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## ON THE COVER

Richard Crapp's Junkers D.1 makes a low pass and last year's Old Warden Scale Weekend. Quarter-scale model was bult from the Balsa USA kit, supplied in UK by Pegasus Models.. Laser 300V Twin 30cc powered.

## JULY 2017 NO.212

**Editor:** Tony Dowdeswell
**Publisher:** Alan Harman
**Design:** Peter Hutchinson
**Website:** Webteam
**Advertising Manager:** Sean Leslie
**Admin Manager:** Hannah McLaurie
**Office Manager:** Paula Gray

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**EDITORIAL ADVERTISEMENT & CIRCULATION:** Doolittle Mill, Doolittle Lane, Totternhoe, Beds, LU6 1QX.
Tel. 01525 222573 Fax. 01525 222574.
Email: enquiries@doolittlemedia.com

**CIRCULATION TRADE ENQUIRIES:**
Seymour Distribution, 2 East Poultry Avenue, London, EC1A 9PT
020 7429 4000.

**NEWSTRADE:** Select Publisher Services, 3 East Avenue, Bournemouth. BH3 7BW.
01202 586848
Email: tim@selectps.com

**SUBSCRIPTIONS:** Doolittle Mill, Doolittle Lane, Totternhoe, Beds, LU6 1QX.
Tel. 01525 222573. Fax. 01525 222574.

**PRINTING:** Henry Stone Ltd., Oxfordshire



The paper used on this title is from sustainable forestry

# CONTACT

## BACK TO THE FUTURE ...

As I cleared the last pages of July FSM for press, the thought occurred that two of the main threads of this issue represented a curious crossover of construction technologies.

Professor Hugo Junkers' all-metal monoplanes with cantilever wings were the product of radical thinking well ahead of the period during which the concept was developed, when aircraft, including Warbirds, were wood and fabric creations with wafer thin undercambered aerofoil sections made rigid by mares-nests of bracing wires. It was a thread of aircraft construction that dominated aviation for at least a further decade and a half, before military aircraft designers began to embrace the performance advantages of the monoplane layout - but even then, as with types like the Boeing P-26, still with the 'safety' of some degree of wire wing bracing.

Transferring theory into practical machinery risks its own setbacks and Professor Hugo's 'Tin Donkeys' had their own fair share of difficulties along the way to military service and arrived too late to have any influence on the outcome of WW1, but the concept was successfully translated into viable comercial peacetime types in the post WW1 years - all metal monoplanes free of external bracing.

In contrast, in Russia a full world war later, Semyon Lavochkin's La-5 and La-7 fighters of WW2, also featured in this issue, relied on wood as the main airframe construction material. Of course, Science played its part in making that possible, in creating the bonding agents, as with that other 'wooden wonder', the De Havilland Mosquito.

But in going against the grain of progress (...sorry about that one!) Lavochkin produced a series of fighter aircraft that, at the low-to-medium altitudes for which they were designed, seriously out-performed the likes of Messerschmitt Me 109s and Focke Wulf Fw 190s that were their main adversaries on the WW2 European eastern front. The Lavochkins were not the only wooden pure fighter aircraft of the WW2 period, but they were far and away the most successful.

Circumstances were different in either case. Prof. Junker was a true visionary, while Semyon Lavochkin achieved the very best from the hand dealt to him from a specification that required the use of non-stratigic materials.

### ... and back again!

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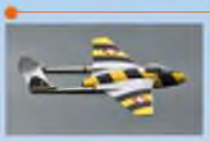

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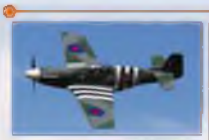

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# BREGUET LE

**An electric powered model of an unusual French monoplane, designed by Peter Rake, with the prototype model built by Pat O'Donnell**

Based on the history of the original aircraft, the Breguet LE might not seem the ideal choice for a flying scale model, because the prototype only made two flights before being abandoned as an idea. The first flight resulted in a crash that removed the landing gear, while the second flight (after repairs) ended in a crash that killed the test pilot. So, not so much famous as infamous!

However, fortunately for we modellers, models do not always share the traits of the prototype they are based on. If they did, very few model Sopwith Camels would get built and almost all modern jet fighters would be impossible to even consider. That's the thing with models, they can be designed to represent the full size aircraft, but built so they have a more than fair chance of actually doing what they are supposed to do - fly in a controlled manner. (Unless I'm the one doing the stick stirring, in which case all bets are off.)

You only have to look at the plan to see that there's nothing particularly unusual about this model. Yes, it has quite a lot of wing area and the nose is fairly short, but that's no different from so many other models that give no problems at all. Why the prototype should have been such a failure is anyone's guess because it all looks straightforward enough to me. If it had been really strange I would never have agreed to draw the plans in the first place.

## THE MODEL

The little Breguet LE is a type I'd never heard of until somebody contacted me to ask about the possibility of a plan. He supplied a three-view drawing and other reference (what little there is) and a promise to prototype the model once a plan was prepared. Well, I'm sure you know how it goes by now. The plan was drawn and sent to the prospective builder, who promptly disappeared. Oh well, such is life.

Anyway, the design sat on my computer for some time, until I thought it might be something that would interest Pat. It was and the model you see here is the result.

There's nothing particularly difficult about building this one but it is important that you keep it light. If using a 300 size outrunner (as shown on the plan) you'll need to keep the ready-to-fly weight down to around 12 ounces. The *e-Flite* Park 300 is good for about 50 Watts, resulting in a power-to-weight rating of a little over 60 Watts/lb. Pat's model turned out roughly 25% heavier than that so he fitted a *Turnigy* motor capable of around 70 Watts to compensate for the higher weight. However, it's better if you can keep the model light because that will result in a lower wing loading and slower, easier to control flight. Fast models may be very thrilling, but their life expectancy tends towards that of Lancaster tail

It's also important to keep all the equipment as far forward as you can possibly get it. The nose is, as I said, quite short, so a few grams weight at the tail could easily require an ounce of weight at the nose if the model is to balance correctly. Avoid any hint of tail heaviness like the plague.

## FUSELAGE

Let's start with what is probably the most complicated part of the model. At least, it's the section involving the most work. Apart from carving the nose blocks there isn't really too much that is complicated about it. It's all pretty basic modelling really.

The fuselage side frames are built in the traditional manner, over the plan with the parts pinned to the board while the glue dries. I know CA glue speeds up this process, but I would recommend a PVA style glue for most of the basic building. CA tends to result in brittle joints that don't react well to any flex they may encounter. PVA takes much longer to dry but does result in a far more durable joint. I normally only use CA where I need to tack something in position and have it 'grab' quickly to hold alignment. Even then I invariably reinforce the joint with PVA. That, Titebond, Aliphatic, it doesn't matter which you use. All give more durable joints than CA and they're far less likely to run all over the place, sticking bits where you don't want bits stuck. That includes stuck to you.

Depending on how soft the wood used for the forward fuselage sides is, you may need to put a few vertical saw cuts on the inside face of each piece where they curve fairly sharply inwards at the nose. You'll have BT and F1 to clamp them to but it's much nicer if they curve easily and aren't constantly trying to spring straight as soon as the clamps are removed.

Now you can start joining the fuselage sides into a basic box structure. Glue parts WM to formers F2 and F4. Those holes that don't appear to do anything are actually intended to assist with accurate alignment of the WM parts on the formers. Since they are the parts that will ultimately determine equal dihedral and correct incidence it's vitally important that they are in precisely the correct position on the formers. Take your time to get that right and the final assembly should go very smoothly.

Laminate F3 and F3A and assemble F1, BT and F2, ensuring they all align precisely as shown on the plan. Whether you bind the u/c tubes in place now, or once you have the basic box structure complete is entirely down to you. Either way works just fine.

Now, working over the plan and ensuring that everything remains perfect straight and square, join the two sides using the F1/BT/F2 assembly, F3/F3A and F4. Don't worry about pulling in the nose at the moment, that can be done once the basic box structure is removed from the building board and you have plenty of room to fit clamps and pieces of scrap to prevent the clamps damaging the sides. Scrap pieces of trailing edge stock work well for this because of the taper.

To complete the basic box, and still working over the plan to keep it all straight and square, pull in the tail and fit TS and all the remaining formers. Cross braces for the lower longeron should be cut to match their particular former width and are from 1/8 square balsa. Allow to dry completely before removing from the board and then pull in and glue in place the front sides. Add the undercarriage tubes if you didn't fit them earlier. Add parts X, which provide the tailplane seat, and the pushrod exit plates.

Sheet the top of the fuselage, around the cockpit, and glue in place the stringers.

With the easy stuff done, let's move onto the messy part - fitting and shaping the nose blocks. As you'll see from the photos, Pat 'cheated' slightly here. Rather than use expensive, and increasingly difficult-to-get, block balsa, he used bits and pieces of sheet to make up the basics of these sections. Also, rather than shape the blocks and then fit part N, temporarily appied part N and fitted the pieces of balsa to suit the thrust lines; neat, simple and pretty much impossible to get wrong. Then it's just a case of planing, sanding, filling and more sanding until you have it shaped to your satisfaction.

Rocker covers and headrest can be made up now, but only you know if you prefer to add them after covering, or cover around them.

**As you can see, there's nothing too involved with getting the fuselage to this basic box stage. Just the remaining stringers and nose blocks to go.**

**Landing gear legs plugged into their tubes and the axle soldered in place. No way are those legs coming out of the tubes.**

**Pat's temporary spacer used to hold part N while he builds up the balsa block sections around it.**

**After shaping the nose looks rather sleek, if a little hump backed.**

**Pat's replacement motor in place. Those wires will ultimately pass through the hole you see just above the mount plate.**


**Typical of the tail surface construction, and the only piece of laminating to be done.**

**A wing panel drying. Note the spar stubs protruding from the root, these glue to the formers and parts WM to set dihedral.**

The landing gear couldn't get much simpler. Bend matching pairs of undercarriage legs, plug them into their tubes in the fuselage and solder the axle into place. Then just fair them with scrap.

## SPINNER

Now things get really messy. Tack glue a piece of blue foam to S, having first fitted a mandrel (a bolt through the central hole) and mount the whole thing in an electric drill. Spin it up and carefully sand the foam to the required shape. As I said, REALLY messy.

Please don't try to use beaded foam, it won't work; all you'll do is pull out beads during the sanding process and the holes will fill with resin during the glassing stage, making balancing the thing almost impossible. Blue foam and 1/2 ounce glass cloth with thin coats of skinning resin evenly applied should result in a perfectly balanced spinner with no further effort from you. I've used the technique on much bigger spinners than this without problems, like the one on a Morane Saulnier type N.

However, before glassing slice of your sanded foam, cover the edges of S with polythene (to prevent the glass sticking to it) and spot glue the foam back in place. Now apply your glass cloth. Two, or at most three layers is ample. Spin everything in the drill again and GENTLY sand the surface smooth. The idea isn't to sand into the glass, just to remove anything that stands proud on the surface.

Remove S and trim your spinner to fit around your prop and you're just about there. Mount S to the prop driver first tighten the prop and then lightly and carefully glue the spinner over both. The lip formed around S during the glassing stage will ensure accurate location of the spinner every time.

## TAIL SURFACES

After what has already been built, the tail surfaces will come as something of a rest cure. Apart from the dreaded laminated rudder outline it's just a case of simply building them over the plan, allowing to dry and sanding.

Shape the wire joiner drill and groove the elevators to accept the joiner and glue it in place. The only comment I would make on this point is that it's easier to match elevator span to tailplane span if you make the elevator leading edge all one piece, only separating them after you have the holes drilled for the joiner.

## WINGS

Apart from the fact that every rib in each panel is different (the joys of tapered wings), building the wings is pretty

**Although still awaiting those remaining stringers and the nose blocks, this is as close as we get to the obligatory naked model shot.**

straightforward, although, since you bought the laser cut parts available from the publisher even that isn't any great problem. Just make sure you glue them in in the correct order.

Note that the full depth 1/8" balsa that forms the false trailing edge (the front one of the two) at the aileron position is glued to the ribs and spar. The one that forms the aileron leading edge is only glued to the aileron ribs and WT2.

Don't, under any circumstances, be tempted to use anything less than bass for the spars. Spruce is better still, but most definitely not hard balsa. These spars are what do all the work where the wings join the fuselage so, unless you're particularly fond of trying to fly a wingless projectile, don't skimp on the spars.

## COVERING AND FINISHING

We all have our favourite covering material but on this model it needs to be lightweight covering. *Litespan* is good, even *So-Lite* will work fine (if a little transparent) but avoid anything much heavier that those. Since both come in the correct colour for this model you can restrict the sealing, priming and painting to the nose areas. The one place its' weight will be an advantage.

There isn't a great deal of detail you can add to this model but exhaust stacks, bracing struts and a windscreen will all add to the scale appearance. The struts aren't functional, so can simply be glued in place once the model is assembled.

Parts are shown on the plan for making your own wheels, and supplied with the laser cut parts. Don't discount this method of producing them. The tyre material is readily available on a certain auction web site and the wheels end up much lighter than commercial WW1 style wheels.

## FLYING

All I can say here is to make absolutely sure the model balances slightly nose down when suspended at the point shown on the plan. This will ensure a 'safe' balance for your initial flights and can always be fine tuned as you become used to the model. The last thing you want is a marginal balance and test flights that prove nothing other than how steady your nerves are - or otherwise.

For various reasons, the Canadian winter, the fact that Pat has been having surgery, and just general lack of time/opportunity, there are no flying shots for this model. Not to worry, if you bear in mind what was said about balance, and don't attempt to hurry the model into the air everything will be just fine. Allow the model to pick up plenty of speed, deliberately holding it on the ground until it has, and then ease it into the air.

Loops, stall-turns and touch and goes are all within the models' scope. Treat her gently until you have the feel of how she behaves and then simply enjoy her. ■

**No spinner at this point but the few details there are really set of the model beautifully.**

**Now that is one very sleek looking model. Rather pretty too.**

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# CANOPY CA

THE TRADITIONAL WAYS ARE OFTEN THE BEST. JOIN CHRIS WHITE AS HE TAKES YOU THOUGH THE STAGES OF CARVING A WOODEN PLUG FOR MOULDING A COCKPIT CANOPY

FIG.3.

**Make sure you keep the sandpaper flat as it is easy to carve in highs and lows.**

After retiring from F3A Competition Aerobatics, I decided that I would re-enter the world of scale building, but start from scratch with my own design. Since I had become familiar with the Corby CJ-1 Starlet, this seemed an obvious place to begin. The Starlet is an aircraft designed for homebuilders, using a range of powerplants including the 50-80 hp Volkswagen engines.

When choosing an aircraft for scale, there are a few obstacles that come along the way. For me, on this model it was the canopy which, as you can see from the picture of the full size Starlet illustrated here, is quite bulbous and the moulding of which, has its own particular challenges.

After chatting with some of the local scale folks, there seemed to be a few options for me to consider, the main topic being the material from which to carve the mould plug. There were several options such as blue foam, balsa wood or, the last choice, carving timber called *Jellutong*. I remember this being the choice for Allan Trinder many years ago, who carved some of my pattern ships' plugs and he would rave about how easy it was to use.

## STAGE 1: TEMPLATES

Before you can start carving away at that new piece of timber, you will need to have some idea of the shape you would like to finish with. This may look harder than it is. Take the canopy outline from your plan and transfer the outline of the side view onto the wood block (allow about 2" either end). This will give you height and length that you need. Then, do the same with the top view to get the width of your canopy.

The next step is to decide how many contour stations along the length of the canopy you will need to achieve a final accurate shape. I used a total of five (one front, near the dash board, the rear from the turtle deck and three in the middle) As the timber is prone to marking, I used 1/8" craft wood for all my templates.

## STAGE 2: PREPARATION

It is now time to prepare the timber and this can be done by cutting the timber to the same length. There is about one hour's worth of work in preparation of the timber because it comes off the saw cut fairly rough. I used medium grade sandpaper for this job, but be careful not to sand any highs and lows in the flat surface as this will make for a untidy seam joint in the middle. I can confirm that at this stage, this material is easy to work with.

After you have made the surface smooth, pick out your favourite glue to join all the

FIG.1.

**The templates are critical to maintain accuracy for shape.**

FIG.2.

**Make sure templates touch the building board, this will keep the plug vertical.**

FIG.4.

**Carved blanks, glued together and weighted down. Weight must be evenly distributed.**

# RVE-UP

parts together. In this area, I would suggest 30-minute epoxy and I used a brush from the local hardware store for this job. Stack all the blocks together and try to find anything that looks heavy with which to weigh the assembly down during the epoxy curing process. House bricks would be ideal for this job. Try to keep all the weight even over the entire surface to avoid uneven contact between the timber sections. **(Fig.4)**.

## STAGE 3: SET-UP FOR CARVING

Once the blocks are dry, it is time to mark out all the stages which will line up with the templates and I also marked centre lines down each block to give me some guide as to how far I was cutting into each. This helped a lot and I was able to make even carving references on each side. As you can see, the reference lines marked on the top and bottom were very helpful. **(Fig.5)**.

The only thing left to do now is to choose your carving tool and I went with the Davies Plane **(Fig.6)**.

## REASONS FOR TOOL CHOICE

**1)** It was light and I figured this job was going to take a while, so it would not be heavy on the hands after several hours of carving, and also be small and light. It was more user-friendly then perhaps a larger wood plane

**2)** The Davies plane is an all-metal casting and there are also some similar plastic planes on the market. I have used this latter type in the past and find that these tend to bend and twist under the pressure of the carving load.

**3)** Last but not least is that there are spare blades to be bought and this can be very frustrating when you find the local store is unable to supply.

The Davies plane is light and small but only needed one blade change for the whole job.

## STAGE 4: THE FINAL CARVE-UP

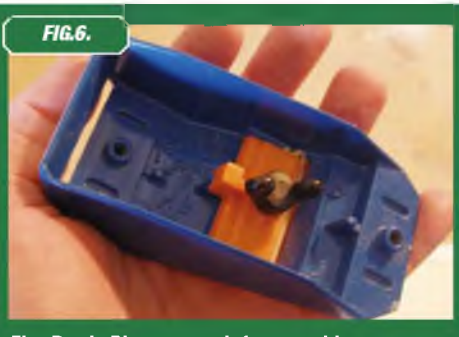
After all the hard work in the preparation, the carving was the easy part. I just started from the front and worked my way back until the job was completed - no secrets in this area other than to be patient. Use the templates for regular checking of progress and expect to have fun carving this timber as it really is easy to work with. My canopy plug took me about four evenings at 3-4 hours at a time. The following picture will show how much timber came off the plug from the start, which gave my daughter something to do while I carved. ■


**The Corby CJ-1 Starlet was the author's choice of scale subject and this picture gives a good idea of the volume of the cockpit canopy that needed moulding. The Starlet is a single seat light aircraft, designed for homebuilders.**

FIG.5.

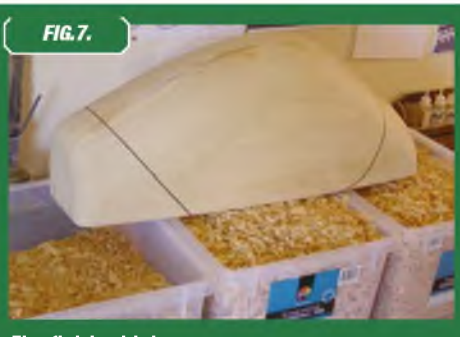
**Reference lines marked out.**

FIG.6.



**The Davis Plane - much favoured by aeromodellers for jobs like this one, and many others too!**

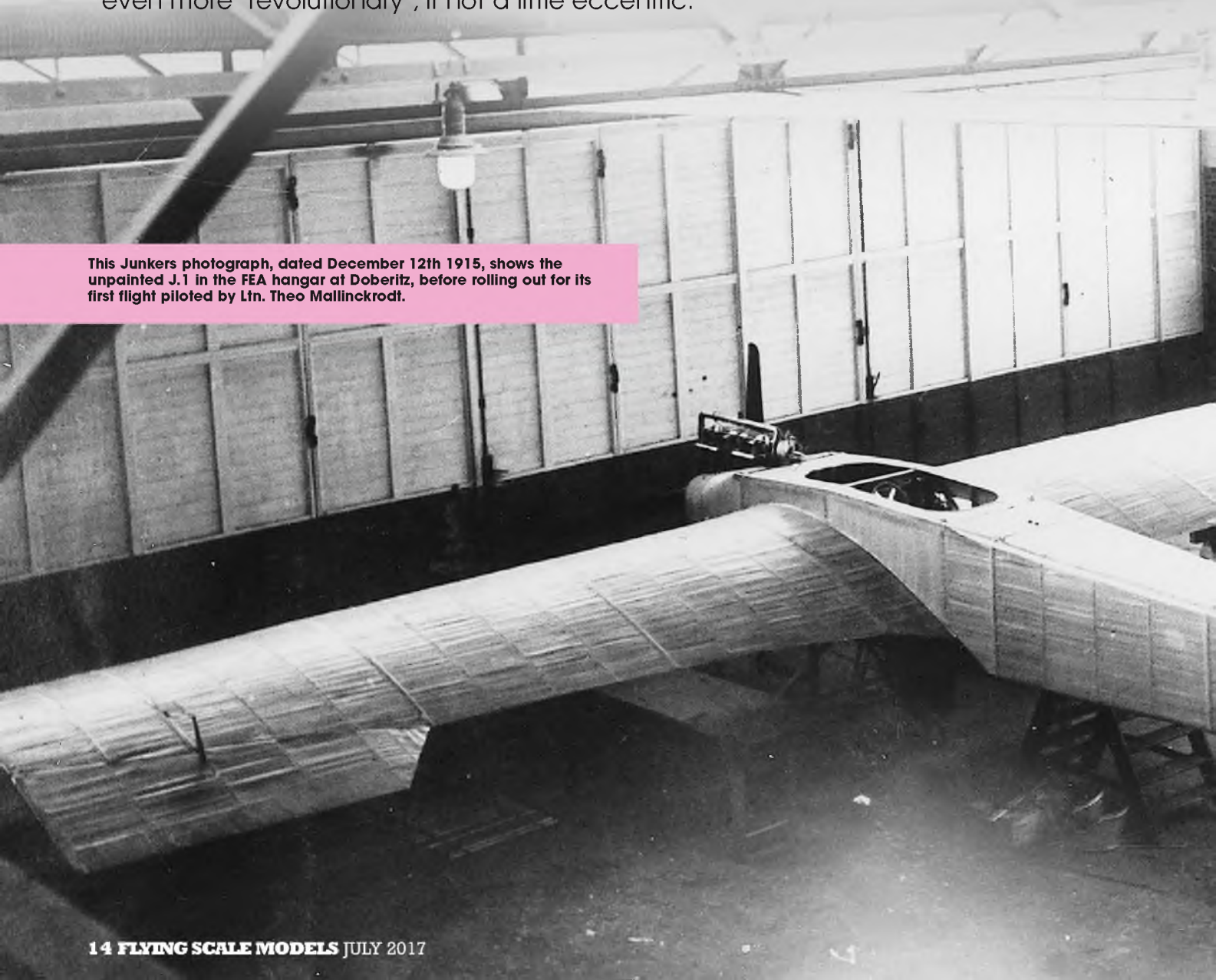
FIG.7.



**The finished job.**

# PROFESSOR HU
# TIN DONI

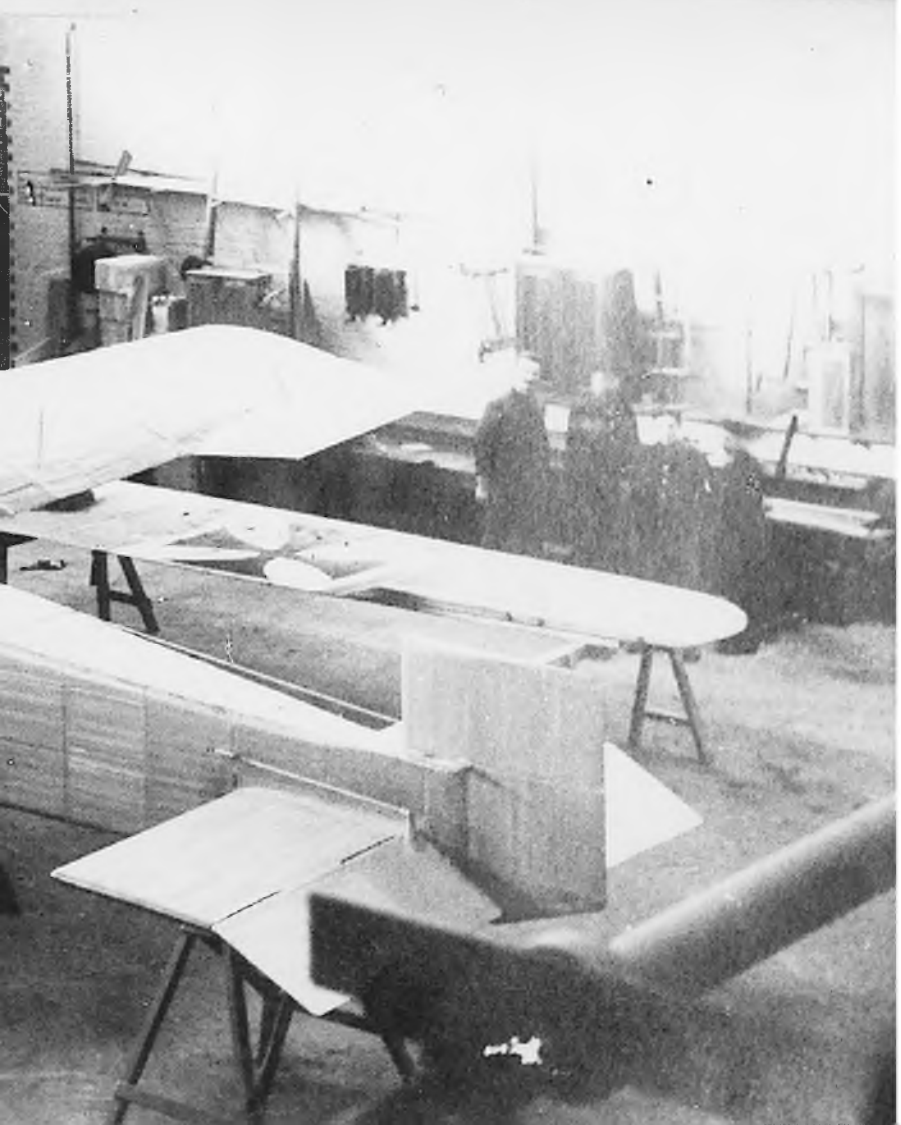
Today, leaders of the aircraft industry have moved to a 'third generation' of construction mat
airframes of the 'first generation', through the long period of metal in all its forms, to 'revolutio
construction, Prof. Junkers' adoption of the all-metal airframe in an era of wire, wood and fa
even more 'revolutionary', if not a little eccentric.



**This Junkers photograph, dated December 12th 1915, shows the unpainted J.1 in the FEA hangar at Doberitz, before rolling out for its first flight piloted by Ltn. Theo Mallinckrodt.**

# GO'S KEYS

erial for aircraft, moving from the wooden
nary' non-metal 'composite' material for
bric all those years back must have appeared



On February 3 1935, on his 76th birthday, Professor Hugo Junkers died at Gauting near Munich. The obituaries, especially those in the Nazi controlled press were lavish in their praise and expressions of regret on the passing of one of Germany's grand old men of aviation. Herman Goering's *Reichsluftfahrtministerium* sent a party of mourners to attend the funeral. However, they never reached the cemetery, for the late Professor's family objected so strongly that the party had to get off the train and return to Berlin.

The newspapers and aviation press politely and diplomatically recorded that Professor Junkers had 'retired' from control of the Junkers Werke at Dessau. In fact he had retired from the company's management in 1932 to devote himself to scientific experiments, although retaining a strong influence in the firm until his death. The fact was, the pugnacious and strong willed Professor was a pacifist and democrat and as such, was an embarrassment to the new National Socialist government of Adolf Hitler.

Hugo Junkers was removed from his controlling position in the company that he had created, by blackmail and threats so that his death, in 1935, came at just the right time so far as the Nazi regime was concerned. Thus passed one of the most brilliant and inventive minds in the history of aviation.

## THE TIN DONKEYS

Hugo Junkers was born in 1859 at Rheydt near Dusseldorf, the son of a mill owner, and studied at the Berlin Technical High School. After gaining experience with a gas company at Dessau, he developed great expertise in this field and first became well-known for his work in the development of gas engines which led to the formation of his own company. He produced the first German gas motor with opposed pistons, also patented a form of Calorimeter and a series gas-associated appliances.

In 1897, Junkers was offered the post of Technical Professor of Thermodynamics at the Aachen Technical High School, which he accepted. It is recorded that he was not too popular with his academic colleagues for it was considered that industrial activities were below the dignity of senior academics. However, the combination of science and industry was to prove useful to the Professor in later life.

Hugo Junkers' background, therefore, was rather different to that of other aviation pioneers, most of whom started as practical flying men with a varying knowledge of engineering and gradually developed their knowledge and experience from actually flying their creations. In 1907, Junkers met Professor Reissner, creator of the first German variable pitch propeller and designer of a strange aeroplane known as the Ente (Duck) which was only one of several tail-first designs being tried out at that time. There is little doubt that Junkers' interest in aviation started at this time, but what struck him as a practical engineer were the often primitive methods of construction, involving many materials stressed with vast amounts of wires and support struts. He was particularly interested in the possibility of improving the lifting properties of the thin and highly cambered wings. In consequence, he applied himself to the scientific aspects of flight, studying the problems and building a wind tunnel in which he tested many models of airfoil profiles to study airflow.

By 1909, Junkers had formulated a rather revolutionary theory. He considered that a very thick, aerofoil section of cantilever construction

was the ultimate way to success. This implied a monoplane construction rather than the (then) current multiplane conceptions flopping about Europe at that time. He was also developing a further idea that was connected with his version of cantilever thick wing monoplanes, which was that aeroplanies must be constructed entirely in metal for strength and durability.

At the time that Junkers was formulating these theories, Germany was just beginning its love affair with the Zeppelin, which was seen as the great air cruiser of the future. The aircraft industry, as such, was mainly under French influence in design and was finding it very hard to make enough money to expand. Their hopes lay largely in finance being made available from the War Ministry which was the only possible source of a large order for aeroplanes.

Junkers, however, was dreaming of a large transport aeroplane incorporating his revolutionary ideas, which he published in patent No. 253788m applied for in 1910, for the Nur Flugel-Fluzeauge, an all-wing machine without a tail. The project, as depicted in the patent, must have appeared as a piece of science fiction to his contemporaries, for it was a large, thick winged machine constructed entirely from metal. The wing section was deep enough to enclose all the crew and the engines as well as passengers. Of course, his ideas were well ahead of the technology available at the time, but he lived to see the concept, almost as he conceived it, become a reality within two decades.

As mentioned earlier, to facilitate his work on various properties of wing sections, he had built a wind tunnel at the Technical High School at Aachen and in this he placed models, not of the usual aerofoil sections, but with bodies of elementary shape such as ellipsoids and he subsequently discovered that sizes and sections were not of any deciding consequence and that thick forms were not only admissible, but within certain limits, superior to thin ones. He started to collect a vast amount of data from his systematic investigations of wing sections, effects of thickness ratios, lift curves etc, which accumulated in pages of calculations, drawings, graphs, diagrams and volumes of notes.

Eventually he resigned from Aachen, probably to the relief of his conservative colleagues, and built another wind tunnel at his factory at Dessau, the Budeofen-Fuhrik and instructed the factory engineer to apply himself to the task of investigating the possibilities of using metal in aeroplane construction.

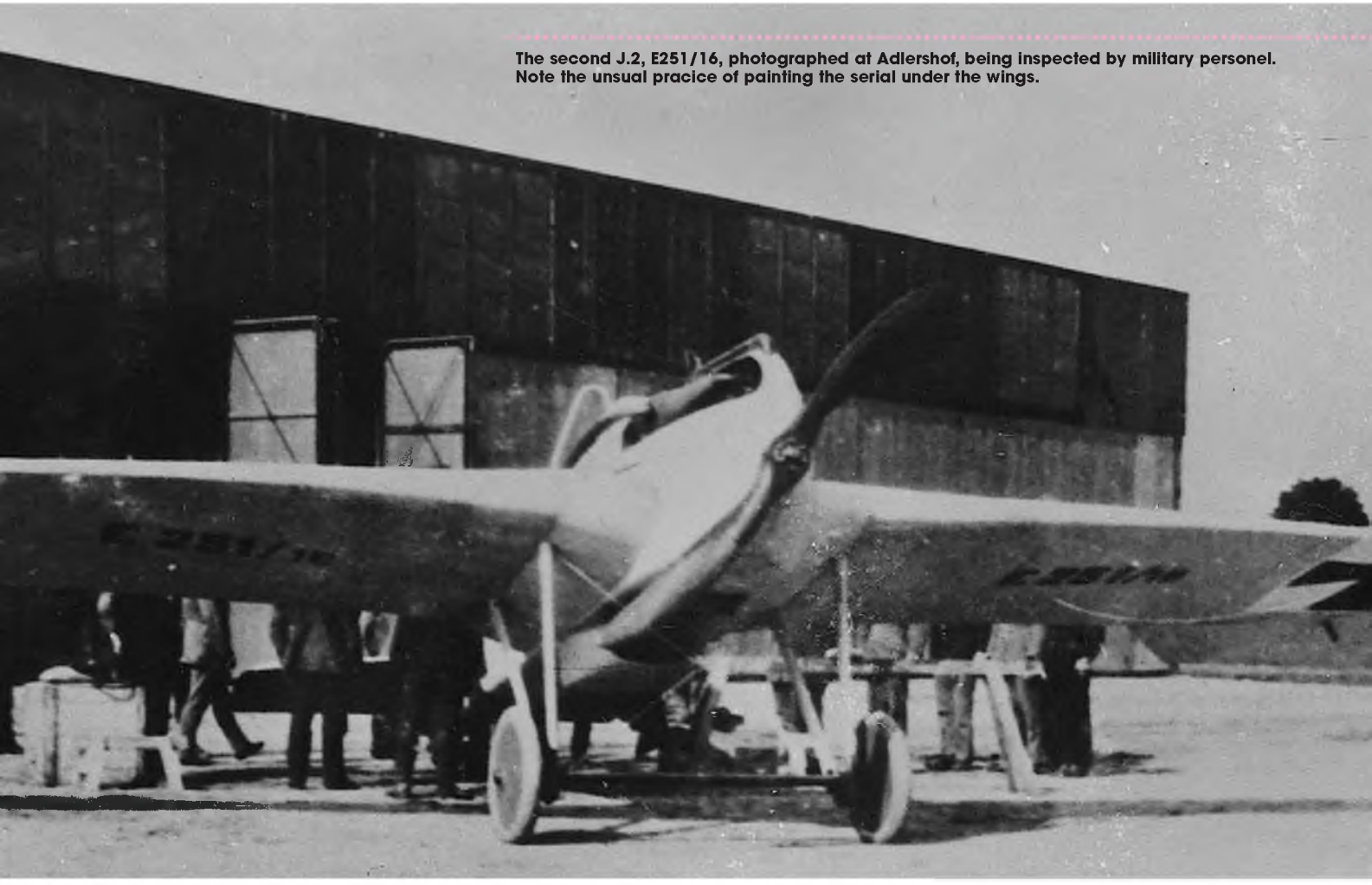
Meanwhile, Junkers himself became fully involved with the development of the diesel engine and set up his own factory the Jumo werke to develop this form of power. His preoccupation with the diesel engine continued until early 1915, when he again turned to aeronautical problems. To quote Junkers himself, *"...the realisation of technical ideas must be the fruit of an institute of research (Forschtungsanstalt) uniformly conducted, but covering many branches. Such an institute I was able to create as a result of many years' hard work, aided by eminent collaborators and I am indebted to this institute for my success in carrying out a technical innovation, like the metal aeroplane, from the first conception to the practical execution in a surprisingly short space of time and with a comparatively small expenditure...".*

The Forschungsanstalt was set up in early 1915 and Junkers approached the Kreigsministerium with an offer to develop and build an all-metal aeroplane. A commission from *Idflieg* (the German military aviation bureau) visited Dessau in May and was sufficiently impressed to issue a contract for a prototype machine.

The subsequent aeroplane, the Junkers J.1 was completed within four months and was a cantilever mid-wing monoplane designed by Dr Otto Mader and Otto Reuter. It was, in reality, a flying test bed. The J.I was rolled out ready for its first test flight in December 1915 and compared with contemporary aircraft, it must have appeared extraordinary. It was built entirely of steel. Steel had been used earlier in aeroplane construction, but as a framework with partial covering, as was the case with the 1913 Breguet biplane.

The J.I, however, was built entirely of iron, framework and skinning and the design was created entirely for this material. The basic structure was formed around a central core which consisted of the mid-fuselage section and the thick central part of the wing; in other words, the wing sections were not merely attached to the fuselage as was usual practice, but the centre section was built as part of the core of the fuselage.

The fuselage was slab sided with a



**The second J.2, E251/16, photographed at Adlershof, being inspected by military personel. Note the unsual pracice of painting the serial under the wings.**

pointed nose in which was placed a Mercedes D.II motor of 120hp. Behind this was a seat for the observer (not in the military sense, but as a flight test observer to record performance and other aspects) whilst the pilot sat in the rear seat, both being contained in one large cockpit. The wings were of the patented Junkers sparless variety which were built up by welding short span truss-tied sections outwards from the thick central stub wing to the tapered tips.

To try to envisage what this peculiar construction meant, the reader should imagine the wing of a plastic kit with the outer panels sawn into eleven chordwise sections. This would be the starting point, for the wing would be constructed by sticking these sections together to form the complete wing. There were of course many difficulties to be overcome with this completely new form of construction and material. To quote Professor Junkers again, reflecting on this period, *"...we had at our disposal as material of construction, sheet iron 0.1mm thick used for magnetic purposes in plates of a very disadvantageous small size and of quite unsatistactory properties of resistance and elasticity.* (Author's note: writing in 1936, Fritz Brandenburg recorded that the iron plate was between 0.1 and 0.2mm thick). *To make the surface built of this iron plate resistant and rigid, a second layer of corrugated sheet metal was welded to its inner side .*

*The short portions or wing sections thus formed were subsequently joined by welding to produce the whole wing. These joints were very difficult. The place of welding had to be reinforced correspondingly to the resistance of the individual wing portions by the insertion of a sort of small iron plate shoe protruding into the undulations; in this way the entire surface was utilised for elastic deformation". In Junkers' remarks is recorded one of the first practical examples of stressed skin construction.*

A short test hop had been made at Dessau and on 12 December 1915, the J.1 arrived at Doberitz for service test flying and evaluation. Pilots at that time were rather conservative in their outlook as far as new designs were concerned and nothing could be newer than the metal monoplane seen by Lt Mallinckrodt, the test pilot. He had been given instructions to be *"...very careful and not to risk his life for the coffin of a crazy Professor...!"*

The general attitude of the military towards the revolutionary design can also be ascertained by the derisory nickname given to the Junkers J.1., the 'Tin Donkey'.

Taking a deep breath, Mallinckrodt opened up the throttle and took off after a run of about 38 metres, but after reaching a height of only 3 metres, he decided to come down again and in doing so damaged the undercarriage, a rather weak structure which Junkers acknowledged. After repairs, the tests were continued in January 1916, during which a speed of 165kph (102mph) was attained, comparing favourably with one of the best German biplane types at the time, the Rumpler C. 1. However, the pilot reported that the J.1 was heavy and sluggish on the controls and with a very poor climb rate, which is not surprising in view of its weight (total 1,010kg or 2,226.66


**A full side profile of J.2 serial E251/16. Note the rippling of the iron skin and the very modern belly radiator.**


**The remarkably modern lines of the J.2 are apparent here, photographed at Adlershof in July 1916. The first of the sweries, E250/16, was used for static test loading, whilst E251/16 was the first to fly.**


**This Junkers Company photograph of the thrid in the series, E252/16, shows some of the modifications incorporated after tests with E252/16. The upper and side areas have also been sprayed a dark colour (dark green or brown?).**


**The most photographed of the group, E252/16 warms up on the hard standing at Adlershof. Performance was improved somewhat by the installation of a 160 hp Mercedes D.III engine. Only the second J2, E252/16, was fitted with a machine gun.**

**This Junkers Company photograph of the third in the series, E252/16, shows some of the modifications incorporated after tests with E252/16. The upper and side areas have also been sprayed a dark colour (dark green or brown?).**

lbs) and its 120hp motor. Other pilots flew the J.1 including Anthony Fokker, who stated that its speed exceeded the fastest machine of that period by 20 kph. Whilst not being impressed by its handling and poor climb, he was certainly interested in the design shape and the thick monoplane wing.

Junkers attributed the poor climb to the heavy wings, especially after the poor performance of the next group of machines to be produced, which were intended to be refined and improved J.1s.

*Idflieg* was less than enthusiastic about the Junkers metal monoplanes, but realised that there was obviously something in Junkers' ideas and appreciated the difficulties in developing such an advanced design. An order was therefore placed for six improved versions of the J.1. This was the J.2 (also given the military designation E for Eindecker).

The structure of the J.2 was basically the same as that of the J.1 but the design was considerably cleaned up and refined with a much stronger undercarriage. In its final form, it was the most advanced looking aeroplane in existence and, like the J.1, had a radiator in a streamlined box under the fuselage - subsequently a design feature of aircraft of the late 1930s. The same motor was used and the aeroplane was smaller than its predecessor, but unfortunately, it was about 136 kg heavier with a smaller wing area, thus increasing the wing loading. In consequence, despite its revolutionary appearance, the performance was inferior to that of the J.1. Nevertheless, *Idflieg* accepted the six machines completed and they were allocated the military serial numbers E.250/16 to E.255./16.

Only the first two J.2s were built as originally designed, armed with a single LMG 08 machine gun. The remaining four were remodelled with a larger fuselage and one of these machines was tested by military pilots in August 1916, who reported unfavourably on its performance, remarking particularly on its lack of speed and response to controls. Another J.2, E.252/ 16, flew on 20 September 1916 and again five days later, when it crashed whilst being piloted by Lt. Schade who was killed. This was the last straw for *Idflieg*, which promptly lost all interest in the J.2, but not in Professor Junkers' ideas on metal construction techniques.

The demise of E.252/16 also resulted in the suspension of work on the next Junkers design, the project J.3, a single or two-seat machine to be powered by an in-line or rotary motor. The incomplete airframe was not destroyed, but remained in existence until World War 2. The J.3 was an interesting project, for it was to be constructed of light metal (i.e., Duralumin covering and spars.

The outer cover was to be corrugated and placed over an internal framework or trestle of tubes. Junkers had realised that whilst the original form of wing structure used in the J. I and J.2 was enormously strong, it was also very heavy and was responsible lor the very poor handling qualities of the aircraft.

To quote the Professor, *"Although the iron wings fully responded to the requirements of resistance, I abandoned the system of 'supporting cover' and altered construction of the wings entirely. This change had become necessary on account of great weight of the wings, amounting to 12 kg per square metre with a length the wing of 6 metres, and was the cause of the bad climb of the aeroplane.... with regard to the unit of weight, duralumin has a smaller tensile and compression strength than a good steel. It is, however, of lower density, and thus for the same weight (i.e. same tensile and compression load) it will be thicker.... it was, therefore, soon decided to let the covering surface partake only of the local stress and part of the torsional stress and to meet the high bending movements by a frame or trestle of tubes in the interior of the wing"*.

This was the basis of Junkers' construction for the next two decades.

## COLOUR NOTES:

Photographs of the J.1 at the beginning of its career show it to be bare metal, but it would have had a clear varnish over the metal to prevent corrosion. A picture dating from 1918 reveals the J.1, partially dismantled in a corner of the works at Dessau; the motor had been covered with a metal hood and the entire airframe painted in pale blue, the iron crosses painted straight onto the the blue without any white base. There is also a photograph taken in 1939 inside the Deutschen Museum at Munich showing the J.1 suspended from the ceiling. It appears to have been stripped of its blue paint and is in varnished metal finish.

The first J.2 was painted overall in pale blue, a not uncommon scheme for certain German aircraft in early to mid 1916. The second J.2 may have been finished in the same way, but darker camouflage paint was sprayed over the upper and lateral surfaces as can be seen in the photographs. The colours are not known, but would most probably have been those used commonly at that time for camouflage purposes, dark green and a reddish brown.

The airframe of one of the late J.2s remained intact as an exhibition piece in the Lehrsehau (Educational Exhibition Hall) at Dessau until World War Two. The subsequent fate of this airframe and other items at Dessau is not known to the author.

**Posing in front of E2152/16 during the Autumn of 1916, it test pilot Max Schade at left, who was killed when he crashed in this machine. He is standing alongside Dipl.Ing. Franz Brandenburg. Seated in the cockpit in Ober.Ing. Hans Steudel. Modifications to the type included an enlarged rudder and extended fuselage and wingspan.**

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The awesome twin engine long range fighter of the late WW2 era operated by US Navy and US Marines. (60 Images)

### Grumman F6F Hellcat CD55
The US Navy's most important, and most successful fighter of WW2, photographed, close-up, from nose to tail and wing tip to wing tip. Example shown is part of The Fighter Collection, based at Duxford. (90 images)

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### Fairey Gannet ASW1 & T.2 CD48
The Royal Navy's post-WW2 anti-submarine workhorse, that also served with a number of other air-arms. Most images are of Mk.T.2, that was more-or-less the same as the ASW.1. (110 images)

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# Junkers J.2

A 72" span model of this radical and futuristic 1916 fighter monoplane for .50 to .60 cu. in. four-strokes

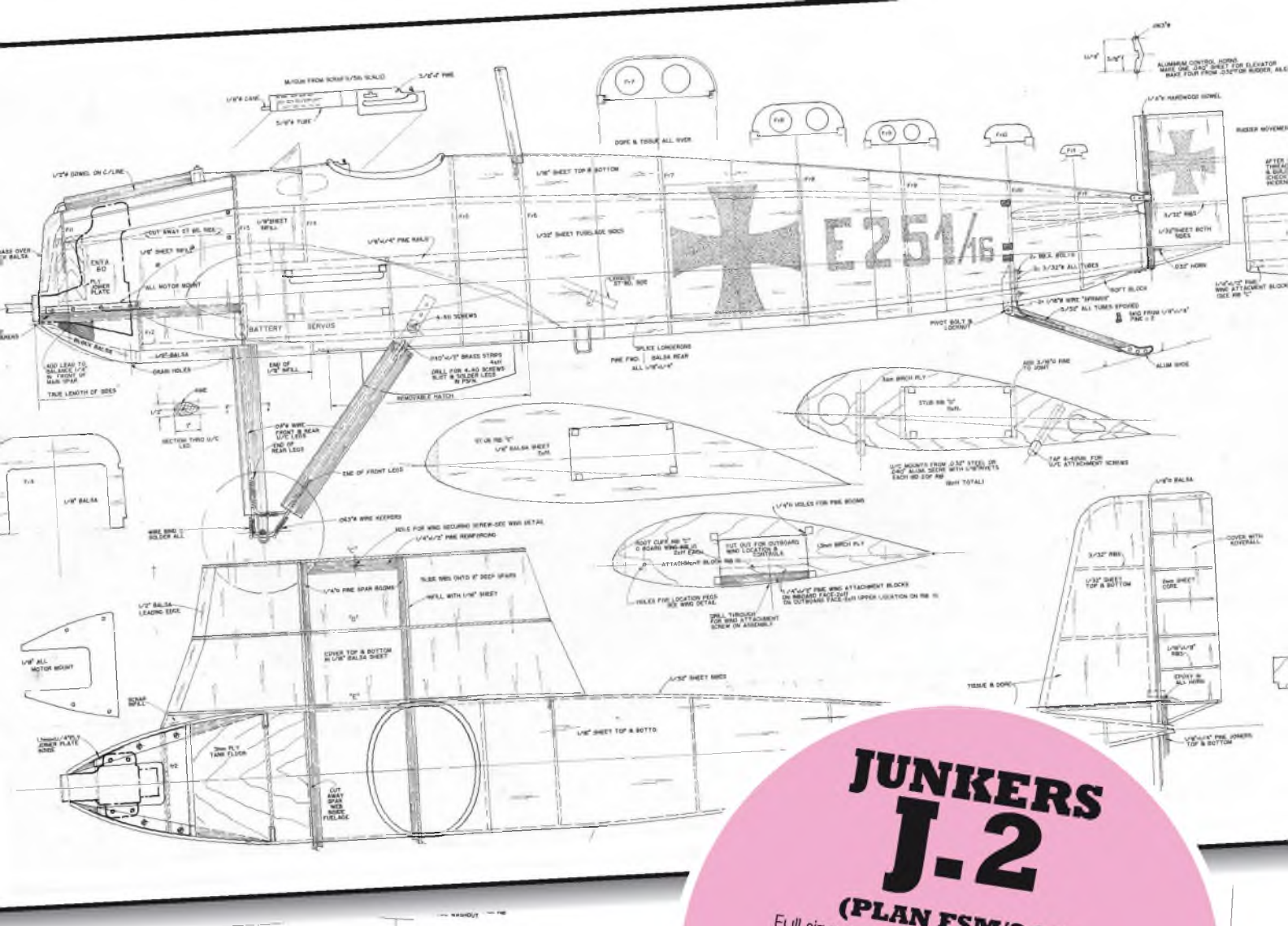
designed by GARY SUNDERLAND

Designed under the leadership of Professor Hugo Junkers, and just twelve years after the Wright brothers first flew in their frail biplane of wood, canvas and wire, the Junkers J.2 all-metal, low cantilever wing monoplane scout (fighter) was a truly revolutionary step forward in both aerodynamics and structures.

Junkers was a pioneer in electric welding of sheet steel and made a fortune producing gas-fired water heaters. His studies in aerodynamics at Aachen technical school, and later with his own Junkers works wind-tunnel, developed a thick section wing which could act as a cantilever structure, without the external wire bracing used by other aircraft designers at that time.

The Junkers J-2, which first flew in 1916, not only featured cantilever wings with a smooth exterior, but the structure was a true monocoque, all of the load being taken by the 1mm sheet steel skin, with internal corrugated steel welded reinforcement in critical areas. This type of structure was not seen again until the 1940s! The cantilever wing was carefully blended into the fuselage to reduce drag, and the engine radiator was likewise

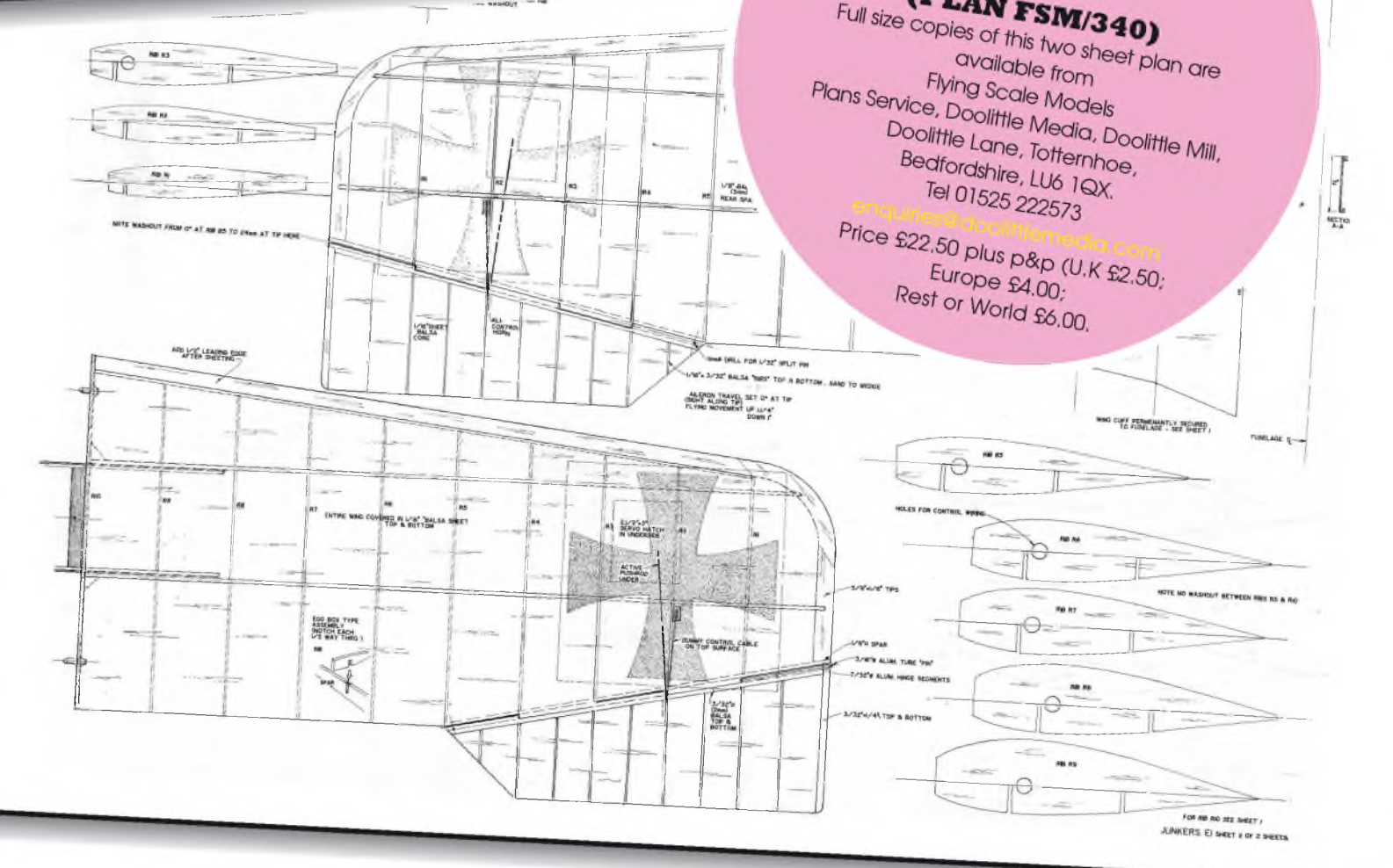
**With a scale dummy propeller, and in realistic setting, this clean monoplane must have seemed strange to the biplane pilots of 1916, although its outline seems familiar today. The very first of a most successful line of fighters, it was years before this layout became the standard.**

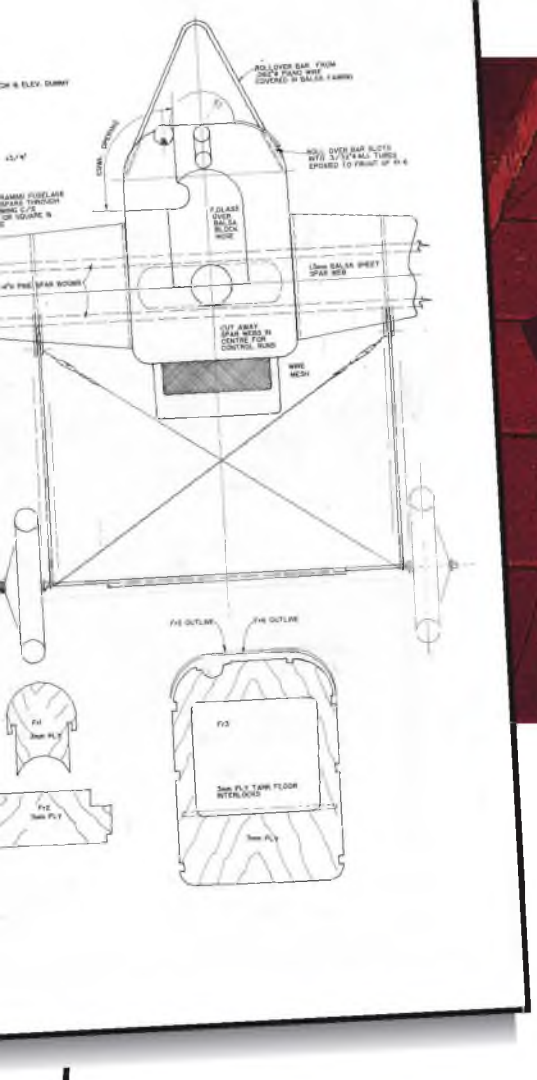



# JUNKERS J.2

## (PLAN FSM/340)

Full size copies of this two sheet plan are available from
Flying Scale Models
Plans Service, Doolittle Media, Doolittle Mill,
Doolittle Lane, Totternhoe,
Bedfordshire, LU6 1QX.
Tel 01525 222573
enquiries@doolittlemedia.com
Price £22.50 plus p&p (U.K £2.50;
Europe £4.00;
Rest or World £6.00.





**The simple box fuselage is shown here with the hole cut in the side for the central spars, which are ready to assemble.. The wing joiners are also ready, together with the tailplane elevators, rudder and tail skid.**

mounted behind and below the wing in the style of a WW2 fighter.

This radical and futuristic fighter had a top speed over 100 m.p.h. with only a 120 h.p. Mercedes engine, but it proved to be very heavy with an unacceptably low rate of climb. However, it showed the practicality of cantilever wings.

Professor Junkers later developed a lighter structure, based on internal steel tube spars and his well known corrugated aluminium skin on the outside. The resulting D-1 was put into production in 1918.

Tony Fokker was also impressed by the so-called 'wireless', or cantilever, structures and developed his famous thick wing triplane, biplane and eventually monoplanes, but with wooden wings and plywood covering. These German monoplanes were the jet fighters of their day, and would have given a clear advantage in performance if the war had continued into 1919, when the new Junkers, Fokker and Daimler monoplanes were planned to be introduced into action over the Western Front.

## Building the model J.2

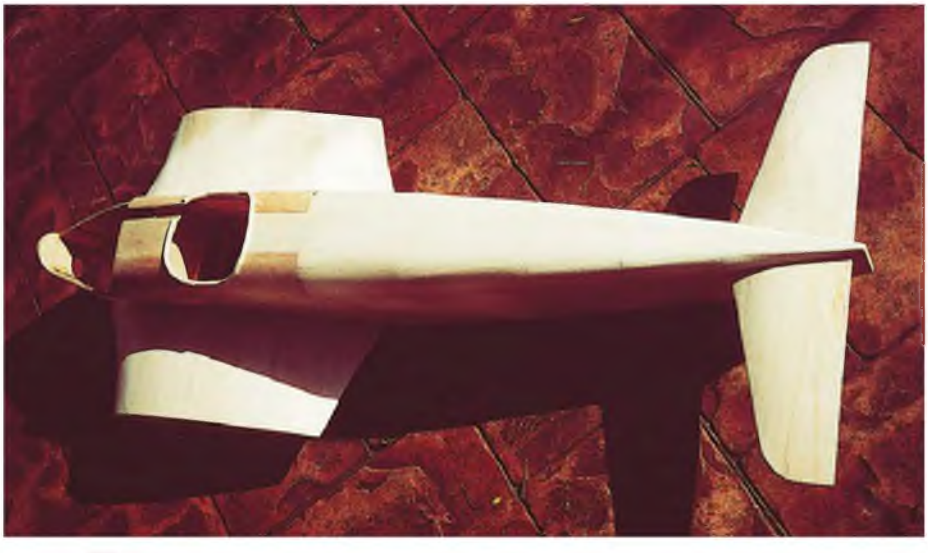
The structure is completely orthodox balsa and ply, although rather novel for me as I usually build braced biplanes. I started construction with the two central spars and then the wing joiners of pine and 1.5mm birch-ply, ensuring these fitted smoothly together. Next were the two fuselage sides, covered with 0.8mm sheet balsa and joined together over the forward ply frames.

Next, the centre section spars are installed, aligning them carefully by sighting from all directions before gluing them into place. Then slide the centre ribs onto the spars from each side in turn. The undercarriage mounts have proved more than adequate in service and have not budged, although I have had to repair the legs several times from hard 'arrivals'.

You will notice there is no fin, although there is hardly any nose and the large area of flat-sided fuselage seems to act to keep things straight when flying.

## Wing design and construction

The original Junkers J.2 wing involved superimposing a streamlined shape of reducing thickness onto a constant camber line. This resulted in a thin wing at the tip. For my model I elected to thicken the tip by filling in the lower surface,



**ABOVE LEFT: The fuselage and centre section are now sheeted, the sides cut away for the tailplane which has been slid across and glued in place. Note the cockpit edging from scrap balsa and the cut-away for the machine gun. ABOVE RIGHT: The port wing has been removed from the board and the wing joiners glued in place. Spars are sanded flush and scrap balsa added between ribs at the trailing edge. Holes for leads and mounts for servos are yet to be fitted before the underside sheeting is glued on. The nose leading edge block is then attached and sanded back.**

**The model is now ready for tissue covering to be applied, using Balsaloc or dope.**

effectively making it symmetrical at the tip. This is done to, hopefully, improve stall characteristics, but it also has the advantage that the aileron servos are easily installed inside the wing.

The balsa ribs are block-sanded between 1.5mm plywood master ribs at root, mid and tip sections. Make one set for each side, port and starboard hands, and carefully mark and cut these, from the underside to the chord line, at the spar locations.

The wings are built on the egg-box principle. That is, the parallel spars are cut from 1/8" (or 3mm) balsa and cut down to the mid-point at each rib location. With the spars pinned to the board, the ribs are then glued into place, ensuring that each rib's chord line is exactly level with the spar mid-reference lines. Then cut and sand the protruding spar tops down level to the ribs before covering with 1/16" (or 1.5mm) balsa sheet. Remove from the plan and, before repeating the process on the underside, install the wing joiners and blocks for the servo mount plates, as well as cutting holes in the ribs for servo leads.

## Engine and control surfaces

Keep the tail surfaces as light as possible. My model used an Enya 60 four-stroke for power, which is of sturdy construction and relatively heavy, but the area under the engine is filled with lead. Any .50 to .60 four-stroke will have plenty of power, but watch the tail weight. One suggestion is to replace my Dural mount with a steel engine mount plate if necessary.

All sheet balsa surfaces were coated with *Balsaloc* and tissue with a couple of coats of nitrate dope. For the ailerons I used the original scale type of hinging with aluminium tube epoxied in place. Be sure to de-grease and rough up the ali tubing before gluing. This hinging method has proven to be quite practical. The ailerons and elevators were covered with silk over tissue and a couple of coats of dope.

## Undercart

The complete undercarriage may be removed by just four 4-40 cap screws tapped into the mounting lugs. This has been handy as I have had to rebuild the

**Undercarriage detail shows the wire cross-axle bound and soldered in the middle to take side loads. The ends are sprung with 3mm rubber bungee cord. The Williams wheels are retained on brass tube axle extensions with split-pins. The legs have substantial pine fairings epoxy-glued in place.**

**The unusual aileron hinge arrangement of the Junkers J.2 has been reproduced in aluminium tube. A pin locks the centre tube in place. The servo hatch cum-mounting is from 1.5mm ply. The actuating pushrod is seen here mounted underneath and there is a wire dummy on top.**

**A view of the cockpit shows the cowl top in place, the windscreen cut from a clear plastic pill bottle and the leather cockpit surround.**

**The engine compartment is a tight squeeze for the Enya 60. A smaller engine could be fitted but additional lead would be required to compensate for a lighter engine. Note the brass tube in the nose to provide pitot pressure to the fuel tank.**

**Rudder, throttle and elevator servos are located immediately behind the front spar, with the battery just forward and the receiver aft. Note the belly hatch with the dummy radiator, undercarriage attachments and drain holes from the engine compartment.**

**ABOVE LEFT: The model is rigged inverted; after slipping the wings in place and connecting the aileron servo leads, two screws attach the wings. According to Harry Woodman's research, the prototype E 251/16 was unusual for a German aircraft of the time, in having its number painted under the wing. This is probably a good idea to add to the model, as it would improve its visibility from underneath. ABOVE RIGHT: The ailerons on the model are rigged at zero to the chord line. All existing J.2 three-view drawings show the ailerons drooping down, which I think is most unlikely, given that most other German aeroplanes of the time had the ailerons washed out towards the tip. Photographs of the original aeroplane indicate that the ailerons were reflexed slightly - that is, washed out. I would not like to fly the model with any incidence on the ailerons, and some differential is also a good idea. Set up this way, the model may be flown at all speeds down to the stall without requiring any rudder. Certainly, the model is a hot ship compared with a Fokker Eindecker of the same size and flies better.**

mains twice. On each occasion the wood fairings were removed and the wires hammered straight before gluing on new wood fairings with epoxy. The tail skid follows the Junkers design, but is wood instead of metal, and removes with just one 4-40 pivot bolt. Two 16 SWG (or thereabouts) wires provide springing. Actually, the only 'repair' required was to renew the brass tail skid shoe when it wore down.

## Controls

As already noted, the model has wing-mounted servos. Normal standard servos are also used for elevator, rudder and throttle. These are located just aft of the front spar and are accessible from a belly hatch, with the battery just forward and the Rx just aft. The rudder drive is fishing trace and the throttle and elevator use pushrods. The three other elevator 'wires' are dummies.

## Finishing

The model was sprayed all over with powder blue enamel. Markings were applied with Humbrol enamels and oversprayed with satin urethane varnish. According to Harry Woodman, the prototype E 251/16 had these numbers repeated under the wings. Very unusual in WW1 but, on reflection, probably a good idea for this model as it would help its visibility, or lack thereof, in the sky! The model came out at 4.5kg (10lb) with nose lead to get the balance point just forward of the front spar.

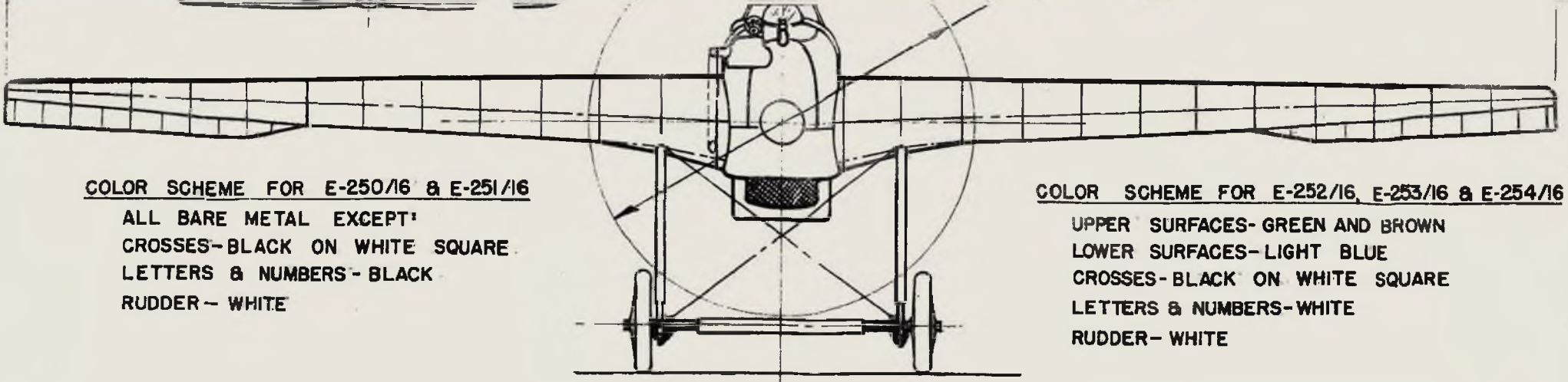
## Flying

This six feet span model seems very small and fast to me, but probably not if you are used to flying an ARF model. Needless to say, I need to concentrate on keeping it flying close and low down where my ageing eyesight can cope with light blue head-on and tail views in a blue sky! Otherwise, it is fun to fly and loops and rolls with alacrity. It will spin if you close the throttle and keep feeding in up elevator until it falls out of the sky. Forward elevator soon has the E-1 flying again.

The landings are more of a problem to an old biplane flyer, but no doubt the Spitfire aces would have no difficulties. My approaches always seem to be too fast or too slow. However, I have established that a nose-over on the strip will result in little damage as the model slides along backwards on the roll-over pylon. Incidentally, this pylon was a Junkers idea, not copied by Fokker in his low-wing designs. Perhaps Fokker never made bad landings!

## SPECIFICATIONS

| | |
|---|---|
| Type: | Scale WW1 monoplane |
| Designer: | Gary Sunderland |
| Scale: | 1/6th (approx) |
| Wing span: | 72" |
| Engine range: | .50 to .60 cu. in. four-strokes |
| Engine used: | Enya 60 four-stroke |
| Controls: | Rud./elev./ail./throt. |
| Servos: | Standard size |
| Construction: | Built-up balsa/ply |
| Covering: | Balsaloc, tissue and dope |
| Finish: | Enamels/urethane satin varnish |
| All-up weight: | 4.5kg (10lb) |

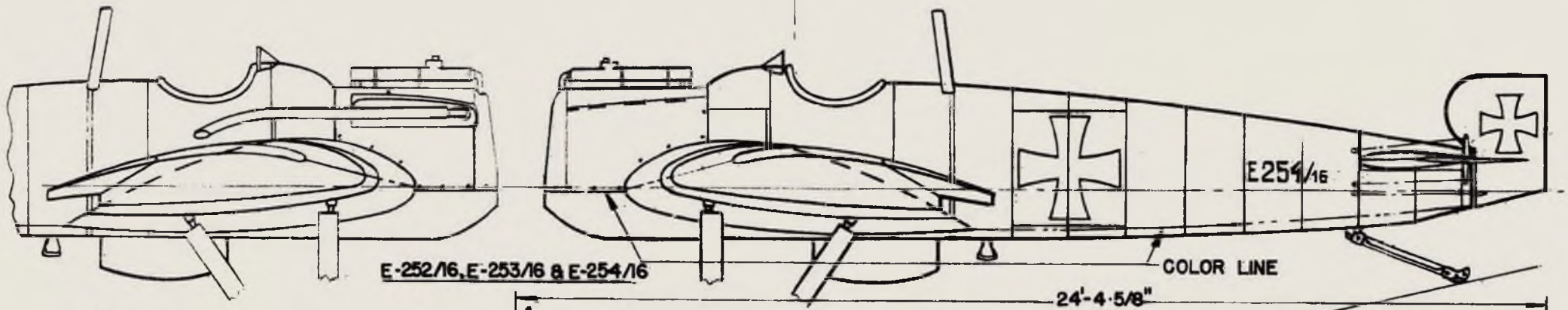


COLOR SCHEME FOR E-250/16 & E-251/16

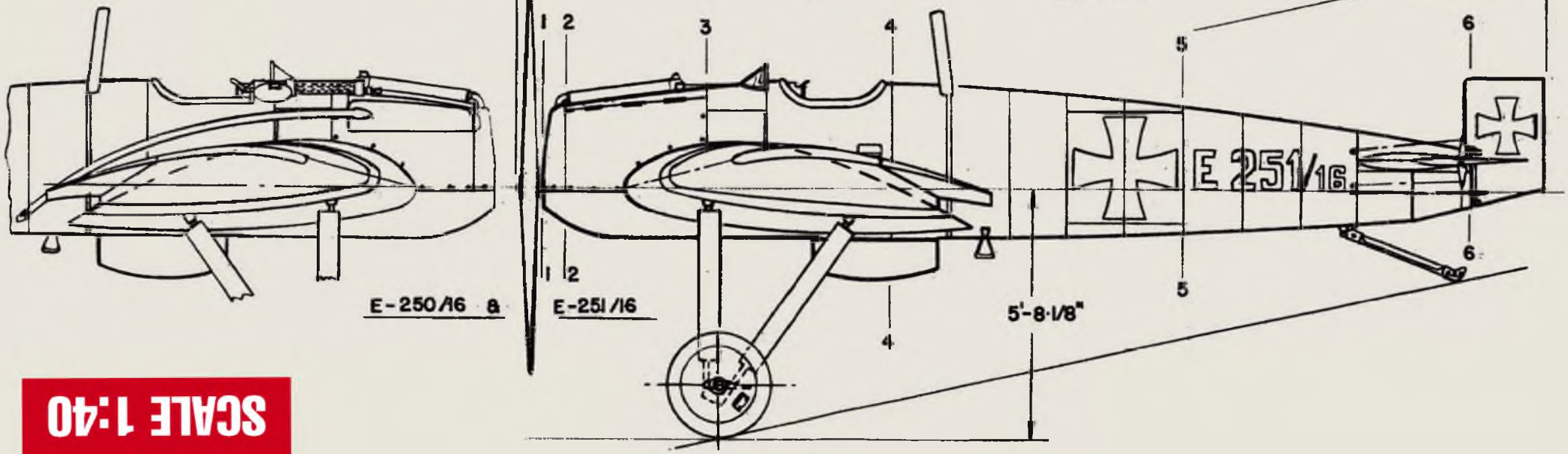
ALL BARE METAL EXCEPT:
CROSSES - BLACK ON WHITE SQUARE
LETTERS & NUMBERS - BLACK
RUDDER - WHITE

COLOR SCHEME FOR E-252/16, E-253/16 & E-254/16

UPPER SURFACES - GREEN AND BROWN
LOWER SURFACES - LIGHT BLUE
CROSSES - BLACK ON WHITE SQUARE
LETTERS & NUMBERS - WHITE
RUDDER - WHITE

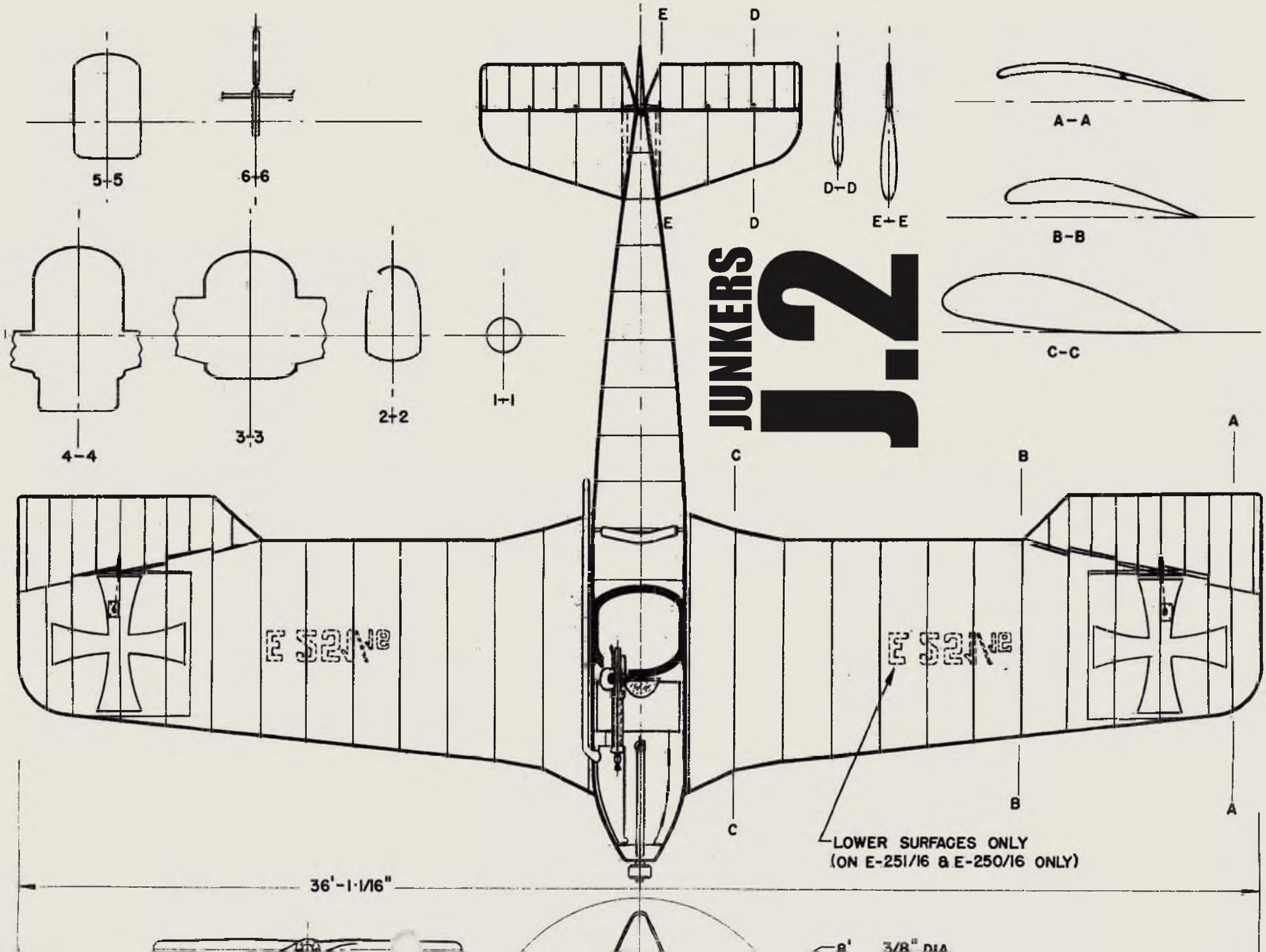



E-252/16, E-253/16 & E-254/16




E-250/16 & E-251/16

SCALE 1:40


JUNKERS
J.2
5-5
6-6
4-4
3-3
2-2
1-1
D-D
E-E
A-A
B-B
C-C
LOWER SURFACES ONLY
(ON E-251/16 & E-250/16 ONLY)
36'-1-1/16"
3/8" DIA

Richard calls the D.1 'sport-scale', but it has all the authority of a pukka scale model.

# A JUNKERS D.1 IN JUST SIX WEEKS!

Alex Whittaker discovers what a Lord Of Scale builds between Thousand Hour Projects

Before the Junkers D1, the overwhelming majority of World War One Scout type aircraft were biplanes, and always made out of wood. The innovative Junkers represented a paradigm shift. The Junkers was the first all-metal military aircraft to enter service. What is more, it was a monoplane. The production D.1 was based on the earlier Junkers J.7. Confusingly, pre-production, the D1 carried the designation J9. The J.9/D.1 included detailed changes from the earlier J.7 to bring its handling and performance up to the required standard. The initial order was for twelve aircraft. However its new all-metal construction taxed the skills of the Junkers

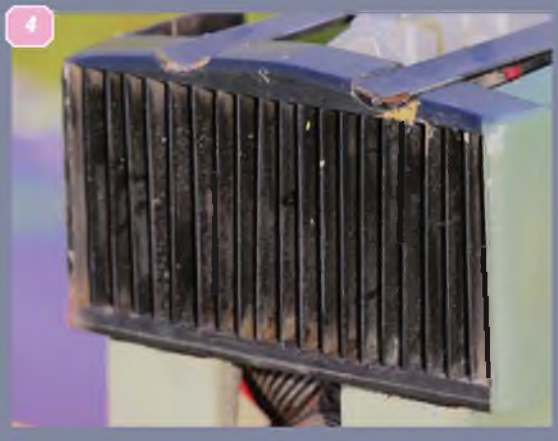
**1: The trade mark Junkers skin surface is achieved with vinyl corrugations, which are included in the kit.**

**2: Nice engine detailing and commercial guns.**

**3: A brace of Williams Brothers' machine guns.**

**4: Distinctive louvred grill dummy radiator in the nose.**




craftsmen, used to working in wood. The problems did not end there. In service, the D.1 proved ponderous and lacked the manoeuvrability of a successful fighter. It soon acquired the nickname "Blechesel", or donkey. It became obvious that it could not compete with the more agile Allied opposition. It was removed from front line scout service and shuffled off to maritime duties.

Overall, 41 D1s were built. At the time of the Armistice in 1918, the surviving D.1s were transferred to the Eastern Front. Only one example now survives. This is on display in the Musée de l'air et de l'espace. This is at Le Bourget Airport, near Paris. Despite its military shortcomings, almost a century on, the innovative and visionary Junkers D.1 remains a significant technical achievement.

## The Model

Richard Crapp is one of our very best scale modellers, with an international reputation. He has represented his country at numerous overseas scale competitions.

However, during a recent long scale project, Richard was looking for a bit of light relief. Consequently he decided to build a scale model from a commercial kit. He chose the *Balsa USA* Junkers D.1. This kit is designed to 1/4 scale, spans 88", and has a target weight of around 25 lbs. It also just so happened that Richard had a spare Laser 300 V 50cc glow engine in the shed. The die was cast! In Richard's terms, this was to be a quick-build project. He also refers to the project as *'sport scale'*, using commercial items such as *Williams Brothers*

**The good wide track undercart aids ground handling.**

machine guns and wheels, speeded up the process. In the end, he knocked out the model in just six weeks! If you look at the finished Junkers D.1 carefully, it confirms that - with care - you can build a characterful scale model from a kit. Encouragingly, this can be achieved in a fraction of the time it would take to finish a scratch-built project.

## The Plan
The kit and comes with the BUSA plan, which Richard followed with only minor departures.

## Documentation
The book 'Junkers D.1' by Seweryn M. Fleischer was used, which Richard highly recommends. He also used the *Windsock Datafile 33*, by Peter M Grosz, but describes the latter as interesting, but not essential. You can find both books on e-bay at the right price.

## Construction
The whole model is of conventional balsa and ply construction and the kit is very straighforward to build.

## Engine
Richard fitted a Laser 300 V twin 50cc glow engine. This supplies more than adequate power turning a 20"X10" XAOR wooden prop, whilst also conferring the Laser's legendary reliability. Richard notes that the engine should have 1.25 degrees down thrust applied.

A standard Laser exhaust unit is fitted, with a short home-made extension

## Undercarriage
This is as per the kit, and fitted with Williams Brothers WW1 period wheels. Scale bungee cord was used to maximize authentic scale effect .

## Covering
The surface skin of the whole model is covered in 1/2oz glass cloth, sealed with resin.

## Surface finish
The Junkers trade-mark surface skin corrugations are a key part of the Junkers D.1's appearance. Richard used the kit-supplied BUSA corrugations. These are made from vinyl.

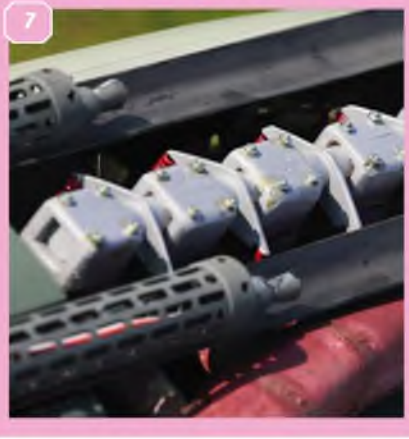
## Painting
Richard painted the model with *Klass Cote* scale paints, sprayed on.

## Legending / Decals
The decals supplied in the Balsa USA kit were used, although he did paint on some items.

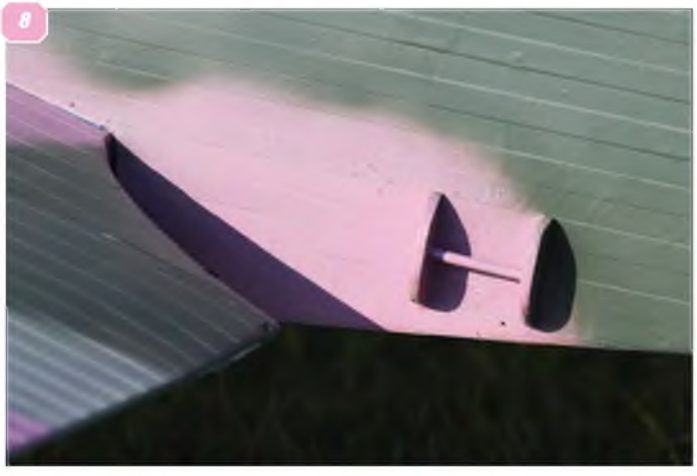
## Scale Guns
These are are Williams Brothers scale items in 1/4 scale.

## Scale Cockpit
The cockpit is furnished with a full set of home made instruments and fittings, with



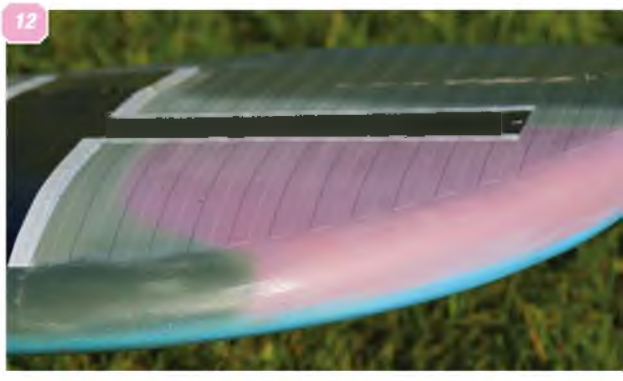



**5: Williams Brothers scale wheels helped speed the build. 6: Richard added scale bungee shock absorption. Bracing wires have scale terminations. 7: Dummy gun troughs either side of the dummy engine 8: Model has the foot rest aft of the wing. 9: Richard did his own lettering. 10 & 11: Distinctive wing panels with huge outboard ailerons. 12: The kit's simplified LE treatment works well.**









**14: Authentic roll-over bar behind pilot. 14: Sparse instrument panel is WW1 typical. 15: Small, flat plate windscreen would have provided pilot with minimal protection! 16: Commercial pilot in the office. Note neat cockpit edging.**

simulated metal corrugations in the cockpit area where such would be visible on the full size.

## Build Notes

Richard discovered that the engine should have 1.25 deg downthrust applied and anyone building the kit should do everything possible to keep the back end light. If not, like Richard, it could be necessary to add as much as 6 lbs of lead ballast at the front!

In addition, Richard notes that the CG should be set rather forward of the position shown on the plan. He also observes that *"... just about any engine will fit, and access is very good..."*. Amazingly, what he calls *"...simple construction..."* took Richard just six weeks to complete, paint, and finish. That's six weeks to get a scale model from a kit to this quality really is impressive.

**More than adequate power with a Laser 300 v / 50cc glow engine.**

*The D1 nicely displayed on a low wing-high fly-by.*

## Flying Notes

The full size was suprisingly fast, and could do 140mph at 20,000 feet according to some claims, although that is debatable. Armed with its Laser engine, Richard's D.1 model will easily fly scale circuits on half power.

The Junkers is very docile in the air and the only other remark Richard makes is that, since there are no flaps, landings have to be both steep and fast. At Old Warden last year the model looked very impressive in the air. Somehow it appears larger than quarter scale. Overall, a very unusual scale subject with real 'presence'. If you are in the market for s - it certainly stands out amid a plethora of WW1 biplanes. ■

## SPECIFICATIONS:

**Balsa USA Junkers D.1.**

**Scale:** 1/4
**Wingspan:** 88"
**Weight:** 26lbs
**Engine:** Laser 300 V 50cc glow
**Prop:** 20" X 10" Xaor wooden

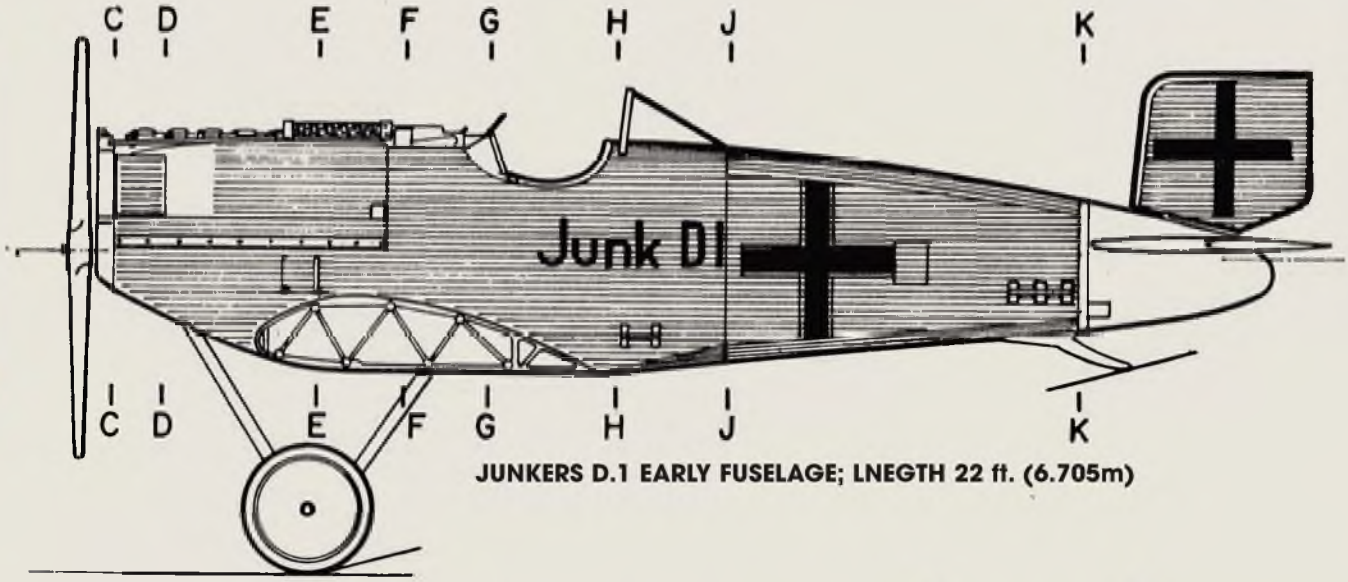
**The Kit:** Pegasus Models stock the Balsa USA kit at £325.
www.pegasusmodels.co.uk

**On-Line Build Blog:** Richard has a full build log of the D.1 on the *RC Scale Builder Forum*

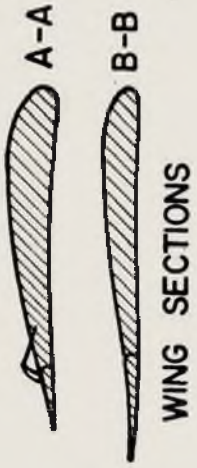


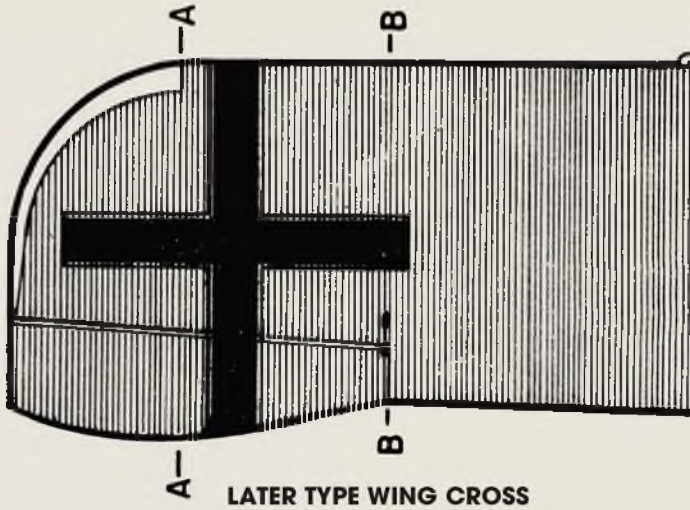
**17: The rear fuselage has the hand grips in place. 18: The BUSA kit deals with the tail end of the fuselage neatly. Note Richard's fishplate and fasteners on elevator.**

SCALE 1:40

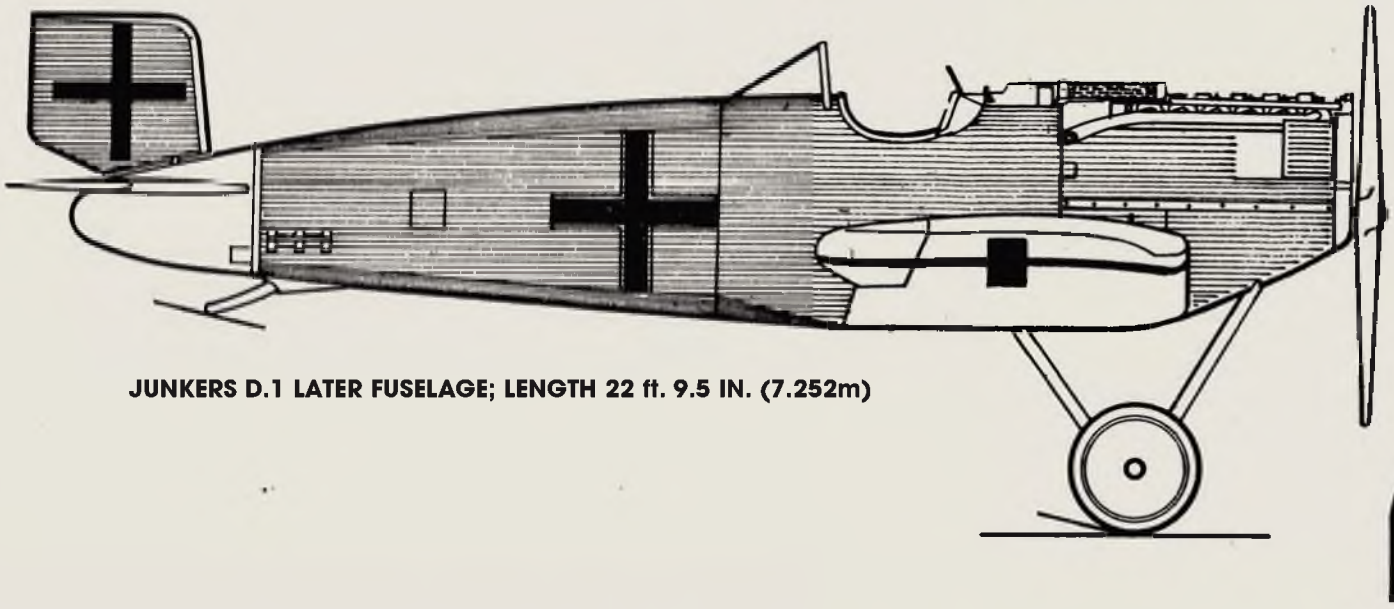



JUNKERS D.1 EARLY FUSELAGE; LNEGTH 22 ft. (6.705m)



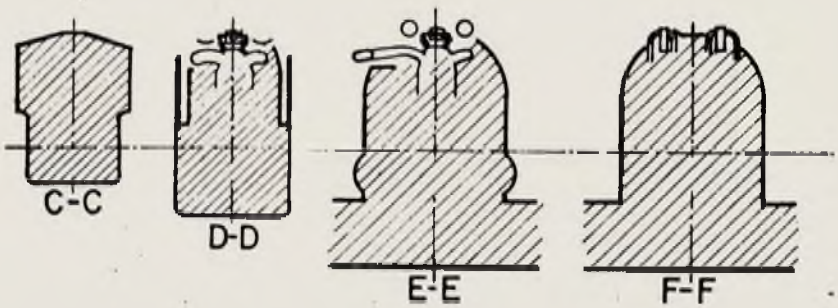



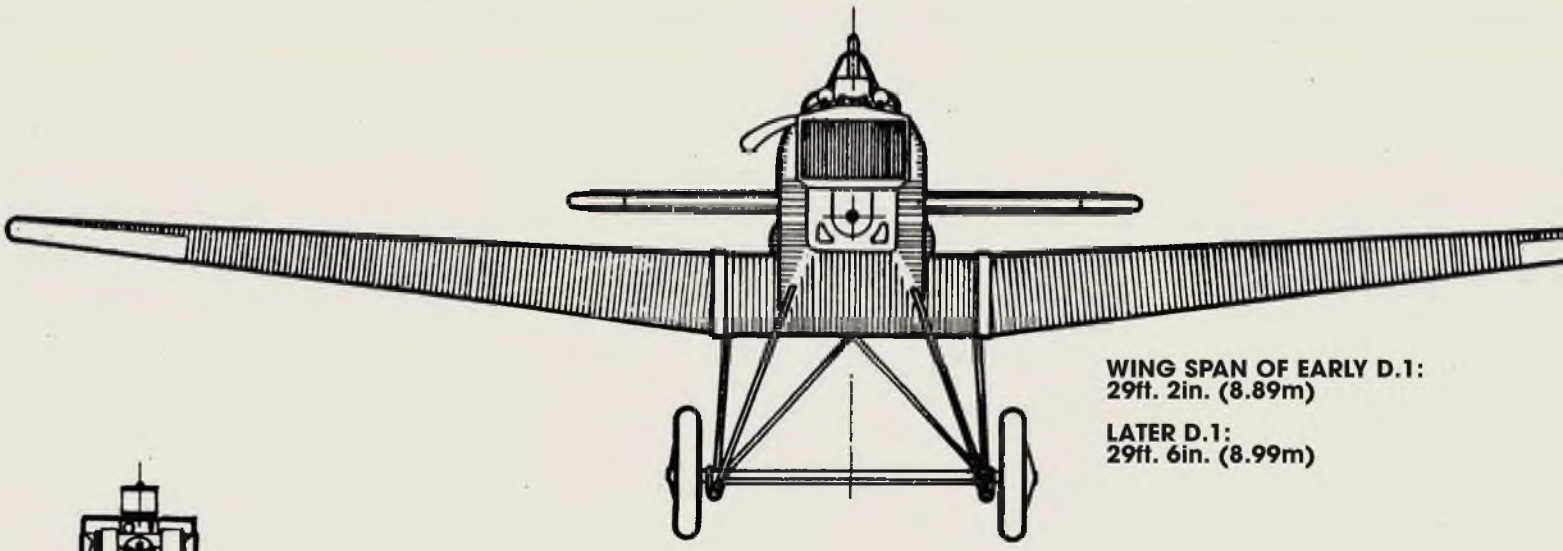

LATER TYPE WING CROSS



JUNKERS D.1 LATER FUSELAGE; LENGTH 22 ft. 9.5 IN. (7.252m)

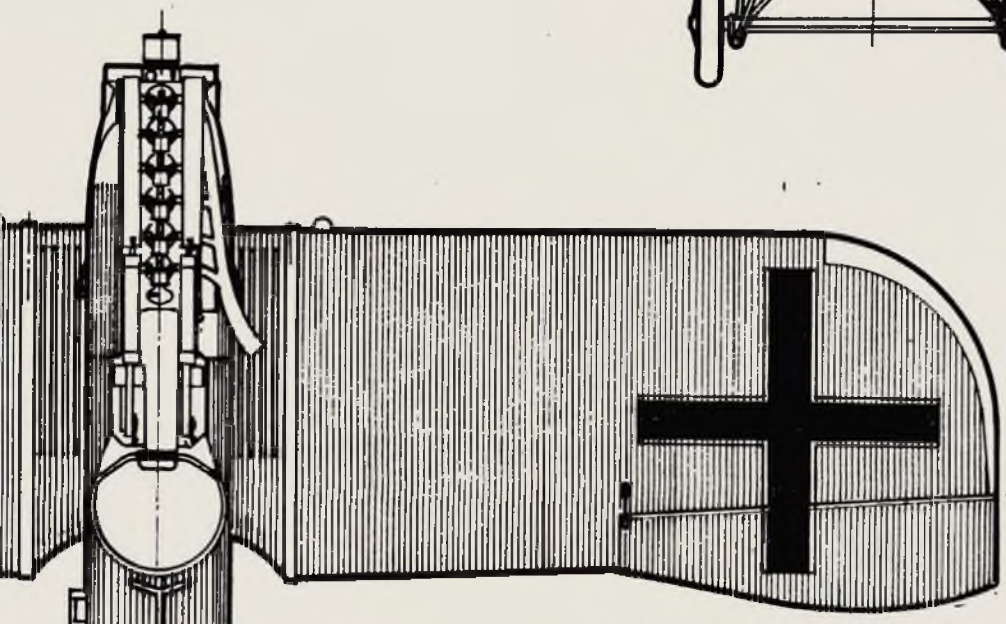
FUSELAGE SECTIONS





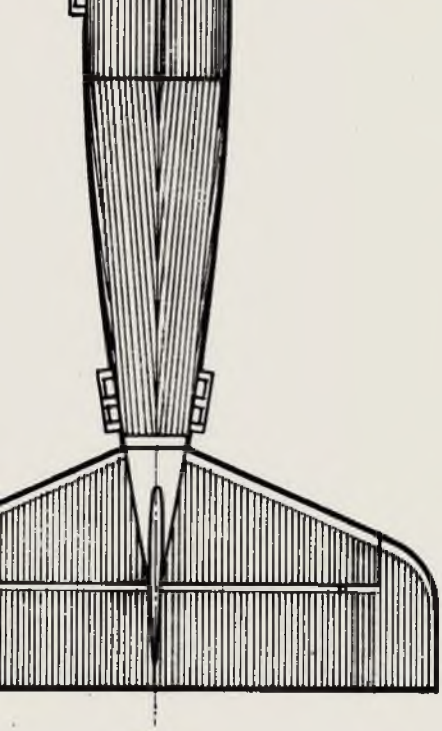
WING SPAN OF EARLY D.1:
29ft. 2in. (8.89m)

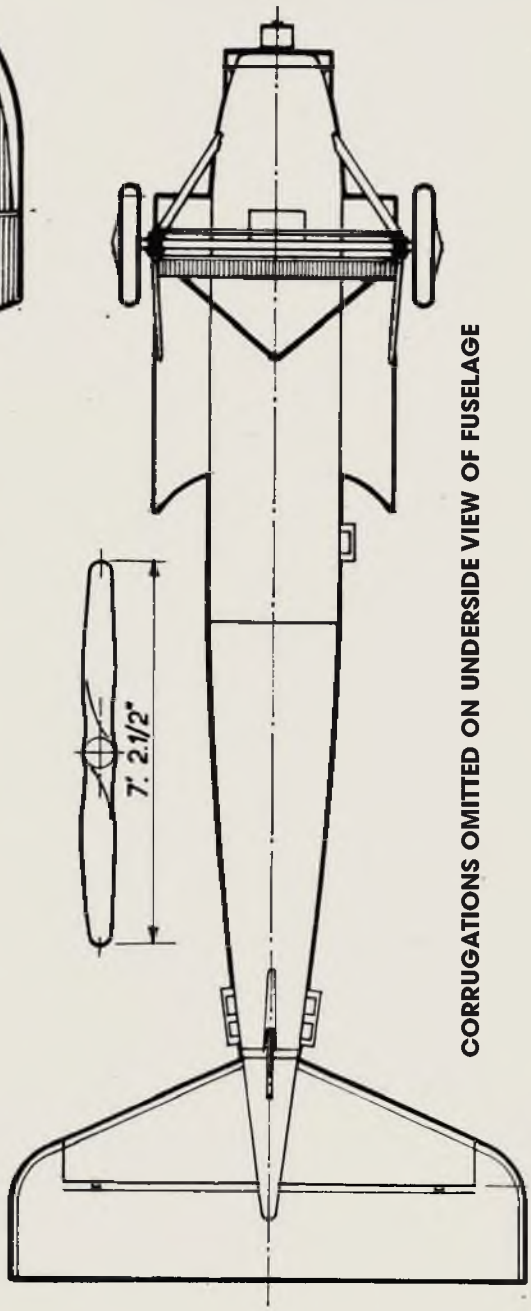
LATER D.1:
29ft. 6in. (8.99m)



EARLY TYPE WING CROSS

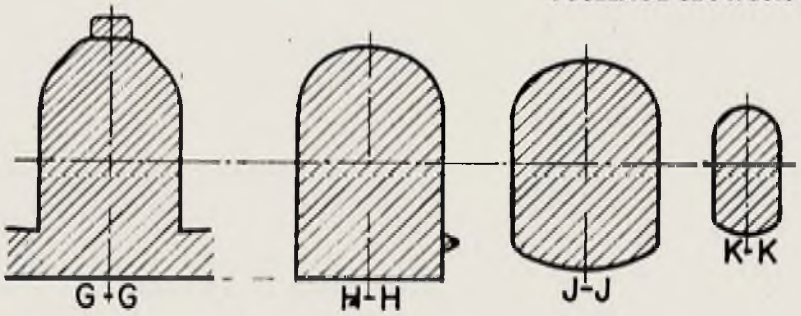
# JUNKERS D.1






CORRUGATIONS OMITTED ON UNDERSIDE VIEW OF FUSELAGE

FUSELAGE SECTIONS



# JUNKERS D.1

Like the Fokker D.VIII, the monoplane Junkers D.1 arrived too late to have any notable effect on air combat during WW1, but its designer can truly be credited for the advanced thinking that went into its design

**The second prorotype Junkers D.1, to which was applied the lengthend fuselage and experimentally installed Benz IIIb engine.**

It is seldom possible to write a description of an aeroplane without referring to the types which preceded or succeeded it. This is particularly true of the Junkers D.1 which is a most important milestone in the development of the modern aeroplane. Owing to its introduction during the last few months of the First World War in 1918, it has remained somewhat obscure and it was left for later types to make the name 'Junkers' famous throughout the world.

Professor Hugo Junkers was one of aviation's early outstanding pioneers. He first became interested in aerodynamics while Professor of Thermodynamics at Aachen University. By 1910 he had developed a thick aerofoil section in radical divergence from the thin sectioned airfoils that were the 'norm' for the period and made it possible to design a cantilever structure that would dispense with the external bracing used on all contemporary aeroplanes.

Owing to the pressure of other work, these ideas did not see realization in the shape of a finished aeroplane until the emergence of the Junkers J.1 of 1916. From this first type, the Junkers Company persisted with all-metal monoplanes (except the J.4 biplane), a formula which was not adopted by the majority of the world's aircraft manufacturers until twenty years later.

The experimental J.1 was followed by a single seater, the J.2 - six being built in 1916. With the radiator slung under the fuselage the side view was more appropriate to the early 1930s than the WW 1 period. Unfortunately, these machines came out very much overweight and were not a success.

Both the J.1 and J.2 had a thin metal skin. This apparently gave trouble in manufacture due to the skin becoming very badly crinkled and this must have caused almost as much drag as the omission of wires had saved!

It is likely that this problem, as much as the need for extra strength, led to the adoption of corrugated metal for the wing covering of the next type, the J.4, which as a biplane (Military designation Junkers J.I). The outer wings of this type were cantilever (as the monoplanes) and were braced. The corrugated skin became a feature of Junkers aeroplanes, particularly the civilian types that followed after WW1, the most famous of which was the Junkers Ju52

The next model to be built was the J.7 single seat fighter type, produced late in 1917. In its first form the J.7 had no ailerons but the wing tips, rounded in planform, pivoted about a central spar. The radiator

**Immediate predecessor for the Junkers J.9/D.1 was the J.7, of which this is the third variant with new ailerons and revised rudder shape. See here during the January 1918 Fighter Competition at Adlershof.**

was placed on top of the engine which obscured the pilot's forward view, while the exhaust, large even by German WW1 standards, gave the machine a very clumsy appearance. This detracted from the overall conception which was very advanced for the period.

The J.7 first flew in September 1917 but lateral control was poor and the pivoted tips were replaced by conventional ailerons. These also proved unsatisfactory and the prototype crashed while being flown by Anthony Fokker. However, it was rebuilt and appeared in January 1918 with square cut wings and balanced ailerons. A the same time, the radiator was moved to the front of the engine. Finally the front of the wing tips were given a generous radius.

In this fully revised format the production aircraft were given the Junkers type number J.9, the J.8 being a two seater developed in parallel with the J.7. The military designation for the J.9 became *Junk D.I*, a curious application of the 'D' abbreviation for *Doppledecker* which made the D.1 (officially at least) a biplane on common with the Fokker D.VIII which actually started life as the E.V! It appears that the letter 'D' was by that time generally used for fighter aircraft, its original derivation being disregarded.

The early production D.1s can be distinguished from the J.7 by the change in undercarriage design and by the crash pylon which replaced the headrest of the early machine. The 185 hp Benz engine replaced the 160 hp Mercedes and the twin gun installation was tidied up, but this did not affect the appearance.

After completion of the initial production batch, the fuselage was lengthened by 1 ft. 9.5in. for greater longitudinal stability. As the D.1 came into service so late in the War, few reports of combat action with the type have been recorded. Allied aviators who inspected captured examples after the Armistice appear to have been most impressed by their resistance to battle damage and by the fact that this aircraft could be left out in the open without appreciable deterioration. About 40 D.1s had been produced by the end of hostilities.

Both the D.I and the two-seat (pilot and gunner in tandem cres positions) CL.I ground attack version saw action against the Bolsheviks in Eastern Europe but little is known of activities during that confused period.

As with most 1914/18 aircraft, various performance figures have been published some crediting the D.1 a top speed of 145 mph which seems unlikely; its weight was 1,439 lbs, and when loaded, 1,840 lbs while the accepted top speed was 119 mph. ■

**This may be the first production Junkers D.1. which carries a three-tone 'dappled' camouflage scheme for the upper surfaces most probably dark and pale greens, plus mauve.. Undersurfaces will have been sky blue**

**View showing the internal structure of the J.9/D.1 wing in which he thick wing section is formed by vertical diagonal braced attached to multiple upper and lower surface tubes to support the aerofoil shape.**

**Sole survivor. The only known surviving Junkers D.1 is held, on display at the Musee de l'Air et de l'Espace at Le Bourget airport, Paris.**

# D.1 REPLICA

**A few replica variants of the Junkers monoplanes exist, some fully flyable. This static example built to the true authentic shape of the definitive D.1 is displayed at the Berlin-Gatow aviation Museum in Germany.**


PHOTO 1


PHOTO 2


PHOTO 3

**Photo 1:** This shot into the cockpit shows the very basic instrument panel; in this replica it is wooden. **Photo 2:** The corrugations on the fuselage sides. **Photo 3:** The front cowling with the radiator in the upper section and the two intakes below, note the use of the corrugation edges for the demarcation. **Photo 4:** The vertical fin (no rudder) and the elevators, note the flat skinning for the tailcone section. On this replica the corrugations of the elevators match those of the tailplanes. The front cowling with the radiator in the upper section and the two intakes below, note the use of the corrugation edges for the demarcation. **Photo 5:** The ailerons, with the crosses painted over wing and aileron. Once again the corrugations on ailerons of this replica match those of the wing.


PHOTO 5


PHOTO 4

# BMFA FREE FLIGHT SCALE INDOOR NATIONALS

Tom Daly enjoys an action-packed day at this annual indoor scale jamboree

The BMFA F/F Indoor Scale Nats comprises six main contests, held in one day. This delivered an exceedingly busy schedule, with a great turnout of models and pilots. If you were attending for the first time, you would conclude that British F/F Indoor Scale competition was very healthy indeed.

## The Pits

The large hall is divided into a flying space and an extensive pits area. The latter was full of work tables for competitors, packed with models and arcane indoor flying paraphernalia. It was noticeable that there was enthusiastic co-operation and cameraderie all day. Besides the UK scale modellers, there was also a determined contingent of Dutch aeromodellers, who gave the event an international flavour.

## The Models

For many attendees it is the models, not the builders, which are the stars and this year there were some very attractive and unusual scale models to enjoy in all classes. The first to demand

Peter Iliffe's perfect new Fokker Spinne.


Kit Scale Waco Coast by Chris Blanch.

Roel Lucassen's Peanut Baumer Sausewind

Peanut scale Bristol Scout by Ralph Sparrow.


John Bowerman's Druine Turbulent in Peanut class.

attention was a clever, neat, and utterly off-beat Pistachio model. This was John Holman's Stits Baby Bird, an ultra-low aspect-ratio flying subject modelled to 1:16 scale. It weighed 11 grams, and flew astoundingly well with such stubby flying surfaces.

Another muchl-observed model was Alasdair Deas's Peanut Waterman Gosling. This was complete right down to a tiny engine gauge protruding on an external pipe; astounding, at this tiny scale. Noted scale builder John Valliant has his own method of foam construction, and never disappoints. His new Focke Wulf 190D in Peanut scale looked simply stunning - an amazingly demanding colour scheme, too. What is more, it flew exceptionally well.

A striking model which arrested the eye was Laurie Kirby's large Open Rubber Ryan STA. This was built from the Bill Galloway plan and looked utterly magnificent. Another large and impressive rubber model was Mike Stuart's Blackburn Shark. Trimmed to perfection, this flew very convincingly, and very safely, within the confines of the hall. Bryan Stichbury's Andreason 4b (Pistachio) also caught the eye with a very happy and colourful scheme.

Scale maestro Peter Iliffe has built another Fokker Spinne (Spider) and this one also flew remarkably well. It really is an exquisite flying model, which looks lighter than air. Noted scale man Bryan Lea was flying a new and beautifully finished Velie Monocoupe. The Monocoupe is an endlessly popular scale subject, and they always seem to fly well. This one is very well detailed too. Kevin Wallace's Flybaby Bipe, was also very appealing. This seemed quite large for an indoor bipe at 23" in wingspan, but it only weighs 85 grams. It is electric powered, using Kevin's new SAMS electroflite unit. (Keen modeller Kevin owns SAMS Model Supplies). This Flybaby looked smashing with some clever 3D printed parts. It did well in its competition class too.

## The Comps

Frankly, there was too much going on to make sense of each competition, and I also spent happy hours cruising the pits, noting down interesting models. I will offer here just a brief synopsis of the six event classes, and thence I refer you to the attached BMFA Official Results Tables.

## Father and Son Teams

It was good to see youngsters in the competiton. This year there were two 'Dad-and-Lad' Teams competing in Kit Scale: Richard Crossley and son Jim, and Andrew Darby with son James. Both lads did very well indeed, and this is a very encouraging trend. Jim Crossley placed 13th with his Piper Vagabond, and James Darby placed 24th with his Cessna 182.

## Open Rubber

All three Top Podium pilots in this class cracked the 3,000 points barrier, though Monz Lyons' immaculate Pitts Special also came very close. Third Place went to Richard Crossley's immaculate Lockheed Vega. Second was Mike Hadland with his Stampe SV4B. Top Podium went to Mike Stuart with his wonderfully reliable DH Fox Moth. There were eleven entries in this class.

John Valiant all foam construction Focke Wulf 190-D Peanut.

Stits Baby Bird by John Holman. 1:16 scale, weighs 11 grams. Pistachio class.

Alasdair Deas' Laird Turner Meteor.

Alasdair Deas' Waterman Gosling.


Dave Bank's scale pilots - incredibly good, plus incredible value.

Pete Smart's Prestwick Pioneer.

## Co2 / Electric

Richard Crossley's immaculate electric powered Piper Tripacer had stiff competition from Pete Smart's very ambitious multi-engined Avro Lancaster. Static scores were very good for both airframes. However, also note that fourth place Graham Banham's Cessna C-37 also did remarkably well in that regard. In the end Richard Crossley triumphed, with Pete Smart on his heels. Kevin Wallace's aforementiond Bowers Flybaby placed Third. There were seven entries this year.

## Peanut

Nineteen entries this year reaffirmed this class's popularity. As usual, there was a wonderful variety of airframes, sporting some very snazzy schemes. John Bowerman's lovely Turbulent did well

**The Walsall University Sports Centre has an impressive main hall.**

Pete Smart's RE8 banking down to land.

Jim Crossley Piper Vagabond. Thomas Designs's Plan, Wingspan 13cms, weighs 14grams.

Mike Hadland's latest Bucker Jungmann. New this season.

Laurie Kirby's large Open Rubber Ryan STA. Magnificent.

and placed Third. Mike Stuart's little-modelled Blackburn Ripon placed Second, but once again Mike Hadland triumphed with yet another Bucker Jungmann. This is an all-new version this season, blessed with a very fresh-looking scheme.

## Pistachio

You might think that these tiny Pistachios are too small to perform well, but that would be a fatal misconception. Andy Sephton's Lacey M-10 flew very well indeed and placed Second, but was pipped to the post by Garry Flack's superb Westland Wyvern which turned in better static scores. Chris Blanch's very pretty Bowers Flybaby placed Third. There were twelve Pistachio entries in total this year.

## Glider

Six entries for indoor glider this year, extending from the perhaps expected high aspect-ratio Slingsbys and Kirkbys, to Peter Fardell's iconoclastic Lilienthal Glider. Peter Smart's Slingsby Falcon indeed took First Place, and Brian Lever's fine Kirby Prefect came Second. However, Peter Fardell's Lilienthal broke the mould and came a creditable Third, beating the remaining the Kirbys and Slinsgbys.

## Kits Scale

With no fewer than 37 entries, Kit Scale has now easily become the largest FF Indoor Scale Nats Competition. It is not

Open Rubber Lockheed Vega by Richard Crossley.

FF Indoor Scale Pylon Racing gets a bit frenetic.

Jim Crossley and Dad Richard un-entangle their Pylon racer.


James Darby's Kit Scale Cessan 182.


James Darby and his Kit Scale Cessan 182.


Monz Lyons with her Fokker D VII.

hard to see why. The models are familiar, highly attractive, and very practical. They can be built easily over the winter, and they are usually not too tricky to trim out. Also, they have a high "Nostalgia Index". This year Monz Lyons was triumphant with her quite large Fokker DVII. Very good static and flying scores combined to give her a commanding lead. Mike Stuart' intriguing Blackburn Shark was the runner up, with Mike langford's DH Leopard Moth taking Third Place. In truth, their seemed to be Kit Scale Models on every table, and this ascendancy can only continue.

## Indoor Scale Pylon Racing

To lighten the tone, there is actually a Seventh Competition: the 'Wacky Races' of Indoorism. I speak of course of the Free Flight Scale Indoor Pylon Race. Now, to dignify this Demolition Derby as a true race is rather to miss the point. It is mad fun, with suitably droll (and deadpan) delivery from the inimitable Peter Smart. Everone tries to stay in the air whilst orbitting a series of helium filled ballons, anchored down by (full) beer cans. Highly eventful, and very, very, amusing.

## Summary

Kit Scale is now a force in the land. Most observers expect entries to grow next year.
Peanut

Mike Stuart's Blackburn Ripon climbing out.

Lots of comps required lots of Judges: this is Ron Johnson in Kit Scale.

Monz Lyons' Pitts Special.

Piper Super Cub on a low pass.

Electric Power in Richard Crossley's Piper Tripacer.

Chris Strachan about to launch his beardmore Wee Bee.

## RESULTS

**OPEN RUBBER**

| | |
|---|---|
| 1 Mike Stuart | DH83 Fox Moth |
| 2 Mike Hadland | Stampe SV4B |
| 3 Richard Crossley | Lockheed Vega |

**CO2/ELECTRIC**

| | |
|---|---|
| 1 Richard Crossley | Piper Tri-Pacer |
| 2 Peter Smart | Avro Lancaster |
| 3 Kevin Wallace | Bowers Flybaby |

**PEANUT SCALE**

| | |
|---|---|
| 1 Mike Hadland | Bucker Jungmann |
| 2 Mike Stuart | Blackburn Ripon |
| 3 John Bowerman | Druine Turbulent |

**PISTACHIO**

| | |
|---|---|
| 1 Garry Flack | Westland Wyvern Regar |
| 2 Andy Sephton | Lacey M-10 |
| 3 Chris Blanch | Bowers Flybaby |

**GLIDER**

| | |
|---|---|
| 1 Peter Smart | Slingsby Falcon 1 |
| 2 Brian Lever | Kirby Prefect |
| 3 Peter Fardell | Lilienthal |

**KIT SCALE**

| | |
|---|---|
| 1 Monz Lyons | Focker D VII |
| 2 Mike Stuart | Blackburn Shark |
| 3 Mike Langford | DH Leopard Moth |

remains healthy, and Indoor Glider is finding its feet nicely. The other classes have their devotees and look secure. As to the overall event, it must be said that this year it felt very positive, energetic, and upbeat. It was efficiently organised by John Minchell and his Team. John always sets the overall tone of a civilised and "Can Do" event. Do not miss next years's event! ■

Bryan Stichbury's Andreason 4b Pistachio mid flight.

Bryan Lee's Aerographics Velie Monocoupe.


Kevin Wallace and his Flybaby Bipe.


Bryan Stichbury's Andreason 4b Pistachio class.

In close-up, Bryan Lee's Velie Monocoupe reveals excellent detail.


Kevin Wallace's Flybaby Bipe, 23" span, weighs 85 grams. SAMS model electroflite unit.

# LAVOCHKIN LA-5

One of the Soviet Union's lesser-known fighters of WW2, this handy little machine proved h

In 1938, the Soviet Government ordered an aircraft design competition for the express purpose of providing successors to Polikarpov's I-15 and I-16 fighters, with emphasis upon ease of production and the use of non-strategic materials. In this latter requirement, the Lavochkin bureau had a head start, for Semyon Lavochkin and his associates Gorbunov and Gudkov had been experimenting for some time with the bonding of laminated wood veneers by phenol-formaldehyde resin.

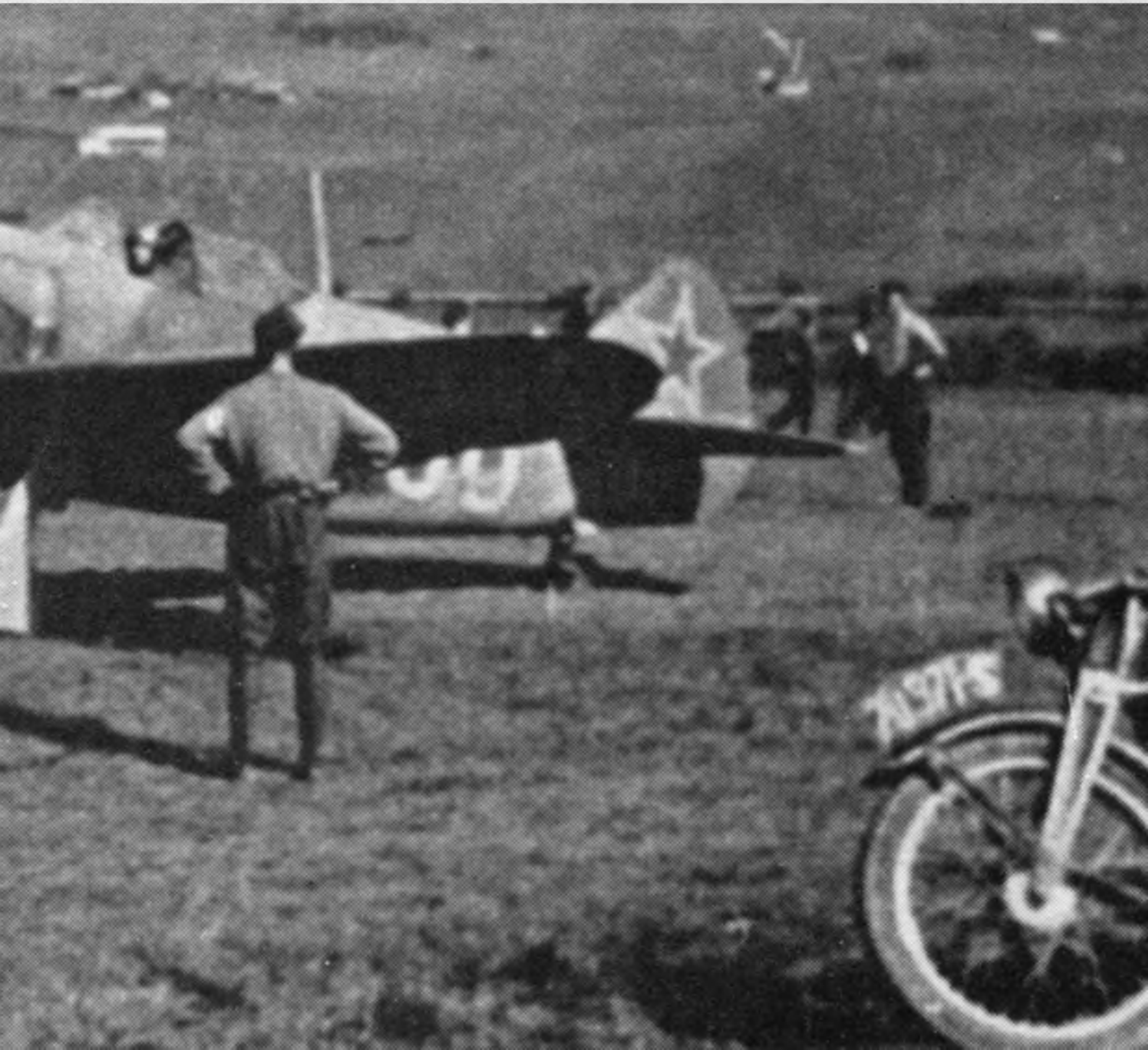
The experiments had reached an advanced stage of success by 1937

# G & LA-7

ighly effective

and a fighter aircraft was built for the competition, utilising the new material. This was the Lavochkin I-22, a low wing monoplane powered by the 1,000 h.p. M-105 liquid-cooled in-line engine. The other contenders were Mikoyan's MiG-I, Yakovlev's Yak-I, and the I-28 designed by Yatsenko, which also featured chemically-bonded veneer in its construction. The I-28 was rejected, while the other three aircraft became prototypes for a whole range of second-generation Soviet fighters.

**BELOW: One of the most fascinating actions of the later WW2 period on the European Eastern Front, was the air operations flown against German forces from Tri Duby, Slovakia in German-held territory TO support a Slovak National Uprising. The German forces were completely unaware of the establishment of the base, from which effective raids were launched against German airfields. The terrain illustrated here was typical of that from which the Lavochkin fighters operated.**



**This late production Lavochkin La-7 seen at the Prague Museum in Czech Republic is a restored example. Rear three-quarter view reveals the tight wing-to-fuselage fairing and the elevator hinge arrangement. Tailwheel unit is fixed, the retraction factity having been deleted earlier in the series to avoid problems with mud clogging the tailwheel well.**

**This view of the Lavochkin La-7 at the Prague Museum reveals the minimalist airframe, tailored to a lightly cowl engine.**

## A fighter is born

The I-22 entered limited production as the LaGG-I being issued to the fighter regiments in 1940, and a modified version, the I-301/LaGG-3, powered by the M-l05PF engine, followed in late 1940. Structurally, these aircraft were a great achievement, but operationally they were not, the pilots soon claiming that 'LaGG' stood for three Russian words meaning *'varnished guaranteed coffin'*! This unhappy situation was only remedied in part by a series of modifications as Lavochkin urgently sought some means of saving his fighters from relegation to the training units.

There was no time for a complete redesign now, for on June 22nd, 1941, Germany invaded the Soviet Union, and in the first nine hours of battle some 1,200 Russian aircraft were destroyed. Acting on impulse, Lavochkin ordered an example of the new Shvetsov M-82 radial engine, developed from the Wright Cyclone and offering 1,600 h.p. It arrived in October 1941 and immediately the whole bureau commenced intensive design studies to ascertain if the LaGG-3 airframe would accept a radial engine.

After many sleepless nights, success was achieved. The M-82 was close-cowled in order to reduce drag to a minimum and further compensation came with the reduction in weight occasioned by removal of the M-105 cooling system cowlings, engine bearers and oil system. Coincident with this work came the retirement of Gorbunov and Gudkov from the bureau; thus the official designation of the new aircraft was recorded as La-5.

## Stalingrad

The La-5 replaced the LaGG-3 on the production lines during the summer of 1942, 1,129 aircraft being completed by the end of the year, and production La-5s reached the fighter regiments in the Autumn, just in time for action at the Battle of Stalingrad. Here, they earned the title of *'Wooden Saver of Stalingrad'*, and a Stalin Prize for Lavochkin.

The main production of the La-5 took

**Simple in design and rugged in construction, the La-5 and La-7 fighters proved to be perfect low-altitude fighters for ground support operations during WW2 of the Eastern front.**

place at State Aircraft Factory No. 21, home of the Lavochkin bureau and many improvement modifications were made at the factory. The standard armament was two 20 mm ShVAK cannon, mounted in the upper cowling and synchronised to fire through the propeller arc; these guns were belt-fed, delivering 950 rounds per minute each. A few pre-production aircraft were designated LaG-5, retaining the unchanged rear fuselage of the LaGG-3, with its canopy faired to the fuselage decking, but all the La-5s had cut-down rear fuselages and framed bubble-type canopies for 360-degree pilot vision.

In March, 1943, a new sub-type was introduced as the La-5FN, powered by the 1,650 h.p. M-82FN engine; 'FN' being the initial letters of two Russian words meaning 'directly boosted'- i.e. direct fuel injection. This model featured a large intake scoop above the engine cowling, a slightly increased wingspan and reduced wing chord, automatic leading-edge slats, and underwing mountings stressed to accept rocket rails for four RS-82 (82 mm) missiles or racks for two PTAB hollow-charge anti-tank bombs.

A modification made universally to most aircraft, La-5s, La-5Ns and the later La-7, was the locking down of the retractable tail wheels, the mechanism of which did not take kindly to the ingress of mud. Less obvious modifications were the replacement of some wooden airframe structure with metal and the fitting of lower capacity fuel tanks. A further reduction in weight was made by lighter structure undercarriage components. The result of all this work had its effect in making the La-5FN 350 lb. lighter than the La-5, with consequent improvement in performance.

## Low down at Kursk

Most Russian fighters were designed for operation at altitudes below 18,000 ft. for, unlike the air strategy employed in Western Europe and elsewhere, the Russian use of air power was almost entirely in support of the Red Army. A good example of this may be found in the gigantic tank battles around Kursk during July 1943, where La-5FNs joined the Ilyushin IL-2m3 'Sturmoviks' in a violent attack against German armoured columns, then climbed a few thousand feet to act as top cover. The Luftwaffe Me 109s and Fw 190s were, therefore, compelled to fight at low level, far below their best operational height, finding themselves completely out-manoeuvred and outfought by the nimble Lavochkins. Additionally, the La-5FN was capable of absorbing severe battle damage and very few went down in flames owing to the fact that their fuel tanks were armoured, self-sealing, and 'topped-up' with inert gases from the exhaust system.

In 1944, an improved version of the La-5FN joined its predecessor on the production lines and later in the fighter regiments. This was the La-7, powered by the M-82FNV engine and slightly altered in appearance by repositioning of the air intakes, simplification of the centre section leading edge, and the introduction of 'D' doors to completely cover the retracted undercarriage. The leading Russian fighter

## ENGINE COWL

The large access panels on the engine cowls in the La-5 made maintenance work easy. The cooling shutters one either side of the fuselage just behing the cowl rear were each one-piece units, rather that multiple 'petals'.

**ABOVE LEFT:** Near head-on view reveals the engine fan just behind he propeller, not unlike one of its primary adversary, the Focke Wulf 190A. Note also the wide track main undercarriage, ideal for the rough-field conditions from which the type operated in support of the Soviet Army in its push westward through eastern Europe. **ABOVE RIGHT:** Sharply tapered wings were a feature of the La-5 and La-7. All control surfaces were fabric covered.

**A further view of the Lavochkin LA-7 preserved at Prague. The tightly cowled engine and clean aerodynamic shape, confirm the visual effect of a tough little bruiser of a fighter aircraft.**

**In its original format the La-5 purpetuated the fuselage shape of the previous LaGG-3 on which the cockpit canopy faired into the rear fuselage shape.**

ace, Ivan Kojedub, scored his last 17 victories while flying the La-7 type and his aircraft is now preserved in Moscow.

## Ace-maker

In common with a few top aces, Kojedub was permitted to have his aircraft somewhat more colourfully decorated than the usual camouflage scheme and white numerals, but there is some doubt that the present colouring represents the original. There is also some doubt concerning the armament of the La-7. Various sources quote three 20 mm or 23 mm cannon, with the third gun mounted on the port side. Extensive research has failed to find any supporting evidence for this installation, although it is probable that an La-7 was used for armament tests concerning a later development, the La-9, which did have such armament and

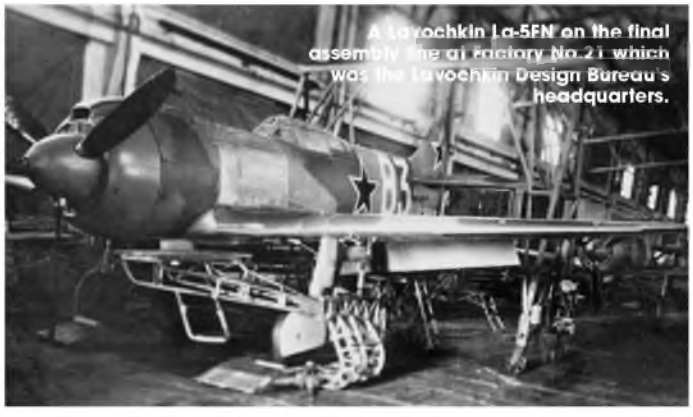
**Typical Eastern Front airfield scene with La-5 in foreground, with groundcrew. The aircraft in the background is either a Lend-Lease Douglas C-47 (for which the Russians, like everything else they were given, never ever paid!) or one of the 'reverse-engineered' copies the Ruskies made - although the former is most likely.**

Another example of the original La-5 with cockpit-to -rear fuselage fairing. Here, aircrew of the 159th IAP (Fighter Regiment) prepare for a mission in the Spring of 1943. Note the name 'Valeriy Tchkalov squadron' inscription of the fuselage.

saw service during the war in Korea from 1950.

Both La-5FNs and La-7s formed the equipment of the Czech Mixed Air Division, formed in the Soviet Union in June, 1944, and in September that year this unit flew from airfields behind the German lines, in support of the Slovak Uprising. After the war, the Division became the nucleus of the new Czech Air Force. One La-7 is preserved at the Prague Air Force Museum, following complete refurbishing by a group of enthusiasts and original display in the Prague Technical Museum.

Both the La-7 and the La-5FN were modified for use as fighter trainers, with the usual designation of UTI, by the addition of a second cockpit, repositioning of the aerial mast and removal of one of the two guns. Every fighter regiment had at least one UTI aircraft, and at times of intensive action these machines were used for operational flying. ■



A Lavochkin La-5FN on the final assembly line at Factory No.21 which was the Lavochkin Design Bureau's headquarters.

**FACTORY FRESH! LAVOCHKINS:**
**La-5FNS at the factory airfield awaiting delivery to a front line unit**


Wing slat detail, open position.

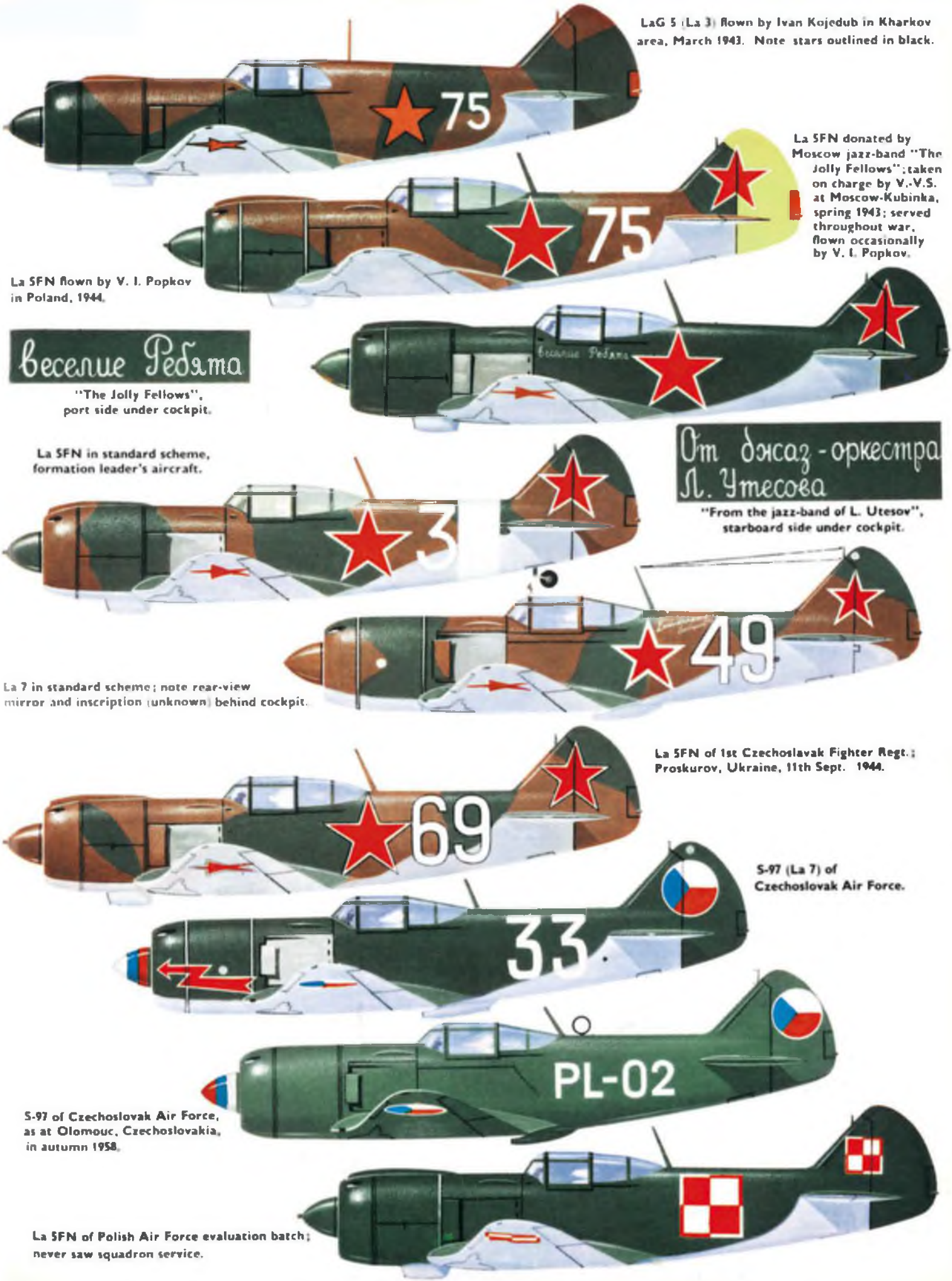
"In the name of Hero of the Soviet Union Lt. Col. N. Koniyev" (under cockpit, port side).

"From collective-farm worker Vassili Koniyev" (under cockpit, starboard side).

От члена колхоза Василия Конева

Имени Героя Советского Союза подполковника Н. Конева

**LAVOCHKIN La 5FN** ***(Forsirovannyi Nyeposredstvenno)*** **flown by Ivan Kojedub between 2nd May 1944 and mid-July 1944. Kojedub achieved 62 aerial victories in 520 sorties on Lavochkin fighters; he thus qualifies as the top-scoring ace of any Allied nation in the Second World War.**




LaG 5 (La 3) flown by Ivan Kojedub in Kharkov area, March 1943. Note stars outlined in black.

La 5FN donated by Moscow jazz-band "The Jolly Fellows"; taken on charge by V.-V.S. at Moscow-Kubinka, spring 1943; served throughout war, flown occasionally by V. I. Popkov.

La 5FN flown by V. I. Popkov in Poland, 1944.

"The Jolly Fellows", port side under cockpit.

La 5FN in standard scheme, formation leader's aircraft.

"From the jazz-band of L. Utesov", starboard side under cockpit.

La 7 in standard scheme; note rear-view mirror and inscription (unknown) behind cockpit.

La 5FN of 1st Czechoslavak Fighter Regt.; Proskurov, Ukraine, 11th Sept. 1944.

S-97 (La 7) of Czechoslovak Air Force.

S-97 of Czechoslovak Air Force, as at Olomouc, Czechoslovakia, in autumn 1958.

La 5FN of Polish Air Force evaluation batch; never saw squadron service.

# LAVOCHKIN FLYING COLOURS

Flying Scale Models
Original Artwork by Richard J. Caruana
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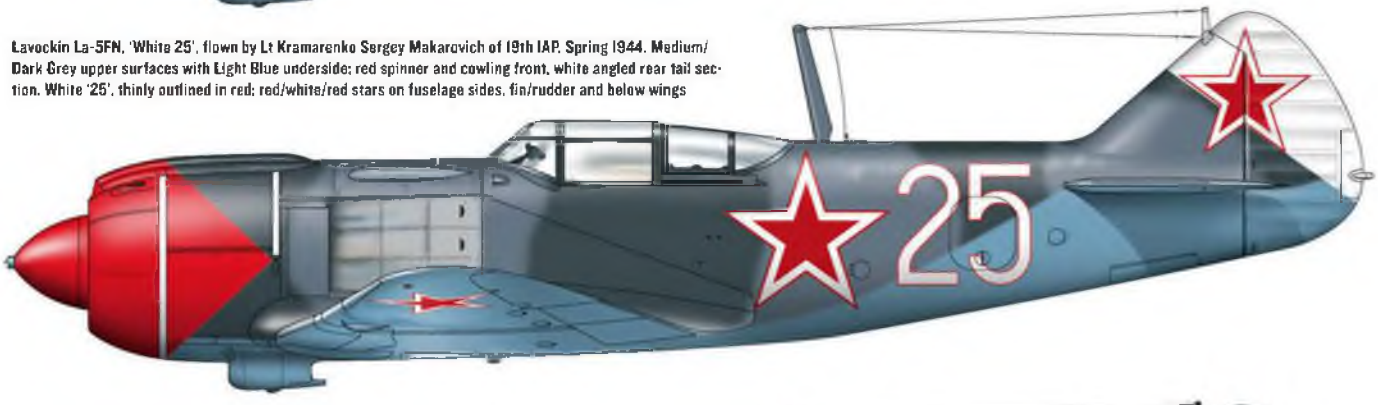
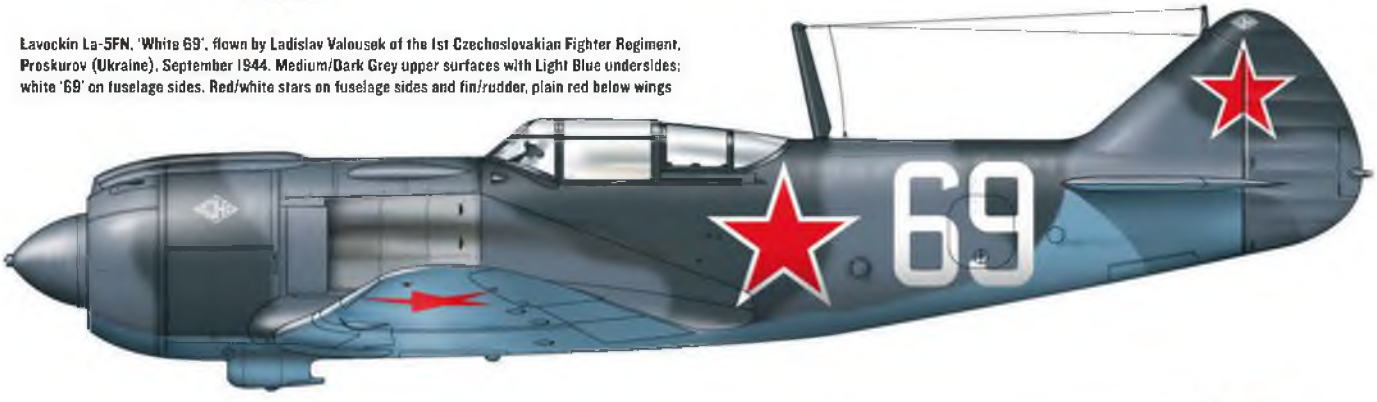
Lavochkin La-5FN, 'White 52', *Mongolsky Arat*, flown by Captain N.P.Pushkin of 2nd GvIAP, September 1943. Medium/Dark Grey upper surfaces with Light Blue undersides; red stars, outlined in white, on fuselage sides and fin/rudder, plain red below wings. White '52', thinly outlined in red; yellow engine cowling front

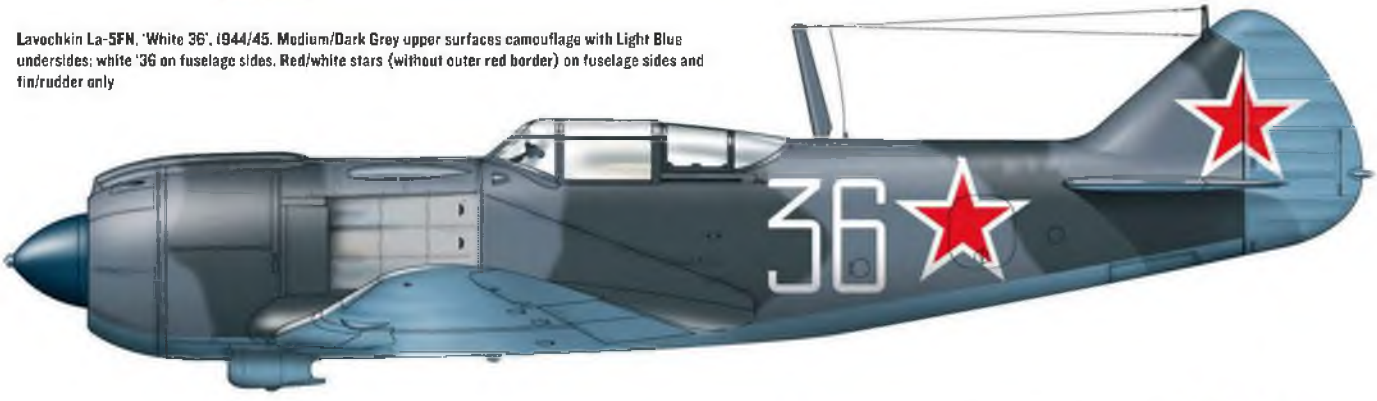

Lavochkin La-5FN, 'White 25', flown by Lt Kramarenko Sergey Makarovich of 19th IAP, Spring 1944. Medium/Dark Grey upper surfaces with Light Blue underside; red spinner and cowling front, white angled rear tail section. White '25', thinly outlined in red; red/white/red stars on fuselage sides, fin/rudder and below wings




Lavochkin La-5FN, 'White 69', flown by Ladislav Valousek of the 1st Czechoslovakian Fighter Regiment, Proskurov (Ukraine), September 1944. Medium/Dark Grey upper surfaces with Light Blue undersides; white '69' on fuselage sides. Red/white stars on fuselage sides and fin/rudder, plain red below wings




Lavochkin La-5FN, 'White 36', 1944/45. Medium/Dark Grey upper surfaces camouflage with Light Blue undersides; white '36 on fuselage sides. Red/white stars (without outer red border) on fuselage sides and fin/rudder only




Lavochkin La-5FN, OP-13, Czechoslovak Air Force, Malacky (Slovakia), 1945. Dark Brown/Dark Green upper surfaces with Light Blue undersides; code in white on fuselage sides, repeated in black below wings. Red spinner, national markings in six positions, with the blue segment always facing forwards and the white segment above and below the wings facing towards the wingtips

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The later, 'cleaned-up' version of the famous Piper J-3, with more elegant engine cowl. Two examples shown. (80 images)

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The advanced trainer aircraft that served in many air arms worldwide and also became a counter-insurgency ground attack aircraft. Examples illustrated are from France, where the type served for many years as the 'Fenec'. (100 plus images)

**North American P51D Mustang CD79**
The definitive bubble canopy Merlin Mustang. In detail, showing several restored examples. This is the Fantasy of Flight Museum's overpolished example, but the close-up detail is all there. (102 images)

**North American P51B/C CD78**
First of the Rolls Royce Merlin engined Mustangs, this collection depicts the Fantasy of Flight Museum's restored example, with overly polished plain metal surfaces. Much detail. (102 images) Also, 41 images of The Fighter Collection's P-51C in bare metal restoration, showing much surface and internal airframe detail. A real bumper bundle! (over 140 images)

**North American B25 Mitchell CD77**
Fantasy of Flight Museum's example. Photographed soon after superb restoration. Full nose to tail detail. (74 images)

**North American AT6 Harvard CD76**
AT-6, SNJ, Texan, Harvard – call it what you will. 55,000 were built – this example is in U.S. Army colours, with comprehensive close-up detail, nose to tail. (76 images)

**North American A36 Invader CD75**
The ground attack variant of the Alison engined P-51A. Photos, in detail, of the world's only airworthy example. (69 images)

**Morane Saulnier MS406 CD74**
French WW2 fighter that fought in the Battle of France, 1940. Swiss restored example (92 images)

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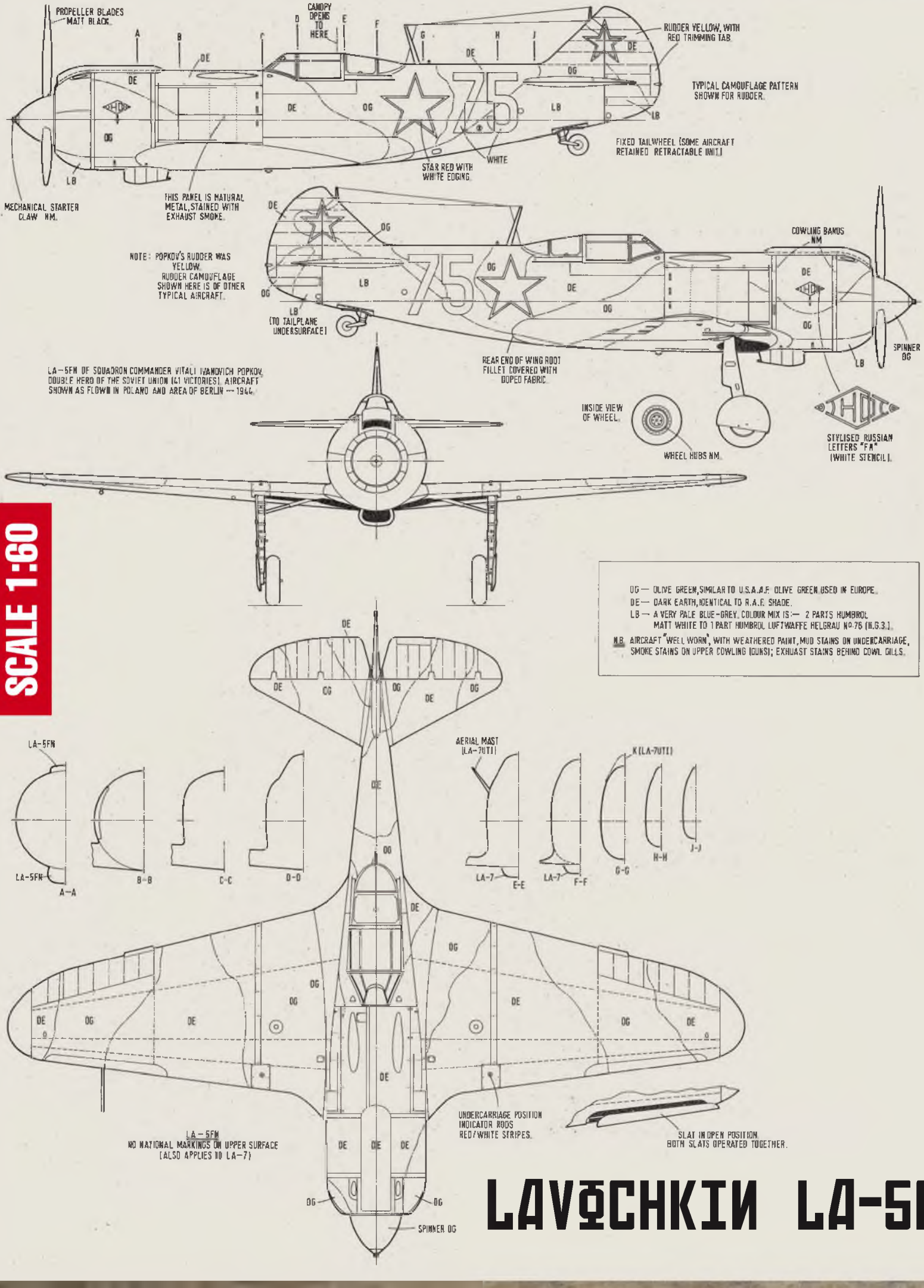
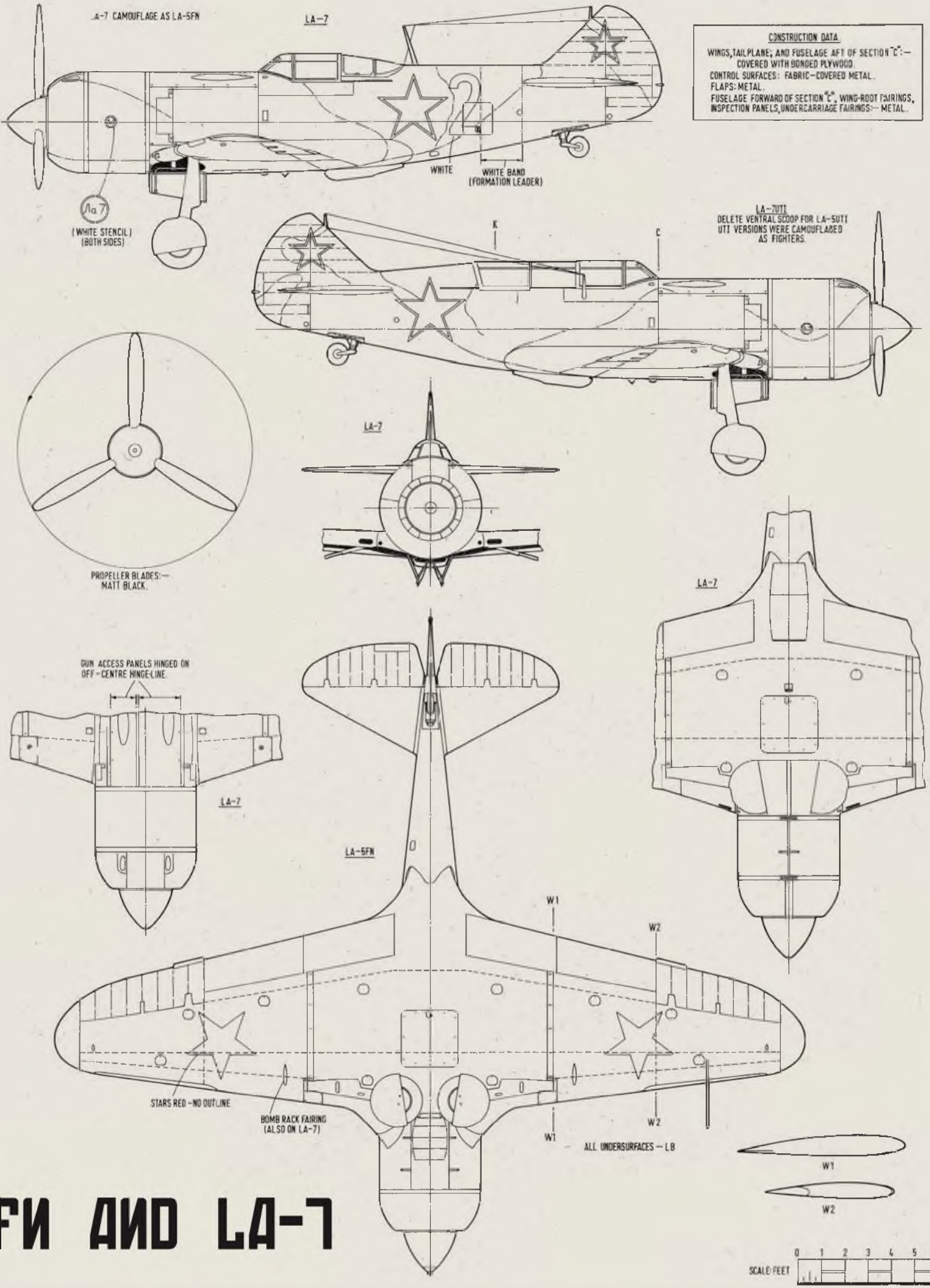



# LAVOCHKIN LA-5


A-7 CAMOUFLAGE AS LA-5FN
LA-7
WHITE
WHITE BAND
(FORMATION LEADER)
(WHITE STENCIL)
(BOTH SIDES)
CONSTRUCTION DATA
WINGS, TAILPLANE; AND FUSELAGE AFT OF SECTION 'C':—
COVERED WITH BONDED PLYWOOD.
CONTROL SURFACES: FABRIC-COVERED METAL.
FLAPS: METAL.
FUSELAGE FORWARD OF SECTION 'C', WING-ROOT FAIRINGS,
INSPECTION PANELS, UNDERCARRIAGE FAIRINGS:— METAL.
LA-7UTI
DELETE VENTRAL SCOOP FOR LA-5UTI
UTI VERSIONS WERE CAMOUFLAGED
AS FIGHTERS.
K
C
LA-7
PROPELLER BLADES:—
MATT BLACK.
LA-7
GUN ACCESS PANELS HINGED ON
OFF-CENTRE HINGE-LINE.
LA-7
LA-5FN
W1
W2
STARS RED - NO OUTLINE
BOMB RACK FAIRING
(ALSO ON LA-7)
W2
W1
ALL UNDERSURFACES — LB
W1
W2
SCALE: FEET
0 1 2 3 4 5 6

# FN AND LA-7

# SCALE BIPLANES - MY WAY

## PART 6: Off to the flying field - at last...

This is the sixth and last Part in the series. My aim has been to get more people starting to build their own scale models, And more importantly, to get more scale models finished! I stick to what I said in the first article - if you want to see your model completed and in the air, DON'T AIM FOR PRERFECTION. Try and get the shapes and outline correct, but don't go mad on the fine detail. The other bit of advice that seems to have caught on, is to try and do a bit to the model every day; it really does help in keeping up the momentum on an ambitious project.

This month we are dealing with tail surfaces, covering and painting, and a few other bits and pieces that got squeezed out of earlier unstalments.

### Tail Surfaces

The great Eric Coates showed us how to make tail surfaces in his articles on free flight scale in *Aeromodeller* , many, many years ago (and subequently re-preented in this magazine some years past. This technique starts by cutting a shape of the tailplane (or rudder) in1/16" sheet balsa, onto which the ribs and spars are added top and bottom of the sheet core **(Pic1)**. Amazingly, this method, originally used on small free flight models, works just as well on the largest scale models. Principal advantages are :-

**(i)** the resulting tail surfaces are very stiff and resistant to warping and

**(ii)** it is dead easy to get the outline shape exactly right, especially for the fin and rudder.

If you have exact side anf top view photographs you can scan it, enlarge it by computer or photocopier, and then transfer it direct to the sheet balsa. That way, even the most eagle-eyed of judges will have to admit that you have got the shape right!

The construction routine is as follows. Join sheets of 1/16" balsa together to the required width (Sellotape on one side, fold back and run in slow cyano from the other side). Cut out the outline exactly, and mark in ribs and spars on both sides. Curved tips are best laminated from thin ply wrapped round a template, so reduce the outline by 1/4" or so to allow for this at the tips. With the sheet flat on the board, add ribs and spars on one side. Turn over, support on lots of bits of scrap 1/4" balsa and glue on ribs and spar to the second side. Keeping everything flat. Add leading edge, trailing edge and tips. **Fig.1** shows typical cross section of the finished article.

If you are trying to save weight at the tail end (as always!) it is worth building up the tailplane spar as shown in **Fig. 2..** The soft balsa spar is capped top and bottom with a strip of thin epoxy glass sheet, which gives a very stiff spar with little weight penalty. *Mick Reeves* sells the epoxy-glass sheet in various thicknesses; the 0.4mm is about right for this job. Double-sided heat activated tape (from sewing shops) gives a quick way of gluing on

Curtiss Helldiver

Curtiss F7C Seahawk

Boeing F4B

Martin T4M

RE8

the epoxy-glass strips. Tailplane leading edge will be spruce, and carbon rod is good for the trailing edge. But whatever you use for the trailing edge, it will always have a tendency to warp when the covering is tightened. Be very careful when applying the covering (see below) and hope for the best!

Add some reinforcing blocks at the hinge points and at the strut attachments - and that is the tail surfaces finished.

## Covering

Over the years I have tried most covering materials for these big biplanes. *Solartex* is pretty good, as is doped nylon. But the best by far, is silk on top of lightweight tissue. It gives a lovely light, even finish with the weave of the silk still visible through the paint. Being so thin, it does not spoil the sharp trailing edges of wings and tail. Best of all, it is very easy to apply and unlikely to go seriously wrong. Thin silk is available from *flitehook* (www.flitehook.net).They also offer lightweight Japanese Asaki tissue. The open parts of the airframe are covered with tissue first and the silk is then applied over the tissue using wallpaper paste. We used to use lightweight *Modelspan* tissue, but this is now virtually unobtainable. Other types of paper tissue are OK (provided they shrink properly) but the modern replacement is polyester tissue. This is a heat shrinkable film (without adhesive), obtainable from Mike Woodhouse's *Free Flight Supplies* website: www.freeflightsupplies.co.uk. The lightweight grade is ideal for our purpose.

Step one is to cover the airframe with the tissue, using *Balsaloc* adhesive if you are using polyester tissue. Do the underside first, and make absolutely sure the tissue is firmly stuck to any under-cambered wing areas. If necessary, run some cyano in to make certain - if it later comes away from the under-cambered ribs, there is nothing you can do about it! Paper tissue needs to be water shrunk and doped; polyester is shrunk with heat and then given a couple of coats of thin dope. The silk is then applied using wallpaper paste, mixed very thick. Brush it through the silk, and then wipe away as much excess as possible with a cloth. When everything has dried out, a couple of coats of dope completes the job. It all takes a little

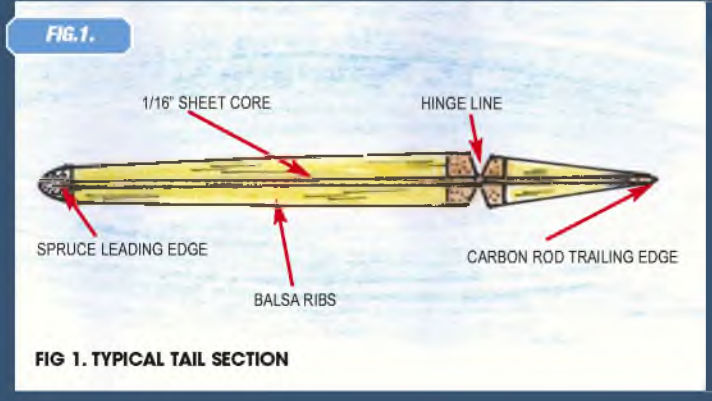



FIG 1. TYPICAL TAIL SECTION

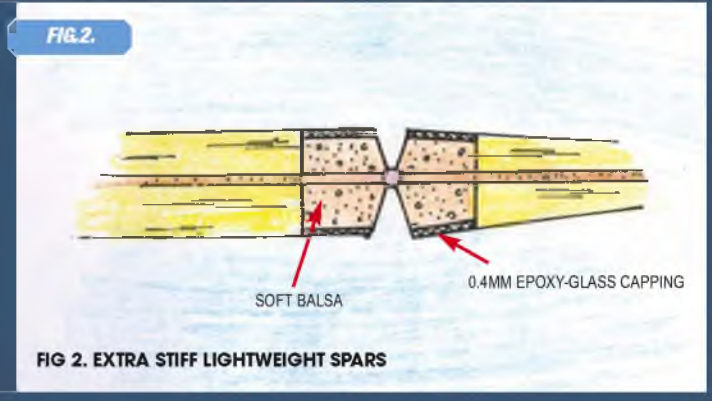



FIG 2. EXTRA STIFF LIGHTWEIGHT SPARS


**Martin's Westland Wapiti, stolen from his car many years ago. And its successor, the Westland Wallace, coming along nicely. The Wallace was the same aircraft as the Wapiti really, except the crew were provided with their own private conservatory to sit in.**


**Do they all look the same to you? That's the usual complaint, but I like them, mainly because they are such good fliers.**

**Everybody needs a bigger shed! I was nearly defeated when it came to rigging this one!**

longer than other covering methods, but I guarantee you will be pleased with the result.

All real fabric covered biplanes had the covering stitched to the wing ribs. The stitching was then covered with a strip of fabric, known as a rib tape. There is ample opportunity for serious scale modelers to go mad here; the edges of the tapes were usually serrated, being cut with pinking scissors, and the stitching shows through the tape to some extent. So for your top class International scale model you need to do real stitching along all the ribs first, and then make miles of 1/4" wide tape with serrated edges and dope it on over the stitching; very impressive, but way beyond our notional stand-off scale level. However, I do think you need something on the wing to break up the smooth surface. I use little blobs of white glue to simulate the stitching, covered with simple paper rib tapes (no serrations!). It takes a little time to do, but greatly increases the realism, even at some distance.

## Painting

If you asked an experienced car-sprayer to paint your model for you, he would produce a fantastic finish - deep gloss, solid colour and not a blemish to be seen. And he would have ruined your model! Real biplanes in the twenties and thirties were very lightly painted with cellulose paint - and a deep gloss finish, such as you can achieve with modern paints, was never seen. Reduce this thin paint layer down to our 1/4 or 1/5 scale model and you can see that what we need is the thinnest possible paint layer. A thick, treacley glossy paint job will give you a model that is nice and easy to keep clean, but the realism will be lost forever. That's the difference between a toy aeroplane and a scale model!

I spray on a thin white undercoat first, and then the colours. The undercoat actually reduces the amount of paint needed, as some colours - especially yellow and silver - can be quite translucent; several coats would be needed to achieve a solid colour without the undercoat. In the past I have used a proper car spray gun, but it always seemed to be putting on more paint than I wanted, so I have gone back to using my old small Airfix-type spray gun. It takes a bit longer, but I feel more in control. The paint needs to be misted on, never allowing build up on the surface to a shiny puddle.

What paint to use? Up to now I have always used Cellulose. There is a huge choice of colours (from car paint suppliers), it's very easy to spray and it dries quickly. Unfortunately, Cellulose and most other solvent-based paints are gradually disappearing from the market and we will have to get used to using acrylics and such like. Two-part epoxy paint is another possibility; it gives an excellent finish which is totally fuel-proof. Because of the danger to health, extreme care is needed when spraying epoxy paints. Possibly for this reason they tend to go off the market now and again, but at the moment an excellent epoxy paint system called *Klass Kote* is available in the UK. Click onto *www.klasskote.co.uk* to see their products.

## Markings

Making a neat job of the markings and lettering is one of the hardest bits on any scale model. You can brush paint them by hand, possibly using ink pen and ink compasses with thinned paint to do the outlines, but it is not at all easy to make a tidy job of it. Spraying is the answer, even though it takes ages masking everything off. After all the careful preparation, you do end up with really neat markings. Special purpose low-tack masking films and tapes do not work well on a non-glossy fabric surface, and I find ordinary parcel tape much more reliable. You have to use a bit of gentle heat from a hot air gun to remove it cleanly, but it sticks really well, preventing paint creeping under the edges. It has the advantage over Sellotape that you can see what you are doing! Circles have to be cut with a sharp blade in a pair of compasses, just breaking the surface of the tape. A bit nerve-wracking, because if you cut too deep you go through the fabric underneath, but not as difficult as it sounds. Letters can also be done by masking and spraying; US aircraft are particularly easy as their lettering is all straight lines - **(Pic2)**. Below a certain size, it become impracticable to cut masks for spraying lettering, and a good alternative is to cut individual letters out of *Solartrim* sheet, and slide them in place using the soapy water technique. The Solartrim is very thin and once a coat of fuel proofer has been applied it is virtually impossible to spot that small letters have been stuck on.

## Dirty Thoughts

No real aeroplane is ever completely spotless, except possibly on a crack fighter squadron with highly polished Hawker Furies just before an inspection is due. At the other end of the scale, a Sopwith Camel in France in 1918 would be a disgusting mess of mud and Castor oil within a week of being delivered to the squadron. Hopefully, you will have a good photo of your subject aircraft so you will be able to judge how far to go with the dirtying-up process. A lot has been written on this subject, so I will just say enough to get you started. Oil pastels are available from shops supplying artists' materials; a black and a brown will do for starters. Rub some black on your fingertip and experiment by applying grime along the line of the wing ribs. Then a few brown streaks where the oily slipstream hits the wing and tail leading edges, and a bit of gunge around the engine bay. Without needing

too much artistic ability, you can soon transform that bland, newly painted model into something much more like a real aeroplane. If you think you have overdone it, clean it all off with white spirit and start again!

## Fuel Proofing

Even if you have used fuel proof paints, a coat of fuel proofer will still be needed, both to protect the dirtying-up described above and also to give an even matt finish to the whole airframe. Clear epoxy is without doubt the best; it is the only way of completely preventing oily exhaust from attacking the paintwork. Klass Kote do a clear epoxy with either a matt or satin catalyst, depending on the finish you want. If you don't want to use epoxy, then matt Tuffcoat (polyurethane) will do the job, but bear in mind that it will not be completely fuel proof, especially against synthetic oils. All matt fuel proofers are loaded with a matting agent (a fine powder) and this has the extra beneficial effect of taking the brightness and sparkle out of our colours. This definitely increases the realism - there were no dayglo paints in the 1920's!

## Correct Colours

It is not easy to be sure about colours when we are going back eighty years. Even within the operational life of an aircraft, the paint will fade, and of course there was little or no colour photography. The US Navy specified it's colours with ceramic tiles which still exist, so we are on fairly safe ground here, but as far as I know there was no comparable system in the RAF. If you want to enter competitions, then the important thing is for your colours to match your documentation (paint chips or coloured artwork). Even if you suspect the documentation colour may be wrong, you have to stick with it. Competing or not, it's still nice to get the colours right if you can, as we want our little bit of living history to be as accurate as possible.

Silver is always difficult. My memory of RAF silver doped aircraft in the 1950's was of quite a bright, white-ish silver, but of course it may have been different in the 20's. Terry Manley still has some genuine silver dope from Blackburn's, and this also is quite light and bright. Whatever else, I think we need to avoid anything that is nearer grey than silver. I use Base Silver Cellulose, from car paint suppliers.

Blue on the RAF roundels **(Pic3)** is another problem area. For many years most published coloured artwork showed quite a pale blue, and we all went along with this. But quite recently the RAF Museum came across some original wing fabric which had been stored away from daylight and the blue was much darker, closer to ultramarine. This seemed convincing, and they actually produced some paint chips which people used in their documentation. The easiest way to get the ultramarine shade is to use artists' acrylic paint. The blue on US Navy star markings is also hard to match - it was a very dark blue-black, like fountain pen ink used to be. Alfa-Romeo Petrol Blue is pretty close!

## Conclusion

That's it for now. I hope you have enjoyed reading my rather random thoughts. And who knows? Maybe one or two of you out there will pick up the Stanley knife and start attacking some real balsa. I do hope so!


**Tail surfaces made by the Eric Coates method. See text.**


**US Navy letters and numbers are easy to paint, as they are all straight lines.**


**General opinion now has it that RAF roundels between the wars were quite a dark (ultramarine) blue, at least before they faded in the sunlight.**


**My Armstrong Whitworth Siskin from some years back. Definitely on the "to do again" list.**

# THE QUIET ZONE

## R/C SCALE ELECTRICS WITH PETER RAKE

**PETER RAKE TAKES A LOOK AT UP-TO-DATE ALTERNATIVES TO THE MOTORS ORIGINALLY RECOMMENDED FOR SOME OF THE MUCH EARLIER MODEL DESIGNS, STILL VALID, BUT THAT WOULD BENEFIT FROM A MODERN POWER SYSTEM UPGRADE.**

Here we go again, you lucky people, yet another instalment of the never ending saga that passes as an electric flight column. Now, I give you fair warning that, as I begin this month's issue, I have absolutely no idea what I'm going to write about (no change there then) so expect more than the usual amount of waffle. Oh well, we do have the waffle-free issue from last month to make up for, so that may be no bad thing, after all, I know how much you enjoy my rambling and I do try to please when ever possible.

So, what precisely can you expect from the column this month? A very good question. How about if I just let the words flow and we'll see what it looks like at the end. Oh, all right then, it won't actually be that bad but is likely to be a montage of ideas. Things that occur to me as I go along.

### MOTORS

With summer (?) firmly ensconced, and all those lovely calm evenings (I wish) to make the most of you may decide that it's easier to nip along to your local park rather than take the trek to the flying field. That means you're going to need a relatively small model to fly there in comfort. No, don't panic, not yet another of my micro designs - unless you insist. Here, I'm talking about models of around 30 inch span with a flying weight

**Although this model is only 18" span you can see how well a printed tissue finish can work out.**


**At 50" span this is much bigger than the models discussed here but still Litespan covered.**

of six to eight ounces. If you can build light there's no reason why they should be more than four or five ounces, but most of us aren't that good. Well, I know I'm not able to build a 30 inch model as light as that.

Over the years (far more years than I care to recount), I've drawn up lots of models at this size . Most of them, however, were drawn some time ago when THE motor of choice was the GWS IPS unit. Okay, so maybe it might not have been the motor unit you'd have chosen given the choice, but there was precious little else available at the time. It was heavy, came in a confusing number of gear ratios and was, to be kind, somewhat variable in quality. Some would last ages, while others would burn out after just a few flights.

From my own experience you had to restrict flight times too. I recall one example that failed first time out simply because the flight was too long - a little over ten minutes.

As you can imaging, in today's brushless motor world, none of these traits are even slightly acceptable. Okay, so you still have to navigate through the multitude of different specification motors that are of a common size (kv rating, current draw, what prop they'll swing, etc), but at least there's a more than fair chance that your chosen motor will actually keep running for more than just one flight. Hopefully, because there are no brushes to wear, they'll last for many flights.

## Where is this all leading?

My word you do ask good questions, really on the ball aren't you? Either that, or a right pain in the neck. If I knew things like that I wouldn't be making this up as I go along. Just have a bit of patience and I'll get to that sort of stuff. Just remember that I've been writing this "vitally important information" for the best part of twenty years and the poor old brain cells aren't what they once were. I have to work up to these things gradually otherwise you end up with three pages of absolute nonsense. Yes, I will be round to visit the person who said it was already that - with a very big stick.

As regards motors for these designs that still show the IPS unit, I would suggest a 15 gram outrunner with a kv rating of 1400 or less. There are some quite nice ones about that are very reasonably priced (well under £10), so it isn't any great hardship if you have to buy one for a specific model. I know some people fit things like the E-Flite Park 280 and Park 300, but these motors are really overkill in the type of model I'm talking about. Not only are they somewhat on the spendy side (I'm known for my meanness), but they really put out far more power than you'll need. Just think about it. We're looking at models that weight (hopefully) well under half a pound and my recommendation for power is around 50 watts/lb. So, a motor that is capable of 50+ watts is going to make the model much less pleasant to fly than might otherwise be the case. Yes, yes, I've heard all that old guff about not being able to have too much power and am here to tell you that you most certainly can have just that - far too much power. I design models (and I am, after all, talking about my designs) to waft around on a minimum of power. Flying on the wing, not on the prop. If you then proceed to double (or even treble) the intended power it will drastically alter the way in which the model will fly. Don't be fooled by talk of that being what throttle control is for, or you may just be in for a nasty shock. With a huge excess of power available, far exceeding the designer's intention, you might just find that not only is low throttle still too much, but it's also so fine an adjustment that maintaining the correct setting is almost impossible. You tend to end up with two speeds, ballistic and dead stop.

As an example of the point I'm trying to make let me refer to a wet and smelly I once owned (even built it myself too), the Flair Taube. Now, me being me, and with the annual club competition looming, I went to town on the rigging. There was miles of the stuff, all creating drag. Power was an O.S. FS48 Surpass, which flew the model with ease. The problem was when it came time to land the damn thing. Just a click or two on throttle trim made all the difference between a model that wanted to keep flying, and one on which drag overcame thrust and the model virtually stopped. No amount of playing with throttle would remedy the problem, but replacing the 48 Surpass with an old and well-worn non-Surpass FS40 worked like a charm. Still more than adequate power to fly the model, but a totally different throttle curve at low power settings. Landings

**Not actually 30" span, but this model uses a similar level of power for its' roughly 6.5 ounces.**

**Yes, it is an awful photo but it's the only one I have of the Flair Taube mentioned in the text.**

**Another covering option is the document laminating film seen on this 32" span model.**

were now a breeze and I was a much happier modeller. I realise that it's bordering on blasphemy to mention such things as wet and smelly models in these hallowed pages, but I am talking about 1994, before I saw the light and converted to electrocution. Just remember that not all of us were born into an age of clean, quiet and socially acceptable modelling. My early models were far from any of those things. Running in engines in the back garden does nothing to endear you to the neighbours, especially since very few people used silencers in those days.

A similar example was a version of my SPAD XIII design. The builder was complaining that it wouldn't fly properly,

**As you can see, painting the doculam hakes a whole world of difference.**

no matter how little throttle he used it still wanted to climb all the time. Further investigation revealed that he was trying to fly it with four times the recommended power level so it isn't really any wonder the poor little model wanted to climb. With that amount of excess power available low throttle was still too much power, taking us into that ballistic or dead stop scenario again.

So, if what you are looking for is a relaxing model with which to stooge around your local park, without worrying the hell out of any onlookers (been there and done that in my misspent youth) please don't be tempted to use more power than the designer intended the model for.

## COVERING

With my periodical rant over (you'll get used to these things if you follow this column on a regular basis) let's stick with small models for the time being. This time focussing on suitable covering materials.

Personally, I like Litespan (Coverlite in the US) for this type of model. It vaguely resembles fabric at this scale, comes in many of the colours we're likely to need and, for those colours that aren't available, takes paint extremely well. However, many people struggle when using it. It requires an adhesive and doesn't shrink as much as a film covering. Now let's see how I get around those problems and maybe it will encourage you to give it another try.

As regards the lack of adhesive, that one is easily solved. I apply a thinned coat of Balsaloc to the sheet of Litespan before using it on the model. Smoothed on with a sponge it adds very little weight and makes the covering much more user friendly - as opposed to user fiendish. Now it can be used exactly like any other covering film. No need to apply adhesive to the framework and no need to apply it to every single overlap, making getting the covering attached to the model a far less trying task.

**The model that may, or may not, appear as a free plan next month - a 30" span Nieuport IV Monoplane.**

When it comes to the lack of shrink that takes a little more practice to overcome. It isn't difficult to overcome but you do need to go about it in a particular fashion. First and foremost is to take your time while applying the covering and make sure you get it on evenly, as tight as you can and WITHOUT WRINKLES. If there's a wrinkle ironed in, that wrinkle will be there for the life of the model because nothing will shrink it out. To assist with this there is a certain amount of stretch available that enables the covering to be pulled into whatever shape is required to avoid getting wrinkles in the first place.

Now, with the covering applied, smooth and wrinkle free, it's time to consider shrinking it. For this I always go straight in with a heat gun. You can use the covering iron, but there's always a chance of sticking the covering to the underlying structure before it's had a chance to shrink. Obviously, if it's stuck to the framework it can't slide and shrink evenly over the entire piece. I make two provisos when using the heat gun. First keep the heat away from your ironed down seams as much as possible. Remember, Balsaloc is a heat activated adhesive and will just as easily unstick with heat. Shrinking covering and unstuck seams are not a match made in heaven. At least, not if the idea is to end up with a smooth, tight and wrinkle free covering job.

Secondly, and possibly even more important, is to keep the heat gun on the move. Don't try to remove more stubborn slack areas by holding the heat on them. Long before they shrink out you'll find yourself with a great big hole in the covering. Shrink it a bit, move on and come back to it once it's had time to cool again. Of course, if you applied it smoothly in the first place, there shouldn't be any particular area that is more slack than the rest, and certainly no wrinkle to shrink out.

While talking about Litespan, there are a couple of points worth knowing, that will make covering a bit easier. Point one is that it has two sides (now isn't that a surprise), one is more glossy than the other. Either can be used as the outer surface, but whether you require a matt finish, or a semi-gloss finish will depend on the prototype you are modelling and how you want it to look. It's worth knowing this because it can be disappointing to find you've got some parts of the model matt and others with a sheen.

The second point is that Litespan most definitely has a 'grain' to it. This grain, although not visible runs along the length of the sheet and should be applied running span wise on wings. If you apply it chord wise you'll find that the covering will tend to pull down between the ribs, giving you excessive sag between them.

As I say, Litespan is my covering of choice, but there are others that work just as well. So-Lite is good, a bit glossy for many models. It also tends to be quite transparent too so that wood grain and any imperfections (not, of course, that you build imperfect models) will show through quite glaringly. Also, I find it to be less durable that Litespan. For instance, if you land a Litespan covered model in the rough (especially if said rough involves stubble) you'll get dents that can be ignored until you are able to shrink them out. So-Lite, on the other hand, is far more likely to be full of little punctures and tears, bringing flying to a halt until it can be patched or replaced.

> ***"First and foremost is to take your time while applying the covering and make sure you get it on evenly, as tight as you can and WITHOUT WRINKLES"***

Then, of course, there's always that good old modelling standard - tissue and dope. I find this to be somewhere betwixt and between the other two types of covering. Almost as transparent as So-Lite (but in a pleasing to the eye sort of way), almost equally prone to puncture but not quite and more easily repaired and not quite as tough as Litespan. However, if traditional is your aim, or you like a printed finish on your models, tissue most certainly has it's place on models of this size. I love it for smaller models (where I can have fun printing the finish to reduce weight to an absolute minimum) but would be less inclined to use it on the type of model being discussed here.

Well that appears to be about it for this month, maybe it's a topic that may warrant more coverage next time. That may be especially so if the free plan turns out to be what I have in mind. In which case, this may help prepare you for it.

In the meantime, you'll find me at the usual place - PETERRAKE@aol.com. ■

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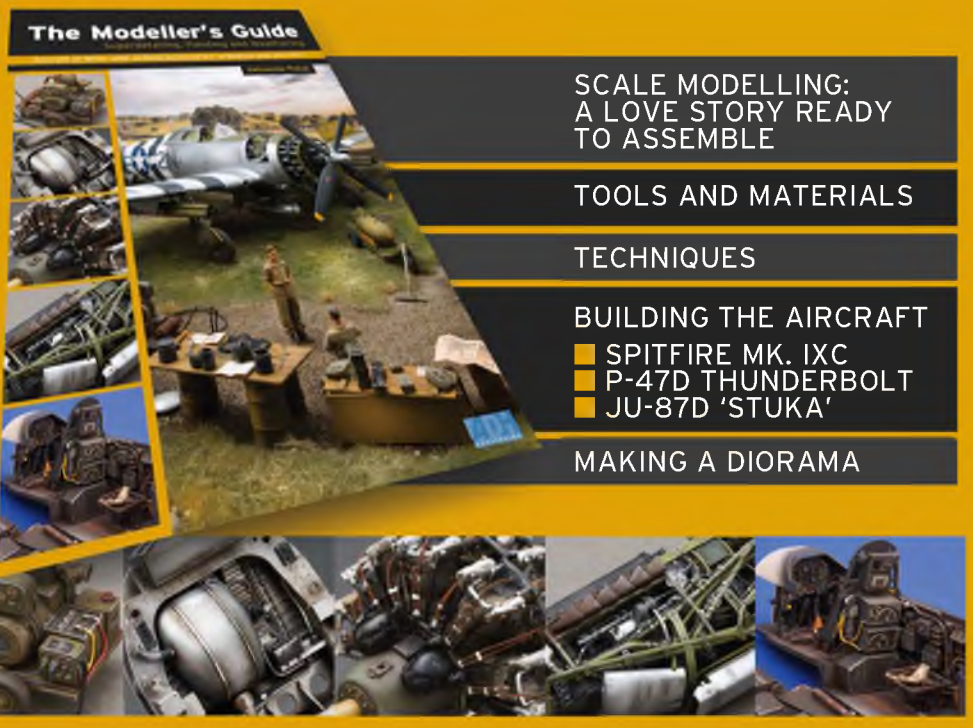


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