need to add the essence and texture of the details to make them look incredibly convincing.

When detailing, go one step at a time, go slowly and step back and take a look at what you've added; is it too large? - Too small? Even though the measurements of your accessory are exact scale, sometimes on smaller models, the items can look way too large or small - and you may need to adjust a little. For additional accessories like the guns or other prominent features, it's sometime easier to build and paint them separately before you add them to the fuselage, and the more fragile pieces can wait to be the last things added.

Here is another fun tip. Every time you purchase something at the store that is in a clear 'blister" pack, like batteries, electronics, and household items, don't recycle the plastic packaging, but place it in your hobby scrap box. I have never had to purchase any clear plastic for windscreens and windows, I have always used recycled plastic packaging. Some packaging may look wavy and slightly distorted, but that adds to the weathering effect, and you are doing the environment a favour.

When you want to simulate metal, especially on smaller panels, try using metal HVAC Duct tape. Use a plastic card (like a credit card) to smooth down the tape, and it not only will look like metal, it is! If you smoothed and painted the base surface before you add the metal, you will not get any Balsa grain through the tape, and it will look like the real thing. (It even will polish up nice and bright with silver polish or toothpaste!)

Panel lines and rivets could probably be a full story in itself, but on these older models it's not like a WWII fighter with thousands of panel lines and rivets to simulate. Just to add a few along the cowl, behind the cockpit and at the transition point between fabric and wood, means a lot in the detail of an aircraft. What I use is small Brass ship nails. You can get bags of them very inexpensively, and they look fantastic when positioned and spaced correctly. You can use a ruler or micrometer and mark the nail hole locations with the tip of a sharp pencil, the pencil will indent the balsa wood and provide a divot for the nail to go into. You can also add stitching and panel lines with thread and tape before you do your final painting. All of these little things add very little weight and look stunning after the final painting is done.

Micro detailing also adds another element that you may have not thought of. Just like a magician or an illusionist, they try to distract you from the 'truth' and only show you what they want you to see. If you have a stunning cockpit detail, with leather seats and accurate paint, the human eye will be distracted from any issues or errors you may have somewhere else on your aeroplane.

Cockpit coaming

The Cockpit coaming is a focal point and a key detail area for any 'open cockpit' aeroplane. The Camel, like other open cockpit aircraft had leather padding around the cockpit opening. I would imagine in combat, with the manoeuvres they performed, the pilot welcomed a little padding around the cockpit opening, seeing as it's right at shoulder level.

The Camel cockpit coaming was done in three steps, first, (after the opening was cut out) I added a piece of copper wire (14 gauge) around the opening right at the edge, carefully gluing it on with CA. This creates the padded "bump" you see in old Camel photographs. Some aircraft coamings are very small and look like they have no padding at all, but the Camel had a distinctive bulge around its combing.

Once the wire was attached, I cut a piece of brown leather-coloured vinyl about 4 cm wide and attached to the outside of the wire with thick CA, starting at the fuselage centreline at the front of the cockpit. I then started around the opening, keeping the edge of the Vinyl uniformity even around the cockpit opening, covering the wire. Work in small sections at a time, going slowly and letting each part dry before you go to the next section, so you can keep the vinyl pulled tight around the cockpit opening. When you reach the end (that should be behind the windscreen where you started), cut the vinyl and attach the end to the beginning piece with a slight overlap, just like the real one.

Now, go back and tuck the vinyl under the opening, and attach to the underside of the cockpit with CA to make a nice 'wrap' around the radius of the cockpit opening. When that is done, you can then add your stitching. There are different stitching types on combings, from wraps to straight stitch. What Sopwith used in its combing was a straight running stitch. What I liked about the Camel is that I could make a nice contrasting colour with my thread, and make it look like the real thing.

To begin, use a micrometer or a compass and mark where you want your stitching on the vinyl (or leather, whatever material you used). Make sure the spaces are even and uniform all around, adjust as needed and make a soft pencil mark where each stitch goes. When everything is measured, go back with a pin drill and drill right through the coaming and fuselage side right into the cockpit, drilling a hole (carefully) in each pencil mark.

When your holes are complete, get a curved sewing needle and some thick thread. Start from inside the cockpit and go up through the first hole, down through the second, and up through the third, until you have gone all the way around the coaming. Next, skip a hole and come up though the second hole, and pass it down through the third, and when complete, you will have a stitch between every hole. Tie off or CA the end of the thread in the cockpit, and you have a very scale-like and convincing cockpit coaming.

Oh well, once again space, or lack of it has caught up with us. Next time we'll take a look at how Jon arranged his 'rotary' engine, before moving onto painting and finishing.

If you want to contact me, I'm at the usual place - PETERRAKE@aol.com. ■

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226	1/4 x 1-1/2	2.06
227	1/4 x 2	2.31
211	5/16 x 1-1/4	1.32
228	5/16 x 1-1/2	2.14
229	5/16 x 2	2.39
212	3/8 x 1-1/4	1.57
230	3/8 x 1-1/2	2.39
231	3/8 x 2	2.73
232	3/8 x 2-1/2	2.90
213	1/2 x 1-1/2	1.65
214	1/2 x 2	2.48

48" Lengths

236	1/4 x 1	2.62
237	1/4 x 1-1/4	2.92
238	1/4 x 1-1/2	3.28
239	1/4 x 2	4.01
215	5/16 x 1-1/4	3.28
240	5/16 x 1-1/2	3.38
241	5/16 x 2	3.86
216	3/8 x 1-1/4	3.67
242	3/8 x 1-1/2	3.67
243	3/8 x 2	4.22
244	3/8 x 2-1/2	4.60
217	1/2 x 1-1/2	3.75
218	1/2 x 2	4.79

Blocks

196	2 x 2 x 2 (Three For)	2.38
197	3 x 3 x 3	1.76
245	1 x 2 x 6	1.02
246	2 x 2 x 6	1.66
247	3/4 x 3 x 6	1.18
248	1 x 3 x 6	1.59
249	2 x 3 x 6	2.46
599	3 x 3 x 6	2.93
250	1 x 4 x 6	2.34
251	2 x 4 x 6	3.65
252	3 x 4 x 6	5.37
198	1 x 2 x 12	2.29
253	3/4 x 3 x 12	2.23
199	1 x 3 x 12	3.17
200	1 x 4 x 12	4.51
201	2 x 2 x 12	3.25
202	2 x 3 x 12	4.92
254	2 x 4 x 12	6.66
255	3 x 4 x 12	9.96
112	1 x 2 x 36	6.43
113	1 x 3 x 36	9.28
114	1 x 4 x 36	13.00
115	2 x 2 x 36	9.38
116	2 x 3 x 36	14.94
256	3 x 3 x 36	19.04
257	3 x 4 x 36	36.03

Birch Motor Mount Stock

748	3/8 x 3/4 x 12	0.82
749	1/2 x 3/4 x 12	0.93
750	5/8 x 3/4 x 12	1.00
751	3/4 x 3/4 x 12	1.06

Landing Gear Blocks Grooved Bass - 3/8 x 3/4 x 12

208	1/8"	1.00
209	5/32"	1.00
210	3/16"	1.00

Hardwood Dowels

355	1/8 x 36	0.24
356	3/16 x 36	0.26
357	1/4 x 36	0.33
358	5/16 x 36	0.40
359	3/8 x 36	0.52
360	1/8 x 48	0.33
361	3/16 x 48	0.37
362	1/4 x 48	0.40
363	5/16 x 48	0.52
364	3/8 x 48	0.67

Miscellaneous Assorted Wood

598	Bag-A-Balsa Sheets & Sticks	8.08
698	Bag-A-Blocks *(when available)*	9.24
699	"Seconds" Wood Box *(when available)*	41.95

24" Basswood Sticks

900	1/32 x 1/8	0.16
901	1/32 x 3/16	0.19
902	1/32 x 1/4	0.20
903	1/32 x 3/8	0.27
904	1/32 x 1/2	0.39
908	1/16 x 1/16	0.15
909	1/16 x 3/32	0.16
910	1/16 x 1/8	0.18
911	1/16 x 3/16	0.20
912	1/16 x 1/4	0.26
913	1/16 x 3/8	0.37
914	1/16 x 1/2	0.44
918	3/32 x 3/32	0.18
919	3/32 x 1/4	0.26
920	3/32 x 3/8	0.42
921	3/32 x 1/2	0.52
924	1/8 x 1/8	0.19
925	1/8 x 3/16	0.24
926	1/8 x 1/4	0.29
927	1/8 x 3/8	0.46
928	1/8 x 1/2	0.62
931	3/16 x 3/16	0.27
932	3/16 x 1/4	0.35
933	3/16 x 3/8	0.52
934	3/16 x 1/2	0.67
937	1/4 x 1/4	0.46
938	1/4 x 3/8	0.58
939	1/4 x 1/2	0.81
942	5/16 x 5/16	0.58
944	3/8 x 3/8	0.77
945	3/8 x 1/2	0.97
947	1/2 x 1/2	1.28

36" Basswood Sticks

680	1/16 x 1/8	0.33
681	1/16 x 3/16	0.36
682	1/16 x 1/4	0.40
683	3/32 x 1/8	0.41
684	3/32 x 3/16	0.42
685	3/32 x 1/4	0.44
278	1/8 x 1/8	0.33
610	1/8 x 3/16	0.40
279	1/8 x 1/4	0.47
280	1/8 x 3/8	0.52
611	1/8 x 1/2	0.67
612	1/8 x 3/4	0.73
281	3/16 x 3/16	0.47
613	3/16 x 1/4	0.52
614	3/16 x 3/8	0.61
615	3/16 x 1/2	0.73
282	1/4 x 1/4	0.75
283	1/4 x 3/8	0.79
284	1/4 x 1/2	0.93
285	3/8 x 3/8	1.00

42" Basswood Sticks

623	1/4 x 5/8	1.40
624	1/4 x 3/4	1.60
625	5/16 x 5/8	1.54
626	5/16 x 3/4	1.87
641	3/8 x 3/4	2.26
642	3/8 x 1	3.00

48" Basswood Sticks

686	3/32 x 1/8	0.47
687	3/32 x 3/16	0.49
688	3/32 x 1/4	0.61
616	1/8 x 1/8	0.50
617	1/8 x 3/16	0.51
300	1/8 x 1/4	0.55
301	1/8 x 3/8	0.73
618	1/8 x 1/2	0.79
619	1/8 x 3/4	0.93
302	3/16 x 3/16	0.52
620	3/16 x 1/4	0.67
621	3/16 x 3/8	0.79
622	3/16 x 1/2	1.00
303	1/4 x 1/4	0.88
304	1/4 x 3/8	1.06
305	1/4 x 1/2	1.20
307	1/4 x 3/4	2.07
306	3/8 x 3/8	1.27

36" Basswood Triangles

315	3/8 x 3/8	0.88
316	1/2 x 1/2	1.14
317	3/4 x 3/4	1.46

42" Shaped Bass Wing Struts

276	3/8 x 5/8	5.67
277	1/2 x 7/8	8.48

24" - 5/32 Grooved Bass Strut Fairings

274	1/4 x 1/2	1.19
275	1/4 x 3/4	1.60

24" Basswood Sheets

860	1/32 x 1	0.78
861	3/32 x 1	0.89
862	1/8 x 1	0.96
863	3/16 x 1	1.23
864	1/4 x 1	1.40
867	1/32 x 2	0.81
868	1/16 x 2	0.91
869	3/32 x 2	0.97
870	1/8 x 2	1.14
871	3/16 x 2	1.25
872	1/4 x 2	1.47
873	3/8 x 2	2.06
874	1/2 x 2	2.99
878	1/32 x 3	0.94
879	1/16 x 3	1.01
880	3/32 x 3	1.16
881	1/8 x 3	1.36
882	3/16 x 3	1.55
883	1/4 x 3	1.77
884	3/8 x 3	2.50
885	1/2 x 3	4.02
890	1/32 x 4	1.60
891	1/16 x 4	1.63
892	3/32 x 4	1.70
893	1/8 x 4	1.94
894	3/16 x 4	2.25
895	1/4 x 4	2.72

Birch Plywood Wing Skins

352	1/64 x 48 x 48	80.04
A352	TWO FOR	146.74

Premium Model Grade AAA Poplar Light Plywood

A327	1/8 x 6 x 24	2.26
A328	1/4 x 6 x 24	3.27
A330	1/8 x 12 x 24	4.34
A331	1/4 x 12 x 24	6.33
327	1/8 x 6 x 48	4.34
328	1/4 x 6 x 48	6.35
330**	1/8 x 12 x 48	8.61
331**	1/4 x 12 x 48	12.34

12" Birch Aircraft Plywood

B333	1/64 x 6 - 3 ply	3.41
B334	1/32 x 6 - 3 ply	2.26
B335	1/16 x 6 - 3 ply	2.39
B336	3/32 x 6 - 5 ply	3.67
B337	1/8 x 6 - 5 ply	3.81
B338	3/16 x 6 - 4 ply	2.26
B339	1/4 x 6 - 5 ply	2.73
B340	3/8 x 6 - 7 ply	3.14
B344	1/64 x 12 - 3 ply	5.86
B345	1/32 x 12 - 3 ply	3.72
B346	1/16 x 12 - 3 ply	3.98
B347	3/32 x 12 - 5 ply	6.26
B348	1/8 x 12 - 5 ply	6.47
B349	3/16 x 12 - 4 ply	3.72
B350	1/4 x 12 - 5 ply	4.54
B351	3/8 x 12 - 7 ply	5.32

24" Birch Aircraft Plywood

A333	1/64 x 6 - 3 ply	6.27
A334	1/32 x 6 - 3 ply	3.93
A335	1/16 x 6 - 3 ply	4.20
A336	3/32 x 6 - 5 ply	6.79
A337	1/8 x 6 - 5 ply	6.94
A338	3/16 x 6 - 4 ply	3.93
A339	1/4 x 6 - 5 ply	4.80
A340	3/8 x 6 - 7 ply	5.67
A344	1/64 x 12 - 3 ply	11.20
A345	1/32 x 12 - 3 ply	6.94
A346	1/16 x 12 - 3 ply	7.41
A347	3/32 x 12 - 5 ply	12.14
A348	1/8 x 12 - 5 ply	12.40
A349	3/16 x 12 - 4 ply	6.87
A350	1/4 x 12 - 5 ply	8.53
A351	3/8 x 12 - 7 ply	10.14

48" Birch Aircraft Plywood

333	1/64 x 6 - 3 ply	11.99
334	1/32 x 6 - 3 ply	7.33
335	1/16 x 6 - 3 ply	7.81
336	3/32 x 6 - 5 ply	13.01
337	1/8 x 6 - 5 ply	13.33
338	3/16 x 6 - 4 ply	7.28
339	1/4 x 6 - 5 ply	9.06
340	3/8 x 6 - 7 ply	10.81
344**	1/64 x 12 - 3 ply	21.02
345**	1/32 x 12 - 3 ply	12.80
346**	1/16 x 12 - 3 ply	13.67
347**	3/32 x 12 - 5 ply	22.81
348**	1/8 x 12 - 5 ply	23.34
349**	3/16 x 12 - 4 ply	12.67
350**	1/4 x 12 - 5 ply	15.87
351**	3/8 x 12 - 7 ply	18.94

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