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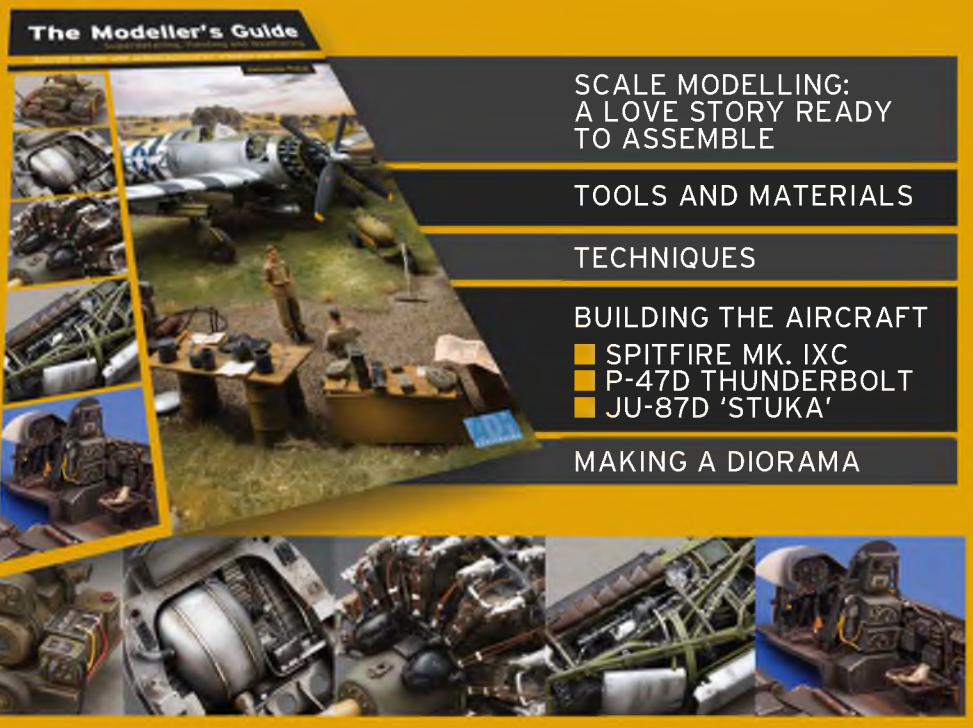

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ON THE COVER

It seemed a good idea at the time as so many of them do - and it would probably have worked too, but the Fletcher FD-25 never went to war as intended, although it did, eventually go to war on weeds as a Crop Duster aircraft. Peter Miller present a 54.5" wingspan, 1:6.6 scale model of the aircraft in this issue.

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CONTACT

From the earliest days, aviation history is littered with the bones of aircraft that never really made it and have been consigned to obscurity. Some owe lack of success to lack of performance in the role for which they were intended. Some of those, usually from the 'dawn of aviation' period never actually made it into the air and so were really 'machines' - as opposed to 'flying machines - since they never did!

At the other end of the performance spectrum, there have been the aircraft types that were entirely workable, DID fulfil their design philosophy and for which there was a genuine need, but for which the intended customer, either civilian or military, saw things differently, or did not have the necessary vision.

There have also been aircraft types that made it all the way to production status, but which proved to be abject failures in service. The 'neddies' who ordered those usually got away with it, while those who drove such aircraft often did not.

One of the 'aviation obscurities' that was in fact perfectly workable for the task envisaged was the Fletcher FD-25B Counter Insurgency (COIN) ground attack type back in the early 1950s. As a Warbird, it never found favour with the US Army Generals to whom it was successfully demonstrated and never wore military colours beyond the few that were eventually sold to the Cambodian military.

However, a redevelopment of the type did find success as an aerial crop-duster type in New Zealand so one could say that its warbird success was one of a 'war-on-weeds'.

Peter Miller was attracted to the type as a scale model; nice straightforward shape, constant chord wing, wide track main undercarriage and simple wing flaps for an added bit of fun. His 54.5" wingspan 1:6.6 scale replica is one of our construction features this month.

Give it a go!

RIGHT: The prorotype FD-25B in flight with napalm canisters slung under the wings.

BELOW: Seen at Fullerton, California, the sole survivor (in 2010) of 16 examples manufactured.

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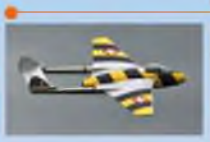

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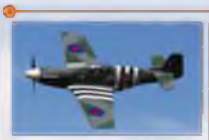

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NIEUPORT 17

PART 3: Concluding the construction article for the 1/6th scale, electric powered model of the famous French scout. Designed by Peter Rake, with the prototype model built and photographed by Pat O'Donnell.

With the wings and tail surfaces built, or at least their build described, it's time we created a fuselage to which they can be attached.

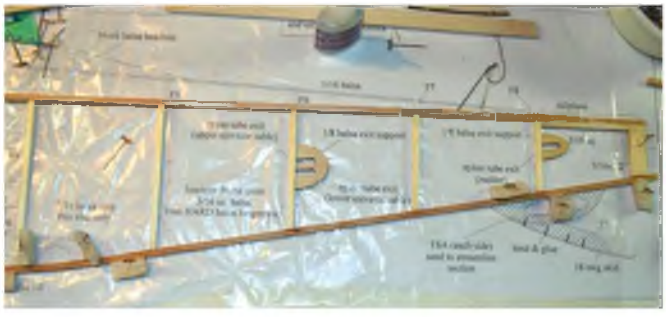
FUSELAGE

As with most of the rest of this model, before you can do any actual building there are some preparatory steps that need to be completed. Not least of these is to fashion the wire parts for the main undercarriage and rear centre section struts. While doing this you'll notice that, for some reason totally unknown to me, the rudder is described as a section through the wheel. I think this must have happened while moving parts around to fit within free plan format and blatantly doesn't belong there. So, ignore that note. Trust me, it really is the rudder, not a wheel.

You may recall from the first part of this article that Pat chose to fit the centre section strut to F3 after the basic fuselage was assembled, using a template to ensure the split pin to which the top wing will attach ended up in precisely the correct location. However, thanks to the degree of accuracy possible with a CAD drawn plan and the fact that similar accuracy is employed to key F3 into the fuselage, the wire can be shaped, accurately spot glued in place over the drawing and then bound and glued securely to the former. The choice is yours. However, since the forward fuselage box keys together in a way that makes it difficult to get it misaligned, I prefer to work over the drawing rather than mess about with templates and jigs later. Yes, pure laziness on my part but you can't have everything.

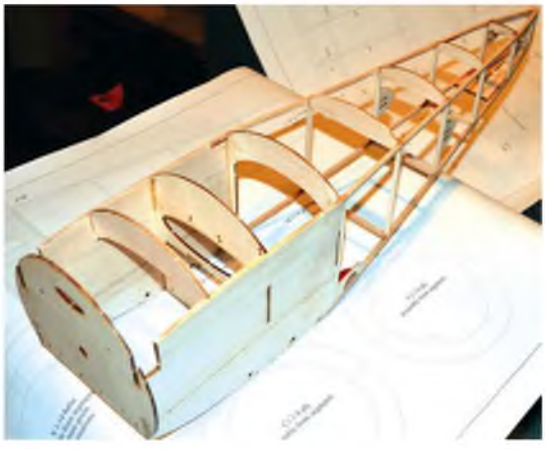
Don't bother binding the undercarriage wires in place at this stage, they will only get in the way as you build the front fuselage box. There's ample opportunity to fit them after the front and rear basic structures are joined. However, I would suggest that you cut the grooves in F1 into which the front leg binding will be recessed . Make sure you have the former the right way round when you do this. The small circular hole in it isn't central in the former, it's offset to allow for motor side thrust (so that the shaft is central in the cowl once the thrust lines are set). The hole simply marks where the motor should centre on the former. The drawing on the

Drifting by in a low pass the prototype model captures all the presence of the full size

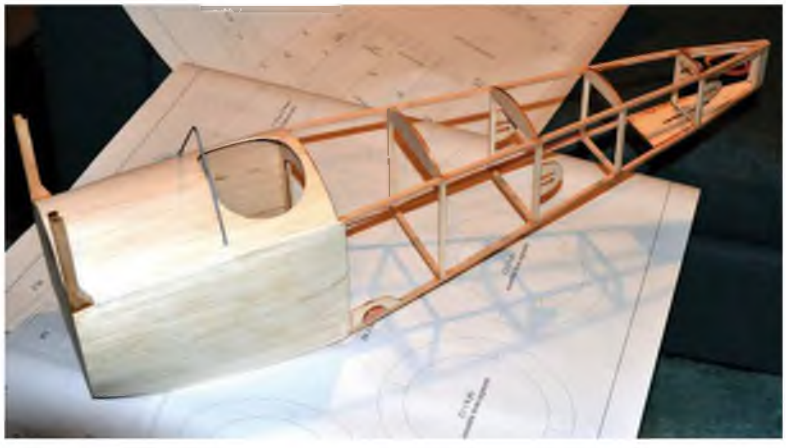


The basic rear fuselage side. Note the darker, harder wood used for the longerons.

Everything jigged up to ensure the front and rear boxes align correctly.



The joined basic boxes. As you see Pat opted to install the centre section struts at a later stage.



The same fuselage but now with the struts installed and the forward areas sheeted.

plan shows it from the front, so that's the face into which you need to cut the grooves. I suggest doing them now so that, in the heat of the moment (while everything is going together so well) you don't glue in F1 the wrong way round.

Moving on to the sides themselves, you'll obviously need to join the upper and lower parts, but there is also the front centre section strut to take into account. Personally, I like to fit these to the sides before I start gluing things together in earnest. I feel that it can be done more accurately then because it can be accomplished directly over the plan. It also gives a clear indication of just how square your fuselage is coming together because you can view across them and see if they align correctly - or not. I know that the way F1, F3 and F4 fit, combined with the accuracy of laser cut parts, SHOULD make it almost impossible to get the sides misaligned, but it never hurts to have something by which to check that that is actually the case.

Before moving on to the actual build, mark the sides with the positions of the formers that fit on the outside. Because these are different on each side, it might also be worth noting which former fits where. The plan view is from above, so you can see that the formers that form that bulge I mentioned in the first part are on the left side of the fuselage. Yes, I do realise they are labelled to indicate just that point but it does no harm to make absolutely sure you understand that. At least then I can't be accused of not telling you.

Finally, check that your servos will actually fit the openings in part RT before it is firmly ensconced in the fuselage. If required, open up the positions until they do fit. You might as well glue RT to F3 at this point too since it's easier to get it square.

GETTING IT TOGETHER

As you'll see from studying the plan, and from my constant reference to a *'front box'*, the fuselage is built as two separate sections, said front box consisting of the sheet sides, the firewall and the bulk of the formers, and a rear, built up section. Both are built to basic box stage and then joined over the plan to assist with arriving at a straight, square fuselage. I'm aware that there are no straight edges you can use to assist with this, but a little packing beneath the tail-post, and ensuring that the forward upright of the built up section fits snugly against F4 will ensure the top longeron is at the angle it's supposed to be, relative to the front fuselage section.

So, make absolutely sure you get those first uprights in 100% accurately. Any of the others can afford to be a fraction out (not desirable, but acceptable), but to ensure the top longeron aligns correctly the front ones must be exactly as shown. If they don't align correctly the angle you get in the next step won't be correct either.

Please note the taper at the rear end of the top longerons (where the tailplane fits). That is deliberate so don't omit it. The positive tail incidence it provides helps keep the tail up in flight and prevents an excessive climb. I've used this method on countless biplanes (monoplanes don't seem to need it) and it works far better than just applying down trim to the elevators. Yes, that will work too, but appears more sensitive to changes in speed - the greater the speed, the less trim you need. Something that is far less noticeable if the entire tail surface is set at an angle.

Anyway, now that you have the two basic box structures joined you can add the remaining formers and set about the sheet sides and top decking. When fitting the top decking, it is perfectly possible to fit it all as one piece; possible, but far from easy, since you have changes in direction, curved edges (the very front part) and struts to work around. Add in the fact that the stock sheet sizes (unless you buy very expensive 6" wide sheet) are

Landing gear on, basic cowl in place and the rear decking added.

Here you see how the cowl is shaped and then sealed and primed ready for painting. Pat also added stiffening ribs to his cowl but not all aircraft had them.

Servos in the tray, closed loop cables connected and ample room for the battery pack immediately behind the firewall.

too narrow and need to be joined and the whole task could easily become something of a nightmare.

Therefore I prefer to do it as two sections, one forward from F4 and the other between F4 and F8. The front part is easiest if done using two pieces, one for each side, that are cut and joined after they have been fitted to the curve and around the struts. To assist with the slight change in height between F3 and F4 I like to make an under size cockpit cut out that will allow the parts in front of the cut out, and the parts behind it to take up the differing curves needed to follow the lines of said formers. Trim each half to match the curve and fit neatly around the centre section struts and glue each to its corresponding fuselage side. Allow that to dry before applying glue to the formers, slightly dampening the outer surface of the sheeting to assist bending and curving the sheet onto the formers before slicing through both where they overlap. Pin or tape into place and allow the glue to dry. After that, but using a similar process, fitting the rear decking should come as something of a rest cure. No cockpit cut out, no nasty struts to work around and only the rear edge of the front decking to fit up against.

Almost as easy, the front side sheeting should now be added, butted against the forward to decking and bevelled to fit flush against the lower fuselage sides. After that it's just a case of sanding the front flush with F1 and giving the entire fuselage a nice, overall smoothing off and trimming the side sheet around the lower wings.

Open up the cockpit rim to its correct size and make up the block balsa headrest. It's entirely up to you whether you glue it in place now, or after the fuselage is covered. It all depends on how good you are at covering around such things. Personally, I'm rubbish at it so would cover the fuselage, get the headrest to be a good fit and then seal and prime it (lots of coats and lots of sanding to hide the grain) and then glue it to the covered fuselage before painting. That way I avoid damaging the edges while ironing on the covering and don't have to worry about wrinkles or overlaps on the front face. Yes, I am a lazy bodger.

Because of that very conveniently placed access hatch the undercarriage wires can be bound in place after the fuselage is covered. Just remember to put some notches in those 1/8 and 1/16" balsa filler pieces so you can get the needle through easily once you start binding. I say needle, but I normally coat the end of the thread with CA and use that in place of a needle. The glue stiffens it nicely and it passes through the holes fairly easily with the aid of tweezers or long nosed plies in the less accessible areas. Fortunately, we still have that open cockpit to work through behind F3.

COWL

Although time consuming, the build of the cowl is pretty simple. Begin by laminating the balsa pieces and setting them aside to dry. Use a sandable glue for this, not CA or epoxy. Remember, both those types of glue will set harder than the surrounding balsa and make getting an even curve sanded into the front more difficult than it needs to be.

For the body of the cowl, start by cutting a strip of ply to the width shown on the plan, and long enough to fit around the cowl formers. To allow it to curve better I suggest you have the outer grain funning fore and aft, even though that means joining two strips to get the right length. This strip is then glued around the formers (remember what I said about assembling former C2 so the mounting lugs are correctly positioned), and allow that assembly to dry too. Join the two assemblies and you have your basic cowl. True, it's still a bit chunky at the front, but it is a cowl. Time to make a lot of mess shaping the laminated balsa section.

As with the headrest, I'm hopeless at covering these things, so I don't even try any more. I get much better results from applying multiple coats of automotive filler primer, alternated by sanding every other coat, until all the wood grain is hidden and a nice representation of a metal cowl results. Then I paint it.

AIRFRAM ASSEMBLY

Since, despite my repeated attempts to pass on what I consider to be building tips, if you are capable of building and flying this model you'll already have a pretty good idea of how you want to cover it and what finish you'll be applying. Therefore, I'll move straight onto assembling the finished model. It really isn't particularly involved so shouldn't cause you too many problems - if any problems at all.

I like to get all the equipment installed while the fuselage is just that: only a fuselage. For the purposes of assembling the individual components it won't matter that the closed loop cables are left well over length and trailing from the exit tubes at the tail. While the fuselage is at this stage is as good a time as any to add what detail you want to apply to your model - if you didn't do it prior to painting. I mention it now because although the rigging doesn't need to be functional (unless you want it to be) you will need to make provision for it while everything is still easy to get at. I find there's nothing worse, or more likely to damage your model, that having to manipulate a fully assembled model to fit detail parts and items like rigging attachments.

So, with the equipment installed and any additional detailing you require in place, assuming you've already got the undercarriage and tailskid as part of your finished fuselage, the first task is to fit the top wing. Check that it does actually align correctly (that's down to how accurate you've built things) and tweak the struts slightly if required before gluing the wing securely in place. If you got the struts right, it should be impossible for the wing to fit at anything other than the

correct incidence angle.

Next to do is the lower wing panels. I'd suggest gluing the joiners into their fuselage tubes so they can't move about while you're trying to slide on the wing panels, but that's for you to decide. I assume you will have already trimmed the fuselage side sheeting to clear the wings, so it's just a case of gluing the root ribs to the main fuselage sides FS. As mentioned previously, because of the way the wing tubes are arranged the wings can only go on at the correct dihedral angle. These same tubes will also ensure that the incidence is correct, and the same on both sides. Now you can glue the i/p struts into their respective sockets. Just make sure you don't induce any warps during this step.

With that much assembled you have an ideal guide for correct installation of the tailplane and elevators. Glue the tailplane in place, check it aligns correctly and allow the glue to dry. Finally, install the rudder paying particular attention to accurate cutting of the hinge slots. It's about the only area that might cause problems if you aren't careful, so it's worth taking the time to get it exactly right.

Add the rigging, connect up the closed loops cables to the control surface horns and stand back and admire your miniature Nieuport 17. That's it, the model is finished.

FLYING

You know how to fly, otherwise you wouldn't have chosen a scale model, so I'll just include a few warnings here. Don't panic, that doesn't mean the model is difficult to fly, just things to make those first flights less stressful.

First and foremost, balance the model to hang just a hint nose low when supported at the point indicated on the plan. Don't even consider flying the model if it doesn't. The model may well survive the experience, but you won't enjoy it one littler bit. Biplanes in general, and short nosed biplanes in particular, are sensitive to balance issues so get it right from the start.

Secondly, be ready to use the rudder during take-off. Models of the Nieuports can be a little bit squirrelly during the take-off run. Something to do with how far forward the wheels are. It isn't a huge problem, but something you need to be ready for.

Finally, don't, under any circumstances, attempt to force the model into the air before it has built up plenty of speed on the ground. I had that happen to a similar size Nieuport 11 when it used a molehill as a ramp and was suddenly five feet up with nothing like enough speed. The resulting wobbl-,wobble, drop-left-wing and crunch wasn't in the least nice and did the model no good at all.

So, deliberately hold the model on the ground until it's ready to lift off of its' own accord. All you should need to do is stop holding it down, rather that actively trying to make it lift off.

Other than those points, you'll find the model is no problem to fly. It's unlikely that you'll need full power very much of the time, or that the model will become much faster when you do apply it. There won't be much perceived increase in speed, but the model will climb fairly rapidly. All the scale type manoeuvres are possible and the model is fun to fly. So, a model that flies well and looks good while doing it, what more could you ask for? ■

That big rudder is effective, remember to use it during take-off.

FLETCHER FD-2

Peter Miller's 54.5" (1384mm) wingspan model of a long forgotten close support counter insurgency ground attack aircraft that punched well above its weight

25B DEFENDER

The Fletcher Defender was designed as a Counter-Insurgency aircraft, or COIN fighter, by Lockheed design engineer John Thorpe who later designed the well known *Thorpe Tiger* home-built light aircraft. The *FD-25 Defender* made its first flight in April 1951and was a single-seater of 30 feet wingspan, the concept being ultra simplicity and economy, combined with a serious weapons load for close ground support - a sort of heavily armed Piper Cub, if you like. The aircraft could operate from unprepared strips with a minimum of ground support.

FLETCHER DEFENDER

(PLAN FSM 59)

Full size copies of this 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 £11.75 plus p&p (U.K £2.50; Europe £4.00; Rest or World £6.00.

The range of weapons that could be carried was impressive. It was equipped with a pair of 0.30 calibre machine guns in the wings to keep the enemy heads down during attacks and under the wings were eight 'stores' pylons on which could be hung a range of ordnance. The list included, two 33-gallon napalm tanks, two 250 lb. H.E. or fragmentation bombs, up to forty 2.75" unguided folding-fin rockets or twenty 80mm Oerlikon rockets or four 5" heavy rockets.

The prototypes were built by the *Fletcher Aviation Company*; the FD-25B was a single-seater, while the FD-25A was a two-seater although the latter suffered from an excessively rearward CG and the prototype crashed killing the two crew members.

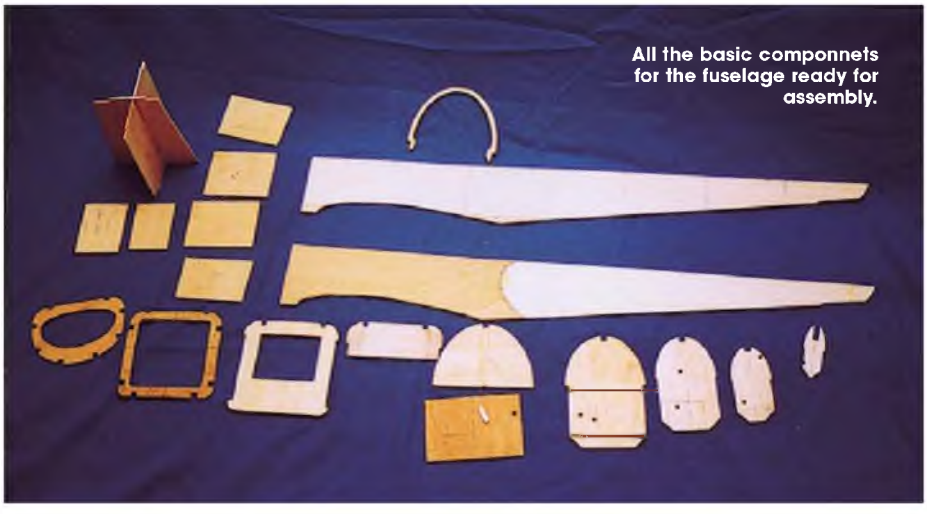
The FD-25B was demonstrated all over the USA to many military units. It fired rockets at targets and scored bulls eyes first time; it dropped napalm on a surplus tank and destroyed it, which rather upset the Unit that had allowed the tank to be used as a target! All who saw the demonstrations agreed that this was just what was needed - small, cheap, light, there when you needed it and able to pack a real punch.

Unfortunately the top brass, the ones who decide what the man in the field needs, wanted something else. They wanted bigger aircraft with more crew and more engines that needed more ground support. Of course, you can't afford as many of those and there was also the risk of loosing multiple crew members at a time in the case of a 'downed' aircraft, but when did the generals care about that?

To put this into context, at about this time when there was war was going on in Korea, the most effective ground-attack aircraft were Piper Cubs with bazookas fitted to their struts. Next down in efficiency came the North American Harvard, followed by the North American Mustang. Bottom of the pile as a ground-attack aircraft came the F-86 Sabre which was just too fast to even see the target before it was past. Think how good this little aircraft would have been in that combat arena.

Anyway, as usual, yet another brilliant concept and design was lost and so Fletcher Aviation sold the rights to the Toyo company in Japan. Toyo made a few aircraft and sold some to the Cambodian Air Force. Various authorities quote different numbers of A and B versions but that is fairly academic. Due to certain problems, which again vary depending on the source, the Cambodian aircraft saw very little use and faded from the scene.

Although the little FD-25 was never given a fair chance to shine, another aircraft from the same stable proved just how good it could have been. The Fletcher Company built the FU-24, a cropduster that was bigger but to the same basic layout which gave long and sterling



All the basic componnets for the fuselage ready for assembly.

Basic fuselage with engine mount box. Note triangular stock in all corners.

The fuselage with the top sheet on - note slot for fin. Canopy frame is not glued in place at this stage.

service in New Zealand, lending itself to varied development, even being turned into a small airliner.

The model

The model is as scale as possible in outline, but has been simplified in a few areas. The original wing section was a NACA laminar flow type with cusped trailing edges. I have tried one of these on another scale model - it was terrible so I chose NACA 3415 section, which, among other advantages, has a large portion of the lower surface flat for easy building.

The ailerons are simple top-hinged surfaces and, instead of slotted flaps, they are just hinged on the bottom. The flaps are extremely effective and only cause a minor trim change. I also incorporated two *SLEC* bomb releases that work well and add a lot of interest to the flight, while providing exercise for those members of the club who are not flying when they go off looking for them!

Flying

Powered by a *Super Custom 32 (a somewhat vintage engine by present standards!)*, the model has more than enough power; a .40 would be too much. Take-offs are fast and straight, with a steady climb-out. The controls are positive and turns are precise. The model will loop easily but rolls need a lot of work to keep them axial, while slow speed handling is good with no nasty habits.

It is here that the flaps really work. As soon as one starts to lower the flaps, there is a slight nose-up trim change but this does not get any worse however much you lower the flaps. On the prototype model, the flaps came down to about 80 degrees and the model slowed to almost walking pace with no loss of control - really impressive. I must just warn that if the engine stops well out from the intended landing spot, then don't put the flaps down because you will land short; while the rate of descent is slow it is also steep.

The test flights were made on a dark, blustery day with turbulence coming over some earth mounds at the side of our runway. I had no trouble at all in the several landings and take-offs made that day. On the model's second outing it took-off from longish grass without any trouble and landed back on easily. I soon found that really tight turns could be made; tight figure eights going from vertically banked one way to vertically

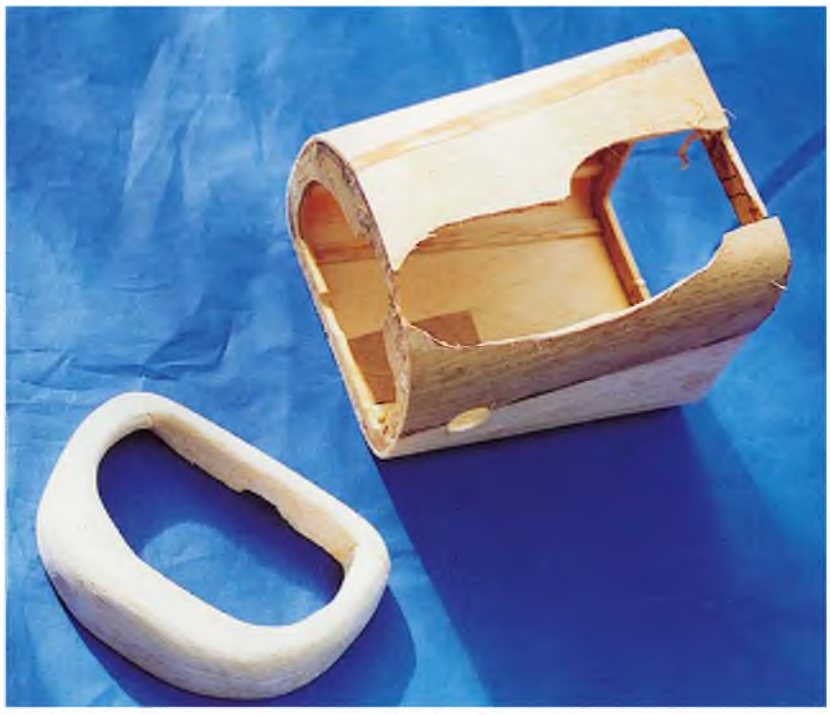
The bombs can be dropped individually - I found that they stop quickly and then come straight down which means that you need to drop them right in front of you. The powder tends to leak out but if there is any left in the bomb it gives a satisfying puff on impact.

The model is fun to fly and the added toys of flaps and bomb drops provide a lot of interest.

Construction

This model is easy to build because in most areas it is just like your average sports model so I will only describe the more unusual areas in detail, leaving the basic construction to your own experience. The fuselage is completely conventional but the cowling is a little different. Not hard, just different. The engine mount box is easy to make, just take care that it is correctly lined-up and that the down-thrust angle is as shown. The position can be adjusted to suit the engine used. I used a Super Custom 32 with rear needle, and

Building the cowl, stage 1 - jig is knocked out later.



The cowl, stage 2. Large hole takes silencer and ensures a good cooling flow of air.

Cowling attachment before final gluing.

Hidden cowl attachment is neat.

Instrument panel from Scraperboard and thin polystyrene sheet. Finished panel is basic, but layout is correct.

this provides all the power that you need.

Note that the front of the box is laminated from two pieces of ply. One fits inside the other, over the end. This forms a very strong rebated joint. Make up the cowl assembly jig from the parts shown and spot glue C-1 and C-2 to it, add the stringers as shown and then skin with panels of 3/32" balsa joined on the stringers. Add an outer skin of 1/64" ply on the underside. This allows the large hole for the silencer and cooling outlet to be cut out without weakening the skin. Also add a 1/64" ply skin on the inside in the area where the needle valve comes out.

Make the front from laminations of soft sheet. You can do this in small pieces round the opening to save wood. The cowl attachment is neat, if I do say so myself. The block representing the exhaust fairing has a hardwood block inserted in the end. The two units are glued to each side of the cowl after covering. The exhaust pipes are made from scrap helicopter tailboom - any helicopter pilot in your club should have a few of these lying round. A hardwood block is shaped to fit inside the tube and this is glued and screwed to the fuselage side. A long self-tapping screw goes through this block into the one on the cowl.

Once this is all working, a piece of balsa is glued to the fuselage side, which fits inside the cut-away portion of the exhaust pipe. The pipe is slid over this and glued permanently in place. It is a bit fiddly undoing the screws to remove the cowl but it is neat and it works.

Miller's patent cockpit canopy technique

The only other unusual area is the cockpit canopy. This is big! I made my pattern by constructing a skeleton from liteply as illustrated here. Next, I added a couple of pieces of foam plastic, which were covered with builders' cement to within about a 1/4" of the finished size. The next stage was to cover the cement with ordinary plaster and build it up oversize. Allow to dry out for a few days. The pattern can then be shaped with rasps, coarse sandpaper and eventually fine sandpaper. Any hollows can be filled with more plaster. The final finish is very smooth indeed.

Now go down to your local supermarket and buy a five-litre bottle of spring water. Cut the bottom off the empty container and wedge the pattern in up against one side. Now apply heat from your iron-on covering film heat gun and watch the container shrink down. Shrink it as tight as possible, and then trim the canopy to fit the model.

Alternatively you can get a sheet of plastic and drape-mould it over the pattern by attaching two sides to hardwood battens, heating the plastic and pulling it down over the mould.

Wings

The wings are a little different because they are fully sheeted. Start off by making up all the wing skins. I used 6" wide and 4" wide sheet balsa. Lay the lower wing skin down over the plan and glue the lower spar to it, glue the ribs to the spar and allow to set. Fit the top spar and allow to set. Rock the ribs back until they are in contact with the sheet and glue - use CA or *DeLuxe Products* Super'Phatic glue. Add the rear spar, leading edge and undercarriage blocks.

Pull the sheet up to meet the leading edge and glue in place. Fit the flap, or aileron leading-edges, depending on the panel you are building, and fit the ribs. Chamfer the trailing-edge sheet. Fit the ply pieces that make up the wing joiner boxes and add all the other bits such as hatch frames, hinge blocks, flap controls, etc.

Most important are the tubes for the servo leads. These are made from paper rolled round a 12mm dowel and fitted into oval holes in the ribs.

The flap controls should be made carefully as there is no adjustment to speak of. The horn is made from a *Robart* hinge point with the pin drilled out. The right-angle bend on the pushrod goes through the hole. Just make sure that when the flaps are fully retracted, they

are equal.

When you are quite sure that everything is in the wing that should be there, support the leading edge and fit the top skin. Use aliphatic resin for this job. Pin the sheet down and then stack of books, catalogues - anything uniformly flat and heavy - on the wing. The ailerons and flaps at cut away after completion of the wing - this way you get a perfect fit.

The wings are butt joined using a 1/4" sheet dihedral brace in those boxes made at the ends of the spars. Do not be tempted to have foam wings made, they will take just as long to complete and will lead to problems when it comes to installing all the mechanics. Worse still, they will be heavier.

Control system installation

Use a separate servo for each aileron - this means that you can use aileron differential if preferred, although I did not and the model does not seem to need it. The bomb release uses two micro servos operating standard SLEC bombs. I programmed my transmitter so that the first click of a three-position switch dropped the first bomb and the next position released the second bomb. Alternatively, you could use a slider and move it one way for one bomb and the other way for the second. The telescopic pushrods mean that you do not stall one servo when the other moves.

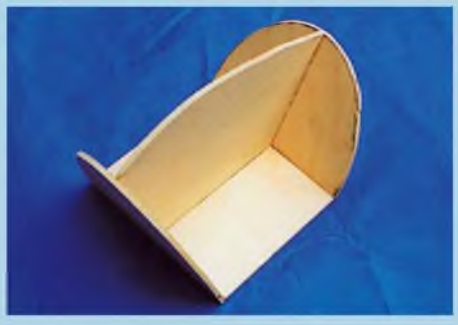
Likewise, the flaps can be operated by the normal rotary control or with a three-position switch. I programmed both in but tend to use the rotary control. The other controls are completely conventional. The three primary control servos sit abreast, the receiver is held to the underside of the cockpit floor in front of the servos and the battery is held to the fuselage side between F-1 and the instrument panel. The Rx and battery are held down with Velcro straps. You need either access to the servo connector on the receiver or even more extension leads; you already have enough of those in the wing so make sure you can get at the receiver.

Control throws are:

Ailerons:	1/2" each way
Elevator:	5/8" each way
Rudder:	1" each way
Flaps:	0 degrees to 75 degrees down.

These movements may seem large but the model is not at all sensitive and needs them for any aerobatics.

The model was covered in *Solarfilm*



The skeleton frame for the canopy pattern.

Yes, that is Portland cement - now it needs the plaster. Real building work!

Completed pattern with the final result. Windscreen is flat sheet.

View of the complete nose area.

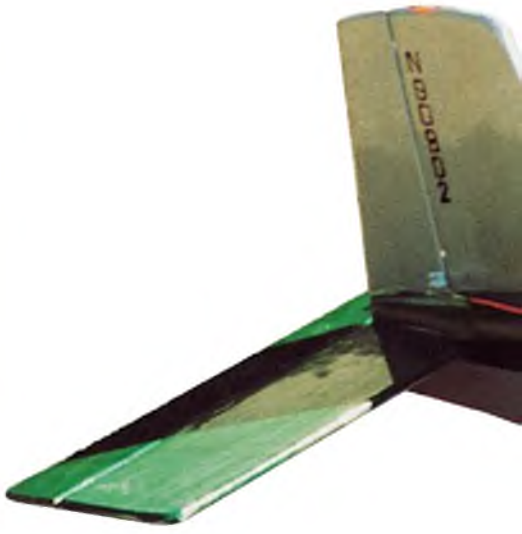
Radio bay, no lack of space. Note access to Rx - saves even more extension leads.

The centre panel of the wing ready for the top sheet to go on. Lots of little bits to go in.

The ends of the wing panels showing the flap (top) and the aileron (bottom). Also holes for dihedral braces. Note: control surfaces are built with the wing and cut away later.

Under-wing stores pylons. The dummy ones are only held on with spots of glue so that they will knock off without damaging the wing skins.

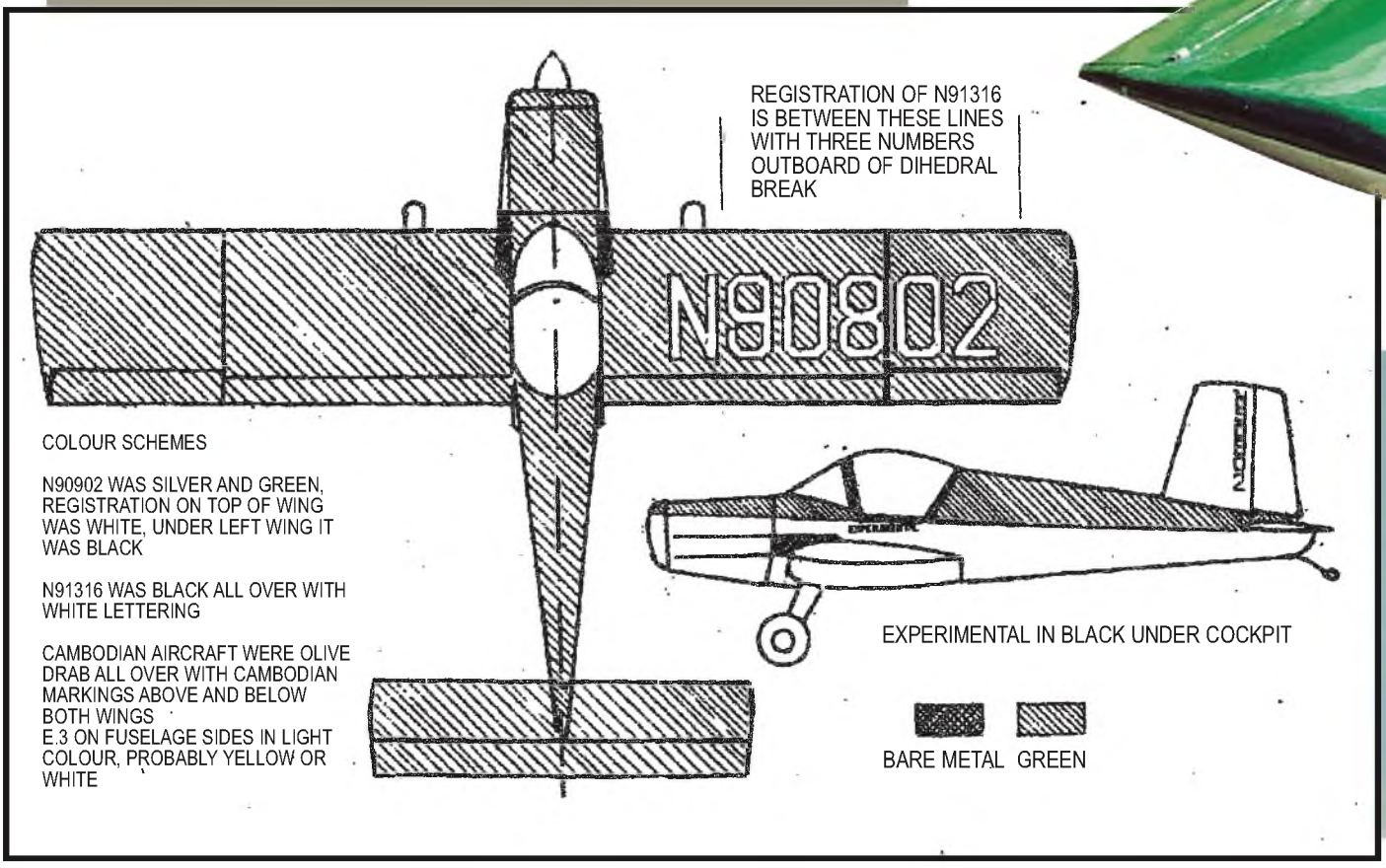
Flaps fully 'down', about 75 degrees travel. They work well.



Supershrink Polyester, a great covering material, light and strong and it doesn't bubble or wrinkle in the sun.

Colour schemes

It took me a long time to get confirmation of the colour schemes but eventually I did, thanks to the help of many people. There are three colour schemes that I can confirm. One of the demonstration aircraft was painted black all over with white lettering; this was done because, at that time in Korea, a Polikarpov Po-2 used to make nuisance raids at night. This aircraft was nicknamed 'Bedcheck Charlie' and so Fletcher decided 'return the favour' of



SPECIFICATION

Model name:	Fletcher FD-25B
Model type:	Scale single-seat ground support
Designed by:	Peter Miller
Wing span:	54.1/2"
Wing area:	504 sq. in.
All-up weight:	82 ounces
Wing loading:	21.5 ounces per sq. ft.
Length overall:	38"
Power:	.30 to .40 cu. in.
Radio:	4 minimum, optional 6 or 7 channel
Controls:	Ailerons, elevator, rudder, throttle, flaps, bomb release

nocturnal rest deprivation.

Another was painted silver and green and this was the one that I chose to model as the contrast would make orientation easier. The Cambodian aircraft were olive drab all over with the Cambodian markings on the top and bottom of both wings and a white E number on the sides.

The original prototype was all-silver, while the Japanese prototypes are a light colour, I suspect either white or yellow, but I only have a black and white photo to go by.

Get building!

Here you have an uncommon aircraft that is easy to build, flies like a dream and has features that add lots of interest to the flying. So go on, have fun! ■

FLETCHER FD-25B

The Fletcher FD-25 first flew on 14 April 1951. The 'FD' stood for Fletcher Defender and the purposeful-looking little 30 feet wing span monoplane was the first to be designed specifically as a COIN (COunter-INsurgency) weapon at a time when the need for armed reconnaissance, battlefield area close air support was becoming recognised in the early years of the Korean War (1950-1953).

Designed from the outset as a close-in ground support weapon, the Fletcher FD-25 was the brainchild of its creator John Thorp, who was a firm believer in a growing requirement for a practical, well armed, but small and manoeuvrable aircraft that could approach low and unseen, strike fast and call up subsequent secondary strikes - a task performed today, as often as not, by modern missile-firing battlefield helicopters. Thorp had been arguing the case for such an aircraft as early as 1944 when he was in charge of Lockheed's *'Little Dipper'* project, presenting the concept tirelessly to the US Army, and his

A very nimble little aircraft, the Fletcher FD-25 could be hammered around at very low level in very tight terrain.

This action sequences demonstrates a napalm attack on a tank at the US Army's Chemical Centre, Edgewood, Maryland.

enthusiasm for the idea continued through 1948 with the *'Sky Skooter'* project, right up to the start of the Korean conflict. When he finally managed to sell his armed lightplane concept to brothers Wendell and Maurice Fletcher, the unique series of FD-25 aeroplanes became a reality and, on 1 November 1st 1950, five engineers including Thorp and five mechanics were assigned to the project. It took them just 22 weeks to get the prototype, civil register N90802, airborne!

Constructed entirely of Dow magnesium (aluminium was expected again to become a critical material as it had during WW2), this prototype was followed by a two-seat version (N90609) which utilised a magnesium wing and aluminium fuselage and was so loaded with heavy navigational equipment after the design stage that it suffered from tail-heaviness which proved, eventually, fatal.

Nevertheless, it was this two-seat FD-25A version (minus its deadly payload) that was shipped to the Toyo Aircraft Company in Japan who were to produce five aircraft under licence while, back in USA, the Fletcher team spent the next nine months completing N91316, an all-aluminium single-seat Fletcher FD-25B. The Japanese-built aircraft were subsequently sold to the government of Cambodia.

N91316 carried two .30-calibre machine-guns in the wings, mounted outboard of the propeller arc and 1,000 rounds of ammunition for each gun. Their use was primarily to discourage small arms fire, enabling the FD-25 to close on its target, at which point rockets or napalm would then be used.

Thorp flew the maiden flights of all the FD-25s and was the first to fire in-flight rockets. Apparently, the cap on the rear of the five inch diameter HVAT 'tank-buster' projectile ejected so forcefully that it damaged the tailplane. The rocket rails were subsequently moved further outboard on the wings!

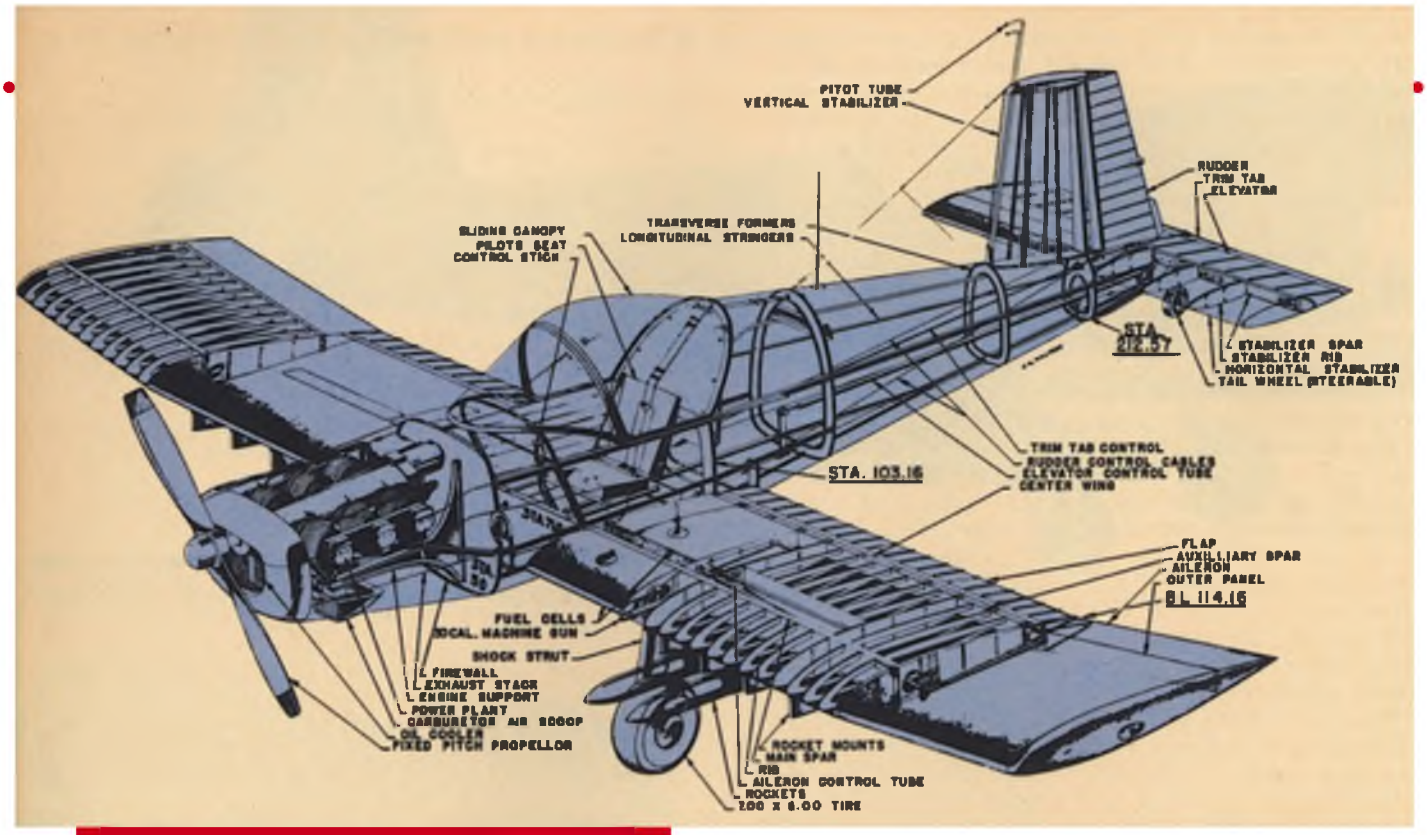
With the aeroplane airworthy and its weapons systems operational, there followed a concerted sales drive by Thorp, test and demonstration pilot Don Downie and colleagues at Fletcher. Between 1951 and 1954 they promoted the FD-25 across the United States, putting the little aeroplane through its paces in front of government chiefs in numerous States. It impressed all who saw it.

At one point Downie took the Defender head-to-head against an AT-6 Harvard, considered at the time to be a highly effective front-line spotter aircraft, and the little FD-25 out-performed the AT-6 in every respect, from slow speed handling, to a higher engine red-line speed. Thorp said he designed the FD-25 to stop the Russian T-36 tanks used by the North Koreans and there can be little doubt that, had it been adopted by the military, it would have been very successful - and, with hindsight, it would assuredly have gone on to fill a need in numerous conflicts around the globe through the 'fifties and into the 'sixties.

Designed to sell originally for $25,000, or less, and powered by a Continental E225 250 hp engine, the Defender was not only relatively inexpensive to manufacture, but easy to maintain and repair - and very simple to fly. As Thorp said at the time: "...it could be flown by a Tijuana teenager and maintained by most any knowledgeable backyard mechanic. We had conventional gear, conventional engine and utmost simplicity of design!"

So why did the FD-25 fail to convince the U.S. government and military authorities of its potential. It certainly was not through

FD-25 could carry a wide range of weapons stores. In addition to two 0.30 calibre guns, ot could carry four 5~" HVAR rockets, thirty-two 2.75" folding-fin rockets, twenty 8cm Oerlikon rockets, two 40 gal. napalm bombs or two 250 lbs general pur(ose bombs.



Prototype demonstrator FD-25, compact, simple - and in military procurement expenditure terms, inexpensive.

Cockpit interior of what may well have been a pre-prototype static inspection mock-up. The large diameter external exhaust pipe diubled as an augmenter device.

SPECIFICATION

FLETCHER FD-25B:
MILITARY DESIGNATION:
CLOSE-IN GROUND SUPPORT

WINGS:	150 sq. ft. total area
AEROFOIL SECTION:	NACA 652-415
ASPECT RATIO:	6:1
CHORD:	60"
DIHEDRAL:	6 degrees (outer tips)
STRUCTURE:	All-metal with main beam and auxiliary spar for attachment of flaps and ailerons
AILERONS:	All-metal and inter changeable port to starboard
FUSELAGE:	All-metal aluminium alloy semi-monocoque
TAIL UNIT:	All-metal aluminium
FIN AREA:	8 sq. ft.
RUDDER AREA:	4 sq. ft.
ELEVATOR AREA:	9 sq. ft.
STABILISER AREA:	21 sq. ft.
POWER PLANT:	Continental E225
POWER RATING:	250 hp
PROPELLER:	Hartzell Controllable Pitch
FUEL TANK CAPACITY:	80 gals (US)
OIL CAPACITY:	2.25 gals
ACCOMMODATION:	Single-seat

DIMENSIONS

SPAN:	30 ft.
OVERALL LENGTH:	20 ft. 11 in.
OVERALL HEIGHT:	6 ft. 3 in.

WEIGHTS

WEIGHT EMPTY:	1,428 lb.
USEFUL LOAD:	1,272 lb.
GROSS WEIGHT:	2,700 lb.

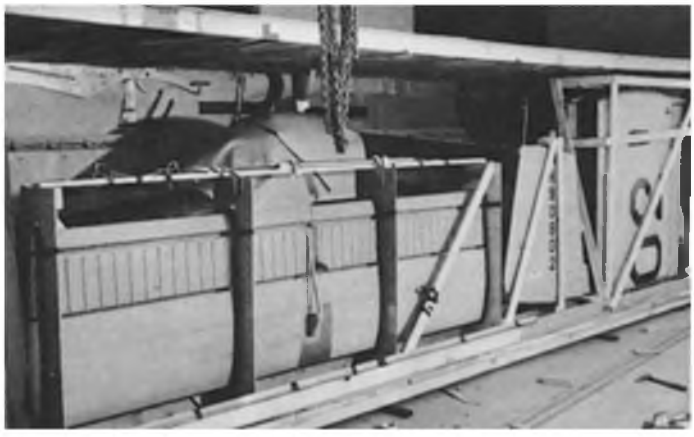
PERFORMANCE (AT SEA LEVEL)

LANDING SPEED:	45 mph.
CRUISE SPEED:	162 mph.
MAXIMUM SPEED:	187 mph.
CLIMB:	1725 ft./min.
SERVICE CEILING:	16,500 ft.
CRUISE RANGE:	630 miles
AIRFIELD:	Unimproved
TAKE-OFF DISTANCE:	500 ft.
LANDING DISTANCE:	330 ft.

Dials of the instruments on the instrument panel, also showing the gun sight mounted on the forward cockpit rim.

Underside wing leading edge view, showing ywo 5" HVAR 'tank buster' rockets pn their mounts.

The amunition trays in the wings of the FD-25 could accommodate 1000 0.30" calibre rounds.



The prortype FD-25B crated for transport tp Toyo Aircraft Co., Japan, for use as a patern aircraft.

Wiew of one of the wing panels. reveals the shape of the airfoil section and some of the structure.

any lack of exposure - time and again the little aeroplane demonstrated its capabilities in the hands of service pilots and Fletcher's own staff, and it certainly was not through any shortcomings in its design or performance. The reason lies in the refusal by the US Administration of the day to fully accept Thorp's concept of the armed lightplane, and failure to agree just exactly what was required by the armed services.

The air command argued that it was acceptable to spot and mark from the air (as in the case of the Cessna L-19) but stated that: "...we can not agree to equipment as costly as this aircraft being used in close support missions which can be accomplished equally well by less costly arms, such as artillery..." The army, on the other hand, were convinced of the need for effective air support for ground operations and even mentioned the two-seat FD-25A as a likely candidate for the job. They went on to say that: "...the Army is capable of developing its own close air support means at less cost than would be provided by the Air Force, with the greater advantage of having the aircraft where they were needed when the occasion arose, and having them flown by pilots (Army) who understand the needs of the ground units with which they have worked and of which they are a part..."

The issue had finally become political and it was to be another 14 years before America's Department of Defense staged a COIN aircraft design competition in 1964, managed by the US Navy! Ahead of its time in 1951, the Fletcher FD-25 Defender had sparked a battle area close support argument that was to lead to current exponents of the role like the A-10 Warthog and Blackhawk helicopter, among others. ■

Prorotype in flight, carrying two napalm tanks slung on hard points under the wing.

SCALE BIPLANES - MY WAY

PART 3: MARTIN FARDELL continues his practical philosophy for designing and scratch building a competition standard scale biplane, this month with his approach to the basic airframe

I know there are many scale enthusiasts out there whose dream model is a large, slow flying biplane. They are competent aeromodellers, they cheerfully build from a kit or a plan, and yet they are unwilling to take the plunge and design their own model. Why not? You can build to the size that suits you best, try out your own ideas - and the whole process is hugely satisfying. There is a vast choice of prototypes from the Golden Age of biplanes (1920s and 1930s) as well as all the WW1 aircraft.

The photos this month are mainly of scratch-built models made by me and other biplane enthusiasts , just to show what a wide range of prototypes are possible. And there are many, many other aircraft just waiting to be modelled!

So what's the problem? There are two big worries, I think:-
(i) engineering the structure
(ii) aerodynamics
....so let's take these in turn.

Structures

For years, we modellers thought we knew better than full-size designers. We made biplanes with cantilever one-piece wings, we made undercarriages and centre section struts out of piano wire and bound them rigidly to the fuselage structure. The bracing wires were added purely for appearance.

After years of struggling, we have at last realized what should have been obvious in the first place - those early designers knew exactly what they were doing! So the main principle when designing a large model is: FOLLOW THE FULL-SIZE WHEREVER POSSIBLE!

EYE OF THE BEHOLDER! Terry's Blackburn Blackburd looks ugly to many eyes, but a design project it has a lot going for it - straight forward lines with few curves, but flies really well. Including gentle landings on those skids.

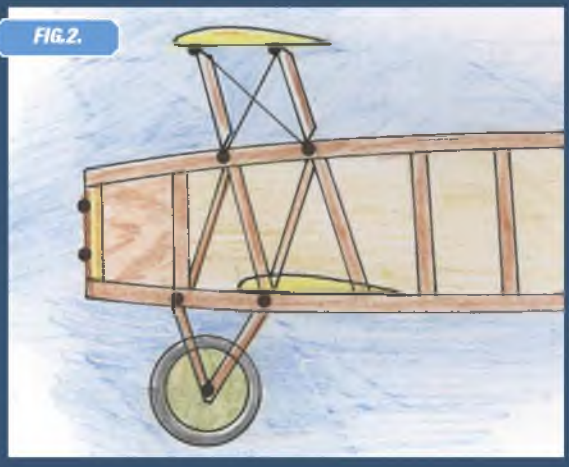


FIG 1: The simplest biplane - Clark Y section, box fuselage. FIG 2: Typical forward fuselage cross section. 1/4"sq. spruce main box structure, balsa formers and 1/8" planking. NOTE: The main box structure will be close to the surface at the corners, for attachment of the cabane struts and main undercarriage legs.

In particular, the whole structure will completely rely on the bracing wires. I know this is contrary to the instincts of many modellers, but believe me, you end up with a structure that is strong yet flexible, easy to repair and many times stronger than is needed to cope with flying loads. Luckily for us, Mick Reeves sells flat-section bracing wire and adjustable end fittings that make the whole job of rigging a biplane very easy.

My intension this month is to go through the basic design process for a big biplane, say 150 -180 size engine (25-30cc) and show how one simple structural design can be used for any slow flying biplane from the pre-1940 era.

Aerodynamics

What about the wing section? What about the incidence angles? What about the thrust line? Well, you won't be surprised to hear that the answer to all those worries is to follow the full size!

Once you get up to 1/4 or 1/5 scale, the aerodynamics for a model will be very similar to the full-size aeroplane. Put the CG (fore/aft balance) at 25% and I guarantee it will fly OK - provided the real one flew nicely, of course. Terry Manley made a model of a strange beast called a Blackburn Airdale (see photo) once upon a time. Sadly, it was a complete failure, as there was no way of making it turn. It was no real surprise to find out that the real one didn't fly properly either!

Test time

Before we start, here is a little TEST. **Fig.1** shows a very simple biplane. No curves, no cockpit, no detail, just the basic wood structure with the struts and wires. My *Test Question* is this: just by looking at the sketch, could you design and build the actual wooden structure? My guess is that most people who have done a bit of real aeromodelling could put together a perfectly satisfactory airframe like this. The struts and wires need bit more thought, and next month we will look at this area in detail. Meanwhile, the point is that any biplane, at least up to 1939, will have the same simple basic structure which is quite familiar to most of us. Your scale model just needs a few extra bits and pieces adding on!

Making a start

You have chosen your favourite aeroplane, so how big is this model going to be? As big as possible I say, but for many people, a model to suit a 150 or 180 four-stroke will be the practical limit. With this size of engine, a non-aerobatic biplane can go up to about 8 feet span, with a wing area of around 18 square feet. The weight at this size should be around 8kg, with 10kg being the maximum.

Actually, weight is not usually a problem with these big biplanes - because there are two wings, we are more or less guaranteed an acceptable wing loading. If you want to be able to fly on windy days, then some extra weight will do no harm. It is possible to build very lightly and make a model that flies extremely slowly, but it will be quite a handful in a wind!

For prototypes that are reasonably aerobatic (i.e. comfortable loops and rolls) we need to drop down in size, and for our 180 engine, a span of 7 feet will be the limit. Bear in mind that all the foregoing refers to the maximum sizes for the chosen engine. These days, most people tend to fly with a bigger engine than is strictly necessary, the advantage being that you can fly at lower throttle settings with a bigger propeller, increasing the realism. Nobody wants to hear an engine screaming at max revs in a slow biplane, after all!

Table 1 below gives a rough indication of model physical specs for three different engine sizes. These figures are only guidelines - a lot depends on the actual prototype: how draggy, how fast was the original, etc.; smaller models usually come out heavier than you would like; halving the engine size ought to correspond to halving the weight, but this is hard to achieve in practice. 15 kg is the limit for BMFA competitions and I have no experience of models heavier than this. Certainly, a Laser 360V engine has some power in hand in a non-aerobatic 15 kg biplane. The LMA has no weight limit, but requires build inspection above 20 kg.

Data gathering

These days, thanks to the Internet, gathering information on your chosen prototype is relatively easy. Type the name into Google and all sorts of good stuff will soon appear. We will maybe talk about data sources in a later article, but for the moment let's assume you have a three-view scale drawing and some photos.

Three-view scale drawings vary enormously, but none of them are completely accurate. Some are pretty good, but most have major errors. So the first thing to do is to compare the drawing with the photos and start marking up errors. Concentrate on the side view - once that is right, the rest usually follows fairly easily. If the drawing is really bad, it may be easier to start with a photograph. But photos can mislead too, as there will be distortion if the camera is near the subject and the shape is distorted by use of a wide angle lens. The ideal (which we seldom have!) is an exact side view, shot with a telephoto lens. Look at the wheels - if they are roughly the same size in the photo, then there will be minimum distortion and we can safely take measurements off the photo to check the scale drawing.

It is unusual, for aircraft of the pre-1939 period, to find a good photo that accurately represnts the plan view, so you usually end up relying on the three-view. A front view photo is useful for checking the undercarriage angles, also to make sure the dihedral is right. You certainly need at least one good photo of the actual aircraft you are going to make, so

TABLE 1 PRACTICAL MODEL SIZES

NON AEROBATIC				AEROBATIC		
ENGINE	SPAN	AREA	WEIGHT	SPAN	AREA	WEIGHT
90 4-stroke	7 ft	14 sq ft	5kg	6ft	10sq ft	4.5kg
180 4-stroke	8 ft	18 sq ft	8kg	7 ft	14 sq ft	7kg
360 4-stroke	10ft	28 sq ft	15kg+	8 ft	18 sq ft	13kg

FIG.3.

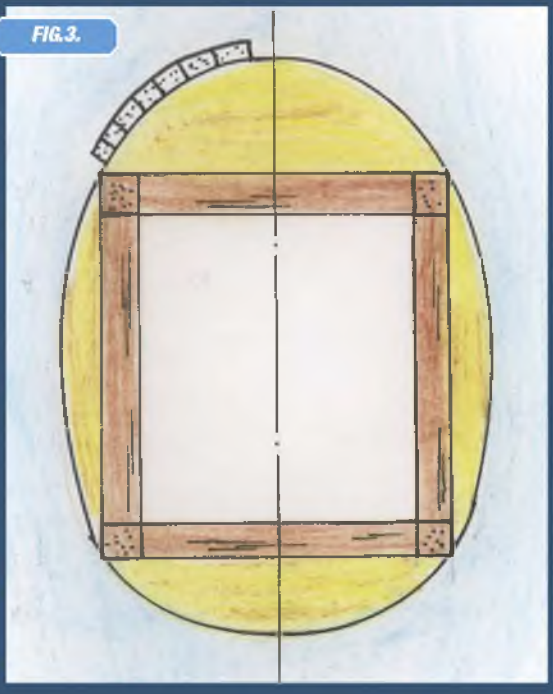


FIG. 3: **The forward fuselage Features: A thick ply front former and a spruce main frame. The black dots show wing the spar, undercarriage attachment, engine mounting and cabane strut attachment points, making one strong, unified structure.**

FIG.4.

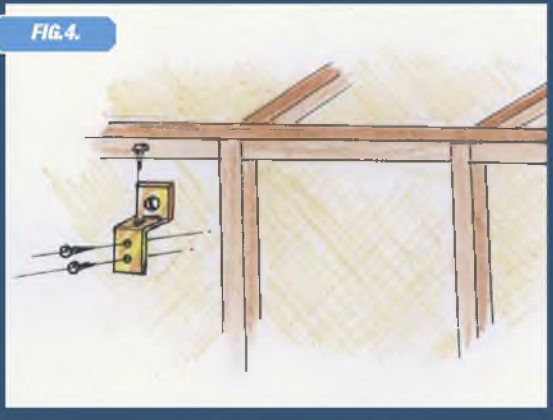


FIG. 4: **Attachment points for undercarriage and cabane struts. The spruce frame can be doubled (or tripled) in high stress areas. The plate fittings are mild steel and screwed to the spruce frame.**

that you can get the letters and other markings on the fuselage in the right place.

The static judging at National and International level these days is very tight, so you need to be able to prove the accuracy of all parts of the airframe. It is very difficult to do this if the aircraft you've modelled was taken to the scrap yard 60 years ago! For this reason many of the serious competition fliers make models of aircraft that actually exist in museums. This route is not for me - I want to create a bit of living history, so I try to model the aeroplane as it actually was, not polished up to within an inch of its life in some museum.

The downside is that you have to put up with judges marking you down, because of gaps in the documentation. Interestingly, our best scale modeller, Pete McDermott, also makes his models of aircraft in 'as they were then' condition, giving himself an enormous challenge in assembling documentation to International standard!

Working drawings

It is amazing how little drawing work you really need to do! Fuselage side view is of course required, but wings often need little more than parallel lines on the building board giving the rib spacing. The outline of the tail surfaces needs to be right, but the position of their ribs and spars can be drawn direct onto the sheet balsa core. A high standard of draftsmanship is not needed, as nobody else is going to have to follow your drawing! So let's clear the dining room table, get a long sheet of cartridge paper and make a start.

Step 1

Draw out the fuselage side view outline as accurately as possible. Draw in markings, stringers and panel lines as well - these all help as a double-check on the outline accuracy; and do your best to draw the fuselage plan view outline accurately as well. Don't worry too much about tail surfaces at this stage.

Now comes the most important bit. We have to work out exactly where the main fuselage frame is. Somewhere underneath stringers and curved metal panels there will be a box structure (see **Fig.2**) to which are attached the engine, the lower wing, centre section struts and undercarriage. It is vital that we get our longerons in the same place as the full-size. Usually this is clear enough from the position of centre section struts, etc. If you are very lucky, you will have a photo of an uncovered fuselage to help.

Mark in all the strut attachment points, also the position of each wing root rib, and the engine. Apply scale incidence angles if you know them. If not, the best approach is for +2 degrees on the bottom wing and +3 degrees on the top, with engine and tailplane datums at zero. It's also a good idea to also work out access for radio and fuel tank at this stage.

Stage 2

Draw some cross-sections, especially for the forward part of the fuselage. These will be needed when we start cutting formers for the double curvature bits at the front of the fuselage, also to make sure the main frame is not too wide for the shape of the fuselage. **Fig.3** shows a typical forward cross section. If you are a super draftsman like Brian Taylor, you will be able to get cross sections and the corresponding formers spot-on accurate. As for the rest of us, we do our best, but I

FIG.5.

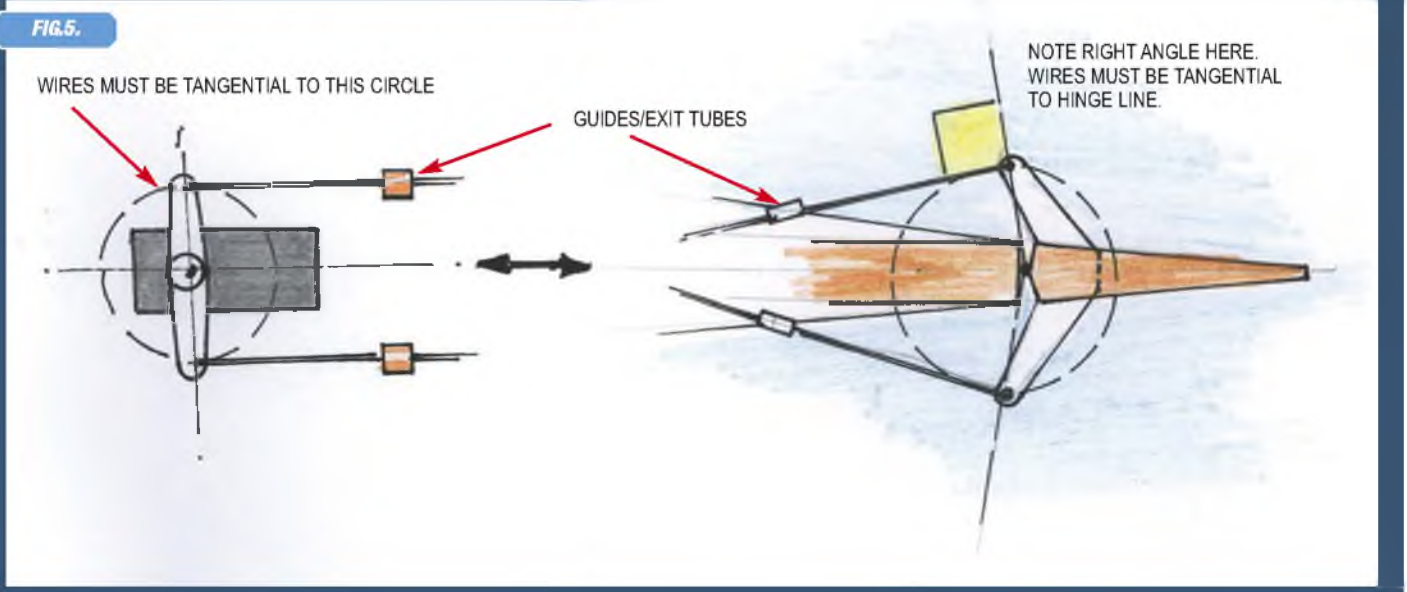


FIG. 5: **Routing of closed loop wires. The wires can follow any convenient route down the fuselage.**

Mike Goldby's superb Sopwith Dolphin. Entirely scratch-built.

There are some lovely colour schemes on US Navy aircraft of the between-the-wars period. This is my Boeing F4B. Nice flier, but tricky to land nicely with its stalky undercarriage.

Terry Manley's Blackburn Airdale. If it looks right, it will fly right. It doesn't, and it didn't! (See text)

There are plenty of De Havilland biplanes to choose from as well as the everlasting Tiger Moth. This is Ian Bryant's DH 51 "Miss Kenya". Ian did his own drawings from measurements taken on the full-size at Old Warden. The model is right up to International standard, and looks fantastic in the air, as you can see.

always end up having to sand bits off the formers, or glue little extra bits on. Not to worry - nobody sees it anyway!

At this point, I start building. Early biplanes were very simple structures and, provided the main fuselage frame is right, it is entirely possible to work out the rest of the structure as you go along. You can plan everything out in much more detail at the drawing stage if you want to, but I find it much easier to work things out with a real structure in front of me.

A fuselage start...

The main frame of the fuselage is made from 1/4"sq spruce, or 3/16" sq for smaller models. **Fig.2** shows the forward part of the fuselage, which is the heart of the model. The black dots show the attachment points for main spars, centre section struts, undercarriage and engine. These must form one strong, unified structure. If this bit is right, the rest of the fuselage can take its chance. Note that each of the struts goes to a single attachment point, and the wing spars have single point attachment at the wing roots. The whole structure depends entirely on the bracing wires. Each wing pair (top and bottom together) detaches as a unit for transport.

In this forward fuselage area the spruce frame is doubled (or tripled) to put the strength where it is really needed. And if any of the longerons have significant curvature, these are best laminated from two strips of 1/4" by 1/8" spruce. **Fig.4** shows a typical bit of forward fuselage construction section with a metal attachment point for an undercarriage strut. Full-size, the whole fuselage frame would be wire braced, but this is unnecessary in a model. Some light 1/4"sq balsa bracing on the rear part of the fuselage will be more than sufficient.

Attachment points

The attachment points for struts, undercarriage and main spars should be added at an early stage. In the 1920s and 1930s these bits of metalwork were a big part of the structural design, and contemporary issues of *Aeroplane* magazine were full of drawings of ingenious little bits of sheet metalwork, all aimed at weight saving, of course. We can try for something similar; it's very nice, when the time comes, to be able to screw the various struts in place to pre-installed fittings.

Provision must also be made for attaching the bracing wires at the cabane. The metal bits are fixed in place with epoxy and self-tapping screws into the wood frame (**Fig.4**). If the screws are a nice tight fit into pre-drilled holes, this is amazingly strong - I have not had one come adrift yet!

It may seem a bit early to be thinking about servos and control wires, but it's much easier to get them in at this stage when you can see what you are doing. Closed loop controls for rudder and elevator are the best for large models, using fishing trace (nylon covered stainless steel) for the wires. A wire loop with brass tube crimped tight with side cutters makes a very secure termination. Some people have tried Kevlar for the wires; it has the advantage that it never stretches, but I believe it is quite hard to terminate securely. The wires must leave the servo arm at a tangent to a circle centred on the servo centre, and must come to the control horn at a tangent to a circle centred on the control surface hinge. Otherwise the wires will tighten (or slacken) as the servo turns. I hope Fig.5 makes this clear. In between servo and control surface the cables can take any convenient route - it does not have to be a straight line, but avoid sharp bends as these cause friction. I use separate servos on each elevator. Standard servos are pushing it a bit on a 180 size models, and something with a bit more torque is advisable. Super-accurate digital servos are not needed on a big floppy biplane, however!

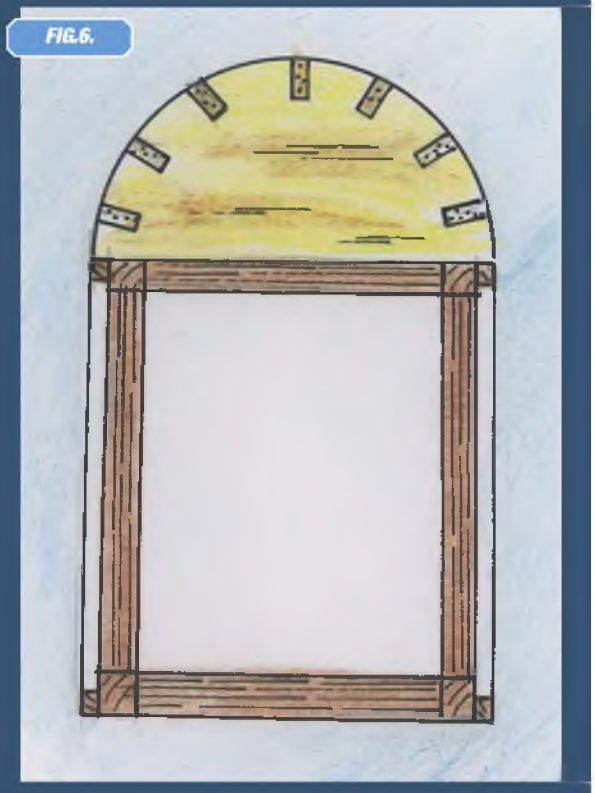


FIG. 6: Typical rear fuselage cross section. Spruce main frame, balsa formers and stringers and covering. Note that 1/8" spruce strip prvents the covering the main frame of the structure.

Curving out the basic box

Once the box structure is complete, the rest is easy. There is no point in my going into much detail here, as every aircraft will be slightly different. Typically, the forward fuselage will have curved metal panels to round out the shape. This bit is usually modelled with formers and balsa planking. People come up with all sorts of clever ways of avoiding the bother of doing the planking, such as using foam (horrible stuff!) covered with brown paper or glass cloth. Sometimes you can use rolled ply if there are parts with single curvature. Actually, planking is not that much of a chore, and you can make things easier with a bit of soft 1/2" sheet in the very curved bits just behind F1.

The rear part of the fuselage invariably has some stringers on the top, but the sides are often flat. In this case we need strips of 1/8"sq. spruce to hold the covering away from the main framework - it really does spoil the appearance if the 1/4" sq framework shows. Fig.6 shows a typical cross section at the rear fuselage. If you are really aiming for perfection, you can arrange for the covering to stand off from the fuselage structure on the underside as well, but it's hardly worth the trouble - the underside is rarely seen except at a distance in the air.

The rear end of the fuselage is always a bit of a fiddle. We have to accommodate a sternpost for the fin, mounting for the tailplane (may be two halves, or one piece), tailskid or tailwheel, and exit points for the control cables from the servos for the closed loop controls. Nothing difficult, but it needs a bit of careful working out (back of an envelope over a few pints of beer). The tailskid always seems to be a weak point on a model and it's well worthwhile making provision for access from the underside so it can be repaired or replaced. That's enough for you to think about for now - so start researching which type YOU are going to build - if you are a real scale buff, you may have it already - in which case, what are you waiting for? ■

They don't have to be warbirds! Mike Trew's Focke-Wulf Stieglitz, with flashy colour scheme. The Stieglitz was more or less a German Tiger Moth equivalent.

The Sopwith company went bust at the end of WW1, but re-emerged shortly afterwards with a new name - Hawker. The first fighter from the new company was the Woodcock. I made this one for a 120 size engine. Nice practical aircraft with no hidden snags!

A brace of bipes at the BMFA Nationals. Mick Henderson's DH4 and DH 9 in the foreground, both scratch-built to a very high standard. The one in the background is the ever popular SE5a.

I made this Vickers Vincent some years ago for an Enya 90. It was a really nice flier, so I built a larger Vickers Vildebeest (essentially the same aircraft) for a Laser 360.

Another view of Ian Bryant's Moth, showing the sort of attachment brackets for undercarriage and struts mentioned in the main text.

Really adventurous1 Not really for a first bipe project, but a Vickers Vimy makes a very satisfying twin bipe.

NEXT MONTH

Wings and tail surfaces, and a close look at struts and wires...

Techno Scale

Mike Evatt prob

Diels Engineering is a provider ofhigh quality model aircraft kits and plans for model builders of all ages and backgrounds. Diels Engineering, Inc. was incorporated in April of 1986 when they offered their first kit, although they had been selling plans for a few years before.

The screen-shot from their website at www.dielsengineeringinc.com shows a selection of their new laser-cut kits including some well-known and some new, to me at least.

It was well over forty years ago, that **'Hobbys'** founder, Mr. W.F. Crossland, was reluctantly persuaded to try to sell a quantity of fifty high quality musical movements by his swiss brother-in-law. Since then, 'Hobbys' have become well known amongst the modelling public for their comprehensive Annuals. Now they have an on-line presence at http://hobby.uk.com where you can find model aircraft delights such as the Dumas 200 series F-82 Twin Mustang.

Ikara at www.ikara.eu is a specialist manufacturer of free flight rubber powered model aircraft. They manufacture kits or ready-to-fly models for indoor and outdoor flying such as the Avionnette HM 8 1928 shown in the screen-shot. Their Avionette is a semi scale model of a French historic plane and comes almost ready to fly.

South East Berkshire Radio Flying Club consists of a group of people who are interested in all aspects of fixed wing model flying. They build and fly aircraft that weigh from a few ounces and fly indoors to larger models powered by electric, internal combustion and gas turbine engines. They particularly welcome youngsters who are interested in joining their club.

Their website at www.sebrfc.org.uk has an excellent photo gallery containing many scale subjects.

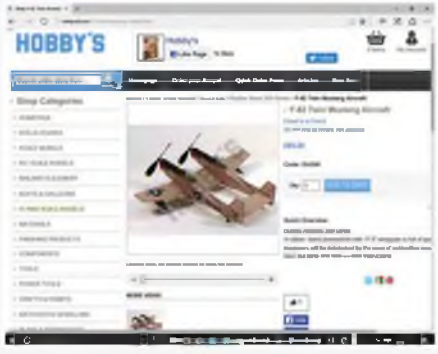
The Real Aeroplane Company (RAC) was founded in 1989 by Tony 'Taff' Smith as the operating company of his airstrip on the former World War two bomber base at Breighton, near Selby Yorks.

On display is their Comper C.L.A.7 Swift G-LCGL (1993). This stunning aircraft, shown in the screen-shot, is replica of Nicholas Comper's 1930's shoulder-wing sports monoplane which was built in 1993 by the late John Greenland. Authentic right down to the incredibly rare Pobjoy Niagara powerplant, the aircraft is only 2lbs heavier than the original. Check out this beauty and other delights at www.realaero.com

Mike Brannan runs an enterprise called **Brankit** with a web address of www.brankit.com

He specialises in producing replica kits from days of yore previously produced by Keil Kraft - Veron - Mercury etc. However, he doesn't stop there! He makes some of them supersize! His Spitfire 27 is 50% larger than the original Veron small flying scale model, designed by Phil Smith, This 27 inch wingspan version flies

Diels Engineering have a New Line of Laser Cut Kits.



The Dumas 200 series F-82 Twin Mustang from 'Hobbys'.

The Avionnette HM 8 1928 from Ikara.

South East Berkshire Radio Flying Club's excellent photo gallery.

A stunning Comper C.L.A.7 Swift replica at Breighton Aerodrome.

A supersize Veron Spitfire from Brankit.

pes hyperspace for more TechnoScale Topics

well rubber powered, or for the more experienced modeller, it is ideal for conversion to electric and /or mini radio control.

Arizona Model Aircrafters (AZM) prides itself on bringing you the finest aircraft model kits anywhere in the world due to technologically advanced state-of-the-art equipment that affords exceptional quality. Although it has taken 13 years, Arizona Model Aircrafters has finally constructed a kit that was the driving force behind creating their business. The Avro Triplane! Designed directly from the replica in the Shuttleworth Collection in the UK, this 1/4th scale design is sure to amaze.

Check it out at http://arizonamodels.com

The **Scale Aircraft Modelling Universe** has a web presence at http://scale-model-aircraft.com

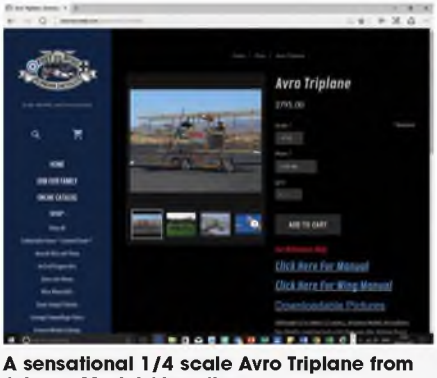
It is an educational website, born out of the purest love for the aircraft that made history. This site is intended to be a tribute to the men who made the ancient and mythical dream of flying possible.

Scale-Model-Aircraft.com is an encyclopaedical attempt that tries to put in one place plans, drawings, blueprints, and photographs, most of them already published on the Internet, along with other relevant information. On each aircraft listing, there are links to plan websites such as Outerzone.

Outerzone at www.outerzone.co.uk is a listing of free vintage and old-timer flying model aircraft plans to download. The listing is free for everyone - you don't need to register or log in to download these plans. Since 2011 they've been collecting and sharing free vintage and old-timer plans and there are now over 7,000 plans in the collection. Clicking on the link on the SPAD page of the above site will revealed twenty SPAD plans listed including a control-line version of the SPAD XIII by Walt Musicano.

The Eynsford RC helicopter Flying Club is located near to Eynsford Village, with stunning views of the Kent countryside. They are a small club of around 80 members encompassing beginners in the hobby to the more advanced flyer. Their website at http://eynsfordrc.co.uk indicates a rise in the interest in scale helicopter flying and many fine examples of member's models are shown in its pages.

E-flite is part of the Horizon Hobby Group pf companies and provides high-performance airplanes, motors, batteries, and accessories which set the standard for RC electric flight. The website at www.e-fliterc.com reveals their Ultra Micro Extreme series of scale models. The Pitts S-1S shown in the screen-shot is a 17.1 inch span delight. From the solid control of AS3X(r) system technology, to the crisp response of performance linear long-throw servos, everything about the UMX Pitts S-1S is concerned with delivering a solid scale aerobatic experience. ■



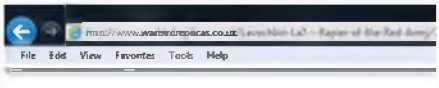
A sensational 1/4 scale Avro Triplane from Arizona Model Aircrafters.

The Scale Aircraft Modelling Universe is a scale modeller's dream resource.

A control-line version of the SPAD XIII by Walt Musicano - a download from Outerzone.

The Eynsford RC Helicopter Flying Club has some fine images on its website.

The Eflite Pitts S-1S shown is a 17.1 inch span aerobatic delight.



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

mikeevatt@hotmail.com

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THE QUIET ZONE

R/C SCALE ELECTRICS WITH PETER RAKE

Right then you lucky people, here we go with yet another instalment of your favourite electric flight column. Not your favourite? Well shame on you after all the effort (?) I put into preparing this for you every month. Okay, maybe not that much effort, but you know what I mean. It's a tough job, but somebody has to do it. I'm still not sure which is the hardest part though, writing it or having to read it.

Anyway, I know you've been deprived of my usual waffle of late, but I promise we will get back to that eventually. Not just yet, but eventually. Once again, we have another of those little models for you in the form of a free plan. This time, however, I'm not just throwing a plan at you and leaving you to work it all out for yourself. Thanks to Paul McCaughey we have a few photos to study and a more than fair indication as to how the model works out using the equipment shown on the drawings.

Although Paul has only flown the model indoors, for which it has proved admirably suitable, we also have Spring rapidly bearing down on us, with all those gloriously pleasant, calm days for nipping along to the nearest park and annoying those pesky dog walkers by buzzing around at low level. Low level passes and the odd strafing run is usually enough to send them running for cover. Yes, I am an evil, anti-social swine. Fun, isn't it?

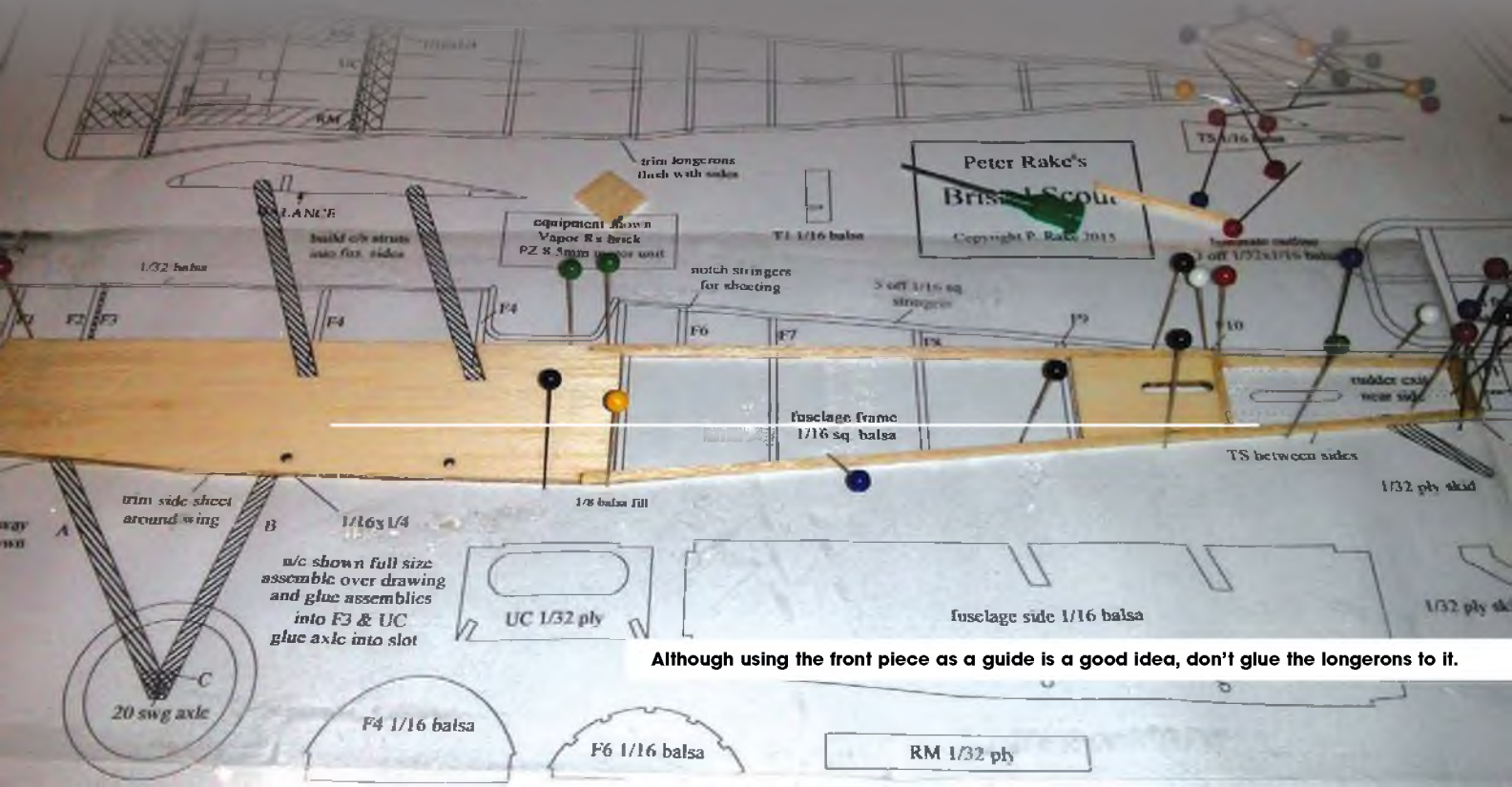
Right then, now that you've had a small ration of waffle (can't have you suffering withdrawal) let's get back to the subject at hand - that Bristol Scout model.

EQUIPMENT

There's nothing too complicated involved as far as equipping the beast is concerned. Everything you need is readily available as a spare part from virtually any model shop (even if some will have to order it), but a quick trawl of the interweb thingy will reveal alternatives to the precise equipment shown on the plan. Different receiver 'bricks' and different 8.5 mm geared motor units come in many forms and at varying prices. Whilst what's on the plan isn't the cheapest by any means it is all well proven and reliable equipment that most of us have easy access to. Also important, especially for indoor flying, is that it's about as light as you'll get from a ready to run set up.

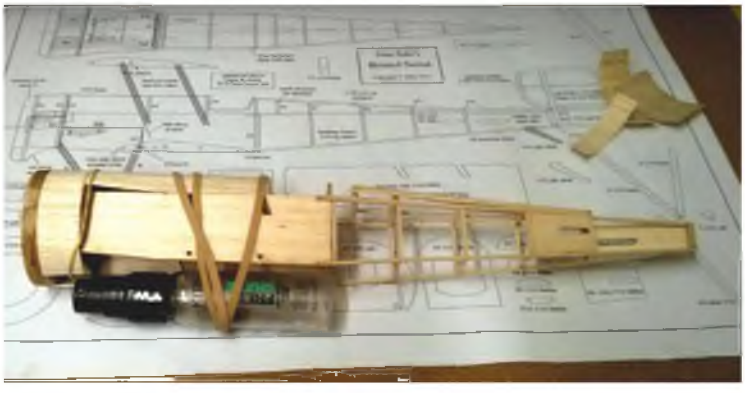
The one thing I would not advise doing is replacing the brushed motor unit with a small brushless motor. The geared motor is hard to beat for efficiency and will provide more than adequate power for

THIS MONTH'S OFFERING IS AN INDOOR SCALE BRISTOL SCOUT TYPE C, BUT THIS TIME IT'S A FULLY THREE-DIMENSIONAL ALL-WOOD BUILD, RATHER THAN A PROFILE FOAMIE

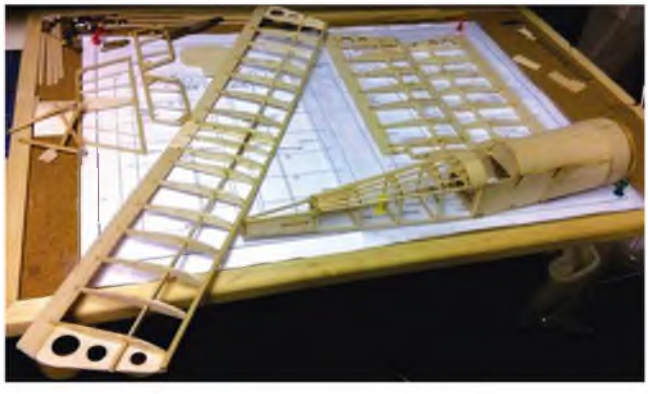


Although using the front piece as a guide is a good idea, don't glue the longerons to it.

All set to buzz around happily. Note what I said about the warped all sheet rudder.



All the basic components ready for sanding. As you can see, Paul opted for a strip and gusset tailplane.



Here you see the sheeting going on, and the pushrod exits as they should be fitted. Okay, sometimes I get confused.

this particular model without the need to resort to heavier, 2S batteries. The trouble with using brushless motors in these models is that the models themselves tend to fall into a sort of in between bracket. The brushed motors generally produce more thrust than the 1S brushless motors and are well matched to the model. 2S brushless motors, however tend towards a higher overall weight and far more power than is required. Great if you want a 3D Bristol Scout, not so good if you have to fly at absolute minimum throttle all the time. A moments distraction, or a slight slip of the thumb and your model has just smeared itself over the opposite wall. Yes, I know that can also happen with the brushed unit but usually not quite as violently because there isn't such a margin of excess power.

Okay, I know there are those out there who simply HAVE to throw a brushless motor at every model they build, obviously they will do what it is they do. At least now you know why I advise against such a course of action.

THE BUILD

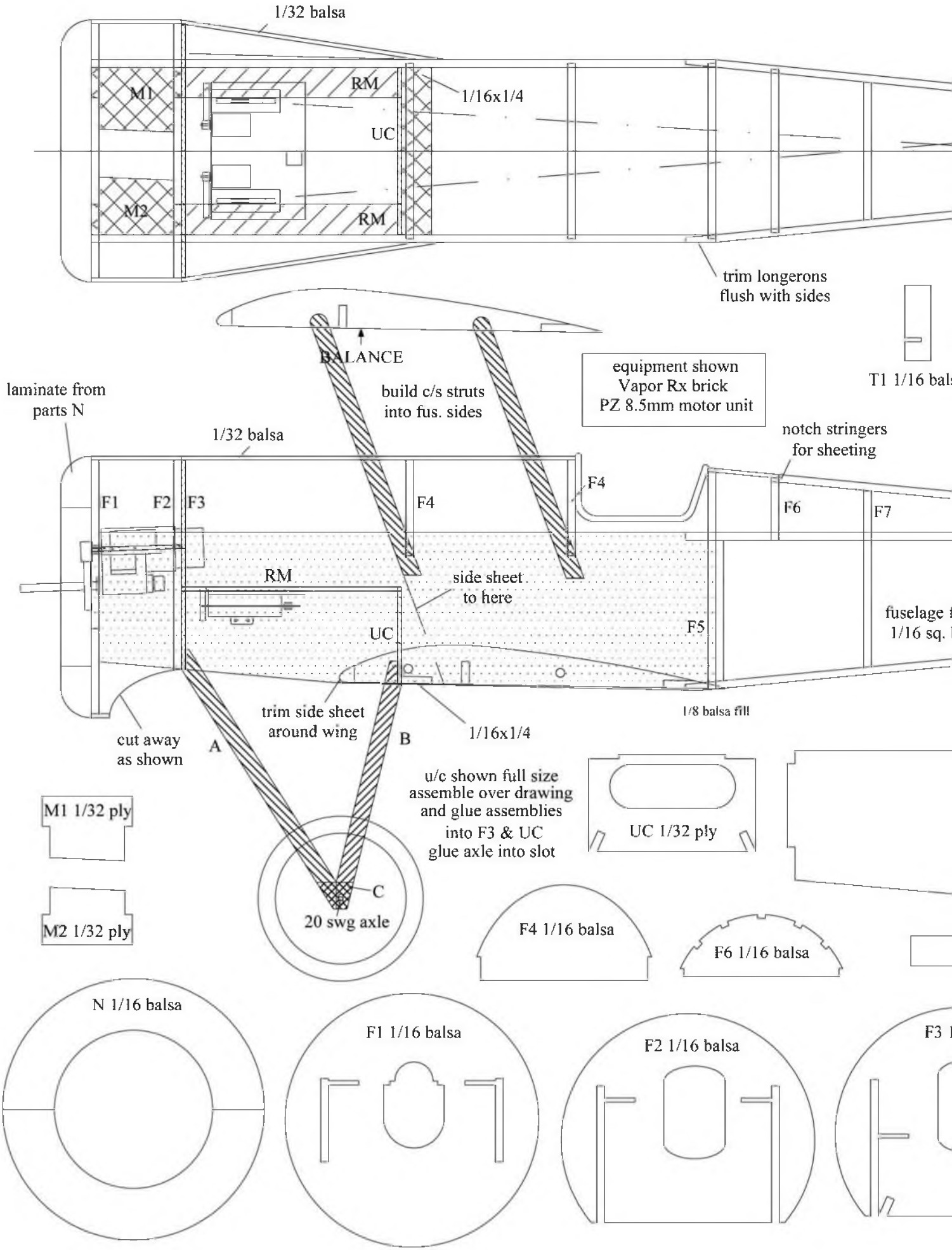
As you can see from the plan and photos, there's nothing particularly complicated about the build. That being the case, and because of space limitations I'll restrict what I say about it to points I think you might need to know.

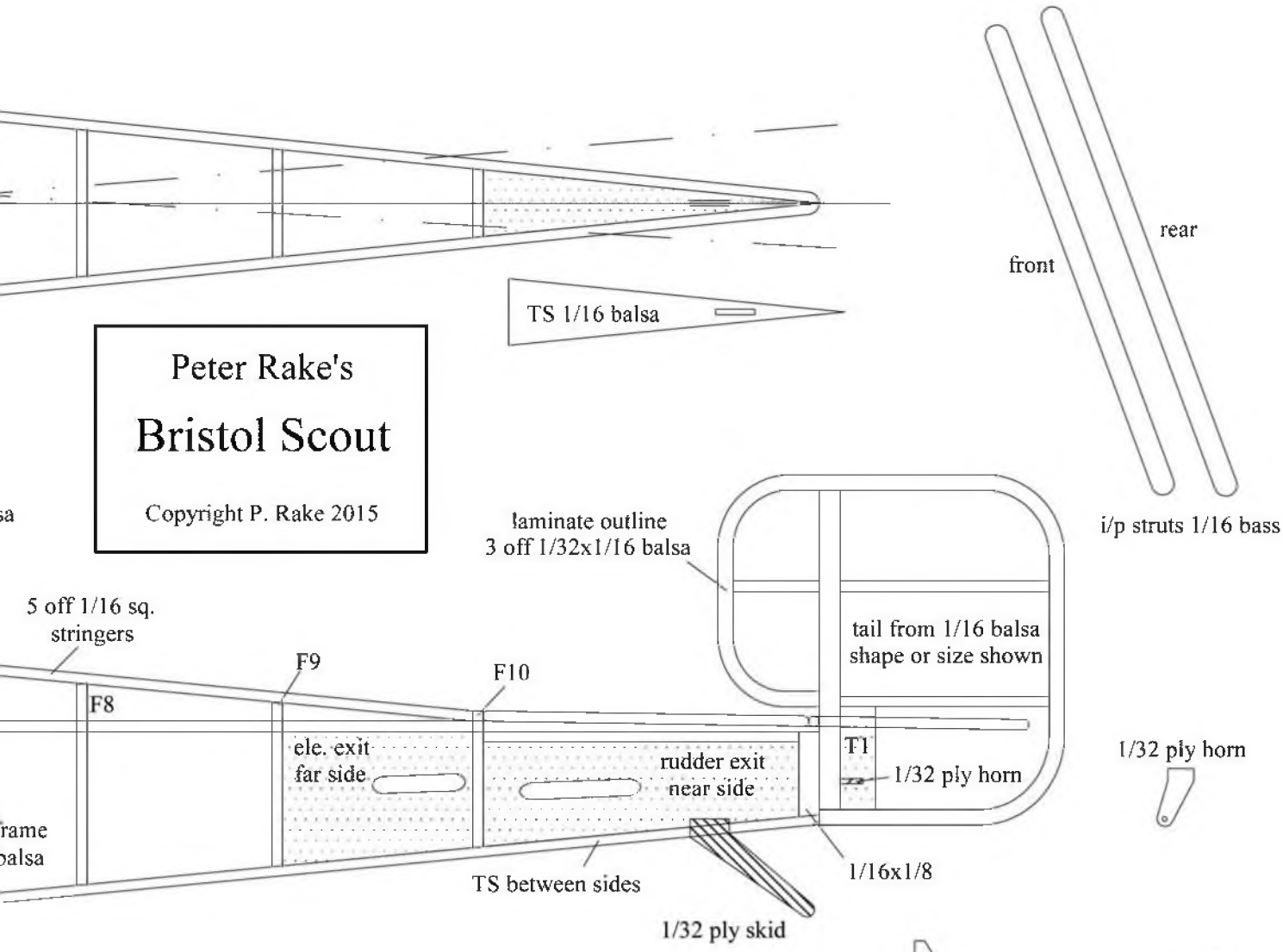
First and foremost, don't be tempted to 'beef up' the structure. I promise you, it's perfectly strong enough exactly as shown. On models like this adding 'strength' is actually counter productive. All it does is increase the weight and mean the model has to fly faster to carry said weight. Flying faster just means that when it does hit something it does it that much harder, causing more damage than would have been the case with a lighter, slower model.

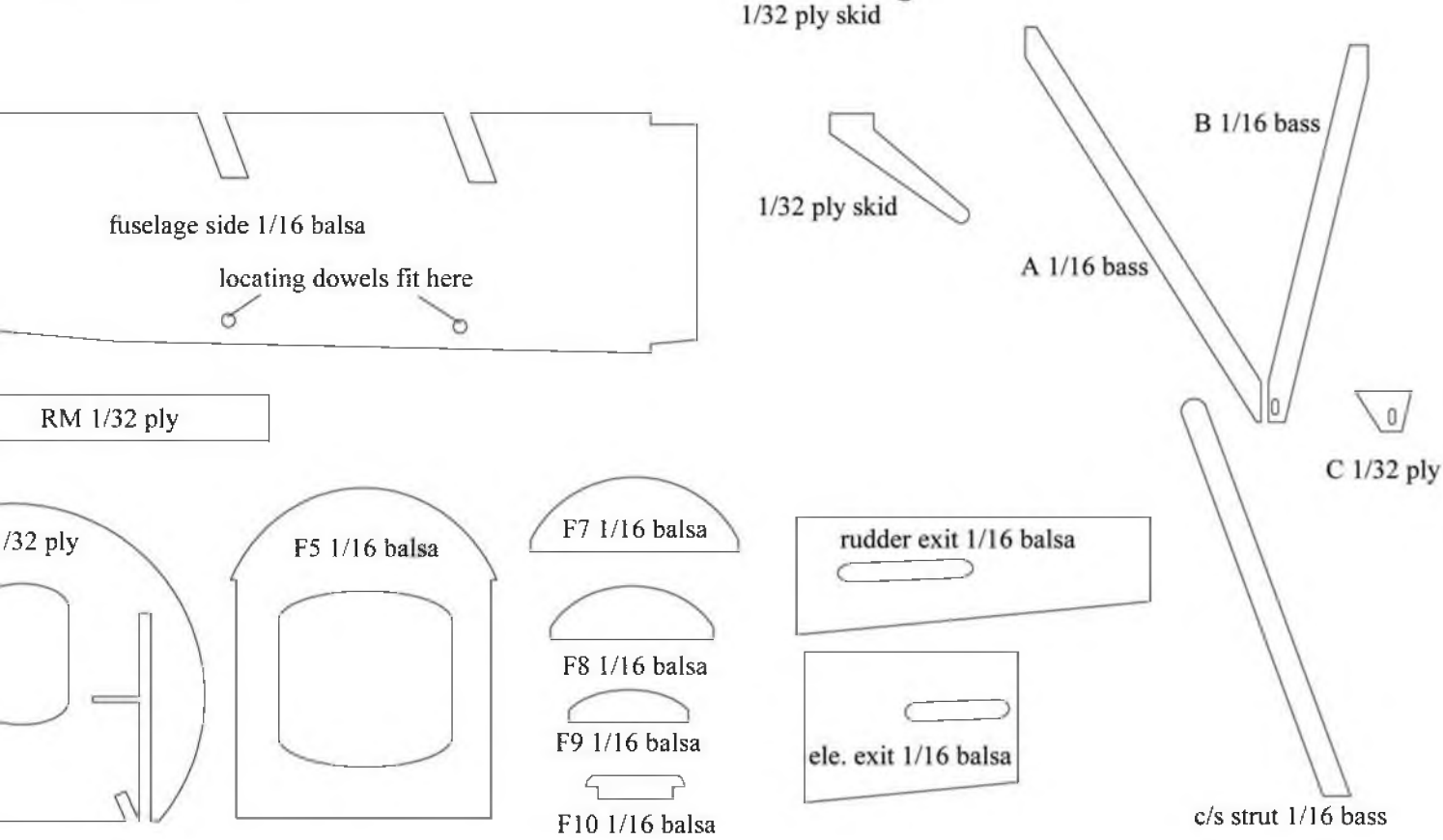
The basic fuselage box is built as two parts that are then joined and have decking formers, sheeting struts and stringers added. Build it as front ad rear sections and then join them over the plan to arrive at a straight, square basic box. Please not that the top longeron is tapered slightly where the tailplane will attach (aft of F10). That isn't a drawing error, it is deliberate and is why there is a 1/16 square doubler piece immediately below that area. I just find that having a small amount of positive incidence on the tailplane is more effective, and creates less drag, at keeping the tail up than applying down elevator trim.

Although the tail surface outlines are shown as laminated they don't have to be made that way. It's far and away the lightest and strongest (for the weight) method of producing them, but simple strips and corner gussets will work almost as well. Paul had trouble laminating his rudder outline, so made it from solid sheet. Not only the heaviest method he could have chosen but, as you'll see from the photos, also very prone to warping. I hasten to point out that Paul's model still flies well but I still maintain that lighter is better - especially that far behind the balance point. Remember, one extra gram that far back may require as much as seven grams in the nose to counter it. A total of almost 8% of the weight of the entire model.

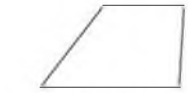
When fitting those exit plates (which can be lightened if you are careful how you do it), bear in mind that they only work as intended if the receiver brick is in exactly the position shown on the plan. Otherwise there's a risk of the pushrods binding where they pass through the exit plates. Please note that the plan actually shows them on the wrong side. Paul's photo


1/32 balsa
M1
RM
1/16x1/4
UC
M2
RM
trim longerons
flush with sides
T1 1/16 bals
BALANCE
equipment shown
Vapor Rx brick
PZ 8.5mm motor unit
laminate from
parts N
build c/s struts
into fus. sides
1/32 balsa
notch stringers
for sheeting
F1
F2
F3
F4
F4
F6
F7
RM
side sheet
to here
UC
F5
fuselage
1/16 sq.
1/8 balsa fill
trim side sheet
around wing
1/16x1/4
cut away
as shown
A
B
u/c shown full size
assemble over drawing
and glue assemblies
into F3 & UC
glue axle into slot
UC 1/32 ply
M1 1/32 ply
M2 1/32 ply
C
20 swg axle
F4 1/16 balsa
F6 1/16 balsa
N 1/16 balsa
F1 1/16 balsa
F2 1/16 balsa
F3

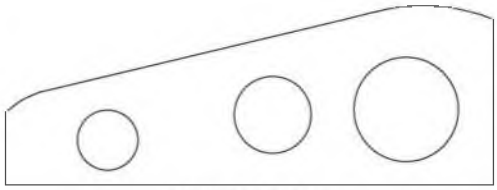

TS 1/16 balsa
front
rear
i/p struts 1/16 bass
Peter Rake's
Bristol Scout
Copyright P. Rake 2015
laminate outline
3 off 1/32x1/16 balsa
5 off 1/16 sq.
stringers
F8
F9
F10
tail from 1/16 balsa
shape or size shown
ele. exit
far side
rudder exit
near side
T1
1/32 ply horn
1/32 ply horn
TS between sides
1/16x1/8
1/32 ply skid


fuselage side 1/16 balsa
locating dowels fit here
1/32 ply skid
B 1/16 bass
A 1/16 bass
RM 1/32 ply
C 1/32 ply

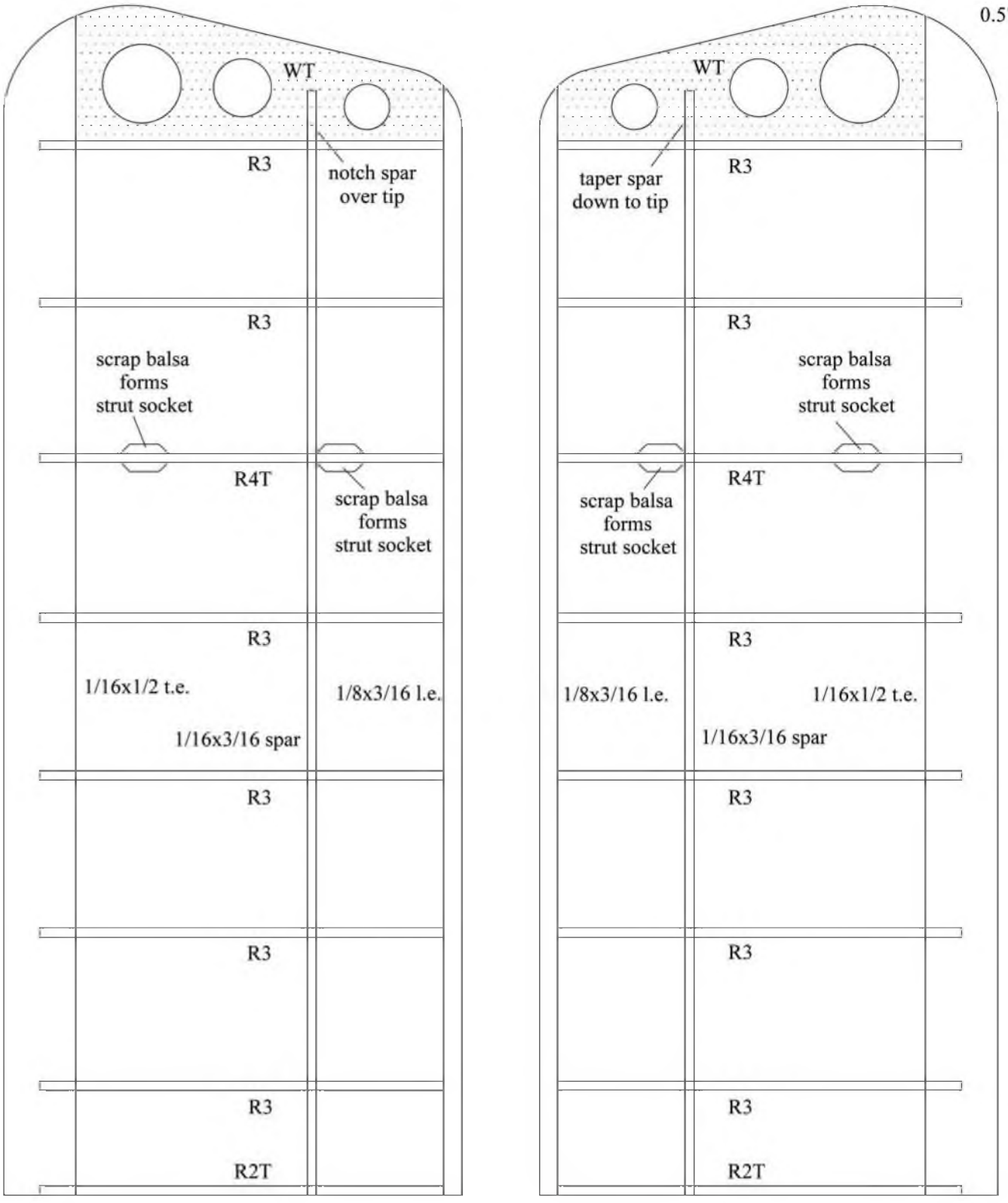
/32 ply
F5 1/16 balsa
F7 1/16 balsa
F8 1/16 balsa
F9 1/16 balsa
F10 1/16 balsa
rudder exit 1/16 balsa
ele. exit 1/16 balsa
c/s strut 1/16 bass



root rib angle guide
1/16 balsa



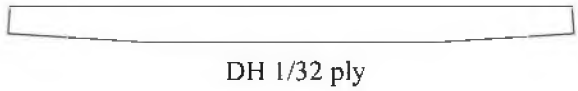
WT 1/16 balsa



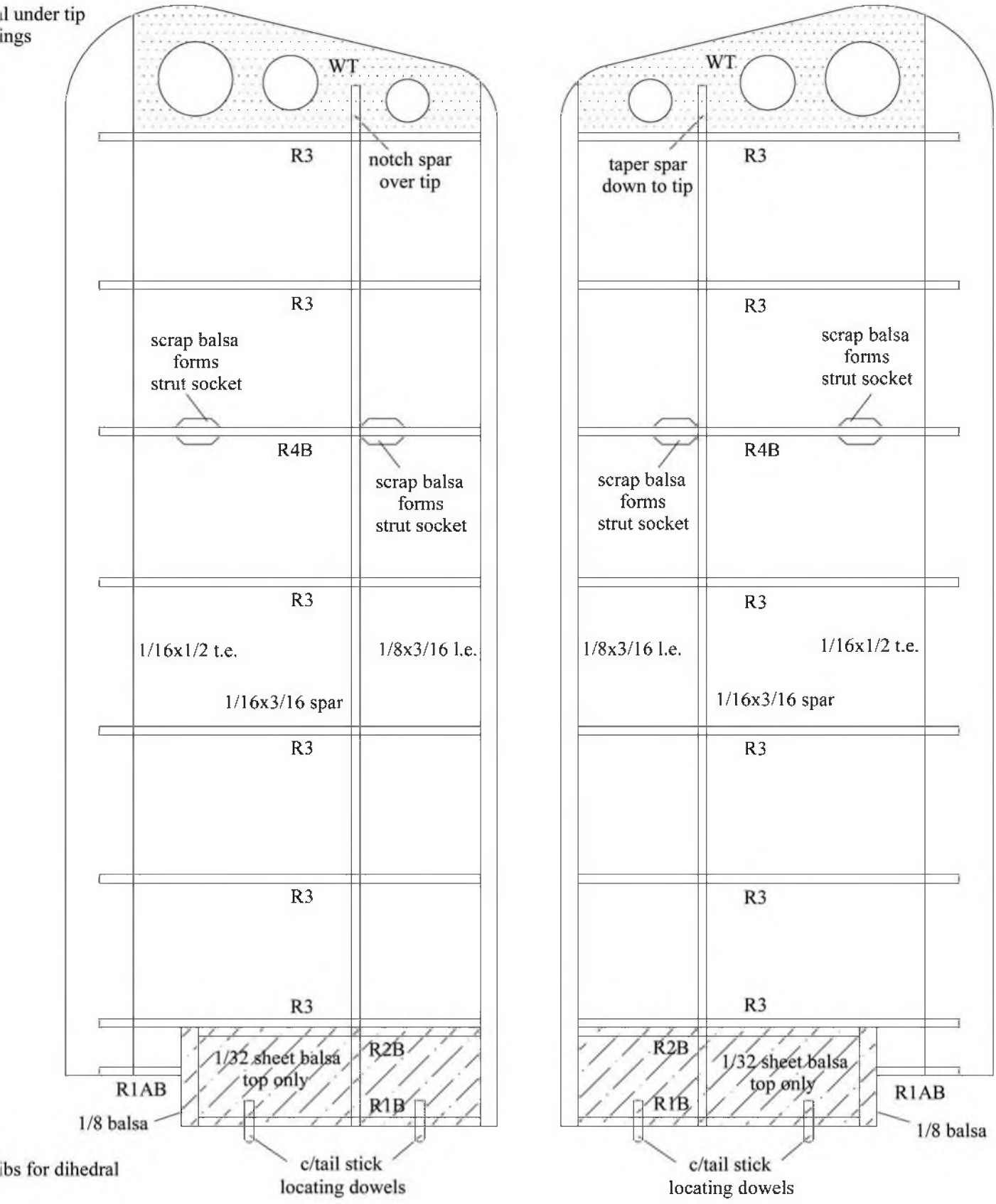
0.5" dihedra
all w

angle all root r

Peter Rake's
Bristol Scout

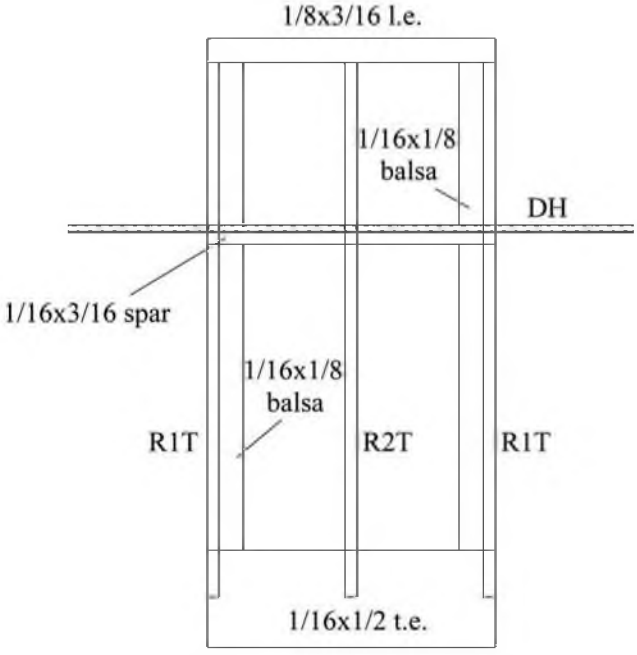


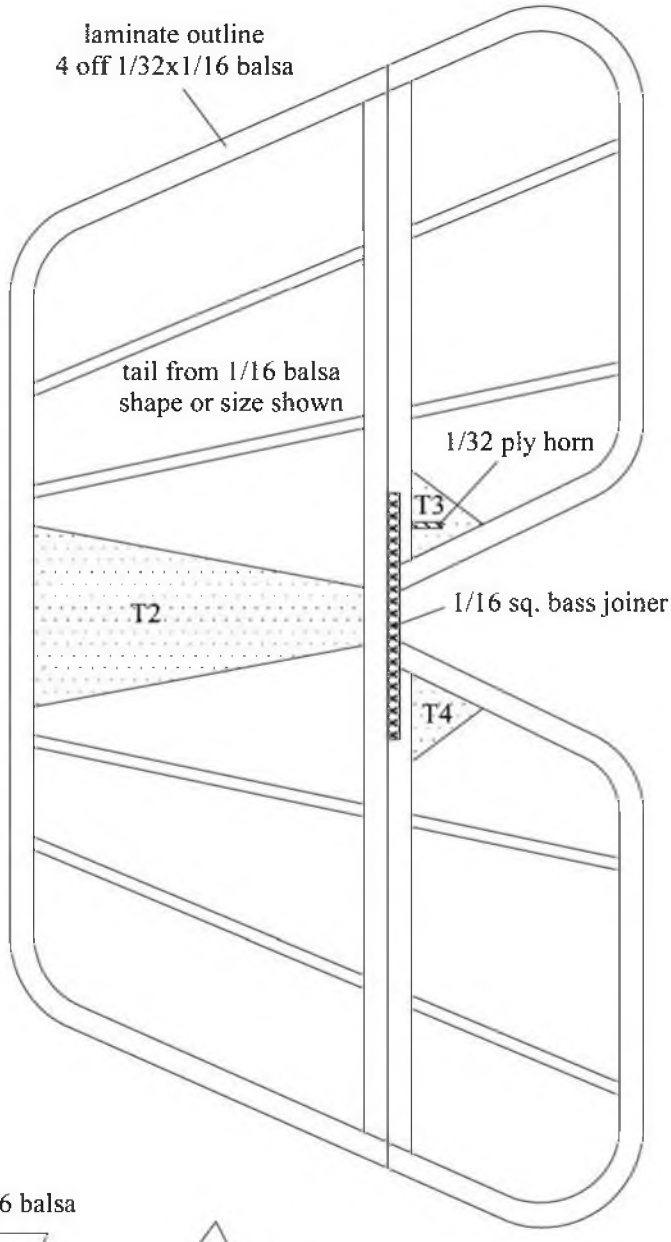
DH 1/32 ply



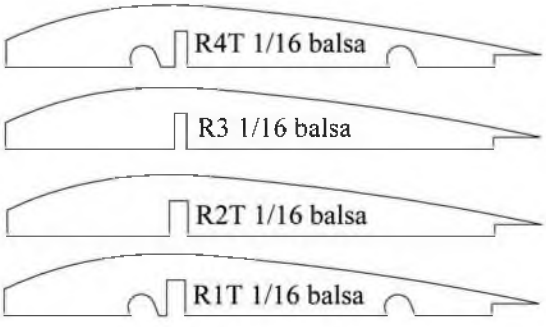
Peter Rake's

Bristol Scout

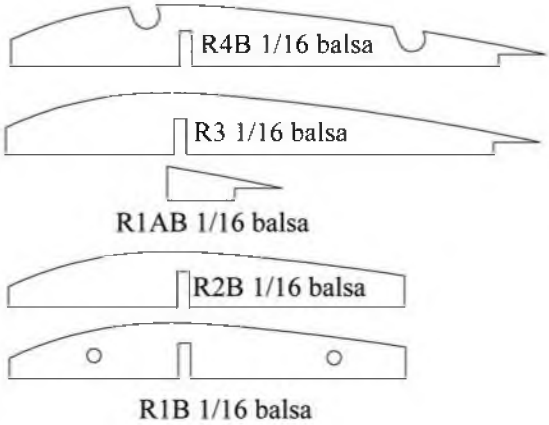


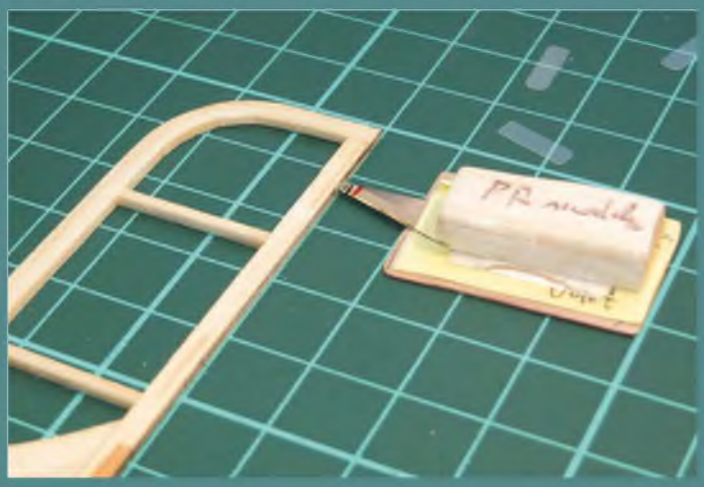


top wing ribs



bottom wing ribs





From the builder of another of my small designs is this rather neat tool for accurate slotting of tail surfaces - along with some of the hinges he'll use.

Not Paul's model, or even this particular design, but it does show what can be done with the model.

shows them as they should be. Check with your particular brick which side they need to go.

As regards those pushrods, I'd suggest nothing heavier than 1mm carbon rod with fine wire (22 or 24 swg) ends secured with heat shrink tube and a small spot of CA. As long as your hinges are free operating that's more than adequate. For hinges I tend to use narrow (1/8") strips of floppy disc material, with the coating sanded off. Other materials can be used, but avoid conventional hinge material like the plague. It's too thick to easily fit into 1/16" thick surfaces and too stiff for either the pushrods or the tiny servos fitted to the brick receiver. Other hinge types I've seen advocated include OHP film or fine fishing line glued intro drilled holes. The latter strikes me as a task fraught with peril. I know I would have great trouble drilling into those thin surfaces without ending up perilously close to the outer surface - or more likely breaking through the outer surface.

FINISHING

To my mind there really is only one finishing method for these little models - tissue and dope. Whether that's coloured tissue (as on Paul's model) or a printed tissue finish complete with markings and mock detail is purely a matter of taste. Gift wrap tissue works, but is at the heavier end of the tissue spectrum. Lightweight Esaki would be my choice, but may be a little on the fragile side for some. Paul's solution is a nice, middle of the road, approach. Proper modelling tissue, not too heavy and already in the (roughly) correct colours.

He was still trying to come up with some markings when the photos were taken, so I drew some for him. If you'd like the pdf file for those markings, to create your own decals, an e-mail to me will get you the file. How you print them is up to you.

FLYING

Paul has had a few opportunities to fly his little Bristol Scout now and I get the impression he rather likes it. The initial launch resulted in a rather dramatic climb and stall, but a little down trim solved that and has left him with a model he describes as 'spot on' and 'a long term keeper'. He intends to add markings and improve the level of detail to make it an even nicer model.

If you'd like that pdf, or want to contact me for any other reason (except abuse or begging letters), you'll find me at the usual place: PETERRAKE@aol.com ■

A pretty little model that will look nicer still once markings and a little detail are applied.

SUBJECT FOR SCALE

GRUMMAN F3F

The Grumman F3F series was one of a clutch of late 1930s aircraft that included such designs as the Gloster Gladiator, Fiat CR42 Falco and Polikarpov I-15 that represented the pinnacle of single-seat fighter development immediately prior to the eclipse of the layout in favour of the monoplane.

A Grumman F3F-1 about to hook the arrester wire on U.S.S. Ranger in March 1938.

Leroy Grumman and others worked for the *Loening Aircraft Engineering* Corporation during the 1920s, but when that organisation was bought by *Keystone Aircraft Corporation* and the operation moved from New York City to Bristol, Pennsylvania, Grumman and his partners (Edmund Ward Poor, William Schwendler, Jake Swirbul, and Clint Towl, started their own company at Baldwin on Long Island, New York. The new company took the name *Grumman* because he was its largest investor.

Officially formed on December 5, 1929, the *Grumman Aeronautical Enginnering Company* opened its doors on January 2, 1930 with a nucleus of former Loening employees. Initially kept busy by welding aluminium tubing for truck frames, but Grumman eagerly pursued contracts with the US Navy. Grumman designed the first practical floats with a retractable landing gear for the Navy, which were applied to the Vought O3U observation aircraft and thus provided a reputational springboard that helped in launching Grumman as a supplier to the US Navy.

The first complete Grumman creation was their G-5 design, in answer to a Navy specification for a High Speed Two-Seat Fighter (HSTSF), which was accepted for carrier-borne service as the Grumman FF-1. It set Grumman on a long and successful

An F3F-1 of VF-7 (Fighting Squadron Seven) with the black fin and rudder with of U.S.S. Wasp with large 'Neutrality Star' applied to mid-fuselage, April 1940. Note bomb rack under starboard wing.

A plain finished Grumman F3F-3 assigned to Naval Air Station Anacostia. On the F3F-3, the cowling was faired around the exhaust stacks in contrast to the F3F-2's cut-out.

The aerobatic performance of all the F3F series was much appreciated by pilots who flew them. This F3F-3, airborne from N.A.S Anacostia commences a slow roll.

association with the US Navy as a supplier of front-line combat aircraft types for the next sixty years until the Company was combined with the Northrop Corporation to become Northrop Grumman.

Following the success of the FF-1, which was significantly faster than even the existing single-seat fighters of its time, Grumman set about the design of a follow-on single seat fighter, the prototype of which, the XF2F-1 armed with two .30 calibre (7.62 mm) machine guns above the cowl, first flew on 18 October 1933, equipped with experimental 625 hp (466 kW) XR-1534-44 Twin Wasp Junior radial engine. It reached a top speed of 229 mph at 8,400 ft - 22 mph faster than the FF-1 at the same altitude. Manoeuvrability also proved superior to the earlier two-seat aircraft.

The Navy ordered 54 F2F-1 fighters on 17 May 1934, the first of which were delivered in January 1935, with the final examples in service by August that year. The F2F-1 had a relatively long service life for the time as the premier US Navy fighter aircraft of the mid-1930s period, serving in front-line squadrons from 1935 to late 1939 although, by the latter date, relegated to training role.

However, operational experience with the F2F revealed issues with stability and unfavourable spin characteristics. In any case, even as the F2F was entering operational service, Grumman were already at work designing the successor, their G-11 that received a Navy development contract in October 1934 as the XF3F-1.

In addition to the carrier-borne fighter role, the contract also required a capability for ground attack. Powered by the same Pratt & Whitney R-1535-72 Twin Wasp Junior engine as the F2F, the fuselage was lengthened and wing area increased over the earlier design. A reduction in wheel diameter allowed greater fuselage streamlining, eliminating the prominent bulge behind the cowling of the F2F.

The first prototype XF3F-1 flew in late March 1935, and during the remaining days of that month intensive testing proceeded without problems, until commencement of a series of high speed test dives intended to prove the structural integrity of the airframe in recovery manoeuvre stresses of eight or nine 'g'. With nine such manoeuvres successfully accomplished, test pilot Jimmy Collins, took the aircraft to 18,000 ft. for a tenth dive at which point, during an abrupt pull-out at 8,000 ft., some of the wing panels departed, together with the engine, while the remainder came down in a flat span killing the pilot.

Further drama occurred with the second prototype, hastily prepared, during ten-turn spinning tests, forcing pilot Lee Gehlback was forced to abandon the aircraft.

Accelerated service testing continued followed by an order for 54 F3F-1 fighters placed in late August of that year, following the conclusion of the flight test program.

Into service

The first production F3F-1 was delivered in late January 1936 to the test group at Naval Air Station Anacostia, squadron service beginning in March with VF-5B of *USS Ranger* and VF-6B of *USS Saratoga*. Marine squadron VF-4M received the last six in January 1937.

Meanwhile, to take advantage of the powerful new 950 hp (708 kW) Wright R-1820 supercharged radial engine, Grumman began work on the F3F-2 for which a

Grumman F3Fs were stars of many air shows in USA. Here an F3F-2 of Marine Squadron VMF-1 comes in to land at the 1938 National Air Races, Cleveland, Ohio. The pilot has cranked the seat up as far as possible for best forward view during the landing approach.

GULFHAWKS TOGETHER. In the foreground the Gulfhawk II, with the Gulfhawk IV Grumman G-58 civillianised Grumman F8F Bearcat.

contract order of 81 aircraft was placed in July 1936 that year, two days before the type's first flight. The engine's larger diameter changed the cowling's appearance, making the aircraft look even more like a barrel, though top speed increased to 255 mph at 12,000 ft.

The entire F3F-2 production series was delivered between 1937 and 1938 and when deliveries ended, all seven Navy and Marine Corps pursuit (fighter) squadrons were equipped with Grumman single-seat fighters. Further aerodynamic developments were made to F3F-2s as these were returned to Grumman for maintenance. In that revised configuration it became the F3F-3, and featured a larger-diameter propeller among other improvements and the Navy also ordered 27 new-build F3F-3s, as a means of plugging the anticipated gap when it was realised that development of new monoplane fighters like the Brewster F2A and Grumman's own F4F Wildcat were taking longer to complete than had been expected.

Twilight zone

With the introduction of the Brewster F2A-1, the Navy's biplane fighter days were numbered and the colourful F3Fs were progressively retired to training duty. However, they were still in service when the bright pre- WW2 colour schemes were lost to the early non-specular grey finish in early 1941. Squadrons VF-70 and VF-71 relinquished their last F3F-1s from combat squadron use in early February 1941 and when *USS Yorktown* left Hawaii for Neutrality Patrol duty on the on the American east coast, their Air Group Five aircraft took on the overall light grey finish that became the universal early warpaint of US Navy aircraft. When VF-5, the Striking Eagles, gave up their F3F-2s and F3F-3s in late June that year, they were the last carrier based US Navy squadron to switch to monoplanes. In the end though it was the US Marine Corps' VMF-1 and VMF2 who hung on to their F3Fs longest, until July 1941.

Fresh from overhaul, this F3F-1 features red wing centre section chevron and section leader's identification band around rear fuselage aft of the cockpit.

TWO STEPS BACK! Grumman's first naval aircraft design was the FF-1 two-seat 'High Speed Two-Seat Fighter' (HSTSF). Here a Fighting Squadron Five (VF-5) about to catch the arrester wire as it comes aboard USS Lexington (CV-2) during 1934.

Immediate predecessor of the Grumman F3F series was the F2F-1, which had a smaller with shorter fuselage and lesser wing span. When the F3F type was introduced, the F2F-1 was progressively relegated to the training role.

All F3Fs were withdrawn from front-line squadron service by October 1941, though more that 100 were assigned to naval bases and used for training and utility duties until December 1943.

Executive Sweetie!

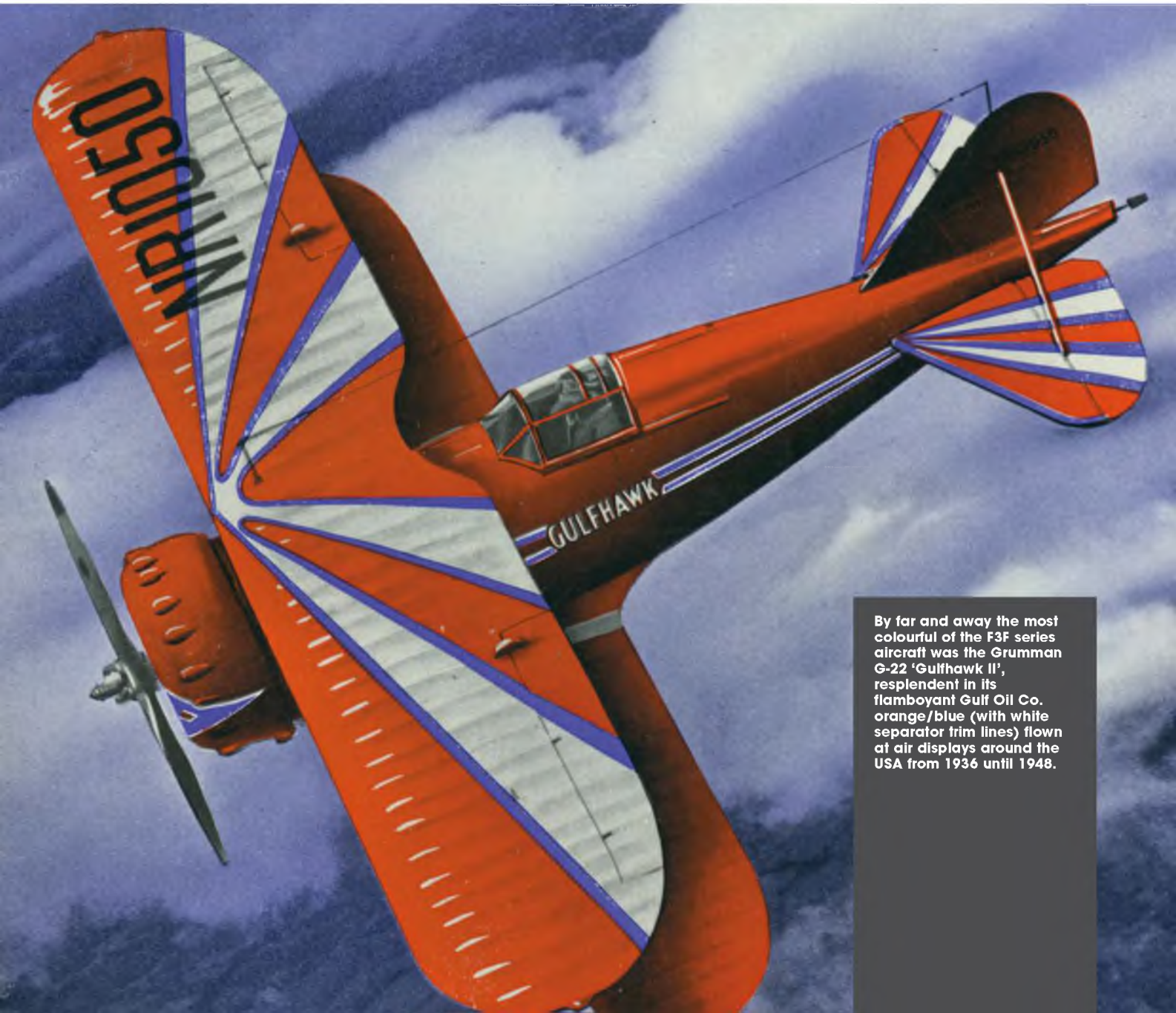
By far and away the most flamboyant and colourful variant of the Grumman F3F was the Gulf Oil Company's *Gulfhawk II*, operated by Gulf Company executive Major Al Williams and flown at air shows throughout the USA as was its predecessor *Gulfhawk 1*, which was a much modified Curtis Hawk 1.

Gulfhawk II was actually a hybrid combination of basically an F3F fuselage and tailcone married to the wings of the Grumman. Designation Grumman G-22, it was specially equipped for inverted flying, which was Al Williams' air show speciality. Gulfhawk II was operated from 1936 and retained its distinctive orange/blue colour scheme throughout the WW2 period and thereafter, being finally retired in 1948 to the National Air Museum (now the National Air & Space Museum) in Washington D.C. Nowadays it is on permanent display in the Boeing Aviation Hangar at the Steven F. Udvar-Hazy Centre in Chantilly, Virginia.

Gulfhawk II was followed by *Gulfhawk III* a two (tandem) seat version of the basic F3F under civilian designation G-32 and also carried the identical Gulf Oil Co. house colour scheme.

Finally came *Gulfhawk VI*, one of two G-58 civilian versions of the Grumman F8F Bearcat. Completed on the 23rd of July 1947 the aircraft was handed over to Al Williams and at Washington National Airport. It was equipped with a JATO (rocket assisted take-off) bottle that was demonstrated to astonishing effect in a brief first public flight of the G-58A.

During the 17th Annual Miami Air Manoeuvres Show on the 18th of January 1949 Al Williams was flying towards his home airfield when he noticed he had an undercarriage problem. He flew back south to Simmons-Knott Airport at New Bern, North Carolina and made an emergency landing there. On rollout, the left main leg collapsed and the Bearcat settled onto its belly rupturing the under-fuselage auxiliary fuel tank and trailed fuel behind the stricken plane. Bystanders helped Williams out of the cockpit but had no way to extinguish the flames that burned the plane to the ground. ■



By far and away the most colourful of the F3F series aircraft was the Grumman G-22 'Gulfhawk II', resplendent in its flamboyant Gulf Oil Co. orange/blue (with white separator trim lines) flown at air displays around the USA from 1936 until 1948.

AeroDetail series

Making a scale model?

Finding the detail needed to finish a scale model can be difficult and getting full size images is not always practical. Our range of detail photo collections provides extensive close ups of a wide range of popular aircraft all on CD in J-peg format

Monocoupe CD108
The Monocoupes were side-by-side two-seat lightplanes of mixed wood and steel-tube basic construction with fabric covering. A braced high-wing monoplane with fixed tailskid landing gear, and the reverse curve rear fuselage lines that were to become one of the signature identifier features of the Monocoupes. 55 photos

Miles Magister CD73
A firm favourite with scale modellers, this extensive collection of images depicts two examples in different Royal Air Force training colour schemes. (100 images)

Messerschmitt ME109G CD72
The 'Gustav' saw Luftwaffe service from late 1942 onwards. Subject version of this collection is a tropicalised G-6. (110 images)

Messerschmitt Bf109E CD71
The 'Emil' was the version of this WW2 fighter that was the mainstay of the Luftwaffe fighter force during the Battle of Britain in 1940. (150 images)

Me 410A – 1/U2 CD107
For those who fancy a twin, but something outside the 'normal' favourites, consider the Luftwaffe's final 'destroyer' heavy fighter that packed a powerful punch 79 photos

Martin B-26 Marauder CD70
The Fantasy of Flight Museum's example, photographed pre-restoration, soon after it was flown into the Museum site, thus in original, unrestores condition. (100 images)

LVG C.VI CD69
The sole survivor of its type from the WW1 era, photographed in extensive detail. This is the machine house at and flown from the Shuttleworth Collection airfield, Old Warden and now in storage, awaiting display at the RAF Museum. (110 images)

Luton Minor CD68
Just one example of this light aircraft, to which the owner has added many mods and variations. (32 images)

Luscombe Silvaire CD67
The elegant late 1940s U.S. light aircraft. Several examples provided, with much close-up detail for modellers. (74 images)

Kawasaki Ki100 CD66
A study of the late WW2 radial engined 'emergency' development of the Japanese Ki 61 Hien (Tony) that provided an unexpectedly superior performance for the squadrons of the Imperial Japanese Air Force during the closing stages of the Pacific war. (60 images)

Junkers Ju87G-2 Stuka CD65
The aircraft that defined the term

Hawker Typhoon CD109
The Hawker Typhoon was a British single-seat fighter bomber, produced by Hawker Aircraft. While the Typhoon was designed to be a medium-high altitude interceptor. 117 images

Hawker Tomtit CD64
Mid 1930s RAF biplane trainer aircraft, from the era open cockpits of silver dope and polished metal. (140 images)

Hawker Tempest Mk 2 CD63
The final development of Hawker

Hawker Sea Fury FB XI CD62
Hottest of all the piston-engine fighter aircraft, the carrier-bourne Sea Fury is also admired for its elegant profile. (140 images)

Hawker Hurricane MK1 & MKIV CD61
Two versions of the famous 'Hurri' – one a true Battle of Britain survivor painstakingly restored to perfect authenticity, plus the cannon-armed, Mk.IV 'tank buster'. (170 images)

Hawker Hart & Hind CD60
A combo collection featuring the RAF Museam's Hart bomber and Hart Trainer, plus Shuttleworth's Hind . (115 images)

Hawker Fury CD59
No authentic example now exists, but the accurate replica photographed in extensive detail in this collection is as good a guide as can be found of this elegant 1930s RAF fighter. Includes some general arrangement pictures authentic to the period. (55 Images)

Grumman FM-2 Wildcat CD58
First of Grumman's highly successful line of prop-driven 'Cats', the Wildcat, in guises from F4F-3 to FM-2 held the line after the Pearl Harbour attack and served from then until the end of WW2. It was idea for operations from the small escort carriers. (90 images)

Grumman F8F Bearcat CD57
Hottest of Grumman's prop-drive fighters – it arrived too late for action in WW2 but was standard ship-borne fighter equipment in the immediate post-WW2 era. (90 images)

Grumman F7F Tigercat CD56
The awesome twin engine long range fighter of the late WW2 era operated by US Navy and US Marines. (60 Images)

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

Grumman F3F CD54
A study of the faithfully replicated example of the 1930s U.S. Navy biplane as seen at the 2001 Flying Legends Show. (34 images)

Gloster Gladiator CD53
The Royal Air Force's last biplane fighter, star of late 1930s air shows and flown in combat during early WW2, including Battle of France, Battle of Britain, Mediterranean operations and North Africa. (50 images)

Fokker D.VIII CD52
The Fantasy of Flight Museum's example of the late WW1 Imperial German Air Service monoplane fighter, in full detail. (69 images)

Fokker D.VII CD51
The most famous of all the German fighter aircraft of WW1. The collection depicts the RAF Museum, Hendon's authentic, restored example. (44 images)

Focke Wulf FW 190A CD50
Germany's 'butcher bird' fighter of WW2, active on all combat fronts from 1941 onwards.

Fieseler Storch CD49
Arguably the first military STOL aircraft, this storky looking aircraft has long been a modellers' favourite. Two examples are represented, the machine at the Fantasy of Flight Museum in Florida and the RAF Museum Cosford's example. (images)

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

Fairchild Ranger CD47
Elegant U.S. high wing light aircraft in full detail. Two examples shown. (60 images)

Erco Ercoupe 415 & Avalon Ercoupe CD46
The elegant twin finned light/sport aircraft. Both original Type 415 and later Alon resurection examples. (115 images)

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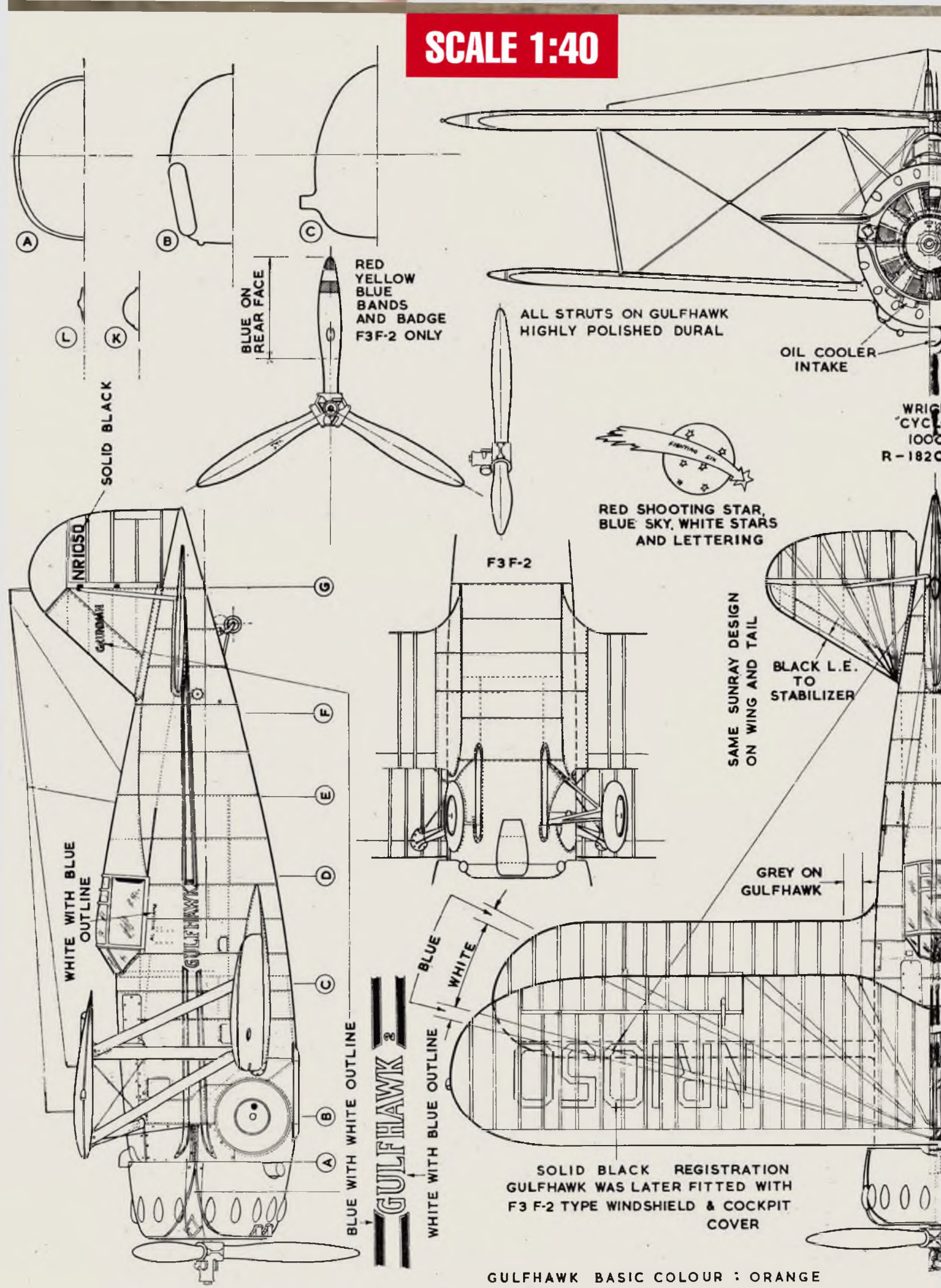
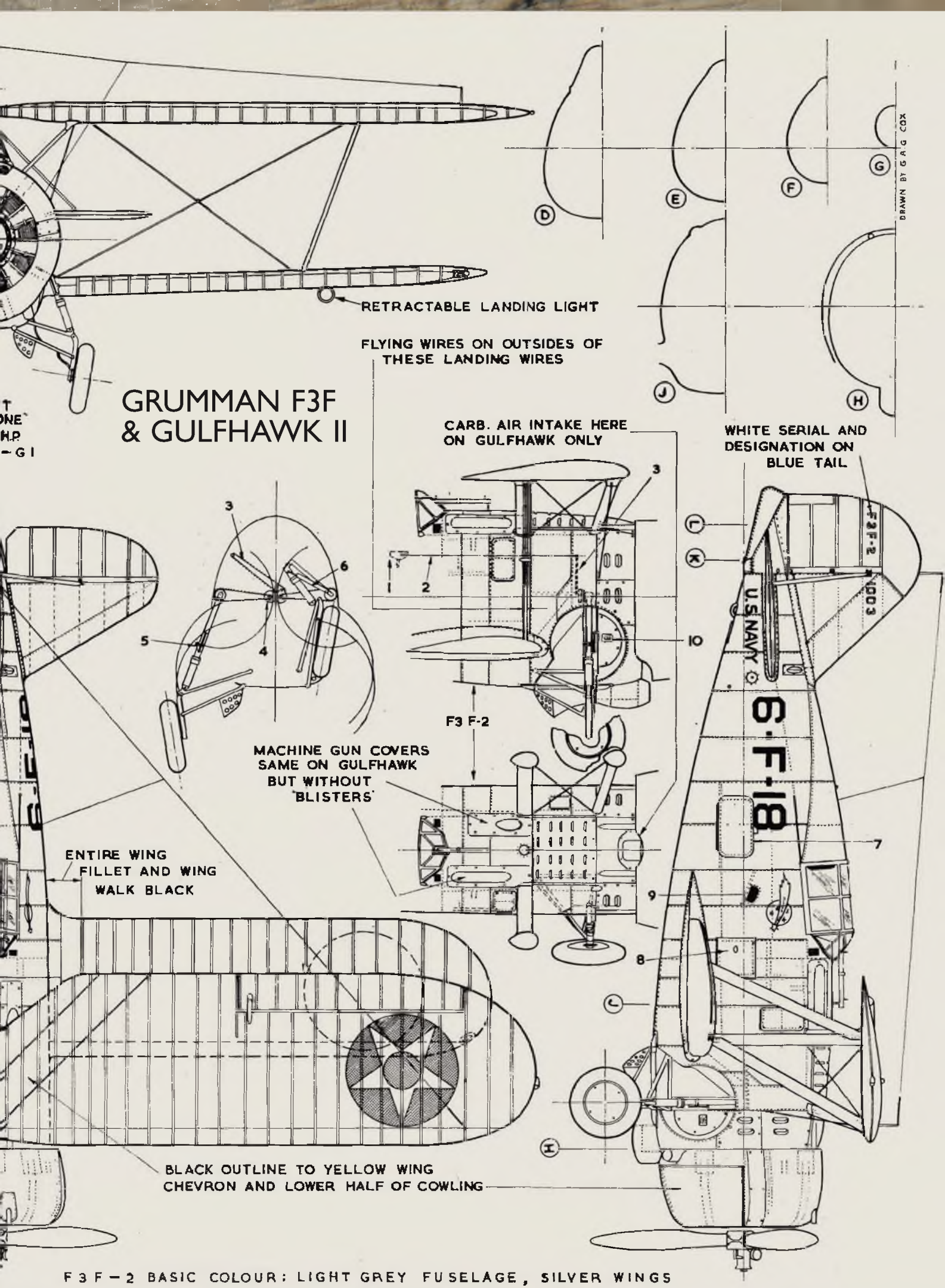


GULFHAWK BASIC COLOUR : ORANGE



F 3 F – 2 BASIC COLOUR: LIGHT GREY FUSELAGE, SILVER WINGS

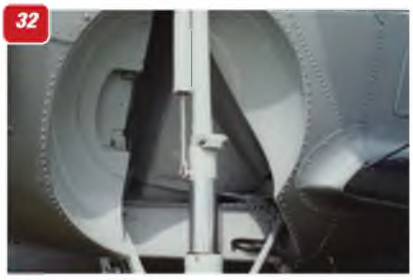
GRUMMAN F3F

THE TEXAS AIRCRAFT FACTORY'S REPLICA F3F-2

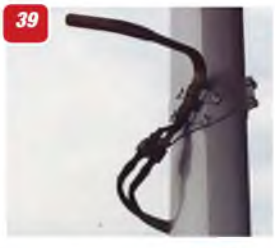
1 - 3: Three views of the cockpit front windscreen. 4: A view of the multiple-frame slidong rear canopy. Note also the extensive use of exposed round-head surface rivets, a construction feature that extended beyond the F3F to its immediate successor, the F4F Wildcat and the subsequent F6F Helcat.

5: Pilot's seat and headrest. 6: Further view of the headrest, also showing the rear canopy guide rail. 7 - 9: Cockpit internals. 10: Cockpit nstrument panel features modern instrumentation. 11: Cowl & prop. 12: Propeller hub. 13: Air scoop under the engine cowl. 14: View rearward under the fuselage. 15: Cooling louvres on forward fuselage. 16 & 17: Fin & rudder.

18 - 20: Access panel detail on fuselage.
21: View forward from behind wings.
22 & 23: Castering tailwheel.
24: Tailplane bracing strut.
25: Extreme rear of fuselage.
26: Arrester hook in stowed position
27: Access hatch just below the tailplane leading edge.
28: Rear fuselage panelling and extensive rivet lines.



29-32: The main undercarriage, showing the oleo strut and the wheel well in the lower fuselage side.
33: The lower part of the main undercarraige and the wheel.
34 & 35: Two views of the main undercarriage fairing panel attached to the main undercarriage struts that folds with the leg to fair with the fuselage.



36: Upper wing aileron, showing the hinge line.
37: Lower wing root, showing the rubber tread panel.
38: Bullet-shaped bracing strut crossover stay.
39: Pitot head, left wing strut.
40: Detail of the fairing over the centre section rear strut upper anchor point.
41: Interplane struts showing upper wing anchor point.
42: Front and rear cente section struts and bracing.
43: Lower wing interplane strut anchor point

44: A further view of one of the pressed metal fairings fitted over the centre section struts.

45: The centre section struts, viewed from the rear of the wings.

GRUMMAN F3F
AND THE TEXAS AIRPLAN

The story of how a quartet of reproduction F3Fs were planned and built by Herbert Tischler and his staff at Fort Worth Texas is remarkable achievement even in today's constantly 'over-achieving' aircraft restoration movement.

Originally a German national, Tischer's introduction to the full size aircraft industry began when he was Apprenticed to the German *Henschel* Company in 1941 when only age 14. Herbert was trained in aircraft metal work for three years before entering the Luftwaffe in 1944. Captured by the Russian Army in 1945 he was obliged to become a sheet metal worker in coalmines near Moscow until repatriated in 1949.

Working for the U.S.A.F., repairing all aircraft types at Erding, Germany, he became the foreman in charge, then decided to emigrate to Ecuador, working on rebuilds of small transport twins at Guayaquil. From there he moved on to Florida in 1957 to repair helicopters and build the prototype *Umbaugh* autogyro, as once seen at Farnborough, as well as a 7/10ths P-51 Mustang.

The vintage warbird bug must have bitten hard. He made a Curtiss P-6E Hawk from original 1931 drawings, then a Boeing P-12 which currently hangs in the *Boeing Museum of Flight* at Seattle. All through the almost thirty years it had taken Herb Tischler to make his name, as well as the reproductions and repairs, he had wanted to establish his own factory. This was realised in 1985 when a contract was arranged through Doug Champlin who co-ordinated other Museums in a four-plane project to create a short run of Grumman F3Fs and so the *Texas Airplane Factory* was established.

Each of the three F3F and a single G-32 two seater repros has a 1050 hp Wright Cyclone and adheres faithfully to the drawings provided by Grumman Aerospace Corporation.

In fact it was a flight of three F3F-2s that lost their way and crashed into a mountainside in Hawaii just a couple of months before the December 7th 1941 Pearl Harbour raid that contributed in no small way to the Tischler repros. The wrecks were recovered and taken to the T.A.F. facility so that parts could be compared with Grumman drawings. Many of the components were special formings, notably the streamlined teardrop section N struts.

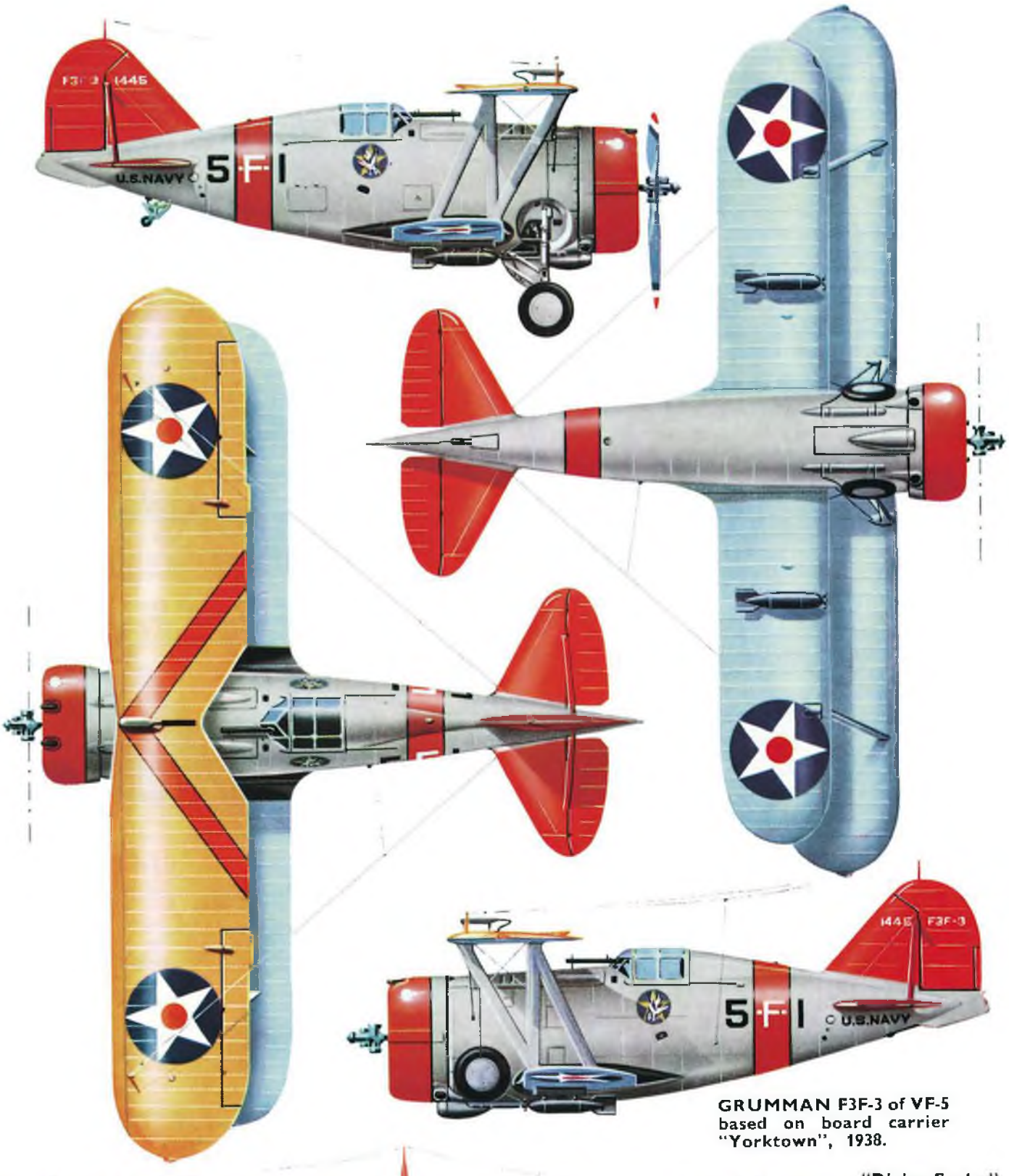
Modern operational standards have required changes in instrumentation and communication, and logical improvements such as replacement of drum brakes with discs, have been incorporated without any effect on authenticity.

With a staff of nine at most, each of them trained to Herbert's exacting standards, the T.A.F. completed its Grumman quartet by the end of 1992, one of which is a repro of the two seat version originally supplied by Grumman in very small numbers.

Two of the aircraft, an F3F-2 and a two-seat Grumman G-32, a small batch that was supplied to the US Navy late in the original production run, performed in memorable and spectacular fashion during the 2001 Flying Legends Air Show at Duxford, in UK. ■

RESURECTION
NE FACTORY

LEFT & ABOVE: The Texas Aircraft Factory Grumman F3F-2 reproduction seen at Duxford's Flying Legends Air Show in 2001.
BELOW: The Grumman G-32 two seat variant reporduction also flown at Duxford with the F3F.



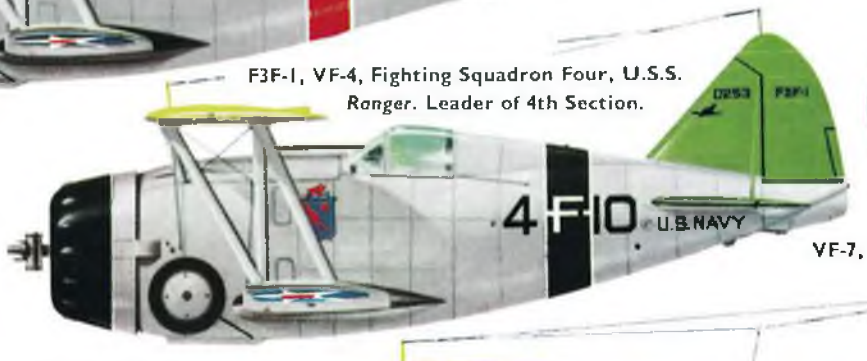
GRUMMAN F3F-3 of VF-5 based on board carrier "Yorktown", 1938.

"Diving Eagles" insignia.

F3F-1, VF-3, Fighting Squadron Three, U.S.S. *Saratoga*. Squadron Leader's a/c.

VF-3, "Felix The Cat"

F3F-1, VF-4, Fighting Squadron Four, U.S.S. *Ranger*. Leader of 4th Section.



VF-7, "Blue Burglar Wasp"

VF-4, "The Red Rippers"

F3F-1, VF-7, Fighting Squadron Seven, U.S.S. *Wasp*. Leader of 3rd Section. Note Neutrality Star on fuselage, April 1940.

3rd a/c of 3rd Section

VF-6, "Comet"

F3F-2, VF-6, Fighting Squadron Six, U.S.S. *Enterprise*. Leader of 3rd Section.

2nd a/c of 3rd Section

F3F-1, VF-4M (later VMF-2), Marine Fighting Squadron Four, 1937.

U.S.N. Section Identification Colours.

1st, 2nd, 3rd, 4th, 5th, 6th

Tailplane detail, upper surface only.

F3F-2, VMF-2 in overall grey camouflage, 1941.

Fuselage and fin lettering detail.

Gulfhawk 2, G.22 flown by Major Al Williams.

Wing detail, upper surface only.

On Silent Wings by Chris Williams

SCALE SOARING

In this age of Health & Safety considerations, some of the proposals brought forward in WWII can sometimes seem pretty far-fetched. One case in point concerned the idea that troops could be deployed in very large, lightly loaded gliders which, due to their low landing speeds could, if necessary, be safely crashed into trees to safely deliver their cargo! On top of that, due to the strategic considerations that meant aluminium was in short supply, these machines would have to be made of wood.

With even as few a number as fifteen troops, and a proposed landing speed of 38mph, the glider would have to be as big as a four engine bomber, and with such a light wing loading, would be very much at the mercy of the elements.

With a long history of glider production, *Schweizer* politely declined the proposition and set about looking for a more practical alternative. With the introduction of the *Waco* troop carrier, of which thousands were built, there came a need for a training glider. The TG3 was one of the results, and was constructed with a steel tube fuselage structure, and wooden flying surfaces. (There was an irony here: due to the restriction on the use of aluminium, and with so many companies in the USA producing gliders, there then ensued a shortage of aircraft grade spruce). In all, 115 TG3's were built, and many were privately owned after the war, although the need for a five man crew to rig, did not endear them to the sport flying community. Only a few still fly today.

So, why am I telling you this? Well, last year at one of the Middle Wallop events, my pal Motley (Geoff Crew) saw, and fell in love with, the quarter scale version of the TG3 that had been built by Colin Cousins and was now being flown under new ownership at the event. (His TG2 was also present). After the event, Mott went on the SSUK forum looking for information, but without too much in the way of success. Eventually he managed to obtain the 1979 Jack Hiner plan from the AMA in USA, which was drawn to approximately one-fifth scale.

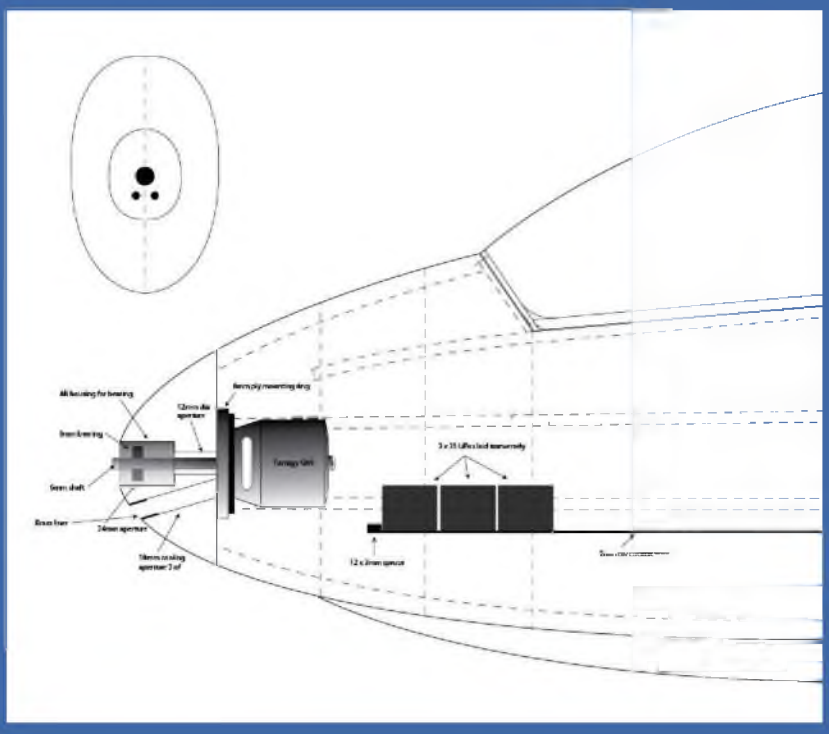
With a desire to produce a much larger model at 1:3.5 scale, the first task was to scale up the drawing in a way that would be structurally sound. For the fuselage this

The TG 3 takes to the air

was relatively straightforward, but we set about to completely redesign the wings to incorporate the HQ wing sections that we favour for our gliders these days. The lifting forces are contained with the use of two 15mm flat steel wing joiner bars. This system has huge constructional benefits, allowing the brass tubes to sit neatly between the main spars and as the wing roots butt against a flat-sided fuselage there are no wing root fairings to worry about. The wing was plotted and drawn in Compufoil, the ribs printed, ready for pasting to wood, and Motley set to the job with a will.

Seemingly in no time at all, the deed was done, needing only the comprehensive decal set from our other pal Smallpiece (Barry Cole), no mean task considering the size of the model. This was all happening around the Christmas period, and as the weather has set its face against any sort of slope flying, the maiden flight took place at the County Model Flying Club, on the border between Dorset and Wiltshire. Smallpiece supplied the tug and the TG3 duly took to the skies.

Geoff Crew (Motley) poses with his 1:3.5 scale Schweizer TG3 2 seater trainer



Details of the E-assist motor fitment

Extended shaft now emerges from the rear of the motor.

Tow release in position on the lower fuselage

Barry Cole's ingenious tow release mechanism

It proved to be a smooth and docile performer, and when it was my turn to fly her, it was with great reluctance that I was forced to hand the transmitter back to its rightful owner. (Mention should be made of Smallpiece's new Greenly tug, fitted with a Zenoah 62 and a self-starter. When it suddenly bursts into life, seemingly of its own accord, heads always turn!)

A success, then, and another rare opportunity to see this WWII type in action. All that remains is to photograph her on the slope, assuming the wind deigns to blow in the right direction one day.

IN THE WORKSHOP

The last time around I started to describe the current project taking place in my workshop. This is a French glider, the wing dihedral arrangement being reminiscent of my old free flight days as a lad.

The Wassmer concern didn't venture into aircraft production until the mid 1950s, when they began production of the Jodel D-112 light aircraft, a type familiar to many modellers. The 15m single-seat WA 22 Super Javelot was a later development of the Javelot II with the steel framed fuselage now fitted with a moulded fibreglass nose cone. This is a very similar construction type to many of my recent models from the Scheibe concern, such as the Topaze, the Bergfalke 4 and the very recent Zugvogel, and as I fitted many of them with E-assist, it seemed prudent to do the same this time around.

From the start it became apparent that this was going to be a challenging build. In defiance of normal procedure, the tailplane sits behind the raked back fin, rather like the much more modern aerobatic S1 Swift, and this makes it problematic for both bolting the tailplane on and attaching the elevator to its pushrod. Also, a mechanism for actuating the rudder internally would also be difficult, so a servo was fitted inside the fin. The three-piece wing is also a challenge, and I swore after building the Slingsby Eagle I wouldn't do it again! Retaining the outer panels is once again achieved with the use of the Multiplex Multilock system. This involves burying the nylon components in each of the wing roots and banging the wing panels into place. When it comes time to de-rig, the loud crack as the wing panel is knocked out of place can cause those of a nervous disposition to jump several feet off the ground!

My previous E-assist models have not been fitted with a tow release, as commercial releases are designed to fit in the front of the nose and would be difficult to fit with all the motor stuff in the way. As well as fitting a new, longer, backwards-facing shaft to the motor, Smallpiece came up with an own-design release that fits flush to the outside of the fuselage, and which is operated with the pushrod close to the inside surface. This allows the servo to sit under the tray that holds the LiPos and will give the model the ability to operate under the widest possible parameters, ie pure glider

View via the airborne camera

Barry Cole's Greenly tug does the honours

from the slope, E-Assist from the slope, pure glider or e-assist under tow, or autonomous powered glider from the flat. (In pure glider form, thanks to the front shaft bearing being recessed into the nose, the prop can be removed and a dummy plug can be fitted to hide just about all evidence of the E-Assist machinery)

At the time of writing, the model is in the covering/painting stage, and it will soon be time to put all that theory into practice...

SLINGSBY TYPE 25 GULL 4

Not too long ago I designed and built a model of the Slingsby Kite 2a, at the same scale as the Super Javelot. In due course I prepared a plan that was duly published. Some time later I received some photos from Luc Meneguz, resident of Grenoble, in south eastern France, who had purchased the plan and set about modifying it to produce a model of the Slingsby Gull 4. The fuselages of the full size shared the same frames, so were very similar in shape and construction, so Luc's main task was to modify the flying surfaces and rearrange the wing joining system to allow for the removal of the wing struts.

As he explained in his e-mail, "... I have finished painting the Slingsby. I found the real glider a little bit insipid, thus I invented a plan of painting, not history...". When you see the one remaining example of this glider, you can see what he means, it's an all-over rather faded looking white. I have to say, I like Luc's colour scheme so much, I'm tempted to build one myself... ■

c_williams30@sky.com

Author's version of the full size monocoque on the front of the glider

Author with the 1:3.25 scale Wassmer WA22 Super Javelot

French modeller Luc Meneguz with his Slingsby Gull 4

Author's original Kite 2a, from which the Gull 4 was modified

SURFACE PANELS

THOSE FINAL TOUCHES THAT MAKE THE DIFFERENCE BETWEEN A PLAIN SCALE MODEL AND A REALISTIC REPLICA

After preparing the surface skin of your latest flying scale model project, which has been done with anything from dope-and-sanding-sealer-over-tissue-paper, to resin-and-glassfibre-cloth, you will be at the stage of having a complete bare airframe without engine or undercarriage. You now have to decide what kind of finish you want and by now you will probably have in mind a colour scheme that applies to the aircraft that you have chosen to model.

But before you get to that, at this stage take time to study the surface detail of the chosen aircraft type, including the colour scheme, taking note of where panel lines are and where rivet lines appear, and also whether the rivet heads are domed or flush with the airframe surface skin.

Start by cleaning the entire airframe surface. If you have gone the glasscloth route, then go over the surfaces with cellulose thinners or, in the case of the dope-and-tissue technique, wipe it all carefully with damp cloths and then finally with a tack-rag. This gets rid of any dirt and grease that has accumulated on the surfaces during previous construction stages. It is a point worth noting that touching the model surfaces during the finishing stages will have advertse effects on your final finish since, when you touch a model, you leave a fine layer of grease behind. This will affect the way the paint is applied in that area, so be sure either to avoid touching, or wear disposable surgical gloves.

After the model has been cleaned in this manner, give it a primer coat. Grey cellulose primer is the basis of the surface painting stage. Make sure that the primer coat(s) goes on well and is free from uneven local patches. If necessary, and in the interest of keeping the primer finish even, apply several light coats rather than one heavy coat. Keep an eye on temperature, because cellulose is quite sensitive. If the ambient temperature is too cold and damp in the workplace where you are spraying, try to warm the air up before you start, otherwise you may get an 'orange-peel' effect in the paint.

Once the primer is dry, you can start marking out panel lines with a soft pencil; soft that is to avoid scribing into the surface. (**See Fig.1**). DO NOT use fibre tip pens because the ink can 'bleed' through the paint and ruin the job. When marking out, take care to reference your pictures/drawings often - it's easy to inadvertently deviate from what is correct. In most cases, it is preferable to mark-up the wings before moving on to the fuselage, but there will always be reasons to do it the other way round depending on the type of aircraft being modelled and on which part of the airframe there are the most prominent panel lines and associated surface details.

It is worth taking your time here, as it will pay off well on the completed job.

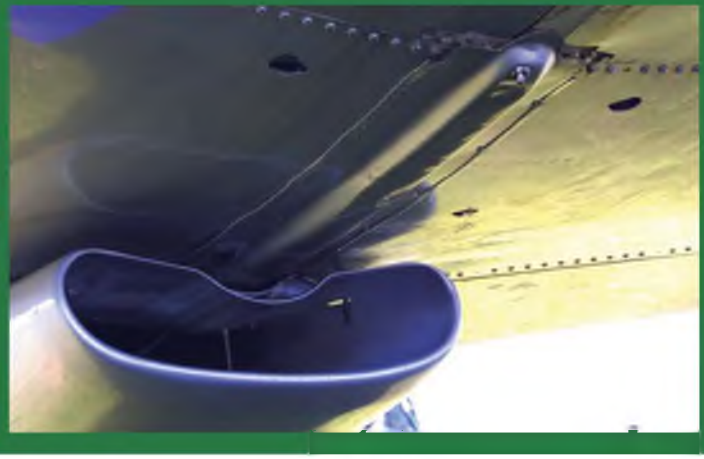
Once this marking-out is completed, you have to make a decision as to what type of panel line is required. There are three main types :-

a) The overlapping panel
b) The raised panel line
c) The sunken panel line

All of these are quite easy to simulate but, as with everything else, it's the preparation that dictates the quality of the final result. In each case, the panel line demarcations are achieved with masking tape of some kind. You can select the type used in auto-body spraying, or the tape marketed by *Tamiya* (the plastic kit people). Both of these are good because the adhesive surface is low-tack, which minimises the risk of lifting the primer coat when the tape is removed.

Common or garden parcel tape, of which *Cellotape* is the definitive example, have a much more 'tacky' adhesive surface, so there is more risk, when removing the tape, of lifting areas of the base surface with it. In such cases, one way of 'de-tacking' the tape is to run it

A-36 INVADER

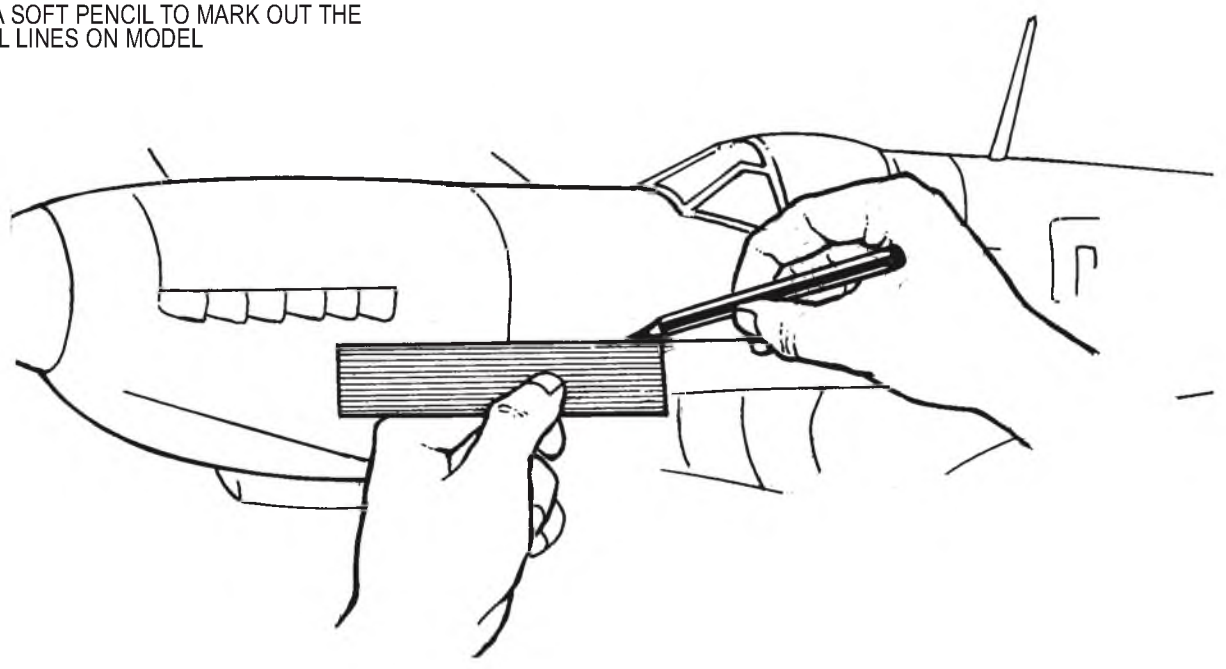


Not all of what might at first appear to be large rivets may actually be removable panel fasteners as seen on the engine cowl panels of this North American A-36 Invader/P-51A Mustang.

S & RIVET LINES

FIG. 1.

USE A SOFT PENCIL TO MARK OUT THE PANEL LINES ON MODEL



across your trouser leg prior to applying it.

OVERLAPPING PANELS

A further complication to the masking process in the case of the overlapping panel is that the larger the model, the thicker the mask will need to be, in order to simulate the thickness of the panel line edge. It may be that two, three or even more layers of tape will be required. In such a case, to get a good crisp tape-line, build up the layers over a 2 ft. metal

GRUMMAN F3F

GRUMMAN TIGERCAT

Grumman were big on overlapped surface panels and domed head rivets as seen on this F3F-2

Later WW2 aircraft types tended to use flush head rivets and butt-edge surface skin panels, but the Grumman F7F Tigercat still made extensive use of domed head rivets.

FIG.2.

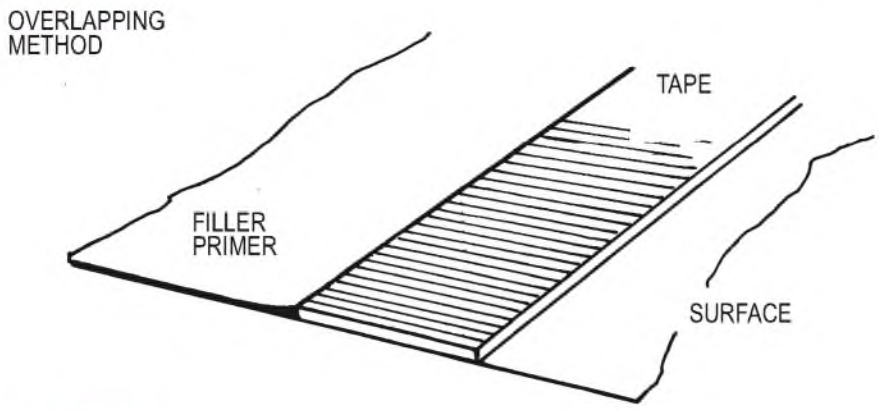
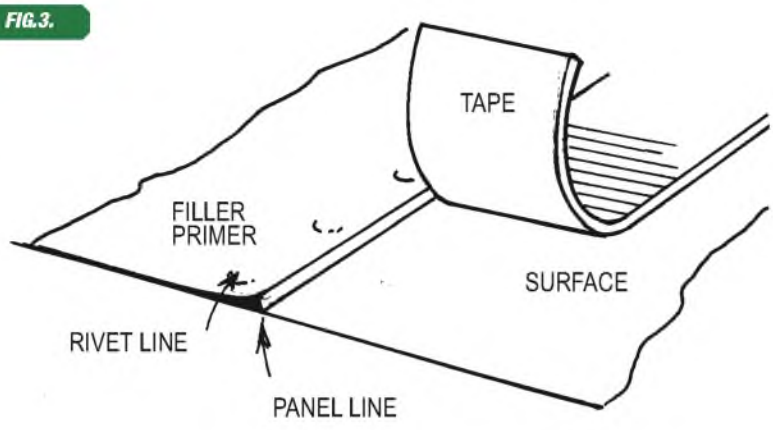


FIG.3.



straight edge, with one edge of the tape overlapping the edge of the metal. Then, trim off the tape overlap edge using a craft knife with a brand NEW super-sharp blade.

To simulate the 'overlapping' panel edges as per **Fig.2**, place the tape along the overlap side of the panel and apply successive coats of yellow primer-filler, building up to level with the edge of the tape mask. The number of coats required will depend on the size and scale of your model.

When the required depth of filler has been applied to level with the tape and the filler is all completely dry, then carefully remove the mask, being careful to hold the tape down against the surface as you draw it back on itself in order to minimise the risk of lifting the base paint surface. (**Fig.3**)

Although each individual panel is done reasonably quickly because the primer dries quite fast, panels can only be done one at a time. However you may find that, depending on the extent and disposition of panel lines required, it might be possible do them two or maybe more at a time if widely separated around the airframe.

Whatever, repeat the step until all the VERTICAL lines have been done. The same pattern of progress can then be followed to apply all the HORIZONTAL! panel overlaps.

RAISED PANELS

Raise panels (**Fig 4**) are achieved by applying two strips of masking tape in parallel just a few millimetres apart. In this case, the whole airframe can be treated in one hit to completely do the model. When all the tapes have been applied, mask off all the areas between the masked-off panel lines with newspaper and apply as many coats of yellow primer-filler as are required, leaving it all to dry between coats.

When it is all dry, carefully remove the masks ... and there you have it!

BUTT EDGE 'SUNKEN' LINES

Finally, there's the method of achieving the 'sunken' panel lines which define airframe surface panels that simply butt up against each other (**Fig.5**). These are achieved with ultra thin artists' tapes available from art stores.

In this case, apply the tape over ALL the pencil lines you have scribed onto the airframe surface. Then, apply the required number of coats of yellow primer filler, again leaving it to dry between coats. When the build-up is complete, remove the tape and, again, there are your panel lines. After it's all dried, you might care to then rub the surfaces over with a cotton cloth to remove any flaky bits.

FINISHING OFF

Once you have your panel lines in place, you should apply a coat of cellulose silver paint. Do not use enamel unless the final finish is to be applied in enamels too, because it will result in a reaction when the enamel is applied over the cellulose. However, the reverse - enamel over cellulose - does work

RIVETTING STUFF

With all panel lines done, any required rivet lines can be applied. Only the most diligent among us could possibly do a completely rivet-for-rivet job, unless the airframe is a very simple one, or where much of the surface skin has been internally spot welded. (One could well lose the will to live in the process!).

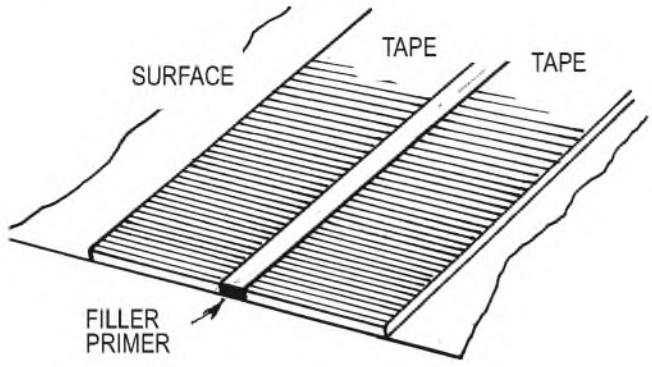
A good compromise is for rivet spacing

GRUMMAN WILDCAT

The Grumman F4F Wildcat was festooned with both overlapping and butt-joined surface skin panels, plus many access panels. The latter tended to sit proud of the basic surface skin - something else to be simulated, possibly with lithoplate, thick paper or thin card.

FIG.4.

RAISED METHOD



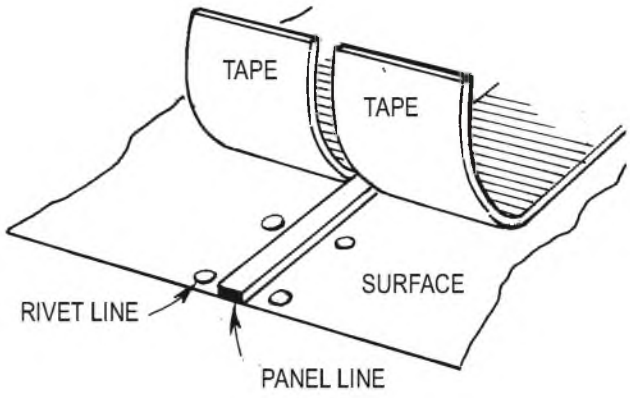
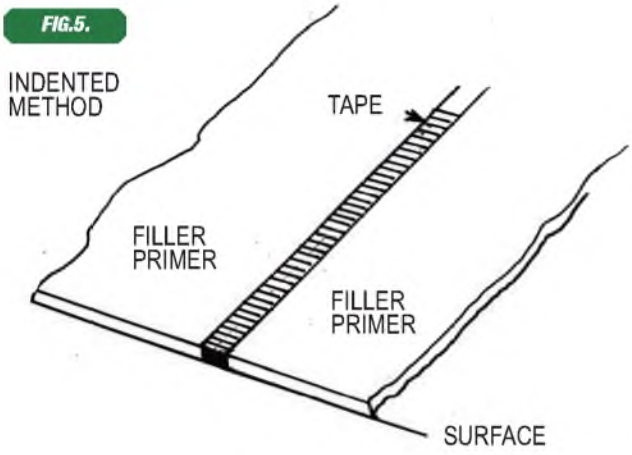
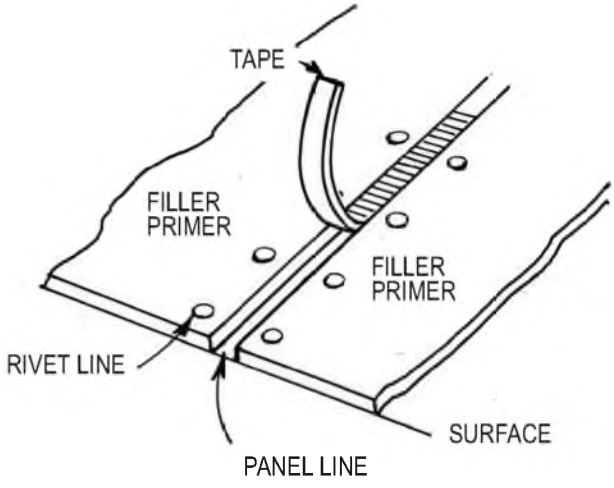


FIG.5.



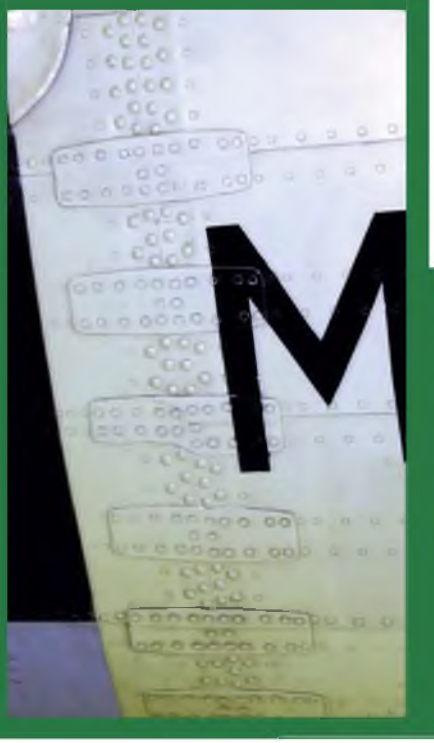


HAWKER TYPHOON

of from 5mm to 10mm. To achieve even spacing, the rivet positions are first marked out in soft pencil. Now come the rivets, the first of which is the domed-head type, the other flush with the panel skin surface.

The dome head type is achieved with a syringe and PVA type white glue (**Fig.6**). Remove the plunger and fill the syringe from the back with the PVA. Gently squeeze until there is a small blob of the glue on the tip of the needle, then touch down on the rivet mark and lift off. There you have one rivet head and the more you squeeze down on the syringe plunder, the larger will be the rivet head.

Practice is of course what achieves perfection here and, just as important - uniformity of size and shape, so a good long practise session is recommended before you 'go for real' on the model. Mistakes and imperfections can be rubbed off with a piece of damp cloth but be sure to clean off completely before re-doing the blob. Occasionally it



MESSERSCHMITT BF 109E

ABOVE LEFT: The externally applied 'fishplates' around the rear fuselage, just ahead of the tail section of the Hawker Typhoon was a classic example of a panic-fix that endured throughout the production run after early 'Tiffies' lost complete tail sections during dives.

The Messerschmitt Bf 109E featured mostly butt-joined surface skin panelling

FIG.6.

PRODUCING DOME TYPE RIVETS. SYRINGE FILLED WITH P.V.A. GLUE

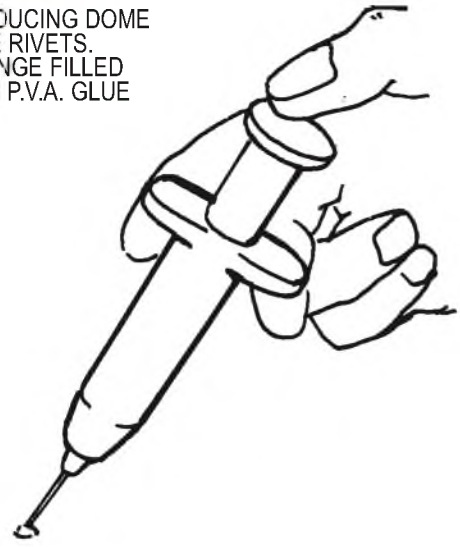
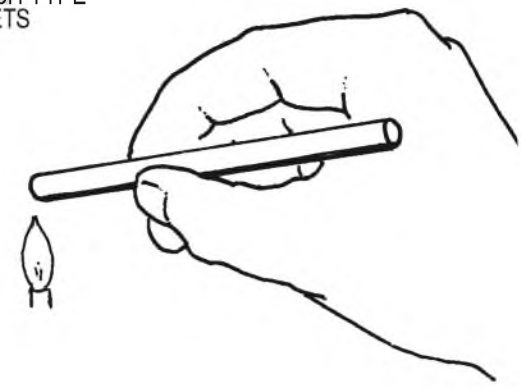


FIG.7.

HEAT END OF TUBE AND PRESS INTO PAINT TO FORM FLUSH TYPE RIVETS



will be necessary to wipe the needle across a piece of damp material to keep the needle clean as surplus glue residue begins to set.

White glue dries semi-transparent, so it will not be possible to see any rivets at all and you may wonder what you have spent so much time doing, but don't panic, they're there anyway!

The other type of rivet is the surface-flush type, which requires the same preliminary marking-out process. However, it does not entail the use of glue and is a 'dry-application' job using an appropriate diameter piece of brass tube, the 'business end' of which should be sharpened from the inside surface.

The rivet marks are then cut into the surface with the sharpened end of the tube that is slightly heated (**Fig.7**) before applying to the surface. It certainly should NOT be read hot, which would cause surface damage. The tube end is pressed onto the surface to melt the paint sufficiently to achieve the require indentation that represents a nice neat, flush type rivet.

As with the domed rivet type, uniformity is vital and practice in required before doing it 'for real'. ■

P-51D MUSTANG

The North American P-51D Mustang was an excellent example of butt-joined surface skin panels and flush riveting.

SEAFIRE 17

Overlapping panels were typical on the Royal Navy's Seafires. This is a bubble-canopy Mk.17. WW2 carrier-borne aircraft were subject to serious rough and tumble, so quickly acquired considerable surface panel dents - something else to think about!

SPITFIRE

Spitfires of all marks featured extensive surface panel overlapping. This one is a buble canopy Mk. XVI

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S.E.5A CD91
Shuttleworth Museum's airworthy example presented in full detail. (100 plus images)

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US military primary trainer aircraft that served with both US Army and Navy, thus providing ab-initio flight training for the majority of US airmen of the WW2 period. A highly attractive aircraft. 90 images of the preserved, airworthy aircraft, hangared at the Shutleworth Collection, Old Warden.

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The world's most numerously produced aircraft of all time, the P0-2 was a great maid-of-all-work used by both military and civil groups in the old Soviet Union and its satellite states. Example depicted is pristine, and now in storage at Old Warden. (170 images)

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