ANTOINETTE MONOPLANE
PART 1: 72" wingspan for electric power (Part 1)

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ON THE COVER

American Ray Stits is best know for his series of ultra-tiny 'world's smallest' flyable (full size) aircraft, most of which looked distintly odd. Infinitely more attractive was his 'Playboy' which Peter Miller modelled to 52" wingspan to produce this great looking sport-scale model for .30-40 size engine. Build it from the construction feature presented in this issue.

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Among WW2 Warbird types, the Supermarine Spitfire is one of the most modelled types, along with the Messerschmitt Me 109 and the North American Mustang. Like its primary adversary, the Me 109, the Spitfire was in service before 1939 and remained in service post-1945. (The Me 109 also continued in production and in service immediately after WW2 in Czechoslovakia, and also in Israel, where it was the first fighter type to equip the newly formed air arm of the equally new State).

The most often-modelled Spitfires are the Rolls Royce Merlin powered Marks, the Mk.IX, with its extended nose being the most common. When the Merlin engine gave way to the much larger and more powerful Rolls Royce Griffon engine, the Spitfire necame progressively a quite different aircraft under the skin, as the airframe was strengthened to cope with the enhanced performance and the shape changed with revised and enlarged tail surfaces, bubble cockpit canopy and a wing planform that was no longer totally elliptical whilst retaining a superficial surface resemblance to the classic Spitfire shape.

The Rolls Royce Griffon powered Spitfires deserve more attention from scale modellers and in this month's issue our chosen *'Subject for Scale'* is the very last of the line, the Spitfire Mk.24. It's still a Spitfire and a very aggressive looking shape, well worth a look!

SCALE WEEKENDS AT HUCKNALL

Rolls Royce Hucknall MAC summer event programme includes Scale orientated meetings: -

Electric Fly-In; May 31/June 1st.
For participants only, not open to general public, but includes a Swapmeet (Sunday only - £2.00 per table. Requires BMFA 'A' Certificate for pilots.

Scale & Jet Weekend; July 26/27th.
Open to general public and thus requires BMFA 'B' Certificate for pilots. Swap Meet Sunday.

For both events, on-site camping is available Friday afternoon, until Monday morning (£5.00). Access is via the Rolls-Royce No.2 Gate on the B6009 Watnall Road, Hucknall NG15 6FQ. The Airfield gates open for Sellers and Pilots - 09:00 'Fly-in visitors' & 'Swapmeet customers' - 10:00.
The Battle of Britain Memorial Flight 'Fly-pasts' have been requested for both of these events.

BIG DE HAVILLAND BEAVER

Truly outstanding aircraft types come in all shapes and sizes and one of the hallmarks of success can be gauged in longevity of service. Among such aircraft types can be counted the **De Havilland Canada DHC-2 Beaver.** Design work on this aircraft commence in 1946, intended as a rugged utility type and maid-of-all-work perfectly suited to operation in the vast, sparsely populated regions of the rugged Canadian outback.

Not surprisingly the wide range of tasks that the Beaver could undertake, gained worldwide recognition and in more that 20 years of production, more that 1,600 Beavers were supplied for both civilian and military service around the world.

From its inception, the Beaver has been a firm favourite with scale modellers. Now, Horizon Hobby's Hanger 9 range has introduced a big 110" (2794mm) wingspan, approx 1:5.2 scale ARTF rendition, designed for 30 cc petrol power.

Supplied fully covered, the airframe simulates all the surface skin corrugations that as such a prominent feature of the aircraft, the kit for which also includes ready formed radial engine cowl, dummy multi-cylinder engine and features 'scale' fuselage access via front fuselage cabin doors, where R/C gear is neatly hidden under scale cabin appointments and cockpit seats.

Big it may be, but Hangar 9's Beaver is made easier for transport thanks to the unusual feature of a two-part horizontal tailplane and there's another unusual feature in the optional scale floats so that the model can be operated from water- as did no many full size Beavers.

Kit price will be £679.99.

AND A BIG SPITFIRE TOO

The Hangar 9 range ARTF range is always expanding - this time with a new rendition of the Supermarine Spitfire MkIXc - the mark of the 'Spit' produced in by far and away the greatest numbers. With a wingspan of 81" (2057mm) it is to 1:5.5 scale (not 1/5th as the publicity blurb says), it is intended for 30cc petrol engine power.

Finished in the colours top-scoring ace 'Johnnie' Johnson when he was Leader of No.144 (Canadian) wing, the model is covered in realistic matt-finish film and the airframe is supplied ready for the optional fitting of E-flite electric retracts. and the model also features operating flaps.

Kit price from Hangar 9 stockists is £574.99.

Brian's Mustang has exactly the right sit on the Barkston tarmac.

The Lords of Scale at the BMFA Nats tend be conservative, with a small 'c'. They are one of the last redoubts of traditional build-it-yourself values - and generally, they tend to be prefer more traditional forms of model propulsion, such as glow and petrol. However, things are changing. Therefore, it is intriguing when established scale practitioners turn to new modes of propulsion.

Certainly, World Scale Champion Emeritus Mick Reeves and his equally gifted son Jim have flown very successfully with electric versions of their designs. However, given the long tradition of internal-combustion propulsion at The Nats, it is still remarkable when a notable scale man such as Brian Woods takes the plunge, and goes over to The Spark Side.

The Model

Brian has based his Mustang on the full-size example that formed part of The Fighter Collection at the Imperial War Museum in 1992. Brian travelled to RAF Duxford and took all his own photos and measurements. He also used the Arthur Bentley three-view drawing. However Brian says he is now minded to adjust his scheme to match the high-quality documentation in the well known Tamiya plastic kit.

Traditional plan

Brian Wood's Mustang is based on the celebrated 1/8th scale plan by

1

2

3

SPARKY MUSTANG

ALEX WHITTAKER TAKES A WALK AROUND BRIAN WOODS NEW ELECTRIC SCALE NATS CONTENDER

1: Nose art is sprayed on using masks from Flightline Graphics. 2: Brian did a lot of his lettering with Letraset. Kill markings are Flightline stencils. 3: This view gives you some impression of the quality of scale finish Brian has achieved. 4: Fin and rudder have trim tabs, of course, but also note the inspection hatches, and tail fileting. 5: Aileron and flaps lines visible in this shot. 6: The instrument panel is very carefully modelled using a Czech instruments kit.

4

5

6

7: Weathered drop tanks add to the scale patina. Essential for those long return trips to the Ruhr. **8:** Undercarriage is a modded Robarts system with DuBro wheels. Scale struts fabricated by Brian from solid aluminium billet. **9:** Wing cannon detailing is crisp. **10:** Brian fabricated the dummy scale exhaust. **11:** Tailwheel door detail.

Moose man / Candyman parked out on the Barkston tarmac.

scale maestro Brian Taylor. However, all is not what it appears. You see, 1/8th scale will deliver a Mustang of 69″ in span, but Brian (Wood) wanted a larger model and so he scaled up the plan by 25%, which yielded a 1/5th scale Mustang, spanning 88″.

Construction

Brian Taylor is renowned for the accuracy of his plans, and also for his absolute mastery of traditional balsa and plywood construction. Brian Wood followed this traditional approach, but added ply doublers for additional strength at the front of the fuselage, near the leading edge of the wing. He also increased the covering skin to 1/8″ inch balsa from 3/32″.

Wings

Brian built the wings as per the original plan, but he upgraded the main spars with laminated balsa and spruce. He used 1/4″ square rear spars, instead of the suggested 1/8″x1/4″ and also upgraded the rib webbing to cover both sides of the spar. The original wing skinning was 1/16″ balsa which Brian upgraded to 3/32″ balsa.

Radio

To achieve the correct centre of gravity, Brian positioned his radio and batteries at the rear of the wing aperture, in the rear fuselage.

There are three servos in the fuselage:
Elevator
Rudder
Retracting Tailwheel.

12: Scale undercarriage doors are crisply modelled. 13: Flap detail: note bright metal roots. 14: Candyman nose art on starboard side.

There are seven servos in the wing:
2 x Aileron
2 x Flap
2 x Fuel Tank Drop
1 Retract servo for the main undercarriage doors.

Undercarriage

Brian chose Robart retracts, which are popular on many 1/5th scale kits. However, he had to modify the rake angle. He also changed their operation to an electric screw-jack system, complete with control box, to give scale operation and speed. This system times and synchronises the operation of the undercarriage and the undercarriage doors. The undercarriage struts were fabricated from solid aluminium with scale details also made up from aluminium parts. Tenacious Brian hand-filed the forks from a solid block of aluminium! The tailwheel assembly is also home-made by Brian, based on the Taylor plan.

Wheels

These are Dubro scale items, with hubs from vacuum-formed ABS

Covering

The whole model is covered in glass cloth and resin, as supplied by Fighter Aces.

Paint

Brian used Flair Spectrum paint, hand-mixed for colour, then sprayed onto the model.

Legending

The ID markings on the tail and the

Canopy drawn back, the Mustang looks very convincing.

Candyman Moose graphics are sprayed on with stencils obtained from Flightline Graphics. Even the kill markings are stencils. The rest of then legending is hand painted, though much of the lettering is hand-applied Letraset. Brian has not finalised the legending, and describes it as 'a work in progress'.

Scale Details

The cowl, canopy, and underside intake were all fabricated by Brian who bought, assembled, and painted a kit of parts for the cockpit and dashboard from a Czech firm. The fuselage and wing access panels are made from aluminium tape. This is then detailed with impressions made by a brass tube, etcetera.

The fuselage has lots of cross-head screws and fasteners simulated with discs of aluminium tape impressed with a Philips head jeweller's screwdriver after first grinding off the point to give the required scale indentation. Flush rivets were simulated with a hot brass tube, heated with a soldering iron, and then pressed into the covering. He observed that rivets on the full-size wing are hardly noticeable. Therefore canny Brian decided to apply rivet detail only to 'strategically placed' areas.

This scale treatment was applied to the prominent machine gun covers, too. The machine gun barrels were made up from aluminium tube, balsa and chemical wood. Brian is currently modifying the aileron linkage to a fully-scale internal system. The external system was only a stop-gap, due to the looming 2013 BMFA Scale Nats deadline!

Electric power train

Brian used an E Max 250kv motor, with a 120 Amp electronic speed controller. The battery presently in use is made up of two five-cell 8,000mAh packs, a specification upgrade from the original pair of 5,000 mAh packs that did not deliver the required power for the demands of the Scale Nats flying schedule. This combination currently drives a 20x"10" prop, but Brian is still experimenting.

Dummy exhaust

The dummy exhausts were fabricateds from aluminium and brass tube with a fibreglass shroud.

Flying Notes

Brian's sally forth into electric flight has not been without its teething problems. His original 1/5th scale Mustang crashed at the 2012 Nats, and required a major rebuild. So he set-too over the winter and built the version you see here. As soon as you look at any of Brian's models, you note the quality of his work which is to very high standards of fit and finish. The current model looks very impressive on the

MODEL SPECIFICATION

Modified Brian Taylor 69" 1/8th scale Mustang design, enlarged by 25% by Brian Wood to 1/8th scale / 88" span.

Mustang:	P-51D
Scale:	1/5th
Wingspan:	88"
Weight:	23lbs
Motor:	E Max 250kv motor
ESC:	120 Amp
Battery:	2 x five-cell 8,000 mAh
Prop:	20x"10"

ground and in the air.

She definetly looks a Nats contender and embodies that indefinable Mustang glamour. She flies very well indeed from grass, but Brian notes that take-offs from tarmac require care. When the flaps are deployed (at 45 degrees) a predictable nose-down trim is established, which gives a solid feel in the air, and promotes smooth touchdown.

Brian says he is still experimenting with electric power. Half-joking, he does not rule out a return to his trusty Laser 240 twin! However, he reports he is learning all the time with this new method of propulsionand clearly sees it as challenge, experimenting with new batteries and props, and is confident a suitable balance between power and duration will be achieved.

Well known Nats conetender Brian Wood and his electric powered 1/5th scale Mustang.

Candy Man / Moose coming in on the 2013 BMFA Scale Nats' cross-wind runway at RAF Barkston Heath.

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Techno Scale

Mike Evatt b

Maxford USA with a web presence of www.maxfordusa.com is a rapidly growing importer and distributor of radio control model airplanes. Their mission is to provide better R/C products and services for their customers. 99% of their products are designed in US and imported directly from their OEM manufacturer's factories. I particularly liked their Hansa-Brandenburg W.29 EP ARF Float Version. The original Hansa-Brandenburg W.29 German fighter monoplane floatplane was a new type of seaplane evolved by Heinkel during the last months of 1917 and served during the closing months of World War I. This model has a wing-span of 53ins and is designed for electric power.

The **Warbird Replicas** range of kits has been around since 1993, and has built a solid reputation for easy construction combined with relaxed flying qualities. Whether you are a new or experienced builder, Warbird Replicas kits will give you back the unique feeling of building and flying something that you have created. Their 57ins span Lavochkin La7 is no exception. Their concept of total design means that they don't just sell you a kit and then leave you to find all the difficult accessories, each kit includes a range of optional but strongly recommended extras including near scale decals, retract packs complete with comprehensive instructions, pilot & cockpit sets and wheels. Check it out at www.warbirdreplicas.co.uk

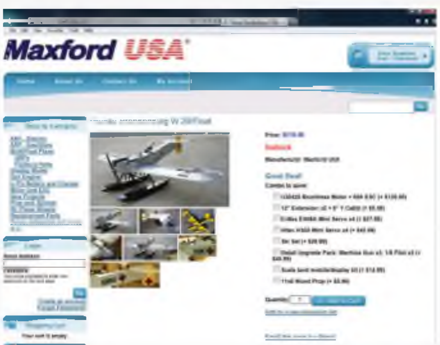
Vintage R/C Plans at www.vintagercplans.com specialise in the sale of fine-quality vintage R/C Airplane plans. They also offer associated plastic parts such as cowls and wheel pants for certain models. 'Vintage R/C Plans' was originally created by Fred Novack's wife's Uncle, Sid Morgan. He started the plan service in the late 1960's. More than half the plans were his own drafting designs. He purchased the balance from Robert Sweitzer (his 'Custom Line') and added them to his own line. Both Uncle Sid's and Mr. Sweitzer's prints are truly works of art. The featured airplane: Rearwin Skyranger" is 108" Wingspan and printed on four big sheets.

Fiberglass Specialties Inc claims to be the World's largest manufacturer of superior epoxy-glass cowls, wheel pants and accessories. All the major plan and kit companies are covered. They cover literally hundreds to components all deigned to make your life a little easier.

Click onto www.fiberglassspecialtiesinc.com for full details.

www.thelikesline.com is the web address of **The Likes Line Retracts**! Their mantra is: "Your Landings Are Only As Good As Your Landing Gear! We'll Give You a Higher Level of Performance!" The Likes Line Retracts have an electrical jackscrew operation that provide both standard and rotation strut movement. Retracts are available for 90-120, 1/5, 1/4, and 1/3 size aircraft. The retracts come complete with struts, battery pack, charger, and switch harness. Retracts have adjustable strut speed and angle.

Hitec RCD at www.hitectred.com was formed in 1973 with a mission to bring burgeoning technology to a worldwide audience. With a passion for modelling, they soon dedicated themselves to developing the most innovative products and advancements in the history of radio



A Hansa-Brandenburg W.29 Float Plane from Maxford USA.

Warbird Replicas' 57ins span Lavochkin La7 is superb.

Vintage R/C Plans in profusion.

Fiberglass Specialties Inc claims to be the World's largest manufacturer of epoxy-glass parts.

The Likes Line Retracts have an electrical jackscrew operation.

Weekender Warbirds from Hitec RCD.

rowses hyperspace for more TechnoScale Topics...

control. In 2003, their acquisition of the esteemed German-based Multiplex, combined the strengths of two respected brands to allow for extensive expansion of their product lines. Most people still think of servos and radios! You should also look at their Weekender Warbirds!

Kamann & Partner run an on-line model enterprise at http://fun-modellbau.de This is one of the largest dealers of wooden construction and scale models in Germany. At the start, they began with a few kits. After much development, they can deliver today over 450 different wood construction kits in scale 1/6. As well as selling the very well proven KOLM motors they are an official sales partner of PEGASUS ENGINES of the United States. They also work closely with the Czech manufacturer of large aircraft Zlin-Aviation and offer stunning Zlin models in 1/2.5 and 1/3 scales. All models are produced from the same materials as the original, so the hulls consist of welded 4130 steel tube and the wings are built from 2024-T3 and 6061-T6 aluminium.

BP Hobbies LLC, at www.bphobbies.com formerly *Balsa Products*, was founded in 1989. The company was originally milling balsa wood and making hand-cut R/C airplane kits. In 1998 they started importing and selling servos. Since the growth of electric flight they continue to expand their product lines to bring you latest exciting products and technologies. Here you will find the RCGF 30CC Twin Gas Engine from China; the smallest RCGF twin petrol ignition engine to date! It is recommended that an 18x8 propeller is used for best performance giving circa 7800rpm.

White Rose Engineering at http://whiteroseeng.com is a company who make superb CNC components to improve your take-off and landing. They offer four different models of tail wheel. Three models feature carbon fibre springs, the other features a titanium spring. Their main wheels are CNC machined from 6061 billet aluminium and are offered in multiple spoke styles. Most of their wheels come with tyres especially moulded for them in moulds they manufactured in their workshop. Also available are friction type disc brakes to slow taxiing and shorten the landing roll out.

Heli-Max designs cutting-edge helicopter models that make the hobby fun for newcomers and experts alike. Check out the many choices available. Whether you're looking for one that's easy to fly, aerobatic, scale, or suited for indoor or outdoor flight, you'll find it at www.helimax-rc.com

Their 1/43 scale version of the Sikorsky UH-60 Black Hawk has a 425mm rotor. From the rotors to the rubber tires, their bird is the spitting image of the Black Hawk. It's also much more. A collective pitch rotor head and variable pitch tail rotor let this model perform aerobatics that would get you kicked out of helicopter flight school!

At present the firm **Valenta Model** is the biggest producer of wide range of model aircraft in the Czech republic, be its models designed by Vojt_ch Valenta or models based on real airplanes. The original Foka first flew in 1960 and gained third place in the Standard Class at the World Championships at Koln-Butzwerhof, Germany, in that year. The company sells a semi-scale model of FOKA 4 glider in scale 1:5. The model is suitable for slope flying and also it is possible to launch it using aerotow. The model is sturdy enough for complete acrobatic flying and excellent gliding properties. Log-on to www.valentamodel.cz and take a peek! ■

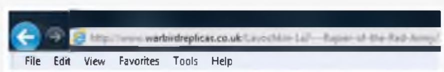
Kamann & Partner sell stunning Zlin models in 1/2.5 and 1/3 scales.

The smallest RCGF twin petrol ignition engine to date!

White Rose Engineering offer superb CNC manufactured wheels.

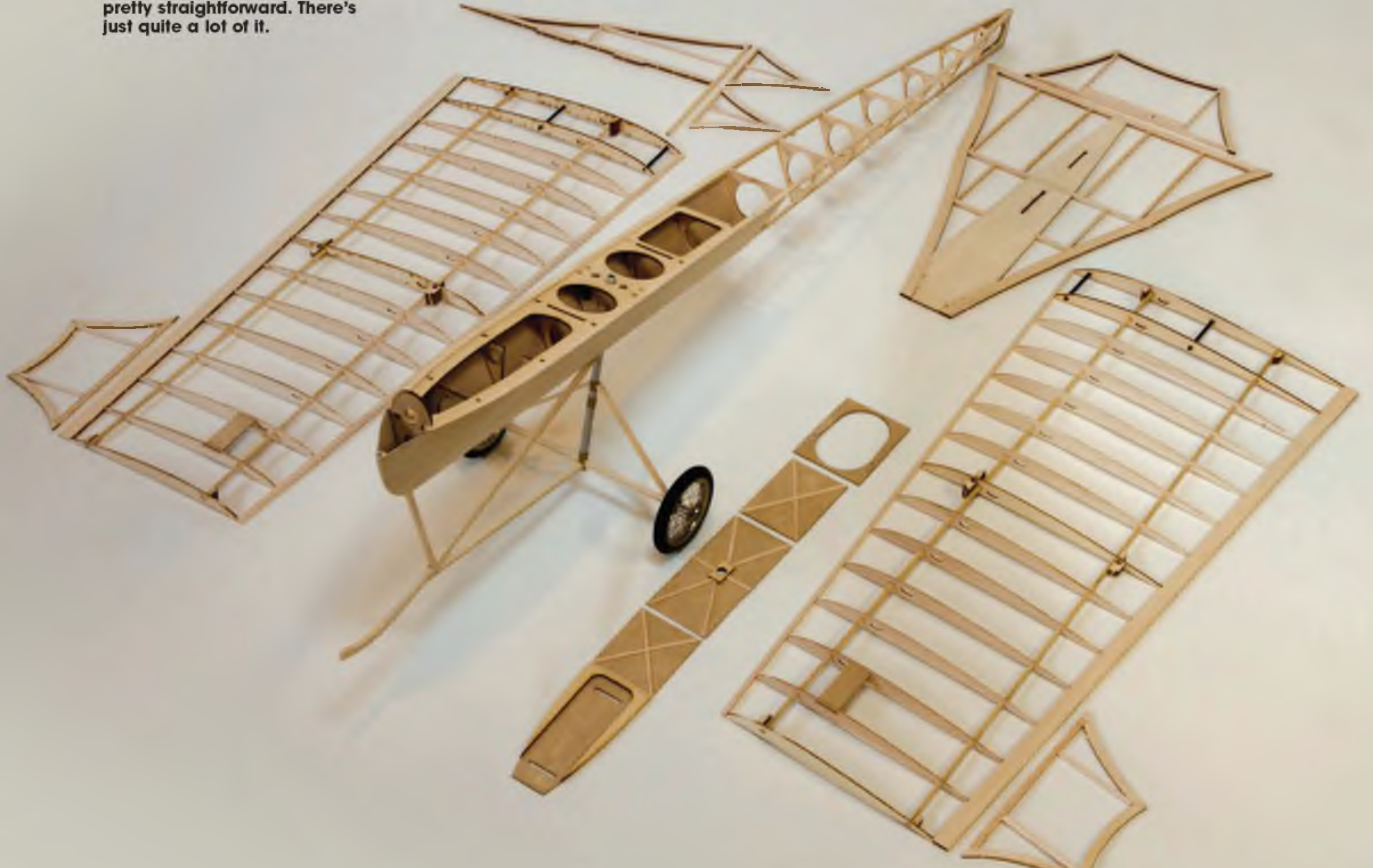
Heli-Max's1/43 scale version of the Sikorsky UH-60 Black Hawk has a 425mm rotor.

Valenta Model sells a semi-scale model of FOKA 4 glider in scale 1:5.



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

mikeevatt@hotmail.com



The finished sub-assemblies reveal that the structure is pretty straightforward. There's just quite a lot of it.

Antionette Monoplane

PART 1: A 72" electric powered model designed by Peter Rake with the prototype model built and described by Barry Maas.

This model, which is a bit bigger than I normally draw, is the result of a request from a prospective builder. Unfortunately, the builder in question ran into the problems life tends to throw at us from time to time and was unable to complete the project. What his model did demonstrate is that there must be some issues with the three-view drawings available - or that the Antionette was a very strange creature indeed.

The model doesn't represent any particular variant of the type, being more of a composite Antionette based on what drawings and photos I could find. However, all drawings found seem to put the wings in the same position, relative to the wheels. The issue I referred to is that all the reference drawings I found place the wing position such that the fore/act balance point is in front of the wheels, meaning that the original model was permanently sitting on the front skid -hardly the ideal arrangement for take-off and landing, and not at all how the original aircraft sat.

I decided that the simplest solution, and the one that best retained the overall appearance, was simply to move the wing slightly rearwards so that the wheels are in front of the balance point - only just in front it's true, but in front of it nonetheless. That's the big disadvantage of drawing with CAD. You spend so much time zoomed in to achieve accuracy that you don't get an overall picture of such things as where the balance point is relative to the wheels. With a model as big as this one, once you can get the whole thing on the screen such details are too small to see clearly. That's my excuse anyway, and I'm sticking to it.

It was at about the time when I had revised the drawings, that Barry volunteered to do a prototyping job on the model, the result of which is the model presented here.

So, without further preamble from me, I'll hand you over to Barry for all the details of the build.

Having spent most of my adult life around aeroplanes, I've found that there's an ebb and flow of aviation era interests. It's not so much a general lack of interest, but changing interest in styles, types, and eras of aviation. My most recent interest is in early aircraft - the ones that a group of people really took a lot of risk in building and flying. In the early 1900s, aircraft development was the all the rage, and the competition was on to do things with aeroplanes that had never been done before. Everyone wanted to be the first!

French engine manufacturer Antoinette was drawn to this competition and in 1903 began developing aircraft engines, which led to the design and construction of the Antoinette aircraft. The aircraft went through eight versions, and can be credited with creating the first flight simulator and the flight control surfaces known today as ailerons. The aircraft competed to be the first in crossing the English Channel, but both attempts ironically resulted in engine problems that ended in a water landing, short of the coastline. In the end, former employee Louis Bleriot won the competition, although the Antoinette went on to break another record: highest altitude (509 ft). All of this was not a small feat for anyone, but a quick study of the aircraft controls show no control column - only wheels on the sides of the cockpit that controlled roll and pitch, as well as rudder pedals. It literally took both hands and both feet to fly, and one has to wonder what the pilot used to control the throttle!

Model aircraft designer Peter Rake found this aircraft to be an interesting example of early flight, and in 2010 developed plans to build a 72" model. It would weigh approximately 3.5 lbs, would be fully electric, and would have optional ailerons. It came together to be a combination of numerous versions of the original aircraft.

Having built a 1913 model in the past, I was not only interested in the Antoinette, but I felt comfortable in my building skill (especially around tension lines and unsupported structures!), so I contacted Peter for the plans and had a set of laser cut parts prepared. I opted to utilise the features of versions VI and VII, which included the ailerons. The features such as the dummy engine and water/fuel tanks looked sufficiently challenging, as well.

FUSELAGE

The short kit from which the prototype model was built arrived within a few days after ordering, and the quality of the plans and the cutting were superb. There were about a dozen sheets of balsa and ply. Some of the balsa was a little dinged in transit, but it's nothing a little steam from the teapot didn't correct. *(A similar short kit, hopefully minus the dings, will be available from the publisher. PR)*

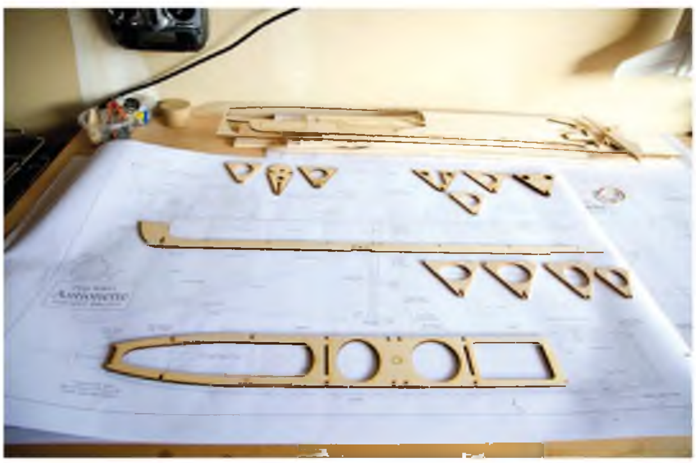
The fuselage went together like a cut puzzle. Just mocking it up, without glue, the structure was incredibly strong and held together perfectly. The longerons for the empenage went on next. The plans have these starting at the firewall, running all the way to the end of the empenage. Laying out the plans for the length of the fuselage takes two sheets, so one must be careful to line them up correctly. Total length of the fuselage should be 57".

It takes four basswood longerons on the top and two on the bottom to reach the end of the fuse. I joined each longeron with a diagonal half-lap type joint, and glued them up. Once dried, these fit into the cut slots on the formers easily, and again I warmed up the teapot to steam the front section to shape (leave them a little long to help lever the shape while steaming).

Once the glue had dried on the front end I cut the overhanging bass and then went to work on the aft end. Matching up the longerons on the aft is as simple as laying them over the plans and cutting them to mate evenly. If done correctly, there will be no twist in the empenage.

From there I put the aft formers in place and glued it all up. This is where I started doing damage to the aft end.

The bass longerons are square, and as you can see the fuselage is canoe shaped. This meant that the length of the longerons needed to be sanded/trimmed/shaved to match the canoe shape. The only tool for this job is the razor plane - which worked wonderfully. The razor plane literally cut

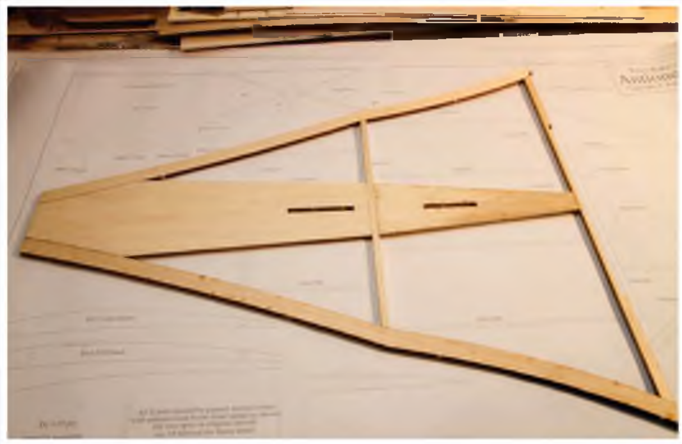


The ply components that go to make up the bulk of the forward fuselage.

The front end keys together nicely to form a very sturdy assembly.

With the longerons and rear formers fitted you can see what a long, narrow fuselage this will be.

Barry did a really tidy job of skinning the forward sides and capping around the keel parts. Note how early you need to fit some of the u/c wires.



Nothing in the least complicated about the tail surfaces. Just assemble the laser cut parts and some strip over the plan.

The wing ribs are slid onto the spars, adjusted to match the spacing on the plan and then you build a wing around them. Ailerons are strictly optional on this model.

hours off of what could have been a sanding nightmare. The flip side of this coin is that the planing action left no former intact. They're soft balsa, and simply looking at them wrong will make them break. Which they did - a lot! *(Honestly, it is possible to plane the longerons without damaging the formers. Hold the fuselage by the two longerons not being planed, rather than by the formers, and stop planing just before you reach the formers. Finish of with a large sanding block. PR)*

Even with broken formers, the whole thing went together great, and for the first time in my life I had no twist in the aft end.

Once the main fuselage structure is in place, it's time to plank. The plans note that you can plank the side, and then build up the nose area with soft balsa, or you could plank it up as well. I like woodworking, and I love full grain without breaks in it, so I really wanted to plank the main body from front to back to keep the continuity of the wood.

I started with a 12"x24" piece of 1/32" ply, and carefully cut it to size. After dry fitting the siding a few times, I took the plunge and tacked it down with a bit of CA. After getting comfortable with the idea that maybe this would work, I glued the main side down and steamed the front end over the teapot again. A few minutes later I glued up the nose area, clamped it down and called it a night.

The next day I pulled the clamps off and carefully cut the round of the nose to match the ply keel. It really looked great having a one piece side and the curves were gorgeous. I repeated on the other side, and the results can be seen in the picture.

If this model is anything, it's an exercise in woodworking (which I love). There's so many ways to approach the siding, trim, decking, etc that require basic cabinet making skills to make it really stand out, and cover up those inevitable boo-boo's

Once I had the siding done up, I wanted to hide some of the keel and the glue spots that wouldn't take a stain, but I also had to get the landing gear in place first. Following the plans, I bent piano wire to the shape of the front landing gear supports. Peter had slots cut into the keel for these, so it was a simple matter of putting the wire in the slots and fixing it with epoxy (the aft wire slot has holes in the keel to wrap the wire in thread or fishing line. I used fishing line and sealed it all up with epoxy). The fore wire fits into a longer slot, and again I fixed it with epoxy.

Once these dried, it was time to trim the keel. To do this, I used 1/4"x1/16" basswood strips, again, using the steam from my teapot to curve the basswood trim around the nose keel. Once the trim was in place, it was a simple task to sand it to the canoe shape of the fuselage. The result is a nice clean line on the keel

LANDING GEAR

I had to figure out how to make the undercarriage woodwork. Everything except the main landing gear tube is wood, and I was having a devil of a time trying to figure out how to curve the wood, yet keep some strength. After some thoughtful evenings, I came up with a possible solution.

What I did was buy a bunch of 3/8"x1/16" bass stringers, and then laminated them up to create a curve. Before putting the last laminated stringer on, I routed out the centre of each piece, so that I could place it over the piano wire. This technique worked like an

Possibly the most elegant aircraft ever built, although I'm still not sure about that tall seat Barry fitted.

absolute charm. I'm sure that anyone with a bit more foresight and skill than I could make these things so well that you wouldn't even know there was any wire in there!

The wheels for this model are the TopFlite 4" spoked wheels. You can see in pictures how I tied all the piano wire together. I was a little sceptical about the strength, but once the basswood was in place, any scepticism I had went away. If anything, the main gear is too stiff!

To finish it all off, I sanded it all down, then filled any gaps with wood filler and sanded again. Finally, I knocked down the edges so that they are even and have a slight, soft, curve to them.

ENGINE

During the build, I looked and looked for some scraps from which to build the engine. After looking around quite a bit, I found the perfect bits and pieces in the wood section at our local craft store. They were 1" round end-caps and 1" square blocks.

Building the cylinders was a matter of cutting a 1" dowel down to size, and then gluing the round end cap on. Building the 'block' part of the cylinder was a bit trickier. I had a 1" round sander that I spun up in my drill and sanded an arc into the block. Once I had that, I rounded the edges on my Dremel router table. Then I simply glued it onto the cylinder and filled the gaps with wood filler.

The grain on the built-up cylinders was pretty obvious (especially after I test spray painted one). It took about threevor four coats of the filling primer to smooth out the wood grain, but it worked like a charm. Once this was done on all cylinders, I drilled holes for the exhaust stacks and air inlets. After that, it was a simple matter of finding some brass coloured spray paint (which is harder to find than you'd think), and painting up the cylinders.

FLYING SURFACES

The wings went together like a well cut puzzle. After conferring with Pete, I opted for wood dowels as the main spars instead of the carbon tubing. The support wires will take most of the load, and this proved to be true when I mocked up the final wing and wired it up. It's stiff!

There's nothing particularly special about building the control surfaces and vertical/horizontal stabilisers. They were easy, and once built I cut the slots for the control hinges.

To make the kingpost and wing support posts, I simply cut a dowel down, stuck it in the chuck on my drill and sanded it to shape. Using a pin vice, I drilled a tiny hole in the top and epoxied a small brass ring (used in boat modelling) into it.

It's should be no secret by now that this plane is huge. 72" wingspan is more than my car can handle, so I had to find a way to make the wings removable, while still maintaining the support structure. After much thought, I came across some small turnbuckles used in boat modelling. This turned out to be the perfect solution, as I could put the turnbuckles on each of the main support lines. This not only allowed me to remove the wings for transport; but to also adjust the tension on each line as required. It was a win/win situation!

Here you see the false structure on the ply top fuselage plates, and the way the pylon is let into the main u/c tube.

STITS PLAYBOY

Build this classic and cute little homebuilt aircraft from the 1950s era. Peter Miller designed this 47.5" (1207mm) span R/C model for .20 -.30 size two stroke engines or .30-.40 four strokes.

The Stits Playboy is a home-built designed and built by Ray Stits in 1952 and was fully aerobatic for its day. Ray is probably better known for his series of 'World's Smallest' aircraft such as the Sky Baby and Baby Bird. I have three views of the latter and a 1/4 scale model would span 18.75 inches (476mm)!

The model shown on the plans is the original prototype. However, if you search the Internet, you will find several other versions. One has a cut-down rear deck and bubble canopy, another has wings with tapered tips instead of round and this particular one also has large wheels and no spats.

There are several variations of canopies and cowlings and there are several colour schemes to choose from as well. You can also find examples of instrument panels to dress up the cockpit - I find that 'Google' is the best internet search engine for aircraft.

The model is to a scale of 1:5.5, chosen because it gave the desired wing area for an SC 30 FS. The power range would be .25 to .35 two strokes or .30 to .40 four strokes, but I would point out that the performance at the top end of the range would be decidedly non-scale.

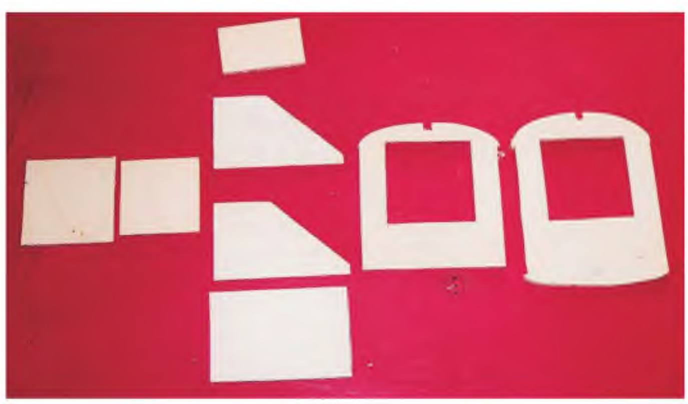
Building is pretty simple - one of the advantages of modelling a homebuilt and the model is very light, an essential for aerobatics.

Fuselage

Start off by making up the 3/32" sides and laminating them with the 1/32" ply doubler. Note that the sides have a bend in the top line. I made them in two pieces as this saves a bit of wood. Note also the hole cut in the doubler, this is to make bending the sides easier just behind the cockpit.

Join the sides with F-1, F-2 and F-3 and leave to dry. Add the triangular stock in the corners at F-1 and F-2. This stiffens the unit up before joining the fuselage at the tail and

Fuselage side components, note two piece side and hole in doubler.



F-1, F-2 and the engine mount box parts.

fitting the remaining formers. When joining the rear of the fuselage fill-in with scrap wood as shown to take the lower rudder hinge. Add the cockpit floor.

The engine mounting box is made from 1/8" ply, note that the front has a piece of ply inside the box and a second piece right over the front so you end up with a 1/4" ply front.

Fit the box into F-1 and F-2 carefully. You need to set the distance in conjunction with the engine so that the prop driver extents just outside the cowl. If using a two stroke engine, you may need to make the box longer or use the same four-stroke mount employed for that type of engine. The turtle decks are from rolled sheet, the technique is simple - for those who don't know it I will tell you my system.

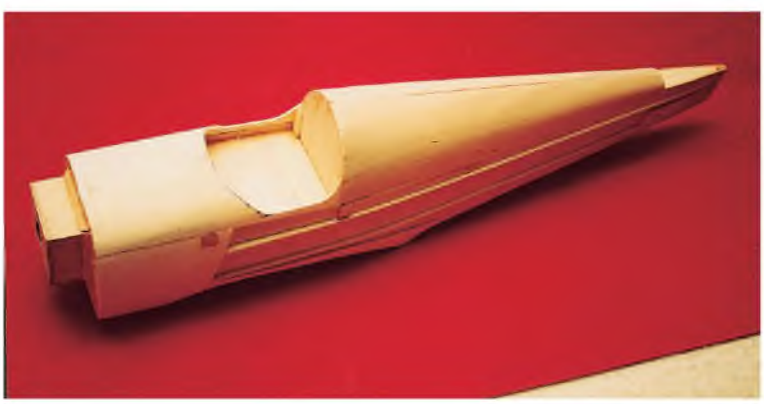
Cut pieces of 3/32" sheet which bend easily across the width. Glue these to the sides only and allow to dry. Now wet the outside of the sheet and apply heat from a heat gun while bending the sheet over the former.

Trim one piece to patch down the centre of the spine and then repeat for the other side. Make sure that when they meet, they also conform to the formers, you don't want gaps between the sheet and the former.

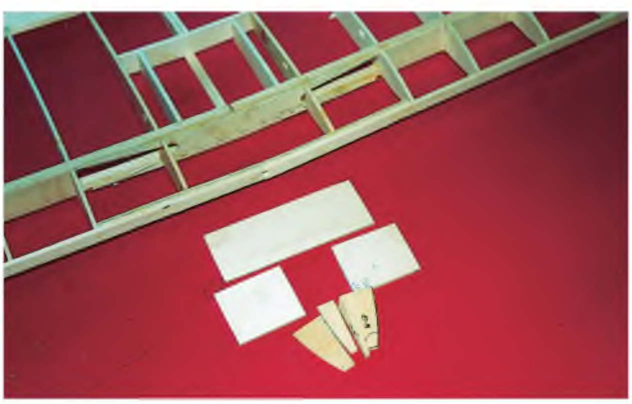
Once satisfied, glue them down. Note that map pins work best as they are short and can be pushed right home, the large heads holding the sheet down.

Add formers F-1a and F-2a. and the side stringers. Remember that the side stringers will need to be trimmed to allow forr the sheet at the front. Add the 3/32" sheet outer sides. The photo shows my model. I made a mistake and allowed air exits each side of the cowl. The version shown on the plan is correct.

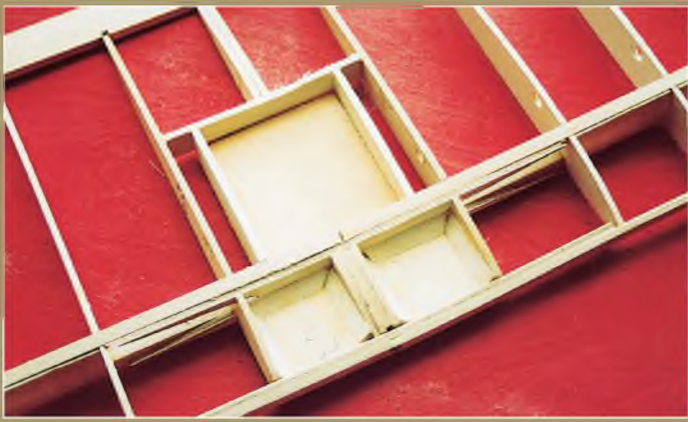
Fit the 3/8" wing seat and lower 3/8" sheet between F-1 and F-2. Blend all these together as shown, to fair into the front outer sides. Fit the snake outers and then add the ply tailwheel mount and the bottom stringers.



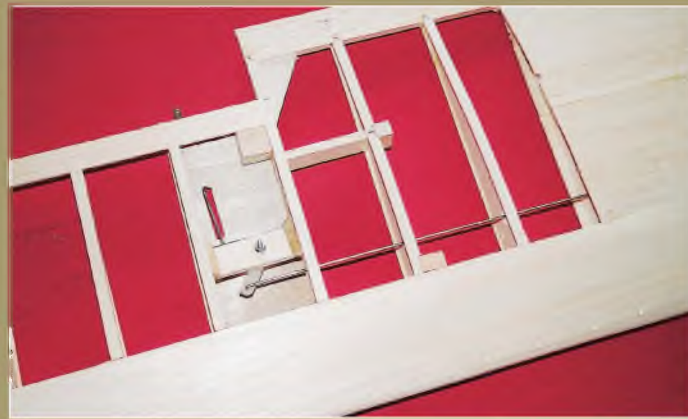
Fuselage completed.



The parts for the undercarriage mount in the wing.



Top view of the completed mount.



Aileron bellcrank bay, the 1/64 ply on the bottom is the neatest way of making the outlet slot for the pushrod.

The cowl is built up in wood. I made a pattern for mine and had it vacuum formed. To build the cowl, cut out the two formers and the core pieces.. Spot glue the formers to the core and then add the 1/4″ square stringers, cover with 3/32″ sheet and add the front form two laminations of 1/2″ sheet.

The cowling is held on with what I consider a rather neat idea. There are two screws at the top of F-1 and two corresponding slots in C-2. There is enough free movement so that when the cowl is fitted, it to allows the slots to slide over the screws. Two more screws through holes in the bottom of C-2 hold the cowl firmly. I have used this method on another model with great success.

Wings

The wings are completely conventional and very easy to build - the only bit that is unusual, is the undercarriage mounting.

Just to run through the basic structure; pin down the lower spar, then fit the ribs except the R-1s. Add the 1/8″ sheet leading edge and webs. When dry, rock the wing back and support it on scrap 1/16″ sheet, this is to allow the trailing edge to be fitted at the right height to take the sheet and capstrips later. Now fit the trailing edge.

The ailerons are built on now, but left attached to the wing. Add all the blocks for hinges. I used Great Planes Pivot Point Hinges but these seem to be unobtainable these days, I have to rely on friends in the USA for mine. Robart make similar ones, but they are much bigger.

The wing tips can be added at this stage or left until later. They are cut from 1/8″ sheet. The outlines are added later.

Joint the wings using the dihedral brace and the leading edge brace. Now comes the tricky bit, well, not really tricky, just different.

Make up the front of R-I by laminating R-1a and R-1b. This will leave you with a sort of socket that takes the wing dowel later. Fit the 1/8″ ply plate between R-2s and add the R-1a/b laminate. Now fit 1/8″ ply pieces between R-1bs and R-2s. The double the thickness to take the screws that hold the undercarriage. Fit 1/4″ triangular stock in the corners.

Groove the undercarriage plate as necessary for the dowel to fit in its socket. The undercarriage is a dural unit that cost £4. Add R-1cs and the parts for the servo mount and also now fit the tips if you have not already done so. Fit the aileron bellcranks as shown.

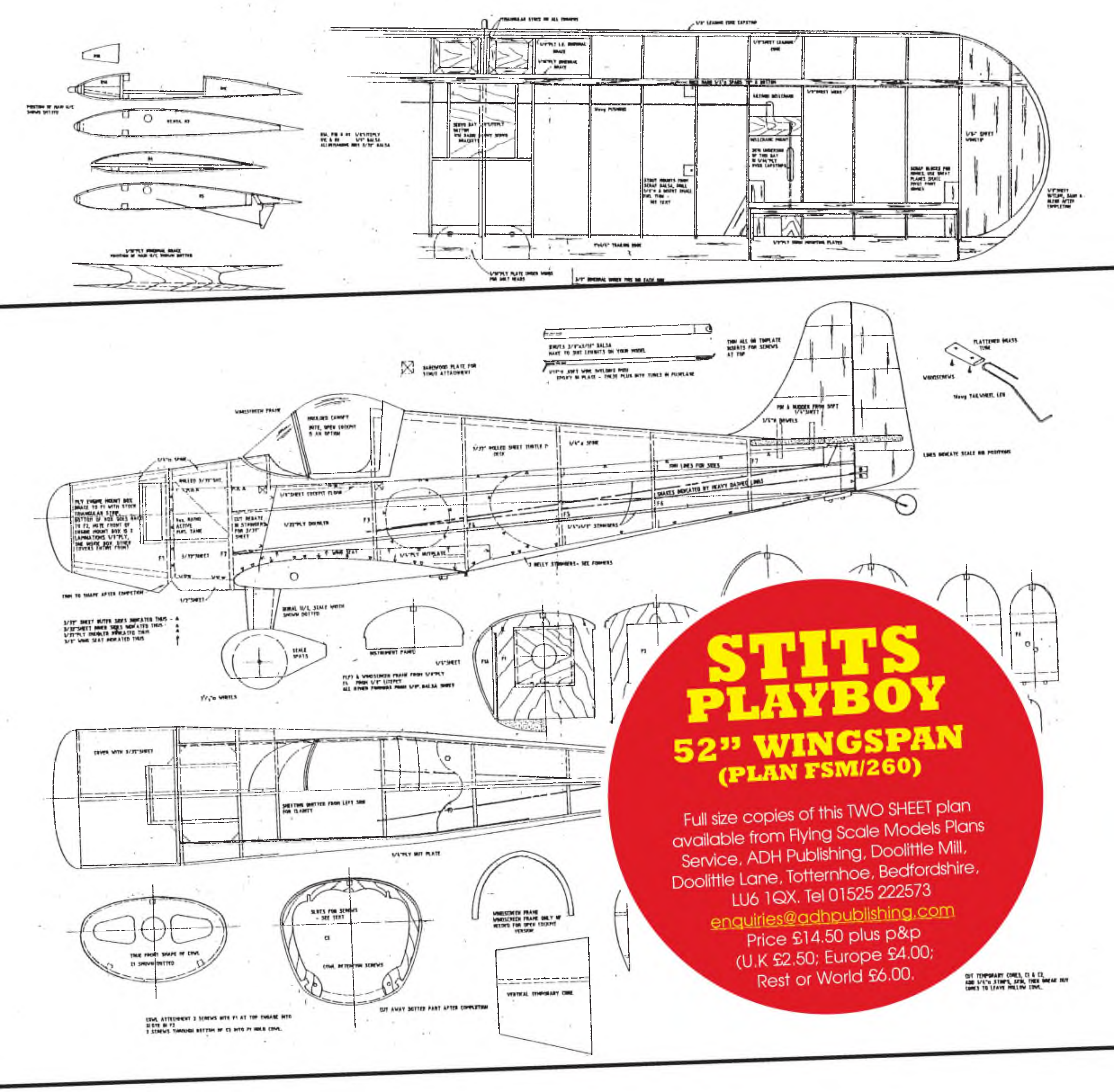
Sheet the leading edge of the wing and apply the centre section sheeting. To make life easier the leadinn edge sheet ends at R-11 and the last corner is filled with scrap block. Be very careful not to incorporate a warp while sheeting the wing. Add all the cap strips and the 1/8″ sheet leading edge capstrip.

Fit 1/64″ ply over the underside of the bellcrank bay. This makes covering that area easy while leaving a slot for the aileron pushrod.

The strut mounts are my own invention. I find that fiddling with masses of screws on the flying field is a real pain. The small blocks are glued in place and drilled to take small-bore silicone fuel tube. Once the model has been covered short pieces of tube are pushed into those holes with a drop of cyano. These take the lower ends of the struts.

The struts are made from balsa. Short pieces of 1/16″ welding rod or other easily shaped wire are epoxied into holes at the bottom. It needs to be easily bent because it has to be adjusted to fit with the struts at the correct angle.

The other end of the struts are slit with a



fine saw and strips of thin aluminium or tinplate are epoxied in. These take the screws that hold the top of the struts to the fuselage. In use it is possible to leave the struts screwed to the fuselage as they are quite short.

Note that some versions of the Playboy have a "V" shaped strut attached to the fuselage at the front attachment point only.

Tail unit

The tail parts are cut from 1/4" sheet and the elevators are joined with a 14 SWG wire joiner. The rib locations are shown and gluing strips of thick paper down before covering could represent these.

Because the fin is simply butt joined to the tailplane, it needs some reinforcement. This is achieved by inserting 1/4" dowels into the base of the fin. These go through the tailplane and into the tailplane platform. Hinges are those Mylar ones with the tissue bonded on. *Sig Easy Hinges* are one type, Kavan make a similar item

I would like to say more about the tail but it is so simple that I can't.

Covering

I used *Solarfilm Supershrink Polyester* for the covering. This is superb material and feels nicer than ordinary Solarfilm, it shrinks really well, can be worked round compound curves easily and it will take more heat. I have yet to burn a hole in it with a heat gun.

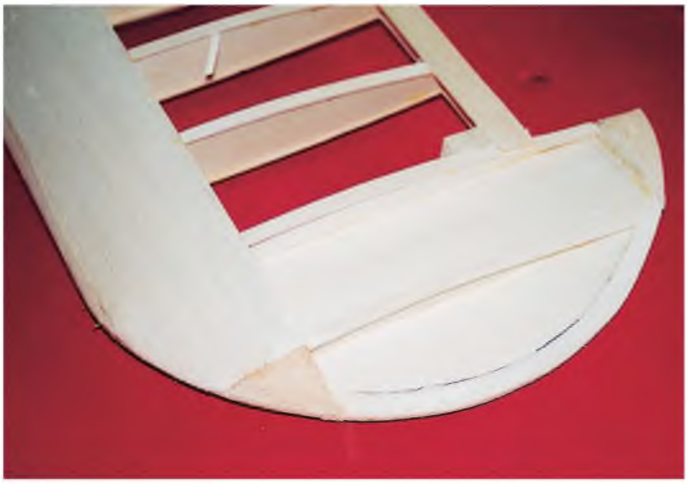
The sunrays were done with *Solartrim*. The lettering across these calls for some care. Because every model's sunrays will be slightly different I used a special method of applying the registration.

The lettering comes with a thick backing paper and a tacky top sheet a bit like very heavy tracing paper. This is used to advantage when applying the wing registration. Having applied the sunrays, trim the backing papers close to the lettering on the white registration. Now position this in the correct location on the wing and hold in place with masking tape. DO NOT remove any of the backing papers.

Mark the location of the sunrays on the top layer of paper. And then cut through the top tracing paper and lettering and remove the sections which lie over the sunrays. Leave the rest attached to the heavy backing paper.

Cut the red registration in the same way but lift the portions that go over the sunrays from the backing paper and lay them down on the thick backing paper with the white portions of the letters. Tape over the joints in the top paper and you can lift the whole thing off the thick backing paper.

Apply the registration very carefully. One touch and it is stuck, so get it right before laying it down. The old dodge of a drop of washing up liquid in water may help here



Completed wing tip, note block right at tip.

Tailplane parts showing the dowel. DO NOT leave these out.

Cutting the wing registration letters. Take great care with this job.

The two parts combined and ready for application.

but I haven't tried it.
This works but do take your time and great care or you can mess it up in one easy lesson.

Installation

The SC 30 FS engine fits in the cowling easily. In operation, you can get your finger in the air outlet to block the silencer to force fuel through to the engine.

The radio is installed in the bay behind F-2. The servos are at the rear of the bay with the receiver in front. The battery goes behind F-3, above the snakes. The switch is mounted on a ply plate and is operated by a pushrod through the side of the model.

The undercarriage is a standard dural unit costing £4 . It needed a little bending to match the front view shown on the plan. It is not perfect scale, but is pretty close.

I used non-standard spats from Vortex Vacform and over-scale wheels. I simply used the wheel bolts to hold the spat in place. It isn't very good. I would suggest using the Spat number SP9 from Vortex, cutting a slot so that the undercarriage goes inside the spat, this would be much neater and better.

I added a 1/6th scale J.Perkins Sportsman pilot. This pilot seems to be slightly over-size and he looks perfect in the cockpit.

Control throws were set at:

Aileron:	5/8" each way
Elevator:	3/4"each way
Rudder:	1" each way

These did not need altering after test flights.
Final ready to fly weight was 4 lbs.; I like that, it means low wing loading.

Flying

This is the important bit. After waiting for some weeks for a decent Sunday, we were blessed with an almost perfect Easter Sunday. The engine was soon running and after a final waggle of the controls, the model was released. Slight rudder correction was needed to hold her straight and she lifted off in a few yards.

The Playboy was quite stable and responsive without being at all sensitive. I put her through the usual manoeuvres, rolls, loops, inverted and found that she performed these easily. However, you do need to fly the model through them, you are relying on wing area and sensible power, not brute force and ignorance.

I then handed over to Stuart Pickett who flies my models for the camera while I take the pictures. Once these had been taken, Stuart had his reward by being told to go and enjoy himself. His verdict was that she is a very nice model to fly, no bad habits, no tendency to turn round and bite and pleasantly aerobatic. With more power she would really tear up the sky. The stall was a non-event; she simply dropped her nose and carried on in normal flight.

Landings are nice with a long flat glide. I may remove the spats because most of our sites are grass strips but apart from that I will make no changes. ■

The completed wing registration.

...LAST OF THE LI

SPITFIRE MK.22 & 24

In its most simplistic terms the Supermarine Spitfire line can be broken into two categories; those, from the design's inception in 1935, which were Rolls Royce Merlin powered and, latterly, the versions that used the much more powerful Rolls Royce Griffon. The Merlin had it's roots in the PV-12 engine of 1933 and went into production as the 27 Litre Merlin in 1936.

Work on the bigger, more powerful 37 Litre Griffon began in 1938 (still pre-WW2) and was immediately seen as a potential powerplant for the Spitfire line. However, due to development demands on the Merlin, a priority given to the eventually disasterous Rolls Royce Vulture engine, plus the Griffon's own development troubles, no Spifire flew with a Griffon engine until the end of 1941 and then only as a protoype test vehicle.

The first production Spitfire to use the Griffon was the Mk.XII, which was a specialized low/medium altitude version. Down low, it was an excellent performer against the Luftwaffe's FW 190, with a high rate of roll thanks to its clipped wing tips, but it was produced only in numbers sufficient to equip two RAF squadrons. However, from the Mk.XIV onwards, with the exception of the Mk.XVI, all further versions of the Spitfire were Griffon powered, The last of the line to see WW2 combat were the Mk. XVIII, Mk XIX and Mk.21.

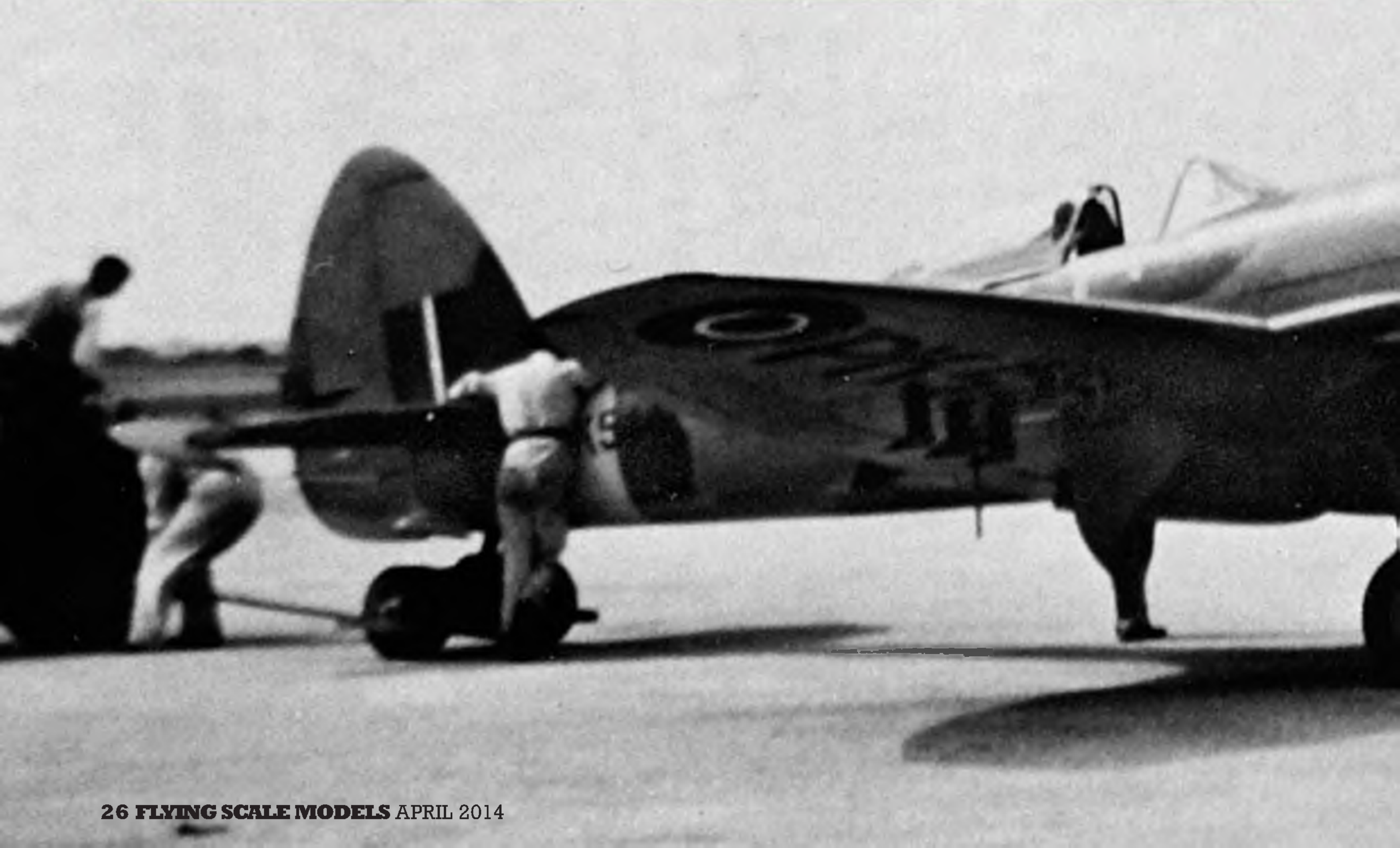
Too late to see combat during WW2, the last Spitfire versions to see service were the Mk. 22 & 24 and represented the end product of the Griffon-engined line. Although the Mk XIV was intended as an interim version until the arrival of the Mk. XVIII, it was to become the most widely used version powered by the Griffon. Moreover, it featured an extensive overall redesign, not only to accommodate the larger and more powerful engine, but also in most other areas.

The 'second generation' Spitfire line was born early in 1941 with an Air Ministry requirement for two examples to be powered by the Rolls Royce Griffon IIB. Originally designated as Spitfire Mk IV, the first example flew for the first time on 27 November 1941, but soon afterwards was re-designated Mk XX. Externally its wing was identical to that of the standard Spitfire, but it had been completely redesigned internally in order to considerably increase its strength and by the end of that year one of the two prorotypes had been fitted with the Griffon 61 and re-designated F Mk 21.

Plans for mass production of the F Mk 21

Where to see one now?

There is one on view and prominently viewable at the Royal Air Force, Hendon. It carries full camouflage and has the long gun barrels of the cannon armament, indicating that it is a quite early production example.



NE...

for the Royal Air Force with orders amounting to 3,373 had to be severely downscaled due to the end of WW2 and from the final total of 120 built, only three front line squadrons received the type, the first of which was No.9 in January 1945. Severe in-flight instability during the development programme had not been completely ironed out by the time F Mk 21 deliveries began and further modifications were eventually also applied to No.91 Squadron's Spitfires by the time it was declared operational in April that year. During its short operational career, the F Mk 21 enjoyed a good degree of success. The other squadrons to receive the F Mk 21 were Nos.1, 41 and 122, but their aircraft were soon handed over to Nos.600, 602 and 615 Squadron, Royal Auxiliary Air Force (RAuxAF).

The mass cancellation of orders for the F Mk 21 was partially offset by diverting orders for the production of other versions of the Spitfire and and Seafires for the Fleet Air Arm. Among such orders were those for a new mark of Spitfire, the F Mk 22, which differed from the F Mk 21 mainly in having a cut-down rear fuselage and the cockpit covered by a bubble canopy as had been applied to the Mk.XIVe, Mk XVI and Mk.XVIII. The new mark also incorporated the new 24-volt electrical system that had been introduced on late F Mk 21s. Although an extra fuselage fuel tank was fitted behind the cockpit, its use had to be prohibited as it was found to critically shift the aircraft's fore/aft balance point. Instability problems cropped once again as a result of the reduced rear fuselage area and the whole tail area required modification. A solution was found in replacing the whole section aft of the angled joint at Frame 19 at the rear end of the fuselage with that of the Supermarine Spiteful. Area of the elevators was increased by 27 percent and that of the vertical tail surfaces by 28 percent, a revision that added only 4lbs in all-up weight compared to the F Mk 21. The increase in length to 31ft 11in made it the longest version of the Spitfire line.

From the outset the F Mk 22/24 was designed to be able to operate in the ground attack role and had provision for the carriage of three 500lb bombs, one attached to a ventral centerline pylon and another under each wing.

The centre pylon could also take a 50gall fuel tank while a special 170gall tank could be fitted for long ferry flights. Of the 627 examples ordered in March 1945 only 260 were built due to post-war cancellations.

Instead of seeing service in the Far East as originally envisaged. Spitfire F Mk 22 &

Spitfire F Mk 22 PK544, 'C' of No.73 Squadron RAF photographed at Ta' Qali in 1947 in company with an unidentified Spitfire Mk IX probably from the same unit. This unit went through a rough time with its old Mk IXs and although the F Mk 22s provided a very able replacement, it was to remain in service for a very short time (R.J. Caruana Archives).

PK724 is a Spitfire F Mk 24 (c/n CBAF255) and one of the three examples of its type still in existence. It became 7288M at Brize Norton in November 1955 and was eventually restored for the RAF Museum at Hendon (R.J. Caruana)

F Mk 22 from No.73 Squadron, PK674, 'L' showing the unit's blue and white flash flanking the fuselage roundels. Although the squadron was based at Ta' Qali, this picture was taken at Luqa, probably during its first stop on arrival at Malta in October 1947 (R.J. Caruana Archives)

24 only operated by one unit of the RAF when No.73 Squadron were relieved of their troublesome and weary F Mk IXs at Ta' Qali in Malta. The first F Mk 22 arrived at Malta to join No.73 Squadron in October 1947 with the unit having eight examples on strength by the end of November. July saw the arrival at Luqa of the first DeHavilland Vampire F Mk 3 and the last of No.73 Squadron's Spitfires left for the United Kingdom (UK) on 18 October 1948. From then on the F Mk 22 was operated solely by units of the RAuxAF: Nos.502, 504, 600, 602, 603, 607, 608, 610, 611, 613, 614 and 615. But by the first quarter of 1951 most of these units began to convert to jet fighters.

This Spitfire version received some export orders; 22 were delivered to the Southern Rhodesian Air Force, 20 to the Royal Egyptian Air Force (staging through Malta) and 10 went to the Syrian Air Force. Based on the F Mk 22, the Mk 23 was intended to be fitted with a new wing of revised cross-section using the laminar flow characteristics of the Supermarine Spiteful wing that had also been strengthened further to accommodate a pair of 20mm Hispano cannon. Such a wing was tested on a modified Spitfire F Mk VIII and test flown for the first time in January 1944, but handling with this type of wing was found to be inferior to that of a standard wing.

The final version of the Spitfire was to be the F Mk 24 of which only 54 examples were built, together with the conversion of 27 Mk 22s, the last example completed in February 1948.

After ten years since the flight of the first Spitfire, the end of the line was considered to be a refinement of the F Mk 22, featuring underwing points for the fitting of zero-length rockets, the addition of two fuel tanks in the rear fuselage holding a

One of the Royal Egyptian Air Force F Mk 22s that staged through Luqa, Malta, showing some wing marking details, such as the non-slip walkway and the position of the national markings (Malta Aviation Museum Foundation)

Superb in-flight shot of PK312, the first of the F Mk 22 Spitfires, after it had been completely modified to take the Spiteful tail unit. Extensive tests were performed on this particular aircraft including the installation of a F Mk 21 style contra-rotating propeller in September 1946 (Vickers Armstrong Ltd)

total of 33gall and the replacement of the hydraulic gun-firing mechanism with an electric system. Externally it was difficult to distinguish between the F Mk 22 and 24, although the latter had the Hispano Mk.V cannon fitted to the wing and, therefore, featured shorter gun barrels. However, this feature was introduced only on the last of the F Mk 24s built, making early examples indistinguishable from the previous F Mk 22.

Only No.80 Squadron RAF was to operate the F Mk 24, receiving the type in January 1948 at its base in Gutersloh (Germany) as part of the Occupation Forces. In July of the following year the squadron was deployed to the Far East where its Spitfires arrived on an aircraft carrier at Hong Kong. There, No.80 Squadron's Spitfires operated from Kai Tak airfield in defence of Hong Kong during a period of great tension in that area. DeHavilland Hornets took over this task in January 1952 and the unit's Spitfires were handed over to the Hong Kong Auxiliary Air Force where they became operational in May and remained in service until the last official official flight on 15 January 1955. ■

Anoher of the Supermarine Spitfire F Mk 22, SA699/699 of the Royal Egyptian Air Force, recorded staging throug Malta in 1950. Note the rocket launcher rails below the wings (Malta Aviation Museum Foundation)

SPITFIRE MK.22 & 24

CLOSE-UP SURFACE DETAIL IS WHAT MAKES A MODEL SPECIAL

1


2


3

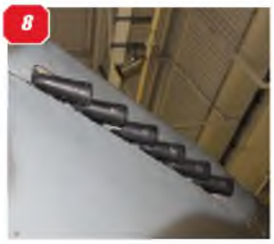

1: Fillet fairing at the fin lower leading/rear upper fuselage.

2: Access flap for the starter trolley plug point, fuselage left side at the wing fillet.

3: Detail of the propeller cuff.

4: Propeller spinner and five-blade propeller.

4

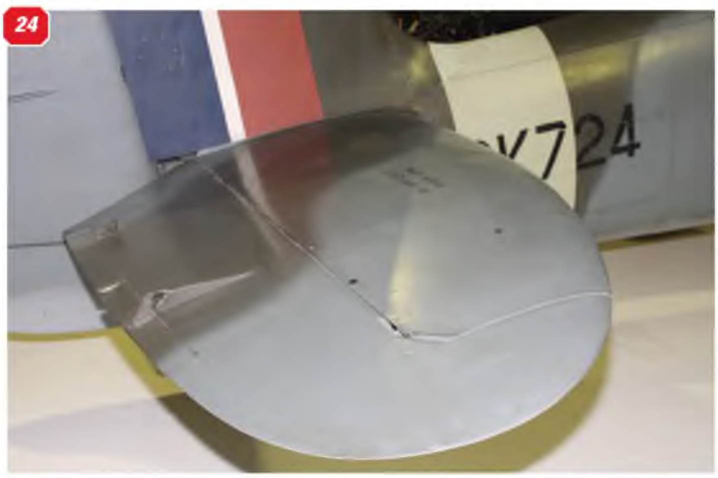



5: Massive bearers for the Rolls Royce Griffon engine. Note the six exhaust stacks
6 & 7: Two views of the carburettor air intake on the fuselage underside ahead of the wing root.
8: Further detail of the engine exhaust, left hand side.
9: Front cockpit side panels and windscreen.
10 & 11 Rear bubble canopy.
12 - 14: The retracting tailwheel and fairing doors.

15 & 16: Two views of the main undercarriage leg and main undercarriage fairing. Also shows the radiators on the wing underside.

17: Close-up of the mainwheel. Late Spitfire Mk.24s had four-spoke hubs, but this one has three-spokes as per Mk.22.

18 & 19: Two views of the rudder control horn and control rod. **20:** The unusually shaped rudder trim tab. **21:** Rudder trim tab control horn and fairing. **22:** Tail light at base of rudder. **23:** Free-to-air void at the fin/tailplane base (at the elevator hinge line). **24:** Tailplane, showing the aerodynamic balance at the tip. **25:** Twin elevator trim tabs, right elevator. **26:** Trim tab close-up, right elevator. **27:** Counterweighted inner tab, right hand elevator. **28:** Single trim tab, left elevator. **29:** Camera gun port at right wing root. **30:** Twin 20mm cannon, wing leading edge. **31:** Pitot head, left wing underside 32: Wing tip light. **33:** Fuselage centre section, showing shape of the big wing-to-fuselage fairing.

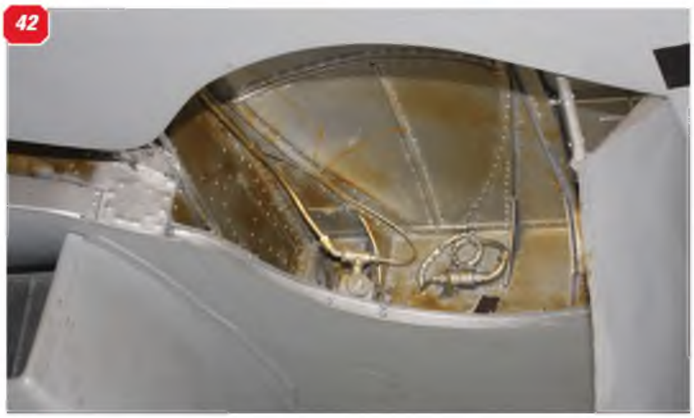










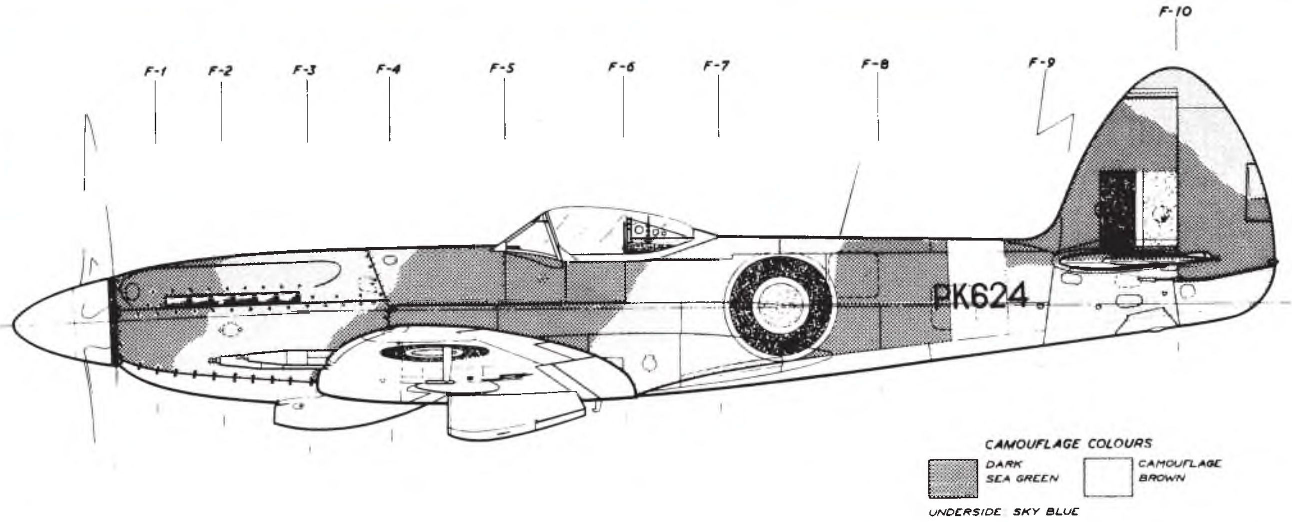


34-39: The Spitfire Mk.24 wing upper surfaces are festooned with with blister fairing over various internals that don't quite fit into the thin wing profile! 40: Rear of underwing radiator. 41: Radiator viewed from front. 42 & 43: the undercarriage well, wing underside. 44 & 45. Fixed spent ammo deflector, on wing undersurface. 46: Wing underside showing the inward folding wheel well cover. 47: Same, viewd from rear 48: Dished innder surface of wheel well cover. 49 & 50: Two views of the main undercarriage leg cover.

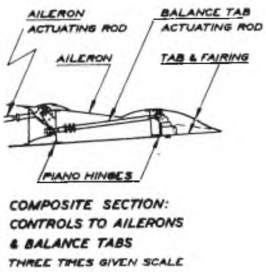




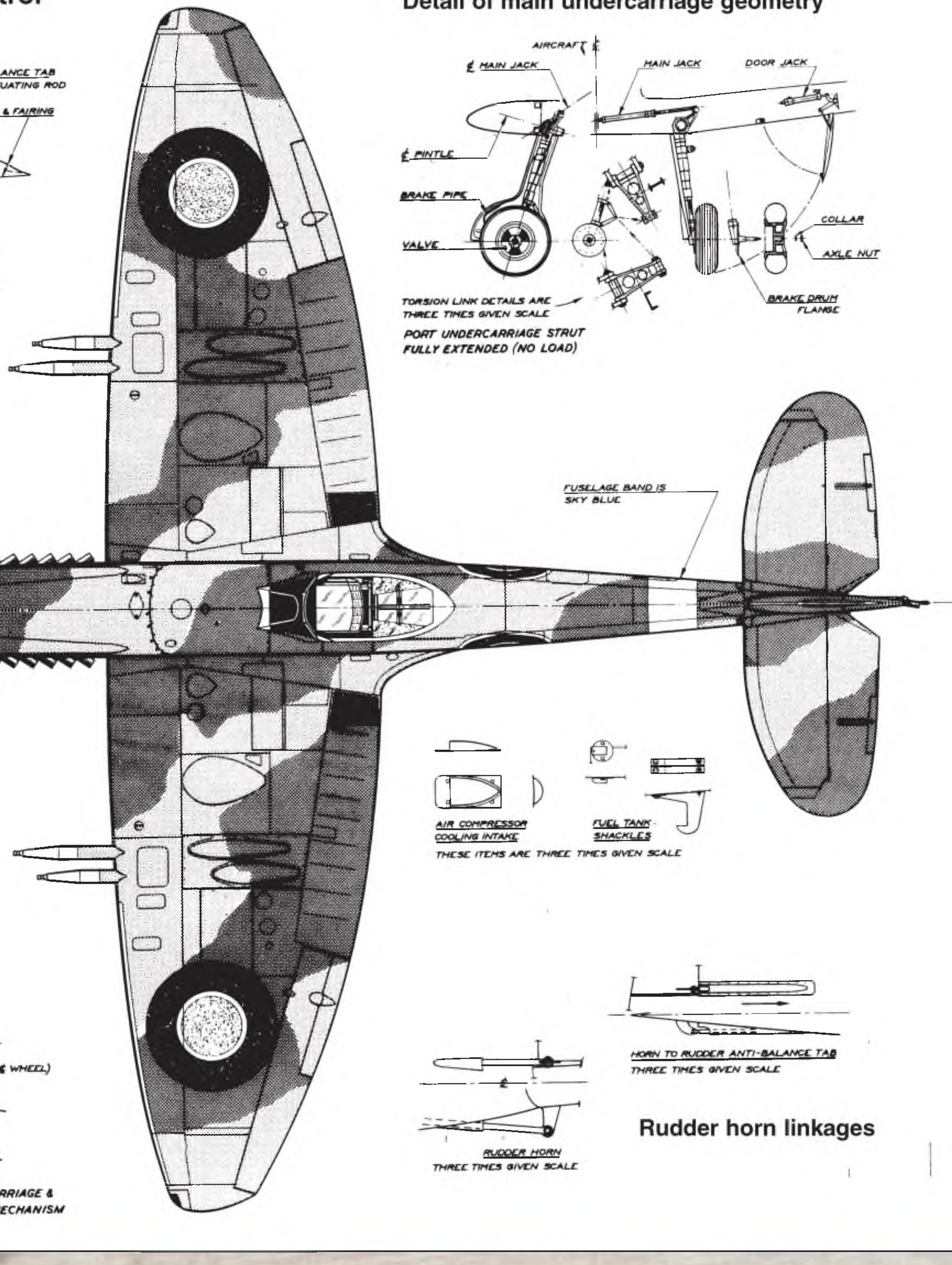

SPITFIRE MK22 & 24



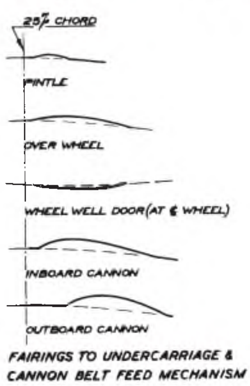
Aileron control linkage



Detail of main undercarriage geometry

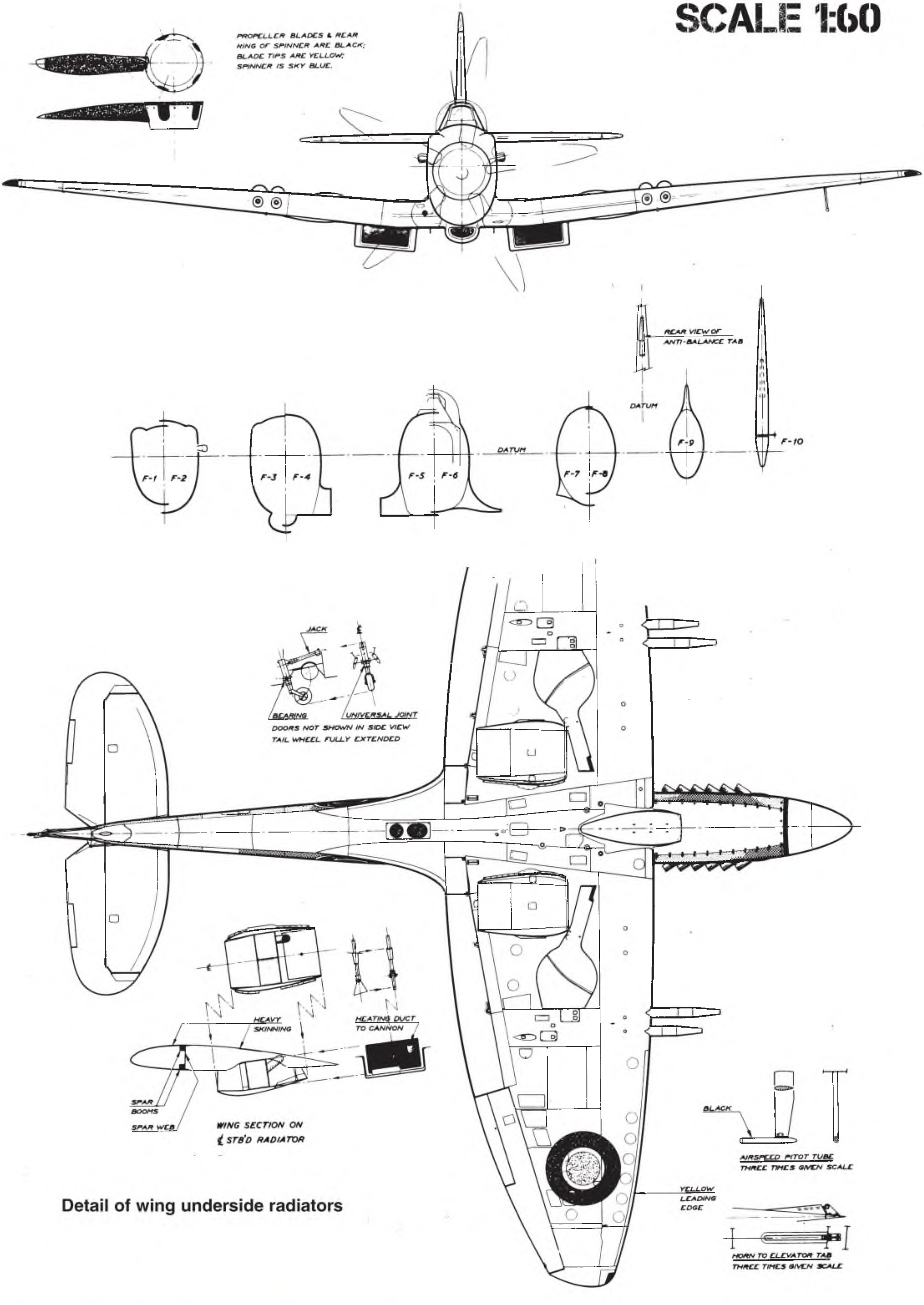


Wing surface fairings



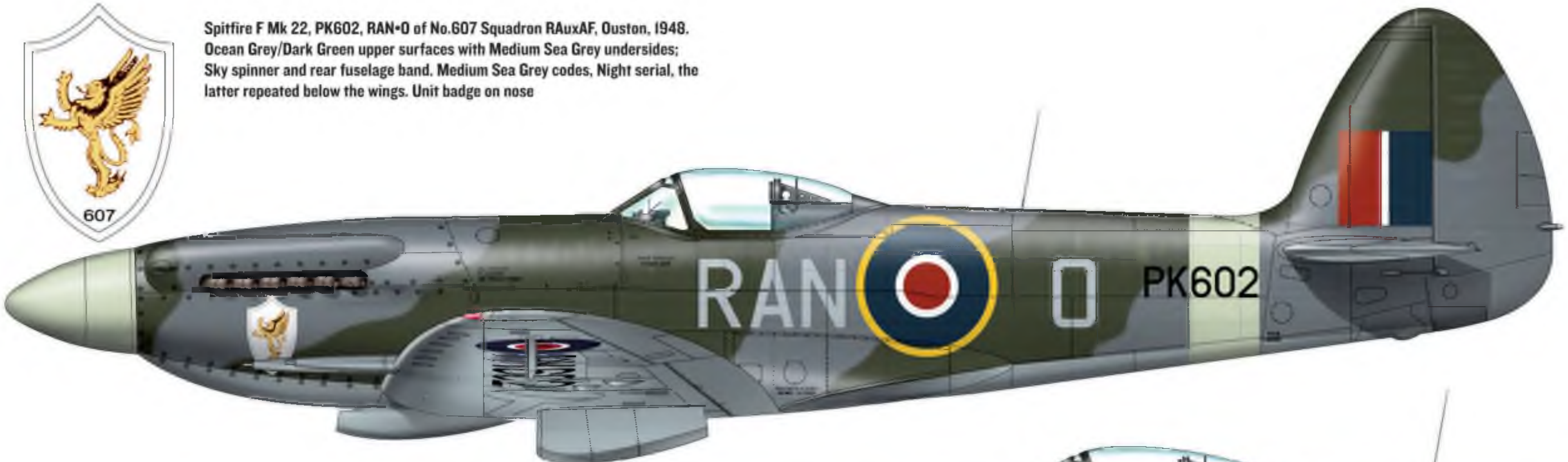
Rudder horn linkages

SCALE 1:60



Detail of wing underside radiators

Spitfire F Mk 22, PK602, RAN•O of No.607 Squadron RAuxAF, Ouston, 1948. Ocean Grey/Dark Green upper surfaces with Medium Sea Grey undersides; Sky spinner and rear fuselage band. Medium Sea Grey codes, Night serial, the latter repeated below the wings. Unit badge on nose



Spitfire F Mk 22, PK605, V9•T, No.502 Squadron, Aldergrove, 1949. Ocean Grey/Dark Green upper surfaces with Medium Sea Grey undersides; Sky rear fuselage band and spinner. Codes in Medium Sea Grey; serials black, repeated below wings; blue/white/red roundels above wings

Spitfire F Mk 22, PK497, RAD•V, No.504 (County of Nottingham) Squadron, 1948. Ocean Grey/Dark Green upper surfaces with Medium Sea Grey undersides; Sky spinner and rear fuselage band. Night codes and serial, the latter repeated below the wings. Blue/white/red roundels above the wingsr

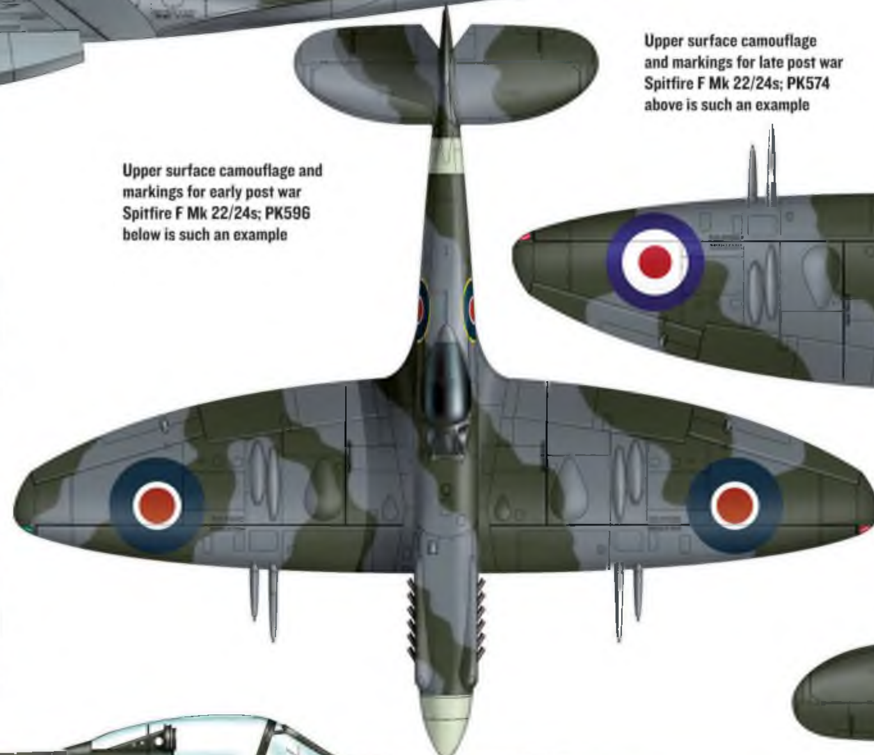
Spitfire F Mk 22, PK674, •L, No.73 Squadron RAF, Ta' Qali (Malta), 1948. Ocean Grey/Dark Green upper surfaces with Medium Sea Grey undersides; Sky spinner and rear fuselage band. National markings in bright post-war colours; dark blue/white arrowhead on fuselage sides

PROFILES 1:48 Scale

Spitfire F Mk 22, PK574, RAT•B, No.613 (City of Manchester) Squadron, RAuxAF. Ocean Grey/Dark Green upper surfaces with Medium Sea Grey undersides; Sky spinner and rear fuselage band. White codes, Night serial repeated below wings; unit crest above fin flash

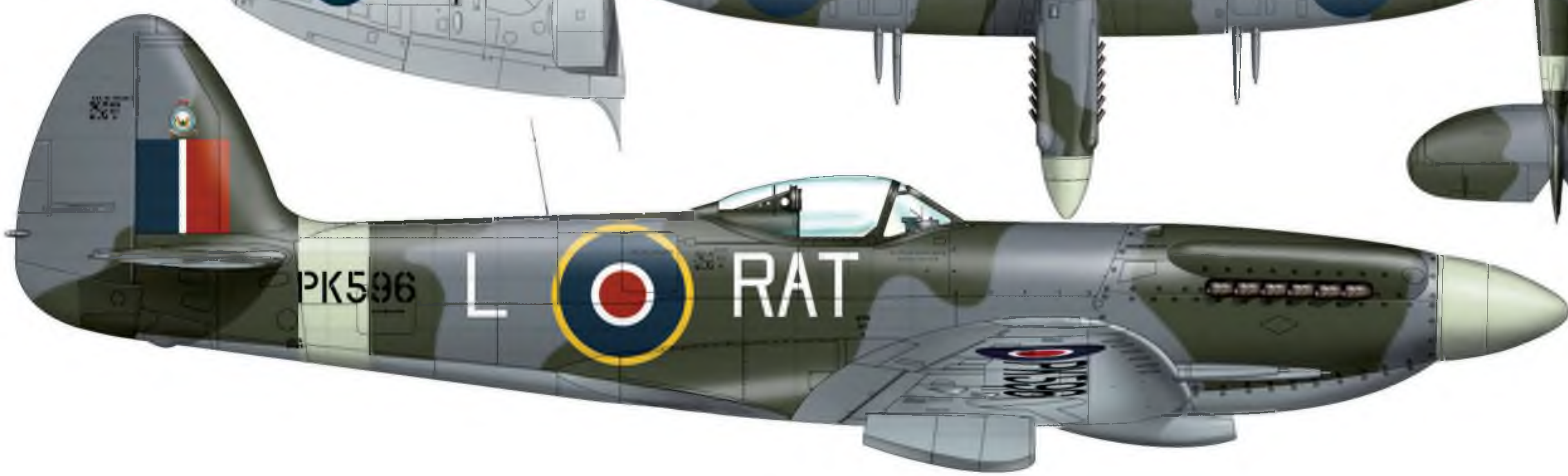
Upper surface camouflage and markings for late post war Spitfire F Mk 22/24s; PK574 above is such an example

Upper surface camouflage and markings for early post war Spitfire F Mk 22/24s; PK596 below is such an example



Typical size and position of roundels and serials below the wings; the latter read from the trailing edge below starboard and from leading edge below port

Bottom Left: Spitfire F Mk 22, PK596, RAT•L, No.613 (City of Manchester) Squadron RAuxAF, Gatwick, July 1949. Ocean Grey/Dark Green upper surfaces with Medium Sea Grey undersides; Sky spinner and rear fuselage band. Night serial, repeated below wings; codes in white. Unit crest above fin flash

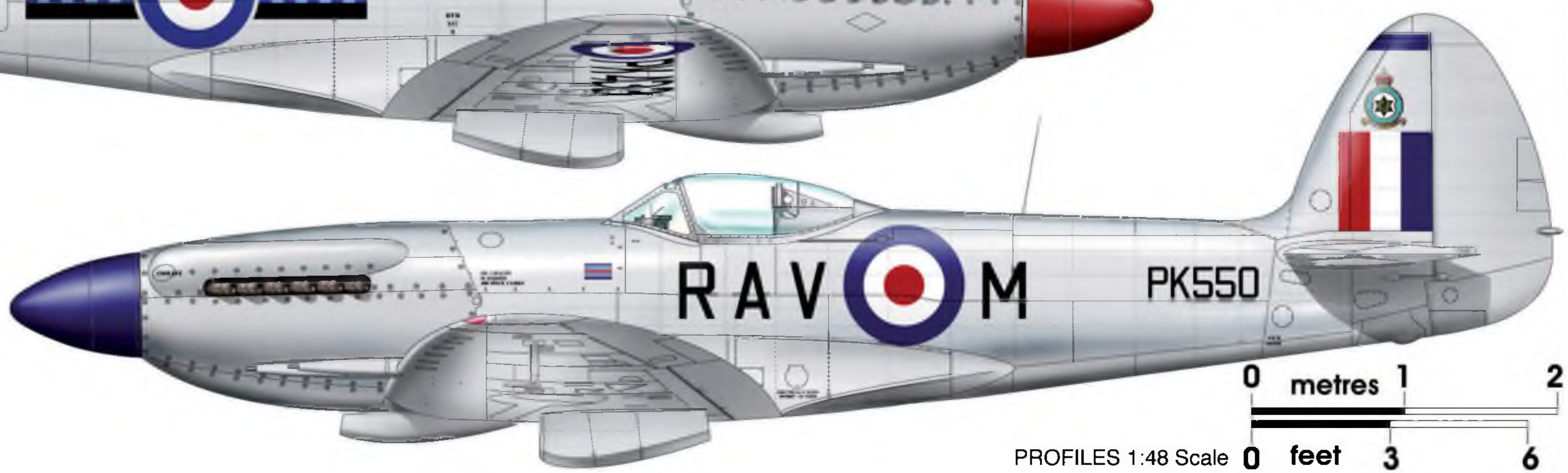


Spitfire F Mk 22, PK504, XT•P, No.603 Squadron RAuxAF, 1949. Aluminium (Silver) overall with red spinner; Night codes and serials, the latter repeated below wings. National markings in bright colours in standard positions

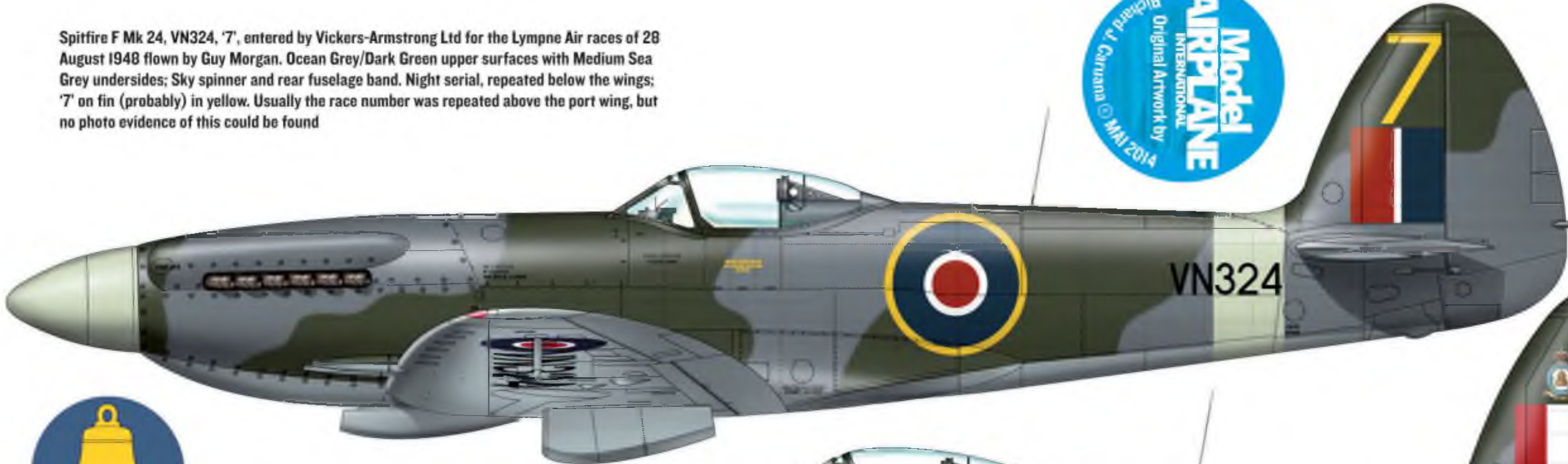
Below: Spitfire F Mk 22, PK519, V6•A, No.615 Squadron RAuxAF, Biggin Hill, 1950. Ocean Grey/Dark Green upper surfaces with Medium Sea Grey undersides; Yellow spinner and Sky rear fuselage band. White codes, Night serial, the latter repeated below the wings

Spitfire F Mk 22, PK433, 'Q', No.603 Squadron RAuxAF. Aluminium (silver) overall with red spinner; dark and light blue checks with a black bar above and below, flanking fuselage roundel. Black 'Q' on fin, Night serials repeated under the wings. Post-war national roundel in bright colours, in six positions

Spitfire F Mk 22, PK550, RAV•M, flown by Sqn Ldr Peter K. Devitt, OC No.615 Squadron RAuxAF, Biggin Hill, 1950. Aluminium (Silver) overall with national markings in bright colours; codes and serials in black, the latter repeated below the wing. Blue spinner and flash on top of fin; unit crest on fin



PROFILES 1:48 Scale



Spitfire F Mk 24, VN324, '7', entered by Vickers-Armstrong Ltd for the Lympne Air races of 28 August 1948 flown by Guy Morgan. Ocean Grey/Dark Green upper surfaces with Medium Sea Grey undersides; Sky spinner and rear fuselage band. Night serial, repeated below the wings; '7' on fin (probably) in yellow. Usually the race number was repeated above the port wing, but no photo evidence of this could be found

Model AIRPLANE INTERNATIONAL Original Artwork by Richard J. Caruana © MAI 2014

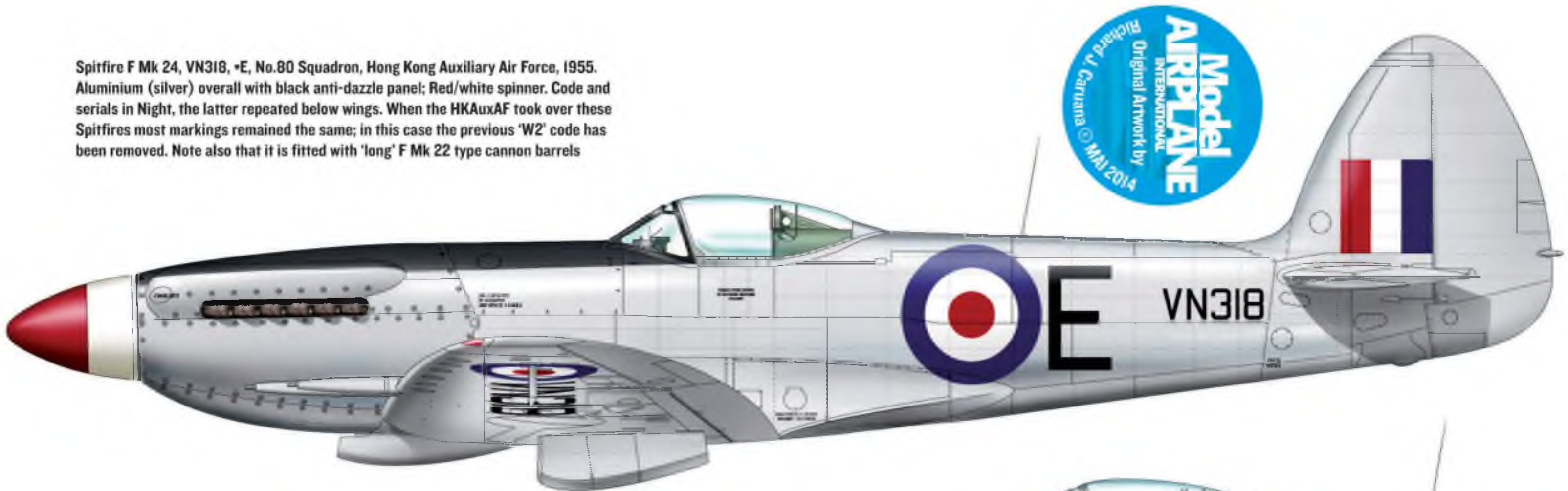
Spitfire F Mk 24, VN309, W2•D, No.80 Squadron FEAF, Kai Tak (Hong Kong), 1950. Ocean Grey/Dark Green upper surfaces with Medium Sea Grey undersides; Red/White spinner. Night/white rear bands with Night/white serial, the latter repeated in Night below wings; unit crest on fin. White codes, national markings in bright colours. Photo evidence indicates that this aircraft did not carry the wing bands

Spitfire F Mk 24, VN312, W2•Y, No.80 Squadron RAF, BAFO Germany, 1948. Ocean Grey/Dark Green upper surfaces with Medium Sea Grey undersides; Sky rear fuselage band. Night serial, repeated below the wings; blue/white/red roundels above and below wings. Sky Blue codes, unit badge on fin (both sides). White/blue spinner

PROFILES 1:48 Scale

Spitfire F Mk 24, VN496, TN•, flown by Wing Commander 'Tiny' Nel, OC Flying, Kai Tak. Natural metal overall with red spinner; black codes and serial, the latter repeated below the wings. National markings in bright colours; rank pennant ahead of windscreen

Spitfire F Mk 24, VN318, •E, No.80 Squadron, Hong Kong Auxiliary Air Force, 1955. Aluminium (silver) overall with black anti-dazzle panel; Red/white spinner. Code and serials in Night, the latter repeated below wings. When the HKAuxAF took over these Spitfires most markings remained the same; in this case the previous 'W2' code has been removed. Note also that it is fitted with 'long' F Mk 22 type cannon barrels



Below: Spitfire F Mk 22, SA699, '699', Royal Egyptian Air Force, recorded staging through Malta in 1950. Silver overall with a small black anti-dazzle panel ahead of the windscreen; '699' on rear fuselage in green; all national markings outlined in white. Fin flash is also outlined in white; 'SA699' in small lettering below tailplane. Note rocket rail attachments below wings

Spitfire F Mk 22, '514', Syrian Air Force. Light Stone/Dark Green upper surfaces with Medium Sea Grey undersides; national markings in six positions. Black serial above fin flash; white spinner

Spitfire F Mk 22, SR60, No.1 (Auxiliary Air Force) Squadron, Southern Rhodesian Air Force, Cranborne, 1951. Medium Sea Grey overall; RAF roundels in six positions with those on fuselage sides being flanked by green and yellow bars. Serial in black, repeated below both wings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WIRE IN THE WIND

GARY SUNDERLAND PRESENTS DETAILED ADVICE ON REPLICATING BRACING AND RIGGING

PART 2:

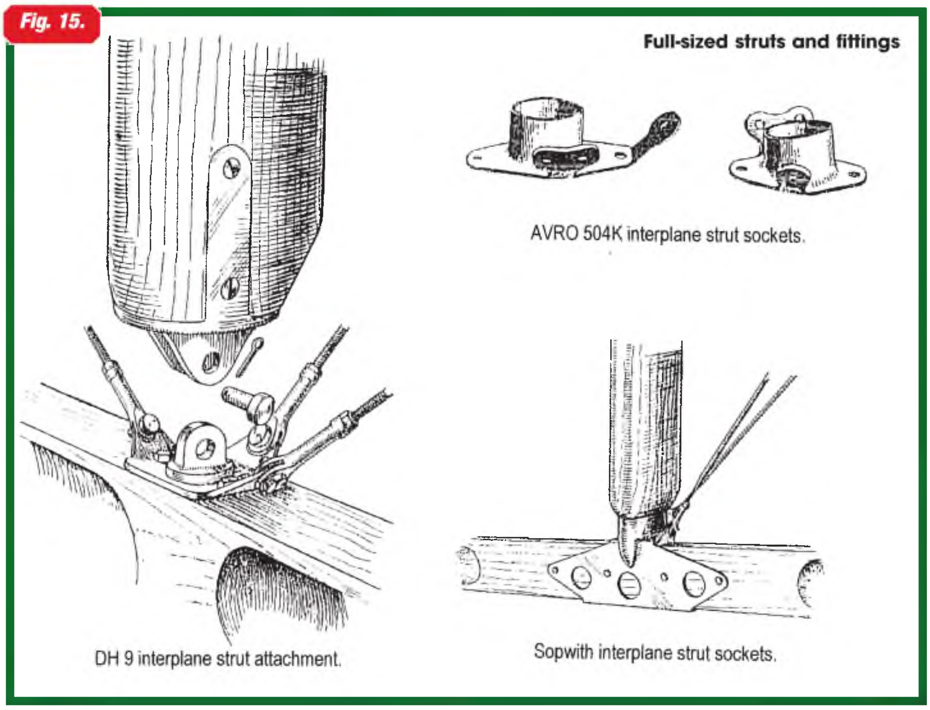
Fishing trace

The nylon-covered flexible wire mentioned at the end of Part 1 last month is probably fishing trace, which you can buy at any fishing gear or hardware shop. Fishing trace is available in a variety of breaking loads from 10 to 90 lb. and a multitude of nylon coatings from clear to black. Currently I am using 90 lb. trace in the control runs on my quarter-scale Bristol F2B and Fokker D.VII, and 60 lb. trace in a Bristol Scout. You can buy appropriate swages to suit the fishing trace, but a length of copper tube will also serve to fix the ends. One variety of trace has a covering which can be fused by the heat of a match. This may be one way to avoid the non-scale appearance of a swaged end, but I have not used this method myself.

The strength of the trace depends completely on the wire inside, which is invariably a twisted strand of seven wires of a magnetic steel. The external plastic coating is there to protect the wire, which for model applications may not be such a good thing.

To start with, the outside coating increases the appearance or bulk relative to its actual strength, which can be a problem, particularly for smaller models. One way to avoid this may be to use trace coated with a clear plastic. The soft plastic coating is also vulnerable to abrasion and wear against any metal or wood contact, including even balsa. This will require some extra work to avoid any contact with sharp edges. The

Fig. 15.



preferred application is a straight control run, without any change of direction. I seldom use trace for rigging even small models because hard wire or stranded cable are better alternatives.

Control-line wire

Essentially, C/L wire is seven-wire, non-flexible stainless steel cable in at least two sizes and strengths of about 30 to 60 pounds. This is my preferred rigging for small models of 1/8th and 1/12th scale. In the case of free flight scale models, the rigging is not intended to be rigid, and passes across as many bays as possible, which are then tensioned by small rubber bands. This 'sprung' rigging normally holds the wings firmly in place during flight, but free to flex on landing.

This sort of rigging is not suitable for R/C models, as control input merely causes the wings to flex up and down during flight, with no response in pitch attitude. (Don't ask me how I know!) A radio-control model needs to have bracing to hold the wing rigid, which means each wire in each bay must be tensioned. The smallest *Proctor* turnbuckle will do the job on a 1/5th scale model, but even at this size are too large for scale appearance.

C/L wire is ideal for scale control operation and really looks the part up to 1/5th scale models. The ends are formed in a loop and swaged with the smallest diameter aluminium or copper tube. After the free end is nipped off, at a small distance from the swage, this end should be coated with a smear of five-minute epoxy to hold it down. If you cut the ends too close to the swage the wires will fray out and form a hazardous multitude of sharp wire ends to lacerate your fingers into the future - so beware!

Rigid bracing

My preference for bracing most radio-control models is .032" or .025" piano wire. The nearest equivalent in the British system is 22 SWG which should work on models from 1/6th to quarter-scale. On smaller models I have used .015" (28 SWG) wire, which is plenty strong enough, the only problem being that this fine wire passes freely through my skin before I can even feel it!

The ends need to be formed with care to a small radius and fastened with a short length of brass tube. The tail needs to be cut to provide enough length to bend back, once again with a nice radius, along the tube. Each wire is formed in place to provide an even tension, and the complete rigging should provide an even, musical twang.

After a period of flying, some wires will lose their initial tension and these may be easily re-adjusted by carefully opening the joints and re-forming the ends.

An alternative bracing these days is carbon fibre rod of 0.5 mm diameter and larger. Small holes are drilled through timber longerons and struts and the rod is poked through and Zapped into place. The ends are trimmed off and sanded back. The carbon rod is much lighter than steel and so is particularly useful for bracing the rear fuselage of a Bleriot monoplane or similar structures. The only problem is the cost of the rod, which is relatively expensive.

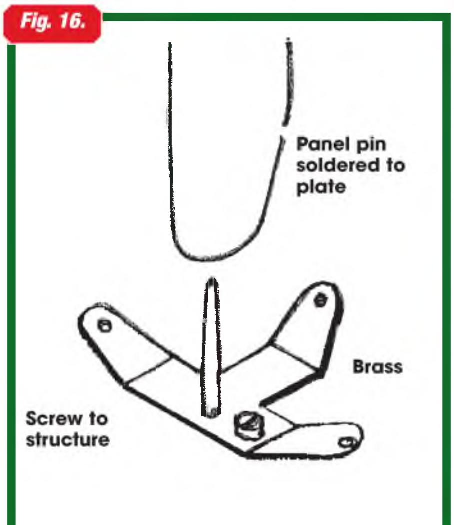
Scale struts and fittings

Figure 15 illustrates the sort of hardware that we are attempting to replicate in our models. Note that the wing strut acts in compression and the fitting only acts to locate it on the spar, consequently the strut end of the early Avro and Sopwith designs was merely retained in a sheet metal socket, so that when the wires were released the struts were free to fall out. The DH9 fitting is representative of current practice, where a small shear pin is used to fix the strut end.

Rigging wires imposed substantial tension forces into the sheet steel fittings but the

PHOTO 13: Author's 1/8th scale F/F Albatros B2 illustrates C/L rigging with extruded K&S aluminium struts over a core of circular ali tube. The end fittings are a short length of brass tube squashed down and drilled for centre wires, which are epoxied into the wing at each strut location. Model weighed about 4 lb. with a PAW 2.49 diesel. PHOTO 14: Author's 1/6th scale R/C Albatros C.VII also has extruded aluminium struts, this time with a core of brass tube. End fittings are also similar to the earlier F/F designs, but rigging is hard piano wire. Note angle of rigging, with the wires meeting at the surface fitting, which approximates the spherical joint of the full-size aeroplane. Sadly, the O.S. 120 four-stroke powered model crashed in flames after hitting power lines!

Fig. 16.

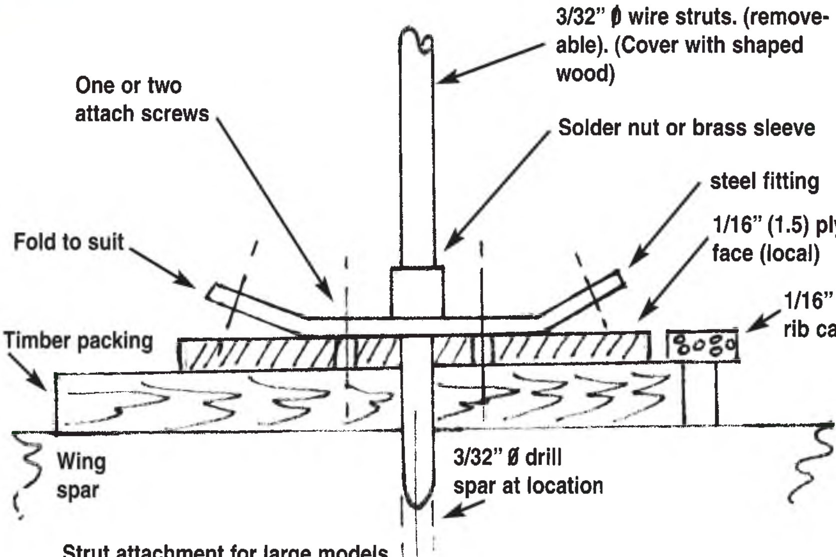


A simple model strut attachment, as used by David Boddington on his scale BE2c

PHOTO14

Fig. 17.

Fig. 18.



latter were actually fabricated from very light gauge material. For example, the SPAD was reputed to be a relatively strong aeroplane by WW1 standards, and the struts and wires certainly look quite substantial, but the metal fittings appear to be made from tin can material fastened with 3 mm diameter bolts! Clearly this was one area where weight saving was carried to the extreme with little or no allowance made for wear or corrosion in service.

Other manufacturers used somewhat thicker metal in their fittings, more commonly from 1 mm and 2 mm sheet steel, but often, as in the case of the Sopwith design illustrated, with lots of lightening holes punched out of the fitting to save weight.

When scaling down fittings to model sizes it is clear that flight loads are not likely to be a problem, but we will require our model to resist a lot more than that. A model should survive a low speed nose-over with no more than a chipped propeller and some paint scraped off the fin. In the same situation, a full-sized aeroplane would be substantially damaged and possibly a write-off! So we need to design and construct our models to look the part but actually be much tougher and crash-resistant.

Struts

Wooden struts were usually made from solid spruce in Allied warplanes and kiefer, otherwise known as silver pine, in the aircraft of the Central Powers. Both are light coloured timbers and take on a slightly yellow tinge when coated with clear linseed oil varnish.

Model struts are usually made on a core of metal tube or piano wire, as will be explained later. To this core light-coloured balsa or a heavier timber is laminated with epoxy glue, and the wood is carved and sanded to shape. Balsa struts are satisfactory for the smaller models, say one-twelfth and one-eighth scale. The balsa is given several coats of dope, sanding between coats, and then a final coat of clear urethane varnish.

With the larger scale models, the compressive strength of the strut will depend on the timber surround. For intermediate and larger scale models, the strut should be formed from white pine or a similar wood which does not have a pronounced grain. Spruce has a definite grain which will look too coarse and dark at model scales. Recently I have been using a local hardwood, Tasmanian Oak, to make struts. This has a very dense grain and looks quite realistic at one-quarter scale. Two coats of urethane varnish provide an excellent finish. So far I have yet to break a Tassie Oak strut. (Touch wood!)

Metal tube struts may be formed in the same way, from balsa or other timbers, bearing in mind that the original parts would be usually smaller in cross-section. The traditional method was to wrap the balsa shape with paper or thin card glued on. This

Fig. 19.

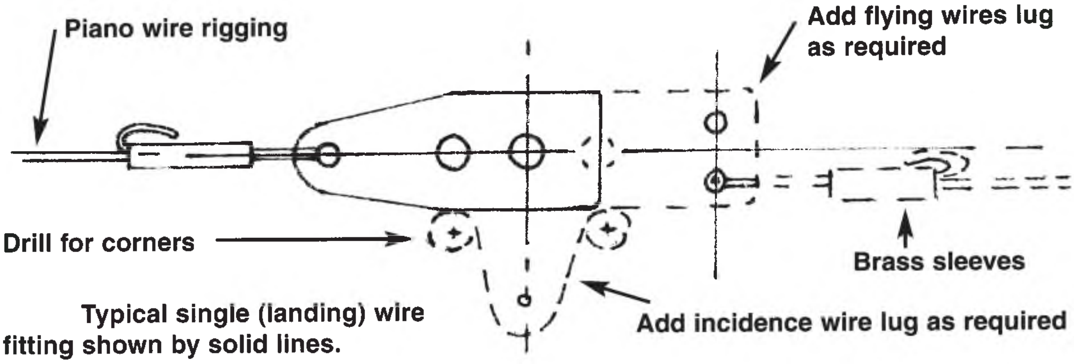


PHOTO 15: Another on the German theme is this 1/4 scale Halberstadt D.V (FSM plan 89), but this time the struts are formed from wood around a piano wire core. Rigging is all Proctor cable with Proctor turnbuckles, and these attach the wings to the fuselage. O.S. 120 four-stroke powered model is still flying.

is a messy and laborious job and a better alternative for small models, and for tailplane struts on large models, is to use K&S round or streamlined section aluminium tubing. In the case of small compression struts, the tube may be strong enough, but it is made from a pure aluminium, of the sort common in saucepans and window frames, so it has not much strength.

It is more usual to combine the tube with a central insert, such as the largest size brass tube which will be a snug fit inside. The soft aluminium is easy to trim back to form the ends and a touch of instant glue seals and fixes the ends. These are an alternative to wire and balsa struts on small models and result in realistic-looking metal struts. Nothing looks more like metal than metal, even when it is painted!

For tailplane bracing, a combined strut and end fittings may be formed from a dural insert across the long inside dimension of *K&S* streamlined tube. The ends are flattened with a pair of pliers, trimmed and drilled to suit the attachments.

Strut attachments

Large-bolted angle brackets, as used on many sports models, would look out of place on a scale model and, besides which, are difficult to rig. One method is to locate the strut with a nail through the rigging fittings, which fittings are attached to the wing spars with screws, as shown in **Figure 16**. This arrangement is a bit fragile in the event of a bad tumble and for my early free-flight and radio models I strengthened it by substituting a length of 16 SWG (.063") wire passing through the fitting and epoxy-glued into the spar. The spar was reinforced locally to beef it up where the holes were drilled and faced with thin ply to resist splitting.

A more recent development is shown in **Figure 17**. This dispenses with the rigging plate and is soldered from two pieces of 24 SWG (.025") wire, one of which has a loop formed before the wires are soldered together. The loop serves to prevent the strut turning and also acts to secure the rigging wires. The strut has a tube core with the end slotted to accept the loop. The length of wire inside the strut is as long as possible to avoid the strut coming off, in the case of a free-flight model, even when the rigging is slack.

In the case of the larger radio-control models, say from one-sixth scale and larger, I now prefer to form the strut around a piano wire core and locate this into a hole drilled into the spar as shown in **Figure 18**. This has a number of advantages in the event of a crash. In the case of a broken strut, the wire core does not fail when the outside timber splinters, and the failed strut can often be straightened and Zapped together quickly to allow the model to continue flying. Struts with the alternative tube core usually fail completely. In any case, wire core struts are easy to repair, just by scraping away the timber covering and replacing it. The critical length dimension is retained if the end fittings remain soldered to the wire core.

The end fittings are soldered brass tube or shaped to replicate the original ends. During rigging these may be shimmed with washers to increase the gap dimension.

From a frontal photograph (not the three-view, in most cases!), check the angle of the rigging wires. Most British aeroplanes had the prolongation of the rigging meet at the centre of the spars in the front view. In contrast, German rigging usually met at the outside surface of the wings, often at a spherical type of fitting, as on the Halberstadt DV and the Pfalz DXII, etc. The British type, as shown in **Figure 15** for the DH9, is easy to replicate on a model. Other designs are more difficult.

Fittings

Working rigging fittings have to be made from materials like steel, brass or dural. Dummy fittings may be made from soft, near pure, aluminium or lithoplate and anything else which looks the part of coarse, but functional rigging needs to be robust, as does the underneath attachment into the spar and the spar reinforcement.

For example, a 1/4" x 1/2" wing spar should have 1/8" reinforcement each side if possible, to not only replace the drilled-out material but also to compensate for the concentration of loads at this locality. Any packing pieces required should be of the same material as the spar and securely glued to it. A facing of plywood is a good idea, to prevent splitting. The fittings are attached by one or two small self-tapping screws, NOT woodscrews. These never break, but sometimes shear out through the wood in a severe prang.

Fig. 20.

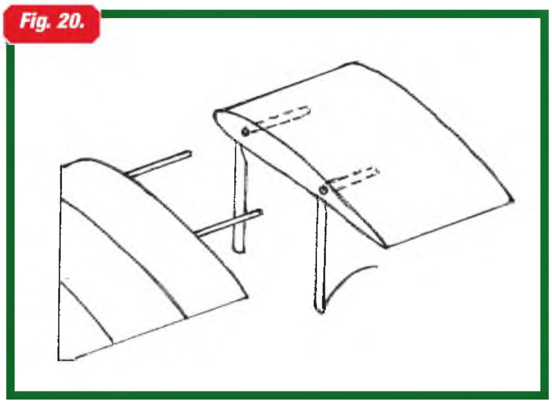
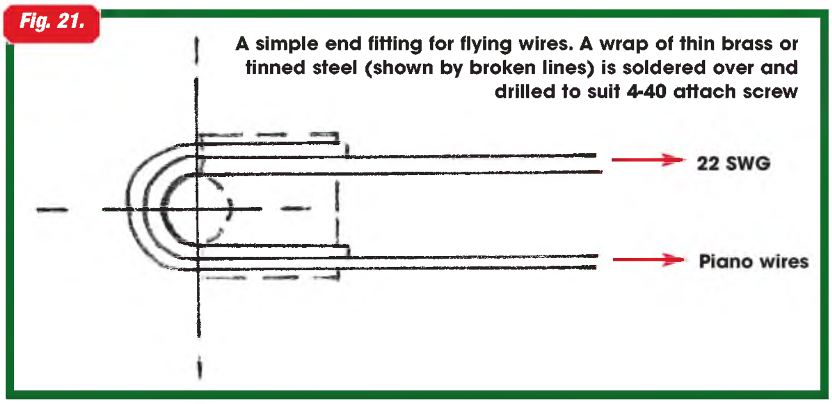


Fig. 21.



The general design of fittings is shown in **Figure 19**. This size and layout is 'fairly scale' for a quarter-scale model but unfortunately is very difficult to scale down to smaller models. The fittings look distinctly large and clumsy on my own one-sixth scale DH4 (an FSM plan) but not too noticeable if painted with PC 10!

At the smaller model sizes I would suggest dural is best, to keep the weight down and because dural is easier to cut and drill. Small pieces of scrap duralumin Alclad is regularly thrown out by your local aircraft maintenance organisations. With any luck, it may also have been etch-primed and painted, which makes it easier to mark out and paint. In happier days I used to occasionally raid the local airfield dump for scraps, but these days you will probably need a security clearance! My recent supply has been via a teacher at an apprentice school, where they use lots of dural in the sheet metal class with offcuts available in .032" (21 gauge). Mark out, punch and drill the holes first before cutting out and making the most complex fittings. That way, if you make a mistake you may be able to cut it off and still have a usable part!

The minimum sized hole for the .032" wire attachments is about .062 (1/16"). This may seem oversize but, believe me, when you come to feeding the springy piano wire, or stranded cable, through the fitting in place on the wing, you will appreciate this clearance. It therefore follows that the lug end is going to have a radius of about 3/16". Double this radius would be better, to increase the tear-out strength and most commercially produced fittings are made this way, but this makes the parts look out of proportion - in my opinion anyway. So by all means increase the size of the lug if you desire it to be stronger.

Most commercially available fittings are made from brass. I tend to avoid brass fittings, not just because of the cost of the material, but also from my experience which indicates problems in getting paint to stay on brass for any length of time. However, brass is great to use where you want to soft-solder it to piano wire, or to build up a complex shape.

These days my favourite material for fittings is steel strap used in packaging. This is about 0.5 mm (0.020") thick and comes conveniently pre-coated in a tough, baked enamel, finish of black or dark green. You can get it for nothing, and builders will almost pay you to take it away!

Wing attachments

The usual method of attaching the wing outer panels to the fuselage and centre section is via piano wire dowels into brass tubes. In most cases the wire is 3/32" (12 SWG). For small models this wire establishes the dihedral angle of the outer panels but, for one-fifth scale and larger, the dowels merely act as a shear connection and the rigging wires provide the control of angles.

In the case of small models, it is often convenient to install the dowel wires in the fuselage, but reverse this for bigger models, where wires protruding from the fuselage could be a nuisance, and possibly a health hazard! **Figure 20**, from Ross Woodcock again, shows this sort of connection, although I would usually locate these attachment elements AWAY from the spars and struts because we often have to mount rigging fittings at these locations. The solution is to have the first two ribs of each panel cut

PHOTO16

PHOTO17

PHOTO 16: Author's preferences for small model rigging are incorporated in his 1/12th scale Short 184. Wire bracing is all C/L wire and the end fittings, epoxied into the wing, are shown in Figure 3. The struts are from aluminium tube, faired with balsa and covered with paper. The F/F model is powered by a Taipan 2 c.c. diesel and weighs 3 lb., complete with a dropping 'torpedo'.
PHOTO 17: 1/5th scale FE8 (FSM Plan 267) shows what can be achieved with just piano wire rigging at this scale. Flying wires are all duplicated and are joined to single landing wires with copper wire 'acorns' where they cross (taking care to use acid-free flux!). Outer panels attach with quick-links at four places each side, and are not too obvious. Struts are all from piano wire cores with Tasmanian Oak epoxied on. Power here is an O.S. 91 'Surpass'

PLANS FOR BOTH THE SHORT 184 AND FE8 ARE AVAILABLE FROM FSM

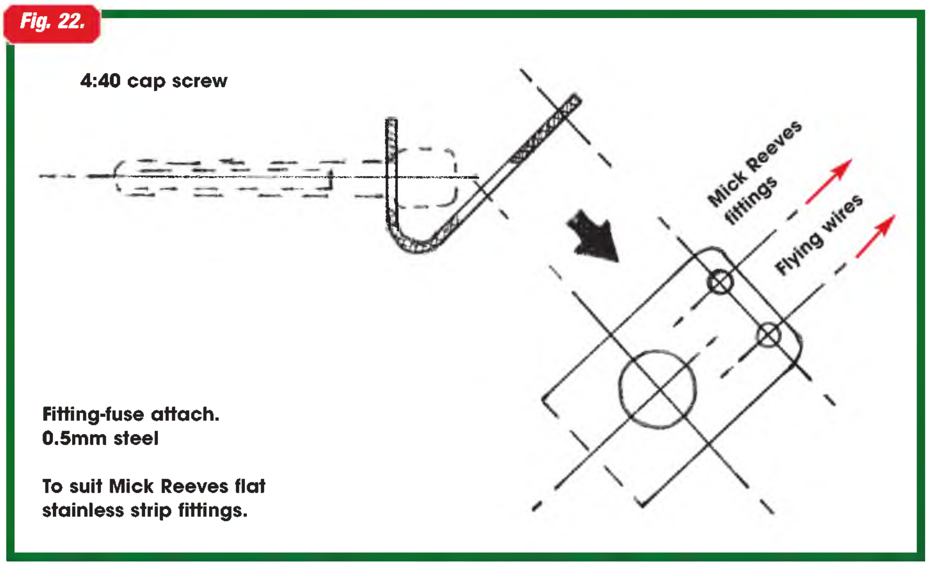
from 2 mm or 3 mm birch ply and install the wire dowels and brass tubes fore and aft of the spar positions.

Next we need a quick and secure method of attaching the rigging wires to the fuselage and centre section. One way is to provide lugs and install quick-links, and this is often convenient under the top wing, where these fittings are not obvious. The lower, flying wire attachments may be formed simply as indicated in **Figure 21**. The 4-40 attachment screws into blind nuts provide a convenient means to tension hard-wire rigging. If you have not tried the hard-wire method before, you will find it easy to form the end loops, as indicated in **Figure 19**, and these provide a crude but effective 'spring' or tensioner in the rigging.

Fittings to suit stranded wire cable follow the same general pattern except that special care is necessary to 'de-burr' the holes and generally remove any sharp edges which might cut into the individual wires. For this reason it might be a good idea to make the fittings from dural or brass. Stranded cable has more 'stretch', or extension under load, and consequently will require a model turnbuckle to provide the dimensional change. Model turnbuckles are relatively expensive and also rather too large to appear 'scale' in appearance. Nevertheless, they look good, particularly on the quarter-scale models and larger, so remain an option. Don't forget to lock-wire those turnbuckles!

For my quarter-scale Bristol F2B 'Brisfit' I used Mick Reeves stainless steel flat strip and rigging fittings, which incorporate a threaded strainer at one end. The attachment fittings to the fuselage were copied from those used on Mick's Sopwith 1.1/2 Strutter, as shown in **Figure 22**. Note the large hole in the bent-up leg, to accommodate a ball-end driver which is used to tighten the 4-40 attachment screw.

Fig. 22.



I had no problems in making and using these fittings, but a local builder of a Mick Reeves kit Sopwith Camel has all sorts of trouble rigging his model because the fittings in the kit do not have this large access hole! Why this is so I cannot imagine, except that the kit fittings may be made to exact scale for some reason. Anyway, my friend will be modifying the model's fittings to my suggestion.

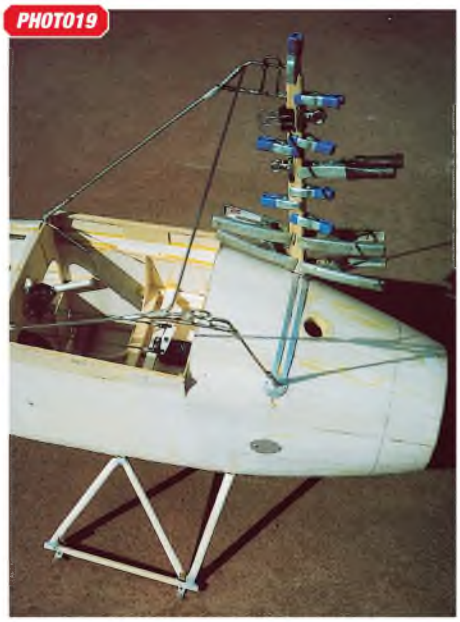
Another obvious problem, if you look closely at **Figure 22** again, is the lack of edge distance from the wire attachment holes. The Mick Reeves fittings were probably designed on the assumption that 1 mm thick steel would be used to make the attachment lug, but, even so, the adjusting fitting will still be more than twice as strong. As noted previously, I usually prefer a lug to have more than one hole diameter of metal beyond the hole, which has to be sheared out to fail the fitting. Unfortunately, I have yet to discover any steel strapping which is one mil. thick, but I am still looking!

Flight experiences

After more than fifteen years of crashing and bashing a variety of large scale biplanes I

PHOTO 18: Rigging wires are very much obvious on this 1/4 scale Bristol F2B Fighter (FSM Plan 21) and the only reasonable alternative is Mick Reeves flat stainless steel strip and rigging fittings. There's a double ration of everything on the Brisfit, including the massive wing struts which are from Tasmanian Oak with a piano wire core and fittings as per Figures 4, 5 and 6. Note that the wires act some distance out from the struts, and, in theory, meet at the centroid of the spars. The parts are not difficult to make - there are just a lot of them!

PHOTO18



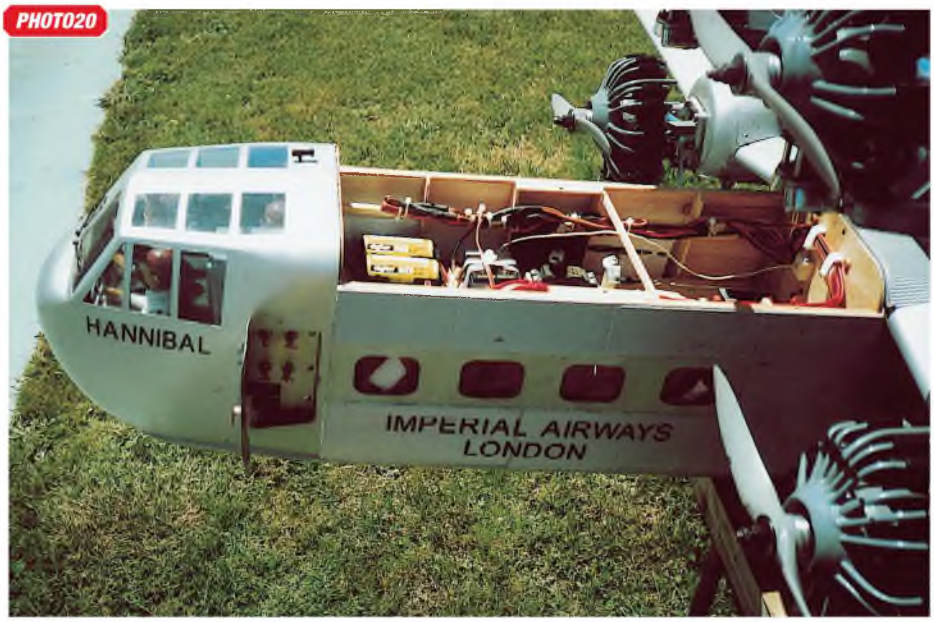


PHOTO 19: Underside view of the Albatros under construction shows large hatch between lower wings, providing easy access to servos and controls. Engine bay is drained from the large hole - a conveniently located scale access on the full-size aircraft. Battery is stored in a compartment forward of the servos and to rear of main bulkhead to which the front u/c legs are mounted. Rear bulkhead provides a mounting place for dummy control column and has an access hole through which the elevator cables pass. PHOTO 20: By way of contrast, the forward hatch on David Balfour's Handley Page HP42 provides ready access to a comprehensive equipment bay, with individual glow systems for the four engines and batteries at the front. Scale opening cockpit door reveals the four engine switches and Rx switch below. Details like these should be sorted out at an early stage in the project and preferably before construction commences.

have only experienced a few 'in-flight' failures. Proctor stranded cable and turnbuckles were used on my quarter-scale Halberstadt DV (an FSM plan) and this is still in flying condition. However, I did have a few breakages on my Albatros DV, which is a bit heavier with a more powerful engine, and of course the 'vee-strutter' is only one bay, which puts more stress on the wires.

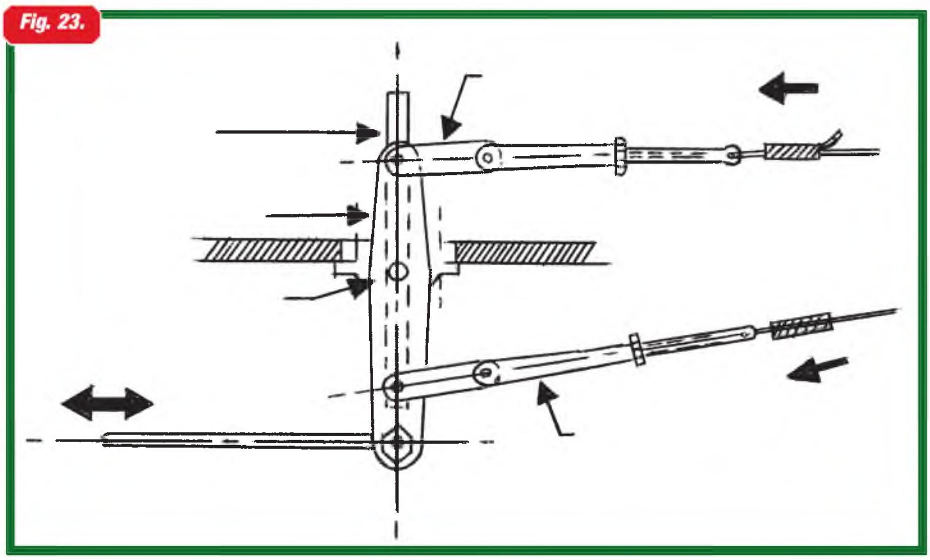
Anyway, I broke one cable in flight and, on another occasion, had a turnbuckle fail. On both occasions I was 'practising' aerobatics, which probably reflects on my standards of flying. Upon reflection, another consideration was that no 'vibration' dampers were ever fitted to this Albatros, so it seems possible that the failures may have been due to the wires vibrating in flight and wearing the bits.

It is worth noting that in both cases the model seemed to respond strangely in the air, so I landed it to investigate and found the broken rigging. The eventual fix was to install 0.8 mm 'shark trace' rigging as well as Du-Bro 'quarter scale' stainless steel turnbuckles. The only problem with the Albatros after that was due to the wires wearing where they touched. This was cured by fitting new cables (again) and coating these with epoxy glue where they crossed.

The only case of a hard-wire rigging failure in flight was on my FE8 pusher (an FSM plan) which was due to solder acid running down the flying wires and corroding them at the end. A problem of quality control, or bad workmanship, rather than design.

Apart from these examples, all the other instances of failure have been caused by contact with the ground in some form, but they do indicate that the various wires and fittings seem to be failing under the same order of load. For example, I have experienced a single landing hard-wire tear through a fitting, at the same time a Mick Reeves fitting tears through another end in a double shear-out and a quick-link fails by the pin pulling out completely, with several brazed joints to stainless wire letting go in sympathy!

Fig. 23.



Controls

When I started to build radio-control models a few years ago (1985) I bought some plans for radio-controlled scale models to see how the radio bits were installed and how the controls hooked up. To my surprise there was very little information on radio-control installations on most plans.

The drawings concentrated on airframe construction and it was assumed that anyone with enough experience to tackle a complicated scale model would have sufficient knowledge to sort out the radio-control aspects for themselves. My own situation was the exact opposite, as I had been building scale models for years and was now just starting to fly a three-channel trainer - with limited success at first! My previous years of aeromodelling and full-sized flying experience seemed to have little application to the strange hobby of radio-controlled aviation.

Even the terminology was a problem, and it was some months before I discovered that a quick-link, sometimes spelled 'kwik-link', was simply a clevis with the pin fixed into one arm. Other traps were more familiar, such as metric hardware from Asia and Europe, mixed with USA and British hardware, with some parts seeming to fit together which could lead to a loss of control. The full-sized gliding fraternity have exactly the same potential problem which we have battled with for years.

R/C modelling involved me in a steep learning curve at first and I must have made just about every mistake possible at least once. I soon established that one way to learn was to look very carefully at other people's models and how they flew.

Some people, who used certain hardware with sound workmanship, achieved trouble-free flying, whereas other modellers using cheaper components with less care and attention to detail seemed to have more than their share of bad luck. This was a bit like free-flight modelling, except that the results were often more disastrous and expensive!

When it came to radio-control scale modelling it also became obvious that different types of scale models involved quite different materials and methods.

My experience in free-flight inclined me towards the early 'stick and string' pioneer aircraft and I soon began to focus on the marvellous models produced by our local experts like Ross Woodcock and Frank Curzon. If your interest is in WW2 warplanes or jets then obviously a whole new set of considerations will apply. With this proviso the following approach to installing the controls may help some modellers.

Basic layouts

In general, the battery and servos will be installed as far forward as practical, but separated from the engine and tank by a fuel- and vapour-proof division **(photo 19)**. With an upright engine the radio gear will usually be located BELOW the fuel tank, and ABOVE in the case of an inverted engine with its requirement for a low fuel tank position.

Like most modellers, I started with a varnished interior to the engine and tank bays and applied silicone to seal the corners. The varnish soon gave way to hot oil and raw fuel and likewise the silicone cracked apart. These days I use epoxy laminating resin to seal the timber and ply (this is a good way to use up any left over from fibreglass work) and later I seal any corners and cracks with two-part slow-set epoxy glue, applied to provide a generous fillet. The forward position of controls is less critical on the larger models of course, but every bit of weight forward will help **(photo 20)**.

The radio receiver itself should be positioned to allow the maximum of aerial outside the model and, in the case of a wire-braced biplane, aft of the major extent of the wire. This cage of wire may then act as an effective ground plane to the aerial and enhance the reception rather than mask the signal. A convenient location for the Rx is to fasten it underneath the dummy pilot's seat, with the aerial led out to the tail. Needless to say, this location is usually a good place to avoid the worst of the engine vibrations, with the Rx wrapped in a felt layer and fastened with a light bungee cord.

A friend was having problems with the radio in his Sopwith Camel until he moved the Rx back to this position. These days the receivers are so light that they could be positioned anywhere. A more practical consideration is to avoid too much cost in extension leads...

Hatches

With the positions decided, the next step is to plan the size of the access hatches. As a general rule, every component should be accessible for adjustment or replacement when the model is completed. This is not much of a problem for a typical model WW2 fighter, when the removal of the wing produces a huge hole in the fuselage and plenty of access to both wing and fuselage controls. Early aeroplanes with box fuselages are also easy to attack, but there are a few types with rounded fuselages which may prove difficult. In the absence of any conveniently located and large hatches on the original aeroplane it may be necessary to improvise some cut-outs and disguise the results.

Cables

Next we need to look at the back end of the full-sized aeroplane and see what sort of control system it is which we are trying to duplicate. Fast-flying models of 'big iron' aeroplanes should have rigid pushrod systems and heavy-duty hardware fitted internally, but perhaps with some dummy controls and cables installed for the judges.

In the case of slow-flying models we have more choices, because we can get away with fitting closed-circuit, cable operated controls as per the original aeroplane. This is not mandatory of course, and there are some subject aeroplane types for which it is not a good option. For example, the elevator controls on a SPAD, and also a Piper Cub, are completely internal, so it is easier to use a simple pushrod drive.

On the other hand, an SE5, or SE5a, has a complex drive inside the fuselage and then out through the tailplane which is best avoided at model scales. The solution is to use a pushrod and install dummy cables and horns for appearance.

In the case of many aeroplanes, like the BE2c, DH4 and the Bristol Fighter, we have no choice but to install cable controls as were fitted externally on the full-size. Most aeroplanes fall somewhere between, and feature cable controls exiting the fuselage at some point and attaching to large and visible control horns. In such cases it is possible to work out the correct position of the control column and the control runs on the aeroplane, remembering that the elevator control wires are crossed-over in side view.

As a general rule the wires will terminate equal distances apart on the control column and these distances are usually the same as on the control horns. These days my usual practice is to install a simplified but functional control column in approximately the correct position, which drives the elevators, as shown in **Figure 23**. This is shown mounted on the floor, just in front of the seat **(photo 21)**. In the Fokker the controls are mounted under the floor, with the pushrod from the servo at the lower end.

Normal servos are adequate to drive the controls of low-speed models like this, even at quarter-scale sizes, although metal gears should be used for models over 7 kg. mass as will be explained later. Note that the rudder bar shown here is also functional but none of the control cables have yet been installed. An optional dummy 'control column' from wood may be pushed into the top of the functioning part, but I usually do not fly with this installed because contact between the dummy pilot and the column could jam the operation of the elevator.

Installing the cables inside a large model is not difficult as you can often get a hand inside the model and most of the way towards the tail. Smaller models are more difficult, particularly the rounded sort with many balsa bulkheads and frames necessary for a planked fuselage. In this case a tool can be made from a length of 3/32" (12 SWG) piano wire. One end is ground to a flat blade which is then pointed, and this is driven from the tail to cut holes through the many frames in the way.

A 3/32" brass tube is then inserted through the holes which have been cut and the control cable is poked inside this. Once the end of the cable is into the cockpit area it can be secured and the brass tube removed.

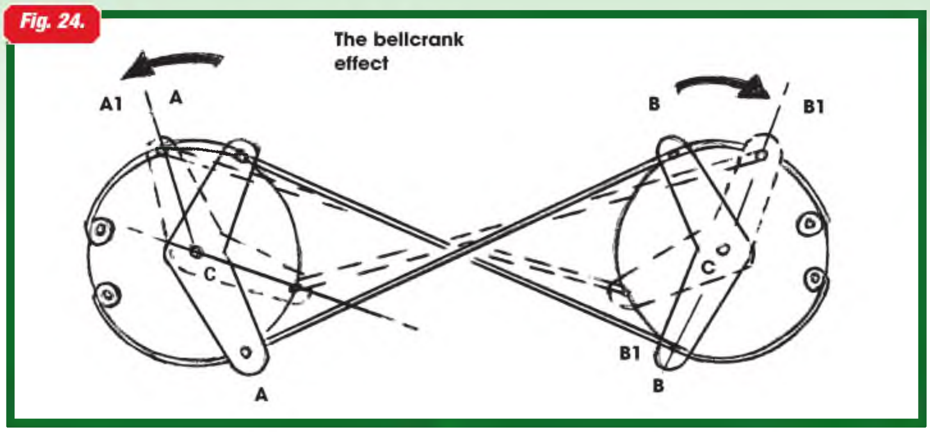
As mentioned previously, many early aeroplanes had all of the elevator control wires external to the fuselage as shown in **photo 22**. This in turn means that we need to drive both elevator horns together, preferably with a mechanical connection. For my one-sixth scale DH4 model I was able to use only one servo driving a 3/32" (12 SWG) wire torsion bar across the relatively narrow fuselage. This worked reasonably well, but for the quarter-scale Brisfit something better was obviously necessary.

The solution was made possible from the range of K&S square section brass tubes which come in a range of sizes which provide a slide fit. One quarter-inch square tube goes right across the fuselage. The horns connect from either side with a slide fit

PHOTO21

PHOTO 21: Functioning control column on author's Fokker D.7 drives elevator cables only. The 'torque tube' forward of this is a dummy from scrap dowel. Rudder bar is functional but not scale, as the original was a steel tube weldment. Note working compass at right. The 'throttle' on the left side switches on the Rx.

Fig. 24.



nesting square tube soldered to the 0.040" brass horn, which also has a piece of round tube soldered on to act as a bearing. The bearing runs in a hole drilled in the plywood-reinforced fuselage side. The horn assembly is simply retained by a small split pin.

Just inside the fuselage sides are two drive arms, also pinned in place, and these are driven by two elevator servos, connected together with a 'Y'-lead. Two servos are required because the cross tube is not sufficiently stiff in torsion and bending to drive both sides across the wide fuselage.

Having a duplicated system also provides an added safety feature in the case of a failure of one servo. Yes, I have experienced one servo fail in flight, which was indicated by the model being slow to respond to elevator signals. The model was still quite controllable and was landed safely. Later inspection in the workshop revealed one servo with a few nylon gear teeth missing - quite understandable if you consider the very large elevator bouncing up and down in the slipstream at 6,000 plus r.p.m.

This lead to a change to metal-geared servos which, as noted, are probably worth-while in all models over 7 kg. Here in Australia the defined limit between small and large models is 7 kg., so this is a logical weight to use. I am concerned only with elevator and aileron servos, of course, where we have large unbalanced surfaces. Normal servos are still used on rudder, throttle, etc.

Pulleys

Not all cable runs are straight, and aircraft designers came up with various solutions to the same problem. For example, the 'up' cable in the case of a Nieuport 17 or Fokker D7 is straight and passes right through the tailplane, but in the Bristol Scout and Sopwith Strutter a pair of pulleys are installed to lift the cable above the tailplane.

Frank Curzon showed me how to make a pulley quite easily from three discs cut from 1mm birch ply, one disc to, say, 1/2" diameter sandwiched between two of 5/8". Drill out the centre and zap in a short length of aluminium tubing to act as a bearing. Zap the surface of the ply to harden it and smooth with fine sandpaper. Bolt in place between ply support plates.

For obvious reasons only flexible control cable or fishing trace should be used over a pulley. A pulley should always be used when the control cable changes direction for more than a few degrees. A typical rubbing strip or fairlead is shown in **photo 23**. The 'up' cable on the Brisfit touches the leading edge of the tailplane and I have fitted a protective rubbing strip as per the full-size. I have moved the cable to one side slightly so you can see that the nylon-covered trace is happily wearing a groove through the aluminium plate. There seems to be no noticeable wear in the nylon cover but any large change in direction would result in very rapid wear to a fairlead and the cable.

Control horns

I always make the control horns from dural sheet and epoxy them in place, even on most of my small free-flight models where they are mostly for decoration. Metal horns bend, while plywood will snap off. Where the originals were wood they just get painted to suit.

Photo 24 shows a rudder horn on the Brisfit made form 0.040" dural (2024 T3 alclad). Note the scale bracing wire reinforcing the horn's attachment into the rudder. This piece of light gauge wire provides an enormous increase in strength and stiffness. Also note the end fitting on the horn to establish the end fitting pivot in line with the rudder hinge.

These small details must be incorporated into a scale model if it is to function correctly.

Actually, a control horn is a somewhat primitive and unsatisfactory way to drive a control surface. The most efficient way to transmit rotary motion from one part to another using a cable or chain is via a drum or sprocket wheel. **Figure 24** illustrates how two drums can be made to transmit smooth angular travel in opposite directions using crossed cables. If the cables are not crossed they will cause the drums to rotate in the same direction.

Note that the length of the free cable or chain which is not touching the drum or sprocket A-B is equal and constant. The drums have been made large in relation to the distance between them to better illustrate the problems caused when we try to substitute control horns to perform the same function. It should be obvious that, for best results, an equivalent control horn should be shaped so that its arm A-C is at right-angles to the operating cable. (Just think of a pushrod end.)

For small angular movements the system works reasonably well, but for large control movements it is obvious that the straight line distances A1-B1 vary from the original A-B as shown by the dashed lines. The same thing happens if we rotate in the opposite direction. In practice this means that if we have tensioned our elevator system correctly at the mid-position, moving the control one way or the other will cause the balancing cable to lose tension, or even go slack.

This would be a real problem for a high-speed aeroplane, because the control surface would be free to flutter. For this reason most modern aeroplanes, and certainly all of the WW2 combat aircraft that used cable-operated controls, did so using control quadrants, which are segments of drum. Even then, cable drives have other problems, such as differential expansion between airframes and steel cable changing their tension, which led to their demise, and of course power-boosted controls became necessary at high speeds.

Even at low speeds they have had their day, as in modern sailplanes with floppy wings which are prone to flutter, pushrod controls are now universal and cables are restricted to the rudder systems only.

At the low speeds that most of our models fly, cable drives still have many advantages, particularly in keeping the weight down at the back end and, of course, looking like the real thing on a scale model. ■

PHOTO 22: The external elevator cables on the Bristol F2B Fighter are 90lb. nylon-covered fishing trace, attaching to the external horn with 2.56 quick-links. Even at 1/4 scale these are a little too large for scale attachments. PHOTO 23: Leading edge protective rubbing strip on the 1/4 scale Brisfit showing wear from contact with an elevator cable. With the model tailplane set at zero incidence the 'up' cable changes direction by one or two degrees. The full-sized aircraft had an adjustable tailplane which could be set several degrees either way, so the contact may have been more severe with the tailplane adjusted up. PHOTO 24: Rudder horn on the Brisfit is typical of all, with an end fitting to move the cable attachment point forward to line up with the rudder hinge. On the model the rudder horn is 0.040" dural, with a 'U'-shaped end fitting from 0.020" steel sheet. An 8BA bolt attaches the rudder cable. Rear bracing is 0.032" wire passing through an aluminium tube epoxied into the rudder and then attached to the other side of the horn.

PHOTO22

PHOTO23

PHOTO24

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Andy's finished P-51D from the Brian Taylor plan. Properly applied and correctly sanded, a glass cloth finish need be no heavier than tissue and dope - and it's certainly a lot tougher.

A NOVICES GUIDE TO GLASS CLOTH COVERING

Andy Ward passes on what he learned from his first attempt at glass cloth surface finishing a scale model

To me, the building and flying of scale models has always been a passion in life. Indeed, it was the very reason I learned to fly many years ago. I strive to build each new model a bit better than the last one, perhaps using new techniques and methods learned along the way. I am also a great reader of books and articles, absorbing information on scale modelling like a sponge, and enjoy the willingness to share information between like-minded modellers.

In an effort to replicate the metal skinning on the full-size better than I had done previously, I used glass fibre cloth and finishing resin on my Brian Taylor P-51D Mustang. I had tried glass-clothing many years ago on a 'Phase 6' glider fuselage. It was enough to put me off for life, as, in hindsight, the cloth was too heavy and prone to fraying. It looked a total mess and added loads of weight. However, the model did fly well and I still regret selling it.

Previously, on models of metal-skinned aeroplanes I had used tissue and dope beneath the paint, but always seemed to get an area where the wood grain would still be visible and spoil the desired effect. It was also a 'soft' finish and prone to hangar rash. For the Mustang, I decided to bite the bullet and give glass-cloth surface finishing another try.

The method outlined below is how I did it and it worked for me. It is a combination of several other people's ideas (nothing is truly original) and I thought that, perhaps, it would be useful to relate my experiences, giving encouragement to other 'glass cloth virgins' to have a go.

Materials

As I was starting from scratch, I had to make an initial investment in basic materials (actually, enough for several models of this size). I purchased most of these from *Fibretech*, but my method uses a combination of products.

By far and away the two most important ingredients cannot be bought. These are time and patience. It is essential with any new technique to allocate plenty of time, as you will be working slower on this first occasion. I think it was Brian Taylor himself who wrote that scale modelling is very time-consuming and that anyone serious about scale should "buy the wife a

TO MAKE A START, YOU WILL NEED THE FOLLOWING:

- Epoxy resin and hardener
- Lightweight glass cloth
- Epoxy thinners
- Cleaning solution
- Scissors
- Old credit card or similar
- Paint brush
- Wet and dry paper
- Measuring cup
- Plastic gloves
- Tack cloths
- Disposable face mask

1: The basic materials. Andy used a combination of g/f supplies from Fibretech and Chemie-Technique. 2: Wing covering starts by cutting a piece of lightweight glass cloth to size, allowing a rough overlap which is sanded clear when the first resin coat has been applied. 3: Far left: Use an old credit card to scrape the resin through the cloth and into the balsa, working from the centreline of the panel towards leading- and trailing-edges. 4: Sanding. The initial material removal was by sponge sanding blocks, then Andy used a progression of grades of wet-and-dry paper for final finishing.

lawn-mower"! Well, I still cut my own grass, but the Mustang was my own project, not a review model, so I could afford to dedicate as much time to it as it needed.

Surface preparation

The completed Mustang airframe was prepared to the point of covering by filling any dents and sanding back to as smooth a finish on the bare balsa as possible. This is important, as any imperfections will show through the glass covering. Next, I gave the whole airframe a coat of sanding sealer to help fill the grain of the wood. This was then sanded back and, most importantly, all dust was then removed using a vacuum-cleaner and a tack cloth. Tack cloths can be bought from the local car re-finishing supplier very cheaply and I now wonder how I ever painted a model without using one.

It is also important to ensure that the work area is clean and dust-free. We don't want any wood shavings sticking to the model, do we!

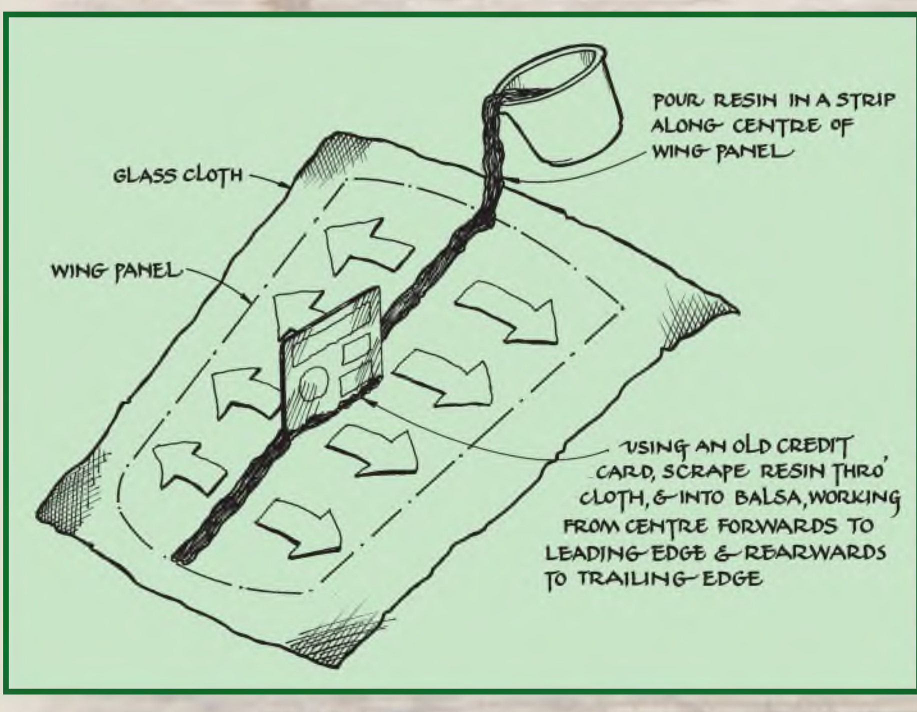
Stage One - applying the cloth

I used the lightweight cloth in the *Fibretech* Starter Kit and used sharp scissors to cut the cloth to cover the component leaving about one inch all round. The cloth is then laid onto the surface to be covered in preparation for the resin.

I covered the bottom of each surface first, followed the next evening by the upper surface, but I don't suppose it really matters in which order you do things. For the fuselage, I found it best to overlap joints in the cloth by 6 mm or so. The joints are sanded to be invisible after the resin has been applied.

Only a small amount of resin needs mixing at any one go, typically around 15 ml, as a little goes a long way. The object here is to adhere the cloth to the wood using the minimum amount of resin possible, to avoid unnecessary weight build-up. I found it most helpful to thin the epoxy by around 10% using the correct thinners. Some sources advocate the use of isopropyl alcohol but I could not find this locally.

Taking the wing as an example, begin by pouring a strip of resin from the measuring cup down the centre of the panel from root to tip. The resin can now be either brushed outwards from the centre to the edges, or an old credit card used to do this job. The credit card was used on the Mustang and by using this, it was possible to really scrape out the resin to a very thin coating, almost out to the leading- and trailing-edges. I then used a brush to wet out the cloth at these edges, around the undercarriage and other



5 & 6: Finished Mustang airframe components, cloth-covered and ready for panelling and other scale detailing. Just visible are the remains of the sprayed coat of grey primer which is sanded back to reveal any areas which may require further attention. 7: Fibretech supply a kit that includes and 'paint-roller' style resin applicator with sponge roller heads and tray for the prepared resin. Celulose thinners is idea for cleaning up brushes and any mess. 8: Fibretech kit also comes with surgical gloves for hand protection. 9: Clothes pegs have just enough weight to prevent the loose edges of the glass cloth tangling up with the resin filled surfaces.

cut-outs on the wing.

I had to work fairly quickly as, although the pot-life of the resin was long enough, I found the thinners evaporated quickly, thickening the mix and making it harder to work. The ideal consistency I found to be that of milk; this then brushed out very well. Any surplus resin at the edges can be mopped up with a paper towel and thrown away. Wastage is minimal, so don't worry about it.

If applied correctly, the result should be a dull surface to the cloth. If it is glossy, there's too much resin on the surface and this must be removed before it goes off as it is only adding weight, not strength, to the wing.

It is sometimes difficult to persuade the wetted cloth to hang over a wing tip or leading-edge. To help this, I hung wooden clothes-pegs on the overlapping surplus dry cloth at the edges to act as weights whilst the resin cured. The wing panel was elevated from the surface of the bench using foam blocks to allow the pegs to do their stuff and this worked for me very well.

Once the surface of the wing has had the resin applied, it must be left to dry thoroughly. I left mine until the following evening before continuing.

Stage two

When one side has cured, the surplus cloth can be trimmed from the edges using a sanding block and a sharp blade for tight corners. This is quick and easy to do. The wing can then be turned over and the cloth and epoxy process described in Stage One is repeated to fully cover the wing.

Once this second surface has cured and the edges have been trimmed back, the wing is almost - but not quite - ready for its second coat of resin. Before this, however, the cured epoxy surface must first be wiped over with a cleaning solution. This removes any wax on the surface, helping the second coat of resin to adhere, and eliminates any 'bloom' which might manifest itself in small 'fish-eyes' on the surface and which are a devil of a job to get rid of. Having cleaned the wing surface, it can now be given a further coat of resin.

Stage three - the final coat

The objective of the second coat of resin is to fill the weave of the cloth, which should still be visible at this stage, without adding weight. To this end, the resin is mixed up as before and is applied to the surface as in Stage One, using the credit card and brush. It is vital to have an even coat of resin, with no runs. Also, this is the time to make sure any bare wood areas, such as aileron cut-outs and the ends of the ailerons, etc., are given a thin coat of resin.

When both sides have totally cured after applying the second coat, you should have a surface which perhaps has a few lumps and bumps, but which is completely covered with a hard surface. Once again, treat it with the cleaning solution as before and then it's ready for the final stage - sanding.

Stage four - sanding back to a finish

Always wear a face mask when sanding glassfibre - or sanding any material, for that matter. Cheap disposable ones are easily available from DIY shops. I started my initial sanding using sponge sanding blocks which are available from your local car accessory shop very cheaply. They are quite rough and ideal for initial material removal. They also do not clog if used with water.

Speaking of water, this is really the key to a good finish, to my mind. Use plenty of it with the wet-and-dry paper. The water will not harm the model and acts as a lubricant, making the sanding phase much easier on the supplies of elbow-grease! I bought a couple of sheets of grades 400, 600 and 800 and, using each of these in turn wrapped around the sponge block, found it quite pleasurable to sand back the resin to a glass-like finish.

I must admit that this stage of the process, the final sanding, had put me off using the method as every article I had read had suggested it was such hard work. I did not find this to be the case at all and found myself, on occasions, sanding too hard right back to the cloth, necessitating the application of a little more resin to correct my mistake - so be warned!

Patience and care is the key. The final 800 grade of wet-and-dry gives an excellent finish, without the need to go right down to 1200 grade, in my opinion.

Having completed the sanding, I then gave the airframe a light sprayed coat of primer, which was then almost sanded back off again. This highlighted some areas which needed a little more attention.

The surface of my Mustang was now silky-smooth and ready for the application of panelling and other detail, prior to final painting - but that's another story!

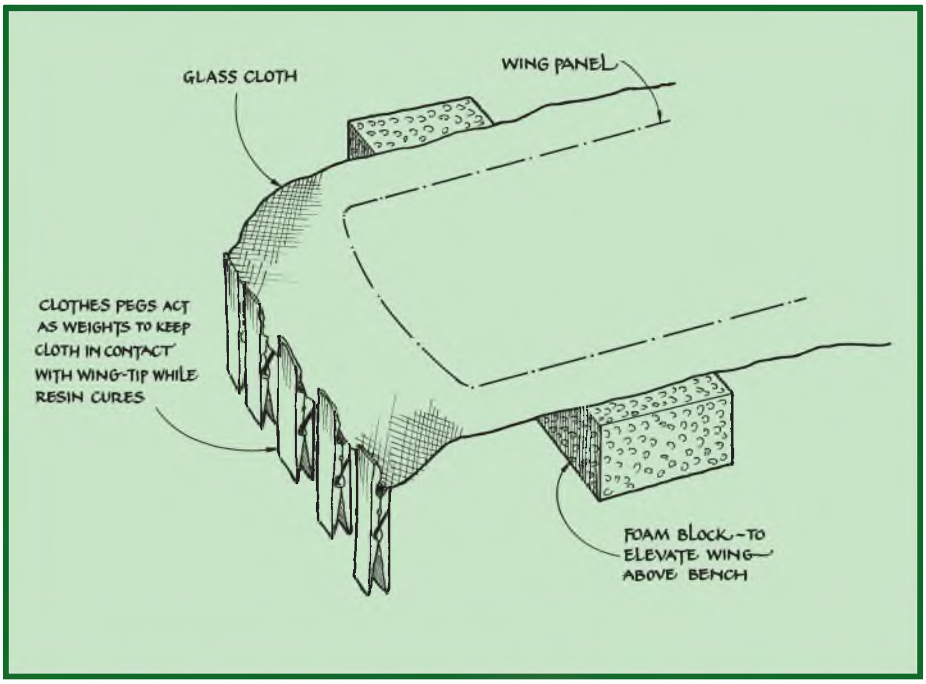
Summary

To sum up, I was very pleased with my efforts. I had produced an airframe that was no heavier than it would have been had I tissued and doped it and one that, being a 'hard' finish, was far more resilient to the occasional knock.

I must admit that I did find that the process took some time (about two weeks of evenings), but I was finding my feet with a new technique and I'm sure that the next model will be tackled with much more confidence and will be quicker.

I'm convinced that glass-clothing is the only way to obtain a permanent hard finish (I've also found that doped 'tex finishes bubble after a while) and gives a real feel of a metallic finish to the model. I'm totally converted. Please give it a try and I'm sure you will be too.

I'm off now to try to teach the wife how to start the lawn-mower! ■



Here's something worth considering. This simple jig with attachment points either end of the fuselage allows the fuz. to be rotated during the operation, leaving both hands free for the work in hand.

Winter Warbirds

Alex Whittaker takes his cameras to RAF Barkston Heath in deepest December

A man can only take so much turkey, booze, and bonhomie. By the time it got to the slack period between Christmas and New year, I was ready for a full day on the flight line. After a 5.30 am start I managed to cross the Pennines by 10 am. As I arrived at the airfield gates, there were 200+ modellers standing in the cool wind. The unseasonable bright sunshine was a delight. The great thing about this laid-back event is that ordinary club modellers like you or I can fly alongside the very best show pilots on the UK circuit.

Get on it

Warbirds events are very sociable. Everybody mucks in, so the pits were soon alive with the sounds of jet turbines and big petrol engines being run up. Since Barkston's 'central' location mutually disadvantages almost every one, such events are always well attended.

This Winter Warbirds event is the one place where you will see Southern and Northern pilots flying together, and pulling each others' legs. The wind remained very cold, but it stayed straight down the runway all day. The light began to fade

There were 200 attending, so the Pits had a few lanes.

somewhat by 2.30pm, but we were not beset by the dreaded Barkston Clag. Unusually, no sizeable clouds blocked the sun all day. The hallowed RAF Barkston Heath tarmac attracted a goodly number of brand new models, fresh from the shed. As we shall see later, onesuch wasn't even a warbird, but it was ecstatically received by an appreciative crowd.

As usual, the crisp tarmac also attracted a crop of shiny new jet turbine models, so whether your warbirds interest was predominantly prop or turbine, there was flying scale action all day.

DH Leopard Moth

With such a huge attendance, I can't mention every model, but here is a cross-section. Paradoxically, the most interesting model at the event from my point of view wasn't even a warbird. It was an elegant 'tween-the-wars British light aircraft: a huge DH Leopard Moth. It was being test flown, so I had no wish to interfere, so I will get you full details when next I see it. Built by Large Model Association man John Rickett and flown by his equally able son Steve, the Leopard Moth was very, very impressive in the air and immaculate on the

Paul Williams imaginatively schemed Meister Corsair in post-WWII Thompson Tro phyracer scheme. 100" span, DL50 power, weighs 16 kgs.

Steve Haughty's Albatros about to land. L-39s are very popular with the the UK jet community.

Dennis Richardson's 69" span HP Heyford powered by two OS .30 Four stroke glow engines. Weighs 6 1/2 lbs.

Much refurbished Cub in military garb by Ian Pallister.

Snazzy scheme on Ryan Edwards' YT International Fw 190 Dora, on flaps down approach. 50 cc twin petrol powered.

Mick Burrell's Lockheed T-33 Shooting Star in Thunderbirds livery. 105" span, weighs 39 lbs, Merlin 160 power.

Immaculately prepared Hawker Hunter by Geoff White flashing by on full throttle. 82" span, weighs 45 lbs. Jetcat P-180 power.

Ali Machinchy's 100" span, BF 220 powered F-100D (sometimes dubbed the Super Sabre).

ground. You can catch up with this one on the LMA Show Circuit this year.

Bud Nosen Thunderbolt

We first covered Steve Foxon's almost finished Republic P-47, built from the famed Bud Nosen kit, at last year's Sleap Warbirds. Since then Steve has completed this impressive model of 103" wingspan. The model weighs 38 lbs.and Steve flewit in a spirited fashion, and she has enough mass to look like heavy metal.

FW 190 Dora

Ryan Edwards was flying a YT International Fw 190D (that's the one with the in-line Daimler Benz engine stuffed into a radial cowl). It spans 82" and weighs in at 25 lbs. The colour scheme was very busy, which business contunued below the wing, too. Power was from a 50cc petrol engine of unstated chinese provenance. The Dora flew very well and is well worth consideration if you want an ARTF, and fancy a different take on an old favourite. When it comes to scale ARTF models, YT do seem to ring the changes.

North American AT-6

Glenn Masters' magisterial AT-6 (Texan/Harvard) has been on the show circuit for a number of seasons. It is much quieter than the full size (!) and looked utterly convincing in the air. Sadly, it suffered a minor mishap on landing with the starboard undercarriage. Knowing Glenn, I'm sure he fixed it that night!

Comp Air P-51D Mustang

Many know Mark Hinton best as an accomplished exponent of the art of radio control. Some people forget that versatile Mark was also a highly successful Free Flight Scale Competitor at National Level in his youth. Today he was campaigning his lovely Comp Air Mustang. As with all his models, this was expertly finished. It spans 100" and is 3W

Warbird Test Flight. Phil "Bubbles" Gould's brand new YT International ARTF Me 109 res-chemed by Dennis Richardson.

70 petrol powered. Look below to find out about Mark's impressive new jet.

Airworld F-100D "Super Schnitzel"

Drawn by the magnetic attraction of the Barkston tarmac, jets are always big at this event. As usual, Ali Machinchy Jr arrived mob-handed with a shedload of jets. His new 100" span, BF 220 powered North AmericanF-100D Super Sabre was finished in what Ali described as a 'phantom scheme'; In other words, it is not a documented scale scheme, but it is very meticulously finished. Up close, the fit and finish was exquisite. Built by Norwegian jet-maestro Trond Hamerstad, it is difficult to describe model jet perfection, but here it was.

Fly Eagle DH Vampire T.11

Ali was also flying the criminally lesser-modelled two-seat trainer version of the celebrated DH Vampire. This Fly Eagle Jets version spans 110" and is powered by a Kingtech 180 turbine. The scarlet trim over the aluminium finish made for a very pretty model in the air.

Skymaster A-10

Well known jetist Mick Burrell brought his usual comprehensive air-fleet, including a fine Lockheed T-33. He also brouught his stunningly aggressive, twin Evo Jet 160 turbine powered, Fairchild/Republic A-10 'Warthog'. Both are strong performers, and beautifully finished.

Airworld Hawker Hunter

If you ever wanted to see a well presented Hawker Hunter, look no further than Geoff White's example. It is from the Airworld kit, soans 82" and weighs in at 45 lb. The Hunter is powered by a Jetcat P 180 RX. Many moons ago, Geoff taught me to fly jet trainers at The Paul Heckles

Lovely Photo -Recon Spit IX, just needs someone in the office.

Ali Machinchy flew this rarely modelled DH Vampire T.11. It is the Fly Eagle Jets version.

Ali Machinchy's DH Vampire T.11, two seater variant. Spans 110" and is powered by a Kingtech 180 turbine.

Glenn Masters impressive AT-6 looked utterly convincing but thankfully was much quieter than the original.

Glenn suffered a gear failure on touchdown. All fixed now.

Mark Hinton's superb Jet Legends F-16 on short finals.

Mark Hinton's F-16 taxying back. Note undercarriage lights.

School Of Flying, so I can vouch for his skills.

Global Jet Club MiG 15

Dave Wilshire is well known as the proprietor of Motors & Rotors, but as a jet pilot he is in the first division. Today he was flying his bright red 1/6th scale Global Jet Club MiG 15. This model is of fully composite in structure, and Jetcat P-100 RX powered. It is a very handy size at 67" in span and certainly scorches along, looking very aggressive in the air. JR XG-11 radio.

Jet Legend

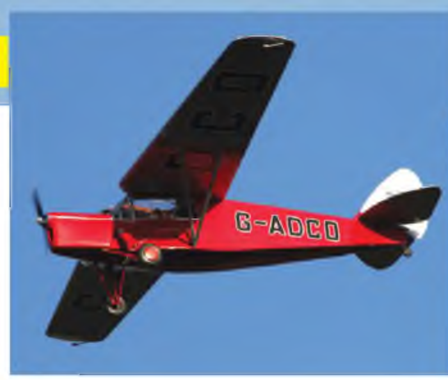
Besides campaigning his Mustang, gifted all-rounder Mark Hinton was flying his new Jet Legend F-16. Mark is one of the best scale pilots of his generation and he flew the F-16 with appropriate military discipline. It is clear that Mark carefully plans his pattern of manoeuvres to best display the individual aircraft. Flying so smoothly, and accurately whilst being faithful to the attributes of the

Mark Hinton's Comp Air Mustang P 51-D. Spans 100" and is 3W 70 petrol powered.

prototype takes real skill. It also indicates active scale research into the realm of operational flying. The F-16 weighs 12.5 kg, spans 1.7 metres, and is Jetcat P-180 powered.

The verdict

Grateful thanks to event organiser Richard Scarborough and all his mates from the famed Ozzenby Club. It is a canny choice of date to holdn such a meeting between Christmas and New year. We enjoyed a very slick event, with no hold-ups, hang-ups, harrassments, or prima-donnas. Michelle's Burger Bar ministered to us all day, and the life-affirming fried egg sarnies were scruptious.



Not a warbird, but being test flown at Barkston on the day: John Rickett's superb Leopard Moth.

Contact! Steve Foxon spins up Bud Nosen Thunderbolt.

Setting out 'cross country, John Rickett's immaculate DH Leopard Moth.

Study In Scarlet. The DH Leopard Moth is appealing from any angle.

THE QUIET ZONE

R/C SCALE ELECTRICS WITH PETER RAKE

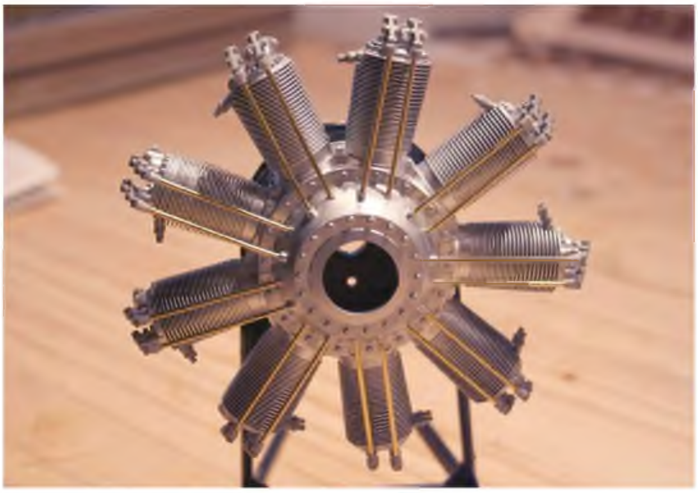
THIS MONTH, JONATHAN RIDER EXPLAINS HIS TECHNIQUES IN PRODUCING A RANGE DUMMY ENGINES; ROTARY, RADIAL AND IN-LINE TYPES

Here we go again, more electric flight stuff for your delectation. As you know by now, this column never seems to go quite according to plan. I fully intended to complete the details of Jonathan Rider's little Sopwith Camel model, and then he sent me more info on making dummy engines. So, I've decided to combine his description of the engine he used in the Camel with the rest of the engine-making item and leave what Jon has to say about painting and finishing until next time. I won't mess about with what Jon has written, so just bear in mind that this is the concluding part of one item tacked onto what could have been a stand-alone item in its' own right. That being the case, we'll start with the Camel engine and then go onto the more general dummy engine article.

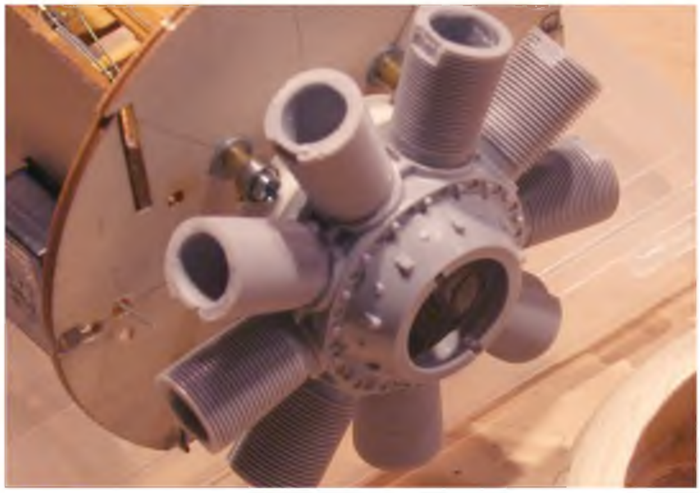
THE CAMEL ENGINE

The early Sopwith Camel used a 130HP Clerget 9B Rotary engine. A Rotary engine is basically just that, an engine that 'rotates' as it operates. The crankshaft is bolted tight to the firewall and the entire engine rotates around the crankshaft. The propeller is mounted to the crankcase, and spins along with the engine. This design provided better cooling, smooth running and lighter weight than a water-cooled equivalent of the same period, although water-cooled inline engines and radial engine technology was getting better much faster, and the life of the rotary engine was comparatively short.

A SIMPLE VAC-FORM ENGINE CAN BE MADE TO LOOK GREAT WITH A LITTLE CARE. HOW LOST WOULD THIS GEE BEE LOOK WITHOUT IT?

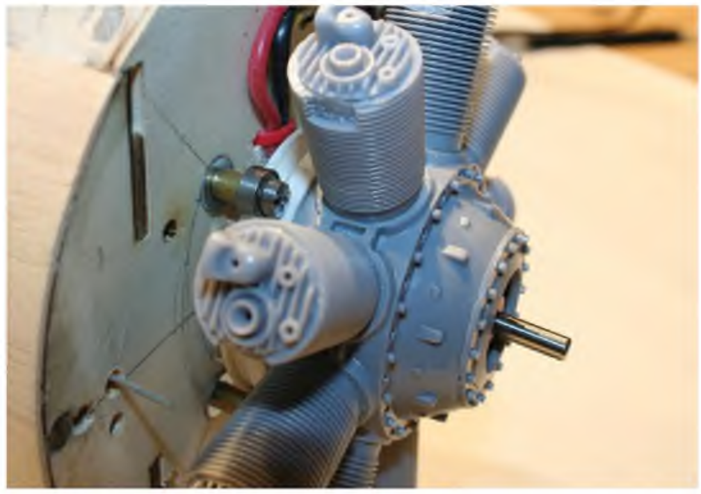


Jon's Camel engine started as a plastic kit but was modified to suit the model.



Here you see the model car bearings used as rollers to allow smooth operation of the rotating engine.

All that will be visible once the model is finished.



A better shot showing the grooved drainpipe and how the rollers fit into it holding everything square to the firewall.

Like a lot of WW1 aircraft that used rotary engines, it's difficult to create the illusion that the entire engine is spinning on a small-scale model. Some people use images of a blurred motor, and glue them in the cowl, others just use cylinders that do not move. In flight, who will see it anyway? Well, I built a plastic 1/9th scale Clerget motor, and I wanted the entire package to spin like the original, and that was going to lead into a challenging engineering problem. As some may be aware, the new smaller outrunner electric motors spin much faster than their WW1 rotary counterparts. These new electric motors can reach 3,000-5,000 RPM, where the Clerget rotary engine of WW1 would spin at 1,700 RPM. If you took a balsa or plastic dummy motor and spun it at the speeds of the electric motor, it most likely would destroy itself and the aircraft you installed it on! Not a great way to start, so we needed to design a way of making it work safely and scale-like.

How do you spin something at a safe speed, while the electric motor and propeller turn at an operating speed of about three times that of scale? Well you could gear it - but that would take far too much weight, and would be too complex to complete at this size. Some modellers have gone the route of attaching a 'dummy' motor with a brass bushing on the shaft of the 'real' electric motor, creating rotation through drag on the bushing. That works very well, yet we had a challenging problem. With the electric motor requiring right and down thrust added for the R/C model to fly, the small cowl did not have enough room to support a dummy motor with any right and downward thrust angles. The dummy motor would hit the straight cowl.

My answer was to take a piece of PVC plumbing pipe that just happened to be the same diameter as the Clerget crankcase, and I turned a 3mm groove into it. I attached the PVC to the back of the crankcase, and made four bearing posts to attach on the firewall, and placed 3mm R/C car wheel bearings to the posts. The bearings on the posts fit right inside the 3mm slot cut into the PVC, and the Clerget spins easily on the four bearings, with no drag at all!

The electric motor fits inside of the cavity of the model Clerget, and I attached a piece of leather to the inside of the Clerget to drag against the outside of the outrunner motor, and when I speed up the electric outrunner motor, it spins the plastic dummy Clerget with very little drag on the electronic motor, at a wonderfully scale speed. Now we have an exact 1/9th scale Clerget rotary that spins along with the propeller.

OTHER ENGINES

Ever since the beginning of powered flight there are the aerodynamic basics that all aircraft must have to fly: lift (wings or rotors) drag, weight and thrust. Gliders convert weight into thrust and helicopters create thrust and lift together. The common method of thrust is a motor or engine of some sort (jet, rocket, turbine or reciprocating). When we build our model aircraft, I bet there is some element of the aircraft that shows a scale component of the propulsion system. It's easy to see in early aircraft, from rotary and radial engines in big round cowls to inline cylinders and large radiators. Later aircraft had fully covered engines and more aerodynamic features that hide the motor details; for example a Mustang or Mosquito. Late model jets had fully enclosed engines, and the only thing you normally see from the outside is the tailpipe!

When building a model aeroplane with a visible engine, it is very obvious when it is missing, and to keep that coveted 'scale look', we need to make one scale to our airplane. O.K. let's see how we can provide a few ways for you to make your own motor without having to use an entire machine shop and have an engineering degree to design it. Remember, you are not designing a working engine, it will just look that way when you are done.

Depending on the type of aircraft that you're building, some engines are

BREAKING THE ENGINE DOWN INTO EASILY FABRICATED COMPONENTS EVENTUALLY LEADS TO A REALISTIC DUMMY ENGINE. NOT AT ALL BAD FOR JUST 1/12 SCALE.

fully enclosed where you'll only see the engine exhaust, while other engines are completely exposed where you see the entire engine, propeller and mounting system. Early aircraft had much more exposed engines for multiple reasons: first the engines were normally air cooled, therefore requiring a lot of airflow over the cylinders and crankcase. Some of the first water-cooled engines required not only air cooling to pass over the engine, it also required a large radiator and cooling tank with significant airflow through the radiator to keep these large engines cool. Early aviation engines that were developed for aircraft provided as much power to weight as possible, but even so, these engines were heavy and not 100% reliable.

So how do we replicate these motors and engines in order to get a very real looking power plant without adding too much weight to our model aircraft? Before we begin, let's get back to that old subject of weight and balance. *(I know Jon, you bring this up all the time, but it's important, I see many people build wonderfully light scale aeroplanes, just to add a lot more weight in the nose to balance it. I get it, sometimes you need to add additional weight to the front of your aircraft in order to balance it, and adding unusable weight is a waste of time and energy. Why not take that needed weight and make scale details to suit your aircraft? Enough rambling on, (Especially since that's my job. PR)* so let's make some engines that are scale, will look good and may also help us with our weight and balance.

'SWITCHES ON'

When building my 1/12 scale DH1a, I noticed the focal point of the aircraft was this beautiful Copper-jacketed Beardmore water cooled engine. Wow, that was great looking, but how do we begin making something like that? It has to be light, scale and it's pretty detailed!

First, I did some research online and found some great colour images to go by. I mounted my electric motor on the fuselage and established the thrust angle and the spacing for the propeller. Using those proportions, I started with a solid balsa crankcase and made six cylinders using stiff construction paper wrapped around small balsa circles made out of very light weight wood. Once the cylinders are made, these are glued on top of the crankcase and then painted with copper paint.

Once completed and dry, the details like rocker arms, exhaust and intake manifolds and details were made to match the photographs of the real thing. As you can see, I use a significant amount of reference material for building the engines, so I can compare my work against the real motor. This helps me create a great replica and answers any questions I may have about parts placement and details. I made two Beardmore engines, one for the DH1a and another for my (same scale)

Jon's Beardmore looks rather good when compared with a photo of the real thing.

FE2b! Many aircraft use the same engines, so keep that in mind if you have a few kits or plans to build - you may end up making more than one engine.

I used the exact same method for the Mercedes engine for my 1/9th scale Albatros D.III, it only shows the upper half of the engine, as the rest is covered by a Litho-plate upper cowl. One nice note about the early Mercedes is that the upper cam cover was cast aluminium, and it had a rough texture. Painted balsawood replicated that rough casting very well, and with a few little brass nails to replicate the attachment bolts, it looks like the real thing. Take your time making the cylinders, and make sure they are attached really well to the crankcase. This is the foundation of your engine, and when you attach intake and exhaust manifolds, the base surface has to be strong.

Another in-line engine example is my 1/6th scale Sig Piper Cub. One of the key visible scale features of the Cub is the four-cylinder motor sticking out of the cowl. The design and build was pretty easy; all I did here was make four separate cylinders by stacking balsa circles, one round, the next one larger and square, then another round, then a square on top of each other. When done, I very carefully sanded down the square fins to shape, and having the smaller circles between the fins, the stack cylinder spacing was perfect!

When the four cylinders were done, I made valve rocker covers from balsa, and covered them with aluminium tape, replicating the chrome rocker box covers on the real airplane. I glued two cylinders side by side together, then attached them to the outside of the cowl. I then added a metal air deflector on top of both cylinders, painted the area around the cylinders to make it look like it comes from within the cowl, added some exhaust pipes, and there you have it, a fully scale engine. The best part of this design is it leaves the inside of the cowl free for any sized model engine or electrical motor you want to use.

LET'S GET ROUND TO IT

One of the most distinguishing things (to me at least) is the rotary or radial engine on an aircraft. From the Fokker Dr.1 to the F4U Corsair, there is something about a big old round cowl with a round motor up front, as they are ascetically pleasing and the sounds they emit are just as beautiful. So are Rotaries and Radials the same thing?

Nope! There are two types of 'round' engines used in World War I and post-World War I. The Rotary engines actually rotated around a crankshaft that was fixed to the firewall and the propeller was attached to the crankcase and cylinders. The whole motor spun around the crankshaft, which made it interesting for pilots of early airplanes, as the gyroscopic results of this spinning mass made turning the airplane quite a challenge!

The Rotary engines needed to be exposed to the air in order to cool themselves as they spun underneath the cowling of the aircraft. They didn't have exhaust manifolds, so they slung Caster oil and unburned fuel back toward the pilot. (That's a whole other story, and why pilots had those long white scarves to clean their goggles). Aircraft like the Fokker Dr.1, Sopwith Pup and Sopwith Camel, as well as other aircraft, utilized this powerplant which was very effective for many years.

A Radial engine is fixed to the firewall, and the crankshaft turned (more traditionally) inside the cylinders. Post WW1 aircraft up to today use this type of radial engine, and some of them would end up producing thousands of horsepower! A great example is my 1/7th scale Gee Bee. It has a radial engine with a cowl ring on it to improve cooling and add some aerodynamic airflow. Think of a cowl ring as a modified full cowl without the needed weight and requirement to stretch out the fuselage to meet the width of the engine. This motor was a vacuum form plastic kit I purchased very inexpensively online. Imagine the look of the Gee Bee without a motor? And making it was very little effort. This type of kit is a great start in making scale additions to your prize airplane.

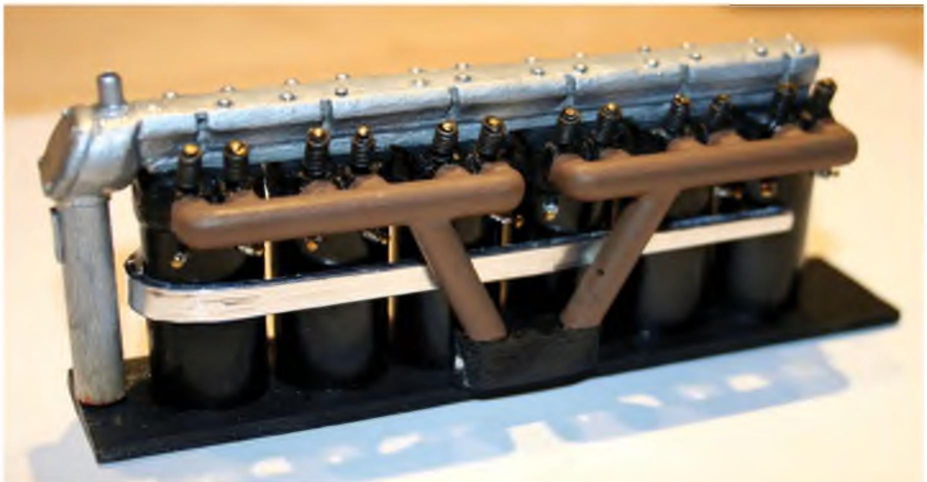
In the case of the Sopwith Camel, you can see that I've used an off-the-shelf 1/8th scale plastic model engine kit. This kit was not designed to put on a model aircraft, but was designed to build as a very detailed display motor only. The plus side is the incredible detail, the downside, this thing is heavy! I took the display motor and I lightened it is much as possible and applied it to the aircraft by hollowing out the centre section and making a bearing race so the plastic motor would spin with the electric motor. The centre section contains the electric motor for the aircraft and completely hides the electronics so all you can see is the plastic motor and the propeller. Not only does is create a very realistic looking motor, but it also provides the needed weight up front in order to balance it correctly (yea, I know - that weight and balance thing again...).

The Sopwith pup is a little 1/16th scale model and to make a full motor would be a lot of work for something so small, and I wanted to keep it light! Soi I just printout a picture of a Rotary motor and cut the picture out and glued it inside the cowl so what we have is just a picture of a motor instead of an actual built out cardboard or plastic piece. The picture looks very realistic from only a few feet away and provides a great looking motor for such a small plane.

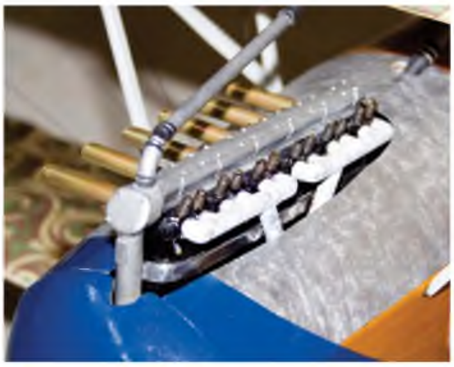
For the D.VIII, I used wire wrapped around wooden dowels attached to a balsa hub. The motor only has four cylinders showing on this plane, so that is all I made. This provided a shiny surface, fine texture and looks fantastic from only a few inches away.

To sum it up, the engine is a focal point of your aircraft. With a little time, a few scraps of wood, paper and plastic, you can make a scale representation of your power plant, and who knows, it may make the plane fly a little faster as well. Until next time, Chocks away.

Next time, I promise most faithfully to complete Jon's article on his Camel. In the meantime, you'll find me at PETERRAKE@aol.com



The Mercedes destined to go into an Albatros is simpler, but basically very similar in construction to the Beardmore.



Once installed the little Mercedes looks very impressive. Yes, that is a real colour scheme on the wings.

Even a fairly plain model, like a Piper Cub, can be much enhanced by the addition of a nice dummy engine. So much better than lumps of dowel glued on.

Classifieds

For Sale

1940s USA, O.K SUPER 60, 10cc spark ignition petrol engine. in very nice condition, great patination. Good compression , runs well, complete with period ignition components and wooden prop. £125.

Contact David Tel: 07707235646.

Soviet Aircraft and Aviation 1917-1941, by Lennart Andersson (Putnam 1994). Very good condition.

Price: £20 inc., postage. Contact 01484 711406

ENGINES - E.D.Bee, paw 1.49, Am 25 and cox texaco 0.049, All £25

Co2 motors - Cox 0.49 With co2 conversion £25. New model teknik gm-300t twin with r/c throttle £60
Gasperin g-24 (new) £25
Brown campus a-23 (new) £30. 2 Telco co2 motors £15 each. Ceto micro receiver & 4 servo to work with futaba transmitter £50
13 Scale aircrafts 18-28 inch spans suitable for rubber or co2 power - £50 the lot
All items collectable or plus p&p

Contact: Malcolm wallis 01262 420611 (east yorkshire)

Model aircraft, Hi Boy 62.5" wingspan with engine and servos, concept 3D helicopter with engine, servos and gyro. PCM high quality 5 channel radio model Net J35P electric engine starter, purpose made spares tray, control panel, fuel pump used very little and in excellent condition. New batteries needed.

Price: £350 ono.
Contact: 01787 228133.

Wanted

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