ANTOINETTE MONOPLANE
72" wingspan for electric power (Part 2)

THE WORLD'S ONLY RC SCALE MODEL MAGAZINE

Flying Scale Models

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May 2014. No. 174 £4.20

VELOMANIA
Indoor Scale at the Manchester Velodrome

HOW TO
SIMPLE FUSELAGE LOFTING
How to plot fuselage sections

SUBJECTS FOR SCALE
HAWKER CYGNET
1920s era ultra-light
- *Scale three-views*
- *Detail close-up study*

PLAN FEATURE
FOKKER D.VII
1/6th scale for electric power

- *D.VII Type History*
- *Fine-line three views*
- *D.VII Warpaint*

FEATURE: WIRE IN THE WIND
RIGGING AND BRACING FOR THE OLD BIPLANES PART 3

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FORMATION...

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ON THE COVER

Peter Rake designed it, Pat Lynch built the prototype to prove the design of the airframe., for this month lead construction feature. At 1/6th scale, the model spans 58.4" (1483mm), for electric power. FSM presents detailed plans and there is aset of laser-cut parts available to get you started in time for the summer flying season.

MAY 2014 NO.174

The Durafly Junior perfectly captures the essence of vintage flight and design.

A classic design is timeless, but that doesn't mean they can't be improved upon using modern techniques.

Specifications

Wingspan : 1100 mm /43.3 in.	Battery : 11.1V 1300 mAh Li-poly
Length : 765 mm / 30.1 in.	ESC : 20A Brushless
Weight : 695 g / 24.5 oz	Motor : DST-1100
Propeller : 8x6(Two blade propeller)	Servo : 9g x 4

Recommended radio system : 4CH



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Editor: Tony Dowdeswell
Publisher: Alan Harman
Design: Peter Hutchinson
Website: ADH Webteam
Advertisement Manager:
Colin Spinner
Advertisement Sales:
Claire Alley
Advertisement Assistant: Joe Brown
Admin Manager: Hannah McLaurie
Office Manager: Paula Gray

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Tel. 01525 222573 Fax. 01525 222574.
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CONTACT

Every era of aviation has its 'glamour' aircraft, which stand out for very different reasons. In some cases it's the attractive shape, for others it's shear volume of numbers and thus the universality of the type - an example of that would be the Piper J-3 & L.4, which features simple yet pleasing lines and one that is know and flow, even todauthe world over.

When it comes to WW1 aircraft, on the Allied side, types like the Sopwith Pup, Camel and Nieuport 11 & 17 are the ones that generally capture modellers' imaginations. Across the lines on the German side, the name Fokker (even though the man himself was Dutch) dominates, commencing with the Fokker Eindekker, then the Dr.1 Triplane and then the late-war fighter of excellence, the D.VII. So good was it that, as related elsewhere in this issue, it was the only aircraft mentioned in an end-of-war Armistice treaty... *" ...especially all aircraft of the D.VII type"*.

For WW1 era biplane enthusiasts, the Fokker D.VII is a very practical subject for scale modelling, thanks the lack of wire rigging and an uncomplicated shape. Another attraction is the wide choice of individual aircraft colour schemes among the fighter units of the Imperial German Air Service - the Jagdstaffeln, or 'Jastas'.

So this month's lead feature commences a three-part feature, presenting Peter Rake's 1/6th scale example. At 58.4" wingspan, it is scaled to a decent size, yet still eminently transportable, maybe fully assembled in a medium size car.

Originally, it had been hoped to present this as a full-size Free Plan, but despite every effort, Peter simply could not shoehorn it all into our standard SRA1 print-sheet size. However, the plan is backed up with a full of laser-cut wood component pack - to air construction.

For those who prefer something less war-like, then our 'Subjects for Scale' challenge in this issue features the diminutive Hawker Cygnet biplane - Sir Sydney Camm's first design in the designer's half-century association with the Hawker organisation. A very attractive little aeroplane of which only two were ever built. One of the originals is on view at the Royal Air Force Museum, Cosford, while there is also a faithfully authentic replica at the Shuttleworth Museum collection at Old Warden.

VELOMANIA

This multi-disciplinary Indoor free flight event is now well established at the superb Manchester Velodrome. Nevertheless it is still amazing to be flying model aircraft inside the middle of such a vast wooden track. You soon get used to swarms of expert cyclists whizzing around the banked Velodrome track, often above head height. Despite the variable weather, and its effects on travelling, we had a very good turnout with 22 pilots, and more than fifty of us in total in the hall.

So many models

So little time. Therefore, I have selected a just a few for comment below. I hope the photos tell the full story. Having all these slots and comps running at such a slick pace, one after the other, can make you go dizzy. Sustained fun all day!

Veron Tiger Moth

One of the big attractions of these events for me is to catch up with F/F scale kits I fancied in my youth. Especially those tantalisingly out of reach at the time. I also get a real buzz from seeing these kits being flown successfully indoors. This is why I adore BMFA 'Kit Scale' comps. So, when Ian Lever strolled up to the ochee with his immaculate Veron Tiger Moth in bright yellow tissue, she pushed all the right nostalgia buttons. 18" in span, and built as per the words and music, she was powered by a single loop if 1/8" Tan Sport rubber, and covered in Jap Tissue. Ian was trimming her for the first time and thought she might need more rubber. She was flying very well, if as little tight on the turns, so by the time you read this she will be sorted.

Farman F-180

Joe Heys flewhis Farman F-180, complete with French registration F-AIXL. She had a paddle prop. The Farman was built to the No-Cal formula, so this was a profile scale model, and rubber powered to boot. Once you get used the flat-pack idea, these models do have a charm all of their own. Their indoor performance is very impressive.

Fike

Again a No-Cal model, and a handy flyer, Neil Stewart's Fike had sufficient adornment to give the right impression. There was another No-Cal Fike with the

Whittaker takes his camera to BMFA North West's Indoor Free Flight Scale event

same registration that confused me, since it appeared to be more of a Cessna shape in the fin.

Blackburn Skua
There was an immaculate brand new Blackburn Skua from Ralph Sparrow. Ralph is a very skilled builder, the finish on all his models was exquisite. The little-modelled Blackburn Skua was built from the famed *Megow Kit* plan. In fact, they were a little before my time, so this is the first *Megow* Kit I have ever beheld, although I have read about them. Most interestingly, Ralph's models are expertly finished in silver mylar, dull side out, and then sprayed with acrylics.

Isaacs Fury
Derek Knight was flying a smartly finished Isaac's Fury, in that beloved 1930s RAF Hendon chequerboard scheme. The model is rubber powered and spans 14". The Isaac's Fury first flew in 1963. It is a home-built replica aircraft, built to 7/10th scale of the full-size Hawker example. Many are fitted with Lycoming O-290-D piston engines.

Fokker Eindekker
Brian Horsefield was flying a very smart Fokker Eindekker. This was built from the excellent 23" span *Aerographics* kit. I was delighted to see she was powered by a proper piston-engined powerplant, too! In this case a Gasparin Co2 motor.

Dassult Mystere IV
Of course we had indoor jets, too. Derek Knight's new Dassault Mystere 4, from the *Skyleada* Jetex kit really did impress. She is 14" in span and fitted with Derek's own design EDF unit. See details below.

Sopwith Triplane
Sarah-Jane Smith has just completed her first Free Flight scale model. It is an ambitious debut too. A demanding Sopwith Triplane, no less. This was her first attempt at flying it indoors, so we were all impressed. Great to see new builders on the FF scale scene.

Kyosho Fly-Baby Mod
Brian Horsefield's electric powered *Kyosho* Fly-Baby pointed up an increasing trend with sports scale indoor flyers. They butcher a commercial ARTF r/c model

THE VAST VELO HAS ENOUGH ROOM FOR THE BIGGEST INDOOR (L-SHAPED) PITS IN THE BUSINESS!

Right up in the rafters. Tim Horne's Hergt Monoplane from the Walt Mooney Peanut plan. First in Peanut.

About to be Static Judged, Tim Horne's very attractive Hergt Monoplane. I am building one at the moment.

and then fly it free-flight. In the case of this mod, Brian had taken out the original Kyosho radio control, and put in a Zombie free flight motor controller.

Chub Cub

Peter Fardell was obviously in a playful mood when he designed his utterly appealing Chub Cub. This chunky-but-cute confection is 16" in span and matches the Bostonian Rules.

Polikarpov Po 2

Besides his playful streak, Peter Fardell is a serious (but light-hearted) scale man too, as he demonstrated with his Co2 powered Polikarpov. Powered by a *Telco* motor, she was built from the Dave Deadman plan. She is 18" span. Incidentally, it is little known fact of aviation trivia that the Ambulance version of the Po2 was known in Soviet circles, as 'The Blood Wagon'.

Arado Ar 96

Reg Boor's new and very pretty Arado Ar 96 looked very attractive in her yellow scheme. We do not see many

Brand new Blackburn Skua from Ralph Sparrow, This was built from the famed and ancient Megow Kits plan.

Ralph Sparrow's almost finished Miles Sparrowhawk. 14" span, from a Walt Mooney plan.

Ralph Sparrow's very smartly finished 18" span Cessna Bird Dog built from the Guillows Kits plan.

Derek Knight's superb Dassault Mysetre 4, from the old Skyleada Kits plan.

Derek Knight's EDF F 86-Sabre, from the Keil Kraft Kits plan. Derek has enlarged it a trifle. She is finished as the Fury naval version.

Reg Boor's very smart and tiny Pistacchio Bristol Brownie Monoplane.

The Master in his natural setting: Derek Knight with just some his models on the day.

Dave Crompton's superb Evans Volksplane.

Sarah-Jane Smith has just completed her first Free Flight scale model, an ambitious Peanut Scale Sopwith Triplane.

Brian Horsefield's very smart Fokker Eindekker from the 23" span Aerographics kit.

The prototype of Derek Knight's very powerful and controllable 18mm fan EDF unit. That's a 5p piece for comparison.

Well finished Miles M18 (not a Magister) also by Reg Bloor. Ideal model proportions!

Arados of any description, but the sparsity of Arado 96s on the scale scene is a mystery to me. After all, the Arado 96 was the Luftwaffe's standard Advanced Trainer of WWII. It is a very pretty twin seater, and scaled up would make a lovely r/c flying scale model.

Stripper

We have noted mechanical strippers for rubber motors before, but the Halan Super Strip version being used by Eric Hawthorne caught the eye. It was mostly milled and polished aluminium, and was a very pleasing and functional object. The two vernier dials set the strip width to very high tolerances. A "must have" for the keen rubber flyer.

Indoor EDF Progress

Derek Knight is perfecting his already impressive Electric Ducted Fan Unit. This

Love it! Love it! Love it! Peter Fardell's playful new own design Chub Cub.

Peanut

1. Tim Horner	Hergt Monoplane
2. Reg Boor	Miles M18
3. Dave Crompton	Evans Monoplane

Rubber

1. Peter Fardell	Fairchild 24
2. Joe Heys	Lacey M10
3. Ken Bates	Comper Swift

Farman F-180 by Joe Heys flew well. A No Cal class rubber profile model.

midget gem has an 18mm electric fan with the sort of output that would shame a Dyson vacuum cleaner on blow. Since Derek has already got the output of the unit working to his satisfaction, he is now developing a one piece plug-in version, comprising fan, motor, casing, and controller. In this way, the new unit would drop into the Keil Kraft Jetex range, etcetera. Clever!

The Verdict
The North West BMFA did us proud. It was good to be in the company of such dedicated indoor flyers, and to remind oneself of the delights of winter indoor scale flying. We had a very relaxed and enjoyable day just playing with scale models in very comfortable surroundings. There was lots of sports flying going on, as well as the comp, so you can fly in a "fun" slot without competing. Incidentally, the adjacent Café was selling lots of very reasonably priced winter "comfort food" too!.

Full results available on the BMFA website.

Sat Nav It!
If you are coming next time, my advice would be to use a Sat Nav. This is because this part of Manchester is pretty dense and impenetrable to the outsider. Note postcode below:

Manchester Velodrome
Stuart Street, Manchester
M11 4DQ. Tel:0161 223 2244
nationalcyclingcentre.com

Reg Boor's new and very pretty Arado Ar 96.

There were a few Veron Comper Swifts in the air. This one was flown by Ian Lever.

Unknown pilot's Fike, but the Cessna-like appearance of the fin confused me!

Reg Boor about to set his Arado free.

Ian Lever's pretty new Comper Swift from the Veron Kits plan.

Some indoor pilots, like Brian Horsefield, are taking the R/C gubbins out of ARTFs like this Kyosho Fly Baby, and flying them fre flight.

File Edit View Favorites Tools Help

Techno Scale

Mike Evatt k

ParkFlyer Plastics at http://parkflyerplastics.com/cart produces high-quality parts formed to perfection that will add amazing detail to your models. These parts are designed by a USAF veteran and airline employee who is additionally an expert class modeller and R/C pilot, and a renowned hobby author. These components come in a variety of sizes and will be sure enhance any scale design. With over 100 different parts available and over 19 years' experience in the hobby, you cannot find a better source for parts to customise your model. Whether it is a pilot or dummy engine, you could find it here.

The **Scale Flyers of Minnesota** are dedicated to building/designing scale radio controlled model aircraft replicas of historic full-sized aircraft. At their meetings, they share information on scale documentation, building and finishing techniques, new available products as well as various discussions on flying skills required in scale modelling. However, I am always attracted back to www.mnbigbirds.com for its stunning images such as the 'Howard Pete' shown in the screen-shot. Pete's first race was at the 1930 National Air Races in Chicago. Winning five of the first seven races, Pete became one of the most successful racers in any form of motor sport.

The **Kings Lynn Model Shop** is a professional retail shop specialising in all radio controlled Aircraft, Helicopters and Cars with an on-line presence at www.kingslynnmodelshop.co.uk I know that there are not too many places to safely fly them but I am a sucker for float planes and their Sebart Macchi MC72 idrocorsa 50E in yellow, just ticks all the boxes. The wingspan is 152cm and length 140cm and it weighs in at around 3.3 Kg. The recommended power set up is a Hacker A50-16S motor with a XOAR PJN 16x8 propeller.

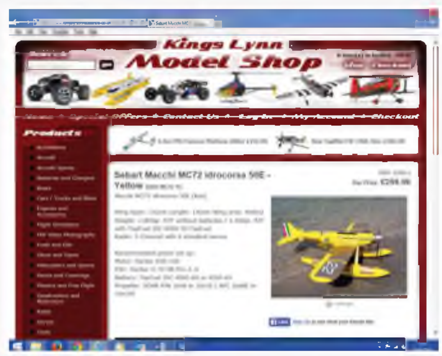
Staying on the topic of electric power a little longer. Not sure what motor you need? Then look no further than 4-Max, The **Electric Flight Specialists** at www.4-max.co.uk 4-Max have many useful guides and recommended setups as well as details of their customers' models. For instance the Tony Nijhuis designed 72" Short Sunderland powered by four PPPO-3530-1100 electric motors has the power to slide along on its belly on grass and take off without the need of a dolly or bungee.

Bob Benjamin's website at www.rcmodel.com is a delight for those aeromodellers who like to scratch-build. Back in those good old days, all of us built our model airplanes the old way using balsa wood and fabric and dope and parts that you cut out yourself. You learned those skills or you did not get to fly. That's what this Old Time Model Airplane Workshop is all about... sharing what Bob has learned over all those years about building model airplanes. Bob's latest venture is converting the 30_ rubber powered Dumas manufactured Piper J-4 to electric R/C.

For over 40 years **Marionville Models** have been introducing people to the amazing world of Radio Controlled Models & Hobbies. They first opened in 1974 as a Radio Controlled Model Specialist in aircraft and boats, but after a few years and the popularity of radio modelling grew we moved into other aspects of the hobby. Of note here is a range of petrol engines by Roto. These engines are manufactured by one of the

ParkFlyer Plastics produce high-quality scale parts formed to perfection.

'The Howard Pete' became one of the most successful racers in any form of motor sport.



The Sebart Macchi MC72 idrocorsa 50E from Kings Lynn.


Not sure what electric motor you need? Then look no further than 4-Max.


Bob Benjamin's website is a delight for aeromodellers who like to scratch-build.

Roto engines from the Czech Republic.

icks up the surf for more TechnoScale Topics...

leading model engine companies in the Czech Republic. No expense has been spared with any of the materials and components used to produce this range of quality high performance petrol engines. Check them out on their website at www.marionvillemodels.com

The Cessna 182 Skylane is an American four-seat, single-engine, light airplane, built by Cessna of Wichita, Kansas and was introduced in 1956 as a tricycle gear variant of the 180. The **Starmax** version sold by **Nitrotek** at www.nitrotek.co.uk is a large-scale model and the attention to detail is amazing. All the decals are already in place and it really does look the part. Striking colours, and its large size - it has a 1600mm wingspan. Included is an electronic speed controller, electric brushless motor and servos - all pre-installed. A 6ch transmitter is required to complete the model and this gives full 3D control of the aileron, elevator, rudder, throttle, steerable pilot and door opening.

Wimborne Model Aero Club at http://wimbornemac.org is a well-respected club located in central Dorset on England's south coast. This is a large flying club of more than 140 members many of whom have a lifetime of experience not just in model building and flying but many have worked in the aircraft and support industry most of their lives. Their website indicates that their members fly quite a number of superb scale models.

Most of us will know **Arizona Model Aircrafters** at www.arizonamodels.com as manufacturers of high quality model airplane kits and museum quality vintage aircraft. They also sell their superb vintage engine kits, separately, for scratch builders. Their replica vintage Gnome 7 Cylinder Rotary Engine Kit is offered in standard scale sizes of 1/3, 1/4, 1/6, and 1/12. These kits feature CNC machined and laser cut parts for the highest level of detail available to the modeller. The NEW 1/12 Scale Size for Electric Power is designed for the instillation of electric drives inside the crankcase and comes with scale documentation.

Only one prototype of the **Blanik L213** was ever built by the Czech firm Inteco. It was all-metal and designed for aerobatics. **Glidermania** are selling an all-glass version to 1/3 scale with a wingspan of 4.6 metres with the HQ 1.5/12 wing profile. All parts fit together perfectly, the finish is very good and the formers and servo holders have been CNC cut. Included is a very comprehensive hardware pack. The canopy is fitted inside a neat glass frame that mounts to the fuselage perfectly, so no need for hours of sanding! Check the spec. at www.glidermania.co.uk

Small Aircraft Components with a web address of www.sacmidwest.com create instrument panels that are fully assembled and ready for installation in the model. Their website shows a vast range of standard items but their custom panels are individually created to your specifications, and they will add that extra, special touch to your aircraft. Features such as full-colour graphics behind moulded lenses, three-dimensional Aresti charts, radios, knobs, and switches give a unique quality to our panels.

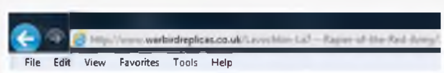
The Cessna 182 Skylane by Starmax by Nitrotek.

Wimborne Model Aero Club have a strong scale presence.

A replica vintage Gnome 7 Cylinder Rotary Engine Kit from Arizona.

The Blanik L213 from Glidermania.

Small Aircraft Components create magnificent model instrument panels.



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

mikeevatt@hotmail.com

Antionette Monoplane

PART 2: Concluding the construction article for the 72" span model designed by Peter Rake and built and described by Barry Maas

With the basic assembly covered last month, we get down to detailing the model. It's worth noting that on the original aircraft the top of the forward fuselage was left open (as were about half the height of the forward sides). Obviously this would not only reduce the rigidity of the model's structure, it would also put all our highly non-scale radio gear on open display.

Since the open area of the sides is behind the radiators, they do an efficient job of hiding sheeting that shouldn't really be there. The fuselage top is a different matter entirely. The false structure applied to the access hatches is all located in pretty much scale position. Therefore, using a dark, fairly neutral colour on the ply parts, and highlighting the false structure by making it a nice varnished wood colour hides the equipment and gives a very close to scale appearance to the finished model.

With that explained, I'll hand you back to Barry for the details of how he finished his model - and the all important flight report.

DETAILS

At this point I had all the major pieces put together. I mocked up the airframe, and took it out for a photo shoot. I still had all the small details to add to the frame, as well as installing the electronics. The motor was going to be tricky to get into the small space allotted. To do so, I hot-glued a strip of 220-grit sandpaper to the bell housing on the brushless motor. I then wired it up, and spun it up to about 30%-50% rpm and very carefully lowered it into position. It lowered in nicely and sanded a perfect fit. Once it was in place, I cut a smaller strip of sandpaper and 'flossed' the tiny gap between the siding and the motor. This ensured no rubbing and a smooth action on the motor.

The water tank and the fuel tanks were simply 1.5" and 2" dowels that I hollowed out and end capped with another piece of dowel. This made for very lightweight tanks. In addition, I used some 1/8" copper tubing from the water tank to the engine. This completed the effect I was looking for.

The main seat came from a manufacturer here in the States, who did a much, much better job of cutting it than I ever could have! *(Seat style and the number and position of water and fuel tanks varied greatly between individual machines, so you can pretty much play those details by ear. Barry has fitted quite a tall seat, but some didn't extend above the fuselage sides - giving the impression of the pilot sitting on, rather than in the aircraft. PR)*

For the control wheels, I had them created on a lathe out of some scrap maple that we had lying around. They fit perfectly over the spokes that

Here you see the wood cladding being fitted around the undercarriage wires -the bane of a skidded undercarriage.

Just how little motor clearance there is can be seen here. Barry used an unusual method to get the fit correct.

With the wood parts nicely stained and the multitude of details starting to take shape the model finally begins to resemble and aeroplane rather than a canoe.

This is the elevator control wheel in place. A pushrod links the horn to the servo and cables around the pulley operate the elevators.

came ready cut in the parts set, and I finished the maple with a coating of Linseed oil, which made the colour pop. Once that was on, I purchased some carbon fibre tubing for the radiator, and used the pre-cut ply framing to put them in place.

Staining the fuselage was a one shot prospect, and I was very concerned about my ability to do it right the first time. I opted to use a gel stain for the wood siding. I was very concerned about a regular stain not taking very evenly, as there were two wood types *(birch ply and basswood longerons) and a few glue spots involved. Gel should do the trick (Famous last words. PR).* I chose a high quality gel from my local woodworking store, and set about fretting over it for a few weeks. If I messed this up, all the work so far would be mostly wasted.

I took the plunge and started wiping it on. To my dismay, it didn't go on very even at all. I kept working the gel, and then did something that unexpectedly helped. I tried to remove the gel (or at least thin it) with mineral spirit. That seemed to help even the colouring. I wiped it around for what seemed like an hour, until I was happy with the tonality. In the end I got it even, and I really love the colour. *(Just as an aside, on certain photographs of surviving examples, the nose actually appears planked rather than sheeted. Probably not too surprising from a company known for building speedboats. PR).*

Next up was covering. I went with the tissue covering from an online retailer, which I've used in the past with some success. *(Please note that I suspect this isn't in fact tissue as we know it - the stuff you finish with dope - but one of the heat shrinkable polyester tissue types available. Litespan is the one that comes immediately to mind. PR).* I wanted all my flight surfaces to have a rounded edge, so I ran them all through the Dremel router and sanded it smooth.

While building the main fuselage, I happened to break every former possible

With all the woodwork in place and stained the undercarriage really looks the part.

Here you see how the laminated balsa blocks that form the mount positions for the rigging kingposts.

(even one of the ply formers). I really wanted straight lines to show through the covering, so I sanded down the formers and put a 1/8" strip of basswood on the outer portion, so that all the lines would be perfectly straight. They're certainly not load bearing, so it wouldn't matter if they weren't strong. Finally...it was just a matter of putting the Balsaloc on the wood and ironing away. *(Confirming the suspicion I mentioned earlier. PR).*

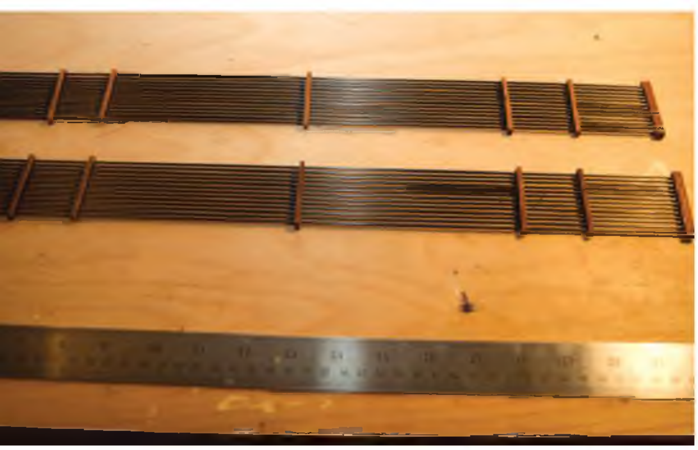
After getting the fuselage covering done, I wanted to cut and trim some nice slots for the control lines. The plans have the lines coming out of the side of the fuselage, but it was apparent that the upper rudder line would rub on the longerons if I ran them out the side. I opted to cut a slot on both the side and the upper fuselage. *(The fuselage side exits do appear to be the scale positions, so I can only assume the cables in question ran through some form of fairlead attached to the longeron. PR).*

What I needed, though, was some vinyl trim to protect the slot. I saw another builder do this on his plane with a vinyl cutter, but I don't have access to one....so I had to get creative. Off to the craft store I went. What I found after some serious searching was some vinyl lettering, which the 'O's seemed to be the right size. I cut the slots, put the O's on them and voila: instant vinyl trim.

It was time to paint the covering. I was hesitant to use *Krylon* after reading some interesting things about it crinkling, but I really liked the Meringue colour they have, so I decided to give it a shot. It went on well, and didn't give me any problems on the tissue. I learned that priming the surface is imperative, and in the end the paint went on well, and is incredibly strong. It hasn't cracked or peeled at all.

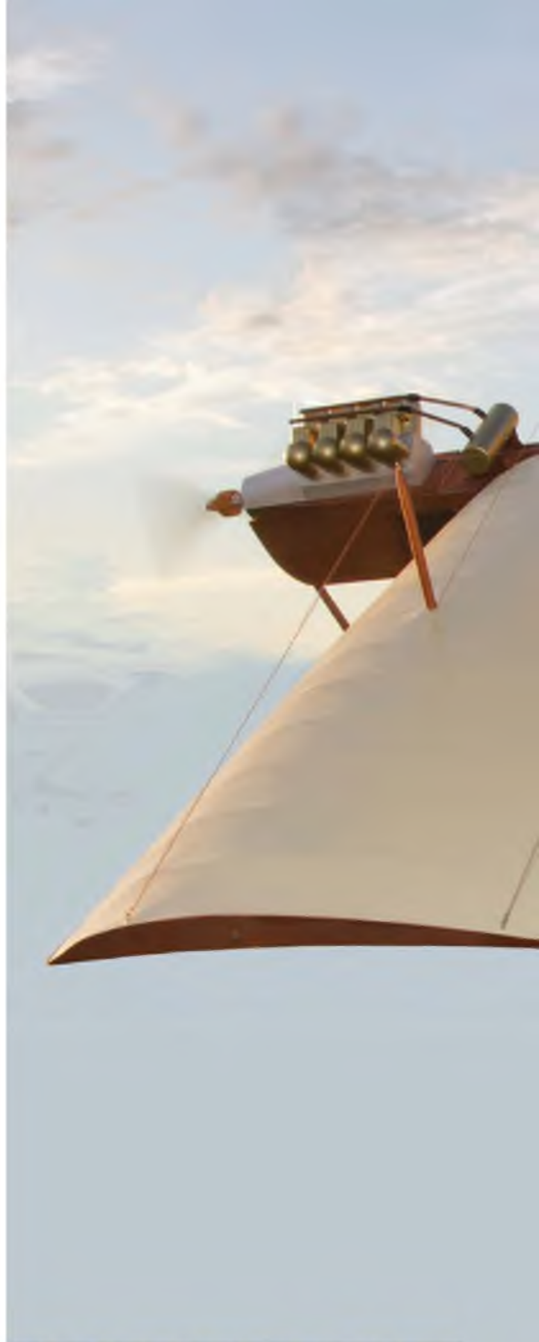
Finally, it was time to wire it all together and tension all the lines. But first, I had to figure out what to use for lines. I wanted something strong, and something that was already black in colour. I also like the idea of the lines having a little bit of flexibility so that the plane would flex a bit under a load, and so that I could have some wiggle room in tightening the lines each time I took it out of the car. I opted for a dark brown fly fishing line that I found at the local fly fishing shop. One of the benefits of fishing line is that it can be shrunk with a little heat. The downside of the line is that it can be quite stretchy, and in testing the line this proved to be true. In retrospect, the stretch of the line is really quite helpful in getting all of the lines tight, which eliminates any unwanted wing flex. *(There are enough rigging cables on this model that a little stretch in each won't have a detrimental effect on the overall bracing they provide. My only concern might be that ability to shrink Barry mentioned. On a hot day it might just cause problems. PR).*

To attach the line, I started with some fishing knots I learned as a kid, but this wasn't getting the line tight enough. After conferring with Peter and others, it was decided that using crimped tubing was the way to go. Of all the things I learned on this experience, that crimping was the most amazing. It not only made the rigging process incredibly easy and fast, but it also made for tight lines that were just perfect. The look of the crimp is nice, as well, when compared to a knot.



There may be a lot of carbon tube involved in producing the radiators, but it saves weight and adds to the realism of the finished model.

The obligatory naked model shot reveals the uncomplicated structure of the model.



The lines connect to the kingpost and main landing gear via a brass eyelet, and then connect to the wing via a double blind knot that runs through the wing support. All of this is locked with a touch of CA. The turnbuckles are crimped on at even intervals in each line, so I won't get confused as to which kingpost line goes to which wing line. The results of all of this are a wing structure that is tight as a drum. The main lines on the wing itself create incredible stiffness for the wing, and the support lines from the kingpost eliminate any worry about the wings supporting the main fuselage.

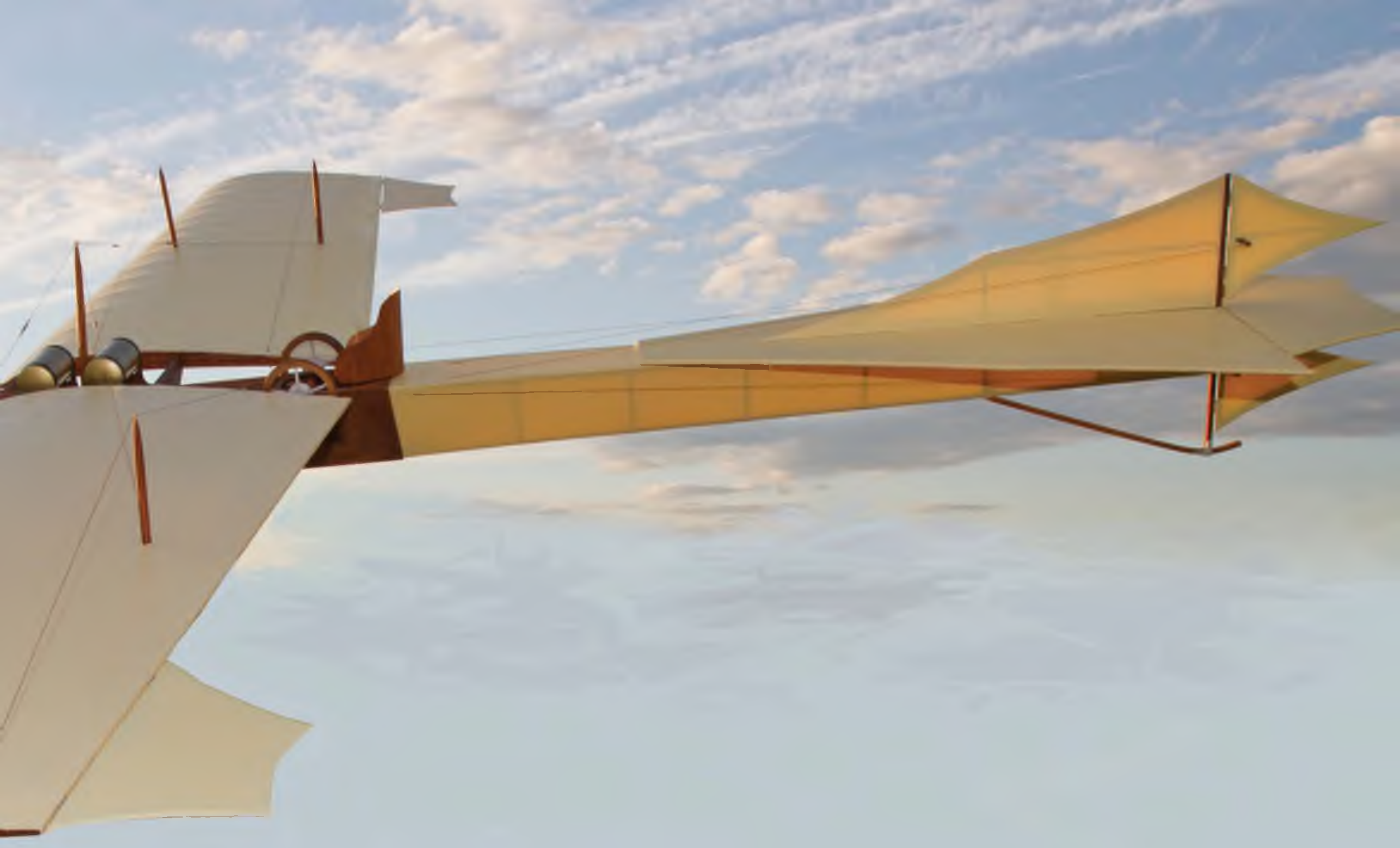
FLIGHT TEST

I completed the model in the middle of our windy season, so patience became a virtue. In the meantime, I took advantage of the clear (but windy) days to get some static images of the model.

Being the largest and most complex plane in my hangar, I learned just how lifelike it really is. When a nice evening came around, I excitedly loaded the model and gear into my car and headed to the field. Upon unloading and putting it all together, I learned just how important a good pre-flight check is going to be. It turns out that a few turnbuckles had wiggled free, and were no longer a part of the aeroplane (the end points were still attached, but the buckle itself was gone!). Also, I had left the aileron y-harness on the workbench. That was the end of that flight attempt, but I learned to pay close attention to the plane.

After putting new buckles in place and waiting out the weather, another window opened up on a calm Saturday morning. I sneaked out of the house and loaded the car, this time ensuring that all the pieces were in place. I also took off the *Xoar* prop that was in place and put on an APC prop from another plane. The Xoar prop was too pretty to risk dinging up on the first flight! Turns out that was a

Posing in the sunshine the Antionette displays her dragonfly-like appearance to good advantage.



Sweeping in for a low pass there's no denying what an attractive model the Antionette makes.

mistake. After doing a thorough pre-flight on the plane, including checking all the control surface and adjusting the tension lines, I ran up the engine a bit. There was a soft purr as the prop went round and round, and I attributed that to the airflow over the support lines. With that, I set the plane down on a small patch of dirt, said a little prayer, and pushed the throttle up. The tail came up quickly and easily. So much so, in fact, that the nose support strut rode on the ground (along with the main wheels). The purring got a little stronger, and I aborted the takeoff. I suspected that the grass and dirt was causing too much drag, resulting in the plane riding on its nose strut.

I took the plane over to a patch of asphalt and repeated the process, with the same results. I called it a day at this point, and upon inspection I realised that the prop wasn't reamed correctly. The purr I was hearing was a vibration from the prop. Lesson learned...again.

Back to the hangar, and on with a new prop. Again, I inspected the plane and tightened anything that came loose from the vibration. Consulting with Peter, we decided that while the main wheels are forward of the CG, they may not be far enough forward to keep the nose strut from digging in on takeoff. The fix was to increase the amount of up elevator throw to help break the ground. *(A typical tail-dragger take-off, in fact. Hold on a bit of up elevator until the model is moving and then release it to avoid a premature take-off. PR).*

The following flight was a huge success. Take-off was a snap, and there were no yawing tendencies. As a matter of fact, I taxied the plane for quite a ways on the asphalt, and it seemed more at home on the ground than my Parkzone planes! Takeoff was accomplished at full power, and it probably took 20-30' for it to take off. I thought it might fly off on its own, but it did take a slight bit of up elevator to break the ground.

Once in the air, it was as gentle as could be. The best way I can describe it is using a 747 analogy. Ever seen a 747 down low, and it just seems to hang there? That's how this was. It's so big, and so gentle that it just seems to hang. There are no bad habits. I never touched the trim, and I'm pretty sure one of my ailerons failed... but you never would have known. Turns were gentle and easy, and the nose didn't drop much at all. Since the most of the surface area is a linen colour, I did get a little disoriented as I turned back towards me, and it sped up a bit as I turned it sharper to regain my orientation. I thought this might cause a little heartburn with the tension lines, but the wings didn't budge.

One more pass, and I brought it back for landing, which was a breeze. Just like the real thing, power controls altitude, and pitch controls airspeed. It takes a bump of power to roll it on, and there's not much of a flare, since the movement between the nose gear and the tail gear is very small. I'm happy to say that this plane flies so smooth and so well that I rolled it on the pavement within a foot of my intended spot. The asphalt landing zone at the particular field is very tight...squeezed between a building, a concrete sports structure, a few benches, and a tetherball pole. Not an ideal location, but it's convenient and it's manageable. It's also no small feat to nail the landing spot with any model, let alone a brand new one! This isn't a testament to my thumbs, but rather the stability and easy flying characteristics of the plane.

Post-flight inspection showed zero anomalies (I usually find something that worked its way loose...but not this time!). In looking back, Peter was right: ailerons aren't needed, and it turned just fine with rudder (I mixed 100% rudder with the ailerons). The field I flew in was a small soccer field in the back of an elementary school, so it really doesn't need much space to fly. I think it would handle a 5kt breeze just fine, but it probably wouldn't be much fun and landings might be a bit stressful.

POST FLIGHT NOTES

The golden era of aviation is alive in this model. The joy of aviation and modelling is really the joy of creativity and exploration. This model embodies that in all it takes to complete it. There are many different ways to accomplish a task, and this is a record of how I did it. There's always a lot to learn in modelling, and I hope this gave you a bit that you can use in your next model. Looking back, there are always things you would do differently, and this is no exception.
I absolutely loved building this aeroplane - to the point that I really didn't want to fly it! Once I did fly it, though, my enjoyment shifted from creating to flying. It's a real thrill to see something go from a bag of wood to a huge replica of an original aircraft that's at your control. Thanks to Peter for designing this plane and thanks to the community for the support and ideas on techniques for building and flying.

Fokker D.VII

Although I've always liked the Fokker D.VII, I'd only designed a fairly basic 38" span model. When Pat Lynch asked for a bigger one, on which he could add a wealth of detail, the gauntlet was well and truly thrown down. Not being one to miss any opportunity, I drew up the plans and left it to Pat. For the rest of the story I'll hand you over to him for all the details. ***PETER RAKE***

Some time ago, I agreed to build a prototype model for Peter Rake - the Albatros D.XI. As I knew little (nothing actually) about this aircraft, some research on the net was in order. Alas, while looking at all things Albatros and D.XI, I stumbled over some excellent photos on the French Memorial Flight's site of The Fokker D.VII. Now, while this aircraft type has been extensively described and modelled over the years, I had never really looked at it closely before! A photograph looking forward from behind the cockpit showed an amazing tangle of machinery - from the cockpit that looked as though much of it was an after-thought, across the exposed twin Spandau guns and their magazines, past the fuel tank, gauges, windscreen and on to the magnificent Mercedes water cooled engine. But it didn't stop there - that distinctive D.VII radiator also caught my eye. Add an airpump, a decompression lever, the usual mighty exhaust stack and I knew a model was required.

An email to Peter asking if he had plans produced the predictable answer *"...no, but I'll draw some up..."*. After warning

A 1/6 scale model for electric power. Designed by Peter Rake, with the prototype model built and described by Pat Lynch.

him that this would be a long build (I really did want all that detail stuff) a set of plans duly arrived and a bunch of laser-cut parts were ordered. The build didn't start for several months due to other modelling commitments, but in the meantime, I collected every book and reference I could find - although only described as 'sport scale', I wanted this to stretch my skills a little. Peter would just have to sit on his hands for a while...

The Model

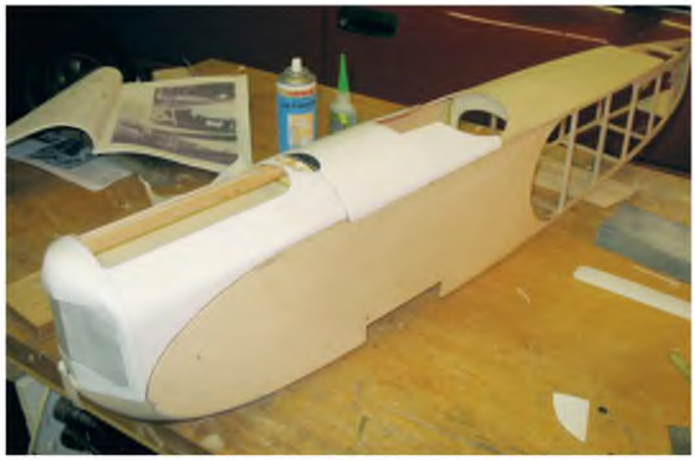
Building a prototype for a designer is a little more difficult than if doing it for oneself. Obviously the model must prove that it is buildable and flyable, but also must be constructed as the plans show, otherwise it hasn't fully proven the design. I wanted to include a little more detail than the plans indicated, but do it with only cosmetic changes if required. Peter had given me plenty of space for a full cockpit, designed the wing struts for a more scale look and located the various formers and bulkheads in near-scale positions making the task of 'tarting her up' a little easier.

The other major aspect of adding scale detail, was to decide at an early stage what would be fitted - it is quite a job to fit out a cockpit completely after the model is finished!

One of the 'cosmetic' changes made to the plan was to clad most of those areas that would be metal on the real aircraft, with thin styrene sheet. I believe this adds very little weight as no grain-filling or heavy coats of primer are needed to get a smooth, even finish. These plastic parts often needed to be formed over the underlying wood before parts were assembled, but more of that later.

A factor that became apparent early in the build was deciding on what individual example of the aircraft was being modelled. The D.VII had so many variations, this became a major concern. An on-line acquaintance in the shape of Dave Roberts became an invaluable source of information on all things Fokker, he having co-authored several books on the subject. While I didn't really need to know how many rivets fixed each louvre to the aircraft, it was valuable to learn when and where those louvres were

Basic fuselage sub-assemblies seen here with one of Pat's low-tech formed plastic panels.



The plastic parts save a lot of filling, sanding and priming around the front end of the model.

The tail surfaces are about the simplest part of the entire model.

How the tail surfaces will fit onto the finished fuselage.

fitted! Thanks Dave for the mass of data, photos, drawings and encouragement. Ultimately I decided on an aircraft of ace pilot Lt. Fritz Hohn of Jasta 21 - much less colourful than many D.VIIs, but rather striking with black and white stripes on the nose, fuselage and tail, plus large 'H' markings on the wings and fuselage sides - all easy masking jobs but with one big drawback - the rest of the aircraft was all the infamous lozenge pattern. But more of that later....

Because the D.VII is a rather simple design structurally, the basic model is also straightforward. An all-ply forward box supports all the critical elements - wing struts, motor, battery, undercarriage etc, and a simple balsa 'stick' framework completes the rear end. The tail group is of flat section and mostly 1/4" sheet and strip with laminated outlines. The tailplane could be given some extra capping strips over the 'ribs' and sanded to an airfoil shape, but I left it as designed.

The wings of late-WW1 Fokker aircraft are one of their most distinguishing features. Designed to be largely self-supporting, both wings are of a very thick section and require no rigging - that's a bonus! The model has spars of almost full depth, notched to accept the ribs and with the ply 'sawtooth' front covering makes for an extremely rigid structure.

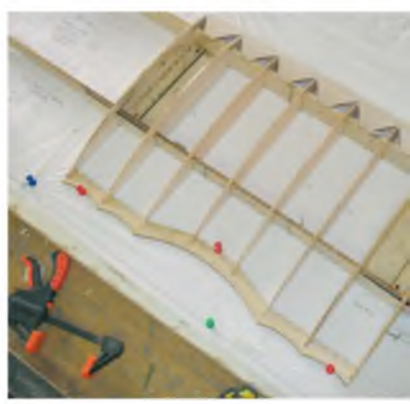
The top of the Fokker's wing has no dihedral while the underside tapers up to the tips. The main spars are of spliced bass with ply laminations each side of the splices. Both wings are one-piece and are ultimately fixed permanently in place. Not being dismantle-able may be a pain for those with limited transport but simplified one of my other requirements for Peter - that the aileron controls be near-scale. That is, cables would run from servos low in the cockpit, out through the fuselage sides and along the wings to the control surfaces.

The various struts connecting the wings to each other and to the fuselage are of wire clad with balsa. These were of shaped steel tube in the original aircraft. Undercarriage is bungee-sprung approximating the original and wheels are simple ply and balsa discs with rubber cord tyres.

All up, not a difficult build - no tricky compound curves, no rigging and as much or little detail can be added to suit your desire. She could be built exactly as

With the spars already joined, build the lower wing panels so that all taper is on the lower surface.

Once complete, the lower wing is a snug fit into the fuselage cut-out.



Begin the top wing by building the centre section onto the ready joined spars.

per the plan with nothing added and would certainly not be mistaken for other than a Fokker DVII! Now on with the construction.

BUILDING THE D.VII

The fuselage was started by building a left and right side using the outer ply nose panels and balsa strip rear frames. These were built so the outside of the frames and the ply were flush. Hardish balsa for the longerons is necessary, with lighter wood used for uprights. The glue used for much of my build was 'Superphatic' - good, but needs joints to be carefully fitted as it does not fill gaps. The curved forward edges of the sides were bevelled and used as a 'plug' for some .010" plastic shapes to be used much later in the build. Basically, heated styrene sheet is pulled hard over the wooden plug and allowed to cool. It will be trimmed to size later.

The inner ply doublers and the various formers, undercarriage supports, motor mount and battery shelf were now assembled into a single unit. This was made accurate and robust as most of model loads will fasten here. Next, the two sides were glued to this box, ensuring they were aligned over their whole length. Fixing this structure over the plan, the cross pieces of square balsa were fitted, slowly drawing the tail end parts together. Lastly the two ends were lightly chamfered and glued using a square to ensure they were vertical and checking against the plan for centring. Cutting the cross-pieces in pairs, for top and bottom, helps to keep things accurate.

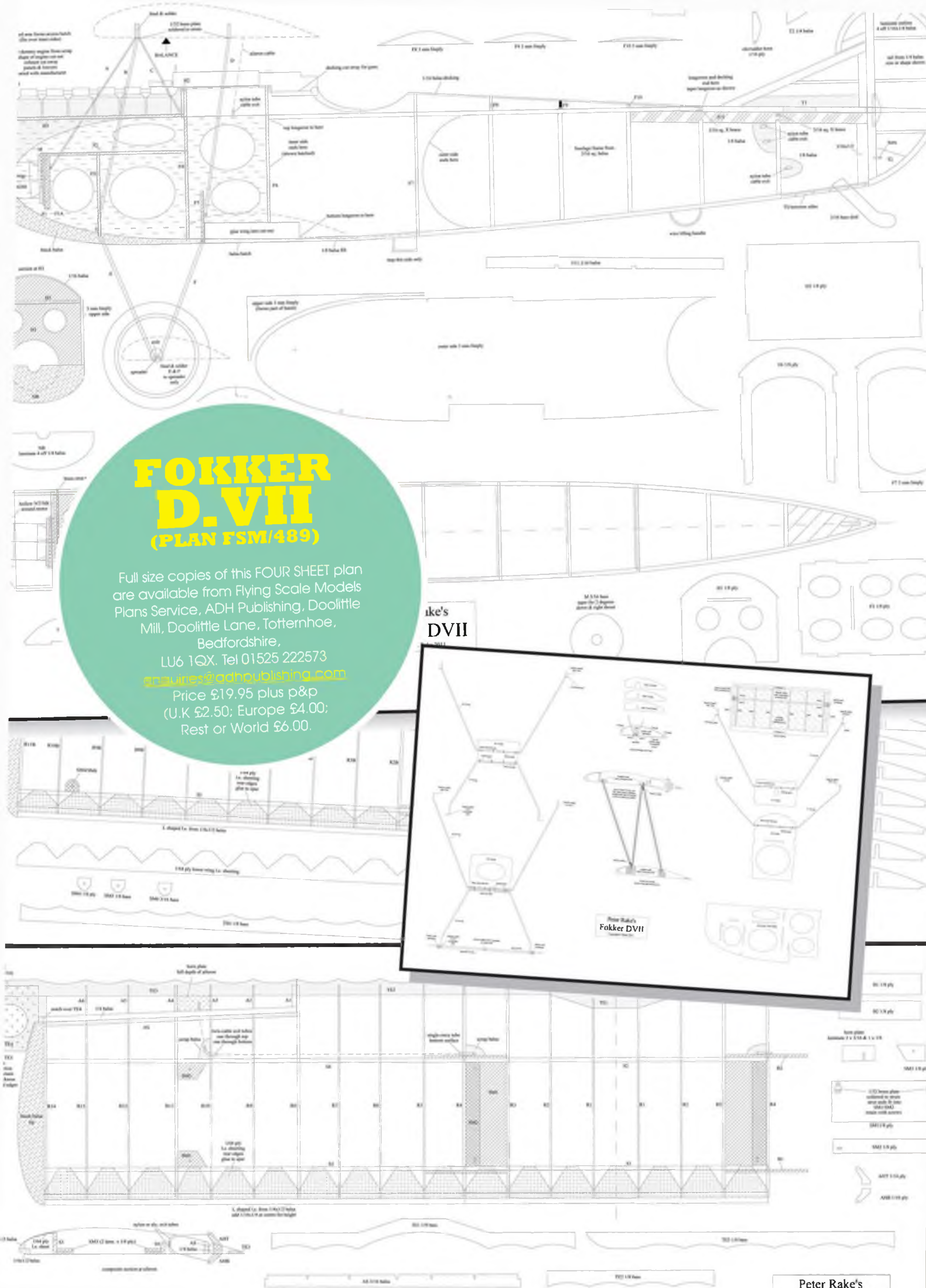
After adding the various half-formers, the battery hatch was built, a simple assembly of ply and balsa which fits snugly over the inner doublers and rests on the curved forward panels. Various brass tubes are bound with copper wire to the formers to secure the undercarriage legs and wing struts. A tiny dab of epoxy at each binding fixes them in place. The battery hatch was now lightly tacked in place and the curved fuselage top sheeted - including the hatch.

The belly pan under the engine was built from layers of soft 1/4" and 1/8" balsa with grain across the fuselage. Card templates made from the plan were used to shape it accurately. The radiator and chin block were assembled and glued to the nose and then shaped to blend with the rest of the fuselage. There is considerable variation in these areas between aircraft and the chosen prototype should be studied to get it right (if desired!) With everything sanded smooth, the hatch was carefully separated with a razor saw and the radiator area hollowed as required to clear the motor being used. Because my field is rough, and nose-overs frequent, the underside of the nose was given a few layers of 3/4 oz glass cloth and epoxy resin.

With all of the fuselage sheeting completed, several more plastic skins were pulled using the hatch, radiator and fuselage top as plugs. Again these were of .010 styrene sheet, simply stapled to wooden handles, heated over a hot plate (mind your fingers) and then smartly pulled down over the wooden parts. After trimming to size, they fitted perfectly and provide an ideal base for later detail and paint.

To provide some support while on the bench, the undercarriage legs were shaped and partly assembled.

As with the bottom wings, build the top wing panels so that the top surface is flat and the lower surface tapered to provide 'dihedral'.



FOKKER D.VII

(PLAN FSM/489)

Full size copies of this FOUR SHEET plan are available from Flying Scale Models Plans Service, ADH Publishing, Doolittle Mill, Doolittle Lane, Totternhoe, Bedfordshire, LU6 1QX. Tel 01525 222573 enquiries@adhpublishing.com Price £19.95 plus p&p (U.K £2.50; Europe £4.00; Rest of World £6.00.

They would be finished later when permanently fixed to the fuselage and the unercarriage 'wing'.

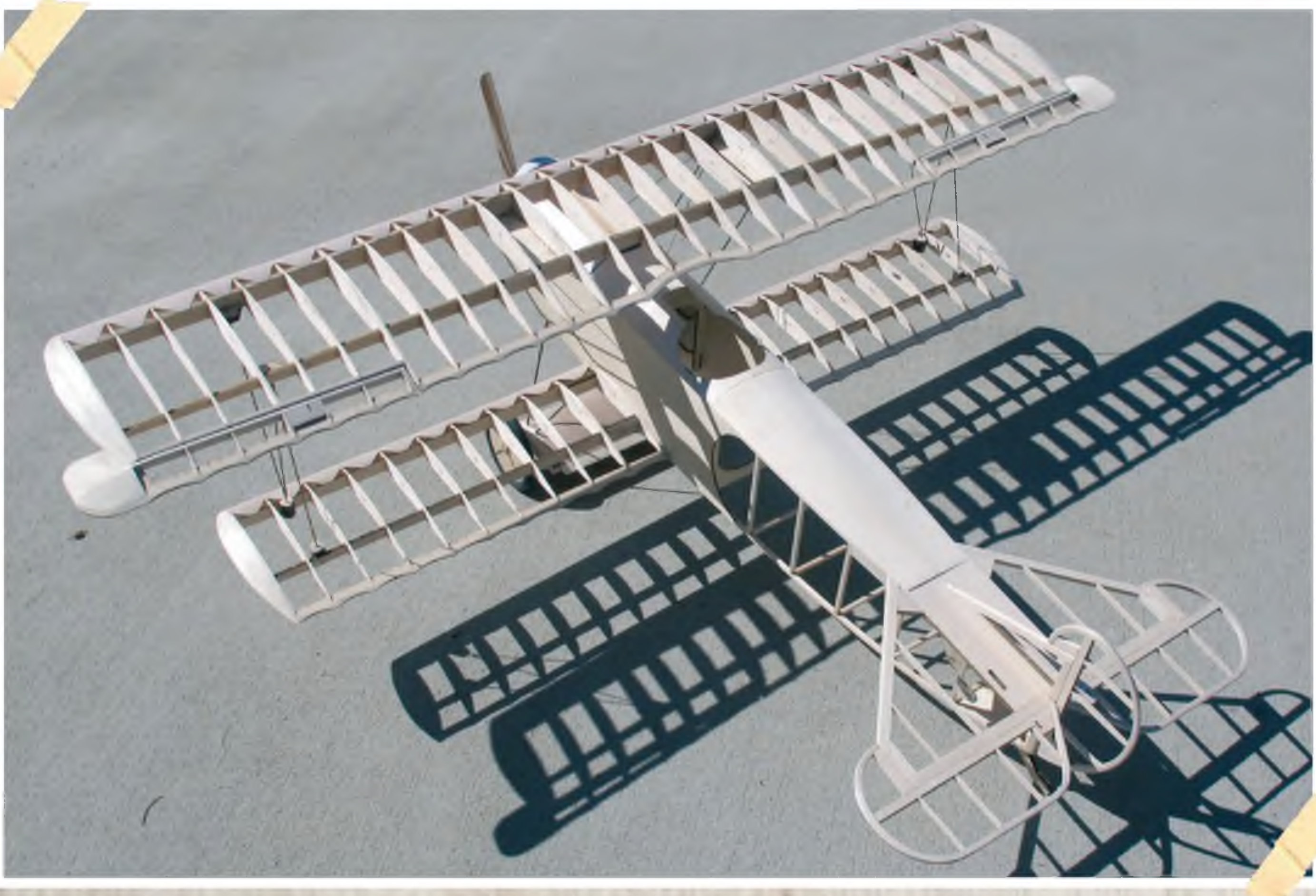
TAIL BITS

The tail section is almost self explanatory. Both vertical and horizontal surfaces are 1/4" thick and built with some sheet parts, strip of various sizes and edges from laminations 1/16" soft balsa strip. After assembly and sanding to 1/4" thickness all over, the elevators were tapered to 1/8" at the trailing edges using different sizes of steel rod at the LE and TE to guide the sanding bar. Leading edges were rounded and the elevator trailing edges also. The tailplane rear spar was left square. The spars holding the hinges should be of a firmer grade of balsa. Ensure that the seat for the tailplane is square with fuselage by clamping the lower main wing spar into the fuselage cut-out as a guide. Sand the tail mount as necessary. A wire 'U' link joins the elevator halves together but with twin pull/pull cables, this may be optional. I like the insurance...

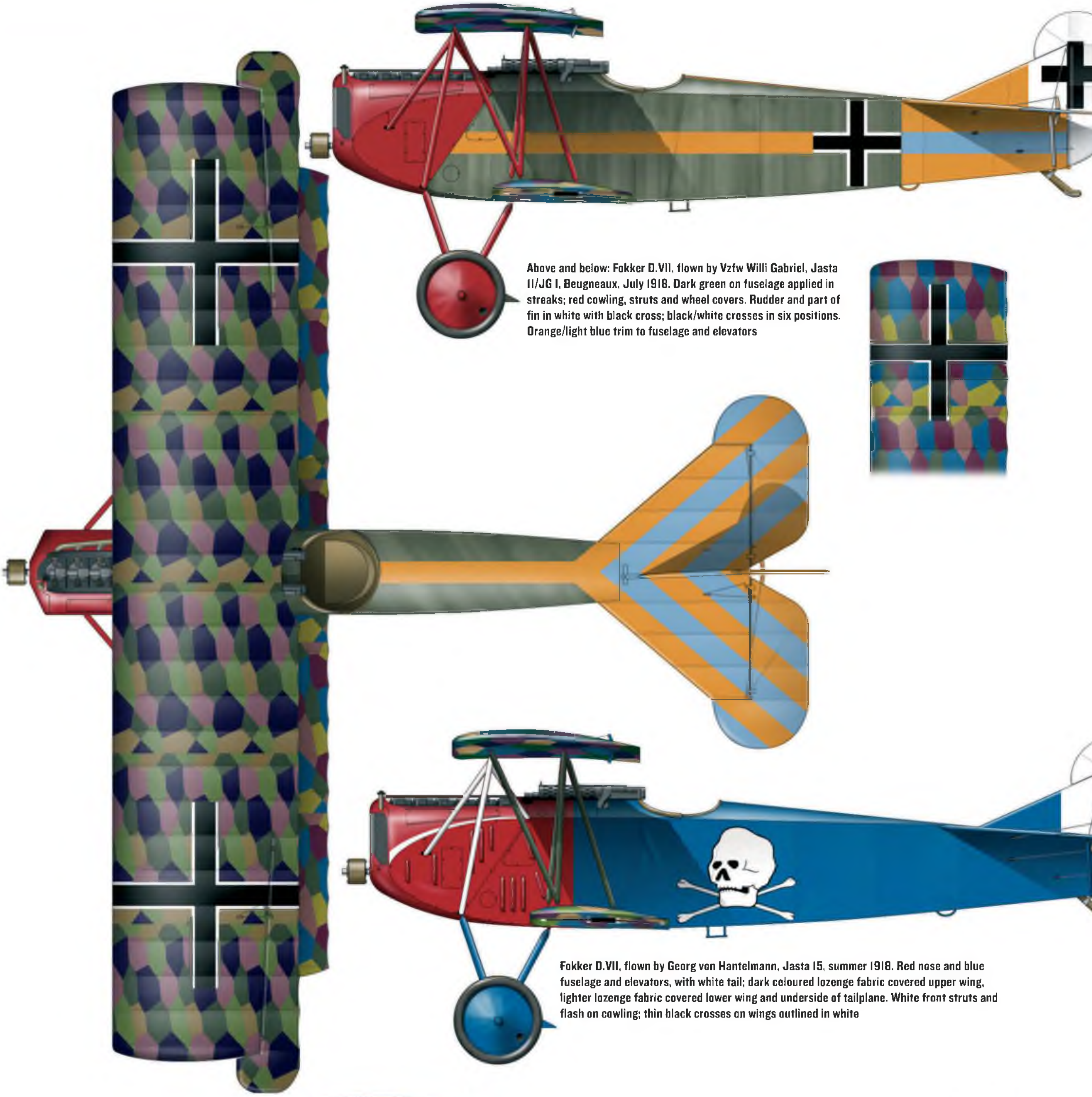
At this stage, the mounting of the servos was determined. I put the tail servos under the pilot's seat area. The aileron servos were a little more difficult as they must line up with the aileron cable exit points and also clear the lower main wing spar. My servos were mounted on 1/8" ply plates positioned to give an easy path for the various cables to their exit points. The servos need to be easily accessible for rigging cables etc.

SPECIFICATIONS

Span: 58"
Weight: 6.5 lb
Turnigy 4250 motor
15X8 APCe prop
4S 3700 LIPO
60A ESC
Hitec Aurora tx, Optima 6 Rx
Loading 15-16 oz/sq ft

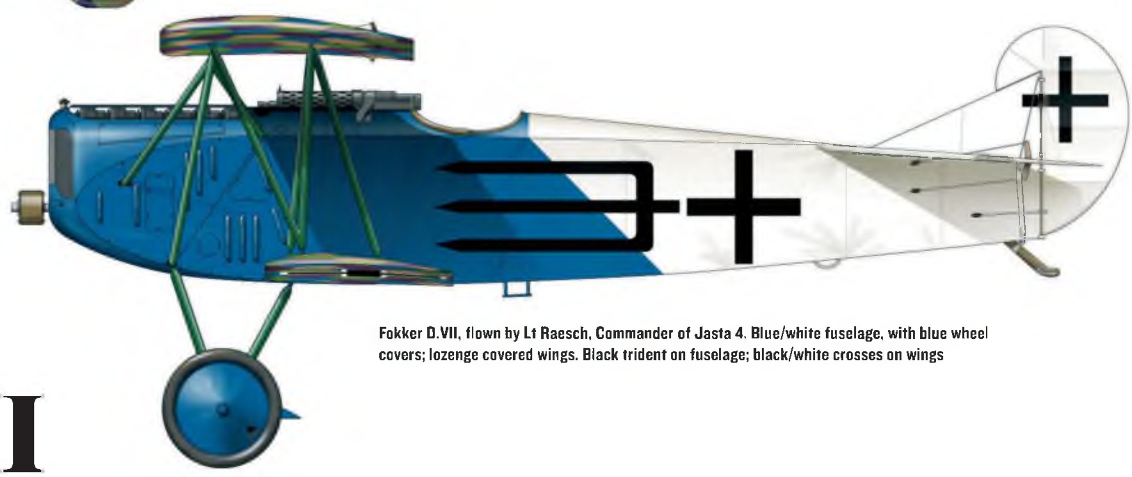


Fokker D.VII

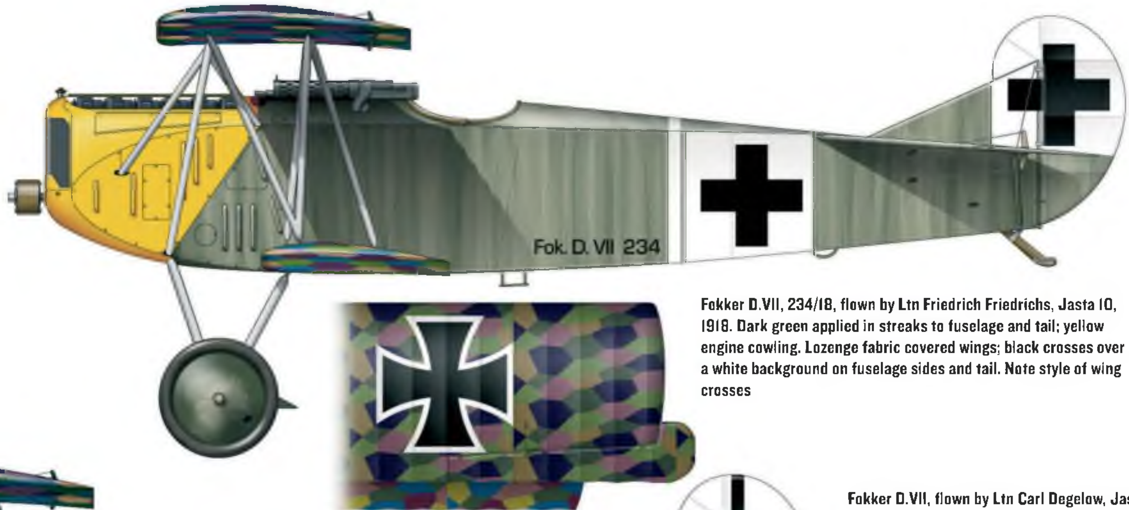


Above and below: Fokker D.VII, flown by Vzfw Willi Gabriel, Jasta II/JG I, Beugneaux, July 1918. Dark green on fuselage applied in streaks; red cowling, struts and wheel covers. Rudder and part of fin in white with black cross; black/white crosses in six positions. Orange/light blue trim to fuselage and elevators

Fokker D.VII, flown by Georg von Hantelmann, Jasta 15, summer 1918. Red nose and blue fuselage and elevators, with white tail; dark coloured lozenge fabric covered upper wing, lighter lozenge fabric covered lower wing and underside of tailplane. White front struts and flash on cowling; thin black crosses on wings outlined in white



Fokker D.VII, flown by Lt Raesch, Commander of Jasta 4. Blue/white fuselage, with blue wheel covers; lozenge covered wings. Black trident on fuselage; black/white crosses on wings

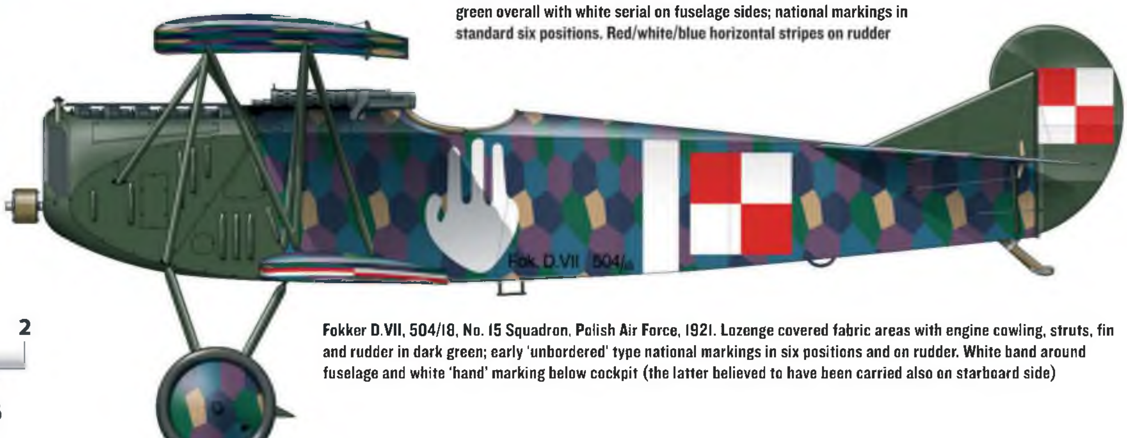


Fokker D.VII, 234/18, flown by Ltn Friedrich Friedrichs, Jasta 10, 1918. Dark green applied in streaks to fuselage and tail; yellow engine cowling. Lozenge fabric covered wings; black crosses over a white background on fuselage sides and tail. Note style of wing crosses

Fokker D.VII, flown by Ltn Carl Degelow, Jasta 40. Black front fuselage with white tail section; lozenge covered wings. White stand with black detail and yellow antlers; thin black crosses outlined in white above top and below bottom wings

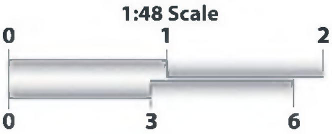
Fokker D.VII, O-BOBE, Ecole D'Aviation Anvers, Belgium, 1923. Lozenge-covered fabric areas with cowling and struts in green; registration carried in black over a white background. Belgian flag covers part of the fin and the rudder; flying school name below the cockpit in white

Fokker D.VII, F-301, Netherlands East Indies Air Force. Gloss dark green overall with white serial on fuselage sides; national markings in standard six positions. Red/white/blue horizontal stripes on rudder



Fokker D.VII, 504/18, No. 15 Squadron, Polish Air Force, 1921. Lozenge covered fabric areas with engine cowling, struts, fin and rudder in dark green; early 'unbordered' type national markings in six positions and on rudder. White band around fuselage and white 'hand' marking below cockpit (the latter believed to have been carried also on starboard side)

PROFILES & COMPLETE UPPER VIEWS
1:48 Scale



‘ ... especially all D.VIIs...’

Fokker D.VII

The only aircraft, ever mentioned in an armistice treaty, the D.VII was undoubtedly Germany’s most famous WW1 fighter

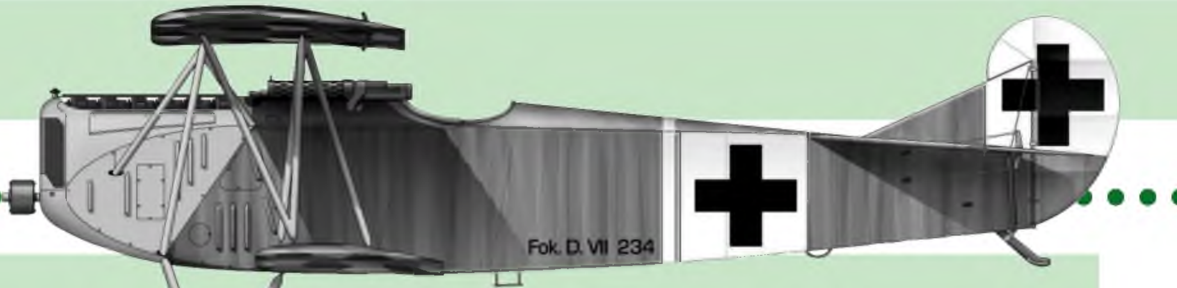
WHEN THE FOKKER D.VII arrived on the Western Front in April 1918, it was immediately recognised as a truly outstanding fighter, but its extreme manoeuvrability, its ruggedness and rapid recovery from a dive were neither happy accident nor mark of genius. Rather, each of the D.VII’s characteristics was the result of methodical trial and error with a sound basic design, a process of development which reached its peak with the installation of the most advanced engine available.

Early in 1917, Anthony Fokker and his chief designer Reinhold Platz had introduced their experimental V.4 triplane, with thick-section, cantilever wings of the type pioneered by Dr Hugo Junkers, but of all-wood construction. Platz had been Fokker’s chief welder and although without formal engineering training, had a talent for sound structural design and a strong preference for the simple solution to any engineering problem. Among the fighter prototypes he and Fokker developed during the second half of 1917 were the rotary-powered V.9 and the Mercedes-engined V.11.

The V.9 was clearly derived from the V.4 triplane, with almost identical fuselage, engine installation, landing gear and tail surfaces. Both wings used the same thick, highly cambered aerofoil section but whereas the smaller lower wing reproduced the V.4’s single compound box spar, the larger upper wing used two orthodox box spars.

Later in 1917 a generally similar, larger machine was produced, powered by a six- cylinder 160hp Mercedes engine and designated V.11. Both its semi-cantilever wings used the same aerofoil section as the V.4 but were of conventional two-spar construction with N-type interplane struts in place of the widened V-struts of the V.9. The central cabane consisted of a tripod of streamlined steel tubes welded to engine bearer, lower longeron and upper longeron on each side and connected to the front spar, while the rear spar was attached to each lower longeron by a single removable

After WW1, many of the surviving Fokker D.VIIs acquired by the U.S. Air Service as war booty. This is one example, still carries its original Germany serial (7776/18).



strut that provided a degree of rigging adjustment. The upper wing was dihedralled outboard of the cabane struts and carried partly inset ailerons with squared-off tip balances. The welded steel tube landing gear was without the triplane's aerofoil axle fairing.

Tail surfaces of V.11 were generally similar to the V.4 and V.9 and the wire-braced welded steel tube fuselage was similarly short coupled, although its longer (and heavier) engine dictated a lengthened nose, with the upper wing mounted unusually far forward. A nose radiator similar to that of the quintuplane V.8 was fitted, removable cowling panels were of aluminium and the upper surface of the fuselage was faired by a plywood-covered turtledeck.

The first of three competitions to find one or more war-winning fighters for the hard-pressed Fliegertruppe was due to begin at Adlershof on January 21, 1918. Fokker's own account of how he personally floated the idea of this competition, then influenced various 'ace' fighter pilots to support 'his' idea, must be considered highly exaggerated, but it does seem probable that the starting date was indeed several days earlier than he would have preferred

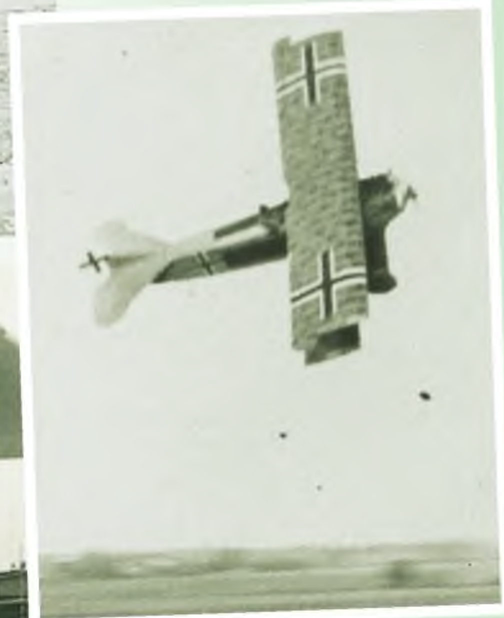
and that, in consequence, the V.11 was finished 'considerably short of what (he) had in mind'.

Nevertheless, with only some three weeks at his disposal, Fokker entered no fewer than eight aircraft in the Idflieg's fighter competition! Photographs of V.11 as delivered to Adlershof show that its upper wing had been moved aft, thus requiring a small trailing edge cut-out above the cockpit, and that its ailerons were now fully inset with their trailing edges in line with that of the wing. A small triangular fin and modified rudder also appears to have been fitted during this period.

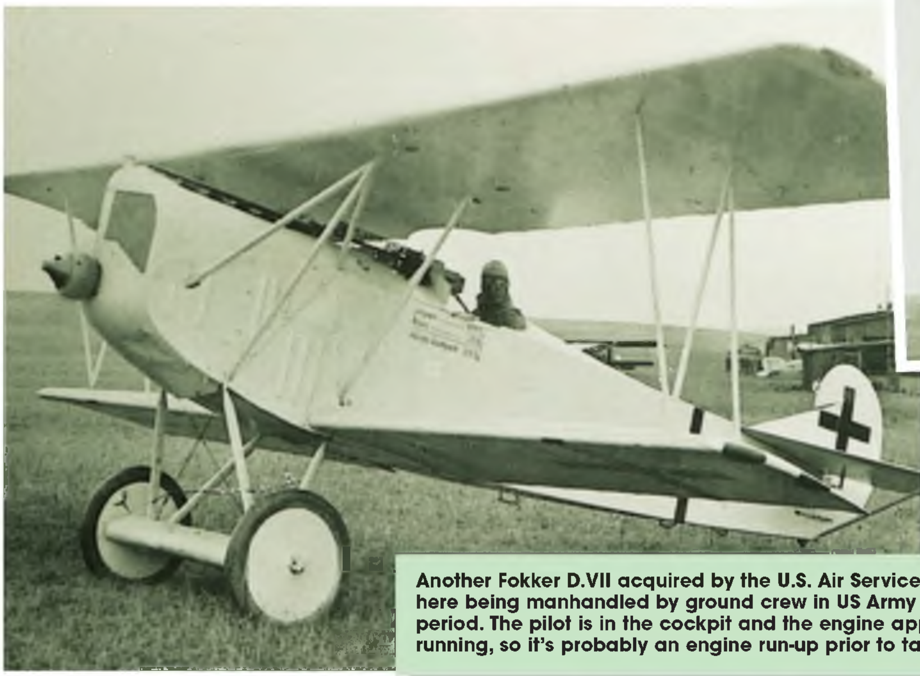
However, Fokker was well aware that his V.11, although highly manoeuvrable, was directionally unstable, with dangerous spinning tendencies. This was confirmed when, at Fokker's request, Manfred von Richthofen flew the aircraft on January 23 1918. On the pretext of making minor repairs following a landing accident, Fokker locked himself in his hangar over the following weekend with two welders from his Schwerin factory. According to his own colourful story, they lengthened the fuselage by some 60cm, increased the vertical tail area, then recovered and repainted as necessary to hide these modifications. Photographs of V.11 in its final form show a longer rear fuselage with wider structure bays, differently contoured longerons and a more prominent triangular fin.

Thus modified, the V.11 was easy to fly with no tendency to spin: it was agile, reasonably fast and accelerated quickly in a dive without loss of directional stability. It was unanimously agreed that the V.11 should be recommended for production as the standard Mercedes-engined type and eventually. Fokker's V.13 was chosen as the best all-round rotary-powered machine. Not only were 400 V.11 type fighters eventually ordered from Fokker's Schwerin factory as the Fokker D.VII, but Albatros Werke and its subsidiary OAW were to build his new fighter under licence.

Captured D.VII acquired by the US 9th Aero Squadron, seen at Trier, France, in January 1919, with 2nd Lt. James A. Royer in the cockpit.



Low flying D.VII shows off its lozenge camouflage and distinctive aileron balances at the wing tips.



Another Fokker D.VII acquired by the U.S. Air Service as war booty, here being manhandled by ground crew in US Army uniform of the period. The pilot is in the cockpit and the engine appears to be running, so it's probably an engine run-up prior to take-off.

This captured Fokker D.VII has either British or French roundels applied over the German crosses. Lighter outer colour implies red, which would suggest French roundels, but tone values on photographs of that era can be misleading.

Another Fokker D.VII acquired by the U.S. Air Service as war booty, here being manhandled by ground crew in US Army uniform of the period. The pilot is in the cockpit and the engine appears to be running, so it's probably an engine run-up prior to take-off.

The D.VII of Ltn. Richard Wenzl. Although the picture is very grainy, the distinctive markings of this Jasta 6 machine are clearly demarkated. Note the stripes on the tailplane, nose and wheel.

Many WW1 German Air Service pilots held senior N.C.O. ranks. This is VzFW. Willi Gabriel of Jasta II, whose aircraft shows little embelishment beyond a white fin/rudder and horizontal bar below the tailplane. The machine features the streaky finish (vertical on the fuselage) applied to very early D.VII examples.

This fully lozenge camouflaged machine is seen at the Adlershof Test Centre.

A second V.11 was built. Type testing at Adlershof began on February 4, 1918 with prototype structural testing that same month and further structural tests of a 'pre-production' D.VII in March. Both aircraft exceeded the required criteria and in service the D.VII proved to be immensely strong: no D.VII structural failure in the air has ever been recorded, other than the failure of top wing ribs aft of the rear spar at the centre section, but no fatal crashes are known as a result of this short lived defect.

At Adlershof the V.11 had been considered rather heavy, with less than outstanding climb and performance at altitude. In an effort to make good these shortcomings, Fokker built two more prototypes. One of these was the V.18, while the 'V' number of the other is not known. What is known is that all three machines (V.11, V.18 and V ?) were modified and eventually were allocated the first service serial numbers of 227/18,228/18 and 229/18 respectively. The first production batch of Fokker D.VIIs were numbered from 230/18 upwards and comprised 295 machines.

The first D.VII from the first Schwerin factory production batch arrived at Jagdgeschwader I (Richthofen's old unit) in April 1918 and by the end of the month, 19 were reported to be at the Front. It was eventually issued to most of the Front-line fighter units: 407 D.VII were operational in July, 828 in September and it is thought that less than 1,000 were in Front- line use at the end of WW1.

The ability of the D.VII to retain control at very high angles of attack while firing into the underside of unsuspecting allied aircraft became legendary, as did its remarkable agility at very low speed while retaining the altitude of level flight.

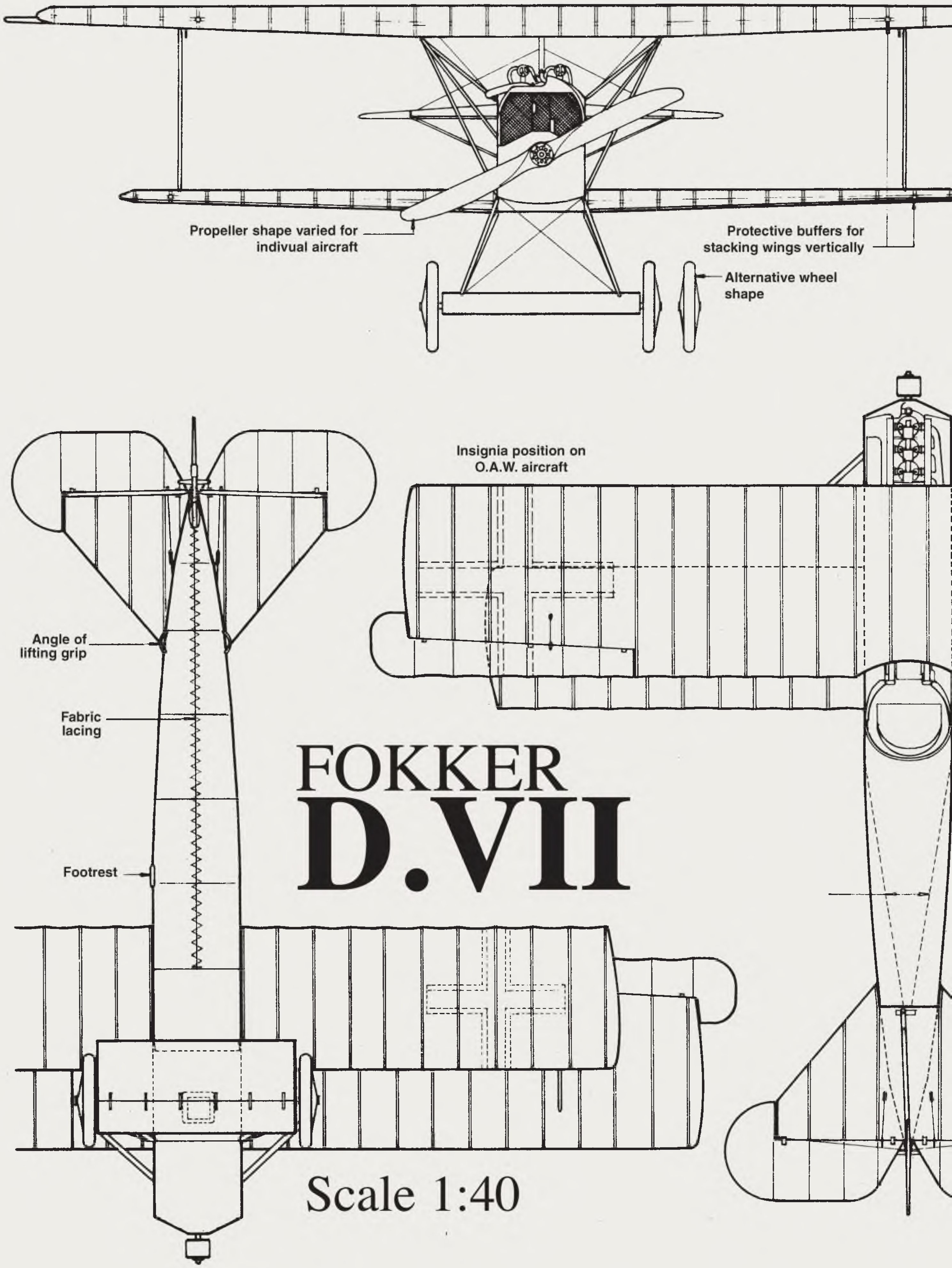
A 'height-compensated' BMW engine of 185hp was installed as availability allowed: machines with this engine were designated D.VIIF and enjoyed improved climb, greater control at altitude and a ceiling of 21,000ft.

In April 1918, 217 Allied aircraft were shot down: in June there were 468 such losses, for July there were 517 and in August 565. Many of these were the results of successful employment of the Fokker D.VII.

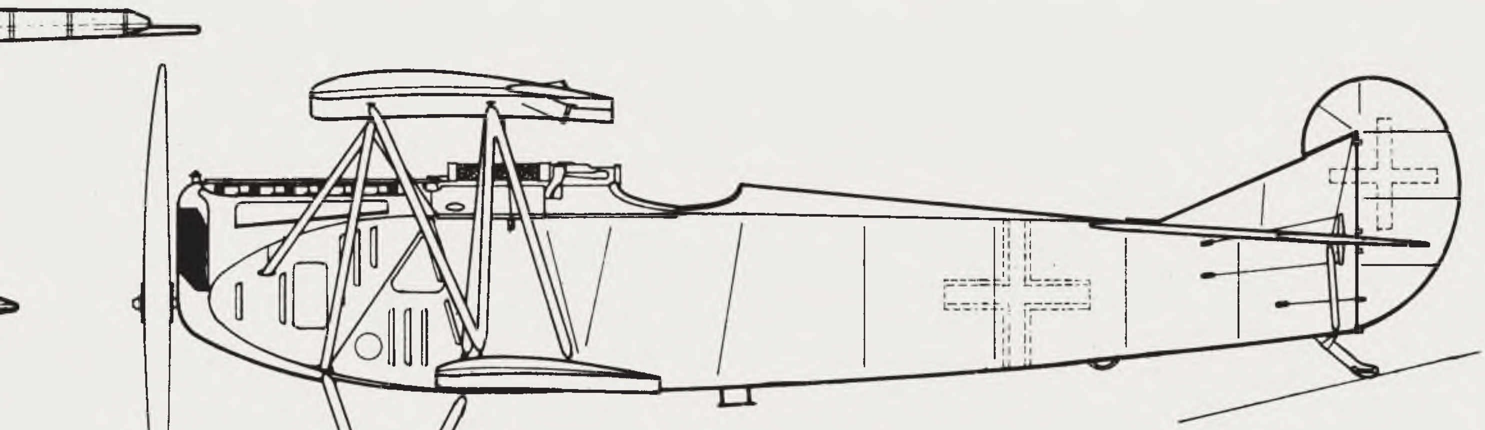
Small wonder that the Armistice agreement of November 1918 stipulated that military equipment to be handed over to the Allies must include '...especially all machines of the D.VII type.' Yet British and French designers ignored the structural and aerodynamic advantages of Fokker's thick, unbraced wing and the structural and production simplicity of his welded steel tube fuselage. But many of the surrendered machines went to America, where the value of their high-lift, cantilever wings and simple rugged structure was generally recognised: the D.VII's influence on design persisted until the advent of stressed-skin metal construction became the norm. ■

Four D.VIIs in German Imperial Air Service livery. Aircraft nearest is Ltn. Richard Kraut's machine and has his stylised initials on the fuselage side.

FOKKER D.VII

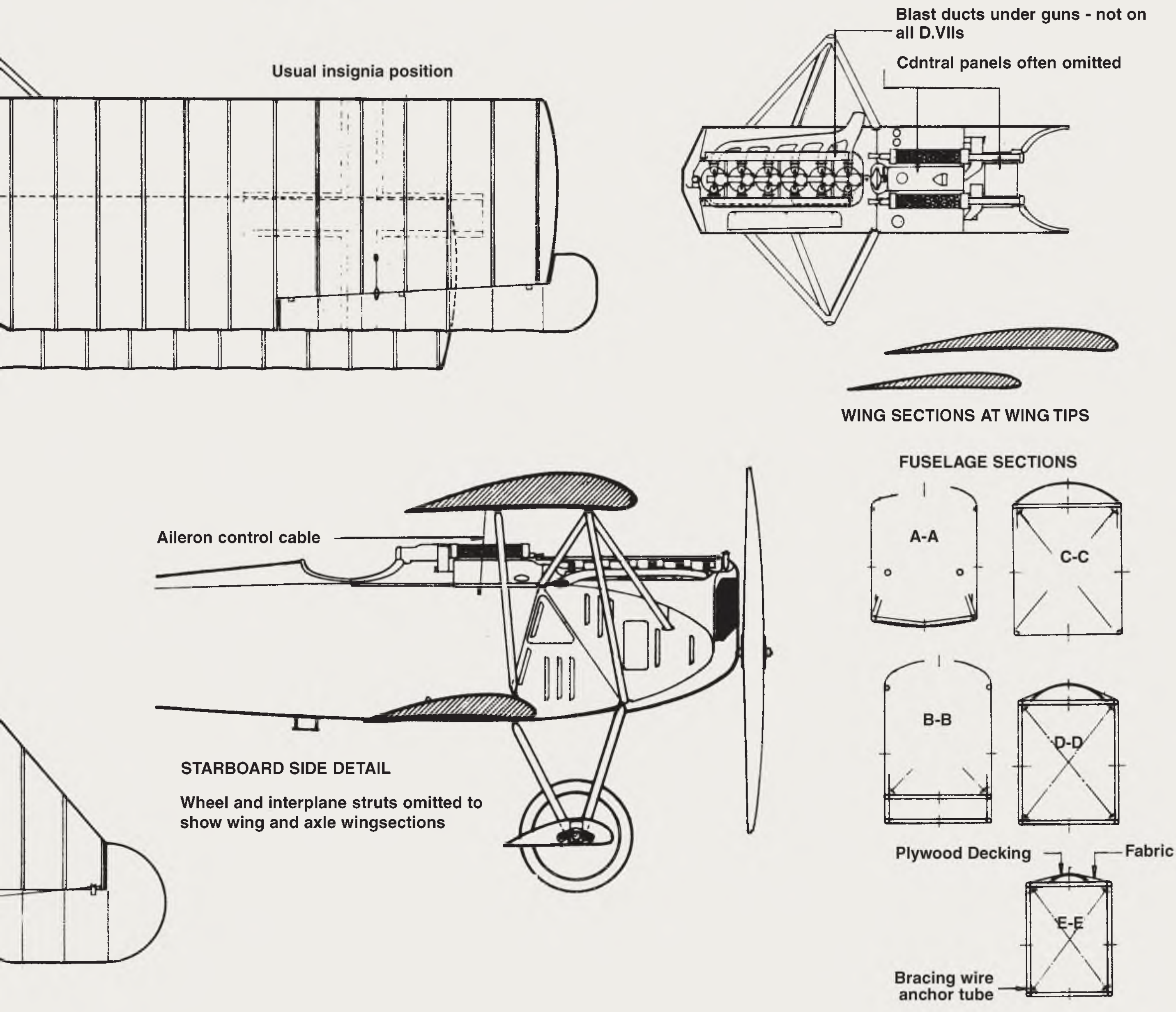


Scale 1:40



NOTE: The drawing depicts a typical late Fokker-built aircraft with a 180 h.p. Mercedes engine, Cowling details varied with different production batches and between sub-contracts. Remainder of airframe was very consistent in detail on WW1 aircraft.

COLOUR: Fabric-printed lozenge camouflage with dark green or grey cowling and struts. Rudder and Fin, white.



WIRE IN THE WIND

GARY SUNDERLAND CONCLUDES HIS DETAILED ADVICE ON REPLICATING BRACING AND RIGGING

PART 3:

Controls for roll

The Wright brothers' invention of the first controllable, and hence flyable, aeroplane depended on wing warping for roll control. This involved flexing the rear part of the wings to alter the angle of incidence towards the tips. **Figure 25** illustrates the system of wing warping used in the Fokker Eindecker and this was typical of most monoplanes of the pioneer era. Note that the change in incidence must increase towards the tips as the rear spar bends, which means that the operating lever arm provides for more deflection of the outer wires. The outer balance cables must also move further and thus TWO pulleys are required on the top pylon, a point which I had not appreciated until I had closely inspected a model of the type built by Mr. Frank Curzon.

With this system of control, using a closed-circuit to maintain cable tension, there is no possibility of introducing differential movement. (That is, more up travel and less down). However, this should not be a problem, given that deflecting a lot of wing a small amount, (typically only three to five degrees change is involved), will not involve much adverse yaw. A bit like strip ailerons on a sports model.

Wing warping had a lot of advantages at that early stage of aeroplane development when aircraft with ailerons were prone to flutter, or 'vibrate' as was usually reported. In the outnumbered German 'Fliegertruppe', the Eindeckers were used defensively behind the lines and in an emergency would depart in a vertical power dive that no Allied pilot dared follow.

Note that the function of the balance cable is to tension the whole system and transmit motion from one side to the other. All the problems of lever systems exist that were discussed previously, except that the smaller angular deflections in warping mean that they do not create a practical problem. In practice the need to bend and stretch the wings provides an appreciable self-centring force. Some early aeroplanes utilised an open circuit to operate the warping surfaces and relied on this elastic

PHOTO 25: Australian Frank Curzon's Etrich Taube featured true wing warping as per the full size. It was built to 1/4 scale, powered by an O.S. 120FS. A single Hi-Tec servo mounted in the fuselage bends one wing tip up and the other down.

structure for return force. For example, the thin, flexible trailing ribs of a *'Taube'* type aircraft were built straight. The operating cables bent these up to provide an initial washout of about ten degrees and moving the control wheel in the cockpit pulled one up to some fifteen degrees, while the opposite side flexed down to five degrees or so. Frank Curzon has made several Taubes of this sort (**see Photo 25**) and the systems work well.

Another adaptation of this method of control was used in the early model Caudrons, except the control wires on these biplanes bent the trailing edge of the upper wing DOWN. To my way of thinking this should have made the Caudrons unstable and hard to fly, but the original aeroplane had just the opposite reputation. A superb model of a Caudron G3 was built by Vladimur Handlick of (then) Czechoslovakia, and flown in the World F4C Championships in way back in 1996 (**see photo 26**), and I can verify personally that the model Caudron seemed to be very stable and controllable. Vlad came second on this occasion and had won the previous World Champs in Spain with this model.

Fig. 25.

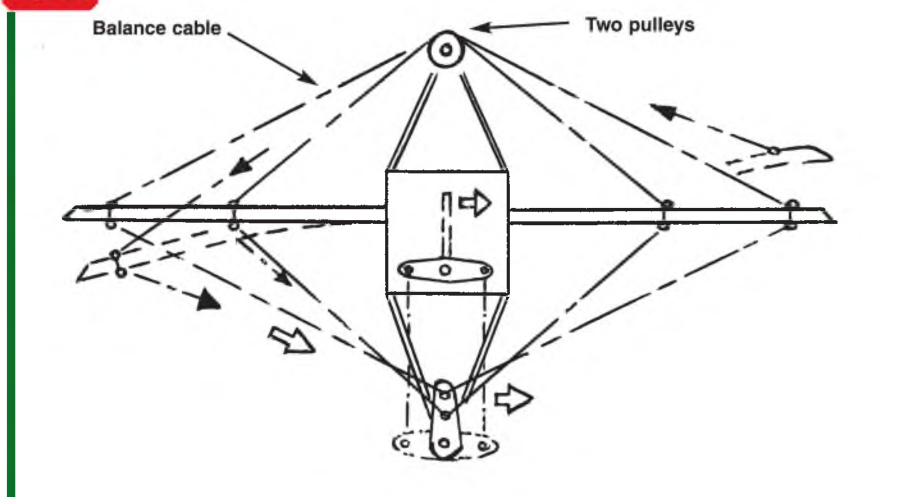


FIGURE 25: Fokker Eindekker warping system schematic vired from rear. Right motion of control column moves lower crank right, tensioning left cables. Left wing warping down tensions the balancing cables warping right wing up.

Fig. 26.

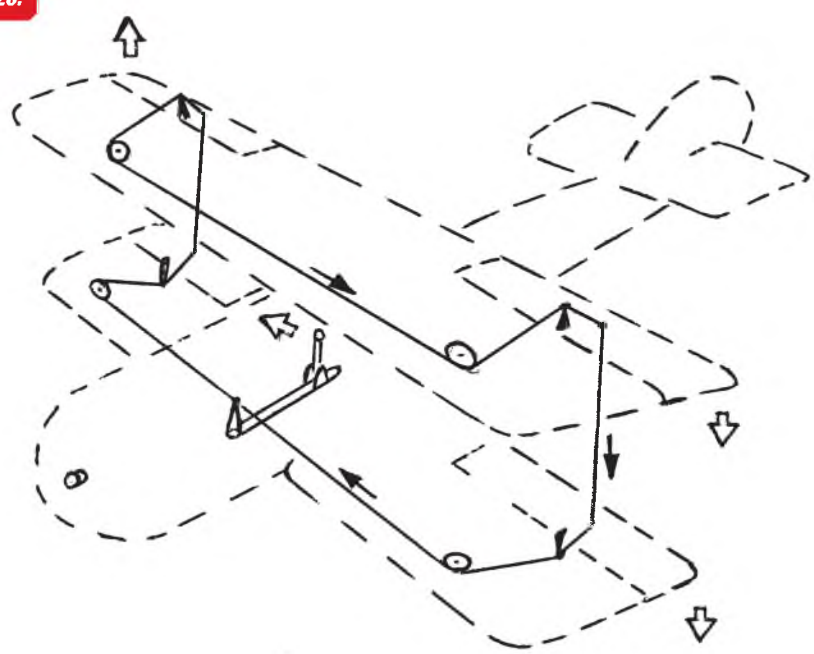


FIGURE 26: Aileron circuit schematic. Right motion of control column pulls left ailerons down, while balance cable pulls right ailerons up.

Ailerons

Ailerons were soon introduced to lower control surfaces and overcame the structural problems, but soon brought a few problems of their own. An aileron is, essentially, a wing flap and the initial down deflection creates mainly lift, and after ten degrees or so there is not much increased lift, but the drag increases substantially. This results from the abrupt camber change at the hinge line, causing the airflow to break away and become turbulent. The presence of a control gap, which permits the air to flow from the higher pressure area below the wing, adds to the problem.

Designers and builders were aware of these problems back in WW1, but not much else. For example, the popular fashion for inverse taper ailerons was presumably based on the belief that more aileron further out would promote the rate of roll. We now know that this was not correct and the aileron should be designed to promote the pressure distribution on the wing. Someone must have been doing some good research on this towards the end of WW1, because Nieuport began to round off the ends of the ailerons and this practice passed to British aeroplanes just after the war.

It was the usual practice for British aeroplanes to have ailerons on both wings and a typical control circuit is shown in **Figure 26**.

Flutter

With the wisdom of hindsight, we know that most early aeroplanes were liable to flutter at anything over 100 m.p.h. or so. The 'barn door' ailerons had all of their mass behind the hinge line and the aileron cables, of stranded steel wire, had a lot of flexibility or stretch under load. The SE5 was an early victim of this disorder, not that the design was much different, but it had a more powerful engine and would often be dived in combat to speeds nearing 200 m.p.h.

The prototype SE5 broke up during tests, killing the test pilot, after which the SE5 wings were redesigned to shorten the tip and aileron and to strengthen the aileron and strut area. The aeroplane thus modified, was re-designated the SE5a, but still had flutter problems. We know this because a late field modification added a forward bracing wire to the fin. This indicates that the SE5a was encountering a more dangerous non-symmetric response at higher speeds.

The first response had been symmetric, with both aileron pairs bouncing up and down together in unison. The second mode is when they bounce in opposite directions, often so violently that the control column thrashes from side to side and the pilot may not be able to restrain it. This vibration may feed into the rudder, which may also start to flap from side to side.

To add to the pilot's woes, the SE5a elevators were not rigidly connected together, as they are in modern aeroplanes, and could also start to flap in different directions, placing severe torsional strains upon the rear fuselage. This is probably the way that some fin failures were generated, as the aeroplane 'fish-tailed' violently. The SE5a had a strong airframe so some aeroplanes encountered such high speed flutter and survived to bring their pilots home.

Other aircraft of the time were a lot worse in their design and various 'Vee-strutters' were notorious for shedding their lower wings and generally breaking up in mid-air. A lack of torsional strength of the lower wings made most of them candidates for high speed dive failures, apart from the Pfalz D.III which had a sound, two-spar, lower wing structure. The main problem with the 'Vee-Strutters' was that the triangular bracing of the wing cellule meant they had half the torsional strength and stiffness as compared to orthodox biplanes. The torsion tube aileron drive of the Nieuport scouts was another bad feature, as long torsion tubes are relatively flexible. However, Albatros also managed to design a very flexible drive into their D.V, and swiftly reverted to the previous design due to a number of in-flight failures, and the D.Va resulted.

The French SPAD was by far the best of a bad lot. Purely by chance, the designers opted for pushrod controls and also, by

PHOTO 26: All struts, wires and warping! Even the elevators on Vlad Handlick's Caudron G3 (and also on the Taube) warped up and down!
PHOTO 27: The author's 1/5th scale LVG C.VI was fitted with scale closed-circuit aileron control driven from a single fuselage mounted servo.
PHOTO 28: Tailplane bracing wires exhibiting near-spherical silver-soldered joints between the stainless steel strip and the screw fittings. Similar joints in the wing bracings did not fail.

another bit of good fortune, even managed to introduce a small measure of mass balancing. The weight of the operating arm and the vertical pushrod is IN FRONT of the hinge line. No one at the time, least of all the designers, had any idea why the SPAD was so safe at high speeds, but it was greatly admired, particularly by German pilots and designers. The Albatros firm tried to design a similar aeroplane in 1917 and built an experimental D.IX with SPAD wing bracing, but for some reason drove the ailerons via Nieuport-type torsion tubes! The Albatros D.IX broke up during test flying and the pilot was fortunate to survive.

In those days, the whole aircraft industry was progressing blindly. With the advent of peace, there was time for scientists, engineers and test pilots to methodically study problems like flutter and work on solutions. Mass balancing of control surfaces on high speed aeroplanes became standard in the 1930s, but then the advent of monoplanes and metal structures led to a whole new set of problems. These days, we conduct ground vibration tests and use computers to predict flutter behaviour, but it is still nice to be sitting on a freshly packed parachute as you get near VNE plus ten percent!

Model systems

High speed flutter may be a consideration for some specialised speed models, but most scale models, jets excluded, are too slow for this to be a problem. The normal model systems for driving ailerons, with pushrods from servos, would also prevent any occurrence, except possibly in some model sailplanes which have very long and flexible wings.

However, engine-driven vibration is a real problem in some large scale models, notably those with large ailerons on upper and lower wings. It is necessary to transfer the motion from the lower surfaces, which are normally driven by the servos. In a small model, the ailerons on each side would be connected with a 16 SWG wire, but for a large model we need something like a 4.40 pushrod, complete with clevis ends, as on my quarter-scale Bristol F2B Fighter.

Now the weight of two ailerons plus pushrod is quite significant, as can be confirmed by lifting them at the trailing edge, and it is all a long way back from the hinge line. When the servos are energised, all this weight is on one servo and, if we could look inside at the gear train, on just one tooth on the output gear. Now start the engine and we soon have that whole mass of aileron vibrating up and down at some multiple of 6,000 r.p.m. or more. Plastic gears are not very resistant to fatigue loading of this sort and I have confirmed they will fail after about one year in service.

Yes, it is possible to fly a complete circuit with the Brisfit and land safely with one pair of ailerons only! The solution is to install metal gear servos in large scale models.

Another solution is to support the ailerons directly, so that the servos do not have to take the hammering from vibration. Some early aeroplanes, the Curtiss Jenny, Avro 504 and DH4 for example, have balance cables which are external and would be easy to hook up when rigging the model. With a balance cable, it is also possible to replace the between-ailerons pushrods with cables, which are much lighter and of scale appearance as well.

Unfortunately, the Brisfit's balance cable is inside the top wing and so I can see no easy way to install this on a model.

There are a few other aeroplanes that lend themselves to modelling with fully scale aileron drives, and these include most of the German WW1 two-seaters. These are configured with ailerons on the top wing, with the cables passing through the lower wing to a pair of pulleys near the outer struts (**Photo 27**). I was very proud of my LVG, with scale operating controls and exhaust smoke belching from the exhaust stack, but in scale competitions the Judges were unimpressed. So be warned that the static points are for just that - so long as it looks correct no one cares if things function correctly.

The LVG had a single servo in the fuselage and the pairs of control cables passed through plastic tubes in the lower wings to two *Proctor* metal pulleys outboard of the rear struts, thence to the ailerons in the top wing. These pulleys are quite small and I did have a cable break at a pulley. This was during rigging prior to flight and not in the air, so I was fortunate. Some time later a friend of mine lost his *Proctor* 'Jenny' in flight, which tended to make me suspicious of those *Proctor* pulleys, which are only about 6mm (or 1/4") diameter. The rule for full-sized aeroplane pulleys is that the diameter should be twenty times that of the wire cable. The *Proctor* control cable, or fishing trace, is about 0.5mm, which means that the minimum pulley size should be 10mm.

These days I make my own pulleys with a minimum diameter of 12mm (1/2"). It is very easy to make control pulleys from three discs of plywood and you don't need a lathe or anything more than hand tools for the job. Even with a good-sized pulley, the plastic-covered control cable will eventually take up a permanent curve or set, which probably indicates that the plastic covering is cracking on the outside of the curve. This may lead to stress concentrations at the stranded wire inside and this will eventually fail as well. Even so, my quarter-scale model Halberstadt D.V has just this sort of aileron drive and operated happily for three years without any problems. It is currently stored, but if I decide to fly it again, a new set of aileron cables will be fitted.

Mick Reeves fittings

To make or repair flat stainless steel wires attached to Mick Reeves end fittings, you need to first take them apart. The ends are attached to the fittings on the model with small screws, which might have gone in easily enough, but the screw threads are now damaged where they have been loaded in flight or in the crash - as in the case of my damaged Brisfit. They can be screwed out using a pair of pliers but the screws and the clevis fittings are butchered in the process and have to be replaced. Fortunately, I had foreseen that this might be a difficulty and had ordered some spares from Mick, just in case.

This resulted in another problem for, although the parts were otherwise interchangeable, Mick or his supplier had altered the length of the adjusting screws. My original set, purchased way back in 1999 (last century!) had swivel screws 20mm long. The adjusting end screws were only 13mm long.

The new replacement screws were all 16mm, which is an improvement because the 13mm screws were definitely on the short side when you needed to adjust the wires. However, this did mean that all my failed wires required to be adjusted for length, and not just brazed back together again. Note that this bracing always fails through the brazed joint and not in the stainless strip or the brass fittings. Most of the failures were in the landing wires, of course. The duplicated flying wires only fail in one wire if it has been tensioned so as to take most of the load and not have it shared.

Blob Theory

I also noticed that the brazed joint failures were invariably at the surface of the stainless steel strip and in nice-looking joints, where the brazed metal tapered smoothly from the rectangular strip to the circular screw. Such joints looked scale, in that swaged stainless steel cable has this nice smooth change in section.

There may be a number of explanations for this, but it was noticeable that where the brazing had resulted in a near-spherical blob of silver solder, these seldom failed (**Photo 28**). Brazed deposits are really just metal castings and consequently are strong in compression and shear but weak in tension. For example, a cast iron cannon ball is very strong but a sword cast from the same material would soon fail and crack apart.

I therefore decided to re-make all of the landing wires and deliberately introduce blobs in the joints. This is partly a scale feature, in that the original RAF-wire in the early Bristols featured a cylindrical pin and socket joint at the ends. This looks a bit like a spherical joint from most angles.

Brazing bits

If you are going to make or repair stainless steel rigging, you will need a simple jig to hold the two parts together while you braze the joint (see **Photos 29** and **30**). Mine was made from my favourite 0.5mm steel packing strip with a few 1/8" Whitworth screws and nuts. Brazing was done outside on the bricks, of course. For this you need just sufficient heat and a very small bit (nozzle). Mine is a small propane torch which has a 2,500 degree Fahrenheit (1,000 C) flame. The r acid flux-cored silver solder is 98% tin and 2% silver. Do not otherwise use any flux, other than zinc chloride soft soldering fluid (killed spirits of salts).

My procedure is to place a drop only of the liquid onto the joint and heat with the tip of the torch until it starts to boil. Then I just touch the solder wire to the joint, wait an instant for the melting solder to drop, and then roll the jig over. If the reverse side is still clean, then repeat the process.

If some of the flux from the cored solder has contaminated the reverse face, then it is necessary to stop and clean this away before proceeding. For such small joints the silver solder flux is just a problem because it has an affinity for the cleaned

PHOTO 29: A simple jig to hold the parts is essential when silver soldering wire-end attachments. The steekl jig can be bent to allow the two items to coincide exactly before brazing. PHOTO 30: The reverse side of the jig, showing simple clamps to hold the parts. In this case, the free-swivelling end fitting is in place, with the scre and locknut.

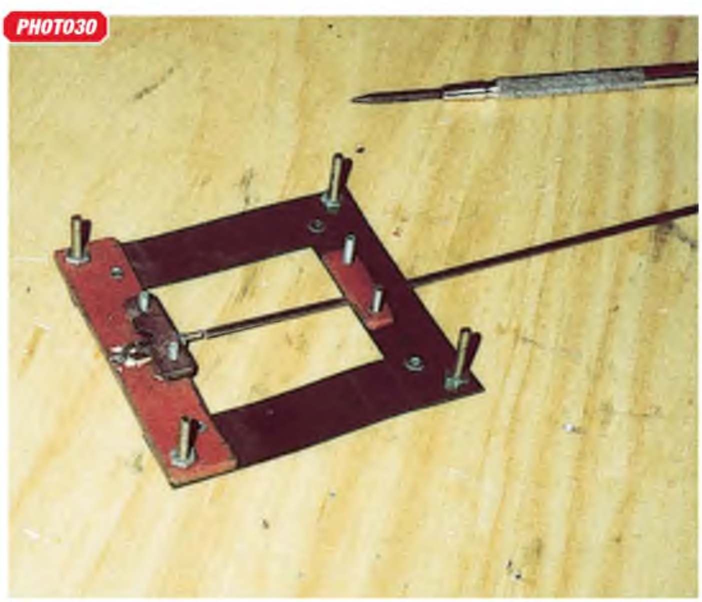


Fig. 27.

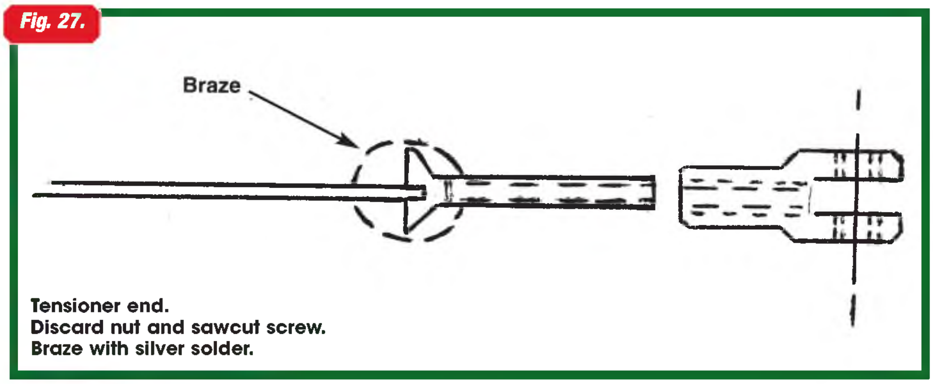
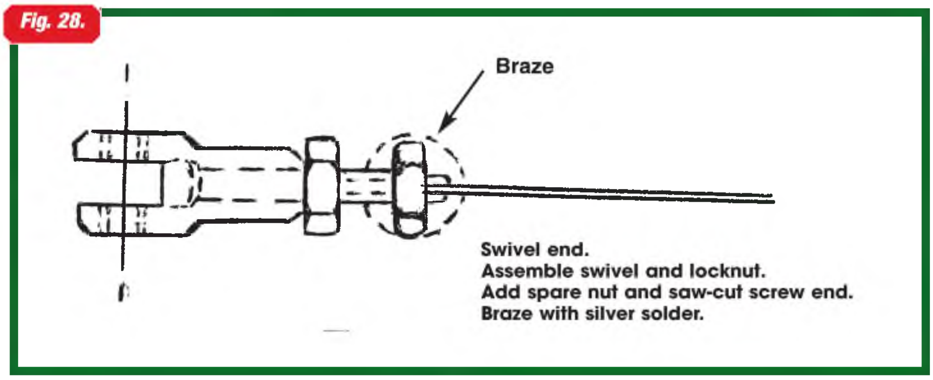


Fig. 28.



surface and then just gets in the way of the molten metal. Some solid solder with perhaps 4% silver would be ideal.

My system for producing stronger spherical joints is shown in **Figures 27** and **28**. This is a simple operation in the case of the adjustable (tensioner) end. Just extend the slot in the screw with a fine hacksaw and braze the strip in. At the swivelling end we can use the locknut from the adjustable screw, and carefully sawcut the screw to accept the strip. Only one locknut is necessary to prevent rotation of the wire assembly and, anyway, the acorn fitting will do this job as well (**Photo 31**).

Proving a design

Before offering a plan for publication I feel that it is preferable to have at least one season of flying with a model. That way, any hidden weakness in the design may be revealed and sorted out. I am then confident that other builders should be able to construct a flying replica, as long as they possess reasonable building skills and do not make any major modifications.

Flying the model for an extended period exposes it to a variety of problems, including bad weather, normal wear and tear and usually a bit of minor crashery. This does not mean that the model is deliberately mishandled to produce a bad landing, just for the heck of it! Like everyone else, I fly for pleasure, which relates to flying in good weather and avoiding damage. It is much better to avoid repairs, so that my time may be devoted to designing and building new models.

However, flying in contests and rallies does mean flying in bad weather, with strong winds, cross-winds and gusty conditions, not to mention the pressure of competitions and some less than satisfactory venues. Contest flying is usually not for the faint-hearted, but once you start it is amazing what adverse conditions you can cope with and survive. However, there is an element of risk, of course, and a bit of minor prangery is inevitable in a season, which is where we came in.

The following story against myself is a salutary lesson in how it is all too easy to design in a mistake with all the best intentions, and concerns my new Albatros D.III model in its first month of operation. Now everyone is aware that most biplanes do not take kindly to cross-wind landings. To handle a cross-wind you really need a low-winger with a wide undercarriage and a powerful rudder. Biplanes usually have none of these things, with the result that they will tip over and scrape the down-wind tip, none too gracefully, on the ground. What happens next depends on how hard the wing hits, what it hits, whether smooth ground or tufts of grass, and to an extent the shape of the extremity.

Some early aeroplanes were fitted with hoops or skids at the wing tips, and these really do function on the model as well as they did at full-scale. The undersides my Bristols (Scout and Fighter) reveal that the paint has been worn away from the bottom of the skids!

My Albatros D.III model has no tip skids but the lower wing shape is nicely curved, which avoids it digging in to the ground, and the undersides of the tips were well worn, to the extent that most of the paint was removed and the fabric was becoming tattered! Apart from snagging the grass and cartwheeling the model inverted, this sort of tip contact can have even more drastic effects, as shown in **Figure 29**.

Here we can see that an upwards load on the tip bends the lower wing about the strut, while at the same time producing tension in the flying wires thereby compressing the wing spars on that side. The Albatros Vee-strutters have relatively long and thin lower spars so they are liable to fail under this sort of mistreatment. To cope with this eventuality on the original D.V model the lower spars were made in the form of a box, composed of two half-inch deep pine webs with one-inch wide pieces of 1.5 mm birch ply top and bottom, to make a very solid box spar. This proved amply strong and the lower wings were never broken and, in fact, outlasted the rest of the model.

When my new D.III was under construction I sought to decrease the empty weight by reducing the plywood thickness in several areas, including the lower wing spars where the ply caps were made only 1 mm thick. This turned out to be a mistake, and a less than elegant landing resulted in the model bouncing from one tip to the other on rough ground, resulting in a D.III with a peculiar polyhedral to the lower wings!

Repairs

The original lower wing box spars of the D.III are shown (**Photo 32**) during construction and they failed at about half-span, between the roots and the strut attachments. The first step in repair was to peel back the wing covering from the top surface of the failed area as shown in **Photo 33**.

My practice is to stitch the lower fabric to the ribs during covering, before adding top fabric which is added OVER the rib stitching. This makes it easy to remove the top covering as shown. In this case the failed 1 mm ply area has been removed and the

PHOTO31

PHOTO 31: The complete rigging of one bay is seen here, appropiately tensioned and with 'acorn' fittings in place where the wire-cross. These fittings are made with a lashing of light wire or thread which is coated with fast-setting epoxy and painted brown. The flying wires have 'vibration preventers' from shaped tinplate as well. The incidence wires have a small ply disc at their intersection.

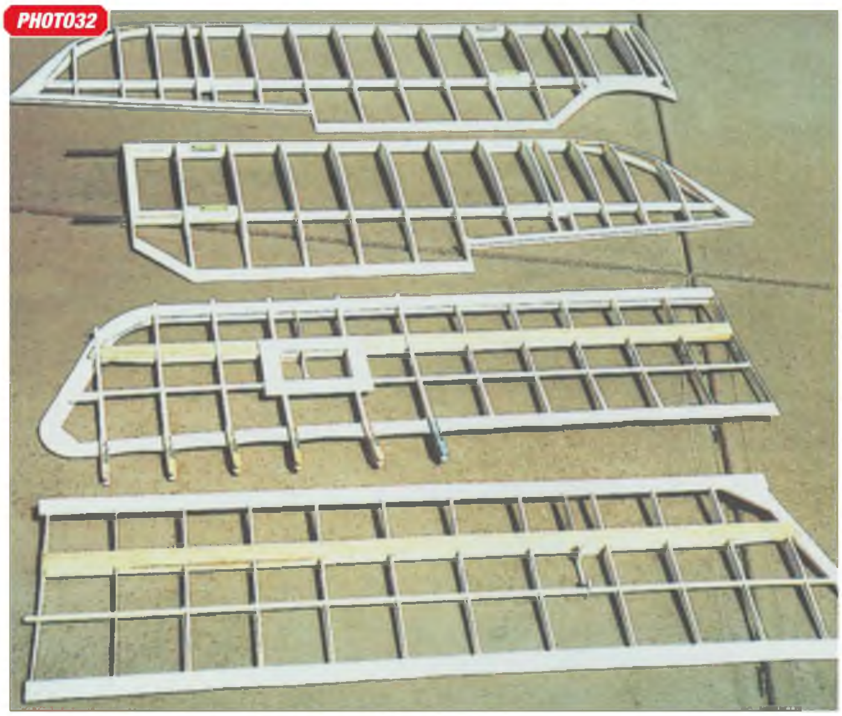


PHOTO 32: The wing panels of the austor's Albatros D.III under construction, show the shallow box spar in the lower wings. PHOTO 33: With the brocken wing pinned down onto the building board, the covering is stripped away and timber doublers are glued and clamped either side of the break. PHOTO 34: As and extra precaution, the ribs have been cut away and an additional layer or 1.5mm birch plywood has been added to re-inforce the spar. The auxiliary spar has been repaired. Note the rib caps which are retained, to simply glue back in place, ready for the covering to be restored.

wing is pinned down on the building board to straighten it. The vertical timber members had failed and were reinforced by sections of the same size either side, shown here being glued and clamped in place.

After adding a new piece of ply insert, the ribs were cut away and a section of 1.5 mm ply reinforcement was used to cap the area as shown in **Photo 34**. This will greatly strengthen the lower spars in this vulnerable region, so hopefully I will not experience another failure. Needless to say, my D3 drawings have now been changed to indicate 1.5 mm ply for the lower spar boxes.

Timber quality

The next failure on the D.III was due to a lack of quality control rather than design, but it is worth reporting because it does illustrate why I am not particularly fond of spruce for model construction. This all started with the current popularity of ARF models in Australia. As a result, our local supply of pine dried up because the mill which used to cut the timber went out of business.

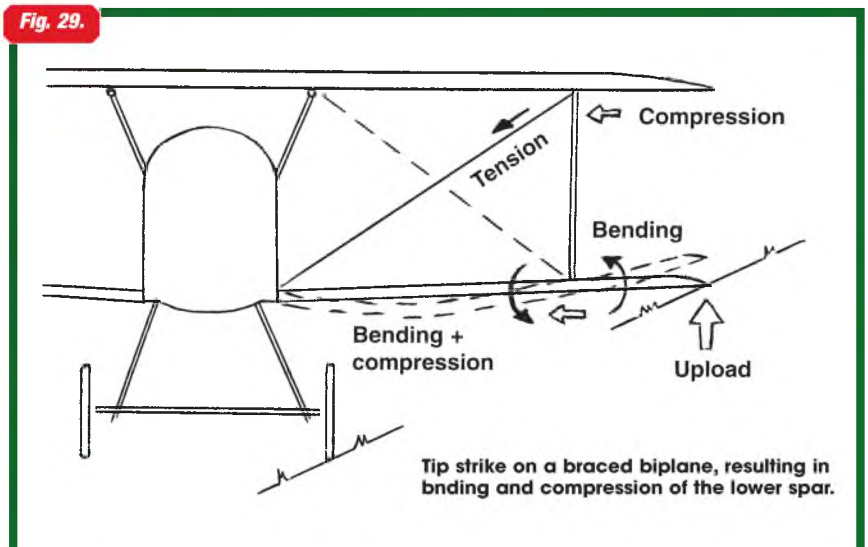
At about the same time, and for the same basic reason, my local model shop also ceased trading and sold off their remaining stock. Being short of timber I took the opportunity to stock up on the packaged spruce strip and sections. This certainly looked satisfactory, given that it was all nice and straight and came from a well known American model supply firm, and was nicely packaged in bundles of each size.

In due course, some of it went into the new D.III, including the tailskid which failed after a few flights. Not a great problem in itself, except that my tailskids do not usually fail! The failed area exhibited a bad case of spiral grain. That is, the face grain appears straight but the internal grain slopes or spirals at an angle. The best way to test for the presence of spiral grain is to split a small piece of timber with a knife. If the grain is perfectly straight you will finish up with two equal halves. Spiral grain is indicated by the knife twisting as it progresses through. There is usually some spiral in most timber, but the total grain slope allowed for aircraft is 1 in 15 and for models I would be looking for, say, 1 in 10. My failed tailskid seemed to have a slope of about 1 in 3! Spiral grain can be found in any timber and spruce is no different in this respect.

The problem is that spruce continues to be TOO popular and is being used without regard to the variability of the species. The very best spruce is sitka or silver spruce which is comparatively rare these days and the best selected timber is used for critical items like yacht masts and spars of some high performance sailplanes. The appropriate specifications call for a high density relative to picea (spruce) genus and a maximum grain slope of 20 to 1.

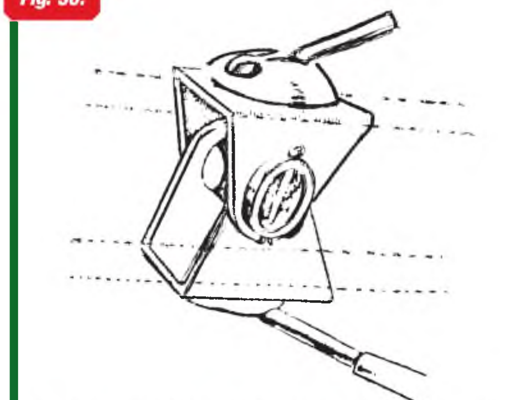
Next in quality are spruce specifications for aircraft. Not much industry these days but the amateur builders are still active. The

Fig. 29.



Tip strike on a braced biplane, resulting in bnding and compression of the lower spar.

Fig. 30.



The original Fokker Monoplane cable attachment fittings to the wing

PHOTO 35: The author's model of the Fokker E.IV illustrates the incorrectly painted cable attachments.The Rectangular base was actually covered by fabric and only the hemisperical boss should have been painted grey (or black?). This model was built to 1/6th scale and was powered by an O.S.60 two-stroke.Note the strip ailerons! Most of the Kanones (German for 'big guns' or Aces) flew the E.IV in 1916 and scored most of their vctories on this two-gun fighter.

British specifications are widely used with a grain slope of 15 to 1 and four grades, covering every use from main wing spars to packing blocks, where a coarse grain, low density timber may be used. At the bottom end of supply we modellers are not likely to see much straight-grained sitka, but a lot of red spruce with variable grain.

The main reason spruce was initially so popular in aircraft construction is that it is relatively easy to form into complex shapes, as seen in the spars of ancient biplanes from the Sopwith Pup to the Tiger Moth. Other timbers actually possess superior structural properties. For example, over the years the spars of wooden high performance sailplanes abandoned spruce in favour of kiefer (pinus silverstris) and then beech (TBU-7). These days they are made from carbon-fibre.

When selecting timber for a model, it is worth looking for a light-coloured pine with a pronounced fibrous grain, equivalent to aircraft grade kiefer or sitka spruce. Locally we have plantations of Hoop Pine coming into production, but the problem is to obtain it in the dimensions we use in models. I may have to invest in a small circular saw to reduce the hardware store timber down in size.

Wing fittings

On braced monoplanes with warping wings, the wire used to connect the bracing and warping cables to the wings were made as small and clean as possible to minimise drag and very little protruded above the wing surface. The early German aeroplanes were made to be quickly de-rigged for transport, and a contemporary *'Flight'* magazine reported on the design of the Fokker A-I monoplane, which was typical of the later Eindecker armed scouts and possibly of other German monoplanes as well.

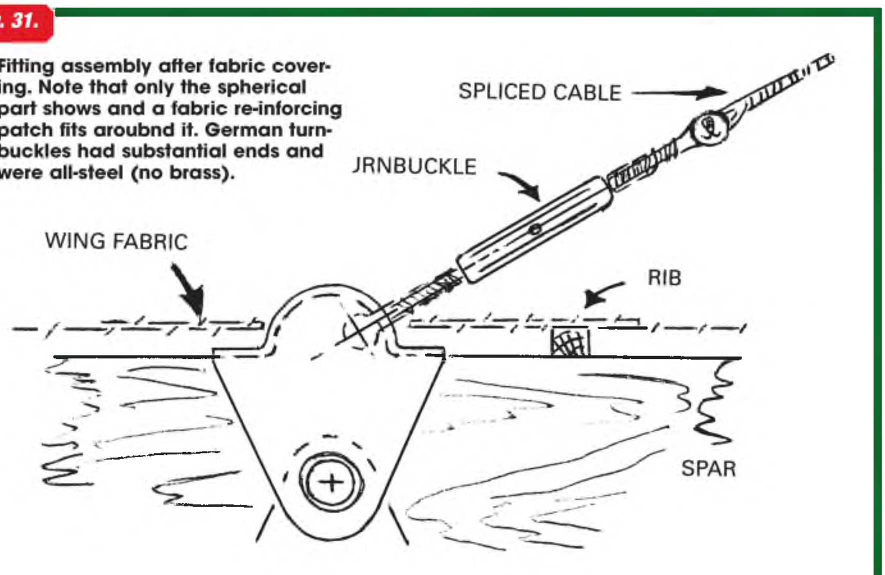
Figure 30 shows the attachment to consist of a hemispherical hollow socket from pressed or forged steel sheet which is slotted so that the head of a turnbuckle enters the outer side and is then retained by the narrow slot on the inner side. This secures the cable when the turnbuckle is tightened, and a slack cable allows the fitting to be quickly separated when disassembly is required.

Assuming that the width of the spar is about 40 mm, then the diameter of the sphere is approximately 30 mm, or about 6 mm on a one-fifth scale model. Reasonable photographs of this feature on a full-scale aeroplane are hard to find, but the cover of the *Albatros Productions Mini-Datafile* on the Fokker E.IV does show one fitting protruding above the wing surface. Another similar photo is in the *Windsock Datafile 91*, 'Fokker EI-II', where page 23 photo 63 shows the spherical end fitting. Incidentally, most of the three-view drawings are incorrect in showing the rectangular body of the fitting which is actually covered by fabric. The photographs prove that only the spherical part is visible from the outside.

Figure 31 shows a front or rear view of the cable and terminal fitting assembled on a wing, and the position of wing fabric. On small models of the free-flight variety I usually

Fig. 31.

Fitting assembly after fabric covering. Note that only the spherical part shows and a fabric re-inforcing patch fits aroubnd it. German turnbuckles had substantial ends and were all-steel (no brass).

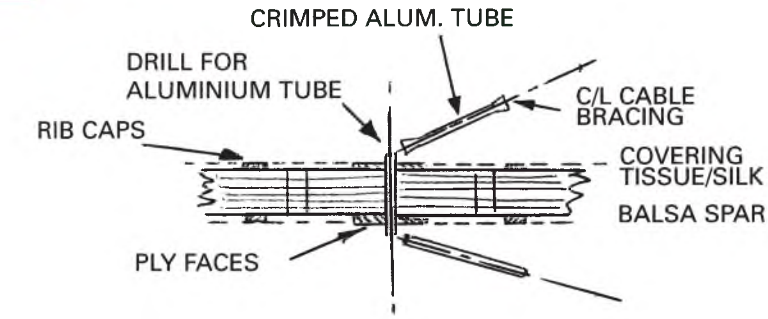


make the wing fitting from a short length of aluminium tube glued into the spar as shown in **Figure 32**. The balsa spar is reinforced locally and thin plywood is glued top and bottom to prevent splitting. The usual bracing is control-line wire, which passes through the tube. Small pieces of tube locate the wire and simulate turnbuckles. These may be aluminium or copper and are squashed to lock them in place.

Some years ago I built a one-sixth scale Fokker E.IV (**Photo 35**) and at that scale the spherical end shapes were simulated by coating the aluminium tube generously with slow-set epoxy glue which, when the tube was pushed slowly into the spar, formed a nice blob of approximately spherical shape. After the epoxy had hardened, the tube was trimmed flush, as shown in **Figure 33**. Dummy 'turnbuckles' were made from copper and brass tubes around 0.032" piano wire. Once again, the rigging was heavy control-line wire. Note that my model has been incorrectly painted to show the rectangular base of the fitting, to correspond with the three-view drawing. Actually, only the spherical glue blob should have been painted grey!

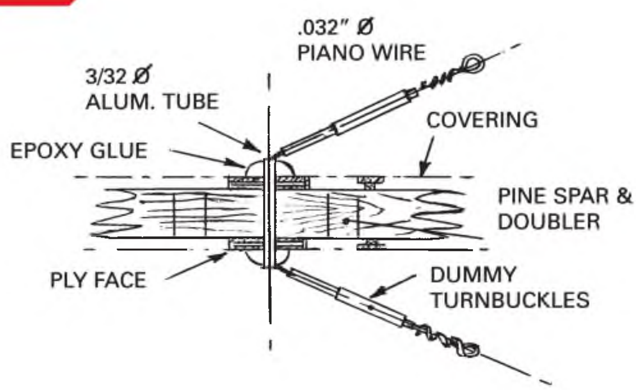
At one-fifth and larger scales the fitting could be simulated by pressing a ball bearing into soft aluminium sheet. Brian Green intends to make his from solid metal, turned on a lathe, but I would still incline to keep the inner tube passing through the spar. Certainly there should be no ugly nuts and bolts showing above the fabric!

Fig. 32.



Wing bracing for small models, 1/12th and 1/8th scale (typicaly Bleriot and Taube). The spar is doubled in width locally and faced with ply. The cable bracing is tensioned with rubber bands.

Fig. 33.



Eindekker bracing at 1/6th scale. Mix and slow-set epoxy on a cold day and allow it to start going off before joint assembly. On the original model, the wire was tensioned by small clips. Model turnbuckles are too large on anything smaller that 1/4 scale.

Hawker Cyg

Designed and built for the Light Aeroplane Trials organised by the British Air Ministry at Lympne in 1924, the Hawker Cygnet was that company's one and only venture into the light aeroplane field. In was also the first aircraft designed for Hawkers by Sydney (later Sir Sydney) Camm, who jointed the Company in late 1923 and rose rapidly to become chief designer.

Two examples of the Cygnet were built and for the competitions, one was fitted with a 1,100 cc. A.B.C. Scorpion twin-cylinder horizontally opposed engine, while the other, with an inverted vee-type Anzani - also of 1,100 cc scored highest marks in the shortest pull-up competition (66.7 yds.).

Unfortunately, recurring engine trouble put both Cygnets out of the competitions - the A.B.C. powered example was actually within sight of winning the £2,000 prize (worth £100,000 in today's money) when a rocker arm broke during the reliability trials.

For the 1924 trials neither machine carried

ALL PHOTOS: Richard Riding Collection

net

The Hawker Aviation Company's one and only foray into the field of light civilian aircraft

official registration letters, the only means of identification apart from the engines being the numerals 14 and 15 carried on the fuselage sides and below the lower wings of the Anzani and A.B.C. machines respectively.

Subsequently, both Cygnets were entered in the 1926 Lympne Trials, this time fitted with 36 h.p. Bristol Cherub III flat twins, perhaps the most reliable and successful engine of its type in existence at that time. That year, all aircraft entered in the Competition had to pass a series of preliminary tests, which included dismantling and erecting, dual controllability-take-off and pull-up-before entering the competition proper, in which scores were awarded for the ratio of useful load carried to the weight of fuel consumed over a distance of 1,963 miles.

The winner was P. V. S. ('George') Bulman, flying the second Cygnet, G-EBMB, his performance being a total flying time; 30 hours 40 mins. 15 sees., at an average speed of 64.9 m.p.h. The useful load carried was 430 lbs. and the weight of fuel consumed was 388.8 lbs., giving a fuel consumption of 39 miles per gallon.

The other Cygnet, G-EBJH, entered by the R.A.E. Aero Club gained second place, and only two other machines out of a total of 16 entries succeeded in completing the course.

The 1926 trials had been organised with a view to selecting a suitable aircraft with which to equip the existing flying clubs, but with the introduction of the De Havilland DH 60 Moth, the official conception of the

TOP: Along with many other small aircraft of its era, the Hawker Cygnet was design to suit the requirement of private and 'Club' flying, for which fold-awy wings were important for hangar stowage. ABOVE: No markings identify which of the two examples of the Cygnet, but this one features a headrest fairing behind the rear cockpit. It may well have just been wheeled out after final assembly.

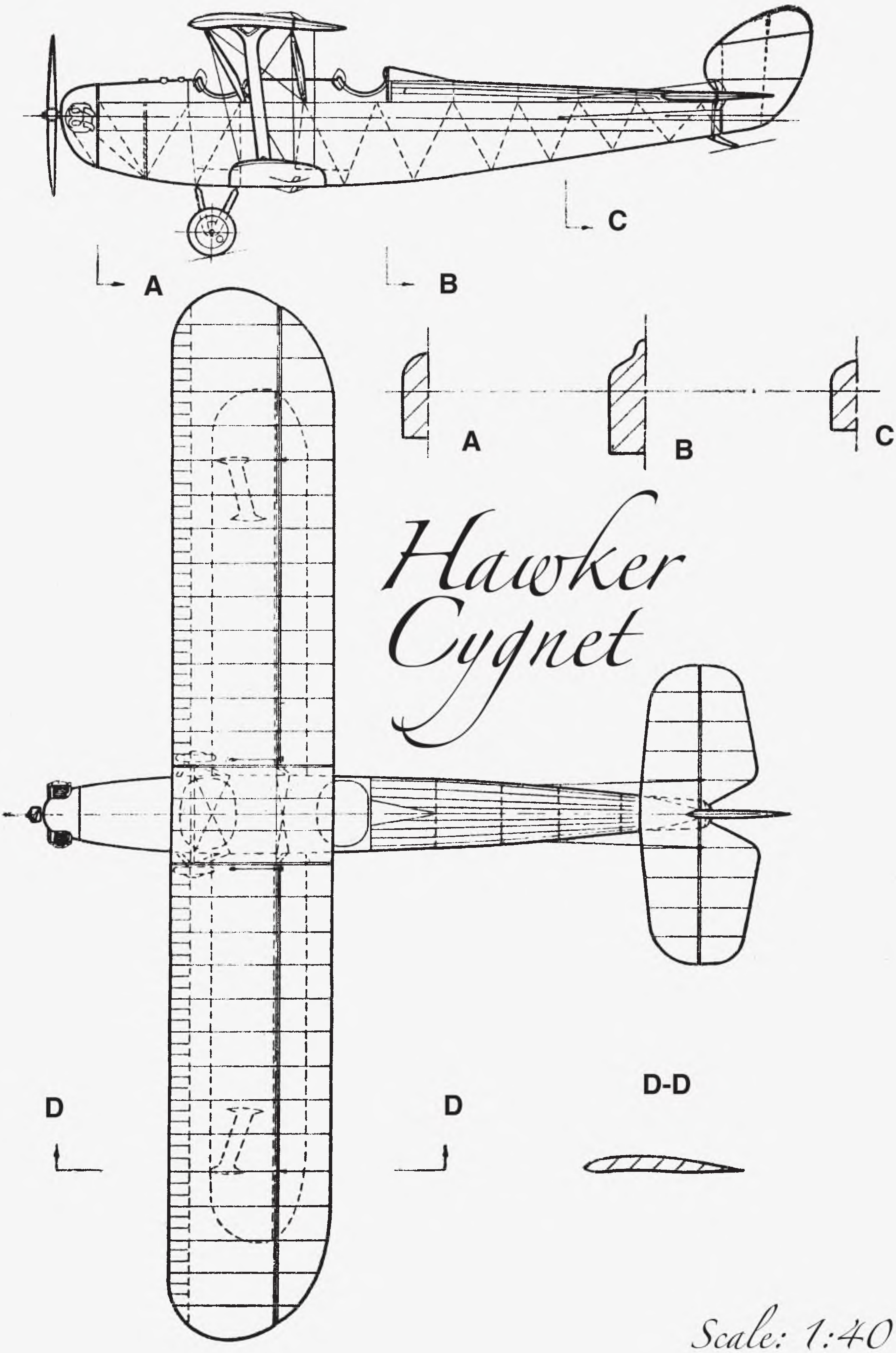
No.14 identifies this as thye first of two Hawker Cygnets built as it appeared at the 1924 Light Aircraft Trials at Lympn

term 'light aeroplane' had to be revised and although the Cygnet had won the Air Ministry competition hands down, it was not adopted for general use so that, with the exception of a brief appearance at the Bournemouth race meeting in 1927, both Cygnets were allowed to fade into obscurity.

For 1927, the plan had been for G-EBJH to fly non-stop to Bucharest, but this Cygnet crashed on take off, killing the pilot and destroying the aircraft. G-EBMB continued flying until 1929 when it was put into storage at Brooklands until 1946, when it was refurbished and reassembled at Hawker's Langley Aerodrome. It was later transferred to their new facility at Dunsfold, where it stayed, coming out for various displays and air shows, until 1972, when it was transferred to the Royal Air Force Museum at Hendon. More recently it was transferred to The Museum's site at RAF Cosford where it can now be seen. An airworthy replica is on display at the Shuttleworth Collection, Old Warden, Bedfordshire.

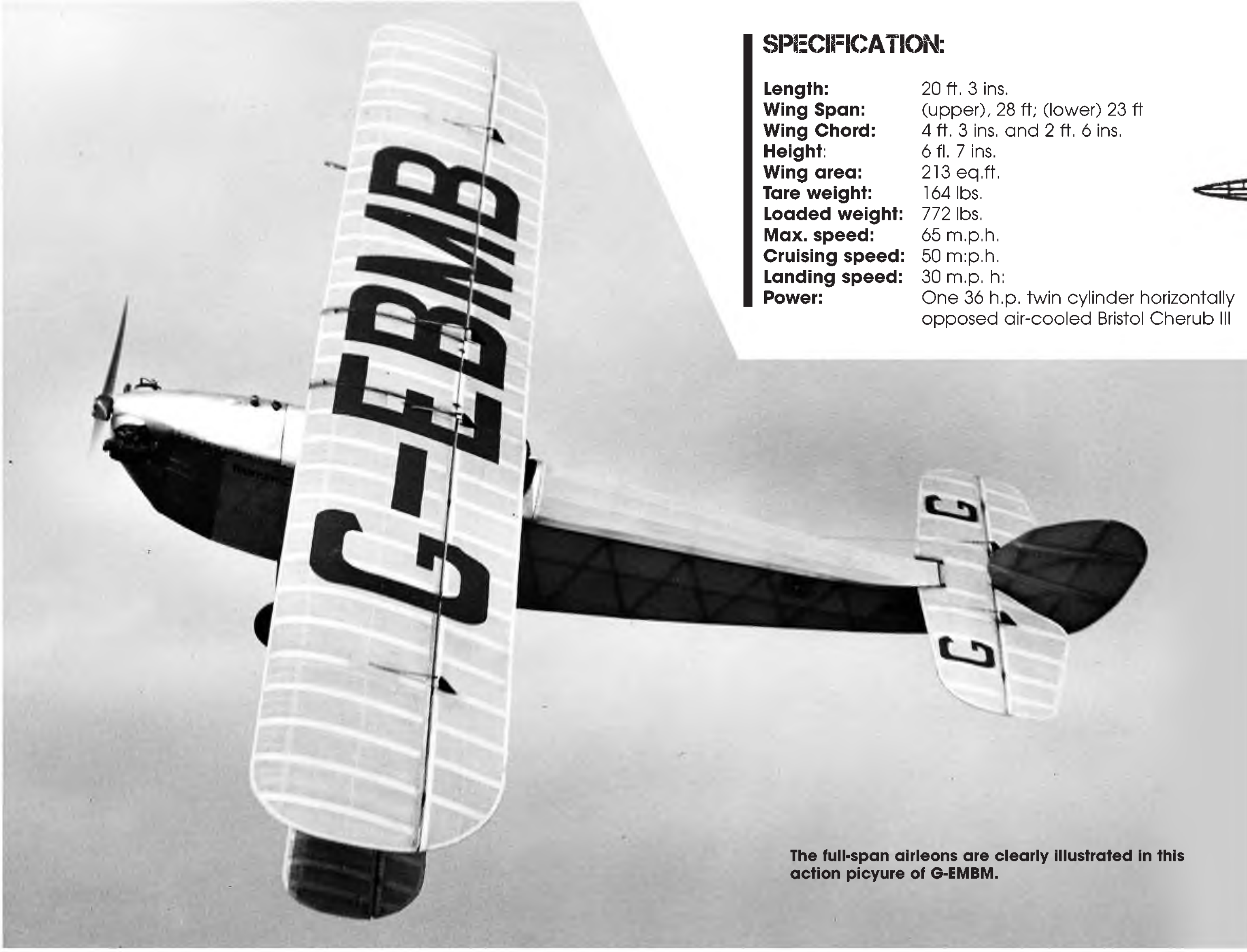
Construction

The Hawker Cygnet was one of the lightest two-seater aircraft ever to be built in this country, the tare weight being a mere 364-lbs., including engine. Great pains had been taken to pare away all surplus weight, even the longerons and crossmembers being spindled out to an 'X'-section. The


A
B
C
A
B
C
Hawker Cygnet
D
D
D-D
Scale: 1:40

SPECIFICATION:

Length:	20 ft. 3 ins.
Wing Span:	(upper), 28 ft; (lower) 23 ft
Wing Chord:	4 ft. 3 ins. and 2 ft. 6 ins.
Height:	6 fl. 7 ins.
Wing area:	213 eq.ft.
Tare weight:	164 lbs.
Loaded weight:	772 lbs.
Max. speed:	65 m.p.h.
Cruising speed:	50 m:p.h.
Landing speed:	30 m.p. h:
Power:	One 36 h.p. twin cylinder horizontally opposed air-cooled Bristol Cherub III



The full-span airleons are clearly illustrated in this action picyure of G-EMBM.

fuselage was an all-wood structure employing spruce longerons and diagonals with thin wedge-shaped stringers running down the back and sides supporting the fabric covering.

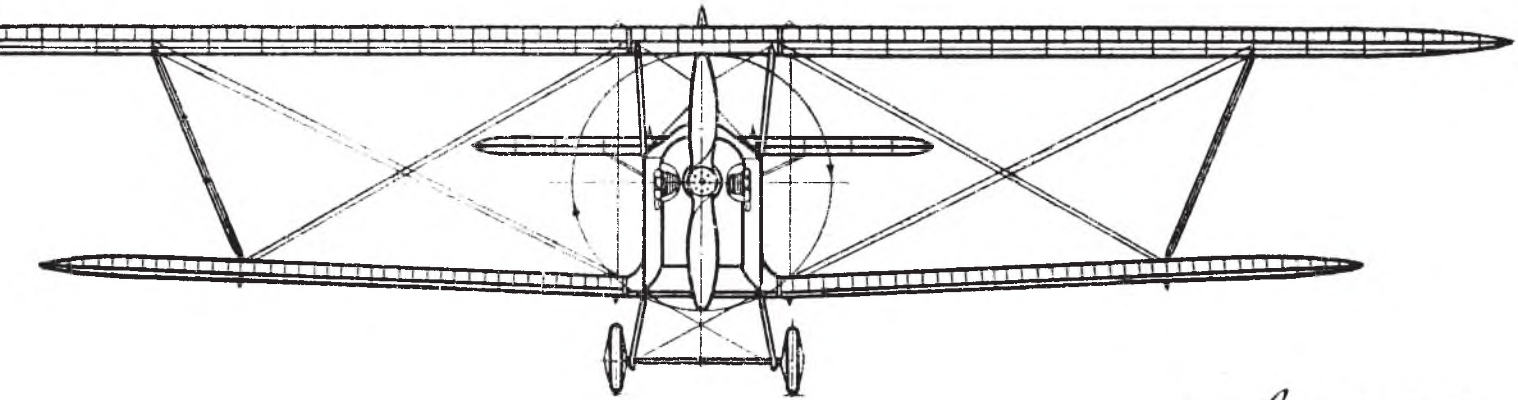
The wings were of unequal span and chord with box-type spruce and plywood spars carrying Warren type girder ribs. The ailerons, running along the whole length both upper and lower wing panels, could be pulled down in order to vary the wing camber. The vee-type undercarriage employed rubber cord shock absorbers.

Colour scheme

Both machines were originally clear doped all over with black racing numerals. Later the racing numerals were replaced by black registration letters on the upper surface of the top planes and underside of the lower ones.

Finally, both machines were painted aluminium all over with black registration letters on the wings and fuselage sides, together with the nationality symbol 'G' on both sides of the tailplane and rudder.

Attendant handlers and pilot confirm the diminutive size to the. same aircraft.



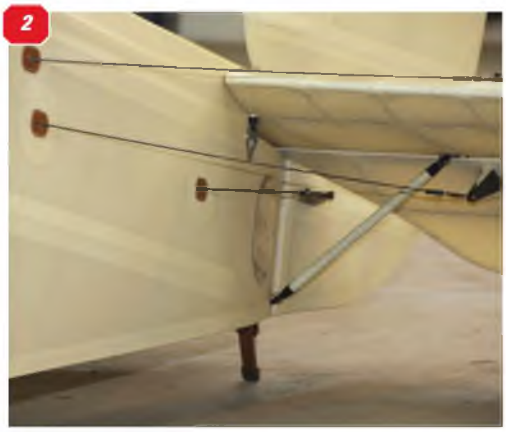
Scale: 1:40

ABOVE LEFT: Another view of the newly completed, unmarked Cygnet, devoid of engine cowl. **ABOVE RIGHT:** G-EMBM. lefts off, this time carryingcompetition No. 6.

Hawker Cygnet

CLOSE-UP SURFACE DETAIL IS WHAT MAKES A MODEL SPECIAL

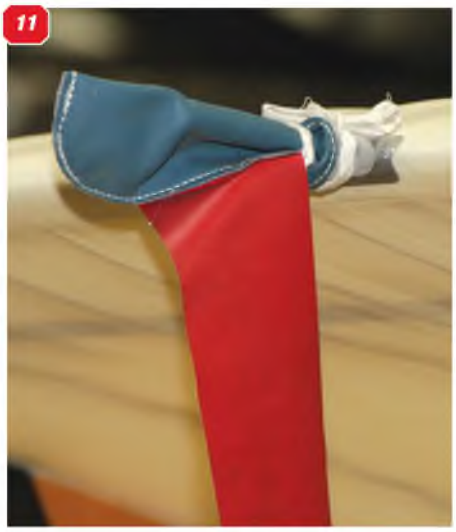
1

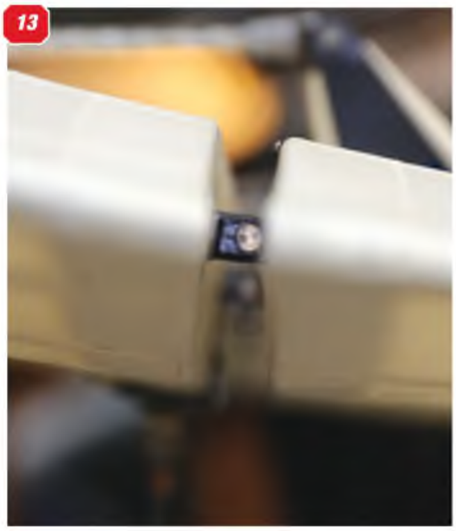

2


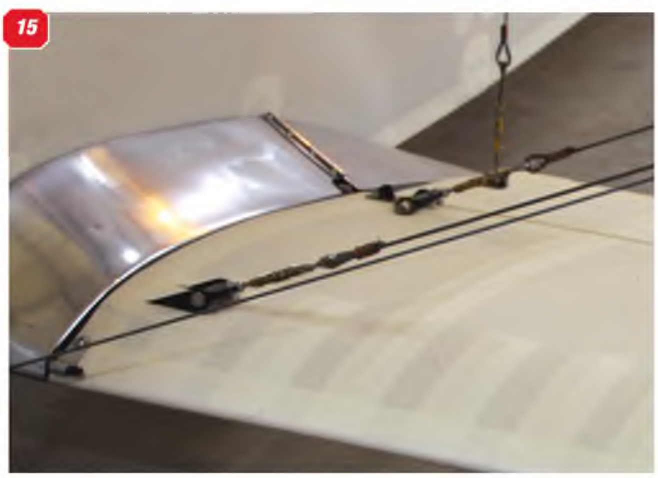
1: The complete rear fuselage, showing the elevator and rudder control cables and the control horns. Note also the circular inspection panel below the tailplane. 2: View under the tailplane, showing the tailplane bracing struts. The control cable exit guides are leather. 3: The sheet metal engine cowl, showing the JAP horizontally opposed twin cylinder engine.

3


4 & 5: The arrangement of the wing cabane struts and bracing wires. **6:** Upper anchor points for the cabane struts. **7:**Close-up of one of the struts, showing the shape of the metal reinforcement bracket. **8:** Detail of the lower anchor points for the cabane wire cross braces. **9 & 10:** Upper and lower wings both have full-span ailerons. Control links to the control horns are bungee cords. **11:** All that we could see of the pitot head on the upper right wing. **12:** The link tube from the pitot head to the airspeed indicator in the cockpit. Note the clear neoprene tube conectors that can be detached from the metal tubes when the wings are folded.





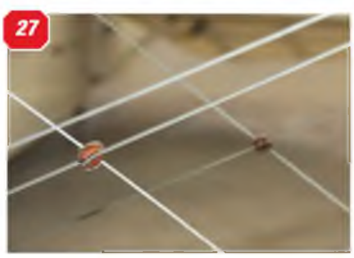


13: Close-up of the upper wing fold line, showing the removable locking pin.

14: Lower wing panel. showing the interplane lower anchor point and the full-span aileron hinge line.

15: The lower left wing at the root, showing the bracing wire anchor points and the metal fuselage-to-wing fairing. Note also the hinge-line and the rearward wing fold.

16,17 & 18: Three views of the JAP engine installed in the Shuttleworth Collection's replica aircraft at Old Warden. **19:** Cockpit detail, right fuselage side. **20:** Panel detail just forward of the cockpit, left side. **21:** Interplane strut, left side. **22:** Close-up of the upper wing interplane strut anchor point. and aileron control wire. **23 & 24:** The interplane strut lower anchor point on the lower wing. **25 & 26:** Wing centre section bracing wire. **27:** Wooden 'acorn' steadiers at the wing barcing wire crossovers.



28: Bracing wire anchor point on the upper wing lower surface.

29: Detail of the elevator control horns and control cables.

30: The wooden tailskid and tailplane underside bracing strut atachment to the fuselage at the rudder post.

31: View of the engine cowl underside.

32 & 33: Metal side panel detail at the nose section.

34: Filler cap atop the nose section, just in fron of the forward cockpit windscreen.

35: Detail of the front cockpit windscreen. Rear cockpit windscreen similar.

36: The two very snug cockpits.

37: Another view of the front cockpit.

38 & 39: The open cockpits are very much a prominent part of the 'personality' of this little biplane.

40: Mail undercarriage, showing the axle and bracing wires.

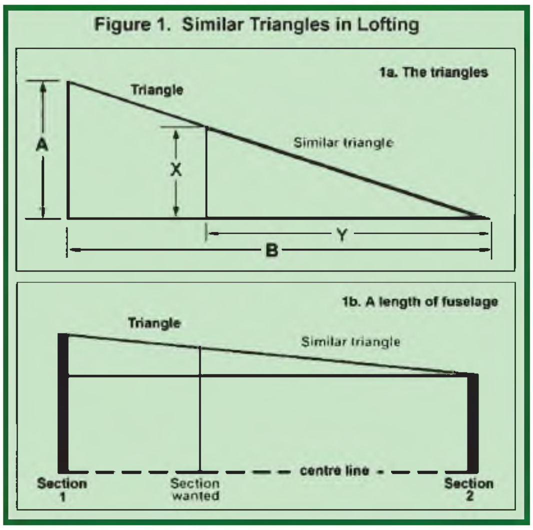
41: Wooden front and rear main undercarriage legs feature a substantial reinforcement bracket.

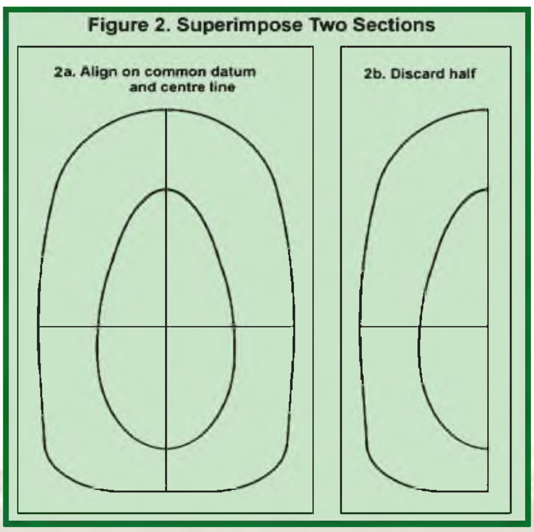
42: Detail of one of the mainwheels on the Shuttleworth Collection's replica aircraft are rather more substantial than those as on the original as illustrated in our *'Subjects for Scale'* feature in pages 44-49 of this issue.

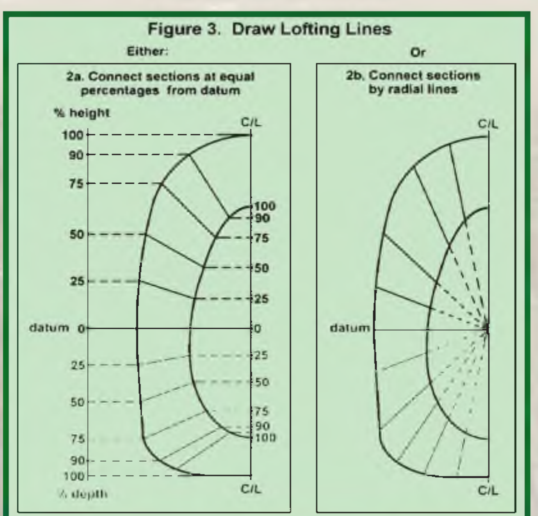
43: The main undercarriage axle and associated front and rear tie-bars seen very much WW1-era technology, but then, since the aircraft was designed only six years later in 1924.

SIMPLE FUSELAGE I

A proven method of creating accurate fuselage former shapes







It's rare that a scale three-view drawing shows all the sections needed to develop fuselage formers for a reasonably large model. That's not surprising, given the scales to which three-views are usually presented. For any reasonably sized flying scale model there is thus the need to plot the shapes of fuselage former stations that fall between those shown on the three-view from which the modeller has chosen to work.

These intermediate-station shapes can be a bit of a hassle. It's even worse when you come to put the model together and find that, like a Sumo wrestler, its skin doesn't fit. To achieve the shapes required, I use a simple process to approximate the outlines of formers that I want to put between given sections, and it works well enough for me.

There is however a limitation, in that it won't work along a length of fuselage where there is a significant discontinuity in outline, as it relies upon there being a fairly smooth transition between one given section and the next.

The method described here is most easily accomplished if you can use a scanner and a drawing or image-manipulation package or computer-aided design (CAD) software on a PC, but is quite practicable even with pencil and paper, for which an enlarging photocopier will be a great help. Whichever way you tackle it, you will probably need a pocket calculator or a brain better than mine.

The process is known as 'lofting', from the full-size practice, along similar lines (!), of drawing out shapes full-size on the floor of a 'lofting shed' in order to perform exactly the same function, but I rather think my approach is a little more suited to our kitchen-table environment. The principle on which it works is akin to that of 'similar triangles', a concept that you may remember from your school-days if you were paying attention.

For our purposes, we need consider only right-angled triangles: if such a triangle **(fig.1a)** has a vertical drawn part-way along its base to form a smaller (and similar, in that all its angles are the same as the original) triangle, the height of this smaller triangle is the same proportion of the original height as is its base to the original base (i.e. X : Y = A : B). We can employ this property to determine the difference in size of different stations along a fuselage (fig.1b). Where there are two given sections (oddly, labelled 1 and 2) and an intermediate section is wanted 33% of the distance between them, all that is needed is to draw a line between the edges of the original sections, move 33% of the way from the starting point, and drop a vertical to the centre line. Where this meets the edge line defines the size of the section at that position.

Apart from this dealing only with one line along the surface, it also assumes that there is no curvature in the surface, a situation that is relatively unusual on full-size aircraft, so it is by no means the complete answer. It does however, I hope, demonstrate the principle.

So now, to the actual practice: I'll proceed on the basis that a scanner and appropriate PC software are available, and you should be able to see from that how the manual process would go.

Start from a scale drawing to a scale as close as possible to the intended scale of the model you plan to build - it won't be THAT close by any means, but the closer you can get, the more accurate the end result is likely to be. Scan and enlarge the sections given on the drawing. If you can achieve the desired final size, it will save a little resizing work later on, but for the best accuracy they should be as large as can be managed and when you see the full process, you will be able to decide just how large that is for you.

A pair of consecutive section outlines should then be overlaid in a single image and aligned on a common horizontal datum, with both centre lines corresponding exactly **(fig. 2a)**. Only one half of each section will be needed, split vertically, so half can be deleted **(fig. 2b)**. There is a choice of two ways to proceed at this point. I mark off and connect by straight lines each section at the same percentages of its height and depth from the horizontal **(fig. 3a)**, but an alternative is to draw lines radiating from the intersection of the datum and the centre line, to connect the sections **(fig. 3b)**. Both methods seem to work well enough, although I must admit to having problems with the radial line approach when the fuselage ends in a narrow vertical shape (e.g. a fin post or knife-edge),

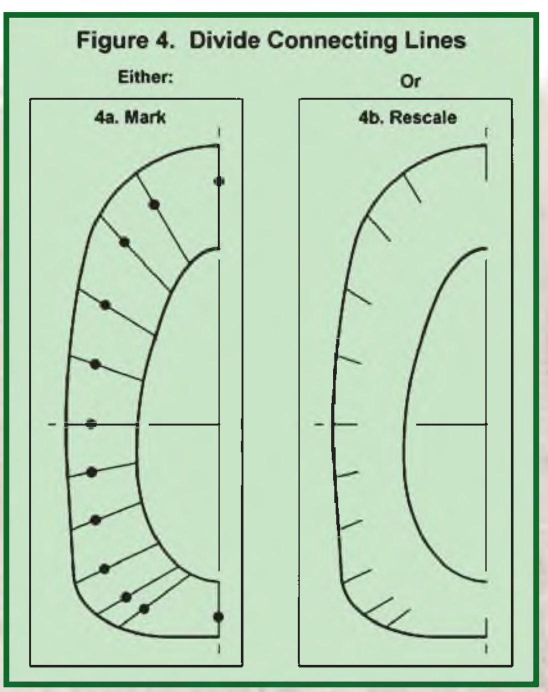
LOFTING

1 & 2: The fuselage formers of this large scale sailplane are typical of the multiple-sation frames that need to be plotted.

so I generally go for the percentage height split. However, try both if you wish and use whichever you prefer.

Each of the connecting lines is then divided off in the same proportions as the position of the required section divides the distance between the given ones **(fig. 4a)**, requiring some careful measurement and work with the calculator. This is another area where the ability to work on a PC is advantageous since, with a drawing package, line lengths can usually be measured easily and accurately in pixels; with CAD software, lengths are given to whatever accuracy you have selected. In both, there is usually an option to adjust sizes, so if a connecting line is re-scaled to the required percentage of its original length, its new end will mark the division point exactly **(fig. 4b)**. For illustration purposes, I have not drawn as many lines as I would do usually, especially round the sharper curves, or the diagrams would become too congested and unclear; as a consequence, the generated sections are less good than they should be.

The division points are now connected together to give a first approximation to the new section's shape **(fig. 5a)**. Of course, this outline, besides being just a series of straight lines, is correct only if there is no curvature on the skin between the sections used as bases. If there is (as would be usual) then the shape needs to be stretched (or shrunk, if the fuselage part is concave). The degree of stretching can be determined by taking the plan and side elevation of the fuselage, and measuring the true width of the section at the required station, together with its true height above and depth below the datum line used for the interpolation process just completed. If the interpolated shape is then stretched (very easy with most image processing software on a PC, less so if done by hand), the points will be extremely close to the true outline at that station. Stretching is in three stages; first enlarge the width by the right amount, then the part above (or below) the datum



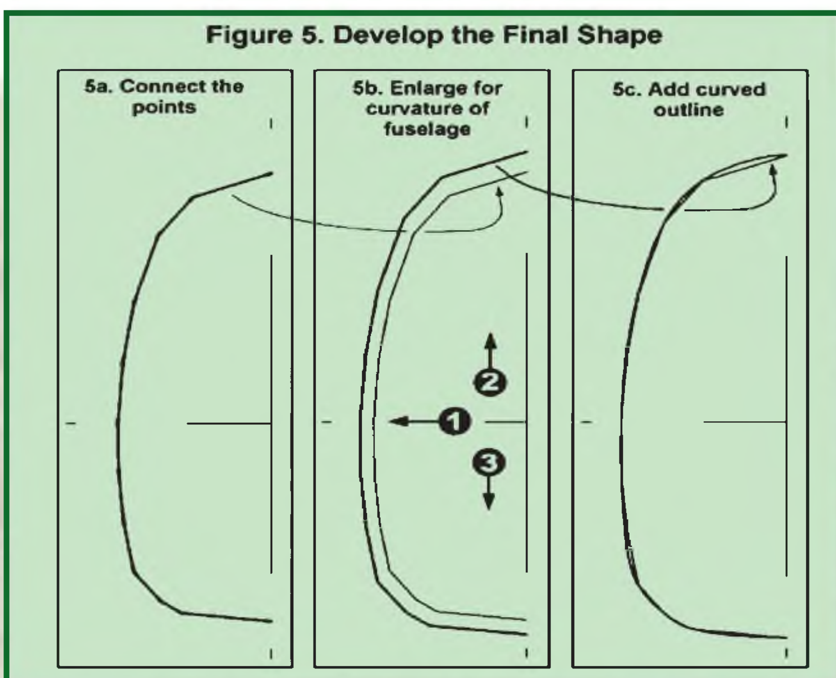


Figure 6. Superimpose Sections to Verify Consistency

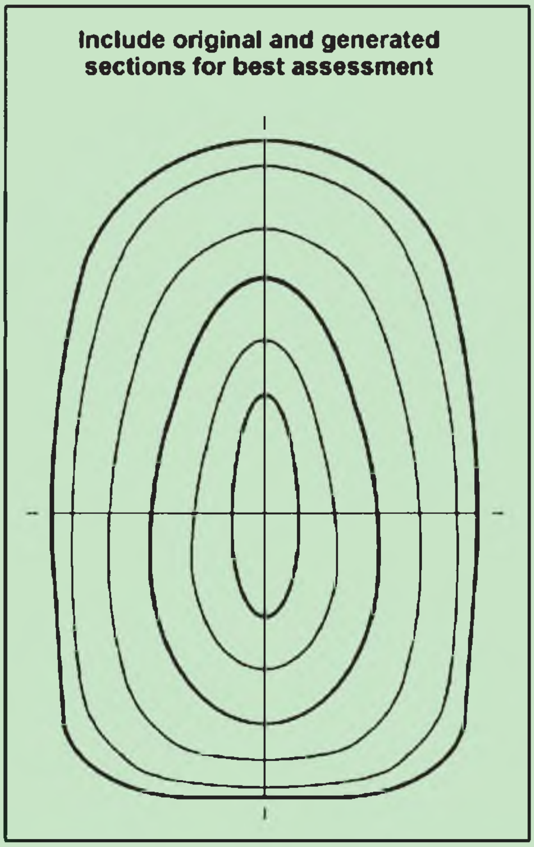
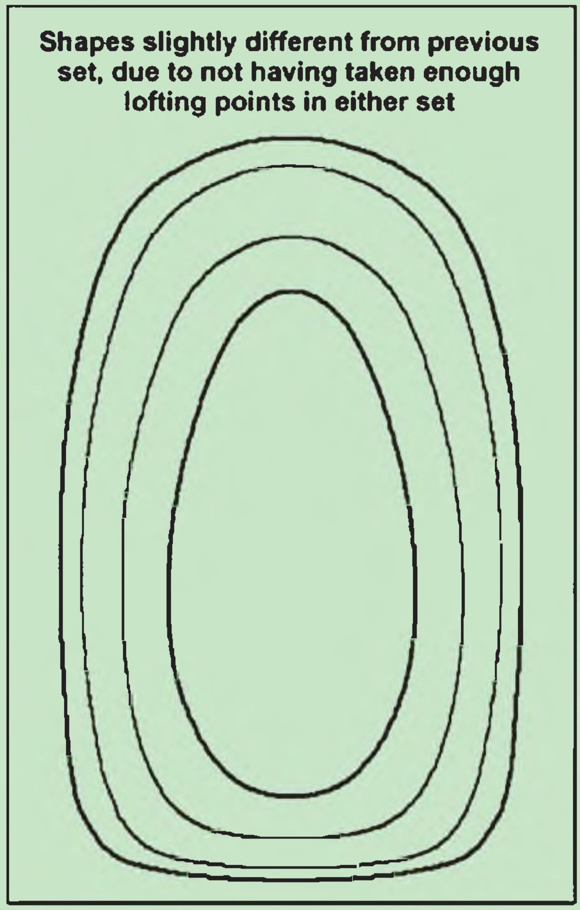


Figure 7. Sections Generated by Aerofoil Program



and finally the part below (or above) the datum. These vertical enlargements must be done independently to allow for the normal situation of different upper and lower surface curvatures, which will lead to different enlargement factors for the two parts **(fig 5b)**.

The polygonal form can then be smoothed off by joining the points with curved lines **(fig 5c)**. In some drawing packages, this is less easy than it sounds, requiring freehand line drawing, and in such cases you might consider printing the shape and using french curves to complete this task before scanning the new shape back into the PC to continue with the next stage. With CAD software, fitting curves to a series of points is generally pretty simple and accurate. What you now have is a good approximation to the external shape of the half of fuselage at the chosen station. Copying the half you have, reversing it, and joining the halves together produces the full section, now guaranteed to be laterally symmetrical.

I hope you will agree that it is a simple process; remember, the title of this article does not say "quick", just "simple", and some time is required to complete the repetitive tasks entailed, but really there isn't anything difficult about it. If there were, I would be looking for an easier way myself; life is difficult enough without making hobbies hard work. Having said that, in developing the sections for illustrating this article, each has taken only ten or fifteen minutes to split the connecting lines, join the dots, stretch, and add curves, including transferring between a drawing package and a CAD program to draw the curves, and then copying back to include in the pictures.

As a final check, when I have developed all the sections I want - and there may be more than one between any pair of given sections - I overlay them in a single image and give them an eyeball check for sensibility **(fig. 6)**. If there are many, the overlaid image can be difficult to interpret, so I look at them in smaller groups. A good approach is to treat all the sections from the largest to the tail as one group, from the largest to the nose as another, with possibly a third composed of the largest and one or two either side. Sometimes an odd little deviation can be picked out and remedied; these, where I have found them, have mostly turned out to be my own fault, from pressing the wrong buttons on the calculator or mis-reading a measurement. As we are all fallible, I think it a wise check to make before going on with the rest of the work needed to turn these external shapes into proper templates for formers. Other points arise from study of photographs, which any designer will do as a matter of course. Sometimes it is possible to pick out subtle changes of shape from shadows and reflections on the surface of the fuselage, and sometimes from the flow of panel lines. With care, these can be incorporated at this stage, and re-verified for sensibility. The most difficult and error-prone situation is when sections are not available for the thickest and deepest parts of the fuselage, and getting these wrong can be noticeable in front or rear views. If this is the case, rather more care must be taken to verify the outline - which might be the combined part-edges of more than one section - from these aspects.

There are some important points to note. The common horizontal datum for a pair of sections must be chosen carefully; it is not necessarily the same as the full fuselage datum in the three-view or the finished plan, although it is useful to mark and retain this position on all section drawings to facilitate later alignment. The datum for our purposes should be placed inside both sections, or some interpretation difficulties may arise from crossed lines, and I find it easiest to align the sections so that the datum is about half-way up each, and as near as possible to the widest dimension. Obviously, when these positions do not coincide, a little compromise is needed. Points selected for linking must always include the highest and lowest points, preferably the widest points on each section (not necessarily linked) and points on the datum; where edge curvature is high, or where there is a concave section in an otherwise convex shape, it is wise to space them a little more closely. Although it is my usual practice to maintain the same set of heights and depths along the whole fuselage, barring any extras on difficult parts as just noted, it's not absolutely essential, so long as a common set is used on each pair of sections.

On an aircraft with a genuinely slab-sided fuselage, there is no need to loft the points along the flat sides, other than at their extreme top and bottom edges; interpolated shapes are needed only for any non-flat top and bottom skins, and on some aircraft it is best to treat the fuselage as a number of separate components. Consider the highly up-swept rear fuselage of a Lockheeed C-130 Hercules; if the datum drawn comes outside the fuselage and continues beneath its bottom line, interpolation of points on sections in that region is, aptly in this case, a pain in the rear.

Wing sections too...

And now I must mention an alternative which produces good results if you have the software available to do it, namely an aerofoil drawing program which includes the facilities to thicken sections and to generate transitional rib shapes (i.e. across the span of a wing which has different aerofoils at root and tip). To avoid confusion, I will now use the term "section" to mean a fuselage section, and "aerofoil" to mean a wing section.

Think of a section as a very fat, symmetrical aerofoil placed vertically on its leading edge. The positions of its "upper" and "lower" surfaces (sides) can be expressed in terms of percentage of its "chord"" (height), and thus a file of coordinates can be created and presented to the aerofoil program as representing an aerofoil. Producing these coordinates requires measurement of the given sections, so scaling them to give it heights in multiples of 100 units makes life easier, because measurements of the edges from the centre are then readily expressed as percentages of the centre line length, this being typically the form in which aerofoil coordinates are recorded.

Being symmetrical, it is only necessary to measure one edge, then reproduce its dimensions as negative values to represent the other. Still simpler, treat half a section as a flat-bottomed aerofoil, then you need only generate a properly curved outline for one half, before adding curves and joining the halves as before. Submit the two given sections to the aerofoil package as root and tip aerofoils, specify their chords (heights), choose an arbitrary value for the span (again, multiples of 100 units helps) and request an intermediate aerofoil at the appropriate percentage of span. Indeed, if there are several to be produced, it may be possible to do all at the same time. Out pops your intermediate section(s) **(fig. 7)**, still needing to be stretched to take fuselage curvature into account, but with some added advantages.

Firstly, if later in your design process you decide that you really didn't want your new section at 33% of the distance between those given, but at 42%, all that's needed is to re-run the aerofoil program requesting an intermediate aerofoil at the new span position, and discarding the old one. Secondly, if you keep the generated coordinates as another aerofoil, when you know the degree of stretch required, the stretched outline can be produced by regenerating an output with a suitably amended thickness-chord ratio on a chord equal to the required height. Thirdly, if you measure enough points on your sections to get a result with more, but shorter, straight lines around it, it will be even closer to the true outline of the fuselage and then by specifying a skin thickness, the outline of the former can be produced at the same time, with top and bottom sheeting defined by specifying suitable values for leading and trailing edge thickness. With the right aerofoil program, output can be to a file readable by most CAD packages and some drawing software, so an intermediate print and rescan may not be needed before continuing.

Nothing is perfect, of course, and aerofoil generation does not work for slab-sided fuselages where the vertical dimensions of curved tops and bottoms change at a rate different from that of the slab side; aerofoil enlargement is applied equally across the chord. For the same reason, it will not produce differential stretching either side of the thickest point, so there may be minor differences in sections above and below your chosen common datum from those generated by hand. It may not be possible also to retain "real" datum references, which would have to be reapplied by hand afterwards.

One final point in favour of developing sections on a computer, by whatever means, is that if a model to a different scale is required later, all the sections and formers are available to be re-scaled to suit without having to go through the whole process again. Don't forget, though, that if you re-scale a former, the skin thickness and longeron sections may finish up at odd sizes; re-scaling should be done on the external shape and then the skin thickness taken off and longeron notches redrawn to arrive at the new outline of the former.

The results of these techniques may not be perfect, but I have found them generally to be close enough to be acceptable, producing indistinguishable or very trivial variations in plan and side elevation. In any case, you might ask yourself the question "If there are no drawings of the sections at the stations I have used, how can anyone say they are wrong?".

Footnote: Examples of drawing and image-manipulation packages are Draw Plus, Paint Shop Pro, Photoshop and Visio. Examples of CAD packages are AutoCAD and TurboCAD. This is not a complete list. Some are available on different computers and operating systems. Due recognition is hereby given to registered trade marks and names, etc. ■

3: The final skinning of the fuselage will be the final proof that the plotting of the formers was accurate.

On Silent Wings by Chris Williams

SCALE SOARING

At the beginning of the year a Terra-Firma-Convergence phenomena happened to the second version of my Scheibe-Loravia Topaze design. For no discernable reason she enthusiastically embraced the soggy hillside whilst in a low level turn, thus exposing the innards of the fuselage to public view. Back on the bench it became obvious that there was a design flaw that presented itself in such situations, which, although perfectly adequate for normal operations, when larger than normal flight or landing forces were encountered, led to an unnecessary amount of deconstruction.

Faced with a repair or a new fuselage, I decided on the latter and at the same time decided to incorporate a modification to improve the strength of the wing/fuselage interface.

I had some previous experience to go on: at the beginning of 2013 my then new 1:3.5 scale Rhonadler suffered the same symptoms, only more so, and the solution then, as now, was to retro-design a new fuselage former sited under the wing joiner box, the two to be locked together via an aluminium bracket. The next thing to ponder was whether or not a former could be retro-fitted to an existing fuselage, this with my 1/3rd scale version in mind. As it turned out, a full former was too difficult, but a part-former was entirely feasible, albeit with a few hours of intense fiddling about. What with one thing and another, I have had more than a passing acquaintance with the Topaze design, this being the fourth fuselage, if you include the 1/3rd scale version.

Eventually, the new version (with the old wings & tailplane) was duly completed and the maiden flight successfully undertaken. For anyone contemplating, or having already built one of these sailplanes, I have put up a thread on the SSUK website under *Topaze Updates*. There you can see the modification process and download the necessary drawings... scalesoaring.co.uk

BEAM ME DOWN, SCOTTY...

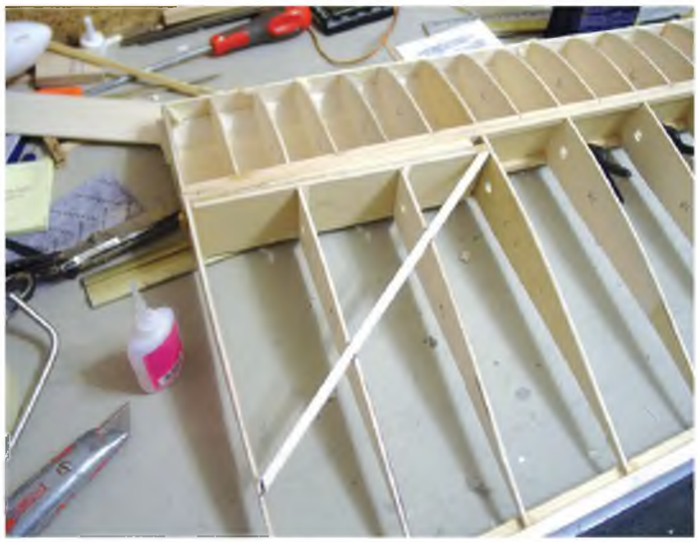
Having now been retired for over a year it has become painfully obvious that my building rate has gone viral. (2013 saw five maiden flights!). This has quickly led to my transmitter memory running out of space, and I was faced with the choice of getting another

The Topaze in action at White Sheet (Barry Cole pic).

Author displays the latest version of his 1:3.5 scale Scheibe-Loravia Topaze.

An automatic retract not so useful on the slope when you want a cleaned-up low pass.

Cutting the slots for the 6mm sq sub-spar is a simple job.



The 'I' beam arrangement on the K.11 wing.

identical Tx, or something else.

That was when *FrSky's Taranis* came to my attention. Two things I noticed straight away: the price of this gear is almost at the Pound Shop level, and also there seems to be nothing that this kit cannot do. With fingers crossed, I put myself on the waiting list and then...well, waited.

You can pay nearly three hundred pounds for a good Variomter of the traditional type. The FRSky Varios come in at £12 for the standard version and £22 for the high precision unit. Add this to the telemetry that you get from the eight channel receivers and you will have the following:

1: Altitude via voice through the Tx (There is an earphone socket on the tranny)
2: Vario via the usual up and down tones
3: On-board battery status via display on the Tx, with a voice alert at a preset level
4: RSSI range strength figures on the transmitter display, with a voice warning if the connection becomes weak.

Last year I lost my Spatz 1 when the receiver went to failsafe. A telemetry receiver might have saved the model by giving a range warning, but on that particular gear all the warnings are via a variety of beeps, so whether or not the warning would have registered is open to question. (Also, the receiver is four times as expensive, and with one less channel)

When range testing the Taranis, it is comforting indeed to hear a 'range critical' warning as you reach the limit.

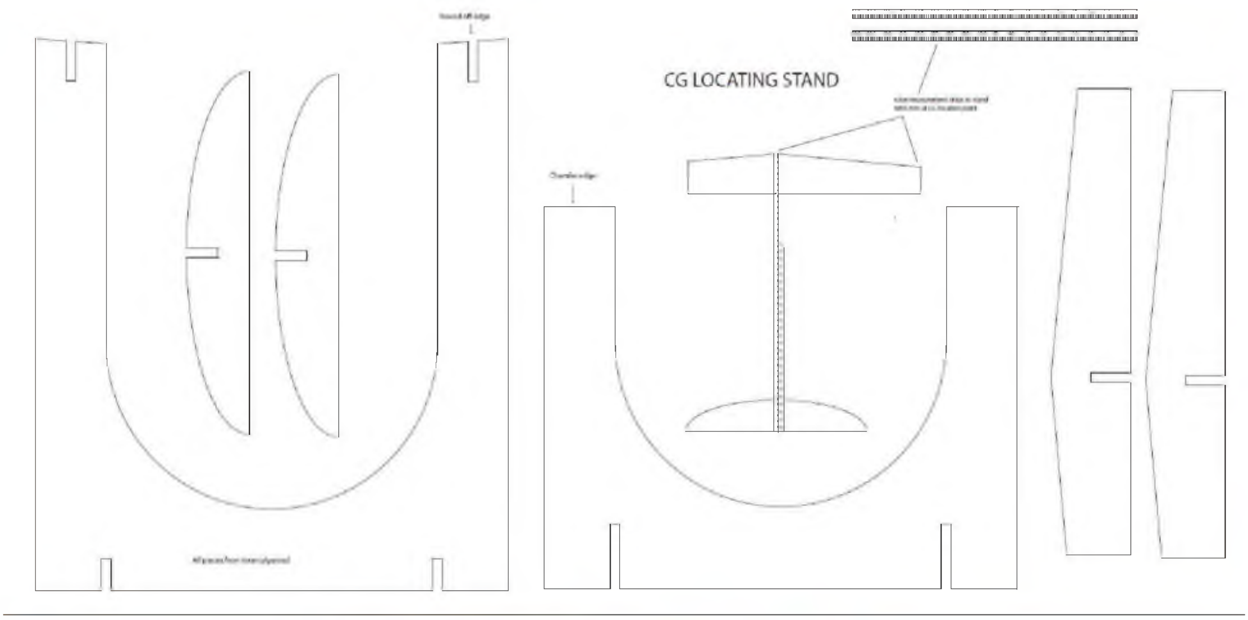
On the back of the Taranis is a sprung-loaded switch that is perfect for the tow release. You can also slave it to the variometer so that you get a spoken altitude reading at the release point. My pal Smallpiece, AKA Barry Cole, has taken the programming of the *Taranis* to a whole new level. Some years ago I was performing a fast, low pass with my Slingsby Dart preparatory to landing, and when I went to activate the retract switch with my gloved hand, inadvertently nudged the elevator stick downwards, with distinctly insalubrious results. To avoid such a situation, he has set up his tranny so that as his model passes a pre-set altitude the retract, slaved to the vario, tucks itself away, and when descending does the same thing in the opposite direction. (For slope work it can be turned off via one of the many switches). It is often said that there are two sorts of pilots: those that have forgotten to lower the undercarriage when landing...and those who are going to: well maybe that's not necessarily true any more. It's too early in the year to have had much thumb-time with the FrSky stuff yet, but it's an exploration to which I'm greatly looking forward ...

BIG BROTHER

Around this time last year I was exploring the delights of the then new 1/4 scale Schleicher K11 electric motorglider. It turned out to be a delightful machine, pretty, with no vices and a practical flat or slope flyer into the bargain. It was inevitable, given the ease of scaling things up in CAD, that my thoughts should eventually turn to building a bigger version. At the time of writing, the airframe is complete and the covering and painting process about to begin.

The full size is only around thirteen meters in span, so at 1/3rd scale, the new version is still under five meters. This is still the largest wing that I've built using my new, modified method of spar construction. Up until recently, the spars in my wings have been tapered, usually from 12mm at the root, to 6mm at the tip. This follows stan-

CG stand drawing.



The stick-on paper ruler simplifies the reading off of the CG.

dard engineering practice, and tapers the strength along the wing in bending mode with no concentrated stress points anywhere. The problem with this approach is that it's devilishly hard to accurately taper a spar over a length of seven or eight feet, and many is the heartfelt curse I've uttered during the process. The whole design process owes nothing to mathematics and everything to everyday experimentation, and it's my suspicion that the wings of all my model deigns are somewhat over-engineered for the stresses they are likely to encounter.

So, a while back, whilst building the latest example of my 1/4 scale Bergfalke design, I came up with the following idea. Make the main top and bottom spars from 6mm sq. spruce. Add ply webbing plates to the front of the spar to tie them together, and then drop in for about a third of the wing length another 6mm sq. spar in front of the webbing plates. (This involves cutting out the 6mm sq. slots post-construction, but it's no biggie).

What you have now is a traditional 'I' beam for the first 1/3rd of the span, tapering over the space of two ribs to a normal spar/web plate arrangement. Now the stress distribution is not so perfect, but it really doesn't matter a darn, because the wing is well over-specified anyway. This has proven to make the wing construction markedly simpler, and I'm confident that it will work just as well in the bigger K.11.

THUMB SAVER

When it comes to determining the position of the CG on a new model, my method hadn't changed from when I was a mere lad, knee high to Spitfire's tailwheel, to nearly the present day. It goes like this:

Little & Large: the 1/4 and 1/3rd scale versions of the Schleicher K.11.

Author's 1/4 scale RF-5b on the CG frame, ready to measure the decalage.

Author's 1:3.5 scale Spalinger S25a at White Sheet (Barry Cole pic).

balance the model under the wing on your thumbs until it hangs slightly nose-down, and that is the balance point. As my models have grown in size, my thumbs seem to have grown in weakness, so it became self-evident that a new solution had to be sought.

The Williams Acme Thumb-saver is what I came up with. This is a CG measuring device that contains no moving parts and can be put together from a single sheet of 12" x 48" x 1/4" plywood. Measuring strips are glued to the top of the frame, with zero starting at the pointy bit. The process couldn't be simpler. You carefully place the model on top of the frame and jiggle it about until it balances on said pointy bits. Eyeing up the leading edges of the wings against the measuring strips (rulers), you ascertain that both sides measure the same, thus ensuring that the model is at right angles to the CG frame. Now, you can read off the distance of the wing leading edge from the balance point to gain instant knowledge of where the CG is positioned.

Further to this, another bright idea occurred...(Two in the space of one year? That's a personal best). What if, once the CG had been found, you then set about measuring the decalage? To do this, the model is moved backwards so that it becomes tail-heavy, and another, adjustable stand placed under the rear of the fuselage and set so that the tailplane reads zero on the incidence gauge, thus allowing the decalage to read off the wings. All this, and you can still make it from one sheet of ply. Should anyone fancy making the Acme Thumb Saver for themselves, I'm quite happy to e-mail the drawings in PDF format.

EVERY CLOUD...

Although the weather at the beginning of 2014 could not be described as clement, there were a few gaps in the monsoon that allowed for the photographing of large sailplanes in their natural element on the hill. The fact that said sailplanes were all mine just goes to show that fortune favours the bold... ■

Choice of two! Author's 1:3.25 MG19a Steinadler at White Sheet (Barry Cole pics).

THE QUIET ZONE

R/C SCALE ELECTRICS WITH PETER RAKE

Okay then, here we go with more electric powered scale model doings. However, even if electric flight isn't what floats your particular boat, this time around the information may still be of interest. Yes, I've finally gotten around to completing Jonathan Rider's series of articles about detailing scale models. This time it concentrates on painting and finishing your miniature masterpiece. So Jon, any time you feel like writing some more...

Anyway, without further delay I'll hand you straight over to Jon, thereby saving you having to put up with my inane waffle.

It was the best of times, it was the worst of times...

IIn the Autumn of 1917, Naval squadron 10 was withdrawn from an active part on the front lines back to IV brigade near the coast due to low morale, bad leadership and numerous other 'Issues' with the squadron. There they sat, December 1917, flying boring and unproductive patrols along the coast. Repetitive and laborious, the moral of the squadron became even lower still.

An idea emerged to paint the aircraft with special designs to 'lift' the spirits of the crews. According to a few of the squadron's Canadian pilots, the idea was to give each Flight their own identity and colour scheme to 'improve moral' and to liven up the squadron. The pilots enlisted a few of the ground crew, and FSL Hall and FSL Nelson received permission from a now uninterested squadron commander to go ahead and paint the aircraft.

The weather during Christmas, 1917 was wild, nasty and downright bad for flying, so under the cover of the hangars, using lamp lights and litres of paint, through Christmas eve and Christmas day 1917, they got to painting - on December 26th, 1917, the new aircraft emerged from the hangars, Black for 'A' flight, Red for 'B' and blue for 'C' flight. The pilots could decorate their wheels as they saw fit, so each had its own custom design. Now the RNAS had their own Flying Circus! I painted my Sopwith Camel after one of them, N6299 a Clerget Camel from 'B' flight, as it sat on the field, on February 1st, 1918 at Teteghem Field, flown by Flight Commander FCdr. N.M. Macgregor.

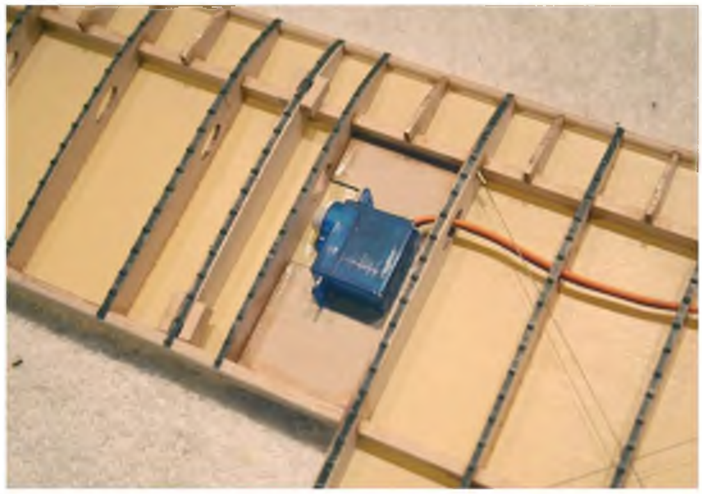
Okay, so why all the pomp and circumstance over the Camel's paint job?

JUST BECAUSE A MODEL IS AN ARTF DOESN'T MEAN IT HAS TO LOOK LIKE ALL THE OTHERS. JON RE-COVERED HIS DR1 TO REPRESENT ONE FROM A FILM.

With the woodwork primed, the Camel nose receives some detailing prior to painting.

Just visible is where the subtle weathering has been washed off to simulate fuel spills.

The board Jon mentioned for making rib tapes. Covering in place, thread wound and glued to covering.



After cutting into strips the tapes are applied to the ribs.

This is the coolest part of building your model. Making it completely custom, making it look like a plane you like, you once flew or you saw in a film or on T.V. or even an exact replica of a particular airplane in a snapshot in time. What you are doing is making your model unique. You are making it your own.

I do have some ARF airplanes (please don't tell anyone) and what I do is either re-cover them, add additional details or customize the plane so it does not look like anyone else's aircraft. I did just that to a Great Planes Electrifly Fokker Dr.1, stripping off the all red covering and finishing it in the Great Waldo Pepper, Ernst Kessler theme. Real aeroplanes are not all red...

Even if you just add a pilot, paint some markings, or add some special design, it turns it from run-of-the-mill to something unique to you. That's what they did in the field from WW1 to now. Remember, every 'real' military aircraft started as an ARF when it arrived at the unit. What they add to it, what they paint on it, or how they design it is up to each unit, pilot or crew chief.

Now is the time to do your homework, and find the aircraft you want to copy or replicate. There are thousands of examples, or even make up your own, no one said your airplane HAS to be a copy of another. (It does help, if it's to be a scale model though. PR - who'd never do such a thing)

Cover Up

The Camel is covered with heat-shrinkable CoverLite in dark green on the top, and tan 'linen' colour on the bottom. (Coverlite is the same thing as Litespan and is, I believe, made by the same people. PR) The dark green matched the original colour very closely, and it's easy to work with, light, and when done right, is wrinkle free. I normally start with the tail surfaces, take my time and make sure your work is pulled tight, and when heating the covering, do not warp the pieces. Excessive heat on one side of the tail feathers will produce a nice little warp in the surface. There are many ways to cover your aircraft, from tissue, Silk and cloth, to iron on plastics. No matter what you choose, keep it LIGHT.

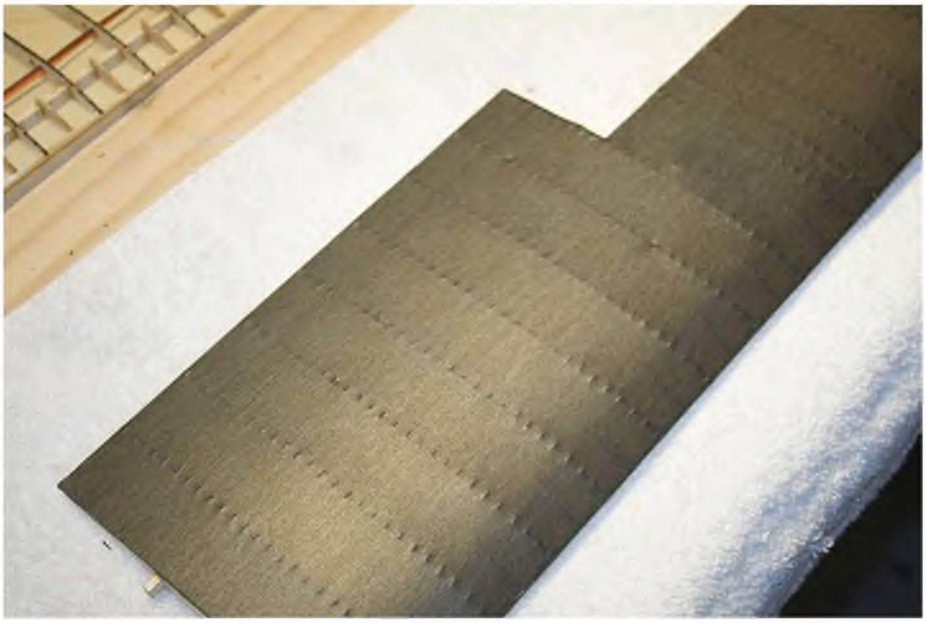
The fuselage was next, with the sides first, then the top. (Personally, I prefer to cover the top first because that can be trimmed and then the straight edge of the side panel aligned with the longeron. PR). I leave the bottom open until the aircraft is basically finished so I can ensure all of the control surfaces, servos, pull-pull lines and structure is perfect, and then I carefully cover the underside. The fuselage front is primed with white paint, and covered with plastic, metal and wood details, and as you will see shortly, it will be painted like a Candy Cane.

Before I covered the wings, I made some false rib stitching, and it showed through the iron-on covering magnificently. These fabric covered aircraft had the covering 'stitched' to each wing rib, so when the air would flow over the wing, the covering would not balloon up and change the aerodynamic shape of the wing. Remember your aerodynamics 101 class? The top of the wing, during flight, creates a low-pressure area, and it tugs at the fabric, actually pulling it up into the slipstream! So it had to be attached to the ribs every few inches. There are actually very strict standards on rib stitching, and we will not dive into that now, but what we want is to show the essence of stitching as that is all we are looking for here.

To make your false rib stitching, take a scrap piece of wood from the shop, say 10" wide by 15" long. Make marks on opposite sides of the long side of the wood every 1/8 of an inch. (For larger aircraft, you can go to 1/4 of an inch). Then cut a notch everywhere there is a mark on the two sides of the board so it has a slit in the wood every 1/8 inch. Cover the top face of the board with light covering (white or linen) and tape securely, leave a little room on each side so you can still see your 1/8 inch slots.

What you have now is a board, covered with light colour covering, with jagged sides. Wrap medium thread from one side to another on top of the covering, going into the slit, under the small tab and up through the next slit, across the top of the board, and repeat all the way up the board. What it looks like now would be a Harp, Piano or Guitar neck, with all the threads in 1/8 in parallel lines, laying over your covering.

Paint on white glue with a sponge brush, coating every thread and making sure it



Once the covering is shrunk you get an effective impression of rib stitching that can be further highlighted during weathering.

The Gee Bee marking that Jon cut using a vinyl cutter. Could be done by hand too, of course.

Even small models benefit from careful finishing. This 18" span SE5A uses printed tissue as its' covering.

sticks to the covering. You can also use clear dope, or clear Poly, your call, but make sure the threads are glued tight to the covering on the board. When completely dry, slice the covering vertically with the width you need for your airplane, if the ribs are 1/8 balsa, cut the strips slightly larger than 1/8, if smaller, use your judgement. When you are done, you should have a strip of covering with a little section of thread every 1/8 of an inch.

Once your wings are built, sanded and ready for covering, the very last step before covering is glue your length of stitching tape to the top and bottom of each rib. Now you can cover the wings, bottom first, then top so the seam is clean, straight and accurate. When you shrink the covering with your heat gun, you will see all the rib stitching showing through! Subtle, but very effective.

With everything covered, and the balsa and detail pieces primer white, it's time to mask your aircraft for painting. You can use an airbrush, "rattle cans" or brush the colour on. In WW1 they did have early spray equipment, so some aircraft were sprayed a colour, some were finished with a brushed basecoat with factory applied camouflage. Don't get too hung up on expensive airbrushes and equipment, you can create a fantastic and scale finish with your model paints, a brush and the right prep work. Now I said the key word here, painting is all in the prep!!! You can make the best and most scale aircraft ever, and if you do not prep it correctly for painting, you will see runs, spots, "bleed through' under the tape and have a real mess on your hands. Take your time prepping your project. On the Camel, the fuselage alone took me three days just to prep it and paint it.

(As an example of what Jon means by preparation is demonstrated in how I finish my own models. On any areas that would be metal on the original I build up multiple coats of automotive filler primer until any grain or covering seams are barely visible. Having allowed ample drying time, the primer is then attacked with fine wet or dry abrasive, used wet. The idea is actually to remove most of the primer you spent time applying, until you have a perfectly smooth and blemish free surface upon which to apply details or paint. Since this is usually at the very front of the model the additional weight isn't an issue - it saves adding weight in order to balance the model. PR)

One nice thing to have is a 12" roll of masking paper, bought at the hardware store, and have it under the front of my workbench on a paper towel dispenser bracket, so when I mask anything, I can just pull off a sheet of paper and it makes it real easy to ensure areas that I do not want paint on, will not see paint. Let me tell you from a few years of painting experience, if you are spraying your colour, it WILL get on any area that is not masked off or covered. I promise you, it will get into areas that you do not want the paint to go. There are magical paint Gremlins or something from beyond that ensures you will have overspray somewhere on your model where you don't want it. So when in doubt, cover it, seal it, tape it and make sure you won't get paint on it.

The Camel nose was masked and painted a basecoat of white. I use water based paints, mostly for ease of cleaning, ease of thinning and I like the way it sprays on. After the white dried overnight, I used red electrical tape to mask off the red stripes. Measure, fit the tape, measure again, re-fit the tape, and did I say make sure you measure? Take your time and make sure where you mask is where you want the colour to go. If you don't like it, remove the tape and do it again. It took me a full afternoon just to mask the nose of the Camel. Push the tape into the gaps, angles and panel lines the best you can.

To save money, I buy inexpensive electrical tape in batches of 6 rolls, and just cut strips of the tape to use as masking. If you cut thinner strips, it easily goes around corners, over details and does not pull up the paint below it. I then go over the masked area with painters light tack masking tape to cover the areas I want to keep white. When everything is masked, I spray a light mist of clear acrylic paint thinned 50% and let dry for a few hours. Spraying a clear coat first seals the area between the tape and the fuselage, so this very stark colour contrast of red over white has no chance of bleeding under the tape as the clear acrylic seals the tape down. I then spray the colour in light mist coats, one coat every 5 minutes or so until fully covered, then I remove the masking while the last coat is still wet. This will allow the paint to settle down at the edges, and it softens the clear coat underneath so the edges are sharp and crisp. Take your time removing the masks, pull at a 90 deg angle and take off the mask the opposite way you applied them, don't rip it off in one big chunk as if you're a child opening your holiday present, take it slow, and start with all the large paper first, then the covering masking tape, then the electrical tape, be careful not to touch the non-painted area with the wet tape. What you have now is a clean crisp paint finish.

For the lettering and other smaller details, you can use Frisket paper mask, or use decals and you can also get vinyl letters and decals commercially. I used them on my Gee Bee and they came out stellar! On the Camel, I used a Frisket mask that I cut out using a craft scrap book vinyl cutter called a Cricut. I use a graphic program on the computer and then cut out my shapes on the Frisket masking paper. Take your time here, and don't worry about brush marks, odd shaped lettering or a graphic that does not look perfect, as you remember, these were painted in the field by crew members, and a lot of the painting was pretty sloppy.

When you do the roundels on the wing, use a compass cutter to cut circle masks onto Frisket paper, place into position and make sure it's pressed down on the covering to remove any gaps. Remember, take your time painting, light colours first, then darker colours. I like to paint the entire circle in white first, then I know the blue and red (in the case of the Camel) will come out true. If I painted it over the dark green, the colours would be much darker and look faded and almost too dark to look scale. You can always make them look dark and dirty later, but it's almost impossible to make colours lighter.

Let's Get Dirty

So you now have a fantastic new looking aircraft, fresh paint, new car smell and not one chip, ding or blemish. If you are making an exact replica of a museum piece, or the second it rolled off the assembly line, then you are done! If you are making an aircraft that has some flight hours, maybe a tour or two in country, then it's time to put some wear and tear on it.

Weathering an aircraft can be fun, and make the aircraft stand out, but I can only really part with of one word of caution. Small amounts go a long way. I once saw a beautiful 1/4 scale "Mr. Mulligan" high wing, all white, racing plane, and the builder put pitch black exhaust streaks on the side of the fuselage, and in my opinion, took away from any other details of the aircraft. For all I know it was perfectly scale, and the real one spattered out thick black soot, but I didn't appreciate the contrast.

Start small, one way is to use a dry brush technique, where you use a wide horse hair soft bristle brush, load it with a little dark coloured paint (not black but gull grey, brown or even white), wipe the brush on a paper towel back and forth until there is only a trace of paint left, then carefully dust the model so the paint only picks up the high areas and the gaps and crevices. Dry brush means just that, the brush is almost perfectly dry, and will only deposit very little paint. You can always go over areas again, like the cowl, landing gear and other dirt-exposed areas.

Another great way to detail is to dry brush with acrylic paint, then spray water right on to the aircraft, and the water will flow the thin layer of paint into crevices, holes and junction points. This is how I did the weathering around the fuel filler caps. On a white surface, I brushed some darker paint, then dripped water like it was spilled fuel, it flowed down the fuselage side, and looks like the fuel "washed" the dirt away.

Get creative; you can use artist's pastels, crayons, paint, and for the experts, wood stain and coloured gel. Why for the experts? If you add too much and it dries too soon, you have just ruined you covering, and you will have to start again. Trust me, I've been there. Just remember, you can add weathering, but it's almost impossible to remove it.

As usual, if you'd like to contact me I can be found at PETERRAKE@aol.com ■

NOT YOUR AVERAGE ALBATROS DIII. THIS ONE IS IN POLISH COLOURS WITH INTERESTING MARKINGS AND CAMOUFLAGE SCHEME.

Classifieds

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Contact: Malcolm wallis
01262 420611 (east yorkshire)

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Contact: 01787 228133.

Wanted

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Contact: Brian on 01922 445616.

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Contact: Tel Sam on 01748 824702 or e mail westonsam12@aol.com

Fuel pellets, gasket super seal silicon II wick, for the Jetx 50cc.

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