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ON THE COVER

HAVE MODEL BOX, WILL TRAVEL!

Dr.Mike Hawkins' 67" wingspan Polikarpov I-152 was built to pack into a model box sized as check-in luggage for a trip from Bangkok to USA, but you can built it without that complication from his plans presented in this month's major construction feature.

MAY 2018 NO.222

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FLYING SCALE MODELS is published monthly by Doolittle Media, Doolittle Mill, Doolittle Lane, Totternhoe, Beds, LU6 1QX.

EDITORIAL ADVERTISEMENT & CIRCULATION: Doolittle Mill, Doolittle Lane, Totternhoe, Beds, LU6 1QX.
Tel. 01525 222573
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.

PRINTING: Buxton Press Ltd.,

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DON'T MISS
Our subscription offer on page 44

Name a Russian fighter aircraft and, for my generation at least, it would probably be something like the MiG 15! (Never mind, age doth not weary us! Well, not that much anyway.)

But that one was, or course, an aircraft from the post-WW2 jet era. Russian fighters of the propeller-driven era are less widely known - and less widely treated as subjects for our particular niche of flying scale modelling.

Even less widely known are those Russian fighter types from the pre-WW2 period, but that may well be because there were so few different 'brands' in a country where there were no commercial manufacturing entities - just a number of state sponsored Design Bureau which developed the designs to state-issued specifications, after which the State nominated state-controlled factories to build the aircraft in quantity.

In the decade from the late 1920s, through to the late 1930s, not a great deal about military aviation development leaked out to western countries, from the closed society that was the Soviet Union. However, that changed with the commencement of the Civil War in Spain in 1936, where part of the overseas military aid received by the Republican side from the Soviet Union included combat aircraft, in particular, types from the Nicolai Polikarpov design bureau, the I-15, I-152 and I-153 biplanes and the later I-16 monoplane.

As with aircraft designers in western countries, in order to achieve progress from the WW1 baseline of aircraft performance, Polikarpov had to wrestle with the universal problem of overcoming the limitations imposed by metallurgy, aerodynamics and engine performance - a cocktail of drawbacks that combined against progress. Polikarpov's answer was the frequently adopted approach of stuffing the largest, most powerful engine available into the smallest achievable airframe. In the Polikarpov case, the powerplants adopted were licensed productions of firstly the radial cylinder Bristol Jupiter and then the Wright Cyclone, which gave the I-15 series biplanes and the I-16 monoplane their quite distinctive rotund, short fuselage shape.

Distinctive in outline, these aircraft do indeed make interesting and unusual, non-mainstream subjects for scale modelling - made easier, we hope, by our extensive feature coverage of these types in this issue.

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MOSKA MB BIS

A 30" model designed by Peter Rake for electric power and three function control

The Moska MB bis was a rather unusual aircraft; not quite shoulder wing, nor quite a parasol monoplane, but something somewhere between the two. The wings had no centre section and were mounted on very short struts that placed the wing only slightly higher than the top fuselage longerons. When combined with the rather shapely curved, all-moving tailplane and the quaint over-and-under two piece rudder, it's certainly an interesting looking aircraft.

The wings and tailplane could be folded for transport, this usually taking the form of a horse drawn cart, hardly the best way, but needs must when the devil drives. Presumably it would have been easier and quicker to fly the aircraft to its new operating field. Maybe the aircraft were not that reliable, or possibly they simply didn't trust the pilots to be able to find the right place.

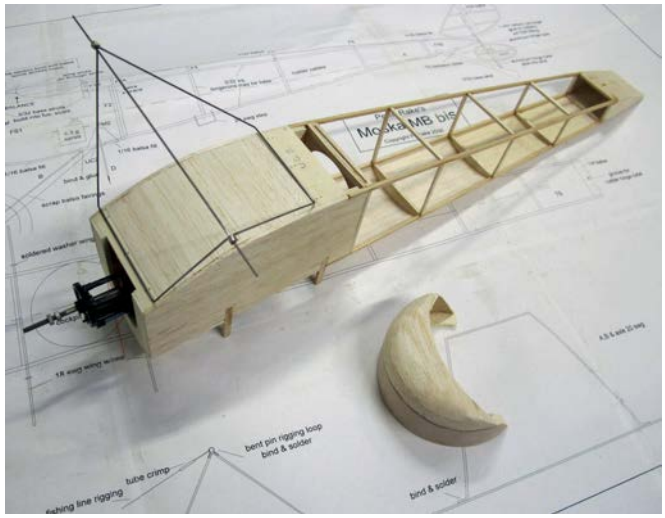
THE MODEL

As a quick look at the plans will reveal, some of the drawings don't quite relate to the photos in the construction article. The reason for this is that the original design was drawn several years ago and things have changed quite a lot since then. Not only have I changed the way I think things should be done, but available motors have drastically changed.

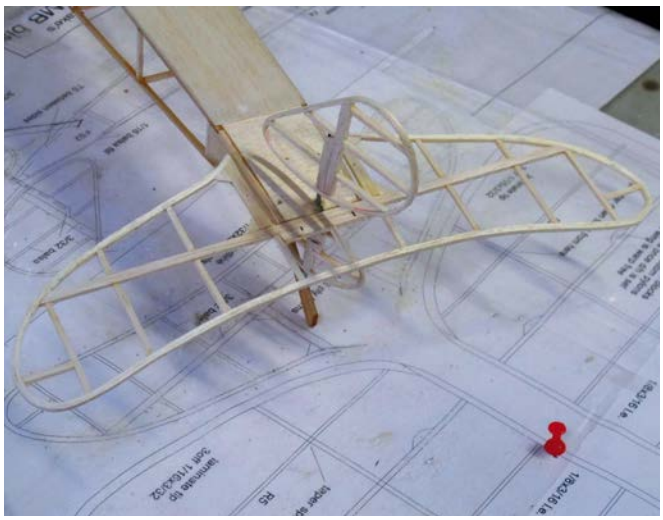
Whilst the original model was designed for a geared, brushed motor, those weren't the most reliable by present standards but were pretty much all that was available at the time, very common, but not great. Some examples would last for ages, while others would begin to fail after just a few flights. I even had one that failed completely after just a single, ten

The model drifts past overhead on a perfect flying day. The model is pretty easy to fly but still not a trainer.

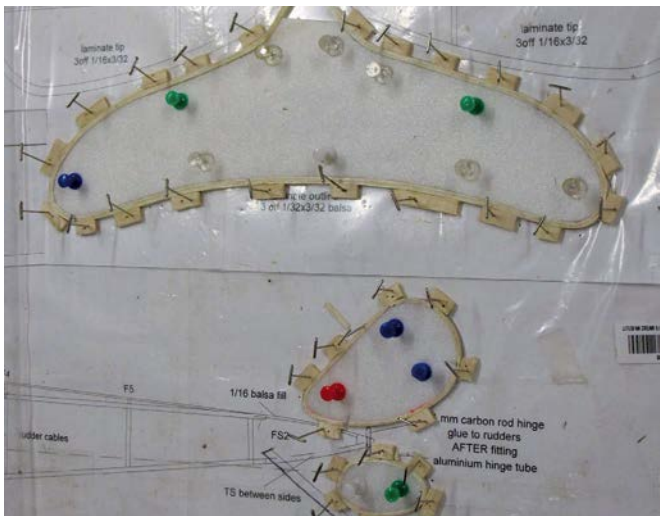
The basic fuselage box. Note how the struts are already in place.



Although sporting the originally shown motor unit the u/c is positioned ready for binding in place while the cowl awaits some paint.



A shot of how the tail surfaces will eventual fit into place on the fuselage.



The laminated tail outlines around Depron formers are left to dry completely before use.

minute flight.

Now , the drawings show a small outrunner brushless motor and all the parts have been updated to match. When choosing a motor, don't be tempted to go bigger than the type shown on the drawing, which is a 15 gram outrunner.

The model should end up weighing no more than eight ounces and the motor shown provides ample power for scale-like flying of a model of that weight. In fact, it's probably already overkill, but beats not having enough power. If you build light, use a modern micro receiver and smaller, lighter servos than those shown, it's quite easy to get the model weight down to well below eight ounces.

In that case you may choose to fit a 10 gram outrunner. However, remember how short-nosed the model is and consider that, unless you dramatically reposition the servos, you're going to need nose weight to replace the 5 grams you saved on the motor. Some dummy engine detail will do that admirably, so that's a good way of adding detail without adding unnecessary weight, or placing the servos where they become hard to access.

Possibly a more obvious change from the original design is that the wings now use two spars, instead of the one originally shown. The reasoning is that unless you can guarantee very hard balsa for ribs R1 and R2, there's a risk of weakness where the wing tubes fit. Now, with two spars, each adjacent to a spar, the tubes may be glued to the spars as well as the ribs. It's important that those tubes can't move because they are the means of setting equal dihedral and incidence on the wing panels. Having both wings remain at the correct angles is never a bad idea - you'd be surprised how much better the model flies if they do. Then again, maybe you won't!

I deliberately stress this point because, the two-spar structure makes wood selection far less critical, whether you cut out the indicidual parts yourself, or opt for the laser cut parts the publisher has available to accompany this free plan - in which case there's no way you can be sure the parts in that will be hard enough. Now, of course, it doesn't matter because the spars are helping to carry the load.

Apart from the dreaded laminated outlines, and possibly cutting out ply parts, there's nothing particularly difficult about building the model. When I design any of my models I like to think of how I'd want to build it and I detest complicated builds, after all, model building is supposed to be an enjoyable pastime, not a chore to be endured. By keeping the build part of things enjoyable, enthusiasm is still high when it comes to finishing the model. You'll take more care over the final stages and may even feel like adding just a little more detail than you would if the build had been taxing. Well, that's my theory at any rate. To me a model needs to be pretty as well as a good flyer, so that's what I try to encourage in my designing.

LAMINATED OUTLINES

I'll deal with these first because they are one of the first things you'll want to get out of the way. I know many people hate making laminated outlines but they really aren't that difficult. They also provide the lightest, strongest method of producing

Okay, so there's a spar missing in the wings but at least you can see pretty much how they go together, while the fuselage lurks in the background.

Some of those curved strips created by rolling with the dowel. As you see, some quite tight curves are possible.

these parts. Normally I would suggest thoroughly soaking the strips, gluing the still soggy strips together and then shaping them around formers. However, just recently I saw an alternative method that appeared to work just as well, but without dripping water all over the place.

Instead of soaking the strips, you start off with thicker strips and use a dowel (or piece of tubing) like a rolling pin. Not only does it help to break up the wood fibres and make the strips thinner, it also causes them to curl quite well. The more you roll them, the tighter they curl presumably, which is no bad thing on the rudders of this particular model.

Once you have all your curled strips, we revert to the more traditional technique, but without the drips. The strips are glued together and shaped around formers before being allowed to dry completely. Once dry, they hold their shape and can be built into the model in the usual way.

Okay, so maybe they won't be the precise thickness of the strips indicated on the plan but that's easily remedied by adjusting the number of strips used, or simply doing the outlines are a little wider than they're supposed to be. I guarantee nobody will notice.

CONSTRUCTION

Because the construction of the model is so straightforward I won't go into great detail about precisely how each component is added. Instead, I'll briefly describe each step, but emphasise and explain in greater detail any areas that I think might need more of an explanation. Since we presumably already have our tail outlines all laminated, dried and removed from their formers (which ever way you chose to produce them), that seems as good a place as any to begin.

TAIL SURFACES

These are built over the plan using the outlines, cut parts (laser or otherwise) and the strip balsa shown on the drawings. Allow them to dry completely before removing from the board, sanding overall and rounding off the edges.

Despite its unusual shape, the elevator is hinged in the usual manner, directly to the horizontal tailpost - but not until the rudders are in place. It's the rudders we need to take a closer look at before moving on.

Very carefully, drill into the rudders so that the carbon rod (or wire if you prefer, but it is heavier) can be inserted and glued into position. The point I need to make is that the holes you drill must be absolutely accurately drilled along the centre line of each rudder so that once joined, they actually form a straight line. Also, DO REMEMBER to fit the hinge tube to the carbon rod before gluing the second rudder in place and ensure that no glue gets into the tube. A hinge tube firmly glued to the rudder joiner is of no use to anyone.

WINGS

Since we still have some laminated outlines to use up, the wings might as well be the next items we build. Begin by notching the trailing edges to accept the rib ends, and then build in much the same way as the tail surfaces. Work over the plan and pin down strip leading edge, trailing edge and spars before gluing in place the trimmed laminated tip bow and the wing ribs.

Although there is dihedral, because of the way the wings are fitted, ALL the ribs should be at 90 degrees to the building board. This is particularly important because the tube holes in ribs R1 and R2 are positioned so that dihedral is set automatically as the wing panels are slipped onto the joiner wires. Glue those tubes securely in place now.

Before removing the wing panels from the board, glue in place the block balsa root pieces (ready grooved to fit around the joiner tubes) and the full depth rigging blocks, so that they end up flush with the lower surface of the wing. Once the wing is removed from the board (or now is you're a bit heavy handed), shape the root blocks and rigging blocks to follow the line of the top of the ribs.

Remove from board, shape the leading and trailing edges, sand overall and drill the holes for the rigging and pylon E.

COWL

I'll deal with the cowl separately because I like to completely finish these parts before fitting to the model. Construction is simple enough; a strip of ply wrapped around and glued to formers C2 and C3, with the laminated parts C1 glued to the front. Once that's all dry, trim and sand to shape.

Now we come to the reason I like to build cowls separately. On the full-size aircraft, these items are metal. They may end up with the odd dent here and there, but they most definitely don't have grain showing. By applying repeated coats of automotive filler/primer, sanding smooth every other coat (400 grade wet or dry, used wet), it is possible to reasonably quickly eliminate the grain altogether and end up with a perfectly smooth finish.

Once at that point, a couple of sprayed on coats of automotive wheel paint (silver looks better than gold) for an effective, durable representation of bare metal. Much the same finish can be applied to the forward, top fuselage too.

FUSELAGE

Now we come to the most complicated part of the whole model; not difficult by any means - just involving more steps.

As you'll note, there isn't a single curve in any of the longerons, so you don't have to worry too much about matching them for hardness. Just make sure that they are fairly hard balsa or, failing that, use basswood. The model is pretty easy to fly and landings should be fairly gentle, but if the longerons aren't hard enough even a relatively hard arrival could, potentially, destroy the fuselage.

So, building the fuselage is all very traditional stuff. Build two matching side frames (complete with struts), accurately glue in place the pylon sockets and then join the sides using F1, F2 and TS and then add cross braces and the remaining formers. As I said, it's all very easy and basic modelling. Drill the undercarriage

parts for the bindings that will hold the undercarriage wires and glue these securely into the assembled fuselage.

Bind the u/c wire components in place, solder it all, then add the sheet fill pieces and 1/4" balsa tailpost followed by the sheet balsa top decking. The access hatch may either be carved from block balsa or made up from formers and sheet, whichever method you prefer.

The motor mount can be adjusted for length (to suit your particular motor) by adding or subtracting balsa discs (MA). The front disc is sanded to a sort of wedge shape so that once part M is glued to it the 2 degrees of down and right thrust is set . Screw the motor in place and glue the mount in position such that the motor shaft exits centrally in the cowl.

Glue in place the two lower rigging pylons.

One further note worth mentioning; the tops of the struts must be drilled for the joiner wires before being glued into the fuselage side frames, and those drilled holes must be accurate if assembly of the model is to go correctly. Also, there is the possibility (in the event of a knock) for the section above the hole to split away from the rest of the strut. A small piece of thin ply glued to the top of each strut will both help guide the drill, and prevent splitting.

ASSEMBLY

Once you have the wire joiners and soldered washer stops in place, the assembly of the model is pretty simple. The only potentially difficult area involves hinging the rudders, so let's take a look at that.

Drill the tailskid for the lower hinge tube and glue the tube in place but don't glue the tailskid into TS at this point, just slip it into TS, fit the lower end of the rudder joiner rod into it and glue the central hinge tube into its notch in the tailpost.

Adjust the angle of the skid until the rudders are truly vertical in both planes and then secure the skid into TS. Now, if nothing else, your rudders are square to the fuselage and the elevator can be fitted, ensuring it aligns correctly with the rudders.

Slip on the wing panels and add your rigging (that's what holds them in place, so don't omit it), but don't secure the rigging into the rigging blocks just yet. Nylon monofilament fishing line of around 12lb strain is perfect for both rigging cables and control linkages. Secure the ends with crimped brass tubes and a spot of CA once the lengths are correct. They don't need to be absolutely as tight as you can get them, just tight enough that there is no slack. Having them too tight will just put a strain n your servos and risk distorting the wings/tail surfaces.

Now comes the tricky part. Carefully slip the rigging through the rigging blocks until the wings are warp free and have equal dihedral. If you want to add a little wing tip wash out, this is the time to introduce it. Once everything aligns precisely a spot of CA run into the rigging blocks will make sure it stays that way.

FLYING

The model is pretty easy to fly, but must balance just a hint nose down when supported at the point indicated. Avoid any trace of tail heaviness like the plague. Despite their small size, the rudders are sufficiently effective that steering isn't a problem. The all moving tailplane is very effective, so watch just how much throw you set it with. 1/4" in each direction is a good starting point.

For the first few flights try not to rush the model into anything. Allow it to climb gently away and then guide it gently around the sky until you get the feel of how it behaves. It is actually very well behaved, but it does no harm to treat it gently until you are fully familiar with it.

Then just get on enjoying it. ■

Simply because I like the way it looks in the air I couldn't resist one more flying shot.

CONSTRUCTION FEATURE

POLIKARPOV 1-15

Dr. Mike Hawkins F.R.Ae.S. presents a 1/6th scale, 67" (170

52 'CHAIKA'

0 cm) span model for 120 and larger four-stroke engines

Scale models of Russian aircraft are not common and the Polikarpov I-152 presents an unusual shape in the air. As with the original aircraft, it had a few little peculiarities in handling, now resolved, but please read on!

The model is fairly complicated and requires quite a lot of 'balsa bashing'. Together with its ground handling characteristics it is not really suitable for a newcomer to scale modelling, so I would suggest that a beginner build my *Heath Suoer Parasol* (FSM Plan no.086) first and that will give him something to fly while he works at this one!

The structure was designed to dissemble into components that fit in a box 38 in. x 16 in. x 16 in. and in this form I have taken it from Thailand to the USA as passenger checked baggage, to fly in meetings there. It subsequently moved on to new 'hangar space' in the garage of my friend, Ray Smith in Tampa, Florida, having completed 41 flights without serious incident.

Why the I-152 variant? Well, there are three main versions of the I-15 design. The first one, the I-15, had a gull-wing centre-section to the upper wing and that particular configuration would make the model difficult to build, with detachable, upper wing sections. In addition, the engine of the full size I-15 was open, with a Townend ring and the model would need a dummy detailed engine.

The final variant, the I-153, had a gull-wing too, and in addition a retractable, twisting undercarriage with the wheels lying where the lower wing spars ought to be - an arrangement that would be difficult to replicate for a scale model.

In contrast, the I-152 had a straight upper wing centre-section and a fixed undercarriage. Photos show that it was often operated without spats or spinner, which makes it, for me, the way to go.

At 1/6th scale, the model presented here it has a span of 67 in. and with its short, stubby fuselage, it fits in its travel box with the cowling in place.

BEFORE YOU START

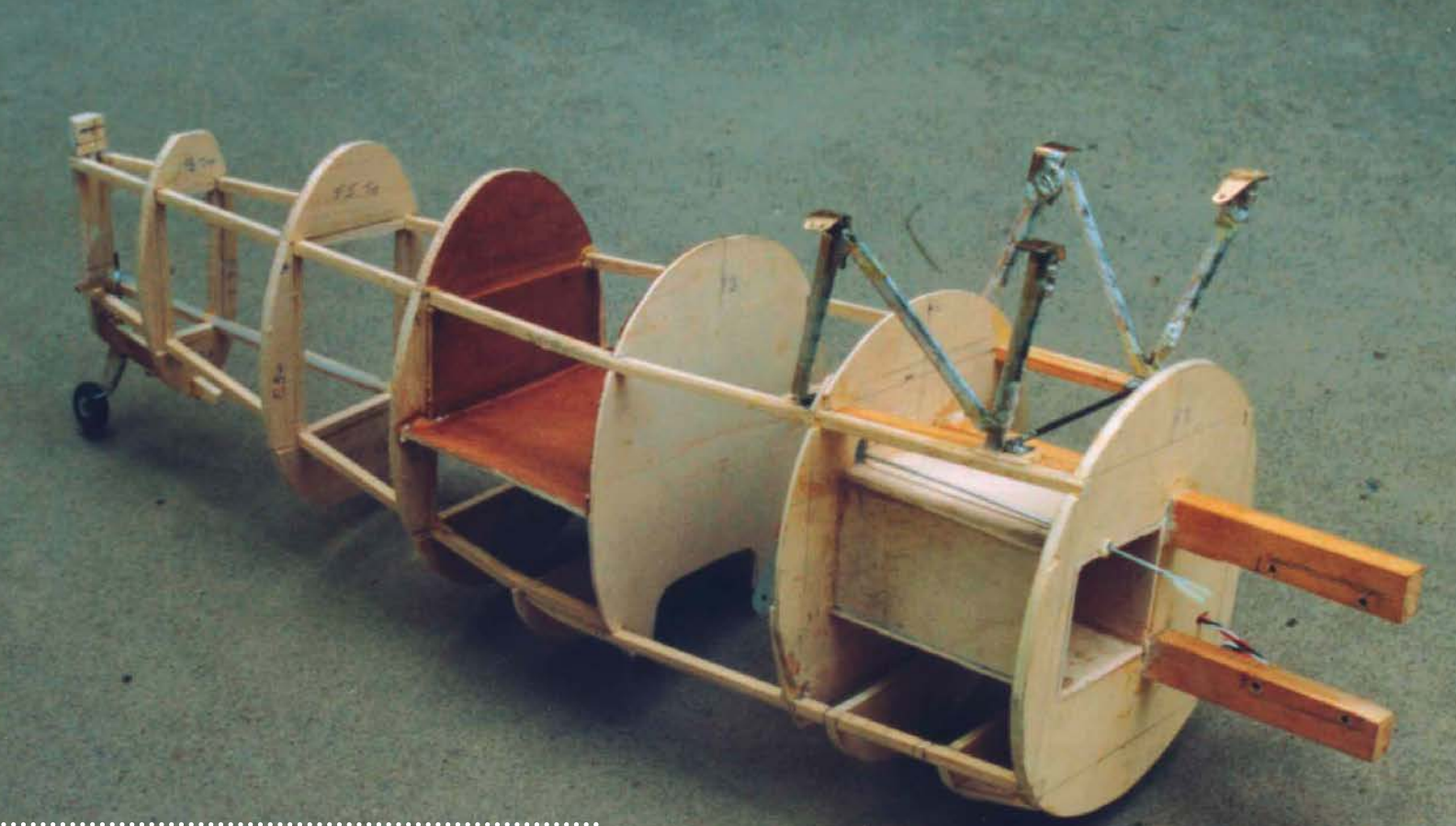
Examples of the same nominal type of aircraft may vary in many detail respects. It is always worthwhile, before starting a scale model, to get hold of as many photographs as possible and decide on a particular aircraft to model. My I-152 was as flown by Snr. Lt. V. F. Abramov of Fighter Regiment 11 of the Red Banner Baltic fleet, operating in support of the Red Army in the Great Patriotic War. (Well, that is what they called it.)

You do not actually have to go to New Zealand (where a number of the type were painstakingly restored by the *Alpine Fighter Collection*) to see the I-15 flying - but it helps !

There is more than one way to kill a cat and I can only recount the way I built my model. If you think of a better way, please go ahead and do let me know if it works !

COWLING

This seemed to be the difficult bit so I started with the cowl. A search of local markets found an aluminium wok of just over 9 in. diameter. Using a Dremel drill with a diamond cut-off wheel, this was cut



Basic fuselage structure prior to planking, with tailwheel, cabane strut assembly and elevator control snake outer installed.

down to form the front bowl of the cowl.

The cylindrical part at the back was from three pieces of 1/32" ply, spliced and joined together with CA glue then rolled around a pair of formers cut from double thicknesses of corrugated cardboard. The ply sticks better if you rub a little soda bicarbonate (baking powder) along the chamfered join line first.

Offer up the ply cylinder to the front cowl and tape the two halves together with masking tape on the outside. Use a fibreglass bandage, put in from the front, inside, to stick the two parts together.

The aluminium is fairly soft and can be dented if the model noses over, which it sometimes does, so reinforce the aluminium in the lower front cowl, inside, with two layers of 6 oz. fibreglass. The fretted front cowl plate is cut from good hard 1/16" ply and can be tack-glued in place until fitted over the engine.

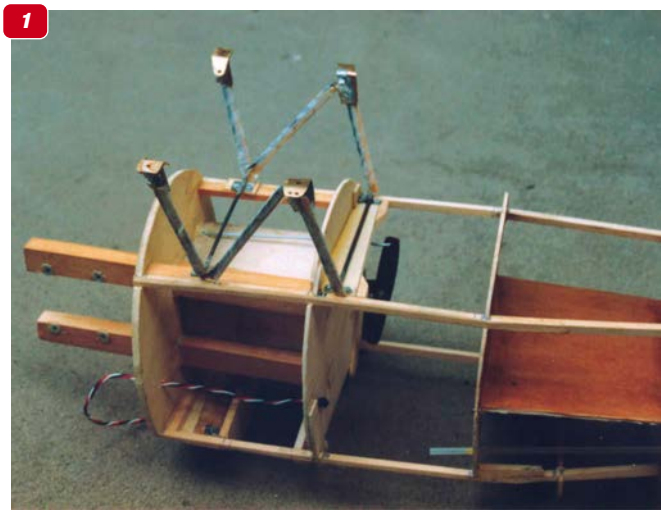
The cooling baffle has to fit closely around the engine and very closely around the battery box, so that component is epoxied in place after fitting to the engine and fuselage. Of course, you can make the whole cowl from fibreglass if you wish. To attached the cowl to the fuselage, four hardwood mounting blocks are epoxied to the front fuselage sheeting.

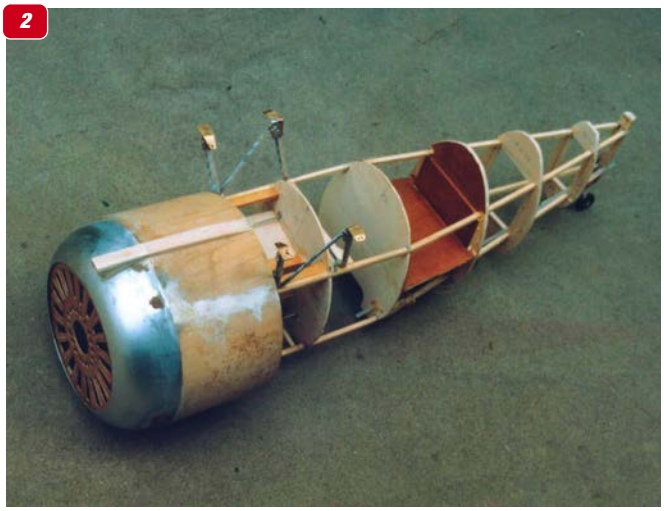
To mount the cowl, drill through the ply, clearance for 6-32, into the blocks with the cowl fitted over the engine. Then drill out the blocks to take 6-32 brass threaded inserts, which are screwed and epoxied in place.

FUSELAGE

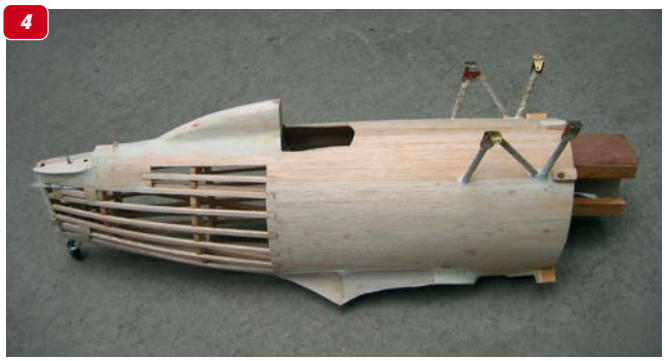
Unless otherwise stated, 1/8" Liteply is used for construction. This type of ply, made from Poplar I believe, is lighter and easier to work than birch ply which is restricted to highly stressed parts. To screw components together, 'T'-nuts, otherwise called 'captive nuts' or 'blind nuts' are used in American sizes. Metric equivalents

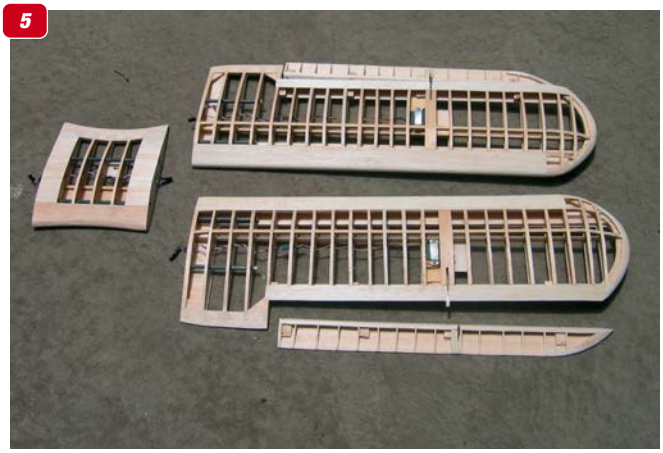
CONSTRUCTION

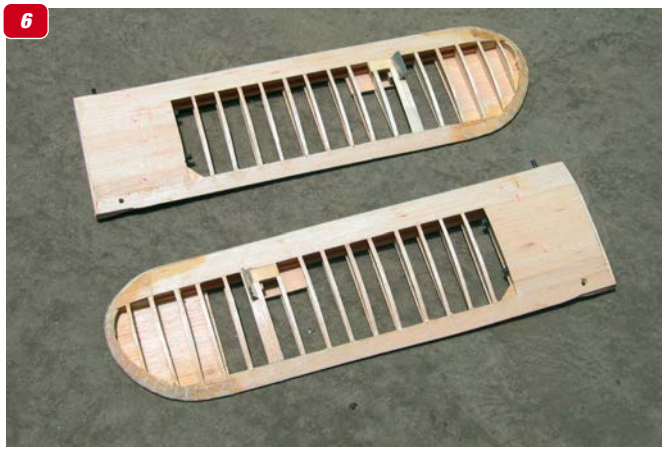




1: Close-up detail of the cabane struts and the traditional hardwood engine bearers. Note the bellcrank in the linkage to the throttle.
2: Big engine cowling started life as a cooking wok; now it houses a Laser 120 four-stroke turning a Master 16 x 8 prop.







3: Underside of the stringered fuselage, showing the servo installation, the lower wing fairings and the tail wheel.
4: The fully stringered fuselage, without, as yet, the engine cowl, looks more like a beer barrel at this stage!
5: The upper wing is built in three sections, with both outer panels removable for transport. One servo in each aileron.
6: The lower wing panels ready for covering. Note the skinning on the lower surfaces near the wing tips.

are given in the tables at the end of the section.

The fuselage is built-up on formers supported by the engine bearers and spruce basic stringers. The bearers, spaced for your engine, are mounted in F1 and F2 and angled to give 2.5 degrees downthrust and 3 degrees right-thrust, with the engine prop driver central in the front of the cowling. As a result, F1 and F2 are NOT at right-angles to the formers and should be carefully lined up using the plan. I did not do this properly and spent a lot of time sorting things out afterwards, so take particular care here! Be sure that the built-up tank box between F1 and F2 is big enough for your tank.

The basic longerons are spliced up from spruce. The top two are angled in between F3 and F4, but the lower pair are angled in and up. 1/4" square balsa is used to join the stringers and the sub-formers can then be attached. Use strips of 1/8" liteply planking, 1" wide, for the lower wing seat and at the top of the fuselage. This forms a firm seating, with scrap 1/4" ply backing, for the undercarriage mounting plate and the rigging attachment plates outside the fuselage. The three 8-32 'T'-nuts for the undercarriage mounting should be inserted before the plate is mounted inside the fuselage. At this stage it is a good idea to give the inside of the front fuselage a coat of polyurethane fuel-proofer before closing it up with the planking.

Centre section struts struts, without the brass mounting plates at the top, are screwed to 1/4" ply cross struts, while bearers for servos and the throttle lever are installed before finishing the planking of the front fuselage with 1/8" balsa. So the moment, leave excess planking at the lower wing seating, this will be trimmed down when truing up the model.

The 3/16" square balsa stringers for the rear fuselage are laid along the formers and a 1/16" notch cut for them. A 1/8 in. slot into the planking secures each end. At the tail end of the fuselage, the tailwheel strut is mounted in a 1/4" ply strut to run between F 6 and the tail post, before inserting the strut into the fuselage. This strut is also drilled for the extended fin retaining bolt and reinforced on each side with 1/16" ply. The tail wheel will be steered by a short connector to the right side of the rudder.

The seating for the horizontal tail is from 1/2" balsa and can be faced with 1/64" ply once everything is lined up.

WINGS

For the prototype model, in order to pack into the travelling box, the wings were built in five sections; two upper and lower wings and the upper centre-section. The wings are joined by carbon fibre 1/4in. arrow shafts running in brass tubes. You could use dural rods but the carbon fibre is lighter and has proved strong and rigid.

The lower wings have dowels in the leading-edge to mate with F2A and nylon wing bolts through the trailing-edge into a ply plate. The rib holes for the joining dowels drop 1/8" between R1 and R4 to allow for the dihedral. The leading-edge is sheeted back to the spar and all ribs are capped with 5/16" x 1/16" balsa. R14 is cut from ply as it has the dural strut mounting plate and the rigging attachment points fixed to it.

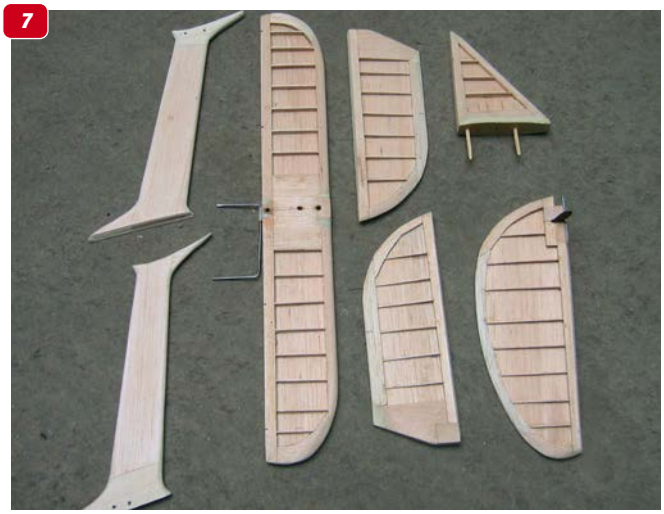
Biplanes often scrape their lower wing tips on tarmac runways, so I suggest covering under the tip with 1/16" sheet balsa and giving a coat of 2 oz. fibreglass fabric to this area to reduce the chance of later repairs being needed.

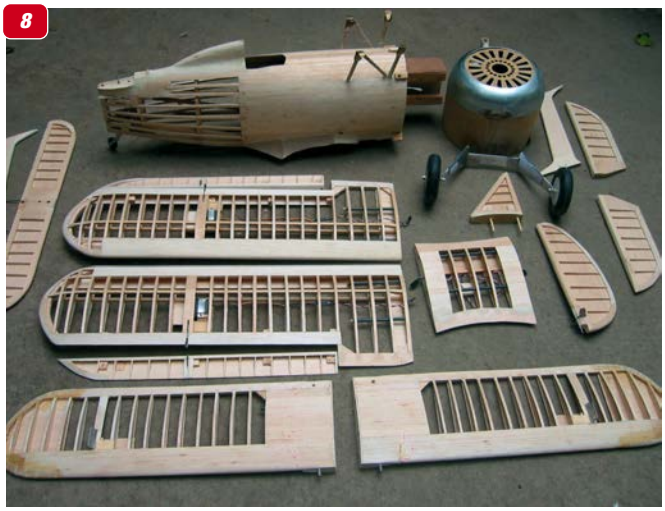
The upper wings are similar and have the aileron servos mounted inside. The servos are not accessible once the covering is installed but, with the reliability of modern servos, I have found this a risk worth taking. Note the offset on the servo arm at neutral, to give differential aileron, more 'up' than 'down'. The ailerons are built up on a 3/32" balsa outline and are attached to the wing after covering, with *Robart* hinges. Make sure the hinge line is back from the leading-edge of the aileron (see 'Flying', later).

The centre-section upper surface should not be sheeted until after the section has been mated to the mounting plates on the cabane struts and the 'T'-nuts installed. It is not screwed in place until after covering and painting. Once this is done, it can be mounted and left in place.

TAIL

The horizontal and vertical tail components are built up on a soft 3/32"





7: The tail surfaces, tailplane, elevator, fin and rudder together with the wing struts. Note that the surfaces are all built up around outline centre sheets. 8: A kit of parts! All the components for the I-152 laid out prior to covering.

balsa sheet outline. 1/4in. ply blocks on the underside of the stabiliser take the screws to retain the support struts.

The rudder horn is cut from 1/16" Paxolin and is shorter on the right side to give reduced movement to the tailwheel. Bamboo dowels (kebab sticks) on the fin pass through brass tubes in the stabiliser to fit into tubes in the fuselage. A wire in the bottom end of the rudder fits into a nylon pintle in the tail post. An extended bolt passes up through the fuselage, the stabiliser and into the base of the fin to hold the tail in place.

STRUTS

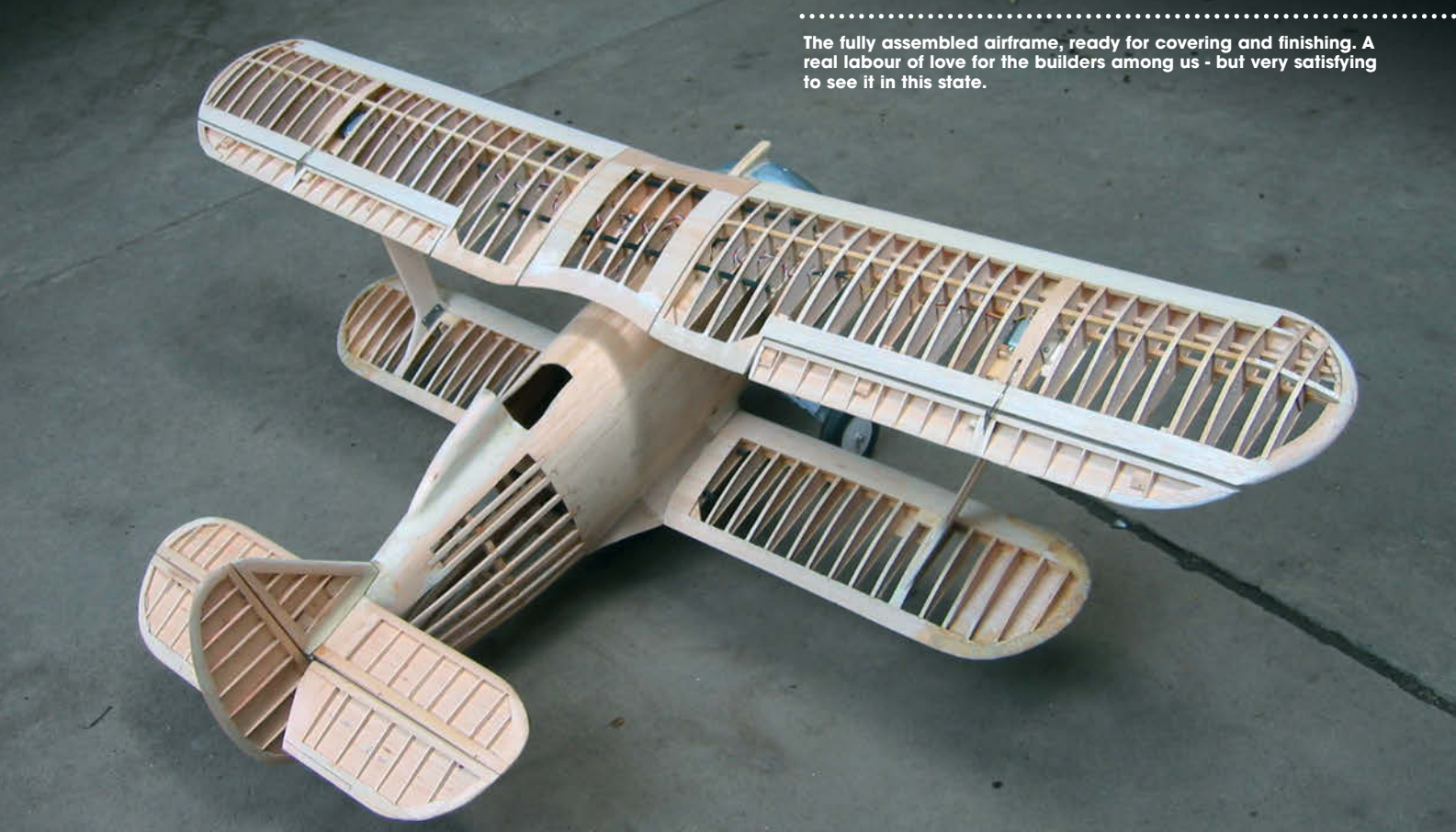
The wing struts are a triple sandwich of 1/8" balsa with a liteply core. Where the struts bolt to the mounting plates, a second layer of ply is used up against the plate. The holes for the retaining bolts are drilled and the 'T'-nuts installed only after lining up with the wings. Then, the third layer of balsa may be added over the nuts. Note that the bolts are screwed in from the outside for the upper attachment and the inside for the lower. This is the EASY way! The other way round is impossible.

The edges of the struts are chamfered to fit the wing surface and when bolted in place, the struts then set about three degrees washout to the outer sections of the upper wing. I would like to claim that this was a design feature as it has a most beneficial effect on low speed stability but, ah me, it was fortuitous!

UNERCARRIAGE

The undercarriage strut is from 1/8" dural. I cut mine from an old commercial strut and added a 3/32" dural reinforcing plate, bolted to the main strut at each upper bend. This has proved well worthwhile and the undercarriage has stood up well to the loads of more than 11 lbs. of model thumping down on it. The struts should be twisted so as to give three degrees toe-out to each wheel when viewed from above.

If you intend to bend dural more than



The fully assembled airframe, ready for covering and finishing. A real labour of love for the builders among us - but very satisfying to see it in this state.

using the old soap trick. Rub a wet bar of soap on the dural and then heat the other side on the gas stove until it turns black. Quench under a cold water tap and you can then bend the dural easily. It will regain its temper in about two days. Allow the smell of burnt soap to clear from the kitchen before cooking supper, as your wife may well take longer to regain her temper...

The undercarriage fairing is in two parts, the lower fitted first. This is cut from thin tinplate and glued with contact adhesive to a balsa rib epoxied to the undercarriage strut. The fairing is glued only to its top attachment, allowing it to slide at its lower edge. It is wrapped round the strut and held in place with soft iron wire while its trailing edge is soldered together. The wire is then removed.

I used 4.1/4in. Williams balloon wheels which have been completely satisfactory. If you want to add spats ('pants' to our American friends) these need to be moulded from fibreglass and mounted by bolting to the struts.

TRU-ING UP

The venerable trade of airframe rigger was invented in WW1 just to line-up the aeroplanes of the time. So, with your Abney Level in hand, you need to set about squaring up this biplane. In order to get things straight you need to start with a reference setting and go on from there, each piece at a time.

I suggest that you start with the lower wing by cutting away the excess sheeting at the wing root until the wing is at 0 degrees incidence and square to the fuselage. Measure the distance from the wing tips to the tail post to check. Solder the brass fitting plates onto the top of the cabane struts. Note that the front one is double in order to take the rigging lines to the fuselage centre-line. The top wing should also be at 0 degrees incidence.

Fit the top wings to the centre-section and line them up on top of the cabane. Mark the place for the bolt holes under the centre-section and install the 'T'-nuts from above. The upper surface of the centre-section can now be sheeted.

The wing struts can then be fitted and the holes drilled to line up with the dural strut mount plates. The upper wings should have about 3 degrees washout when bolted on. The horizontal tail should be at +1 degree incidence and the seating adjusted so that the tail is square to the fuselage. The fin should be set at right-angles.

After this, the fairings can be built up for the lower wing using thin ply and microballoons and similarly for the tail.

RIGGING

The rigging lines on the wings are made from 80 lb. test nylon-covered steel fishing trace. Note that two of the wires are doubled. At mid-point, an anti-vibration joiner from 1/8" bamboo dowel is drilled for the wires and slid in place before adding the rigging couplers and clevises on the outer ends.

I used to use 2-56 nuts to lock the clevises but lost so many that I went over to using narrow silicone tube instead, with much better results.

ENGINE

The Laser 150 as used on the prototype model simply bolts in place. Originally, I fitted a Laser 90, but take-off was prolonged and, since I had the larger engine temporarily redundant, this was installed, conveniently fitting the same mounting holes. The full-size aircraft tears round the sky at a rate of knots (as I have witnessed) and the model is by no means overpowered with the Laser 150 on a 16 x 8 prop. The more powerful 120 four strokers, such as O.S. Surpass II and Y.S. might be sufficient but probably not the early O.S. 120 and Magnum, reliable though they be.

The exhaust is ducted out of the bottom of the cowl with a piece of the flexible copper tube that plumbers use to connect sink drains. Silicone tube proved unable to cope with the temperature at the exit of the silencer and I made up a washer by winding a thin strip of aluminium round and round, covering it in heat resisting silicone gasket material and fixed it all together with a 'jubilee' or screw circlip.

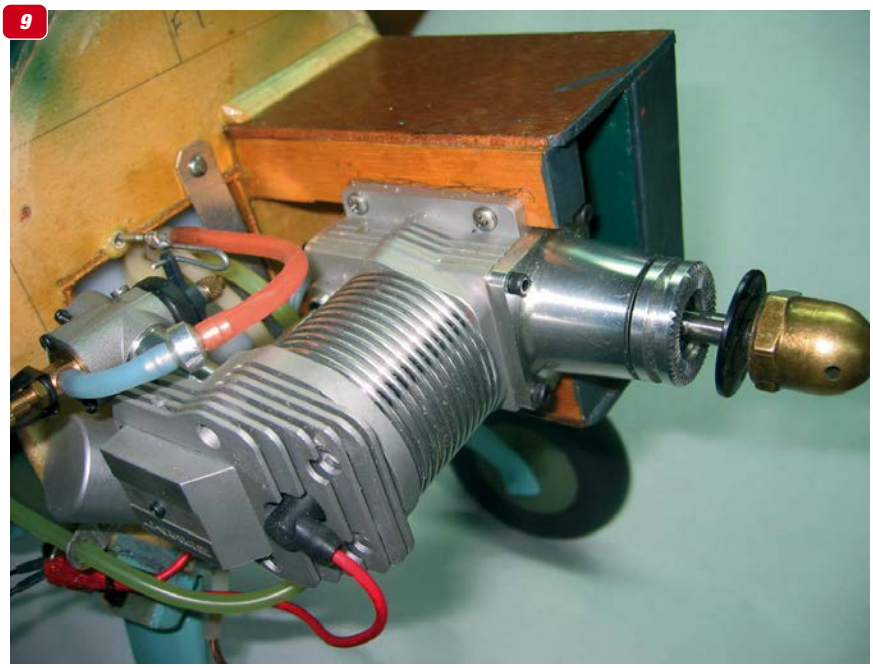
A large Super-Tigre two-stroke should be acceptable - if you can fit the silencer in. The Laser, incidentally, is the most unbothersome engine I have ever had.

RADIO

Four channels are necessary, with a fifth as an option. I use Hitec equipment with satisfaction but I am sure the others are as good. Servos are a pair of HS 215s in the upper wing for the ailerons and three standard servos in the fuselage. I used a high power HS 605 on elevator but do not think it was really needed, a standard one would do.

A 'Y'-lead in the centre-section has a 12 in. extension to run down to the receiver in the fuselage. Where the plugs emerge from the upper wing root ribs, use stout

9



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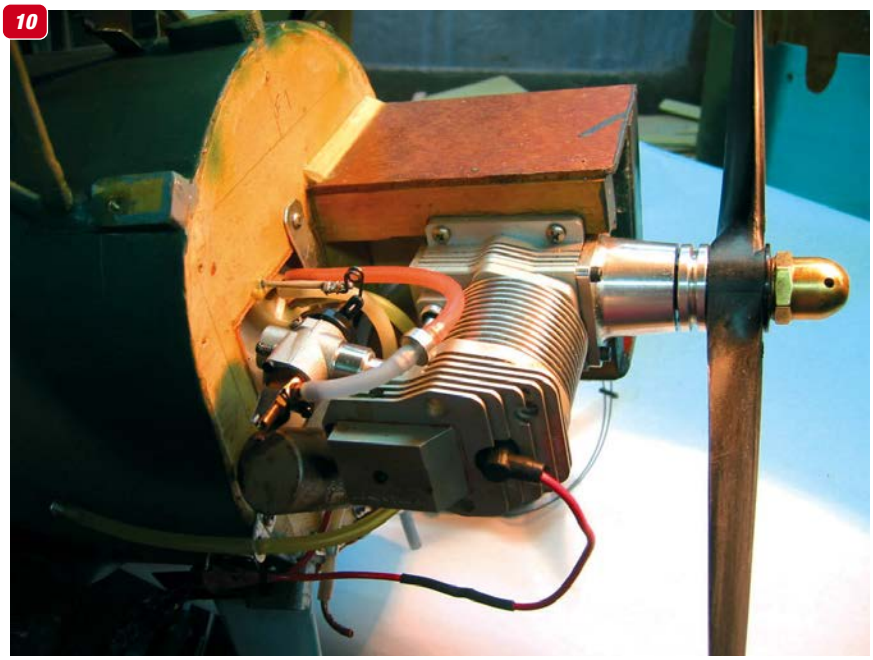
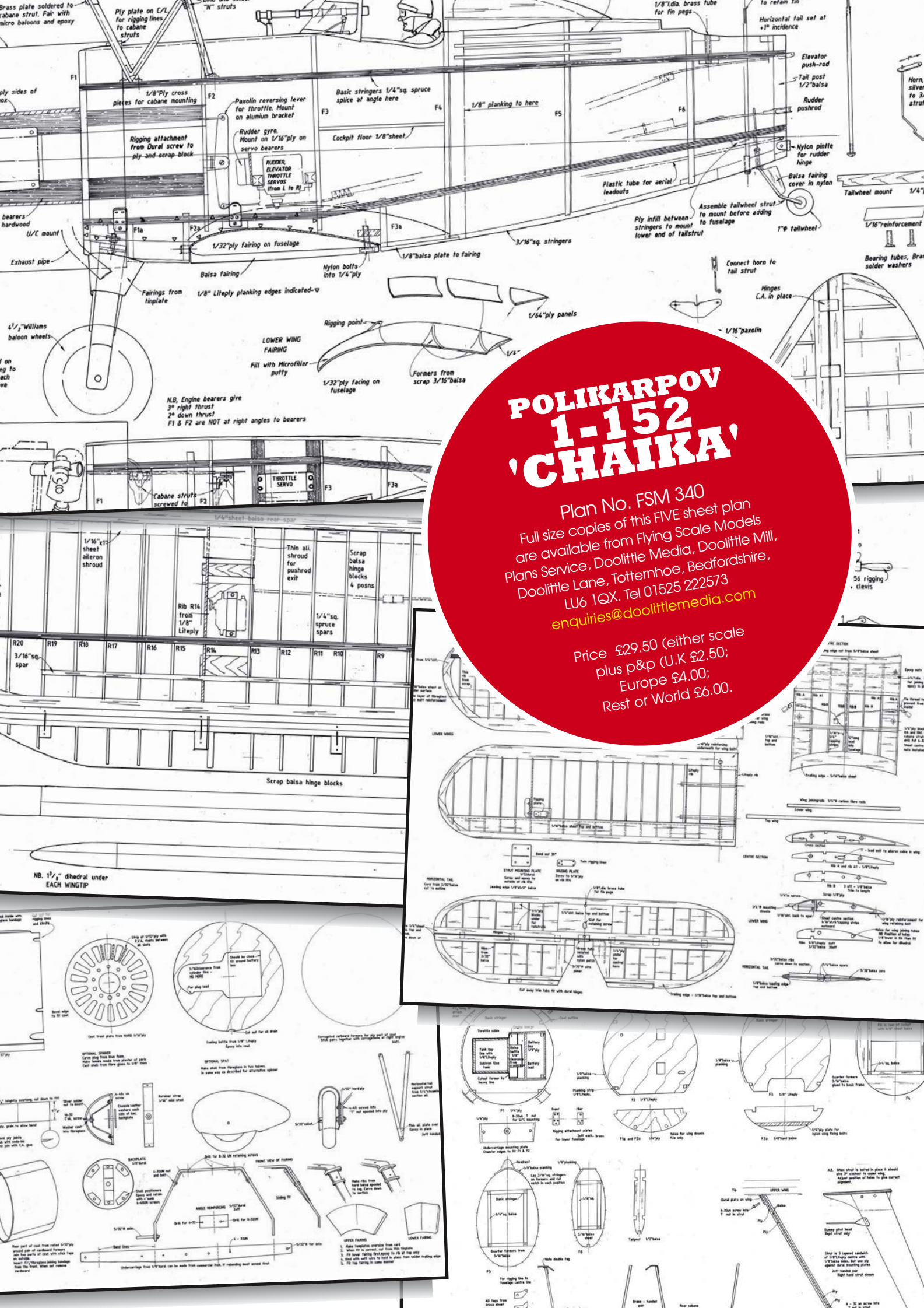


9 & 10: Two views of the engine installation, showing the side-mounted Laser 120 four-stroke - The 'most unbothersome engine' Mike says he has ever had!


POLIKARPOV
1-152
'CHAIKA'
Plan No. FSM 340
Full size copies of this FIVE 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 £29.50 (either scale plus p&p (U.K £2.50; Europe £4.00; Rest or World £6.00.

11: Engine cowl interior, showing the cooling baffle referred to in text; the front part of the cowling started life as a kitchen wok. 12: The finished cowl showing the fretted shroud at the front. The metal front end of the cowl was fashioned from a metal Wok, while the cylindrical rear is made of 1/64" ply, wound around cardboard formers. 13: The main undercarriage complete and in a state ready to fit the the botttom of the fuselage.

linen thread to tie the plug to the rib. This avoids the plug inadvertently slipping into the hole which would mean cutting the wing open to retrieve it.

Batteries used were 1000 mAh and a bit of weight in the nose does no harm at all. I originally planned to use a gyro in rudder, but, having mounted it on the back of F2, I found vibration caused the rudder to wander during engine runs, so I took it out. Later, when flying, I found that it was necessary for directional stability during take-off and landing runs so a simple GWS servo was re-installed for the rudder. Expensive helicopter type servos are not needed and this one costs little more than a good servo and is now mounted on the servo support bearers. 75% gain setting is about right to help the ground handling and does not seem to affect the model in flight. I first fitted a servo switch connected to a fifth channel; it only cost $15, but in practice I found that the gyro could be left 'on' all the time and the switch was deleted.

The first time I took the model out to fly, I put it on the tarmac and gently opened the throttle. The model did not move. I was standing on the aerial ! (This all happened way back before the arrival of 2.4 GHz). On the third flight, I noticed a glitch and landed immediately to find that there was no aerial coming out of the rear fuselage. On checking, I found it had broken off at a soldered joint just 4 in. from the Rx. I have a photo to prove it! I can only offer my thanks to Hitec for the old Platinum Rx that, in the circumstances, safely brought the model down.

COVERING

Open areas are covered with neutral or antique Solartex. Sheeted areas on the fuselage are covered with panels of brown paper, put on wet with 50/50 diluted PVA glue. When this dries out and tightens up, rivet lines can be added with PVA glue from a syringe, which gives a good simulation of metal panels.

COLOUR SCHEME

There is a wide choice. In a photo of I-152s under repair in a Soviet factory, each one had a different paint scheme and arrangement of markings. See the colour references and choose between Russian, Spanish, Chinese or Finnish schemes.

There are no colour photographs of WW II Soviet aircraft that I know of, so the nearest we can get for wartime tints is the colours used by the Russians themselves for restorations. The replica at the Museum of the Great Patriotic War in Moscow is olive brown, the same colour as the I-16 in the cockpit view of my photo taken at Wanaka. The olive green/dark green scheme that I used is based on the tints of the I-153 at Wanaka.

The paints were mixed from oil-based polyurethane, 'Perfect Paint' and sprayed on with an airbrush. Markings were done by hand using a bowed ruling pen for the red stars. Finally, a coat of matt polyurethane varnish gave the right appearance for a service aircraft.

FLYING

The balance point should be at 3.3/4in. behind the top wing leading-edge, or forward of that. I stand in awe of modellers whose models fly 'right off the drawing board'.

A scale model of a tricky aircraft can expect a few excitements along the way and the number of photos of I-15 aircraft upside down on their airfields gave some warning of what to expect. This, combined with the commentators at Wanaka who told us of the difficulties of these aircraft and their dislike for cross-wind landings. Nevertheless, the pilots there made it all look easy, which it was not - and well worthwhile, which it was.

So here goes for the problems and what to do about them! On my first attempted take-off the run was long and immediately after take-off a Dutch roll started. The model touched down, yawed and flipped over.

Action: the Laser 90 was replaced by the new 150 and the aileron horns were extended forward to put the pick-up point in front of the hinge line, giving correct

CONSTRUCTION

14: Rudder, elevator and throttle servos sit line-abreast in the fuselage, with the receiver off to one side.

15: Nose end of the finished model sshowing the fretted baffle on the front of the cowl - an essential detail to get the feel of the full size.
16: Intrepid 'Tavarich' ready for action on the Eastern front against the Luftwaffe.
17: Tailcone, showing the tailplane strut anchor points and the linkages to rudder and elevator.
18: Wing detail, showing the cabane struts, plus flying and bracing wires.

Designer Dr. Mike Hawkins and the prototype model.

differential.

Take-off number two was fine, but there was too much elevator movement. I had just about got that sorted out with the reduced rate on the Tx when the engine stopped due to overheating. The front cowling plate is intended to keep the engine warm when operating in Russian winter conditions. Bangkok (where I live) was just too hot for it. Fortunately, my fuel mix included 10% castor as well as 10% Klotz oil so the engine survived.

Action: the front grill could be removed (photos of the full size showed that sometimes it was, in the Russian summer. However, you then need a dummy engine. I therefore installed a 1/8" ply baffle with a 3/16" gap around the cylinder, allowing 1/8" under the crankcase and fitting as closely as possible round the battery box. This ensured that all the air entering the front of the cowl HAD to go past the cylinder. It worked and I have had no trouble at all from overheating since then.

At the start of further test flight, the model took off every which way and tipped over on nearly every landing. While this was true scale behaviour, I did not like it and dashed to the nearest model shop to get another gyro to install on rudder.

Action: the model tips because it yaws and, with the narrow undercarriage and high centre of gravity, over it goes. Now a pilot standing at the side of the model does not appreciate the yaw until it is too late to stop it. A pilot inside the aeroplane notices it sooner and with his hands directly on the controls, he has a better chance of correcting the swing in time. We cannot sit inside our models, but a gyro can and it really helps. The gyro should be applied to the rudder control function, in the opposite direction to the yaw (nose RIGHT - rudder LEFT).

After that, things were much better but finally I remembered that one set of drawings, in this case for the later I-153 variant, that the main wheels were shown toed out by about 3 degrees when lowered. Now, Polikarpov must have done that for a reason and I thought I knew what it was. A large adjustable spanner was applied to the undercarriage legs and they were duly twisted outwards 3 degrees. After that, take-offs were immaculate and landings, if done without yaw, were fine.I should add that no serious damage occurred during these trials.

SPECIFICATIONS

Name: Polikarpov I-152
Type: 1/6th scale
Designer: Mike Hawkins
Wing span: 67" (1.70 m.)
Length: 41.2 in. (1.04 m.)
Weight: 11 lb. 6 oz. (5.16 kg)
Engines: 120 and larger four-strokes
Engine used: Laser 150 with Master 16 x 8 prop.
Fits in box: 8 in. x 17 in. x 16 in.
For USA: IMAA legal.

CONTROL THROWS

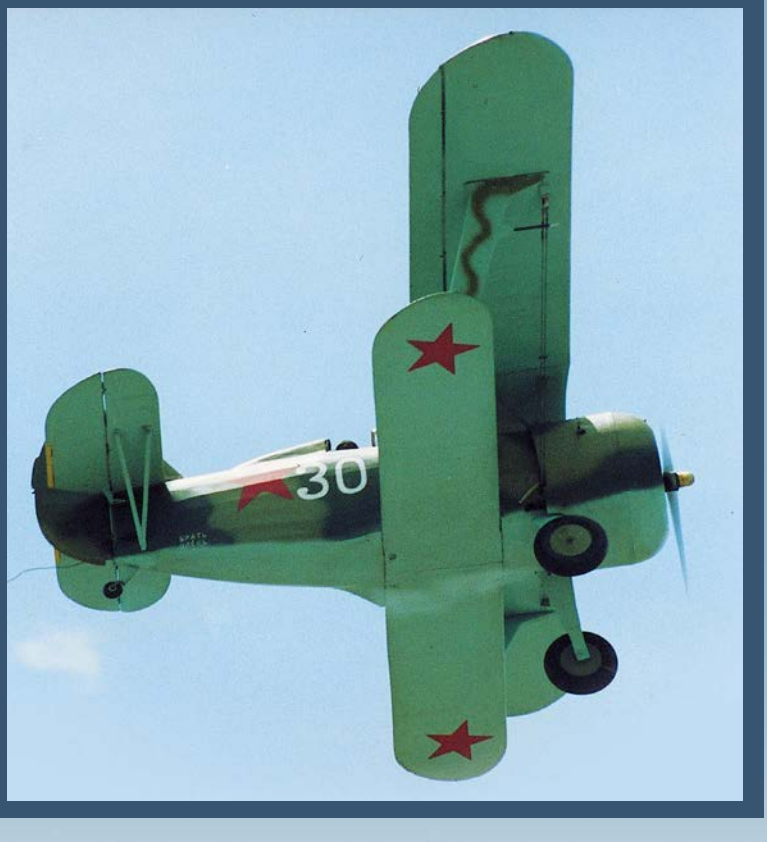
Aileron: Up 1/2" Down. 5/16 in.
Elevator: Up & down. 1" full rate/reduced rate 75%
Rudder: Each way 1.1/2 in.
Rudder gyro: Set 75% gain.

RIGGING

Both wings: 0 degrees
Horizontal tail: + 1 degree
Engine downthrust: 2.5 degrees
Right thrust: 3 degrees
Balance point: 3.3/4 in back from top wing L.E.

CONVERSION

US/Metric bolts	
8-32	4 mm
6-32	3 mm
4-40	2.5 mm
2-56	2 mm



Apart from the ground handling, the model is easy to fly. It will not stall, it just mushes and I cannot get it to spin, even with the gyro switched off. It is rather sensitive to down elevator and if your transmitter has exponential (mine had not) this could be used to reduce sensitivity around neutral.

Looping and rolling manoeuvres are fine, but it does not like to fly level inverted, trying to roll out. It is very stable at low speed and my favourite manoeuvre is to call "High Speed Pass" and then throttle back to chunter by at just about walking pace. As you pass the flight line, slam open the faithful Laser and climb out at 45 degrees for ever!

For landing, line up straight into wind quite a long way out. Then, try not to use ailerons or rudder while you gently flare with elevator. Be ready to check any swing in the latter part of the landing roll. A reasonable breeze helps, as the controls are effective down to a lower ground speed. If anything, the model is more stable on grass than concrete.

I have had my pennyworth of fun from this one! If you have any queries or comments, please e-mail me at: mikeh@samart.co.th ■

POLIKARPOV'S FLYING BARRELS

Dr. Mike Hawkins outlines the type history of Nicolai Polikarpov's distinctive biplanes and the subsequent I-16 monoplane development

The 'I' in the designation of this line for aircraft is short for *'Istrebitel'*, which is the Russian word for 'fighter', and the I-15, together with its two major developments the I-152 and I-153, plus the later I-16 monoplane, which we will deal with separately were the major Soviet fighter types during the 1930s.

For a start, it has to be understood that in the Soviet Union, unlike in Europe and USA, there were no aircraft companies. Designers were assigned to a design bureau (OKB) and the Central Construction Office (TsKB) would decide on production and allocate a particular design to a factory, based on political as much as engineering factors.

Nicolai Polikarpov's first fighter, the R-1, was an adaptation of the D.H. 9a, but with a Liberty engine. Later, in 1927, he designed the U-2 utility biplane, subsequently renamed in his honour, the Po-2 that remained in service until long after WWII.

The notorious Joseph Stalin believed that his aircraft designers would work harder if they were in prison so, in 1929, Polikarpov was arrested, charged with industrial sabotage and sentenced to death! This was later commuted to imprisonment and his design bureau set up shop in prison. The same fate later also fell to another highly gifted Soviet era aicraft designer Andrei Tupolev, who also managed to survive, creating high performance military aircraft right into the jet age. Polikarpov's conviction was eventually quashed after the death of Stalin in 1956, some twelve years after Polikarpov's own death.

THE I-15 'CHAIKA'

In 1930, a prototype fighter designed by Polikarpov was built, bearing the crest of the 'Internal Prison' on its rudder. This aircraft was to become the I-5 fighter. It was similar to the Bristol Bulldog and shared the same Bristol Jupiter engine, produced under licence as the M-22, and the aircraft became the standard Soviet fighter of the early 1930s.

At the time, the Soviet Union was lagging in aircraft engine development and the excellence of the Wright Cyclone was recognised, so licence production was arranged as the 635 h.p. Shevetsov M-25. Polikarpov realised the potential of the new engine and designed both a biplane, which became the I-15 and a monoplane fighter, the later I-16, to utilise it.

The biplane had a gull-wing centre-section for the upper wing and had the unofficial name of *'Chaika'* (seagull). Both went into service with the VVS (Soviet Army Aviation).

Wobbling on it's narrow retracting undercarriage, the Alpine Fighter Collection's Polikarpov I-153 taxis out during the Warbirds over Wanaka air show in New Zealand back in 2002.

The monoplane became known as the *'Ishak'* (little donkey).

At the time, the Soviet Union was a closed society and little was known of its internal affairs or developments, although the I-16 was shown at a European International Salon. Meanwhile, the left-wing Republican Government of Spain was in turmoil and, in 1936, a revolt was launched by Army Generals and landowners. The resulting bitter civil war attracted support for the Republican cause from the international 'left' and later the Soviets, which for the Nationalists from the political 'right', the Fascist Italians and Nazi Germany.

SPANISH CIVIL WAR

Republican Spain sent its gold reserves to Moscow and in return received arms and 'advisors' who later took over the Republican cause for the Communists. (See George Orwell - 'Homage to Catalonia' and 'Animal Farm'). Much of the armaments that the Republicans actually received were in fact obsolete, such as Canadian rifles sent to the Tsar's army in W.W.I, but Stalin did send his latest fighters, the I-15 and I-16 to be flown at first by Russians and then by Spanish pilots as they were trained. The I-15 was even put into production in Spain.

The I-15 was named the *'Chato'*, (snub-nosed one) in Spanish and the I-16, the *'Rata'* (rat). Since the Russian biplanes were not known to Western reporters, these were often reported as 'Curtiss Hawks' or 'Boeings' (the latter presumably a misinformed reference the P-26 'Peashooter).

The Germans sent Ju52s and then Heinkel 51 fighters and later the Condor Legion with early Bf 109s, while the Italians sent Fiat CR 32 biplanes with their troops. Both sides used the Spanish Civil War as a testing ground for their equipment and personnel and combat tactics. Here, many Luftwaffe pilots who later fought in the Battle of Britain had already learned their fighter tactics in Spain, where they developed their basic fighter formations - the 'Schwarm' (four aircraft) made up of two smaller elements (the 'Rotte') which were so much more effective than the RAF's three-fighter 'Vics'.

In contrast, the Russians who returned home were shot as a result of Stalin's paranoia - their crime being that they had seen the outside world. Russia later paid dearly for this loss of experienced middle-level commanders.

The fighting in Spain had an effect on the

Polikarpov I-152 of the Western military district during the Summer of 1941 at the time of the commencement of 'Operation Barbarrosa'

An I-152 Superchato in Spanish Nationalist colours, either captured or impressed into service after the end of the Spanish Civil War and used as a trainer, with gunsight removed. No wheel spats

A Polikarpov 1-152 in Soviet Air Force(VVS) colur scheme, used for ground attack tasks on the Eastern Front.

The short fuselage, and resultant high ground angle of the Polikarpovbiplane fights requires carefull handling during landing to avoid a nose-over.

Viewed from the rear, the I-153's gull-wing upper centre section shape, as also appied to the I-15 is clear here.

> “Many of the arms that the Republicans actually received were in fact obsolete, such as Canadian rifles sent to the Tsar’s army in W.W.I, but Stalin did send his latest fighters, the I-15 and I-16 to be flown at first by Russians and then Spanish pilots as they were trained. .”

Forward fuselage view here shows the deep lower wing fairing. The angle at which the upper wing panels meet the fuselage minimises drag.

The cockpit of the Polikarpov I-16 looks to be a very tight fit for the pilot.

development of the military aircraft involved. Both sides drew wrong conclusions in that the Luftwaffe believed in the efficacy of unescorted, fast long-range bombers and dive-bombers, while the success of the I-15 *Chato* led Stalin to believe that there was still a future for the biplane fighter.

As a result, the I-15 was updated to use a new 775 h.p. M-25 engine. Soviet pilots had complained about the poor view for the cockpit caused by the gull-wing layout, so a straight centre-section was used in a partial re-design of the type. The resulting aircraft was much heavier and its performance was no better, and in some respects worse, than its predecessor. It was known either as the I-152 or the I-15 bis (bis; from the French or Latin for ‘second time’). Nevertheless, quantity production was ordered and the aircraft entered service with the VVS in large numbers.

Only 31 of the new biplane fighters reached their destination before the collapse of the Spanish Republic in April 1939, where they were called the *‘Super Chato’*.

At a conference presided over by Stalin himself, it was decided to continue the biplane I-15 development (one did not argue with Comrade Stalin) by fitting a 1,100 h.p. M-25 and a retractable undercarriage. Polikarpov did manage to reinstate the gull-wing, however, in which guise it became the Polikarpov I-153.

Some crated examples of the Polikarpov biplane fighters waiting in France, were handed over to the new Nationalist government in Spain and were retained in service there until as late as 1954, which must surely be some kind of longevity record for a fighter biplane.

IN CHINESE SERVICE

Meanwhile, on the other side of the world, the Japanese had started their war against China and in 1937 some one hundred I-152 fighters were supplied to the Chinese as a result of a secret Russo-Chinese pact. Training of the pilots was very poor and they had little success against the Nakajima Ki-27 (Nate) monoplane fighters of the Japanese Army. This became a slaughter with the initial deployment of the A6M2 Zero in September 1940 when nine I-152s

(together with eighteen I-16s) were shot down, without loss by the Japanese, in a single day over Chungking.

The Russians fought their own undeclared war with Japan along the Khalkin-Gol river in Mongolia, in the summer of 1939. Otherwise known as the *'Nomonohan Incident'*, large forces were employed by both sides with many major air battles. Both I-152 and I-153 fighters took part, together with I-16s. Claimed victories on both sides were high, but following Soviet Comander General Zukhov's massive tank offensive on the ground, a ceasefire was declared in September 1939.

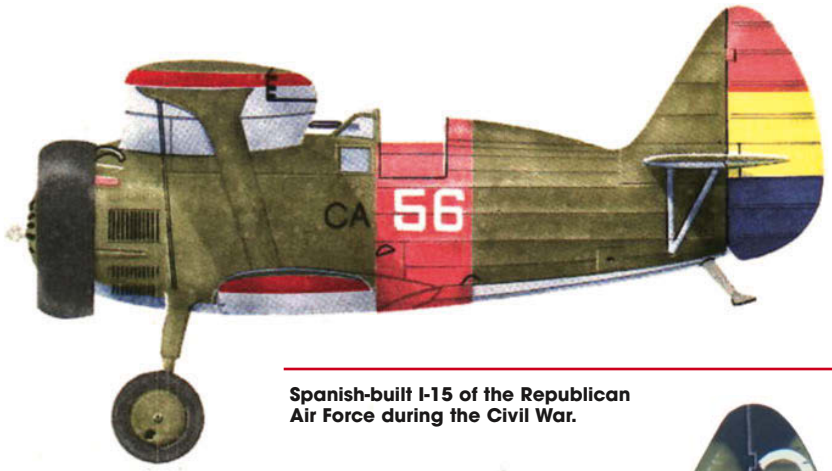
This 'war' went unnoticed in the West as events closer to home were drawing all attention...

WORLD WAR TWO

Following the Ribbentrop-Molotov pact between the Soviets and Germany, Stalin annexed the Baltic States of Estonia, Latvia and Lithuania. Finland refused Russian demands for territorial concessions and the Russo-Finnish 'Winter War' of 1939 followed. Once again, I-152s were widely used by the Russians, some being captured by the Finns and impressed into service with in their own Air Force.

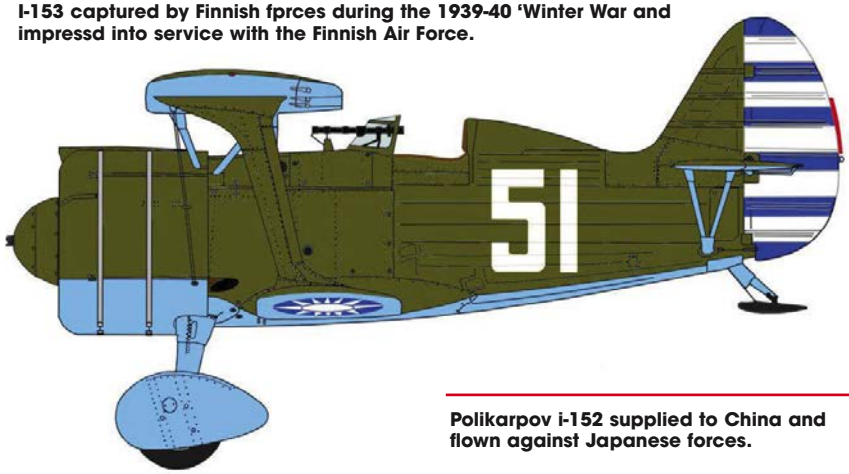
Many I-152s were still in use by the VVS and were dispersed on forward airfields when Adolf Hitler launched *Operation Barbarossa* against his former ally on June 22nd, 1941. The Luftwaffe had done their homework and about 1,500 Russian aircraft were destroyed on the ground in the first few days of the German attack. One factor that added to the losses was that the I-152 needed a Hucks Starter truck to start its engine. It was therefore not possible to scramble parked aircraft when the Germans suddenly appeared.

I-152 and I-153 fighters continued in use during 'The Great Patriotic War' well into 1943, mainly for ground attack, using RS 82 rockets, but were no match for current German fighters.



Spanish-built I-15 of the Republican Air Force during the Civil War.

I-153 captured by Finnish fprces during the 1939-40 'Winter War and impressd into service with the Finnish Air Force.



Polikarpov i-152 supplied to China and flown against Japanese forces.

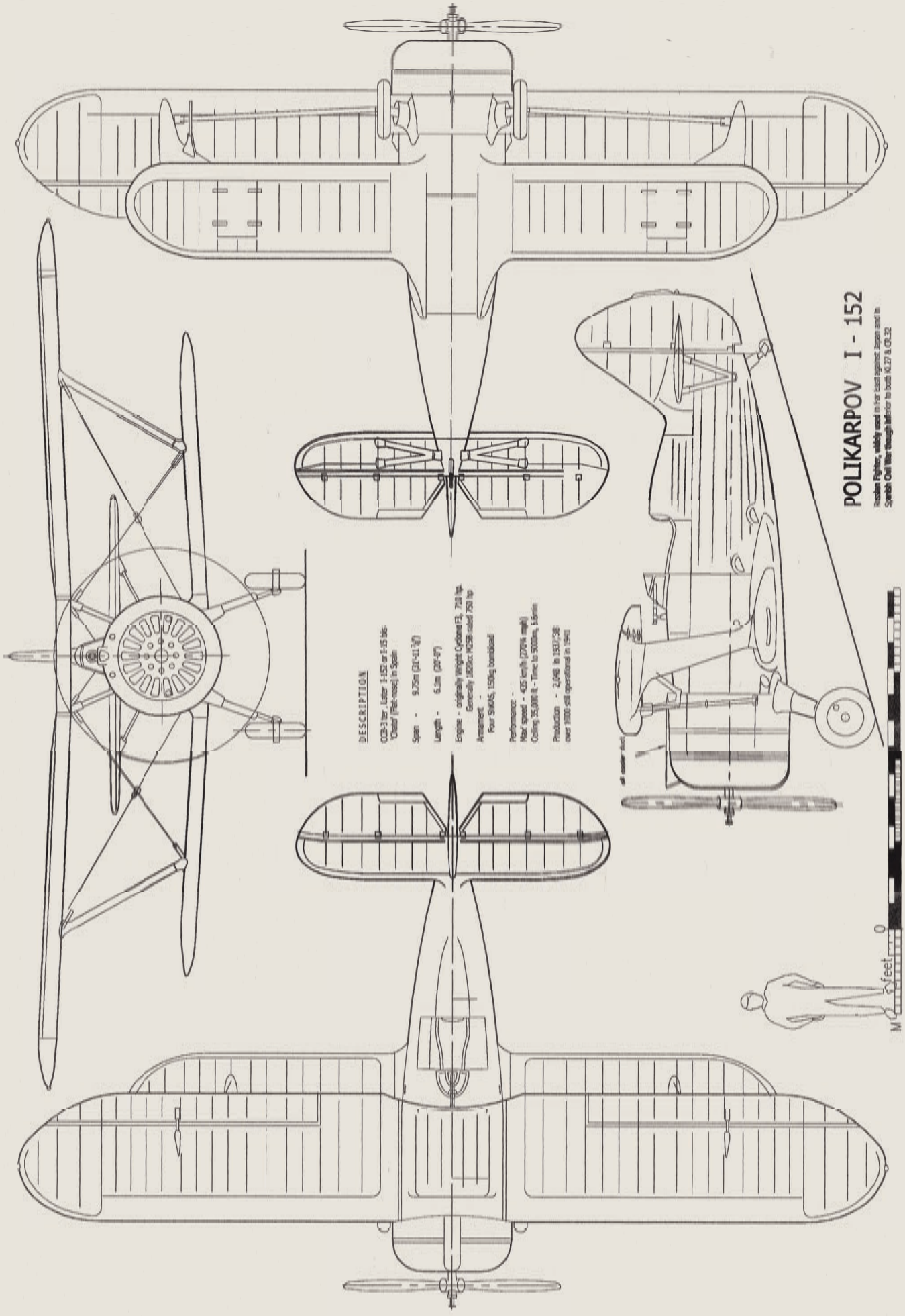
Whilst wheel spats were a design feature of the I-15 and I-152, these were often discarded for operational convenience.

Captured Polikarpov 1-152 impessed into Finnish Air Force service during the 1939-40 'Winter War', remaoning in service thereafter

Spanish Air Force pilot and ground crew with an I-152, probably one received via France at the end of the Civil War in 1939

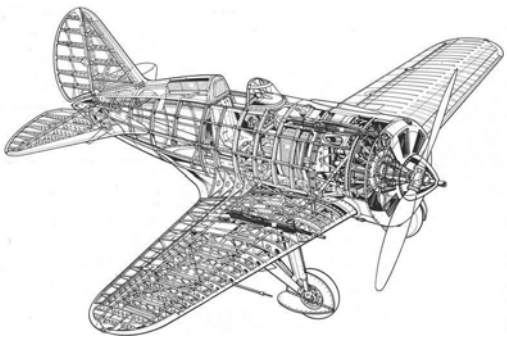
Fore-runner to the Polikarpov I-15 fighter series wat the Bristol Jupiter powered I-5, which featured a shorter main undercarriage.

SCALE 1:60


POLIKARPOV I - 152
DESCRIPTION
Span - 9.75m (31'-11")
Length - 6.1m (20'-0")
Armament -
Four SHKAS, 150kg bombload
Performance -
Max speed - 435 km/h (270½ mph)
Production - 2,048 in 1937-38
over 1000 still operational in 1941
0
feet

From biplane to monoplane - the POLIKARPOV I-16

THE NOISE IS ON! Three Polikarpov I-16s and a single I-153 in action at the 'Warbirds over Wanaka air show in New Zealand, back in 2002. Earplugs would have been a good investment, that day!



ANATOMY OF A LITTLE TOUGHIE! Cutaway illustration reveals the airframe strucrure of the Polikarpov I-16

Nikolai Polikarpov extrapolated much of his design ethos to his ZKB-12, by which designation the prototype I-16 was first known and which first flew in November 1933. Like the I-15 series, it was equipped with the M-22, 480 HP, engine (Bristol 'Jupiter' under licence) and production began in Moscow and Gorki with the factory designation ZKB-12bis. The maximum prototype speed was 360 Km/h., but the production type slightly improved this to 400 Km/H. with the more powerful M-25, 725 HP version of the Wright 'Cyclone', driving a two bladed all-metal propeller.

The basic aircraft had a low, cantilever wing, with large root fillets, two chrome-steel spars forming a box structure with duralumin ribs. It was fabric covered except for the duralumin leading edge. The wing was built in three sections, the centre section integral with the fuselage.

The I-16 *'Ishak'* featured the short stubby barrel fuselage shape of the I-15 biplane series, now using rugged monocoque fuselage structure, with diagonal bands of birch plywood covering. The enclosed cockpit had a hood that was arranged to slide forward and was provided with light armour plates to protect the pilot. Nevertheless the main fuel tank remained between him and the engine.

The undercarriage was retractable, both main wheels and tailskid. Shock absorbers and brakes were not very effective and the undercarriage retraction was operated by means of a manual control using a hand crank that drove cables from the cockpit. It was necessary to turn the crank 44 times, and the last turns were fairly difficult. Undercarriage lowering required careful action, to avoid injury to the pilot's hand and as a safety precaution, a cable cutter was provided in the cockpit that enabled the pilot to cut the cables in an emergency!

Preparing for take-off at Wanaka, New Zealand, the Polikarpov I-16 features a rather wider track undercarriage than the I-15 sweiwes biplanes.

iiTail up and about to lift off from the grass m the Polikarpov I-16 has all the air of an aggressive little terrier.

"As a result of the efforts of Sir Tim Wallis of the New Zealand based Alpine Fighter Collection, a number of Polikarpov fighters have been restored to flying condition in Russia and shipped to New Zealand."

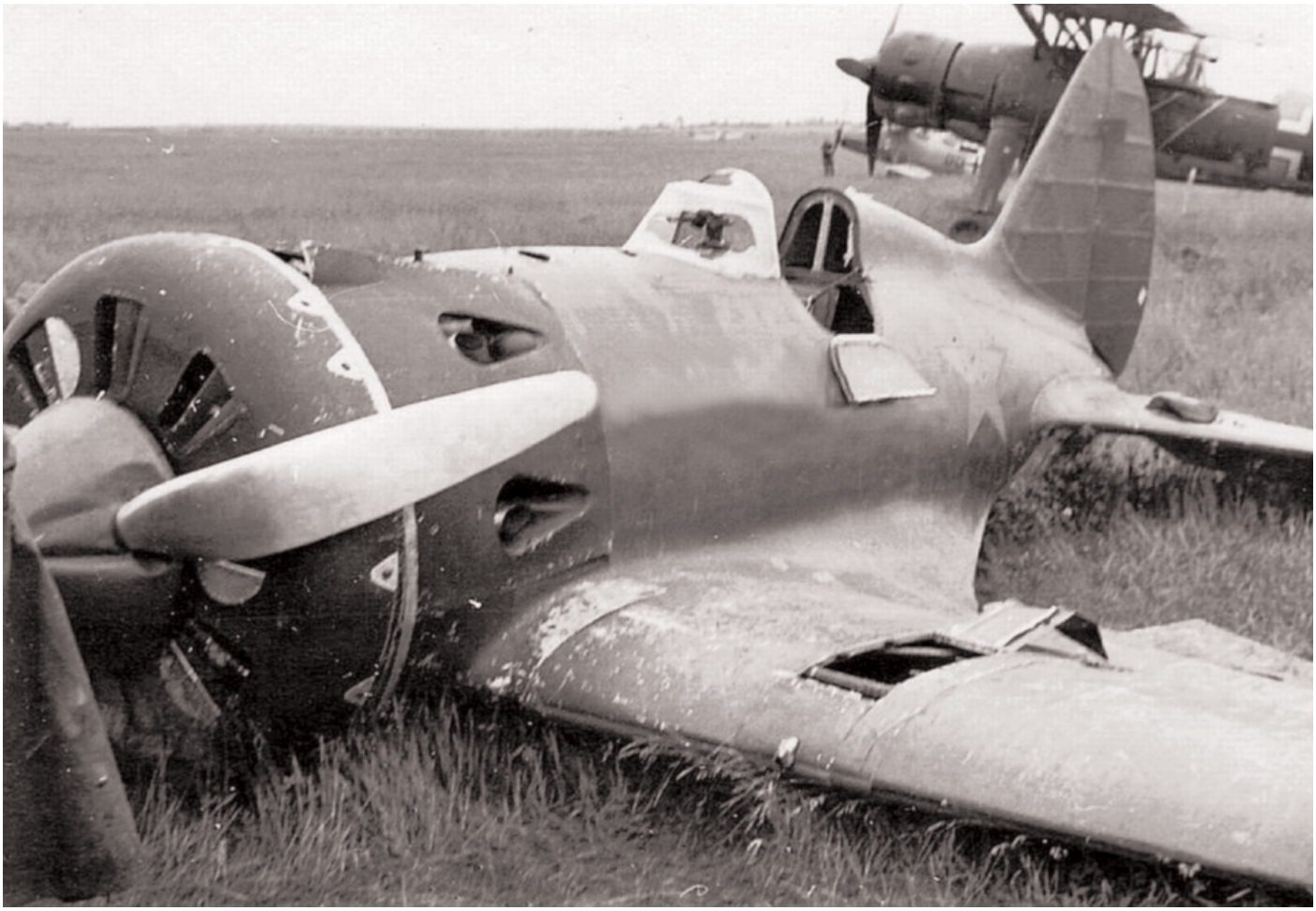
During the summer of 1936, deliveries of I-16s arrived in Spain together with Polikarpov biplanes. The Republican forces named it the *Mosca* (Fly) and the first combat action by a large number of Ishaks/Ratas occurred in November 1936 manned by Soviet pilots. But by the Autumn of 1938, the Russian crews were replaced by Spanish pilots, some trained in Spain, but the majority in the U.S.S.R. A total of 475 I-16s were supplied to Spain of which 415 were shot down.

Further Polikarpov I-16 action prior to WW2 occurred in China during 1937 by Chinese Air Force crews against Japanese invasion forces and during 1938 in Mongolia by the Soviet Air Forces, also against the Japanese. Then, in the 1939-40 *'Winter War'* in Finland, the I-16 was pitched against Finnish Air Force Fokker D.XXIs and thereafter, in 1941, against Finnish A/F Brewster Buffaloes.

WW2

When Germany struck east against Soviet forces in Eastern Europe in the summer of 1941, the I-16 was still front line equipment

This formation of three Polikarpov I-16s and a single I-153, in formation at the 'Warbirds over Wanaka' air show in New Zeakand during 2002 demonstrate, among other things, that the full size aircraft restoration movement knows no bounds.



FOR YOU THE WAE IS OVER. A wrecked I-16 at an airfield in eastern Europe, soon after the German Operation Barbarossa in Summer 1941.

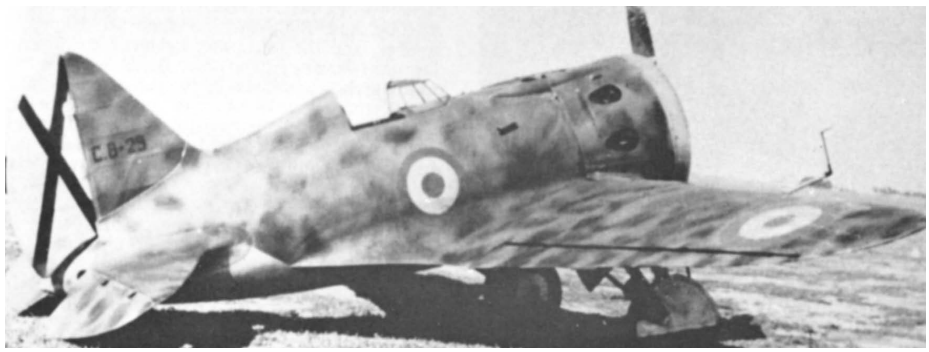
with the VVS (Soviet Air Force), albeit much outclasses by the Messerschmitt Me 109E and 109F but could nevertheless, still give a good account of itself when manned by an experienced pilot and against unescorted bombers, while its rugged construction was a positive feature in maintaining serviceability.

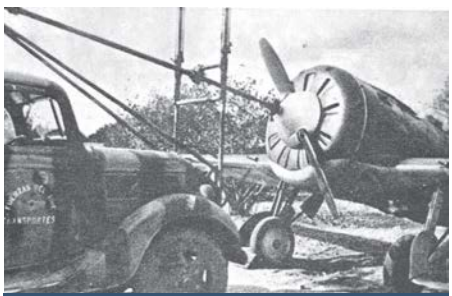
By 1942, newer, better performance fighter types became available to the VVS in sufficient numbers that the I-16 could be relegated to the fighter-trainer role for which many Russian pilots claimed that if one could master the I-16, one could handle the newly arrived Yaks and Lavochkin fighters without any difficulty.

STILL FLYING

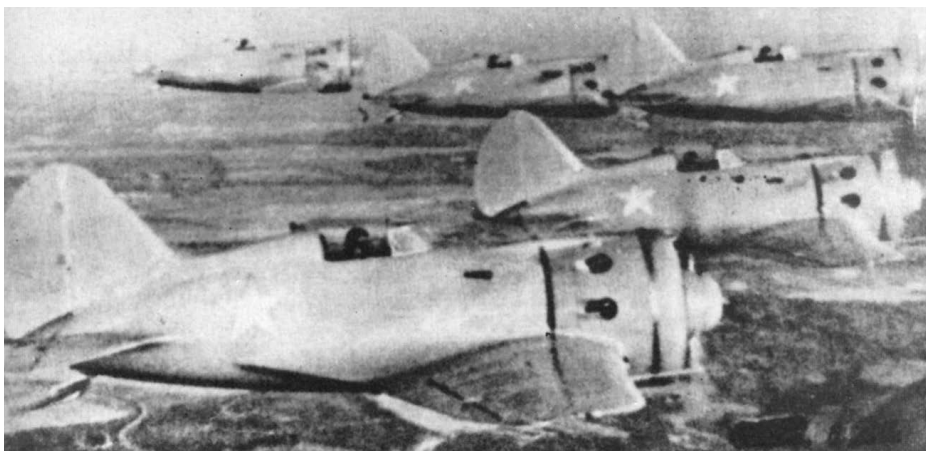
As a result of the efforts of Sir Tim Wallis of the New Zealand based *Alpine Fighter Collection*, a number of Polikarpov fighters

The last airworthy 1-16 in Spanish Air Force service, which remained as a fighter trainer up until 1952.



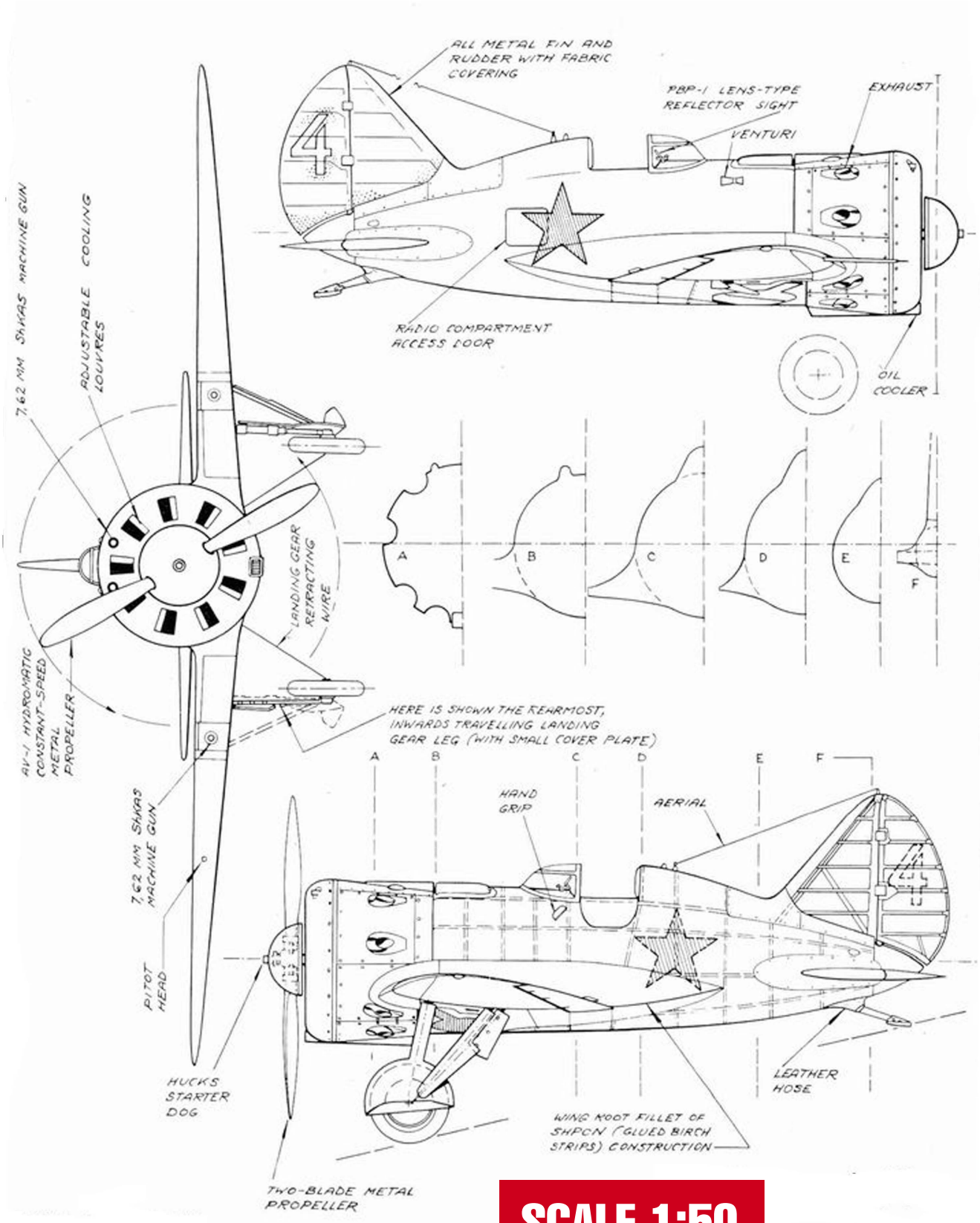


Without a dedicated Hucks type starter for each individual I-16, rgere could be no emergency 'scramble'. But then, there would probablu have been no early warning radar either.



A formation of I-16s of the Soviet Air Force, carrying only the star insignia.

Polikarpov 1:16 'Ishak'

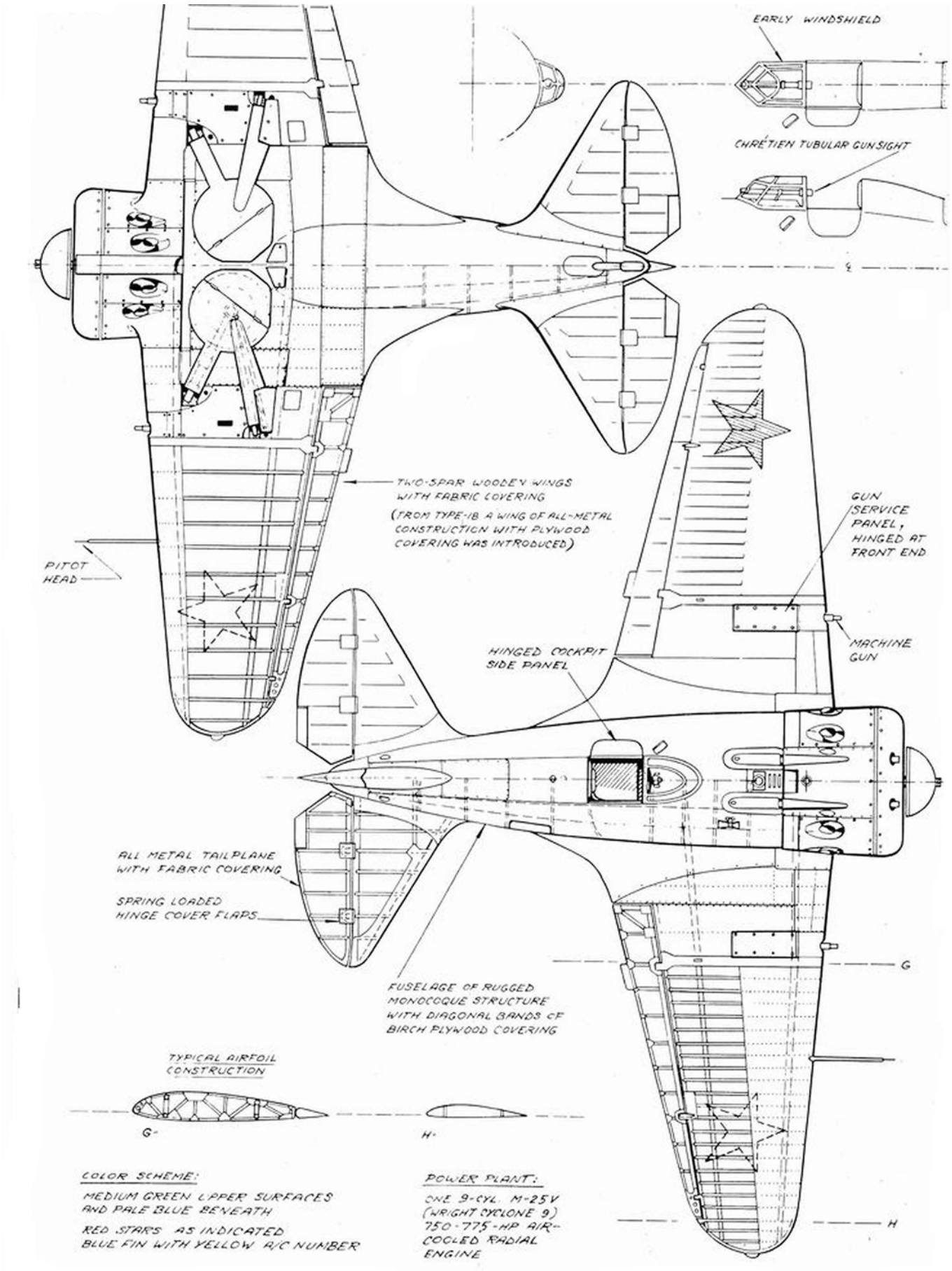


SCALE 1:50

have been restored to flying condition in Russia and shipped to New Zealand. I was able to see and hear them take part in the *Wanaka Air Show* on South Island back in March 2002.

One I-152 later went to USA, also an I-16, but a formation of an I-153 with three I-16s on that day was an unforgettable sight at the *Warbirds over Wanaka* air show with their characteristic stuttering engine sound. Any idea that the rugged Russian fighters represented 'agricultural' engineering was dispelled by the obvious attention to detail and finish of these aircraft.

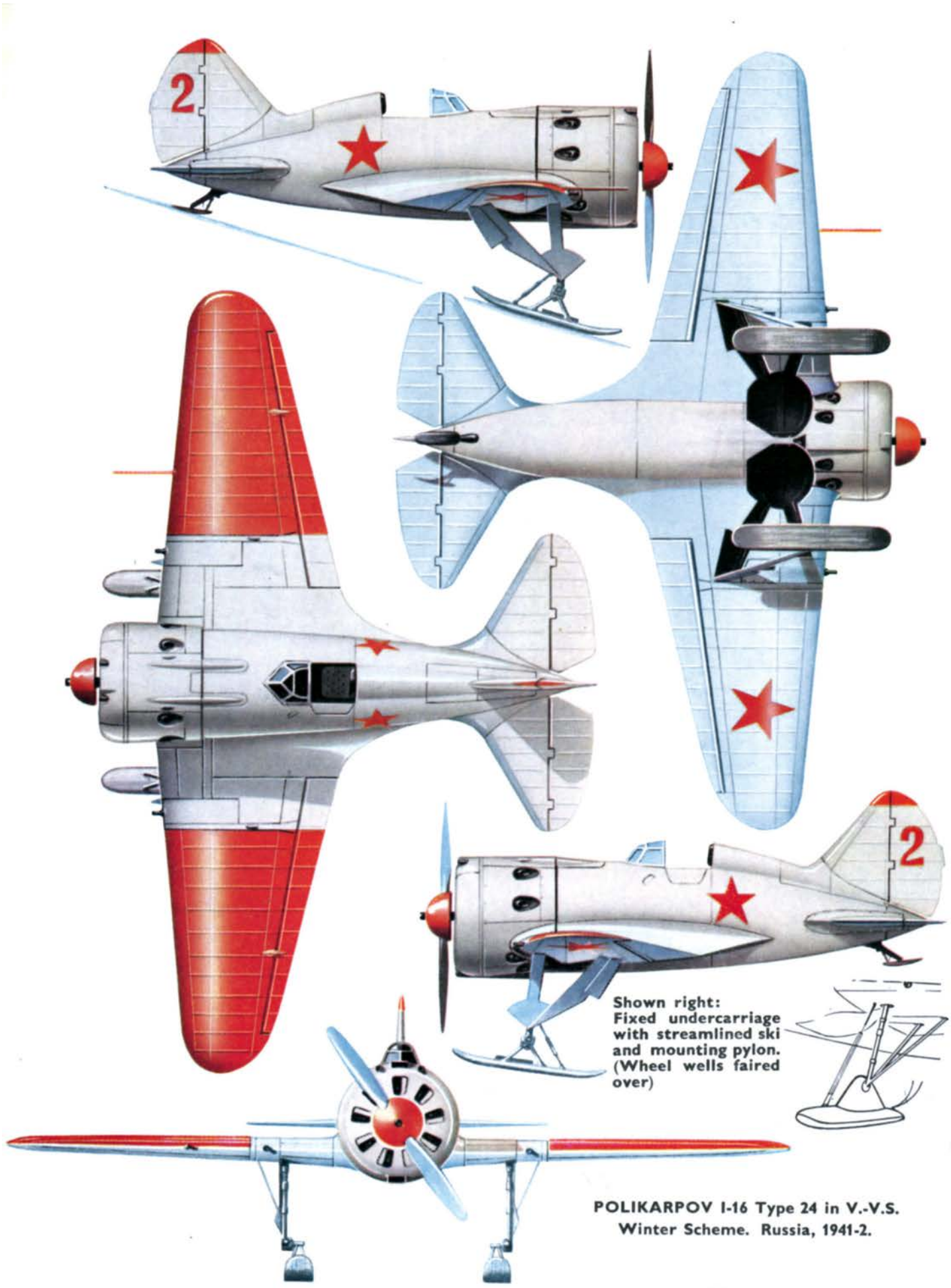
A resemblance to the *Gee Bee* racers is not just co-incidental. The Polikarpovs were, similarly, an attempt to build the smallest possible airframe around the same engine, the Wright Cyclone. The Gee Bee, back then, had a terrible reputation as a difficult aircraft, since disproved by modern piloting techniques as demonstrated by Delmar Benjamin with his modern Gee Bee R2 replica. Similarly, the restored Polikarpovs, immaculately handled by the New Zealand display team, made it all look easy. Long may they last. ■



POSTSCRIPT

The I-153 was not the last biplane fighter. That was the Canadian Car Foundry FDB-1 of December 1938. It had a Pratt and Whitney radial engine, a gull-wing, a retractable Grumman-style undercarriage and was designed by a Russian, Mikhail Gregor.

It attracted no orders!



Shown right: Fixed undercarriage with streamlined ski and mounting pylon. (Wheel wells faired over)

POLIKARPOV I-16 Type 24 in V.-V.S. Winter Scheme. Russia, 1941-2.


I-16 Type 10, with unit identification colour on tail and spinner. Russia, 1940.
8
I-16 Type 24 in standard winter scheme.
7
I-16 Type 10 of 22nd Fighter Regt.; Nomon Khan, Russian Mongolia, August 1939. Overall grey scheme.
7
I-16 Type 10, Bialystok, Eastern Poland, 1939-40. Note white under-surfaces.
I-16 Type 24 in standard medium green temperate climate scheme.
7
Captured I-16UTI in Luftwaffe trainer markings.
DM HC
I-16 Type 24; fuselage inscription reads "For the U.S.S.R."
13
ЗА СССР!
A Spanish Nationalist Air Force emblem.
Upper/under wing, Republican A.F.
I-16 Type 10, Fighter Group 31, Spanish Republican Air Force, 1938. Fin emblem of "Popeye the Sailor-man" probably indicates use by sub-unit of International Brigade, rather than by Soviet Air Force cadre.
CM 127
I-16 Type 10, serial C.8-25, Moron Fighter School, Spanish Air Force circa 1941-1952.
C.8-25
China.
I-16 Type 10, Chinese Air Force, 1938.
I-16 Type 10, Fighter Group 1W, Spanish Nationalist Air Force, 1938.
Upper/under wing, Nationalist A.F.
1W
69

PULL-OUT FREE PLAN

ITALY'S FIGHTING ARROW

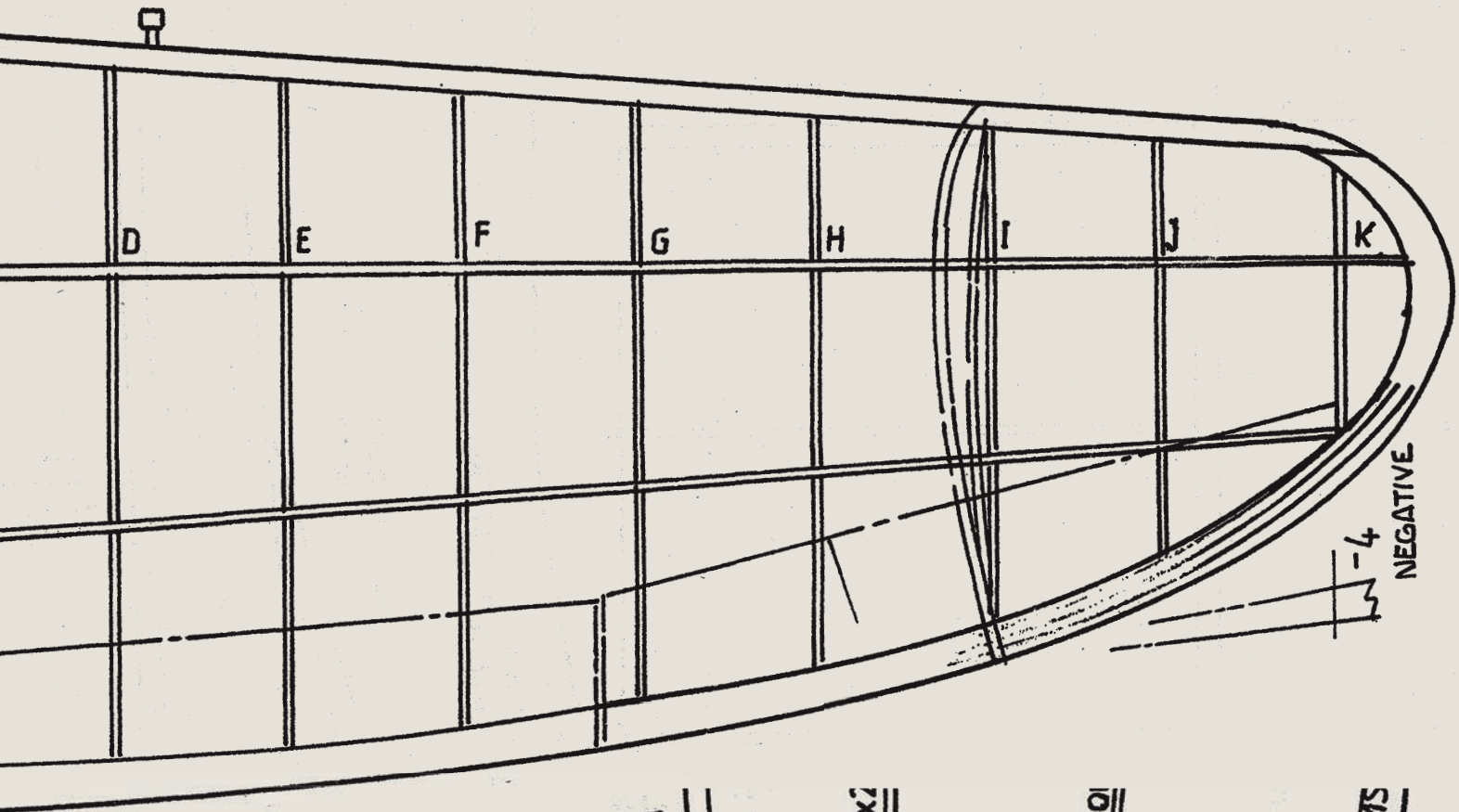
REGGIANE Re 2005 'SAGIITTARIO'

1/20TH SCALE, 21.5" (533MM) WINGSPAN ITALIAN WW2 FIGHTER FOR RUBBER POWER, BY LUBOMIR KOUTNY

The Reggiane Re-2005 'Sagittario' (archer) was one of several Second World War Italian fighters to utilise the famous German Daimler Benz DB-605 engine and is generally believed to be the most successful. It proved superior to the similarly engined Messerschmitt Bf-109G, being very fast in the climb, highly manoeuvrable and it carried a formidable armament that made it ideal in the role of interceptor in the hands of German pilots during the defence of Bucharest, the Ploesti oilfields and, during the last desperate weeks of the war, the Reich capital itself in Berlin.

In its final form with the German VDM variable pitch propeller, longer fuselage, big spinner and up rated supercharged engine, the Re-2005 achieved 730km/h (456mph) and, although only two of these final development aircraft were built, the airframe of one of them can still be examined in the Milan Technical Institute. The other was used in Italy's jet aircraft programme after WW2 in development of the Reggiane Re-2207.

I had long been attracted to this most elegant of fighter monoplanes and drew up 1/20th scale plan from William Green's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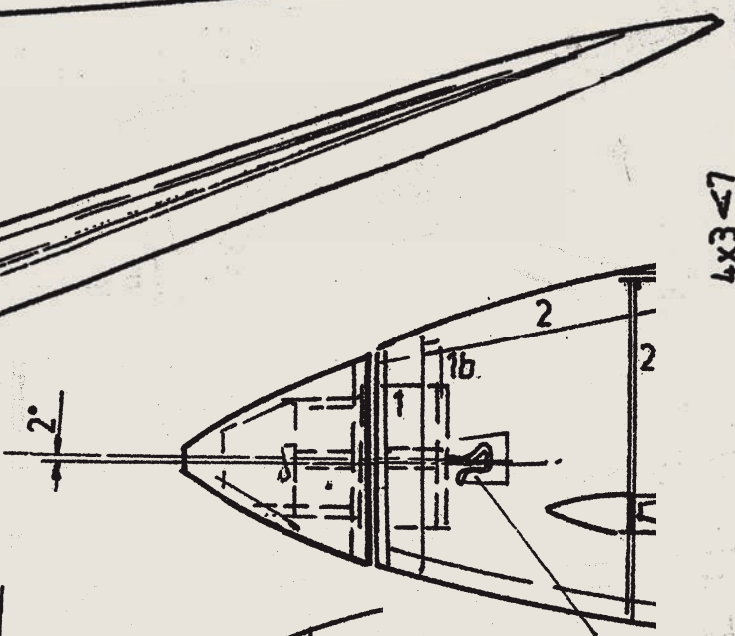
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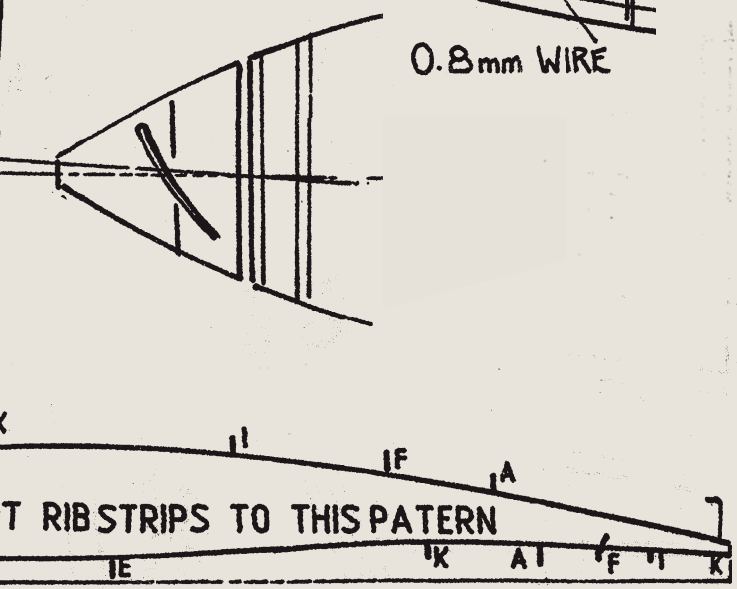
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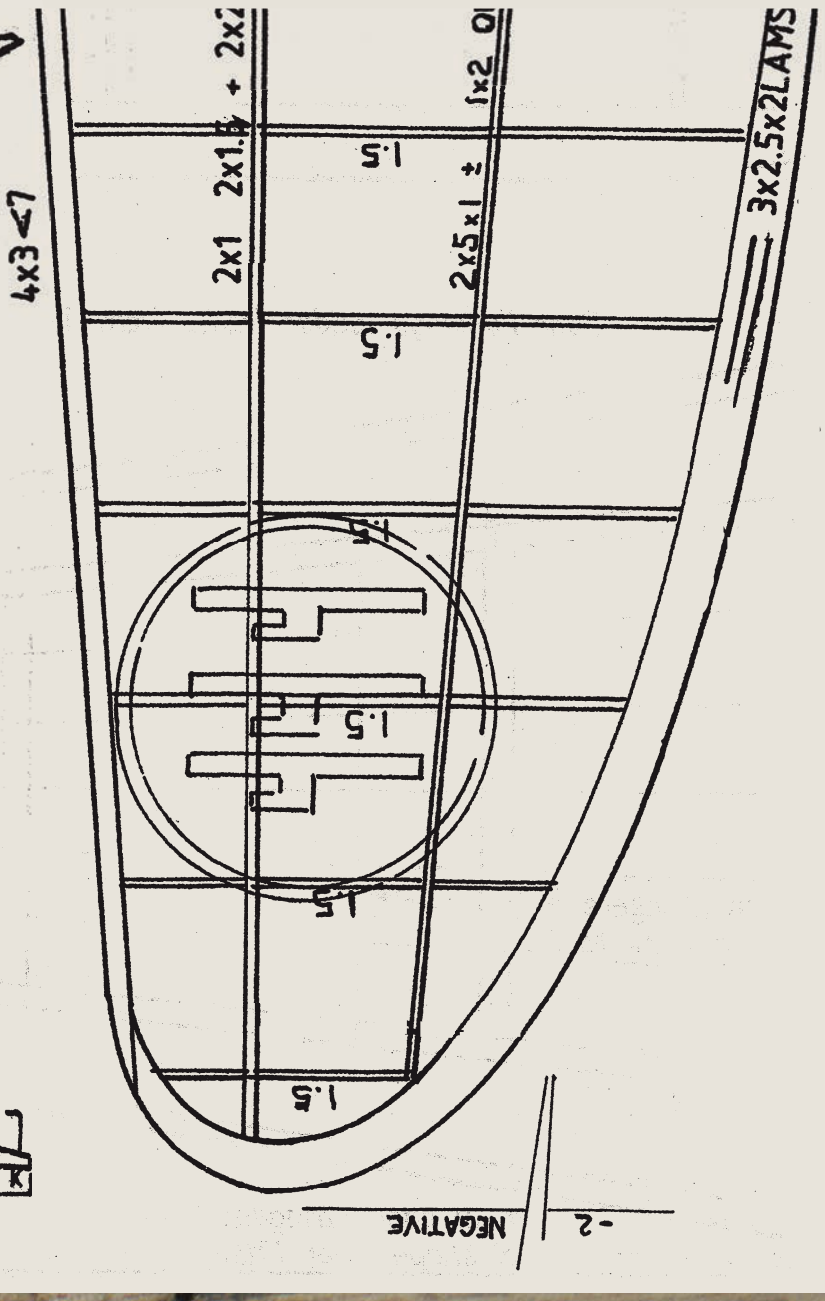
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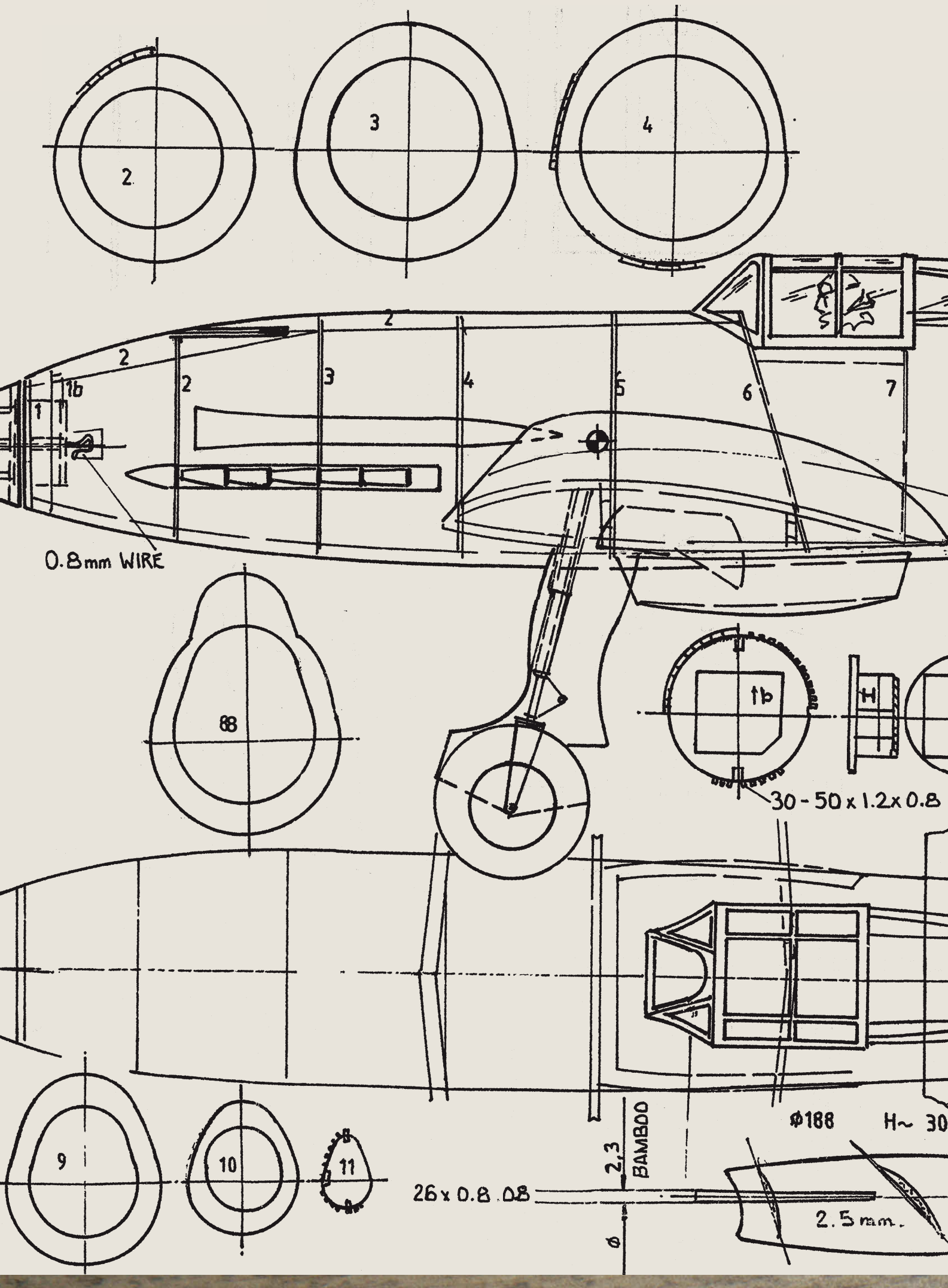
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30-50x1.2x0.8
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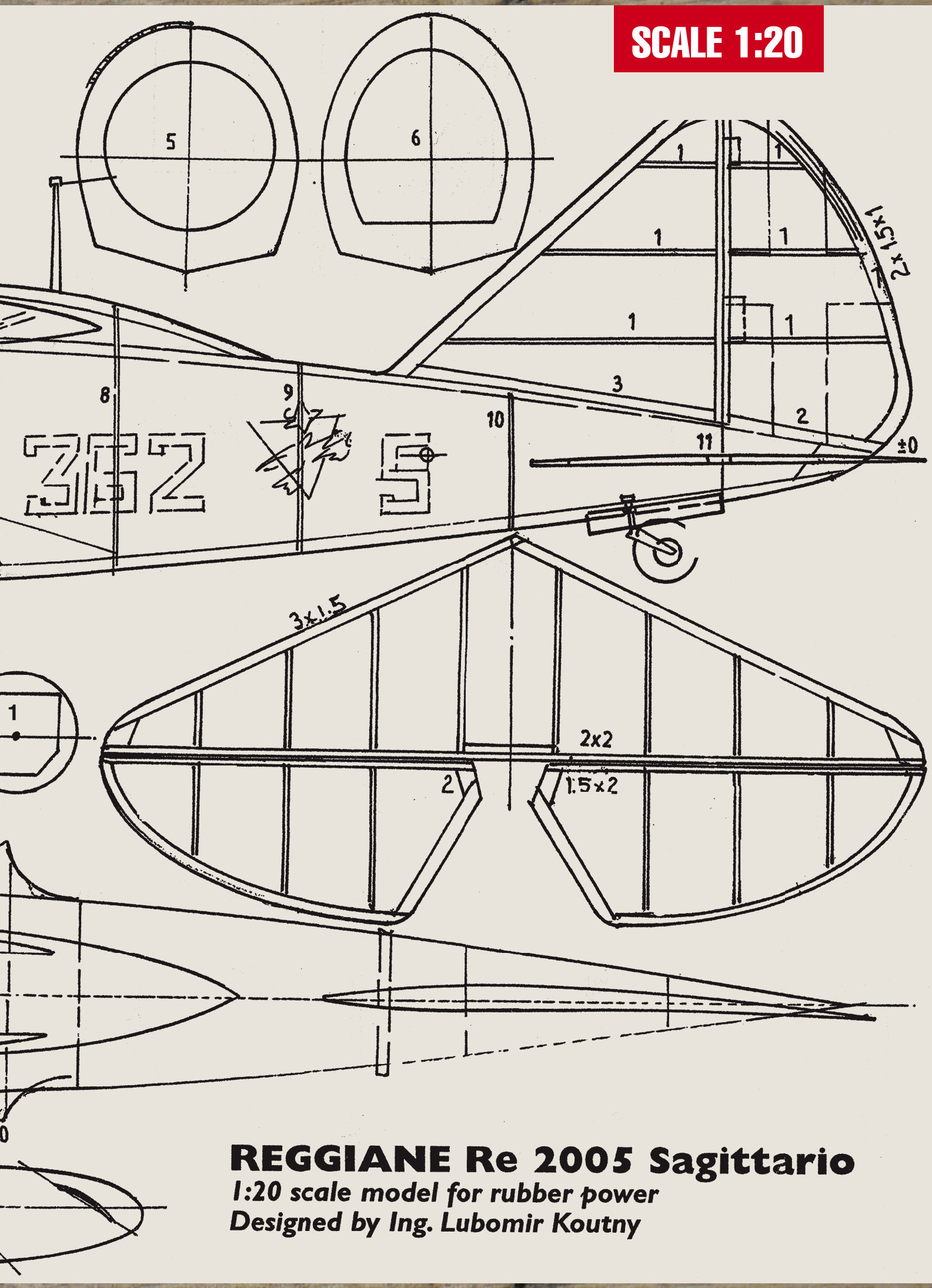
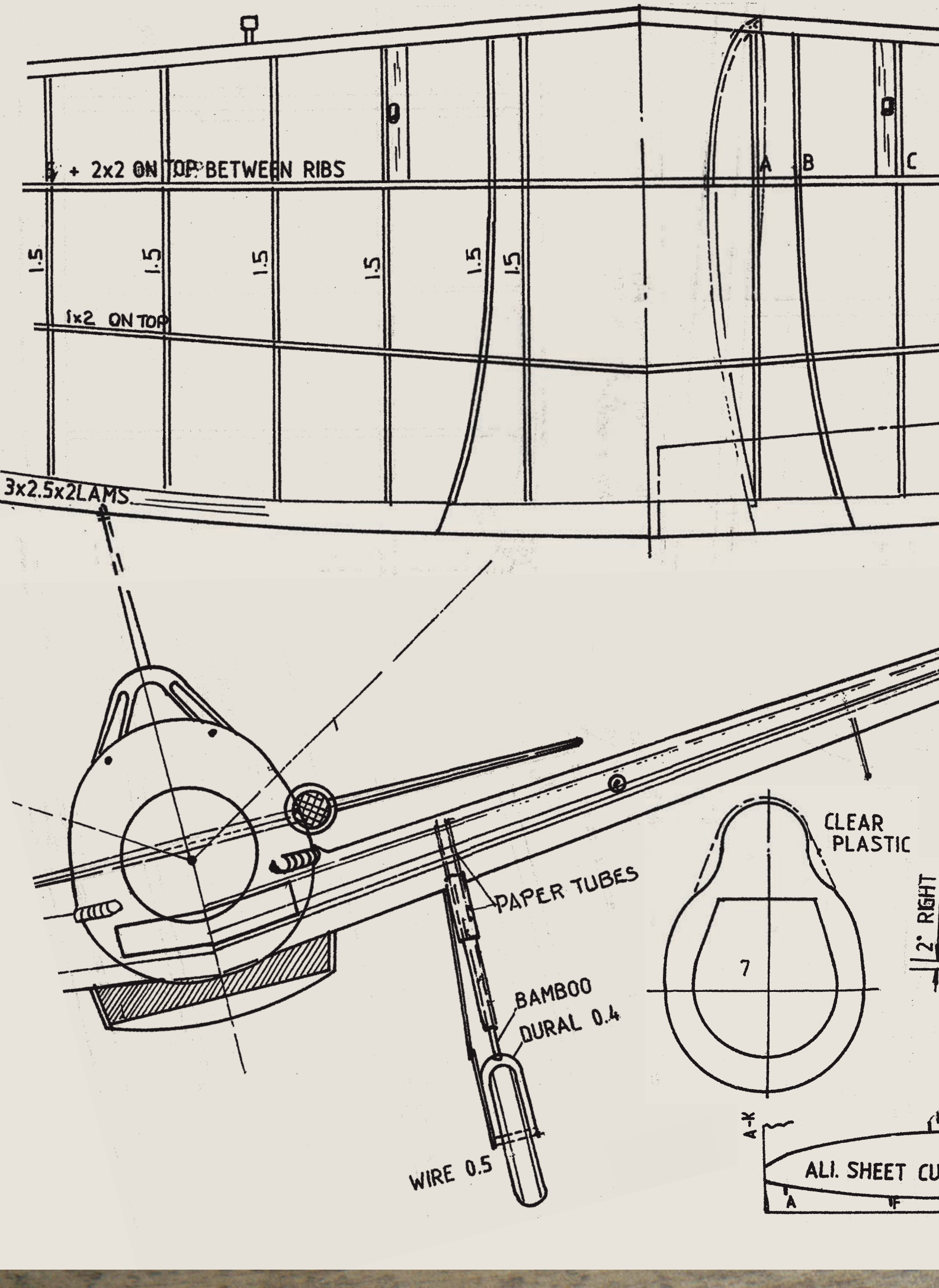


REGGIANE Re 2005 Sagittario

1:20 scale model for rubber power

Designed by Ing. Lubomir Koutny


+ 2x2 ON TOP BETWEEN RIBS
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B
C
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1.5
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1x2 ON TOP
3x2.5x2LAMS
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WIRE 0.5
CLEAR
PLASTIC
7
12° RIGHT
A-K
ALI. SHEET CU
A
F

Prototype model achieved some spectacular thermal-assisted flights.

first published during the 1970s. Several models were built from these plans by a succession of friends, among them Osvald Janish, whose very lightweight example won numerous junior competitions here in the Czech Republic. Another good example has been that built by Frantisek Krontorad, who produced a somewhat heavier but superbly airbrushed and decorated fine-scale version. Another friend, Jiri Merta, also built an Re-2005 to his own plan from information on the aircraft published in the book *'Italian Fighters'* and it flew very well.

Later, I discovered extensive and much more accurate documentation on the aircraft published by the Czech *'L&K'* magazine. This included six-view scale drawing with lots of photographs of the Re-2005 and I immediately set about drawing up a new 1/20th scale plan based on this data. Sadly, the scale-area tailplane dimensions proved to be smaller than I had supposed when I first drew the model from the three-views I had at the time but, thanks to a very light build (the prototype came out at only 26gm less rubber motor) and some very good Pirelli Alfa Romeo 'Little Orange' rubber (8 x 1.5gm/m, 650mm long) it flew beautifully. The power run was a consistent 70 seconds, followed by an extended glide - more than enough to ensure maxes in our Czech Rules rubber contests.

Some truly spectacular flights have been achieved, in particular during a competition at Borac where, after the 70 seconds motor run, it became apparent that the Re-2005 had caught a thermal in which is drifted for a further two minutes plus, performing an extraordinary series of impromptu aerobatic manoeuvres, including steep spirals and loops! Just as we thought the flight was about to end calmly enough, after a one minute glide back towards the field, the Re-2005 was caught again by rising air and drawn upwards in a repetition of the earlier aerobatics. Eventually, gravity triumphed and the model began a long, uninterrupted descent back to the ground. This flight was a memorable exception but, over the years, I've had scores of one-minute-plus flights with the Re-2005 and many much longer ones, although not quite as dramatic as that described above - something that the early versions built from the previously used three-view drawing, with the larger tailplane, could never achieve. For sheer aeromodelling fun and satisfaction, in my view, this little model has few rivals.

CONSTRUCTION

As is the case with all small models of this type, weight is the major enemy, so good flying performance will depend on careful balsa selection. Choose only top quality wood that is both light and strong; if you can't find the sort of material you need at the local model shop, a call to one of the specialist F/F balsa suppliers is worth the effort. You'll pay a bit extra, but you don't need a large quantity and, as I said, the final performance of your Re-2005 may depend on it!

Wings and tail surfaces

With the plan taped or pinned to your favourite building surface and protected with Clingfilm, begin construction with the wings. Make the trailing edges/wing tips from three laminated strips, soaking or steaming at the tips to achieve the required degree of curvature (Peter Rake has something to say elsewhere in this issue - which is worth a read).

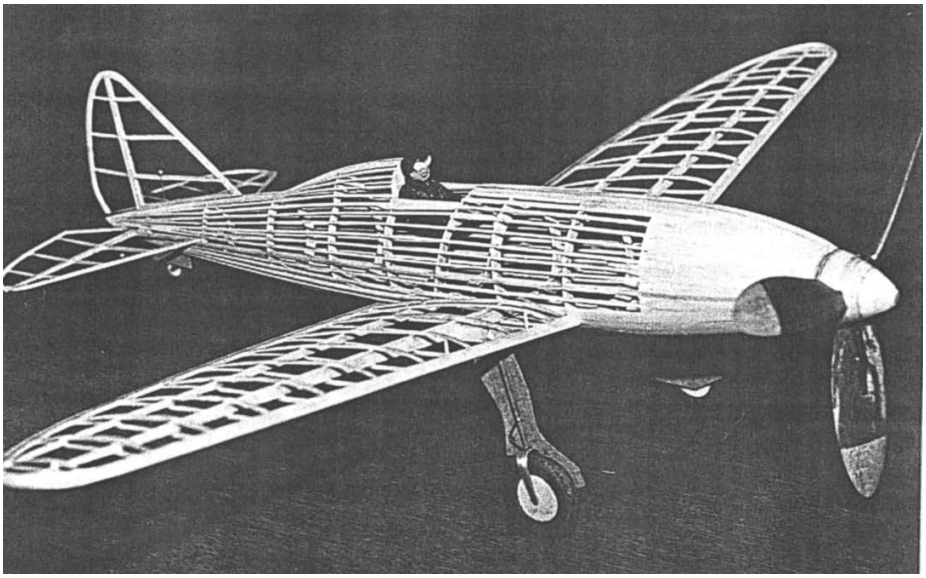
The built-up spars (two per wing panel) comprise top and bottom square-section strips with vertical grain tapering sheet infill and their precise angle of taper can be calculated by measuring the depths of ribs A and I from the plan and projecting the lines produced, out to tip rib K and the extreme wing tip.

The ribs themselves consist of an upper and lower strip, sliced 2mm deep from 1.5mm sheet using the template on the plan to determine their profile. For example, for upper rib strip A, slice from A to A on the upper side of the template. To produce rib K, slice another 2mm deep strip shaped as A to K using the top of the template. For the lower surface rib strips or halves, slice profiles between K to K (for lower rib K) and F-to-F for lower rib strip F, etc.

The simplest way is to slice sufficient full-length top and bottom strips for the entire wing, then trim them to final length, in pairs, over the template.

Raise the leading and trailing edges above the plan sheet surface to take account of the wing section under surface curvature with packing pieces pinned pinned in place. Then, glue all lower rib strips in position followed by both spars glued directly over them. Addition of the rib top strips completes the basic wing structure.

Join the wing halves at the required angle of dihedral and add undercarriage mounting points from sheet and block.



Uncovered airframe reveals the stringer pattern on the fusleage and also wing rib upper and lower strips described in the text. Propeller has wide balsa blades.

The undercarriage legs are from bamboo dowel wrapped in paper tube as per the plan, with laminated soft balsa wheels on a thin Dural mount. Undercarriage doors may be from thin card.

The fin, rudder and tailplane are simply built directly over the plan from light but strong balsa strip, again using laminations to construct the curved trailing edges. Sand carefully to aerofoil section when dry and hinge the control surfaces with soft wire hinges.

Fuselage

This is built on the familiar 'keel-and-formers' system, with a large number of small section stringers to produce the surface contours. The nose back to former no.3 is planked with ultra light, soft balsa strip. Nose block construction is shown in detail on the plan, comprising soft block balsa and 2mm ply formers. Dimensions and blade sections for the simple three-bladed propeller made from hard balsa and bamboo dowel are also shown. You may find a commercial prop to do the job, but this scratch built version works really well. The propeller hook, from 0.8mm steel wire, is similar to those used by F1D microfilm models, but with the important addition of a heat-shrunk plastic sleeve that works well at preventing bunching.

Covering and finishing

The model is covered in lightweight tissue, appropriately coloured (dark green upper surfaces, light grey lower) with hot water dye before application. Water-shrink the tissue, then apply three coats of clear dope thinned 40% dope/60% thinners. Markings and insignia can now be cut from coloured tissue and applied by brushing on with thinned dope. The predominantly white upper surface numerals and national 'fasces' emblems were hand-painted using thinned enamels. Finally, any detailing you wish can now be added in the form of radiators, carburettor intake, guns, etc., but do watch the weight.

The canopy can be built up from individual celluloid panels or, ideally, moulded from a carved plug over a heat source.

Motor, trimming and flying

For a model weighing 30gm or less (I hope yours will!) the recommended motor is a loop of 6mm x 1mm FAI Tan II 600mm in length. Check the fore/aft balance point (C.G.) position and eye the model up for any warps, adjusting as necessary. The prototype was trimmed to fly left/left.

Start by winding on about 300 turns and aim for a gentle left-hand horizontal circle about 30 metres in diameter. If the model climbs or dives dramatically, thrust line adjustment will have to be made; likewise if the model turns or spirals sharply.

With this sorted out, wind on about 600 turns and the Re-2005 should climb steadily in a left-hand circle, the diameter of which may be determined by adjustment of the rudder. On 1,000 turns, the climb should be rapid and on 80% of maximum winds (1,400 turns) the prototype model was quite capable of climbing to 50 metres and flying for over 80 seconds without thermal assistance. I've won many outdoor competitions with it here in the Czech Republic.

Have fun with your Re-2005 'Sagittario'! ■

Fully tissue covered model. The suface detail and insignia are finely applied on prototype.

PLANS 'N PA

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De HAVILLAND DH 82a TIGER MOTH

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An 80 inch (2032mm.) wingspan, 1:4.33 scale model for 1.20 cu.in. motors and four function radio control systems, No moulded cowl required - all wood construction. Three sheet plan.

De HAVILLAND DH60 MOTH

Plan price **£19.50** Plan No.054

Component Pack **£115.00**

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WESTLAND LYSANDER MK.3

Plan price **£19.50** Plan No.109

Component Pack **£135.00**

Superb true scale construction replica on the WW2 Army Co-op and Special Operations aircraft in 1.75": 1ft scale. 87.5" (2223mm) wingspan model suits .50-.60 size two stroke motors and requires minimum 4-function radio control. Two sheet plan.

DE HAVILLAND CANADA DHC-1 CHIPMUNK

Plan price **£27.50** (Either scale)

Component Pack **£155.00** (Either scale)

Dave Womersley's 1/4 scale plan no.341, 103" (2616mm) wingspan Nationals scale winner, for 1.8 cu.in. four stroke engines.The plans are also available in 1/5th scale plan no.342; please specify which scale is required. Please note: no proving prototype of the 1/5th scale model has been built, the plans are simply a scale-down from 1/4 scale.

D.H. 103 HORNET

Plan price **£22.50** Plan No.052

Component Pack **£130.00**

80" (mm) wingspan sport-scale replica of the hottest production piston engined fighter ever. Suits engines .40-.53. Original retracting undercarriage unit included with the plans.

FAIREY GANNET A.S.I

Plan price **£19.50** Plan No.065

Component Pack **£135.00**

A 1/8th scale 81" (2057mm) span model of the Naval search aircraft. Flaps and retracts shown, plus bomb doors, extending radome and tail hook, and optionanal folding wings. Minimum 4 function R/C (Two sheet plan).

BUCKER BU180 STUDENT

Plan price **£26.50** Plan No.015

Component Pack **£120.00**

A big, but manageable scale model of the German pre-W.W.2 trainer, designed for .90-.120 four stroke motors and four function radio systems. Four sheet plan shows conventional wooden structure for airframe, plus alternative foam core wing.

BOEING PT-13 STEARMAN

Plan price **£19.50** Plan No.243

Component Pack **£99.00**

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

Take the tedium out of building our Boeing PT-13 with this set of precision laser-cut wing ribs and fuselage formers. It takes the hard graft out of preparation, while leaving all the fun of the building!

PIPER SUPER CUB

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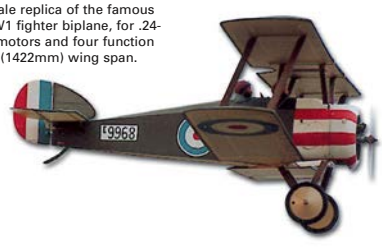

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Plan price **£19.50** Plan No.286

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A 1:3.44 scale, 79" (2006mm) wingspan replica of the late 1940s Belgian light aircraft, des9igned to suit .90-1.20 cu.in engines. Designed by Philip S.Kent, the model features all built-up balsa/ply construction throughout and makes an excellent entry into R/C scale modelling. Rudder, elevator, aileron and throttle controls.

PERCIVAL PROCTOR

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1:5.5 scale: Plan price **£24.50** Plan No.152

COMPONENTS PACK: 1/7th scale OR 1;5.5 **£115.00**

A scale model of the light communications aircraft. Plans available in 1/7th scale, with a wingspan of 65" (1651mm). Engine size .50-.60 cu.in. .

AERONCA C3

Plan price **£19.50** Plan No.293

Component Pack **£95.00**

A quarter-scale" wing span model of the famous 1930s American single seat light aircraft, designed by Philip S. Kent to competition standard. Suits four function R/C and 1 to 1.20cu.in four stroke engines. Two sheet plan set

CHILTON DW1A

Plan price **£22.50** Plan No.303

Component Pack **£125.00**

1930s sporting monoplanes, the tiny DW1a makes a truly attractive subject for scale modelling. This 1/3rd scale version comes from the expert design board of Phil S.Kent. 96" (2438mm) wing span, features flaps as per the full size, suits 1.5 to 1.8 cu.in. four stroke engines, and five function R/C systems. Two sheet plan

SOPWITH PUP

Plan price **£16.50** G/F Cowl price **£17.50** Plan No.177

Component Pack **£135.00**

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

FOKKER D.VII

Plan price (either scale) **£26.50**

1/4 Plan No.241, 1/5 Plan No.242

Component Pack 1/4 **£125.00**

Component Pack 1/5 **£120.00**

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

BRISTOL F2B 'BRISFIT'

Plan price **£24.50** 1/4 Plan No.021, 1/5 Plan No. 023

Component Pack **£125.00** (either scale)

Accurate, 1/4 scale replica of the famous WW2 British two-seat fighter. 117.75" (2991mm) span model requires 25-30cc two-stroke power. Model construction closely follows the structure of the full size. Three sheet plan set.

HAWKER FURY

Plan price **£17.50** Plan No.091

Component Pack **£125.00**

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

PIPER SUPER CRUISER

Plan price **£17.50** G/F Cowl price **£17.50** Plan No.150

Component Pack **£95.00**

A 1/5th true scale 84" (2134mm) wingspan replica of the Piper PA-12 light aircraft, designed for four function radio control systems and .90 cu. in. size motors.

PFALZ D.XII

Plan price **£27.50** Plan No.313

Component Pack **£175.00**

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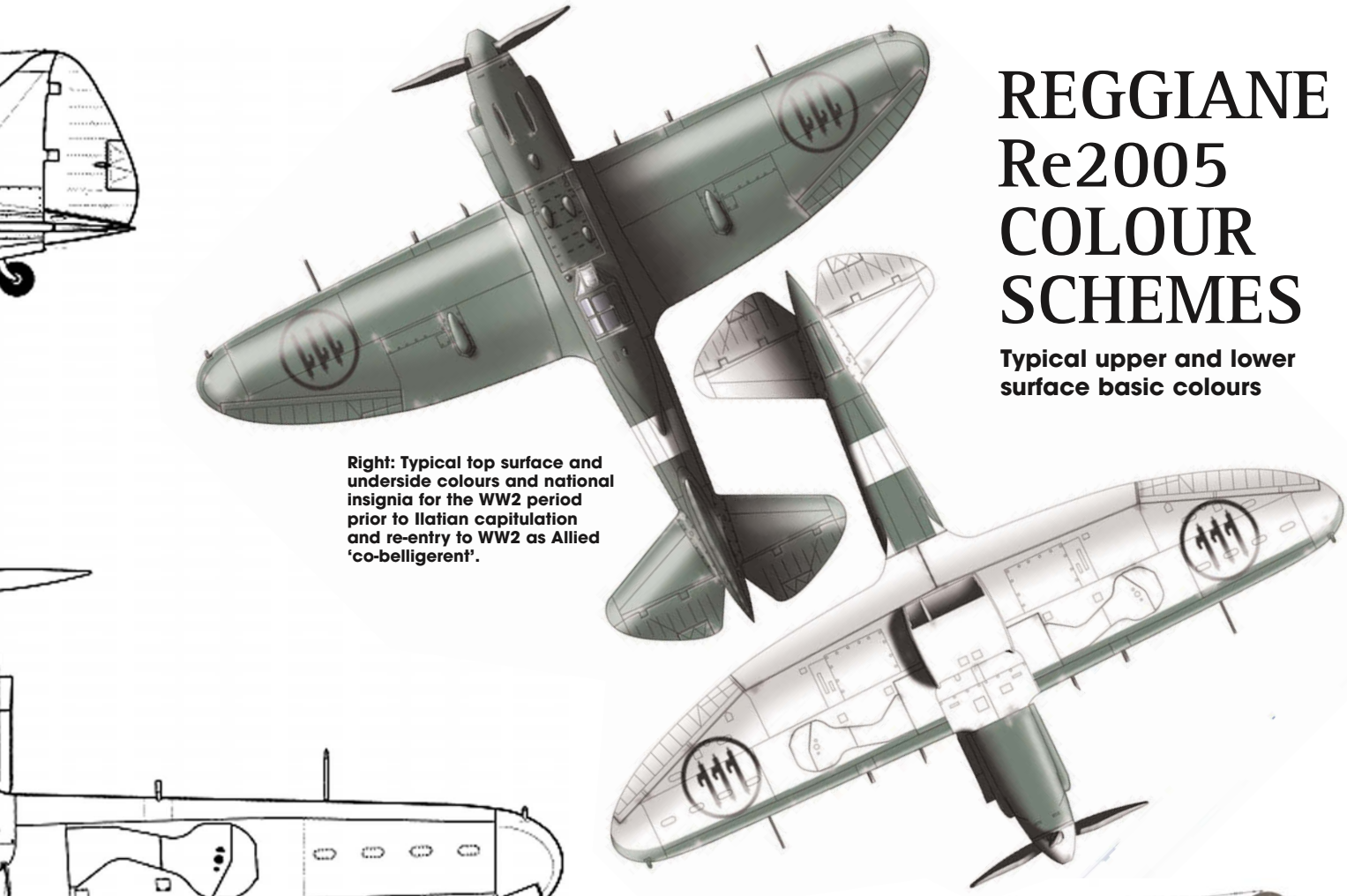
REGGIANE Re 2005 'Sagitario'

SCALE 1:60

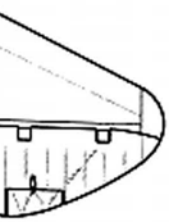
REGGIANE Re2005 COLOUR SCHEMES

Typical upper and lower surface basic colours

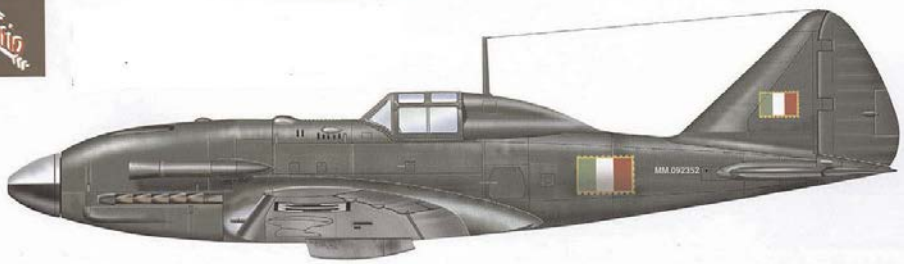


Right: Typical top surface and underside colours and national insignia for the WW2 period prior to Ilatian capitulation and re-entry to WW2 as Allied 'co-belligerent'.

Two Reggiane Re 2005s of the 362nd Squadriglia, 42th Stormo, Littoria, 1943



Re 2005 of the 22nd Groupo, Sicily, August 1943



In October 1943, Italy joined the Allied side against Germany, not as an Ally, but as a 'Co-Belligerent'. Some units, nontheless served alongside Germany forces as the Aeronautic Nazionale Repubblica, carrying red/white/green tricolore insignia

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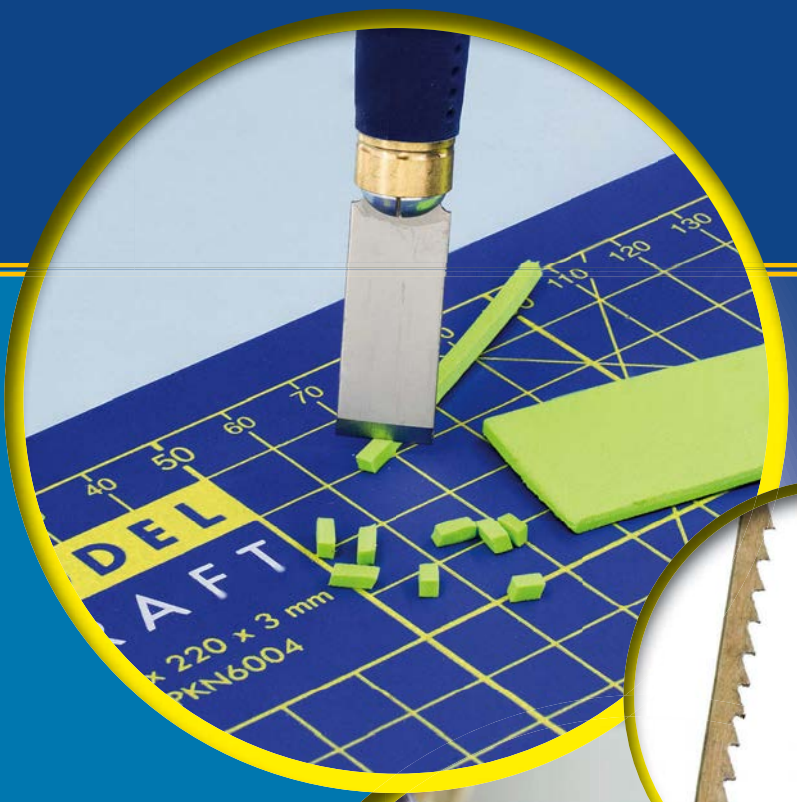

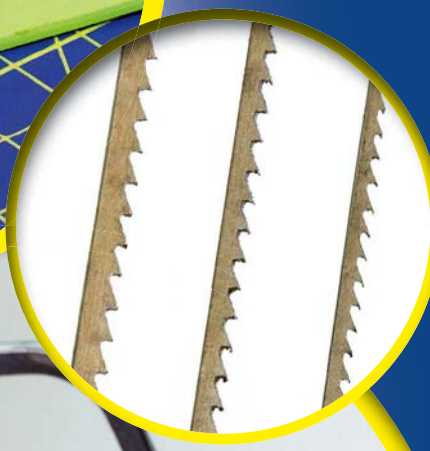

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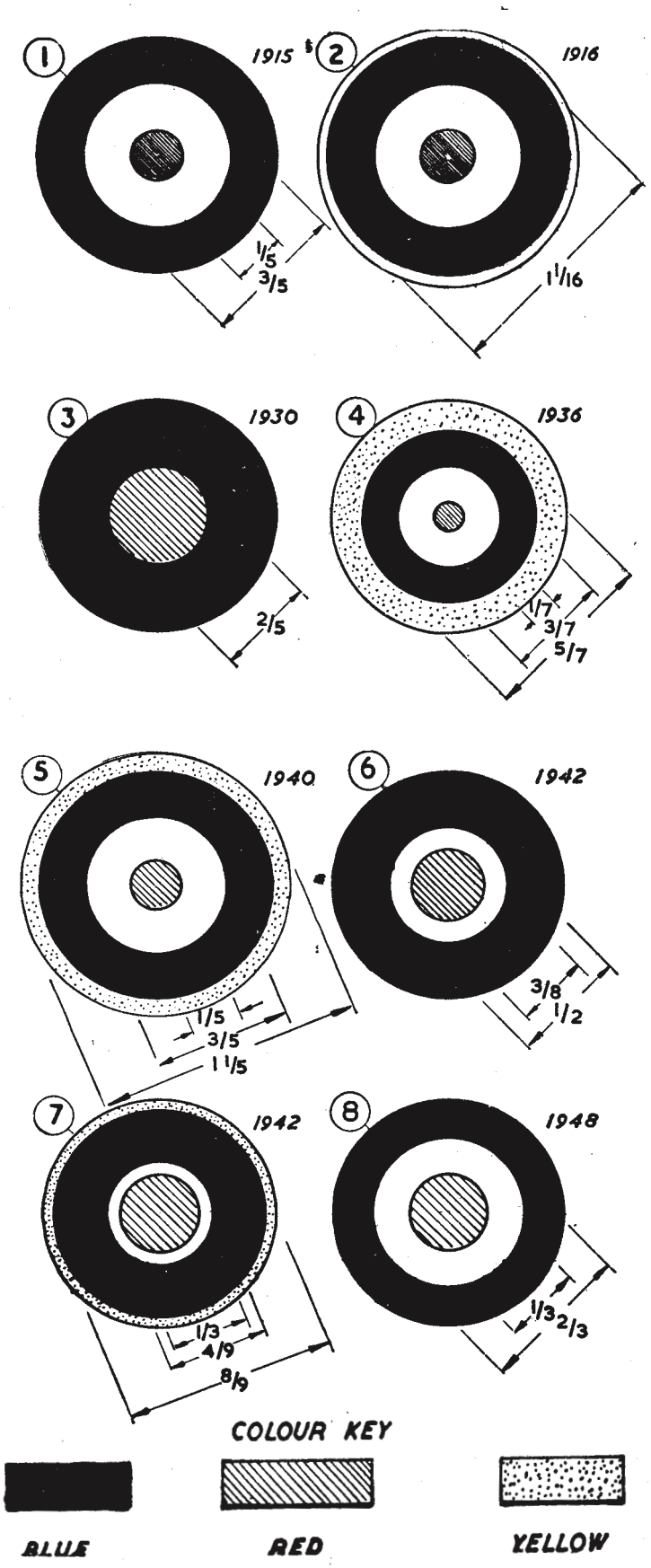


R.F.C/R.A.F. Roundels; 1915 -1950s

ROUN STAR

Throughout military aviation history, the established shape of national identification insignia, and also the colours have, from time to time, undergone revision of shape and colouring as circumstances have dictated while, at least for the majority, maintaining a basic commonality of style. A military aircraft can be 'dated' by the periods during which such superficial revisions to national markings and colouring have applied.

Therefore, for the sake of accuracy, it is essential to get both these items correctly applied on our models to ensure authenticity and, since many of the military aircraft selected for modelling will be either British or American in origin, the tones are tabulated as a general guide.

To cover the complete story, with individual variations, would fill a book. Perhaps one little illustration of how complicated things can get is that at least one Brewster Bermuda had the honour to carry the 1940 R.A.F. roundel alongside the 1942 United States white star on the fuselage and presumably belonged to both air forces for a short time!

Naval aircraft have always carried distinguishing marks, usually in the form of large lettering to advertise their service, or, in the French case, with a discreet anchor superimposed over the roundels. U.S. Marines are likewise proud of distinguishing marks, and other special services, Rescue, Coast Guard or Arctic, are clearly defined in their colouring.

As well as such standard insignia, the myriad items of small stencilled instruction that litter the fuselage exterior can all be reproduced to render the model, more realistic. Fire extinguishing gear, ejector seat and turbine or propeller position lines (U.S. aircraft only) are in red. Dotted *"cut here for rescue"* lines are bright yellow. First-aid panels, tend to be white with the traditional red cross superimposed ... and so on. To indicate this lettering on a small model, use a mapping pen and indian ink (waterproof drawing ink). A coat of clear varnish over the top will protect

NDELS, RS & B'ARS

it after completion.

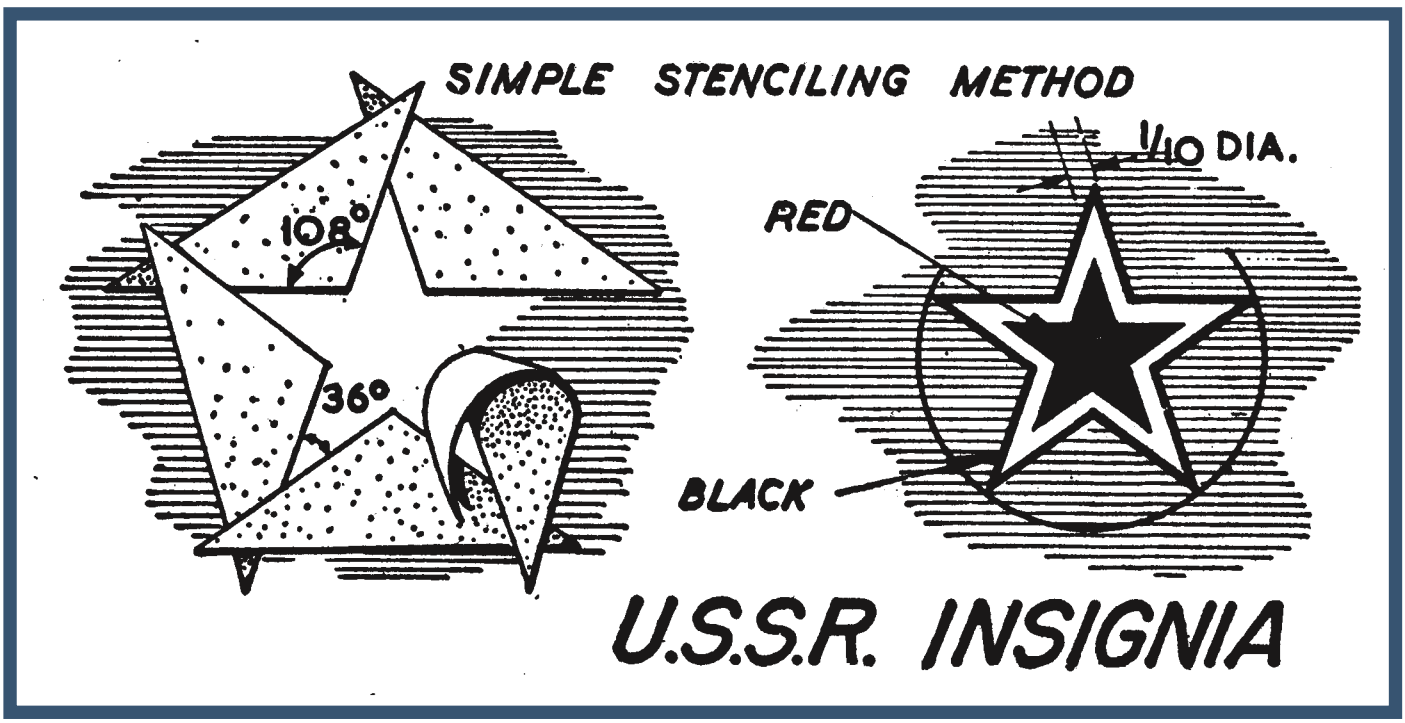
Badges of rank and squadron markings can give a model more specific purpose, and the colourful patterns used between wars by the R.A.F., now revived for their post WW2 jet engine steeds of the 1950s and '60s in particular are interesting and decorative. Ranging from simple checkerboard designs to elaborate tartans, these patterns are a more modern continuity of the Squadron indentification patterns that were spread along biplane wings as well as on the fuselage. Flights within the squadron carried different colour wheel hubs, red, blue or yellow whether "A", "B", or " C " Flt., and coloured tassels of linen streamer were trailed from outer interplane struts in the heyday of such classic fighter types of the 1920s and 1930s, the Gloster Gamecock and Bristol Bulldog.

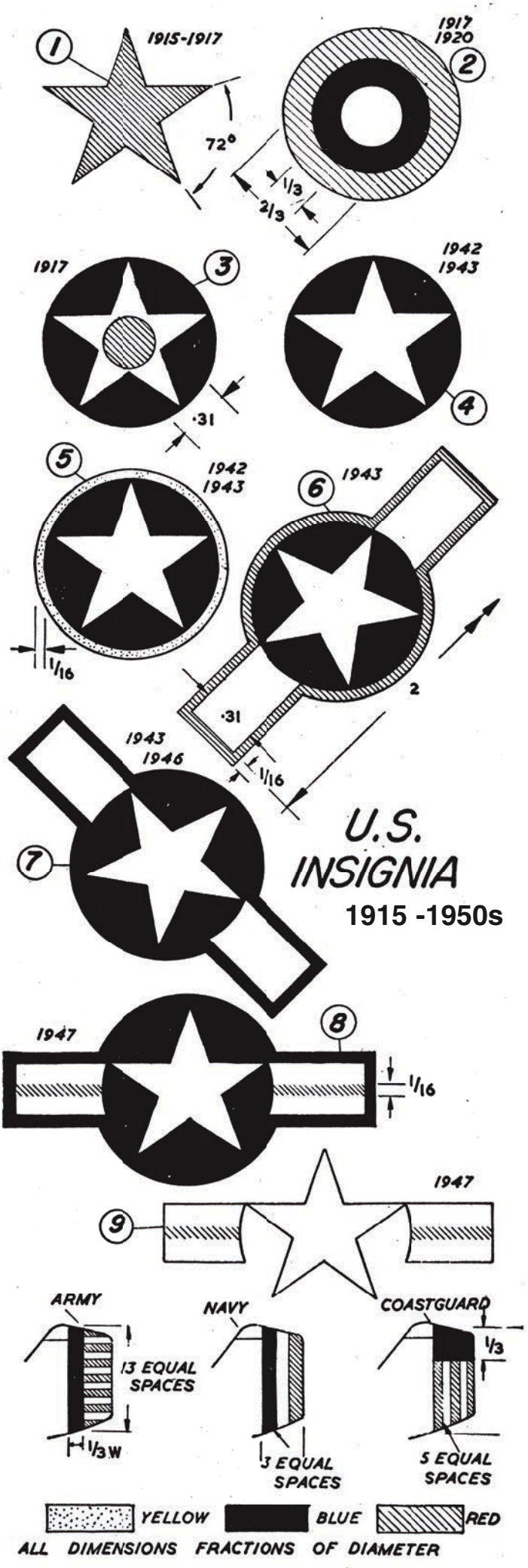
One more military marking deserves mention, for it applies to so many WW2 era Allied aircraft, and that is the five-stripe D-Day "invasion" decoration which were a revision of the identity marks applied to Typhoons used for the Dieppe Raid in 1943. Whereas the Typhoons had white noses and three 2 ft. wide white stripes, with four 12 in. black stripes, the 1944 'Invasion' markings were of equal width.

The latter was 2 ft. wide for assault gliders and support bombers, and approximately 18 in. wide for fighters. There were two black stripes and three white-extending in many cases right around the fuselage and the wings.

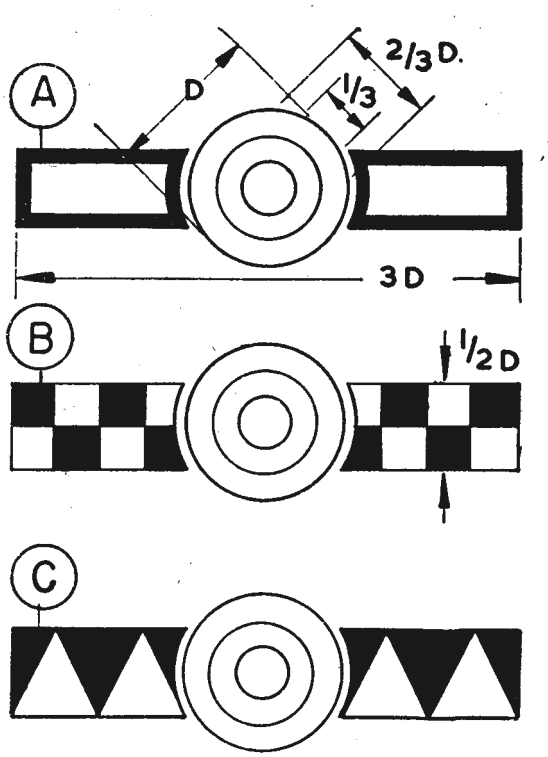
PLOTTING THE SHAPES

The usual method of drawing out a particular insignia is to treat any component part of the shape as a fraction, or percentage of the shape as a whole. So, for example, in the case of an





RAF roundel, the reference dimension is the outer diameter which is blue, while the white and the red centre are calculated as a fraction/percentage of the outer edge of the blue. USAF/US Navy/Marine Corps Star & Bar insignia are a variation on that theme in which the circle outer diameter is the reference, with left and right Bar dimensions also calculated as fractions/percentages of that reference dimension. ■



RAF Squadron insignia

TYPE A SQUADRON	FRAME	CENTRE
1	RED	WHITE
25	BLACK	WHITE
66	BLUE	WHITE
72	RED	BLUE
247	BLACK	RED
504	RED	GREEN
605	RED	BLUE

TYPE B SQUADRON	CHECKERS (DICE)
19	BLUE AND WHITE
43	BLACK AND WHITE
54	BLUE AND YELLOW
56	RED AMD WHITE
85	BLACK AND RED
245	DARK BLUE AND YELLOW

TYPE C SQUADRON	TRIANGLES
501	BLACK AND GOLD
600	RED AND WHITE
601	BLACK AND RED
604	RED AND YELLOW
607	RED AND BROWN
614	RED AND GREEN

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Graceful twin engine biplane airliner that saw service from pre-WW2 through to the mid 1950s. Several are still flying and three are shown in this picture collection. (100 images)

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Forerunner of the more famous DH 89 Dragon Rapide, this collection depicts a superbly restored example. (40 images)

DE Havilland DH 60 CD41
The aircraft that set the British 'club' flying movement on the road to success during the 1930s. (140 images)

De Havilland DH 53 CD40
1920s lightweight low wing sports aircraft designed to a low-power specification. Machine illustrated is the sole remaining example. (60 images)

Curtiss P-40M CD39
One of the later versions of the famous Curtiss Warhawk, the WW2 fighter aircraft that saw service in just about every combat theatre of operations. (100 images)

Curtiss P-40B Tomahawk CD38
Rare, full restored example of the early version of the Curtiss fighter aircrfaft that was at Pearl Harbour on Dec. 7th 1941 – and survived the attack! (130 images)

Curtiss Jn-4 'Jenny' CD37
An authentic, restored example in full detail. (130 images)

Curtiss Hawk 75 CD36
The 'export' version of the Curtiss P-36 that saw service in durng WW2 with Finland and during the 'Battle of France' in May/June 1940. Example shown is a combat veteran. (130 images)

Comper Swift CD35
1930s racing aircraft. Example depicted is the radial engined example at Shuttleworth Mussel (91 images)

Cierva C.30 Autogiro CD34
A study of the example hung in the Fantasy of Flight Museum, finished in RAF WW2 colours. (35 images)

Christen Eagle CD33
The spectacular, stylish aerobatic biplane revealed in close-up. Example shown is the two-seat version. (90 images)

Chrislea Super Ace CD32
Late 1940s civil light aircraft with distinctive twin fins and nosewheel type undercarriage. A fully restored example. (123 images)

Chilton DW1 CD31
Original upright engined version of this diminutive British low wing sports/racer. (90 images)

Chance Vought F4U-1D Corsair CD30
The famous 'bent wing bird' in super detail. (132 images)

Bucker Jungmeister CD29
Radial engine version. Example from Fantasy of Flight Museum. (79 images)

Bucker Bestmann CD28
Authentic example as exhibited at the Fantasy of Flight Museum, in WW2 Luftwaffe colour scheme. (43 images)

Bristol M.1C CD27
Early WW1 fighter monoplane. Example depicted is the faithfully authentic replica built by the Northern Aero Works and operated by the Shuttleworth Trust museum. (100 images)

Bristol F2B Brisfit CD26
Full close-up detail, including photos of engine cowls for both Rolls Royce Falcon and Hispano-Suiza engines. (28 images)

Bristol Bulldog CD25
This collection depicts the example assembled from two donor airframes and restored to superb standard by Skysport Engineering. It can now be seen at the Royal Air Force museum, Hendon. (60 images)

Boeing Pt-13/17 Stearman CD24
Subject aircraft is a current British civil register example used for air-show displays. (54 images)

Bleriot Monoplane CD23
The Shuttleworth Museum's machine, the oldest original example still flying. Much close-up detail showing all the exposed rigging, structure and the "bedstead" main undercarriage, plus Anzani engine. (74 images)

Bell P-39Q Airacobra CD22
Superbly restored example of this much-maligned WW2 fighter aircraft that was used with great success by Russian forces in the ground attack role and with saw much action in the south Pacific, from where this restored example was recovered. (130 images)

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SCALE SOARING

Kirby Gull 3 air-tested and a new, larger Groppingen Wolf project under way

Last time around we saw the 3.25 scale Kirby Gull 3 in her underclothes, waiting to get dressed. The usual procedure took place, *Solartex* all round, two-pack primer brushed on the join areas on the fuselage, which was flatted prior to two-pack priming the whole of the fuselage. Underneath the *Solartex*, thin strips of the stuff were ironed in place to simulate the scale joins in the separate pieces of plywood with which the fuselage would have been covered. (Hopefully, you can see the effect in at least one of the photos). The flying surfaces were treated to two-pack clear lacquer, which was also flatted prior to adding another coat of two-pack lacquer, this time with some matting agent added. This was followed by much masking out and the application of the cream and the trim colours.

As mentioned last time around, the colour scheme as described by the owner was the one to be applied to the full size upon completion of its restoration. Not long after the completion of this process came the news that *Solartex* was no longer going to be in production, leading to a frantic search for supplies, which was largely (but not completely) fruitless. This has led to much discussion on the *Scale Soaring UK* forum about alternative coverings such as *Diatex*: much less expensive, but without the super convenience of the adhesive being a part of the product. No doubt new procedures will perforce be used in the fullness of time.

Meanwhile, with still no sign of slope-friendly winds, the newly completed Gull's maiden flight was set to take place from the flat, at the County Model Club's peerless site just the other side of Shaftesbury.

Conditions were ideal, with next to no wind and plenty of blue sky between the fluffy white clouds.

My long-time pal and tug-pilot-for-hire Smallpiece, fired up the self-starter on his Z 62 powered Greenly tug, tensioned the line, and looked at me enquiringly. There was nothing left to say, I nodded, the engine roared, and aviation took place. The Gull sat snugly behind the tug, with no

The model action at the Wessex Soaring Association's Stoney Down slope

View from the onboard camera (Mobius wide-angle)

Author with the nearly completed Goppingen Wolf at 5th scale

Another view of the Wolf

Inset bolts on the Wolf's centre section

evidence of errant pitch behaviour or roll divergence, so I was able to relax and enjoy the ride.

Once released, it was time to assess the model properly. I have been using the same aerodynamic set up on all my gliders for many years now, so it didn't come as much of a surprise that the model was stable, and free of any annoying vices. The benign properties of the Quabeck wing section that I use means that no washout is required in the wings, this once again being shown to be the case when the stall test proved to be perfectly satisfactory. There being little in the way of thermal activity, it was soon time to land, and the Gull demonstrated that very desirable 'floaty' property when in the ground effect that allows the pilot to put the model down gently at a time and a place of his choosing.

All very satisfactory, then, and subsequent flights reinforced the foregoing. Fast forward now to a slope near us, when a very rare opportunity arose with a useful wind direction was forecast and hurried preparations were made. The lift was plentiful, and no time was lost getting the camera switched on and the Gull into the air. What happened next typifies the change in weather patterns that we have been trying to come to terms with in recent years, the wind disappeared, taking the lift with it, and an emergency landing had to fashioned to avoid the unthinkable... a walk to the bottom of the hill!

In conclusion, then, this model flies in pretty much the same fashion as its predecessors, predictable, safe, and a treat for the eyes with the sun flashing off the surfaces of the gull wings as she wheels and circles. Since these sessions, with a camera affixed to the airframe, and plenty of ground-to-air video, I have been able to put together a 4minute video of the beast in action. You can view it by putting AIRBORNE WITH THE GULL REPLICA into the Google search box. Should you like that, the previous video FLIGHT OF THE GULL WINGS III might also tickle your fancy.

MEANWHILE, BACK IN THE WORKSHOP

I may have waxed poetic previously about the unexpected delights of flying the diminutive 1/7th scale Goppingen Wolf. How such a small model could have such impeccable behaviour, to the point where she is practically un-stallable, still remains a mystery to me, but it wasn't too long before I started to wonder what a

Author at the County Model Flying Club with the Gull replica, prior to its maiden flight

slightly larger version would be like?

One of the many advantages of designing models digitally, is that the job of scaling your drawing up or down is the work of moments. Of course, at the same time, all your slots and cut-outs get scaled up too, and need to be re-drawn, but that's not too much of a complication. As this model will span nearer three metres than two, a one-piece wing is out of the question, so once again, scale fidelity and practical realism clash: what to do?

Experience with previous, if larger, strutted models has shown that a system that allows the wings to pull out and snap back in again in the event of an emergency landing, is far superior to any rigidly-mounted arrangement, and rubber bands have always been the cheapest and simplest method of wing retention from way back before I was fitted with my first pair of shorts (also held up with rubber bands!)

The trouble is, with a scale arrangement, the gap between the wings is too short to get any tension on the rubber bands, so a centre section, wide enough for the job, was envisioned. This is bolted to the fuselage pylon with two 5mm nylon bolts, and the struts then attached with metal clevises for quick rig and de-rigging. With the bolts partially pre-cut at the head end, a heavy landing or, heavens forefend - a crash, the whole lot should spring apart with the minimum of damage. (Fans of the Jack Reacher novels will be aware of his favourite aphorism: 'Hope for the best, plan for the worst')

As this model is also just a little too large to have the tailplane permanently bolted in place, a quick-rig arrangement was also needed here. On my larger models I have traditionally relied on a rod from the elevator slipping into a brass tube, which slides inside another brass tube and is connected to the elevator servo. This has always worked pretty well, the only problem being that the rods from twenty or more tailplanes make stacking them all rather difficult!

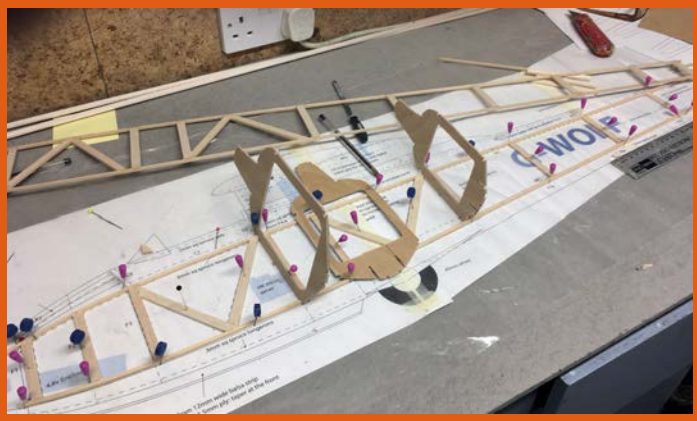
On his current build, my pal Smallpiece came up with a similar but maybe better solution (I can't tell him that: I'll never hear the end of it!), involving the use of a ball link attached to a carbon pushrod, which is supported by a slot in a purpose-built former at the rear of the fuselage. I have used a similar arrangement for the Wolf, the only problem being how to secure the rod to the balsa tailplane. I have opted for two 3mm plywood blocks either side of the elevator; a little unsightly, but experience tells us that elevators are quite important!

Time will tell whether or not this will work satisfactorily. Meanwhile, the Wolf is about ready to cover, so next time we will see if she lives up to the promise of her smaller sister...

PROFILE DRAG

Those of us that have used nylon bolts for retaining wing panels or tailplanes, will be familiar with the fact that the head of the bolt will stick up in an unsightly manner, both ruining the look of the thing, and causing a small amount of extra drag. If you can find a thin walled metal tube that is an exact fit over the head of the bolt, you can insert it in your drill, and

Inset bolt on the Slingsby Petrel tailplane



Earliest stage of the Wolf's construction from the scaled-up plan

offer it up to a spinning sanding disc to sharpen the end. The tube can then be inserted over the bolt, the drill gently fired up, and a smooth cylindrical cut made to the depth of the bolt head. The excess wood can then be cut away with a scalpel blade and ... Bob's yer flippin' Uncle! However, if the only tube you have is oversize, you end up with an offset, over-size hole. So, what to do?

The years I spent working in the car body repair trade have taught me that car body filler has a plethora of uses, and this is one of them. First up, the bolt needs to be coated with some spray-on silicon dry lube. The bolt hole is then filled with some of the aforementioned filler, and the bolt inserted, preferably into the fuselage with the wing or tailplane to establish its final position. The trick then is to wait a few minutes until the filler starts to cure (dependent on ambient temperature), then the bolt should be turned to break its adhesion to the filler. Don't leave it too long; you might never get it out! Once cured, the excess can be sanded back and a neat fit for the head of the bolt will have been achieved.

The next trick is to achieve an equally neat effect with the covering material, but that's another story... ■

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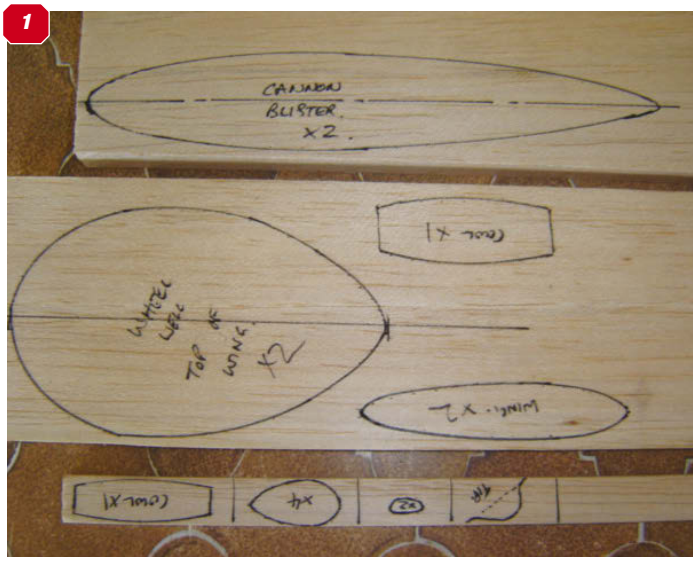
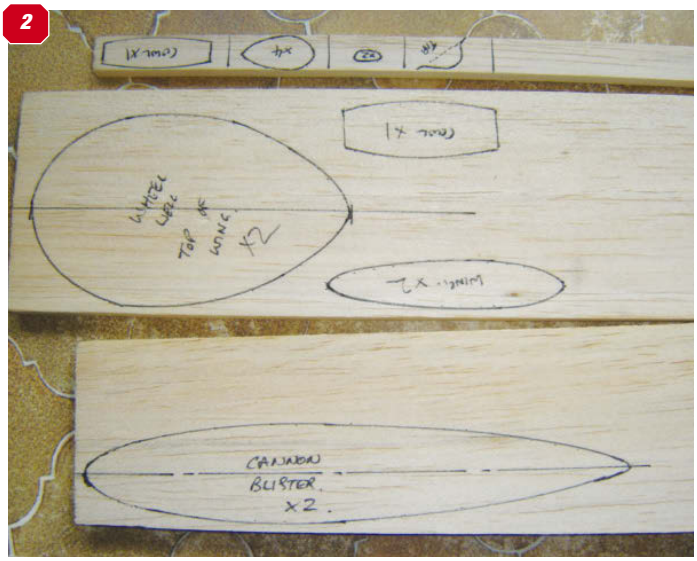
SURFACE DETAILING A SPITFIRE

ANDY WARD DEALS WITH CANNONS, EXHAUST STACKS AND HIS OWN APPROACH TO D.I.Y. PLASTIC MOULDINGS

When closely examined, the surface of any fighter aircraft of the same vintage as a Spitfire is seen to be covered in various lumps and bumps. These might be access points for re-arming, refuelling and often factory additions to improve performance such as extra air filters for use in dusty conditions. At the scale of my Spitfire (83" span), I really had to include all this detailing which, to me, was half the pleasure in building the model in the first place. I really enjoy this phase of a scale build as the project becomes a true scale model and no longer just





1 & 2: The shape of each part to be moulded is transferred from the plan onto sheet and block balsa as required. 3: Having cut out and shaped the plugs, a handle is glued on each one after drawing round them to create the draw plate from ply. The holes are cut out approximately 1mm oversize. 4: Here we have the plug for the cannon blister on top of the wing held in a small bench vice ready for moulding. 5: The first mould taken from this plug. I found that if too thin material was used, I would end up with a very flimsy moulding that would not be strong enough. 30-thou. sheet is about right for this size of component. 6: This is the heatgun used, and I attached the acrylic to the ply former with bulldog clips which get very hot when heated (guess how I found this out!).

another 'toy aeroplane'.

Looking at the three-view plan from FSM of the Mk.IX MH434, I concluded that a great many lumps and bumps needed to be applied to my model for it to look anything like the full-size.

I had already taken many close-ups of the full-size during a visit to the BBMF hangar at its then home at ..... and from these, I was able to plan the making of the cannon and undercarriage blisters on the tops of the wings, the cannons themselves, the exhaust stacks and the various other small blisters.

I could have carved some of these from balsa and grain-filled them prior to gluing them in place, but I wanted a ready-paintable surface straight away, together with the facility to easily replace any parts that subsequently might get damaged or fall off the model during its lifetime.

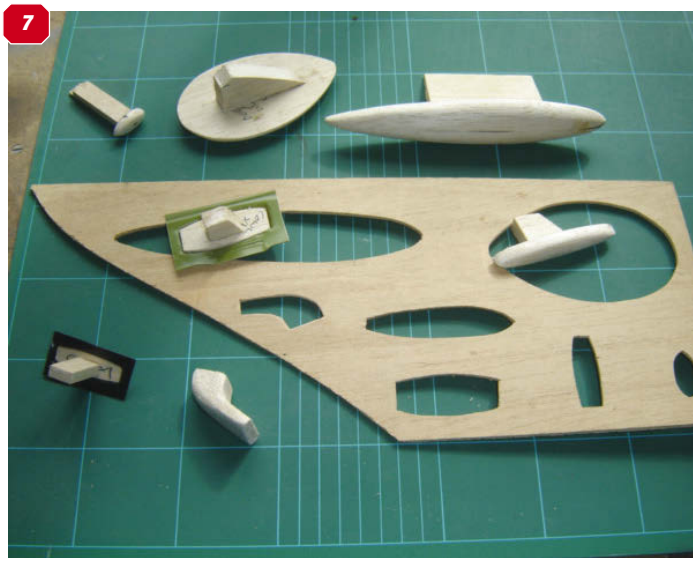
To this end, I decided to have a go at moulding most of the features I needed from styrene sheet, using the time-honoured plug-and-hole method. This is certainly not a new process; the plastic kit modellers have used this idea for years, when moulding canopies, for example. However it was a process relatively new to me as I had only moulded a handful of things in the past.

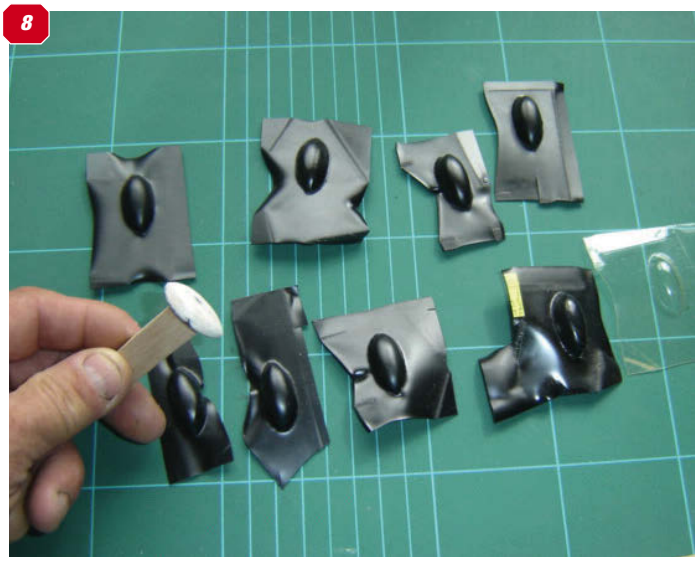
There's nothing like having a go at something to improve your ability at it and I actually had a few failures doing this, but I hope my experiences will encourage others to have a go without wasting too much acrylic sheet!

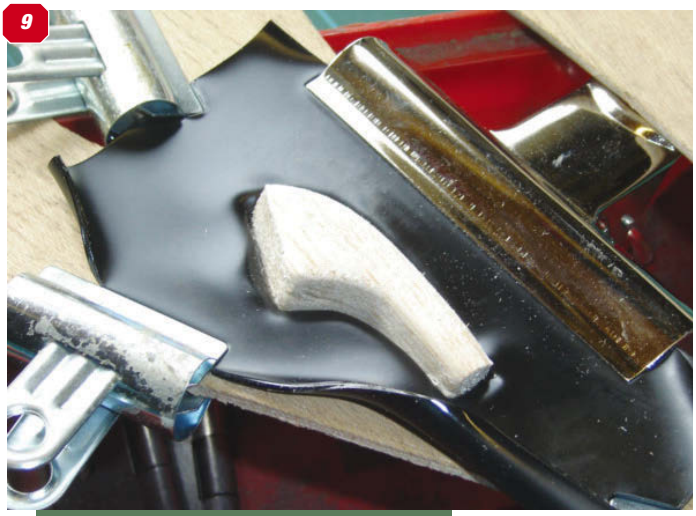
Basically the idea is to heat up a sheet of plastic and push it over a wooden plug, whilst the sheet is soft, to create the part. Of course the reverse could be done equally well - that is, to heat the plastic and push the plug through it. I used a combination of these ways to make my parts and the method I used is as follows.

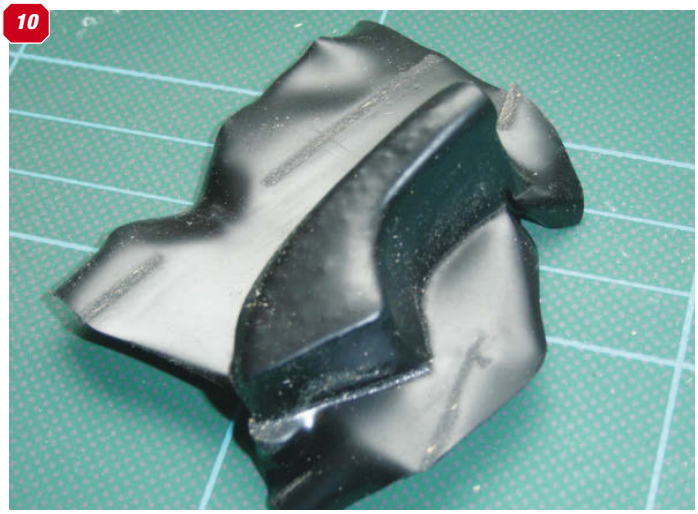
CREATING THE PLUG

The plugs required for my model were simply made from soft block and thick sheet balsa. The first job is to transfer the shapes of the parts required from the plan to the wood, bearing in mind that the wood needs to be at least the thickness









7: Plugs and draw plate used.
8: There are many of these small blisters on the underside of the wings, so this method made them very quick to produce, each one literally taking only a few seconds to complete.
9, 10 & 11: Moulding one half of the exhaust stacks. The plug is simply turned over and pushed through the opposite side of the draw plate to create the other half. Only push it through the acrylic to halfway.

of the finished part, if not a little thicker. I needed to make plugs for the exhaust stacks, cannon blisters, various small blisters, the rear-view mirror shell and the large-ish blisters over the wheel wells on the top surface of the wing.

Having transferred the shapes to the wood, I cut them out slightly oversize with my Dremel jigsaw. They were cut oversize to allow for sanding back to the exact size needed. The blanks were then planed and sanded to their final shapes using the plan and photographs as a reference and a short length of balsa strip was then glued on the back of each part for use as a handle.

I found that although I finished each part to as good a finish as possible with fine grade paper, this did not matter too much as any grain left in the plug would be on the inside of the mouldings and, because of the thickness of the acrylic sheets used, would not show up on the surface of the finished part. I gave each part a coat of finishing epoxy resin before final sanding to harden up the surface of the plug. This was because some mouldings, like the top and bottom halves of the exhaust stacks, would require the plugs to be handled several times and the resin surface would improve the longevity of the plug.

THE FEMALE 'DRAW PLATE'

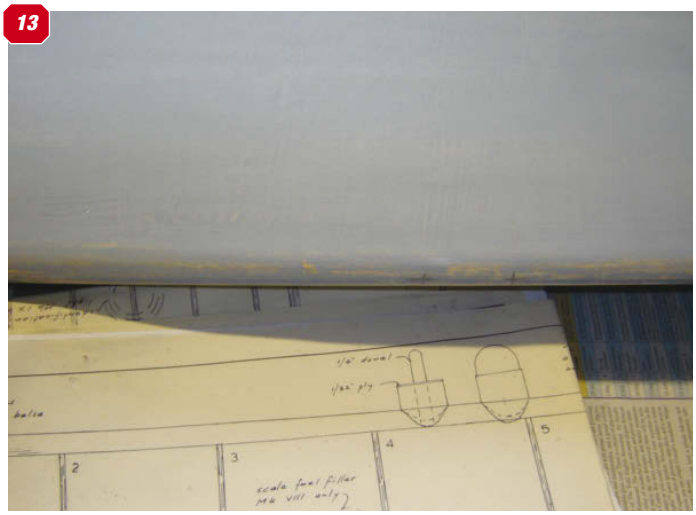
Having created all the plugs, I needed to make a holed plate through which I could push the plug when the acrylic is heated. I used a sheet of 4mm liteply for this, drawing round each plug and allowing a further 1mm or so when cutting out the holes with the fretsaw. This is to get the acrylic to 'draw' properly when heated. I gave the edge of each of these holes a small radius with glasspaper to help the moulding process.

MOULDING

The method I used was to hold the plug by its handle in a small bench vice and attach the acrylic sheet over the hole in the draw plate with small clips, allowing for plenty of 'meat' for the styrene to expand and draw. The draw plate, with the acrylic attached, is then held over a heat source - in my case a heat gun - until the acrylic goes floppy. The acrylic is then pulled over the plug and held for a few seconds whilst the plastic cools.

Any bad mouldings can be reheated and repeated and I found that the larger the component required, the thicker the sheet of acrylic needed to be. I did have a few failures, but it's a great way of using up scraps of acrylic from the stock box and is very easy to do. Clear mouldings, such as wing tip lights and canopies, are also possible using clear acrylic sheet of course.

Once the moulding has cooled, the part can be lifted from the plug, trimmed to shape and fixed to the model.



12: Some of the exhaust stack components. 24 were made as I needed 12 top halves and 12 bottoms!

13: Using the plan to mark off the positions of the cannons on the wing leading edge.

14, 15, 16 & 17: Drilling and enlarging the leading edge holes for the cannons.

18, 19 & 20: Opening out the holes in the leading edge so that the plastic pipe is a close push-fit in them. I found a sanding drum to be exactly the right size for this.

EXHAUST STACKS

One very prominent feature of the Spitfire (Mk.9) that I have modelled is the twelve exhaust stacks of the Rolls Royce Merlin engine. On a previous model (a Brian Taylor Hawker Hurricane), I had made the items from resin using a silicone mould. This worked well and my method was featured in a previous issue of this magazine. However, I thought that, on this occasion, I would try to make them from acrylic moulding using the above process.

To do this I would need a top and bottom moulding, which would be glued together followed by a shaped lithoplate 'wrap' over the rear part of each stack. To this end, top and bottom halves were moulded using 30-thou. acrylic to get the required strength in the draw.

Examination of the photos here will show that I made some from black plastic and some from white. There was no reason for this, other than the fact that I was using up some scraps of material.

Having trimmed each half to shape using scissors and a sanding block, they were glued together using the proper Revell adhesive purchased from the local model shop (a bit like assembling an Airfix kit!). Using photographs to guide me, I cut out the twelve lithoplate 'wraps' which go round the rear of each stack and, when assembled and the rear of the stack hollowed out with a knife, the result was most effective. Having taken some time making this first one, I only had another eleven to go!

To provide extra cooling for the Laser 180 engine in the model, I mounted each exhaust stack onto a strip of 3mm liteply in which an 8mm hole had been cut under the position of each exhaust. In this way, hot air could escape through each scale exhaust stub. The completed side of exhausts, mounted on the ply base, was then glued inside the cut-out in the cowl using polyester resin.

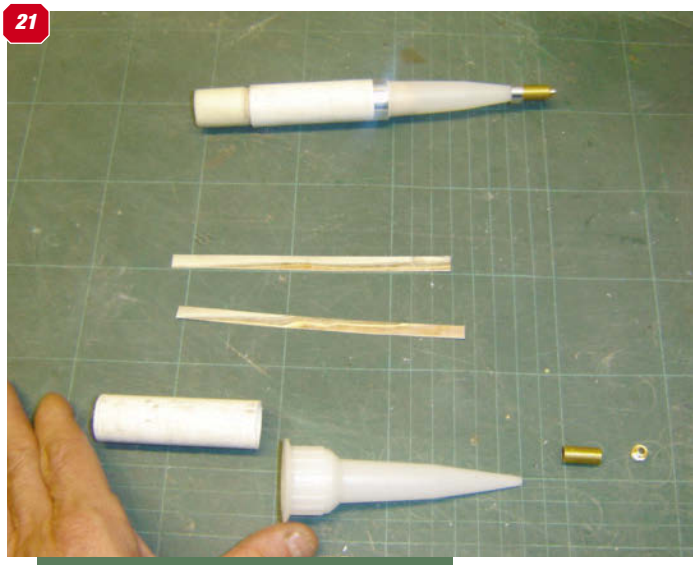
One advantage of moulding the exhausts in this way is that the finished result is reasonably lightweight; the resin ones on my Hawker Hurricane are quite heavy, although the weight is usually needed at the front of a model, anyway.

To finish off the exhausts, I gave them a coat of matt black paint and then stippled each one with silver, matt white and brown, using a piece of sponge, until they looked about right. I think the effect is very good and most realistic.

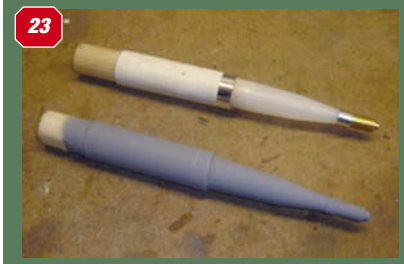
MAKING THE CANNONS

Another prominent feature of MK356, the Spitfire Mk IX that I was building, is the wing cannons. Two were required, one on each wing as the other one was blanked off on the full-size. Once again, being a hoarder of scrap bits and pieces, I thought about what was needed and how I could achieve it.

To mount each cannon in the wings, four holes were drilled in the leading edge, using the model plan to get the correct



21: The components of a cannon laid out, with the other one complete behind it. 22: This shows which part of the sealant nozzle is used for the front part of the cannon. I used a tapered piece of 3/4" balsa dowel to join this part to the pipe of the main cannon body, covering the joint with a strip of self-adhesive foil. 23: The cannons with and without primer. With the addition of a few PVA dot rivet heads as well, I think these look excellent. 24: The rear-view mirror, which again is made from a moulded rear bowl and plastic card parts.



locations for the holes. I wanted to use a short length of plastic overflow pipe (available from your local plumbers' merchant) in each leading edge into which the cannons would be a push-fit, so the holes I had already drilled in the leading edges were opened out with a sanding drum until the plastic pipe I had was a tight push fit in them. The short pipes were then cyanoed into the leading edges and the inner ones were capped off.

Using photographs, I was able to gauge the size of the model cannons and actually made them from short lengths of 3/4" balsa dowel glued onto more of the plastic overflow pipe. About 25mm of dowel is left to use to mount the cannon into the leading edge tube, and any slack here was taken up with a wrap of masking tape.

The front of the cannon is made from the top of a tube of silicone sealant, cut off and glued in place. The joint was covered with a strip of the silver self-adhesive tape that I used for the access panels on the wings, while I made the muzzle from a piece of brass drilled and turned in the lathe, although I could have used various sizes of tube inside one another.

This is real 'Blue Peter' modelling, but it's strangely satisfying making something out of scraps - and the price is right as well! Once painted, these cannons, whilst not being 100 percent scale, look the part and have sufficient detailing to be interesting to other modellers. I'm pleased with them anyway!

One other feature which I made using a self-moulded bowl was the rear view mirror. I used a marble to get the correct hemispherical shape of the rear of the mirror, pushing it through a circular hole in ply as described with heated acrylic. A piece of self-adhesive foil is the mirror itself and a plasticard stem just pushes into a slot in the top of the canopy.

Well, I hope I have encouraged others to have a go at making scale details for themselves rather than reaching for the credit card and buying them, ready-made from various specialised outlets. I find the detailing stage an exciting part of the building of any scale model and obtain great satisfaction from making something out of nothing. Quite often the only outlay is my time as well... now that's a real result! ■

25: Each cannon is a tight fit into the leading edge tubes. Any slack is taken up with a wrap of masking tape - real high-tech stuff!
26: The finished cannon in place. Looks good, don't you think?

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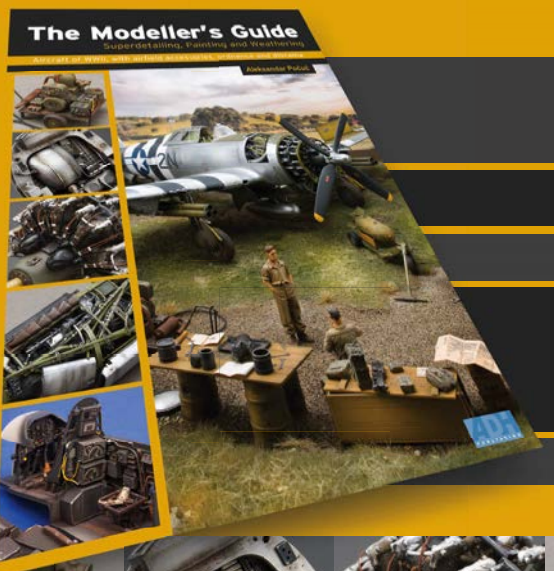

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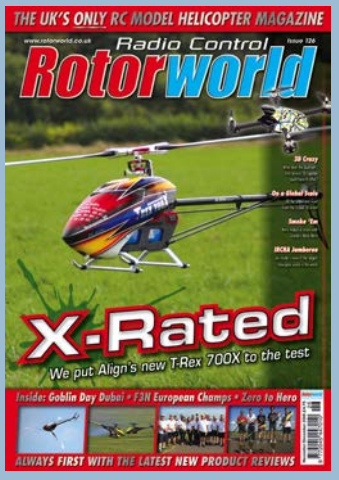

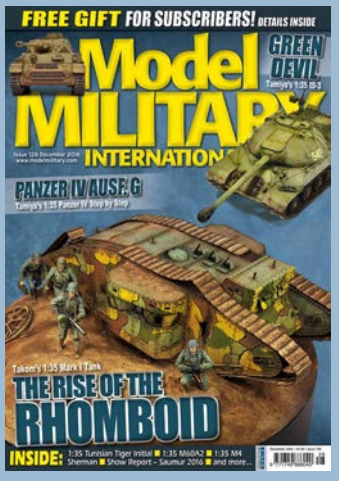

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THE QUIET ZONE

R/C SCALE ELECTRICS WITH PETER RAKE

I don't know, it's amazing how quickly this time comes around. I no sooner seem to have finished writing one thrilling instalment than it's time to begin another. I sometimes wonder how I manage to fit in any modelling of my own; I wonder about it, but still manage to find a little time for balsa butchery. Well, you have to keep the creative juices flowing somehow.

So, what have we got lined up for you this month? That's a good question, the answer to which came about in a slightly obscure manner. Just recently I've had the urge to build a few rubber powered models and set about converting some of my drawings for small radio models into lighter, free-flight types aimed at rubber power. Yes, I do have these strange ideas at times, but it keeps me amused and off the streets. Let's face it, the world can only take so many delinquent granddads roaming around unattended.

Okay, so maybe the model designs I've been abusing so far weren't scale models, but that will come once I start to re-acquire the hang of these long rubber bands and strange looking propellers. Enormous, strange looking props compared to what I'm used to. Yes, I know I'm supposed to be writing about electric flight. Give me time and I will get there eventually. At least what I am writing still qualifies for the *'Quiet'* part of the Column's title.

It's quite funny how these things work

PETER RAKE CONTEMPLATES THE POSSIBILITIES OFFERED BY SMALL RUBBER-POWERED FREE FLIGHT KIT MODELS FOR LIGHTWEIGHT ELECTRIC R/C

Okay, another non scale model converted from a rubber power design. At least this time it looks as if it might be scale.

Although actually drawn up as a radio model, as seen here, you can see the free-flight potential of this model. Structure is pure rubber power, even if not scale.

out really. When I got back into model flying, after a protracted spell of painting model soldiers, rubber power models were what gave me a lot of pleasure. However, niggling away there was the desire for longer flights and more control, so I didn't have to chase the beggars - not that many of my efforts required much chasing.

Anyway, that started me designing models that ultimately would turn out to be pretty much like reinforced rubber powered models fitted with electric motors and radio control. Now, as readily available radio gear has become progressively smaller and lighter, so did many of the models I drew up, right back to the point at which they could become slightly over-built rubber power models with only a minor alteration to a few of the parts.

So that's pretty much what I'm trying to do, altering a few designs so that they become dual purpose models, without actually changing the way they're built too drastically; all jolly interesting and entertaining stuff. Well I think it's interesting at any rate.

GETTING ON WITH IT

So, although I'm converting electric R/C designs to rubber power by removing the motors and micro radio components, it's quite viable to go the opposite route and convert rubber power designs to electric R/C. Yes, I'm aware there's nothing new about that, and I've looked at a few such conversions in the past. This time, however, I thought we'd take a closer look at exactly what's involved in these rubber-to-radio make-overs.

Now, I hasten to add that I haven't actually done any of these conversions myself. Oh no, I'm far too mean to pay for kits when designing purpose-built models is something I enjoy so much. So although I haven't made any real life conversions, I have done quite a few rubber-to-R/C conversions electronically by drawing plans for models that were inspired by rubber power designs.

As you can perhaps imagine, that gave me quite a good idea of what's involved, what equipment is available and what changes need to be made to actually install said equipment so that it would function in the way in which I intended. Any info involving actual hands-on conversions, I've gleaned from those far more experienced in the field than I, after all, when you do a conversion in the way I've done them, you can build the model in precisely the way you prefer to build.

Working with a kit, you're rather stuck with the way the designer of the kit thought things should be done. Much the same applies to the countless rubber power plans that are available from various sources. Unless you're doing a complete revision of the design, you have to work within the confines of the plan at hand.

DEGREES OF CONTROL

Although, given the prevailing weather we've been having lately, CONTROL OF DEGREES might be more use! Seriously though, just because you're converting what is essentially a free-flight model to radio control, that doesn't mean it needs to have umpteen control functions with retracting landing gear, bomb-drop and rotating gun turrets. Don't get me wrong, there are those who attempt to include many such features on their poor abused rubber models, but you don't have to.

The real appeal of these models as far as I can see is their very simplicity, so use that simplicity to produce enjoyable builds that result in relaxing flyers - at least, that's the theory I work on. I know that many rubber powered scale models appear very complex with all their stringers and formers, but they aren't really that difficult to build. Remember, many of these, especially some of the Guillows kits are actually aimed at non-modellers and youngsters. As such they tend to be a little over-built (read heavy) but do provide a good basis for just the sort of conversion we're talking about.

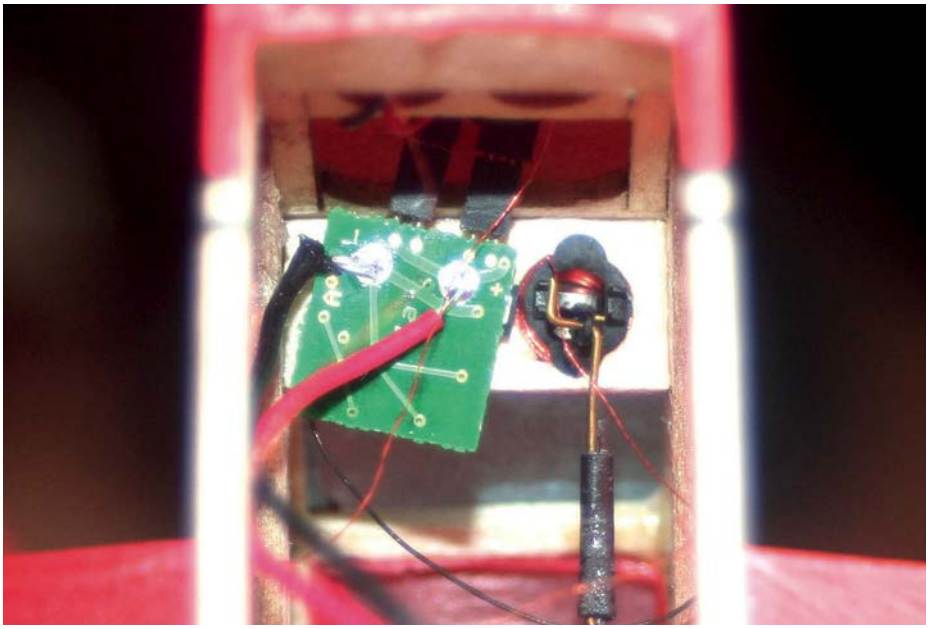
In its absolutely simplest form, your conversion need be no more than replacing the rubber motor with a receiver, battery and throttle controlled electric motor. It remains, to all intents and purposes, a controlled free-flight model, requiring trimming just like any other free-flight model, but with you in complete (hopefully) control of how much power is used and how long the model flies for. Some people call it RADIO ASSIST.

If it starts to wander too far, just shut the throttle and let the model glide down. It's so much more versatile than a flight profiler (as fitted to `proper' free-flight models) because you can vary the power as you see the model flying, rather than setting it up and then losing all input in the matter. You can even use it to obtain a minimal kind of steering control if it's set up properly.

Picture the scene; you have you model set up for a nice gentle, circling flight at a given throttle setting. If the model needs to be turned more tightly, if it's wandering too far perhaps, increasing throttle tightens the turn. Having got the model heading back towards you, reducing throttle will lead to a straighter flight path and mean you don't have so far to walk to retrieve the model once it has landed.

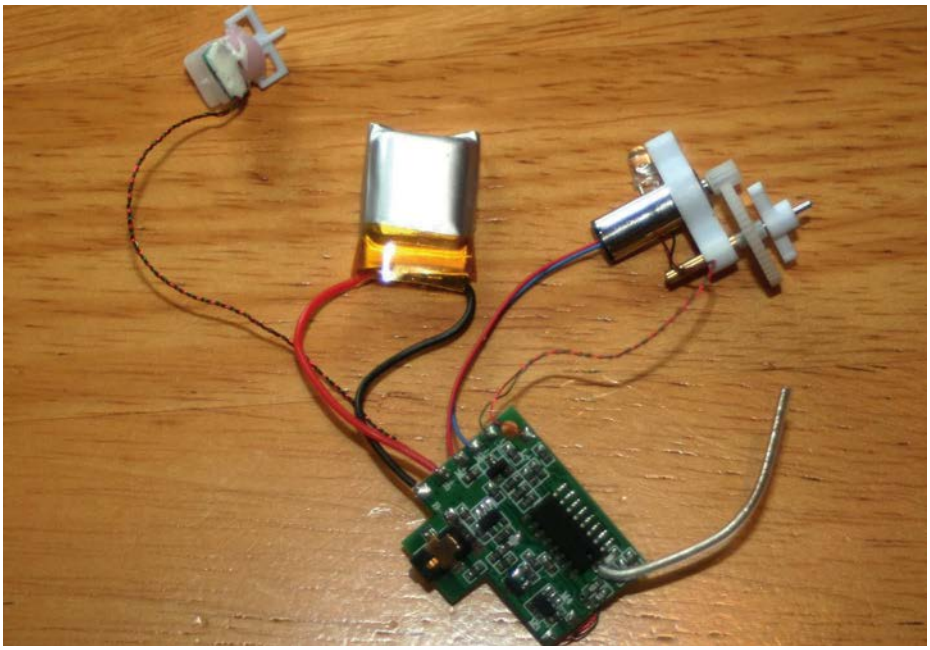
Too basic for you? How about two channels, controlling throttle and rudder. Forget all the horror stories about single channel models; reliable radio and the ability to control the motor makes all the difference in the world. As I'm sure you've noticed from previous issues, virtually all my indoor models use this form of control and they fly very nicely indeed.

Still retaining the slightly free-flight feel, two channel operation means that you have a positive control over where the model goes - not necessarily how it goes, but definitely where it goes and for how long it does it.



Typical of the gear suited to lightweights, a DT receiver and micro actuator. The heaviest part is probably the battery lead.

Yes, the transmitter does look a bit toy like but it works well enough. Throttle is proportional, rudder control isn't.



The airborne package that goes with the transmitter. Although not the lightest at 7.82 grams, it is eminently usable for our conversion needs on small models.

Whether you use a three channel 'brick' style receiver (with built in speed controller and two linear servos - of which you only use one) or separate components is immaterial, the precise equipment you use will be determined by the size of the model you are converting. For instance, Peanut class models (13" span) aren't going to carry much more than a couple of grams of equipment before they become too heavy to fly in a scale-like manner. Even that isn't impossible (although you do have to be very weight conscious), as you'll see a bit later in this discourse once we start to look at suitable radio gear.

Okay, so models for one or two-function control are going to need to be pretty stable fliers to begin with; models that will pretty much fly themselves once fully trimmed, but they are both viable routes into this converting lark.

Just as an aside, I've even seen two channel radio used to control where a relatively large (40"-plus) rubber power model goes when flown in a city centre park. It's a very interesting thought for those who want to fly high performance rubber power, but don't have vast areas in which to do so.

Once you get past two control functions ,the world is your lobster, so to speak, in terms of radio gear choices. Yes, it's still going to have to be small and yes, it's still going to have to be light, but there is a huge variety of small, light and inexpensive equipment available that is all eminently suitable for our kit conversions. There are numerous four or six-function receivers weighing under 5 grams, servos that tip the scales at around 1.5 grams each and speed controllers that weigh next to nothing, so even though the function-count is higher, the equipment weight doesn't have to be that much higher. It's very much a 'horses-for-courses' sort of thing. You just have to tailor your equipment to suit the size and weight of the model, and how you expect the model to fly.

SIZE DOES MATTER

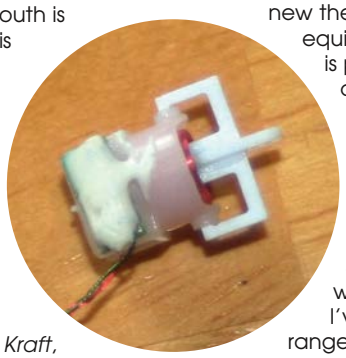
At least, it does as far as converting rubber power models to electric powered radio control models. However, the thing you have to remember is that just because a model was designed for rubber power, that doesn't always mean it has to be a small model. In fact, *Easy Built* offer a kit for an SE5a that is roughly 1/6th scale. Yes, a 54" span rubber power model. Can you visualise the amount of rubber required to get something like that to fly well? There's every chance that the radio gear you fit to a model of that size will weigh less than the rubber used to power the original. You might even be able to include the weight of the battery pack and still not exceed the weight of the rubber motor.

Probably about the only rubber power models that don't convert well are those restricted (by class rules) to having a wingspan of 9" or less. No doubt it has been done, but is hardly novice converter territory.

Peanut scale models - and there are an awful lot of them about in either kit or plan form - can be converted with minimal effort on the part of the builder/converter, but they do require that you can build small structures lightly.

Always bear in mind that the smaller the model is, the more difficult it is to trim and the more restricted you are about when and where it can be flown.

Far and away the most practical are models ranging from about 18" span up to 40 inches or so. There are loads of kits available in this size range (mostly at the lower end) from such companies as *Guillows, Easy Built* ans *SAMS Models*. However, if reliving your youth is what does it for you and is the motivation for converting a rubber power model, I strongly suggest you check out the *Vintage Model Company* site. They list a vast range of the old *Keil Kraft*, *Veron* and *Frog* rubber models, but with the advantage of laser cut parts; no more of those horrible, multiple stringer notches to cut into formers, with every other bit between the notches splitting off! In most cases the wood is of infinitely better quality than the heart-of-oak wood so common in the old *Keil Kraft* kits. I have several of these kits stashed away for conversion - unless the desire to build them, as intended, wins out.



A closer look at the rather nice actuator from the very cheap radio set.

As for building from plans, there are literally hundreds of them available, not only from magazine publishers, but also from several on-line plan download sites. All shapes and sizes of models just begging to have electric motors and radio control gear fitted.

MY NEW TOY

Since I can see I'm running out of space long before this article is finished (nothing new there) I'll take a look at some equipment I bought recently that is possibly ideally suited to both one and two-function controlled models. As anyone who knows me will attest, for me to buy it, it had to be cheap. At around £15, from a well-known Chinese model supplier, it really had to be worth a try.

I've no idea yet what the range is like, but these little models need to be kept fairly close anyway. What you get for your money is a complete set-up. It has a toy-like transmitter with USB style socket, USB charge lead, receiver with built-in ESC, actuator, geared motor and LiPo, all wired up and ready for use. It also comes with a GWS style 5"x4" prop and 'O'-ring to attach the prop to the motor.

The one potential issue for some would be that rudder control isn't proportional. You hit the button and the actuator slams hard over in whichever way you've told it to move. However, fitting stops, or simply using a long control horn, should tame it a bit. It isn't actually that difficult to control a model using 'bang-bang' rudder control.

We used to manage it with single channel radio that was far from reliable and the half a flight you actually got under control was perfectly acceptable. It was only when the gear stopped working properly that the problems started. Rubber powered escapements and diesel engines are not a match made in heaven - far too much vibration for the escapement to remain reliable. (Many of us have been there before and made it work. Only those who gave up are no longer with us!)

Anyway, I've had a little play about with the gear and it all seems highly satisfactory. There's a charge socket and a switch mounted to one side of the receiver board that needs to either protrude from the fuselage, or have an access point in the fuselage. The neatest solution would probably be to have it external, but camouflaged as something that should actually be there.

Right then, I'll leave it there for this month and we can start getting more involved with actual conversion details next time around. If you'd like to contact me, I can be found at

PETERRAKE@aol.com ■

This time it is a scale model, and converted from a rubber power 'dime scale' design. Equipment fitted is a three channel 'brick' and geared motor.

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