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ON THE COVER

You can almost hear the rumble of four Wright Cyclone engines as George Murgatroyd's Century UK ARTF 2m span Boeing B-17G Flying Fortress passes along the flight line at the Liverpool DMAS/NW Wardbirds winter scale meet. No rumble here though,it's electric powered.

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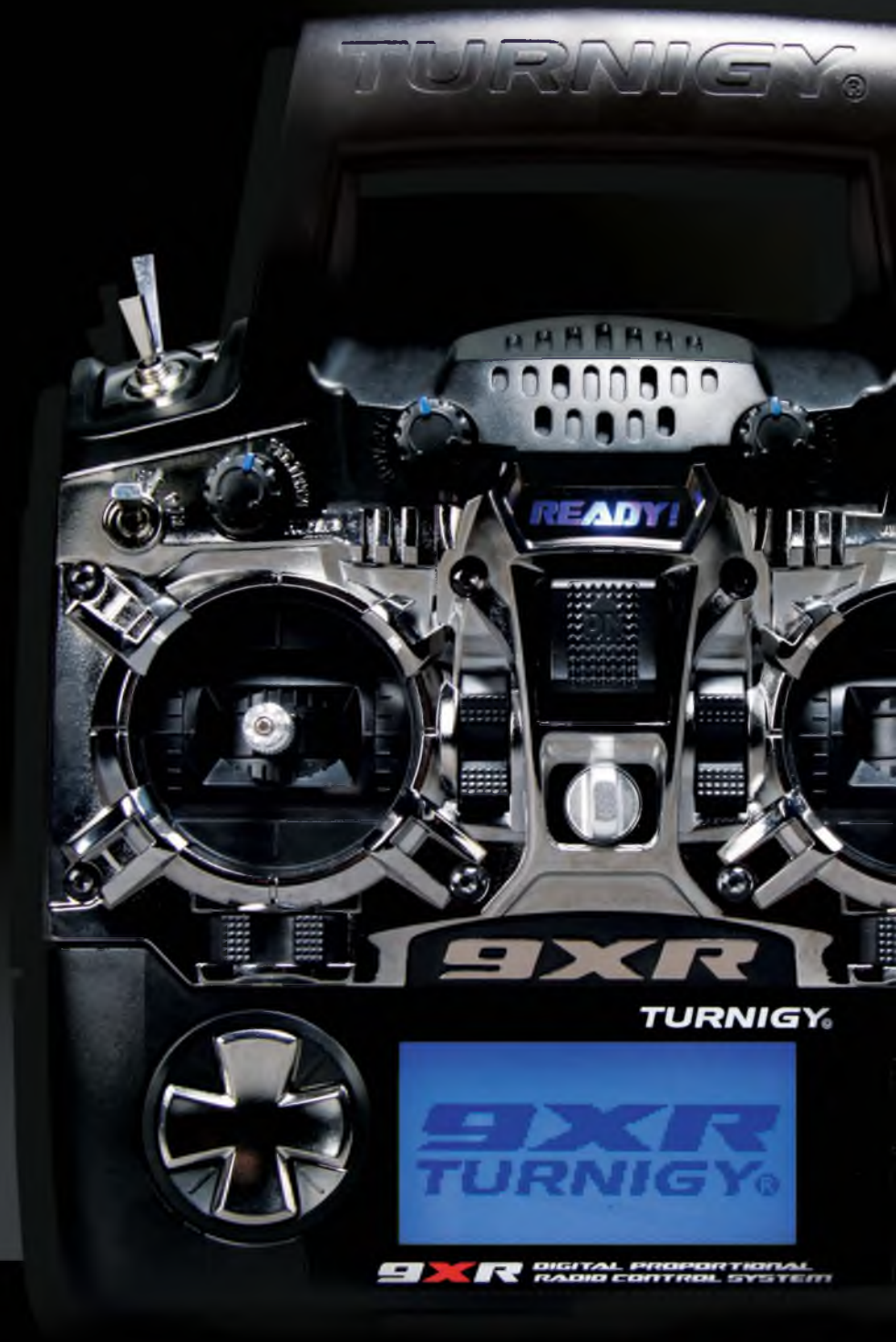

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CONTACT

IWM Duxford's American Air Museum redevelopment wins Heritage Lottery Fund support

The American Air Museum building at the Imperial War Museum, Duxford has been the most visually distinctive feature on the airfield site since its construction back in 1996-7. Here, on public display, is the best collection of American military aircraft outside the United States, telling the story of American air power from the late pre-WW2 era onwards.

Now, the Imperial War Museum has received a grant of £980,000 from the Heritage Lottery Fund (HLF) for their American Air Museum redevelopment project, which incorporates three main aspects.

The first is a new website based around The *Freeman Photographic Collection*, a compilation of approximately 15,000 prints and slides assembled by British aviation historian Mr. Roger Freeman (1928-2005), an East Anglian farmer who specialised in US Eight Air Force operations during WW2 - an interest he cultivated during the period when there was so much USAAF activity among the huge number of wartime airfields in the East Anglia area. Many of these images have not, up until now, been publicly available.

The Freeman Collection chronicles, in pactures, the many and varied experiences of the United States Army Air Forces (USAAF) in Britain during the Second World War. Images depict the different roles undertaken by members of the USAAF and also off-duty leisure time, the aircraft, the combat missions, events and the local communities in which the USAAF served.

Using *The Freeman Collection* of photographs as its core content, the website will link each photograph to the serving group or unit it represents. It will show the geographical location in which the photograph was taken, the type of aircraft the group operated and may also give the personal story of a man or woman shown in the photograph.

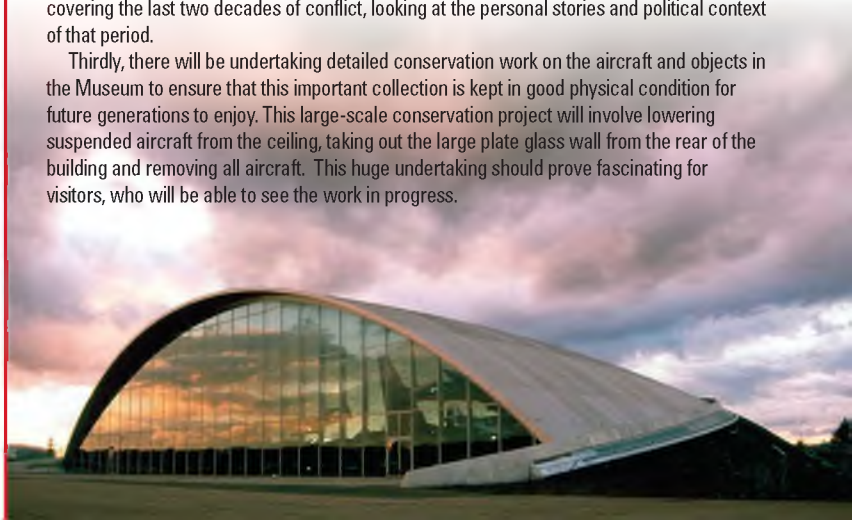
With thousands of images in the collection, IWM Duxford will be inviting people to help uncover the stories behind the photographs by logging-on, to tell what they know, contributing recollections from their own personal and community heritage to create an impressive bank of memories, knowledge and information for current and future generations.

It is hoped that the first phase of the website will be live from summer 2014.

A further part of the project is to physically refresh and re-energise the *American Air Museum* to ensure maximum visual impact for the next generation of visitors displaying key objects in new ways with a greater emphasis on the individual stories of war and conflict, which show events from a range of personal perspectives.

The American Air Museum range of exhibits will be brought up to date with material covering the last two decades of conflict, looking at the personal stories and political context of that period.

Thirdly, there will be undertaking detailed conservation work on the aircraft and objects in the Museum to ensure that this important collection is kept in good physical condition for future generations to enjoy. This large-scale conservation project will involve lowering suspended aircraft from the ceiling, taking out the large plate glass wall from the rear of the building and removing all aircraft. This huge undertaking should prove fascinating for visitors, who will be able to see the work in progress.



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HAWKER HURRICANE Mk.1 FROM CML DISTRIBUTION

New, virtually ready to go addition to the Dynam range of scale R/C all-foam airframe range from CML Distribution is there Hawker Hurricane Mk.1. This 1250mm (49.2") wingspan model is supplied finished in the colours of Hurricane R4118 that served during the Battle of Britain and restored to full flying condition in a saga that involved a tortuous decade-long recovery from a University junk yard in India.

In outline, the model looks good; an excellent representation of the early Hurricane shape, the colour scheme is authentic 'dark earth/dark green' of the early WW2 period. The kit is supplied complete with electric motor, servos and retracting undercarriage installed, requiring only transmitter, receiver and 4S 300mAh power pack to be ready for take-off.

Price from CML Distribution stockits is £154.99.

TECH SPEC

- Wingspan - 1250mm (49.9in)
- Length - 1003mm (39.48in)
- Servo 4 x 9g
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- Motor - Brushless outrunner 600kv
- Flying weight - 1450g
- Retracts - 2 x Electronic worm drive
- Controls - Aileron, Elevator, Rudder, Throttle, Electronic Retracts

MORE SCALE REFERENCE SOURCES FROM SQUADRON/SIGNAL

The Squadron/Signal monograph range is a 'benchmark' reference source for scale modellers that provides first class pictorial detail of the kid that scale modellers need when detailing their models. Here are three more, all available direct from ADH Publications: -

MESSERSCHMITT BF 109G - WALK AROUND

The 'Gustav' was the last MAJOR variant of the line, serving the Luftwaffe and Germany's WW2 allies from its introduction in early 1942, right up to the end of the war in 1945, during which some 23,000 examples were made.

Extensively illustrated with wartime photos as well as modern museum shots, this volume recounts in detail the numerous versions of the versatile Gustav, including the G-1 and G-5 with their pressurized cabins; the prolific G-2 and G-4, which saw extensive service on the Eastern Front and in North Africa; the G-6, which was built in greater numbers than any other Gustav; the short-range reconnaissance G-8, and others.

Particular attention is devoted to Gustav aircraft flown by Germany's allies during the war - wartime photos of Croatian, Finnish, Hungarian, Italian, Romanian, Slovak, and Slovenian pilots and their aircraft fill the book, highlighting a facet of the Axis war effort often overlooked by historians. Illustrated with more than 200 photographs, detailed colour profiles and line drawings; 80 pages.

ISBN 978-0-89747-503-7 Paperback, price £16.99
ISBN 978-0-89747-679-9 Hardback price £18.99

REPUBLIC P-47 THUNDERBOLT IN ACTION

During WW2, the Thunderbolt was the USAAF's first escort fighter, preceding the P-38 Lightning and the P-51 Mustang on long-range escort missions over continental Europe. While it lacked the extreme range of the P-38 and P-51, which could follow the bombers deeper into the German heartland and beyond, it nevertheless bore the brunt of the escort duty, before it's mission was re-focussed toward the ground attack task, where its radial engine and huge airframe strength enabled it to be used with devastating effect.

This new 88-page volume chronicles the development and use of the famed 'Jug'from its genesis in the Seversky P-35 all the way to the long-legged P-47N. Production by Republic and Curtiss is discussed, along with the numerous experimental variations that did not see production. This story is told through the detailed captions associated with the 62 vintage colour images and over 150 black-and-white photographs that illustrate the text. These vintage photos are augmented by over a dozen line drawings and six colour profiles. Illustrated with over 220 photographs plus colour profiles and detailed line drawings; 88 pages.

ISBN 978-0-89747-749-9 Paperback price £14.99
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GRUMMAN F8F BEARCAT IN ACTION

The Grumman F8F Bearcat represents the pinnacle of US carrier-borne piston-engine fighter design. Marrying a compact, lightweight airframe with a powerful 18-cylinder Pratt & Whitney Double Wasp radial engine churning out more than 2,000 horsepower produced an aircraft intended to be an interceptor that could operate from the smallest escort carriers. While the Bearcat prototype first took to the air in August 1944, and the first squadron equipped with the new fighters was operational in May 1945, the war ended before the Bearcat actually saw combat in World War II. The type would ultimately see combat in the First Indochina War. Chronicling this diminutive fighter in this 80 page volume is a blend of 89 vintage black-and-white photos, as well as 13 colour photos from the same time period, augmented by 77 further colour photos of preserved aircraft. Five full-colour profiles and 17 line drawings capture the nuances of this famed warbird.

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LIVERPOOL & DISTRICT MA
NW WARBIRDS

When two modelling groups get together for an event, you can savour the result!

S SCALE EVENT

Unfortunately, the original LADMAS / North West Autumn Warbirds Event 2013 had to be cancelled. The weather Gods had callously intervened, taking with them one of the few outdoor winter events on the scale calendar. Now for those of us who like to get our 'outdoor' scale fix every month of the year, this was brutally disappointing. However, the LADMAS / NW Warbirds Joint-Organising Team are made of sterner stuff. They quickly re-grouped, and set a new date in November. I knew things would turn out well when I opened my curtains on the morning of the event: clear skies, no precipitation in sight, and manageable winds. Game on, as they say.

For The Fallen

The day chosen, at a bare two days notice due to a propitious BBC Weekend Weather Forecast, turned out to be Remembrance Sunday. Therefore, the first duty of the day was to observe the traditional Two Minutes Silence. This was all the more moving, since we all acknowledged that were only able to play with our 'toy aeroplanes' in freedom like this on a Sunday morning due to the sacrifice of others. The day remained bight, but pretty cold. Most importantly, the wind was right down the strip. This is a significant consideration at the otherwise superb Liverpool field, since there is a line of trees adjacent to the run of the strip that can generate challenging turbulence in a bold cross-wind. All in all, it turned out to be a cracking bonus of a scale day, all the sweeter since it had earlier been cancelled.

Supermarine Attacker

The model in the air as I arrived

George Murgatroyd's Century UK ARTF 2m span electric BOEING B-17G Flying Fortress. Flies very well.

Barry Sherborne's 1/5th scale Beaufighter. Flies very well indeed at a round 9,000 revs cruise.

Barry Sherborne's Beaufighter Mk VI F. Twin ASP 61 FS power driving two 12"x 6" (3-blade) Master Airscrews.

belonged to well-respected Lancashire scale man Doug Rigby. Dougie was flying his new jet-turbine powered Supermarine Attacker. As a committed scale builder, Doug had designed and built this fine airframe from scratch. In fact, Dougie has built quite a few now, all from his own moulds. Doug has special skill when it comes to incremental model development. Especially when it comes to paring down a model's flying weight. For example, he has finessed his new Attacker's fuselage weight gradually down from 28lbs, to a very creditable 21 lb. The model is built to 1/5th scale, spans 82", with a fuselage length of 80". It is powered by a *Wren Jubilee* 75 gas turbine, with kero start from the transmitter. This latest Attacker, his fifth, has a clear canopy, whilst his earlier versions were all fibreglass. All Doug's Attackers have his clever, practical, and effective mono-wheel undercarriage, which instantly circumvents many of the complications of a retracting undercarriage. The model flies very smoothly, indeed. Doug suffered a couple of flame-outs towards the end of long flights, so I can vouch for the Attacker's rock-steady dead-stick approaches. It has always surprised me that the handsome Supermarine Attacker is such a little-modelled British jet scale subject.

Classic Mustang ARTF

Besides his jet, Doug was flying a very old *YT International* Mustang. It is the 72" span version. One of the very first modern scale ARTFs to be offered, Doug reckons. He thinks it must be nudging 20 years old. Now this prompted the question: can you have a classic scale ARTF? Will they become collectable like old modelling magazines and old engines? Hmmm. I do not know. The main point is that despite its slightly care worn appearance, it flew well on its Al's Hobbies 26cc petrol engine. Incidentally, Dougie liked this new petrol motor so much, that he bought two.

Thunderbolt

No longer new to us, but still under development, Ozyray Peters' bubble-top big Republic P-47 has been carefully uprated. This big model is the epitome of a Yankee warbird. On long, low, fast-passes it really does look the business.

Barry Sherborne's well-executed own-design, scratch-built, Beaufighter. 78" span.

'Frigid Migit' is built from a plan pack, with a glass fuselage and foam wings. It spans 102" and weighs 41 lbs. She has Unitract retracts and is fitted with an MVVS 50cc petrol engine. This drives a Menz 28x10 prop. Ray had to persevere with a few prop changes during the day, since the prop noise was a bit energetic.

Corsair

Ray also brought his 101" span *Meister* F4U Corsair. The model was very interesting right down to its Tony Clark custom can exhaust. Ray has finished this impressive warbird in late 1945 Fleet Air Arm colours. It weighs in at 36 lbs and is fitted with a Zenoah 80 petrol engine, driving a Menz 26"x10" prop.

Me 109

John Jackson, of the famous scale clan, is a well know Messerschmitt afficionardo. Normally, John builds his own, but today he flew an ARTF. This was an 80" span *Blackhorse* Me 109. Black Horse stuff really has improved of late and this new model deserved a second look. John has fitted a Zenoah 38 petrol engine, driving an 18"x10" Menz prop. He was flying it with the original *Black Horse* ARTF's retracts. This is unusual since some ARTFs routinely have to have their factory-fitted retracts replaced or modified. Full marks to *Black Horse*, says I.

Flair Triplane

The venerable *Flair* Fokker Triplane is a classic design that has a strong following. Designer Dudley Pattison certainly knows how to design an excellent airframe. John Jackson's well-used, high-hours version flew very well indeed. She was powered by an equally classic Quadra 45 petrol motor. Many older scale modellers will remember that Quadra was one of the first modern commercial petrol engines to be offered for model use.

Chipmunk

Phil Ogden was flying his bright red 1/5th scale *Apache Kits* Chippie fitted with one of Mr Tidey's lovely Laser 180 glow engines. A delightful sound, and utterly reliable of course, driving a Master 18"x 6" prop. The model is all built-up, and Phil has used glass-cloth over the fuselage. The wings are Solartexed. Phil told me a strange little story about his Chipmunk. His Chippie is modelled on the example kept at Barton. One day, Phil took the model to Barton to fly it, not far from the full-size original. However, Phil damaged the nav. light in the wing as he stuffed the model in the car. He temporarily patched up the damaged light with some gaffer tape, and thought no more about it. Shortly after, when Phil arrived with the model at Barton, he decided to take a look at the full-size Chipmunk. He was taken aback when he spotted that the full-size Chipmunk's nav. light has also been damaged. It had also been hastily repaired with gaffer tape!

Spitfire 24

Andy Wynn and his dad Colin are both

Phil Ogden's Chippie banking nicely.

Phil Robertshaw's Cripes A'Mighty 3rd P51-D Mustang on final approach. Hand built from the Pica kit.

LADMAS has a Mick Reeves Hurricane available for Members' Use. There's posh.

Burning in over the boundary hedge, Andy Wynn's Eurofighter.

Ozyray Peters' 101" span Meister Corsair in Fleet Air Arm colours. Tony Clark custom can exhaust on the Zenoah 80 petrol engine.

Phil Cummins and his ARTF foam / electric Mustang from FMS.

John Wheeler shows us his weathering skills on his ace new 100" span TopFlite Stinson Reliant SR10.

Ozyray Peters' magnificent Frigid Midgit is 102" in span and weighs 41lbs.

keen scale modellers. They arrived at the field with two fine models. The first was their wonderfully aggressive Spitfire 24. Now you may think that you have seen her before, but in fact she is a full rebuild since the last version crashed. Colin and Andy have reconstructed the model almost identical externally, although the rebuild process has involved much modding and re-working of the underlying *Century Jet* kit. The Spit spans 88", weighs 34lbs, and is powered by a Zenoah 62 petrol engine. Powered is delivered through a 22"x10" Menz prop. She is fitted with *Eurokit* retracts. The fuselage is essentially the original *Century Jet* fibreglass item with much fettling, and the wings are foam. This is a satisfyingly powerful and impressive model in the air.

Eurofigher

Andy also flew his fast jet Eurofighter. The model spans 66" and weighs 28lbs dry. She is from the *Composite* ARF kit, and is fitted with a *Jet Central Rhino* turbine. Performance is outstanding, with easy 'out-of-sight' capability if you keep your mitt hard on the throttle.

Flying Fortress

ARTF electric scale warbirds with foam structures are very fashionable. There were quite a few such warbirds present on the day. One of the largest was George Murgatroyd's all-foam *Century UK* Boeing B-17G. This flew very well, and has a span of two metres.

Foam Electric Mustang (1)

Another all-foam ARTF warbird was Phil Cummings pretty *FMS* Mustang of 1700mm span. These fly very well and seem to represent a good all-round package.

Foam Electric Mustang (2)

Mark Hiley flew another beautifully finished-straight-from-the-box Mustang. This was the *Durafly* 'Ferocious Frankie' P-51D. This spans 1100mm and comes with all the toys, and I do mean all. The electric retracts, wheels, and tyres were surprisingly well executed.

Pica Mustang

Phil Robertshaw (of large Heinkel fame) flew his brand new, immaculately finished *Cripes A'mighty* 1/5th scale / 90" span Mustang P 51-D. A lovely model, this was built from the famous American *Pica* Kit. In their day, Pica Kits were correctly renowned in their day for their completeness, accuracy, and quality. They were not cheap, but they were always very good. Phil bought the kit many years ago and has only just finished her. She has a Zenoah 62 petrol engine driving a Menz 22"x10" prop. The flight went well and she flew with great authority, but mystifyingly, on finals, she veered off a touch, and made a heavy landing. The balsa wing skins were split. Most aggravating to see a lovely hand-crafted model get damaged, and nothing to do with its piloting. I suspect gusts. Industrious Phil will have fixed the Mustang by the time you read this.

Stinson Reliant SR 10

A newly completed model that suffered minor teething troubles was John Wheeler's fine Stinson Reliant SR 10. This is the variant with the parallel-sided radial cowl, without the blisters for the engine rockers. John was going to get Andy Johnson to test fly her, but there were issues withe fuel feed, so she stayed on the ground. She is built from the excellently presented, but not particularly accurate *TopFlite* kit. She spans 100" and weighs 24lbs. She is powered by a CRRC Pro

Ozyray Peters (left) and Roy Palin roll out Frigid Midgit.

Doug Rigby's rare Supermarine Attacker, smooth and fast.

Dougie Rigby inspects his new Supermarine Attacker. Scratch built, of course.

26cc petrol engine driving a Master 18"x6" prop. John had to modify the kit in a number of areas for scale fidelity. John also suffered some issues with paint-lift when using cellulose paint over Solartex. I will get you the full story when we return to this classic in the near future.

Bristol Beaufighter

Beaufighters are like buses: none for ages then two come along one after the other. We recently saw Dennis Richardson's fine 92" span Beaufighter. You see, Barry Sherborne appeared with his fab scratch-built / own design version at the Liverpool event. Like Dennis's Beaufighter, Barry's Beau flew very well too. On steep climb-outs she looked especially convincing. I will return to this Beau at a later date.

Club scale hack

Finally: an interesting item of local colour: LADMAS have a Hurricane, owned by the Club, available for Members' use! It is a venerable Mick Reeves Hurricane. It is powered by a Zenoah 23 petrol engine. Well. I never...

The Verdict

Ozyray Peters and the lads at NW Warbirds and our generous hosts at the Liverpool Club presided over an unlikely triumph. Despite the onset of winter, the weather was good, the wind stayed down the strip, and I counted 28 pilots. And there's more: the Liverpool lads assured me that their famed Wright Memorial Event will run on the 15th December 2013. What? Another winter outdoor scale date? Bring that on, too! ■

An unseasonably fine day on the threshold of winter.

John Jackson's Blackhorse ARTF Me 109. Worth a good look if you are in the market for a Messerschmitt.

Andy Wynn's totally rebuilt, heavily modded Spitfire 24.

Andy Wynn with the reconstructed Spitfire 24. Dad Colin should be in the picture too!

Techno Scale

Mike Evatt s

Since its foundation in 1991 **S-S-M Technik's** passion has been large scale helicopters with a 1800mm rotor diameter. Wear resistant mechanics and a highly reliable I/C motor has been paramount. Over the years the mechanics have been tested extensively and now their on-line catalogue at www.ssm-technik.de shows large scale turbine and electric powered versions as well. The screen shot shows their Bell 205 complete assembly kit with mechanics for electric propulsion, main rotor head and tail rotor.

Staying with Helicopters and Bells a little longer, **Super Scale Model Helicopters** at http://superscalehelis.com has scale kits and accessories to drool over, particularly if you are a Bell fan! Super Scale Helis has yet another first in the 1/4 scale market. Replicating the new style adjustable Anti-torque Pedals found on newer Bell Helicopters, Super Scale Helis has faithfully reproduced all the details found on the full size version in 1/4 scale. Not only that, adding to their extensive line of highly detailed 1/4 scale items is the addition of a fire extinguisher Model RT A600. Sold separately, this item includes the fire extinguisher head, main cylinder, pin and label.

Pahl Power is an Austrian company specialising in the development and production of model turbines and gearboxes, in particular turbines for use in model helicopters. Flawless function, performance and safety distinguish their products. Their Taurus range is of a twin shaft design which can be used in both helicopters or turbo-prop fixed wing aircraft. The Taurus 12 has an output of 12KW - check its credentials at www.pahlhelicopter.com

BoWings Online Store at www.bowings.co.uk doesn't usually cater for scale enthusiasts - it is a haven for those addicted to F3K!! However it does sell **TeXtreme(r) Carbon fabric** 64 g/m² HT bias-cut! This is a relatively recent Carbon Fibre cloth that is used in F1Motor racing and does enable some very good CF composite configurations. TeXtreme(r) Spread Tow Fabric (STF) increases the performance and reduces the weight of your composites as well as enhancing the surface finish. Bowings now offers bias-cut fabrics, which are mainly used in the model aircraft as torsion reinforcement in wings and fuselages.

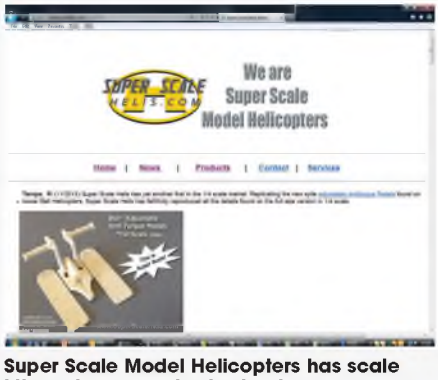
Yellow Aircraft has manufactured scale model jets and propeller aircraft since 1988. Their highly experienced engineers and skilled craftsmen are committed to creating the highest quality models possible. After 10 years of being one the most popular ducted fan jets, their A4 - Skyhawk is now completely redesigned, incorporating all the latest design concepts. The perfect blending of performance and value is why this model is so popular. This deluxe kit features a higher degree of pre-fabrication than most kits costing hundreds of dollars more.

Check it out at www.yellowaircraft.com

Philip Avonds won the 2013 Jet World Masters title in the 13.5 kg Class flying a Fouga Magister.

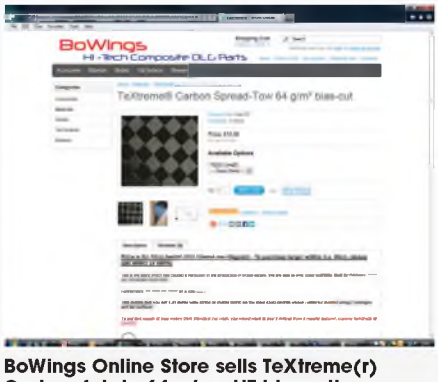
Philip started his jet kit manufacturing company back in 1987 following his scale competition successes with his twin Ducted Fan powered F-15C Eagle model. His website at www.avonds.com reveals a redesigned F-15C which is possibly the most accurate, the best engineered and the best flying F-15 model around. This

S-S-M Technik's Bell 205 complete assembly kit with mechanics for electric propulsion.



Super Scale Model Helicopters has scale kits and accessories to drool over.

Pahl Power is an Austrian company specialises in turbines for model helicopters.



BoWings Online Store sells TeXtreme(r) Carbon fabric 64 g/m_ HT biascut!

Yellow Aircraft has proudly manufactured scale model jets and propeller airplanes since 1988.

Philip Avond's redesigned F-15C.

urfs cyberspace for more TechnoScale Topics...

F-15 is a complete redesign in terms of scale fidelity, prefabrication, landing gear, gear doors system, fuel tank system, mass distribution, equipment installation, internal airflow, internal linkages, hatch fit, ease of transport, ease of set up, flying qualities etc.

3W Modellmotoren GmbH is a German company best known for its excellent model engines. However logging on to their website at www.3w-modellmotoren.com shows a range of warbirds such as their Bearcat F8F .with a wingspan100ins. Fitted with one of their 3W-157 engines it should be superb. Their warbirds are of full composite construction. They selected this technology in order to be able to simulate a perfectly detailed surface. Rivets, bolts, panel lines , hatch covers, caps and textile surfaces are perfectly reproduced in the surface giving an authentic scale look.

If powered sailplanes are your thing then log-on to www.rokemodell.de

Roke Modell have in their catalogue a Grob G 109 in 1/4 scale. This gem spans over 4metres and with the engine switched off can achieve a gliding angle of approx. 1:30 which permits extended flights. The short take-off distance and the good climbing performance will always satisfyeven the most discerning flyer.

The **Electric Flight in Australia** website at www.flyelectric.com is the brainchild of Peter Pine and was created to answer aeromodeller's questions about electric flight. This is an excellent website if you want to learn more about electric flight. Peter stocks some interesting scale kits such as the Aero-Naut Catalina. We are talking here about a super-scale model of 1.81m wingspan weighing in at about 3kg. Recommended power level is two Actro-C8 out-runner motors on 10 cells each.

Active Scale Models is based in Hockley, Essex, UK and has a web presence at www.activescalemodels.co.uk If you are fascinated by classic scale warbirds powered by a rubber motor then this is the shop for it! They stock a splendid Spitfire rubber powered kit. Kit FF-55 Supermarine Spitfire Mk 1A is a 1/9 scale flying model that uses the box and former method of construction. This pre-1942 design is eligible for Society of Antique Modellers (SAM) contests. This 55ins span jumbo rubber powered model is very popular for electric or gas conversion. This kit contains a full-size rolled plan, building and flying instructions, printed balsa wood, hand-picked balsa stripwood, rubber motor, 11" Peck propeller, nose package, clear plastic for the windshield, wheels, landing gear, and Easy Built Lite coloured tissue.

Balsa USA at http://shop.balsausa.com has long been recognised for the supply of balsa, aircraft grade plywood, and other specialty woods primarily related to the hobby industry. Starting from humble beginnings in 1946 the Joy Products company was bought by Ron Busch in 1968 and renamed Balsa USA. Nowadays the company sells a wide range of scale model kits, plans and accessories. Their WW1Warbird range includes the fabulous 1/3 Scale Albatros D5 shown in the screen-shot. This beauty is available for the enthusiast in kit form, has a wing span of 118ins and is designed for 80-100cc engines. ■

3W Modellmotoren GmbH doesn't just specialise in engines!

Roke Modell have in their catalogue a Grob G 109 in 1/4 scale.

"Electric Flight in Australia" answers aeromodeller's questions about electric flight.

A splendid Spitfire rubber powered kit from Active Scale Models.

Balsa USA's fabulous 1/3 Scale Albatros D5.

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

mikeevatt@hotmail.com


G-BSER

PIPER CHEROKEE 140

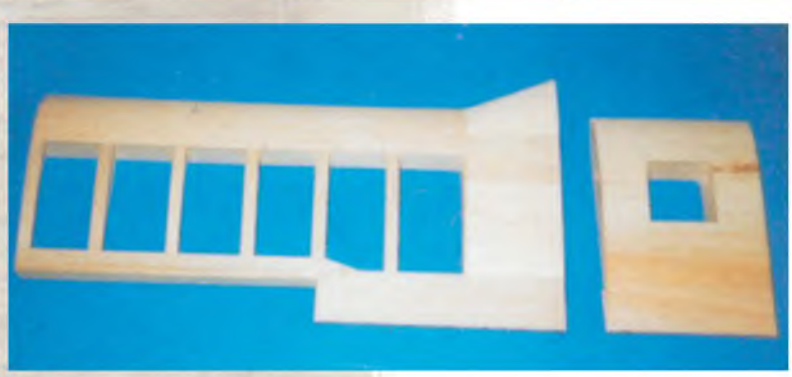
A double-bill feature, with full size free plans for a 39" wingspan model for .15 cu.in. size engine, with the option of a larger 52" wingspan version for .30-.35 power, available through FSM Plans Service. Cut parts sets are available for both model sizes. Designed by DAVID BODDINGTON.

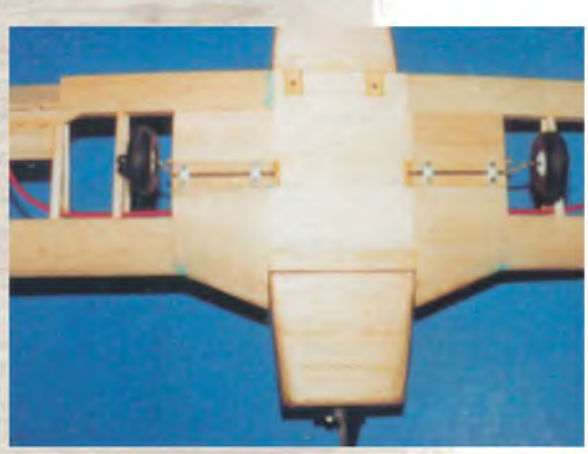
Considering the popularity of the Piper PA28 series for use by Flying Clubs and private owners, the aircraft has been very under-modelled in all parts of the world. Why this should be is something of a mystery, not least because of the overall layout and proportions of the design are entirely suitably for our purposes. With the low wing, tricycle undercarriage, generous dihedral and longish capacious cowling, the Cherokee has all the natural attributes to provide the basis for a good low wing trainer. You can't say that about many scale models.

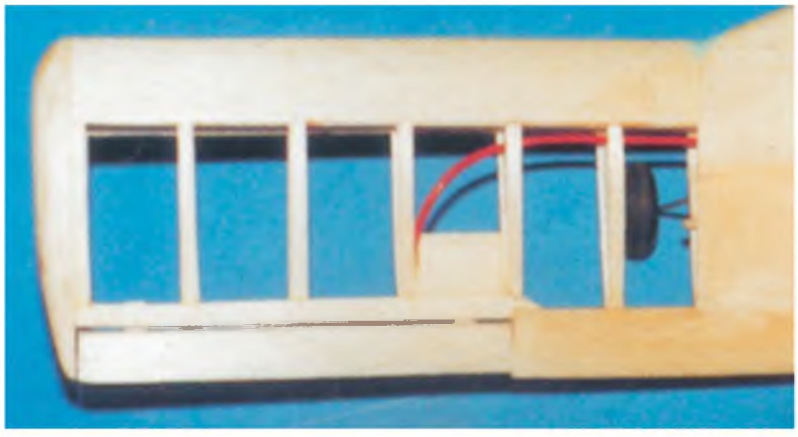
Over the years the Piper Corporation developed and modified the series to include the stretched-fuselage *Cherokee Six* with extended wing and tail surface spans, longer fuselage and larger cabin. The *Cherokee Arrow* also had slightly larger wingspan than the 140 and featured retracting undercarriage. Fixed wing undercarriage models were flown with and without spats and/or wheel fairings.

With constant chord tailplane (stabilator) and wings (except for the wing leading edge), construction is not difficult. Certainly the canopy and engine cowling require sizeable mouldings, but not impossibly large.

Colour schemes are fairly simple to duplicate, the







factory examples being generally white with striped colour flashes and no doubt there are some more exotic examples around if you care to look for them.

Why then, with so many bonuses for a model project, has the PA28 series been largely ignored? In the past, scale drawings have not been readily available and kits have been thin on the ground. Popularity comes by one modeller seeing another enthusiast having success with a particular deign, which encourages further interest and numbers increase - a real chicken-and-egg situation!

Little and large

Your first decision, before building commences, is whether to go for the smaller version as presented in this month's free plan or go for the enlarged option which spans 52" (mm) and is designed for engines of around .30-.35 size. If you opt for the larger one, we have copies of the plans available to order and in both sizes we have the additional option of ready cut parts available.

Another option to consider is the Cherokee Arrow, with its retracting undercarraige as shown in the 1:60 scale three views that back up this construction feature. Whichever version you choose to build, the stage-by-stage construction sequence photos shown here are applicable to both.

Make a start

Whichever version you choose to build, the stage-by-stage construction sequence photos shown here are applicable to both, as is the written building sequence that follows, with material sizes in brackets for the larger version. Some wood sizes are common to both - for example the 1/16" skinning to fuselage and wings.

So start by sorting out your engine, silencer, fuel tank radio equipment and linkages, then (if you're not taking advantage of the cut parts sets available via the publisher, cut out a kit of basic parts.

Wings

The wing is built in sequence of centre panel, followed by the addition of the two outer panels. The main spar is pinned directly over the plan as is the rear spar, which is extended on the lower portion, to be cut away later.

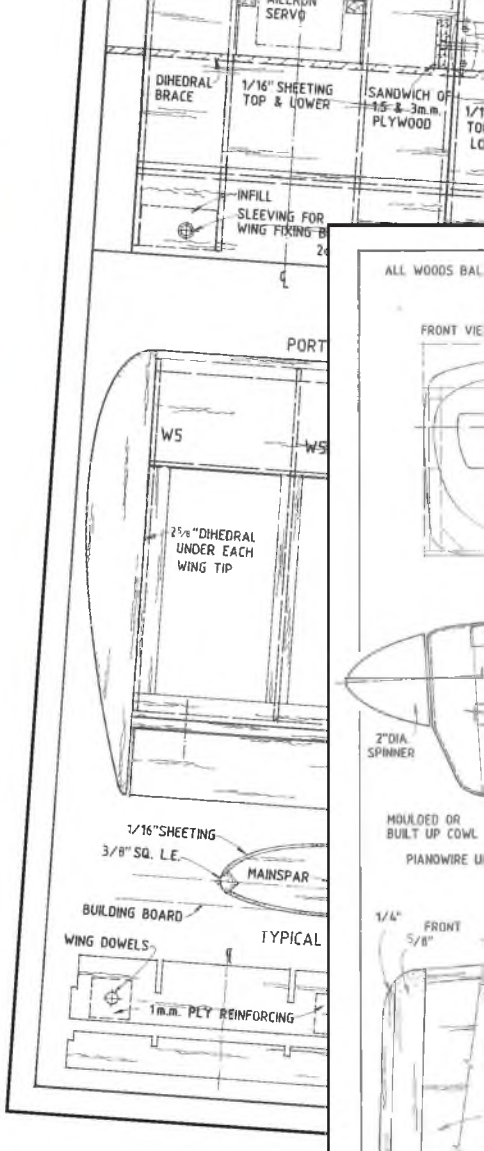
Pin down the centre section spars and prop up the plywood undercarriage dihedral brace by 3mm (4mm). Glue W1 and W6 in position with the leading edge and sheet the completed top surface with 1/16" sheet balsa. When dry, the centre section is removed and then tilted so that the starboard (right) wing panel can be added (the left centre section rib is propped up by 15.5mm (20.5mm) and the dihedral brace lower edge parallel with the building board on the starboard side)

Pin the spars over the plan, also the 3/16" x 3/4" (1/4" x l") trailing edge strip at the aileron location. This is glued to the rear spar. Glue ribs and leading edge in position, sighting down the leading and trailing edges to check for correct alignment. Add the 1/16" top trailing edge strips, top leading edge, top capping strips and top root area sheeting. When dry, remove from the board and carry out the same procedure for the port wing. You will now have the three wing panels joined, but without any underside sheeting fixed.

Fix the wing leading edge beech dowels in position, reinforcing the area behind the leading edge and the scrap in-fill for the rear bolt fixings. Glue the plywood main undercarriage plywood strips (reinforcing with triangular strip) to the underside and form boxes for the vertical leg of the piano wire unit. Sheet the lower leading edges and allow to dry.

Cut down, using a razor plane, the rear spar until it is flush with the ribs; the same applies to the trailing edge at the aileron. Lightly chamfer the rear of the trailing edge sheeting so that the thickness is reduced when the lower trailing edge is added. Glue these trailing edge pieces to the wing panels, also the centre section sheeting - cutting around the undercarriage plywood strips - and the capping strips. Check constantly for any twists trying to creep into the structure. Add the soft balsa wing tips and when thoroughly set, spot glue the ailerons in position and sand the whole wing smooth.

Cut away the top centre section sheeting and add provision for fitting the aileron servo. Fit the aileron cranks (unless, with the 52" wingspan model, you are using separate aileron servos) and mounting plates, also the pushrods. Check the fit of the undercarriage legs and drill pilot holes for the saddle screws, reinforcing behind the plywood plate if



necessary. Fit the aileron horns and check aileron movement is free - and working in the opposite directions to each other! Drill pilot holes for the wing fixing bolts.

Fuselage

Start by gluing the top longeron, uprights and doublers to the fuselage sides, also the triangular reinforcement to the lower nose sheeting and F4 and mark on the location of the rear formers. The Cherokees are fairly tubby Indians and it is important to check that their body curves are equal on both sides. Centre marking the top and lower edges of the formers will help to give a visual check that alignment is correct before adding the top and bottom sheeting.

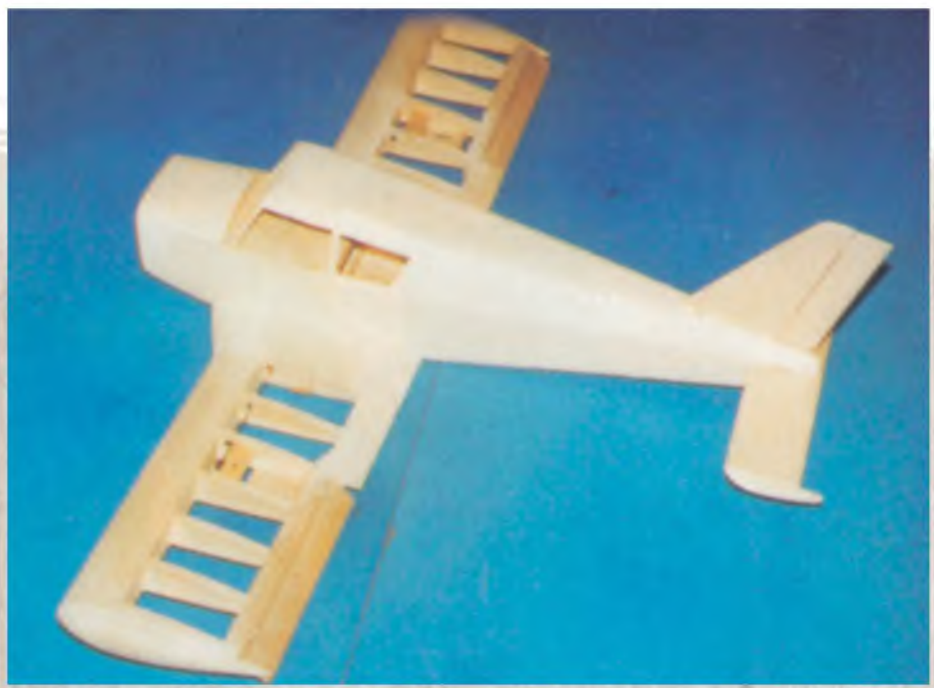
Glue formers F3, F4 and F5 to the sides, together with the servo bearers, pre-drilled for the servo screws. With this unit 'squared-up', glue the cabin sheeting in position to add further rigidity. Glue formers F6 to F10 to the fuselage sides, in turn and engine bulkheads F1/F2. Add the fuel tank floor, gluing it to the top of the doublers and the formers and fuel-proof this inner area. The underside nose sheeting and top decking block can now be added.

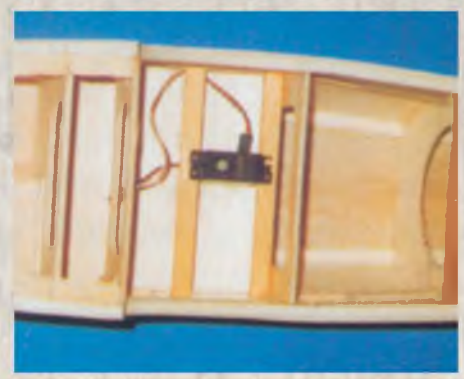
Note that the rear top side decking sheet is thinner than the fuselage sides - the sides are sanded to blend in with the sheeting.

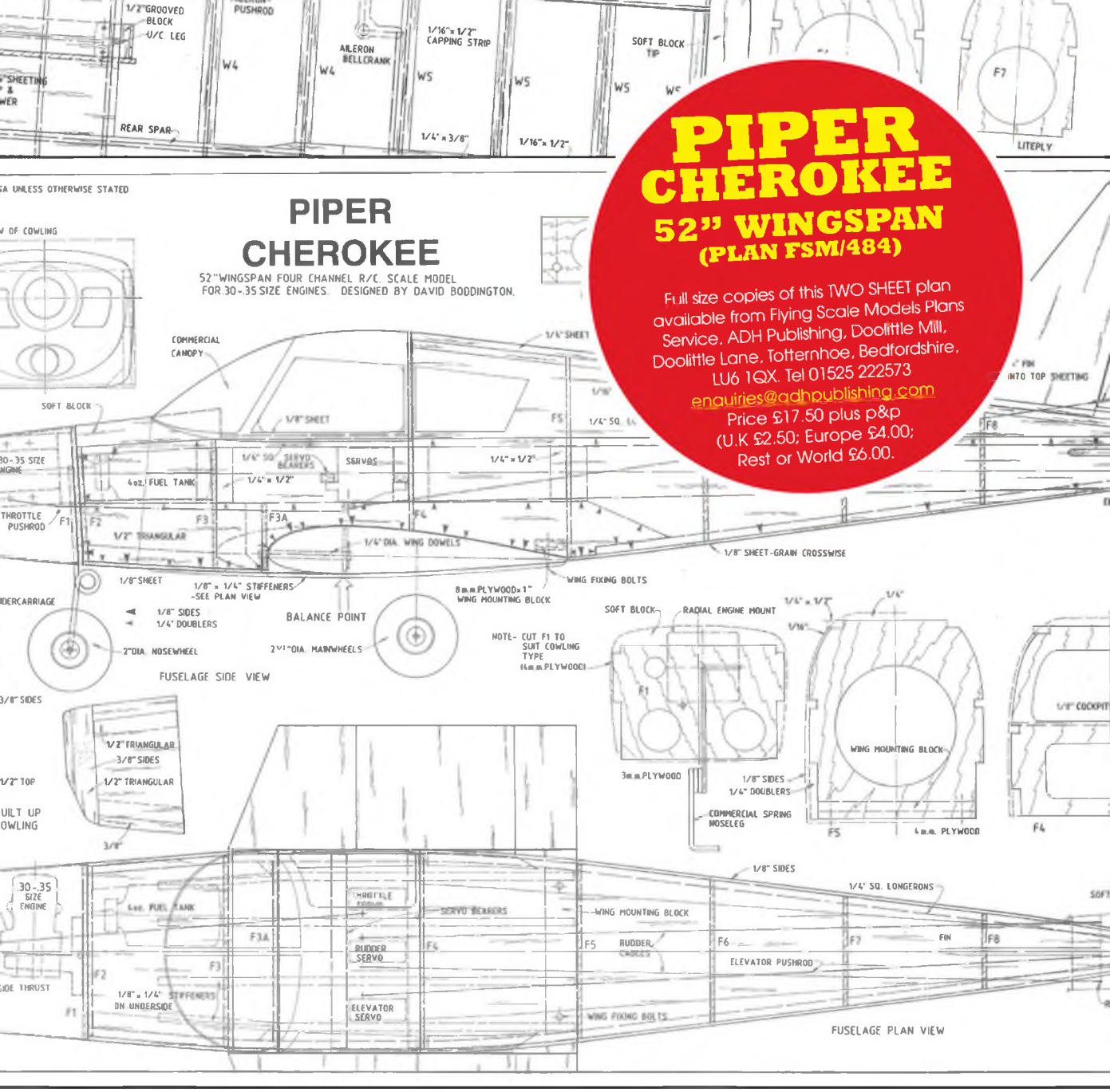
When fitted, sand the top edges and fit the 3/16" x 3/8" (1/4" x 1/2") top fuselage strips. Before adding the lower 3/32" (1/8") and top 3/16" (1/4") sheeting, check and install provision for the elevator and rudder control linkages.

Cut a slot out of F10 at the location of the tailplane; the latter is glued into the slot and supported by the soft balsa blocks at the fuselage rear end. The fin fixes into a slot cut into the rear fuselage top sheeting.

You will have to use a non-standard silencer for the engine if you do not want too much showing outside the cowling. The engine mount is fitted to F1/F2 at right angles, but you should use engine thrust wedges (2-3°) to give the correct engine side thrust. Shape and sand the fuselage to the final contours, protecting the engine cowling edges with masking tape when sanding the fuselage to blend with the cowling. Trim the canopy and check the fit, the interior must be painted before the canopy is attached and the







PIPER CHEROKEE

52" WINGSPAN (PLAN FSM/484)

Full size copies of this TWO SHEET plan available from Flying Scale Models Plans Service, ADH Publishing, Doolittle Mill, Doolittle Lane, Totternhoe, Bedfordshire, LU6 1QX. Tel 01525 222573
enquiries@adhpublishing.com
Price £17.50 plus p&p
(U.K £2.50; Europe £4.00;
Rest or World £6.00.

rear window must also be cut-out and glazed before fitting the canopy.

Tail surfaces

These are cut from firm, light balsa and sanded to section. Adding small triangular sections to emulate the corrugations will definitely add to the appearance - and to the time in finishing.

Covering

Before commencing the covering and finishing, check-assemble the model to ensure that it all fits and alignment of fuselage, wings and tail surfaces is good. You can use most types of coverings and finishes on this model (except for glass cloth and resin on the open structure areas. Oh, you did remember to fit a pilot in the cockpit, didn't you?

There are nearly 1,000 PA28s listed on the U.K, and Eire register so you can choose a simple scheme or something more complex. Remember that smallish models disappear fairly rapidly in the sky, so light colours are an advantage for visibility.

Flying

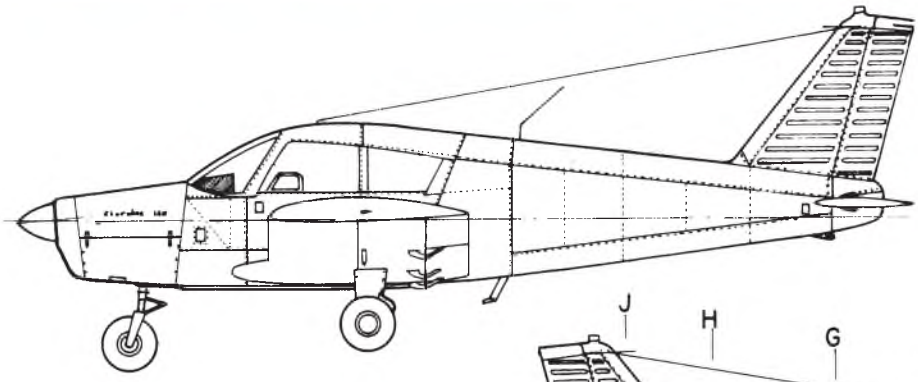
(From notes made by Andy Ward)

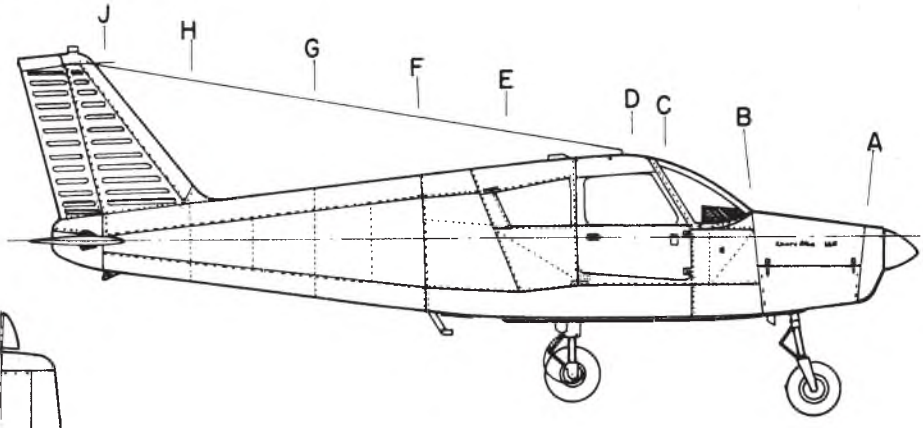
All checked out and ready to go? If you can find a hardstanding take-off area, or really short grass, so much the better. With small wheels and not an abundance of power it is asking a lot to get the speed up on anything but a smooth surface and then there is the tendency to haul the Cherokee into the air before it has reached a safe flying speed. With correct wheel tracking and facing into wind a minimum of rudder should be needed during the take-off run, the prototype models tracked well.

Some 'up' elevator was required on both the small and large sized models and the tailplane incidence has been adjusted on the final drawing to allow for this tendency.

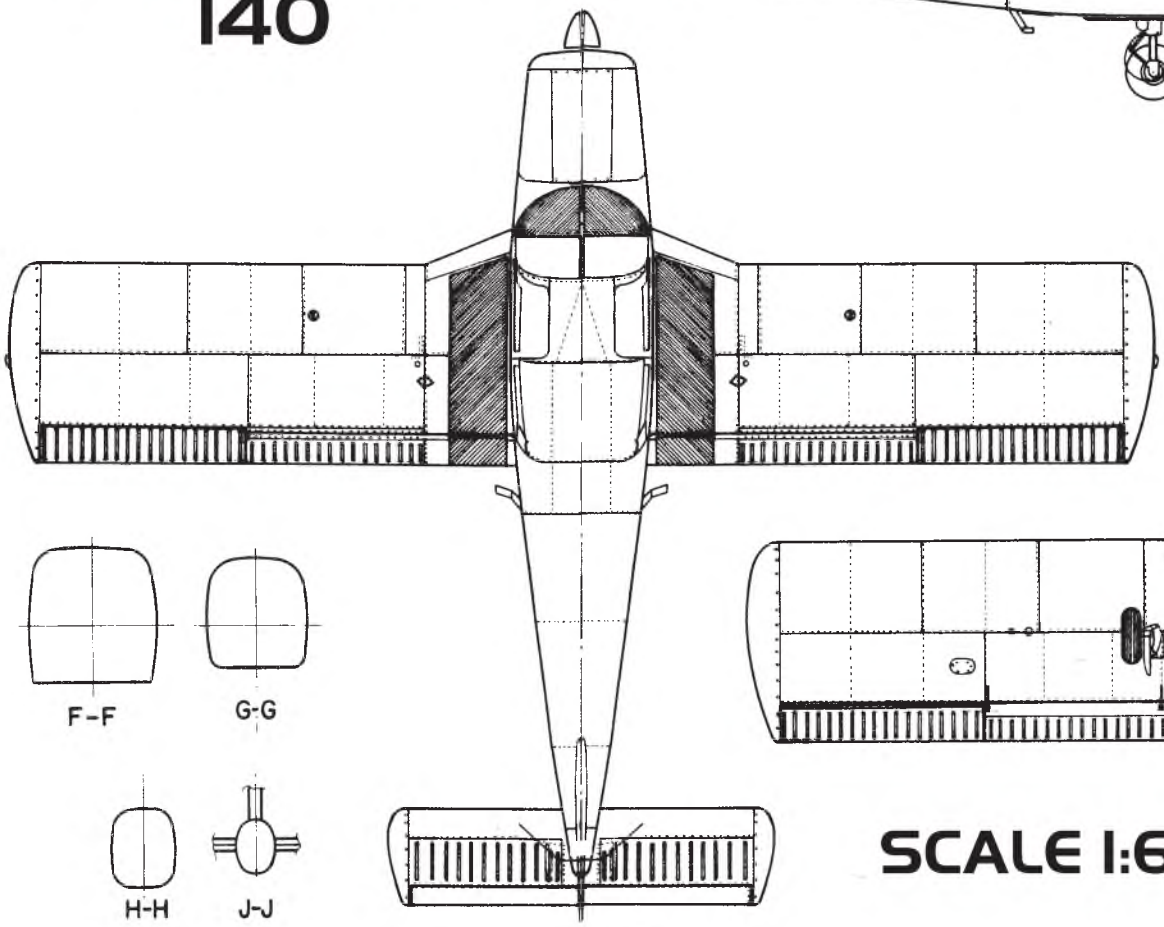
The Cherokees proved to be stable fliers and sufficiently aerobatic to satisfy most pilots, although I doubt whether a full size Cherokee would survive the gyrations we put out models through on the first flights. Landing proved to be no problem although I lost a wheel on mine on the rollout!

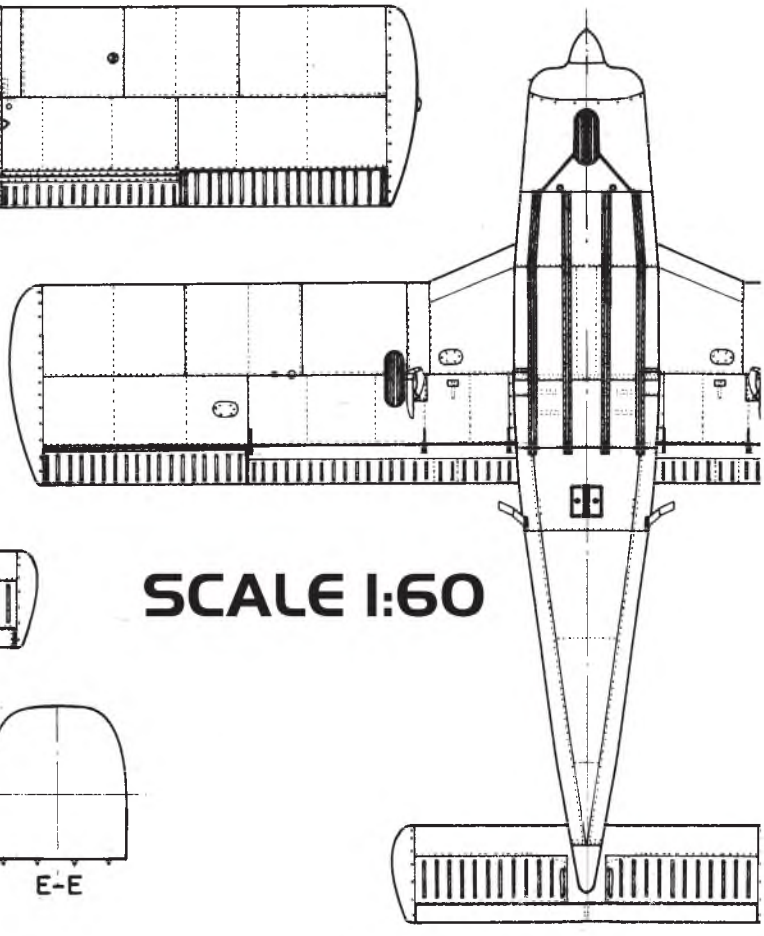
In summary then, the Cherokee builds into a well mannered model in both sizes. Mal was so pleased with his, he built another one! Actually, he was only waiting for me to finish mine so we could do the first flight together - I really must build quicker in future!



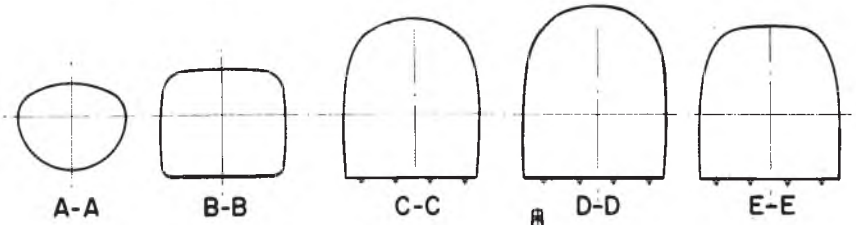


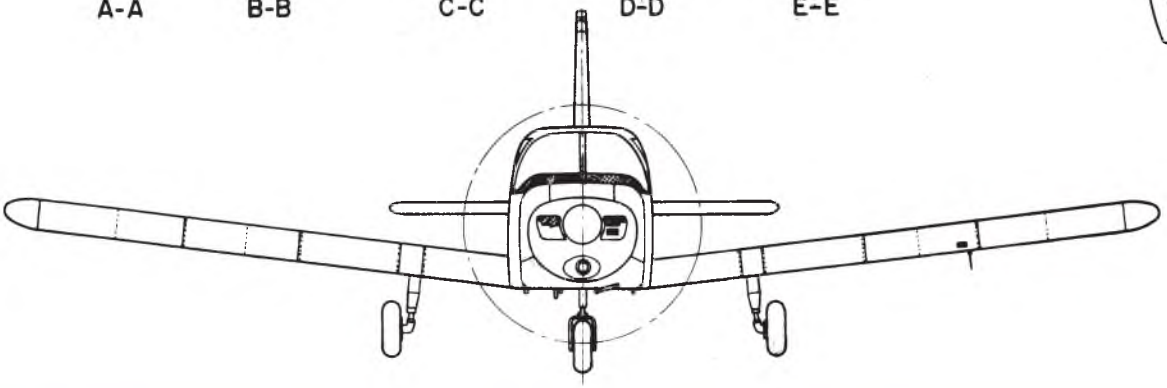
PIPER CHEROKEE 140

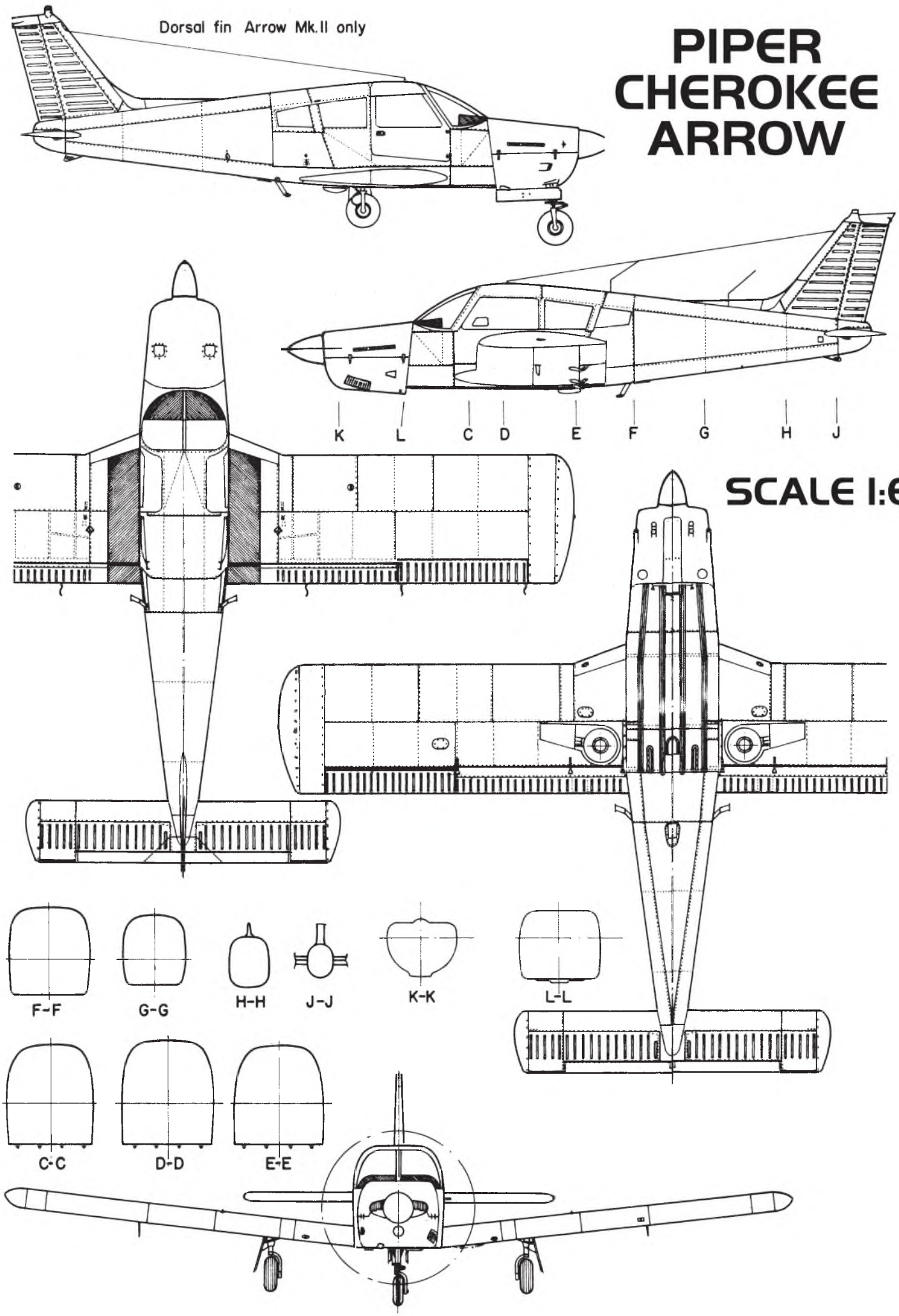




SCALE 1:60






Dorsal fin Arrow Mk.II only
PIPER
CHEROKEE
ARROW
K
L
C
D
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F
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SCALE 1:60
F-F
G-G
H-H
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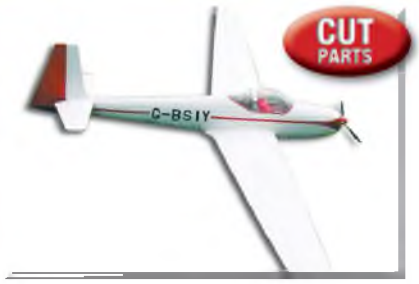
K-K
L-L
C-C
D-D
E-E

PLANS AND PARTS

BE READY TO START BUILDING AS SOON AS YOU UNFOLD THE PLANS WITH THESE LASER-CUT PARTS SETS

Cliff Charlesworth Scale Gliders



ASK 16 Motor Glider

A 1:3.5 scale replica with a wingspan of 179.9" (4570mm). Suits 1.20-1.80 cu.in. motors. Four sheet plan.

Plan: £32.50
Cut Parts: £130.00

PLAN268

Cliff Charlesworth Scale Gliders

ASK-13

1/4 scale 147.6" (3750mm) span replica of the most popular club two-seater glider and trainer in Europe, with a first class performance. Plans on two large sheets.

Plan: £24.50
Cut Parts: £135.00

PLAN4

Cliff Charlesworth Scale Gliders

DFS Reiher II

1/4 scale replica of the famous pre-WW2 vintage gull-wing German sailplane. This is one for the enthusiast who loves building. Three large sheet plan.

Plan: £28.50
Cut Parts: £135.00

PLAN158

Cliff Charlesworth Scale Gliders

ASK-18

1/4 scale 157.5" (4000mm) span replica of one of the best and most elegant pre-glass fibre era club single-seater sailplanes. A great flier. Two sheet plans.

Plan: £24.50
Cut Parts: £130.00

PLAN6

Cliff Charlesworth Scale Gliders

Grunau Baby

1/4 scale superb example of the machine which is the epitome of pre-WW2 vintage open cockpit gliders. 133.5" (3390mm) wingspan. Two sheet plan.

Plan: £24.50
Cut Parts: £125.00

PLAN83

Cliff Charlesworth Scale Gliders

Hutter H-17

1/3 scale 129.9" (3300mm) span replica of a lovely vintage scale 'floater'. Light, yet tough. Two sheet plan.

Plan: £22.50
Cut Parts: £130.00

PLAN81

HOW TO ORDER: www.adhpublishing.com/shop

WHAT DO THE CUT-PARTS SETS CONTAIN?

The components, in balsa and ply that you would otherwise have to trace off the plan onto the wood and then tediously cut out prior to commencing building! Basic strip and sheet wood not included. Be ready to start building as soon as you unfold the plans!

WE CAN ARRANGE A CUT PARTS SET FOR ANY MODEL IN THE PLANS SERVICE RANGE. SO IF YOU ARE ABOUT TO EMBARK ON A NEW SCALE MODELLING PROJECT FOR OUR PLANS RANGE AND WANT TO GET A HEADSTART ON THE BUILDING PROCESS, JUST CALL TO ENQUIRE AND WE'LL DO THE REST!

PLANS POSTAGE: UK: £2.50. EUROPE: £4.00. WORLD £6.00
CARRIAGE CHARGE FOR LASER-CUT COMPONENTS SETS: UK £9.50. Europe £26.00
Shipping Note: For shipping to destinations outside the UK and Europe, you will be charged our standard flat-rate price of £49.
This covers most destinations and secures your order with us. However, we will contact you accordingly with an accurate total shipping charge prtor to dispatch and either issue a refund or a PayPal money request for the balance.

Cliff Charlesworth Scale Gliders

Kaiser Ka6E

1/4 scale 147.5" (3750mm) wingspan model of an elegant high performance sailplane. Two large sheet plan.

Plan: £24.50
Cut Parts: £125.00

PLAN220

Cliff Charlesworth Scale Gliders

Kaiser Ka-7

1/4 scale 157.5" (4000mm) wingspan model of the famous German two-seater glider. Performance is superb and simulates the full size very nicely. Plans on two large sheets.

Plan: £24.50
Cut Parts: £125.00

PLAN101

Cliff Charlesworth Scale Gliders

Kaiser Ka-8

1/4 scale 147.6" (3750mm) wingspan Class 1 scale model of the most popular Club glider. Very docile and a joy to fly. Two large sheet plans.

Plan: £24.50
Cut Parts: £125.00

PLAN98

Cliff Charlesworth Scale Gliders

MU13-D3

1/4 scale 157.5" (4000mm) span, super lightweight model of the famous German Soarer. Three sheet plan.

Plan: £26.50
Cut Parts: £125.00

PLAN125

Cliff Charlesworth Scale Gliders

Lo 100

1/4 scale 98.4" (2500mm) span model of a famous aerobatic sailplane. Two sheet plan.

Plan: £22.50
Cut Parts: £125.00

PLAN217

Cliff Charlesworth Scale Gliders

Olympia 2B (DFS Meiser)

1/4 scale 147.6" (3750mm) span of a really lovely soarer of the pre-glass fibre 'hotship' era. Two large sheet plans.

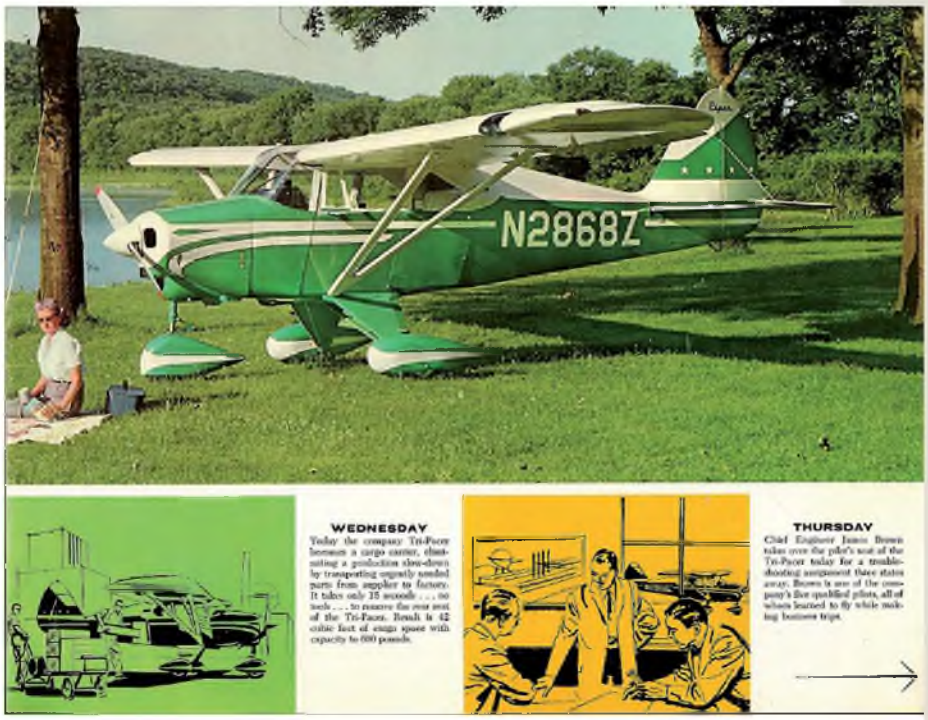
Plan: £22.50
Cut Parts: £145.00

PLAN139

TEL: 01525 222573 **FAX:** 01525 222574

The ëshort wingí Pipers

A brief history of the post-war Pipers that spawned the PA-22 Tri-Pacer



Just after the second world war, Piper Aircraft were in dire need of a replacement for the venerable old *Piper J-3 Cub*, The introduction of the PA-15 *Vagabond* in 1948 marked the start of a series of aircraft commonly know as 'Short Wing' Pipers. The J-3's wing was clipped by about 6ft, giving a span of just under 30ft, and a new wider fuselage was constructed featuring side-by-side seating for two. The *Vagabond* was economical to produce and became an instant success. It is credited with saving Piper from bankruptcy.

Following on from the *Vagabond* in

ABOVE: An enticing scene from a 1958 Piper Aircraft sales brochure. This Piper Tri-Pacer is finished in Santa Fe Red and Daytona white.

LEFT: Colour schemes and patterns got flashier as the 1950's drew to a close. This 1960 Piper Tri-Pacer is finished in Montego Green and Daytona White, and marks the final year of production. Wheel spats were offered as an option on Pipers at an extra cost.

1949, was the short-lived PA-16 *Clipper*. This was a stretched and refined version of the *Vagabond*, intended to seat four people. Powerplant was the 116hp Lycoming 0-235, and there was an extra wing tank, as well as a rear door to accommodate the rear seating. Interestingly, Pan Am Airlines, who traditionally called their luxury airliners 'Clippers' took offence at Piper using the name for their light aircaft! As a result of this pressure, Piper further refined the model, adding flaps, more fuel tankage and a more powerful 125hp engine, thus the *'Pacer'* was born.

The PA-20 *Pacer*, introduced in 1950 was available with 125hp, 135hp and 150hp engines, and was prized for its rugedness, spacious cabin, and at the time impressive speed and load carrying capability. The *Pacer* was disconinued in 1954.

To help introduce more pilots to easier, safer flying, Piper introduced the PA-22 *Tri-Pacer* in 1951. It was a straightforward development of the four-seat, tail dragging *Pacer*. The *Tri-Pacer* had more powerful engine options, and this, coupled with its easier ground handling meant that it was a much more popular seller than the *Pacer*. Its stalky-looking undercarriage arrangement earned it the affectionate nick-name of 'The Flying Milkstool'. At the time, the 'trike' was very popular, and in 1953, the *Tri-Pacer* outsold the *Pacer* by a ratio of six to one. A novel feature of the *Tri-Pacer* was its bungee linked control system. This effectively linked the ailerons to the rudder, simplifying the co-ordinatioin of inflight manuevres. This system, which could be overridden, led to Piper offering a basic form of autopilot as an option, called 'Auto-Control'. The *Tri-Pacer* is regarded as being a solid, easy-to-fly aircraft, and can be readily trimmed to fly hands-off enabling the pilot to sit back and watch the scenery go by.

A total of 7,629 *Tri-Pacers* were built in its near 10 year production run, price in 1956 was $7,295. Typical flight statistics for a 150hp model are; cruise 132mph, max speed 139mph, stall speed 49mph. Typical fuel burn is 9 gallons per hour, and range is 528 miles with 36 gallon tanks. Interestingly, although the *Tri-Pacer* was far more popular than the *Pacer*, many *Tri-Pacers* have laterly been converted to the tail-dragger configuration of the *Pacer*. It seems many people like the tradition of a tail-dragger, and prefer the sleeker look it imparts.

Production of the PA-22 *Tri-Pacer* finished in August 1960. However there were a couple of spin-offs produced in the last few years of production. The PA-22-150 *Carribean*, a cheaper, less well equiped version of the Tri-Pacer. And a two-seat trainer version, the PA-22-108 *Colt* was introduced, this had a lower power 108hp engine, but shared many of the *Tri-Pacer's* components.

Probably the most unusual *Tri-Pacers* were the seven aircraft supplied to the Cuban Army Air Force between 1953 and 1955. During the Cuban revolution these aircraft had their rear doors removed and a 0.30 calibre machine gun was installed in place of the rear seat, effectively turning the humble *Tri-Pacer* into a mini-gunship! Hand-dropped grenades could also be used against insurgents.

The PA-22 was the final 'short wing' Piper, and last of a long line of famous fabric covered Pipers, They were superseded in the early sixties by the all-metal Piper *Cherokee*.

Just like the auto industry in the 1950's, Piper Aircraft updated the trim and colour schemes for its aircraft every year. Towards the end of the 1950's the *Tri-Pacer* was starting to look a little long in the tooth, the striking fuselage graphics went some way to disguising this. The Butyrate dope colours used were vibrant and fresh, with evocative names like, Daytona White, Cadilac Red, Montego Green and Pasadena Rose. ■

Piper adverts from 1955 and 1956. The 1956 style decoration on the right is the same as that applied to my model featured in this magazine.

PIPER PA-22 TRIPACER

Richard Crossley presents his Indoor Scale 1/17th scale design for radio control or free flight

Although my main modelling interest is indoor free flight scale, I have grown up flying radio control too, so when I learnt that a radio control class was to be flown at the annual Indoor Scale Nationals at Nottingham University I just had to have a go. The new class will consist of a flying section and a static section - to be judged to the same static rules as the free flight event.

The flying section will consist of a number of manoeuvres that are performed in front of judges, and although the manoeuvres are not particularly demanding on their own, its a real challenge to string them all together smoothly without making any mistakes, especially when the judges are watching.

So I set about looking for an ideal model for the new class. My main consideration was to build something that I liked but that would also have enough wing area to carry the extra weight of a radio system and still be stable, yet easy to control with rudder and elevator. The Piper Tri-Pacer is ideal - it has an unusually low aspect ratio wing of very generous area, which is helpful in keeping the wing loading and flying speed low. Also, many survive, which is great for the static documentation as there

The finished colour scheme is Daytona White and Cadilac Red, and represents a 1956 aircraft that is in restored condition. The colours are airbrushed Humbol Enamels, and all masking is done with yellow low-tack 'Frog Tape' available from DIY outlets in the UK.

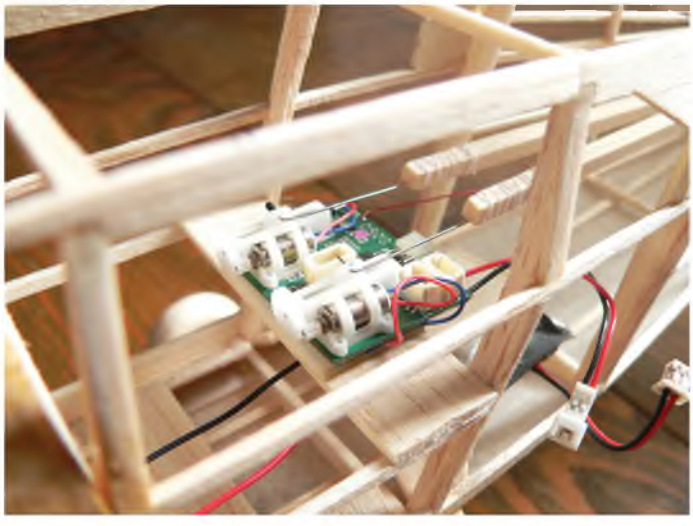
are lots of colour schemes and photos to choose from on the internet. Some of the original 1950s colour schemes are superb.

BUILDING

This is an easy model to build. It is conventional in layout and the structure will not prove taxing for the average modeller. I have set it up with a generous 3 degrees of incidence, which makes it a lovely stable performer with dihedral slightly increased from scale, mainly to improve the effectiveness of the rudder. Much information is listed on the plan, but I will run you through the build just in case anything is not clear. You may choose to make a copy of the plan and printwood patterns at your local copy shop. If you do this, do check to make sure there is no distortion on the printouts. Using spraymount or similar adhesive, glue the paper templates to suitable lightweight balsa sheet. Careful wood selection is the key to keep the weight down. If you are building this model for radio control, don't fall into the trap of thinking you can afford to be less fussy about weight control than a free flight model. Things like pushrods and receiver mounting plates can be very light balsa, there is no need to build extra strength into the model. Cut out all of the parts before starting construction. For the wing ribs, I usually make a simple ply

The basic fusealge after construction. Note the sheet in-fill between the stringers around the nose. You can alo just see the way the rear upper side stringer joins rear of the window. The wheels are simple, having printed paper hubs for detail.

Wings employ a scale rib spacing and slightly increased dihedral. The strut anchor plates are from light 1/16" sheet balsa. This picture was taken before I cut out the cowl hatch.



The Spektrum AR6400 combined RX/Servos/ESC unit weighs in at 4.9 grams. mounted this on a 1/16" balsa platform using servo tape. At this early stage I had the battery located behind the RX unit, (just visible in this picture). I later moved the cell forward under the cowl hatch. The pushrods are made up from your lightest 1/8" square balsa, with 0.45mm dia. piano wire ends.

The control horns are made from 1/64" ply sheet. The end of the wire pushrod is simply held in place with sleeving cut from fine electical wire, fixed with a tiny dot of cyano

template and use this as guide to cut around. This saves time, as well as ensuring all ribs are pretty much identical. You can then pin together the 'block' of ribs and cut the notches using a modellers file.

FUSELAGE

This is a basic box structure - build the fuselage sides directly over the plan (note that this structure is shown shaded grey). The cabin uprights are from slightly wider wood, and the rear window surround and wing support are from sheet balsa. Pin each side of the 1/16" strips, never through them. Glue the joints with your favourite adhesive as you go (I like good old fashioned balsa cement). Once dry remove from the plan and build the other identical fuselage side. Make up the two formers 'F1' and 'F2' directly over the plan. When dry, remove from the plan and glue into position on one of the fuselage sides. Note that you will have to crack the joints slightly at the window sill level to form the correct angle. Cut another pair of 'F1'uprights and glue these into the position in the fuselage sides as noted on the plan (between F1 and F2). Crack the longerons inwards at the F2 position (see top view). Now join the sides together, and when dry, pull the rear of the fuselage sides together, glue and hold together with a clothes peg whilst the glue dries. Check that everything is nice and square and that the fuselage is not curved when viewed from above. Make up the nose section from parts N1 - N4, this can be done in the hand as the parts interlock. Again, crack the longerons (at the F1 position, see top view) and pull the nose together slightly, gluing the longeron extensions into the notches in N3, before adding the dash at the correct angle..

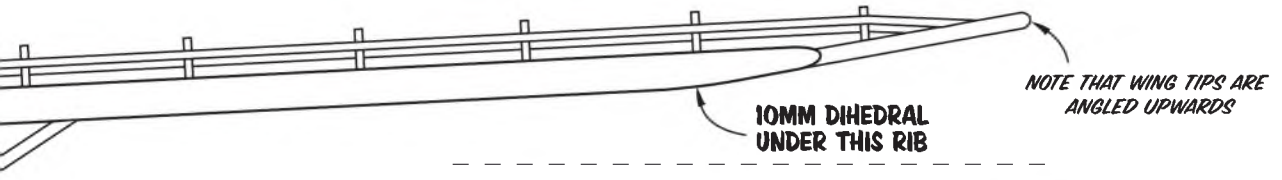
Cut all of the 1/16" square cross members to length, using the plan top-view as a guide and glue in place. Undercarriage next - cut to shape and sand the main 1/16" balsa U/C legs and glue into position to the inside of the lower fuselage longerons. Note that you will need to chamfer the lower corners of the longerons where the legs touch. It is a good idea to temporarily brace the legs whilst the glue dries. Now glue in place the two 1/16" balsa 'webs' as shown on the plan. This will form a strong assembly. The wire axle can be bent to shape now and epoxied into position. Note that it is best to cut a notch at the end of the balsa legs for the wire to engage before gluing firmly.

The nose leg is bent up as shown on the plan, with a dog-leg at the top so that it can be fixed to a 1/16" sheet balsa platform that is offset to one side of N4, I would recommend that this unit is 'torsion sprung', with the wire running in thin aluminium tubes.

If you are building your model to fly using radio control, now is the time to install the RX unit. I made a couple of 1/16" balsa bearers and mounted the unit to a sheet of 1/16" sheet with servo tape. Lightly wrap some cling film around the unit to protect it from balsa dust as you progress the build.

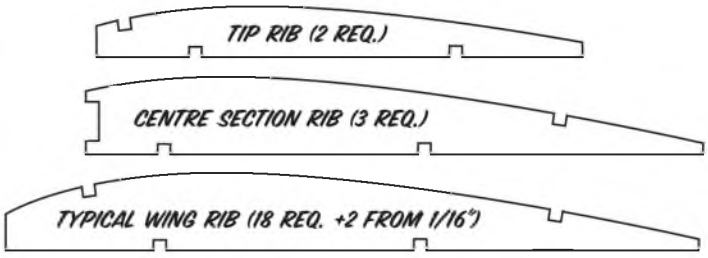
Lightly tack in place the 2 remaining cowl formers N5 and N6 that make up the edges of the removable hatch. Add the stringers to the cowl and when dry in-fill in the gaps between the stringers with 1/16" sheet balsa. Add the two lower stringers and the 'spine' from light 1/16" sheet.

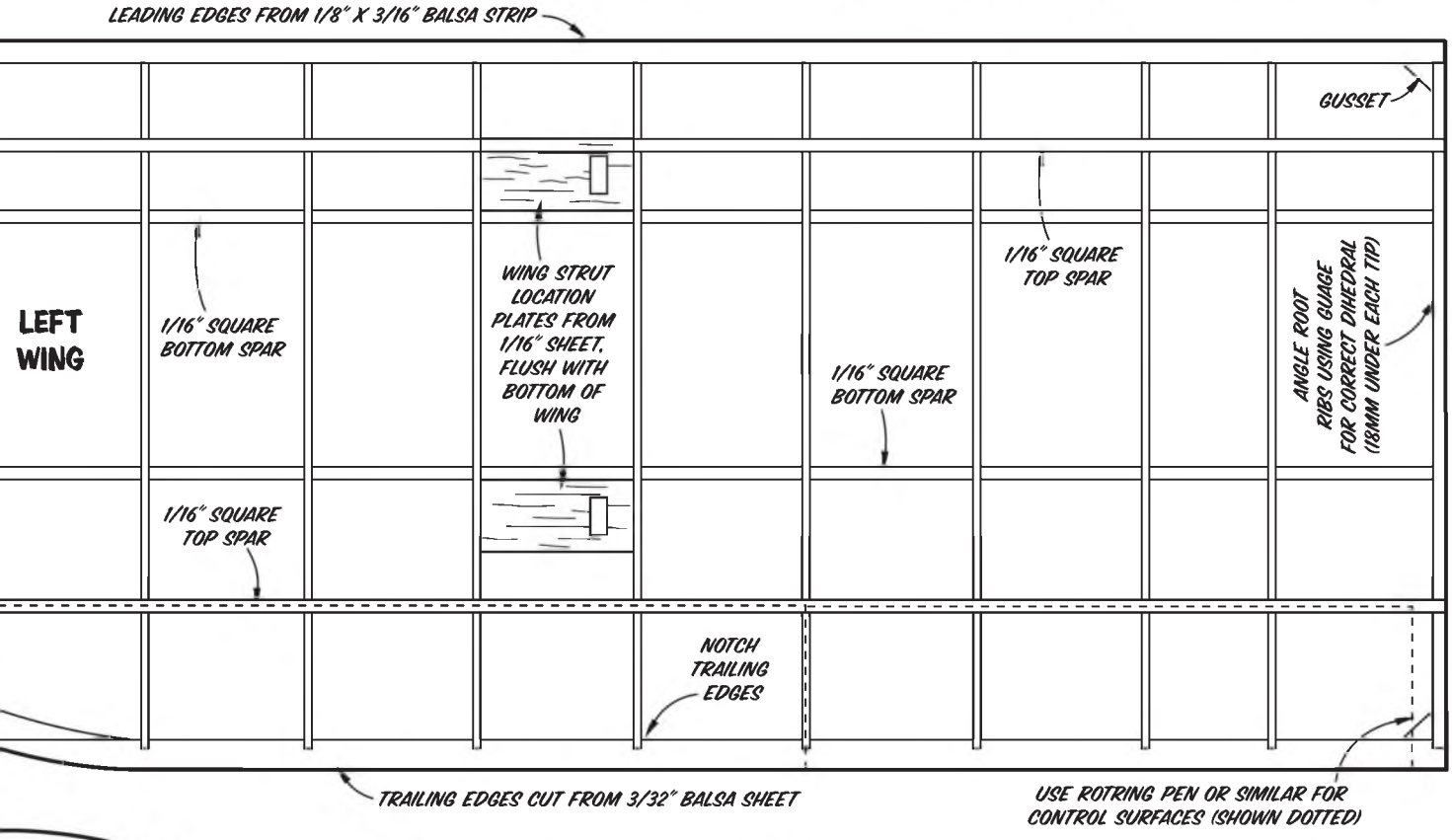
Complete the basic fuselage structure by adding the two stringers to the rear of the fuselage sides. Bear with me here, this is a little tricky to describe - The upper of the two side stringers bisects part 'FX': Cut

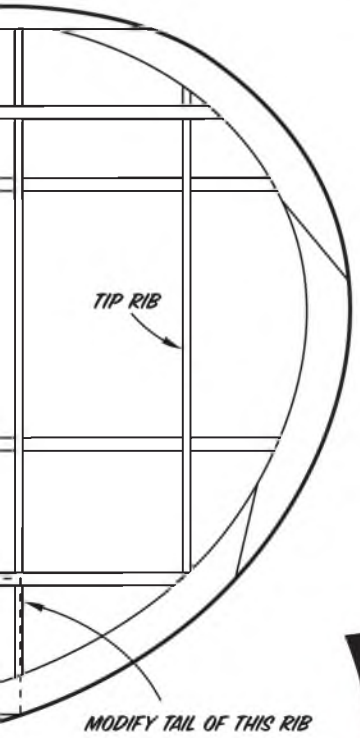


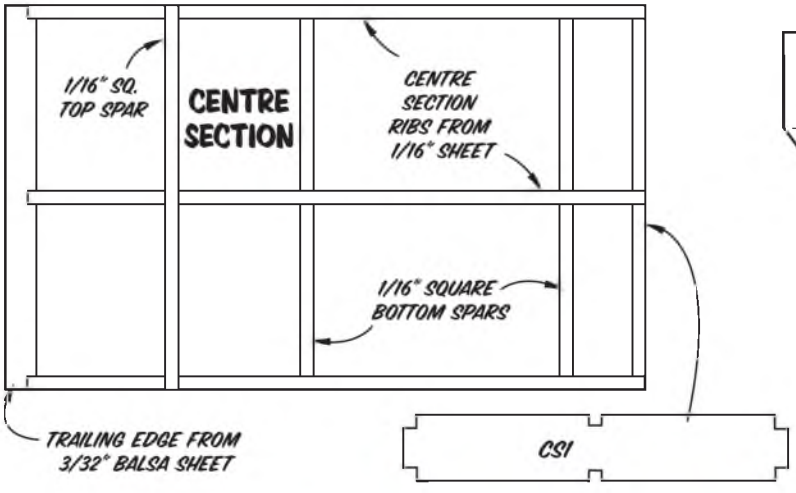
COVERING THE WINGS:

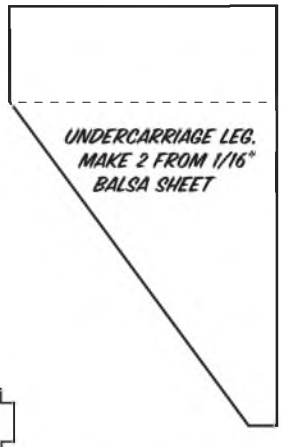
TO KEEP THE WEIGHT DOWN, THE WING RIBS ARE 1/32" SHEET BALSA. WHEN COVERING, BE SURE TO APPLY TISSUE PASTE TO ALL RIBS. THIS WILL MAKE FOR A STRONG WING, AND PREVENT THE RIBS DISTORTING WHEN THE TISSUE IS SHRUNK AND DOPED.











RUBBER:
THIS MODEL WOULD FLY WELL USING RUBBER POWER. THE COWL AND NOSEBLOCK WILL NEEDADAPTING.

SHEET 2 OF 2

PIPER PA-22 Tri-Pacer

An accurate 21" span model designed for indoor R/C fun or competition. Also suitable for free flight electric, or even conversion to rubber power

DESIGNED AND DRAWN BY

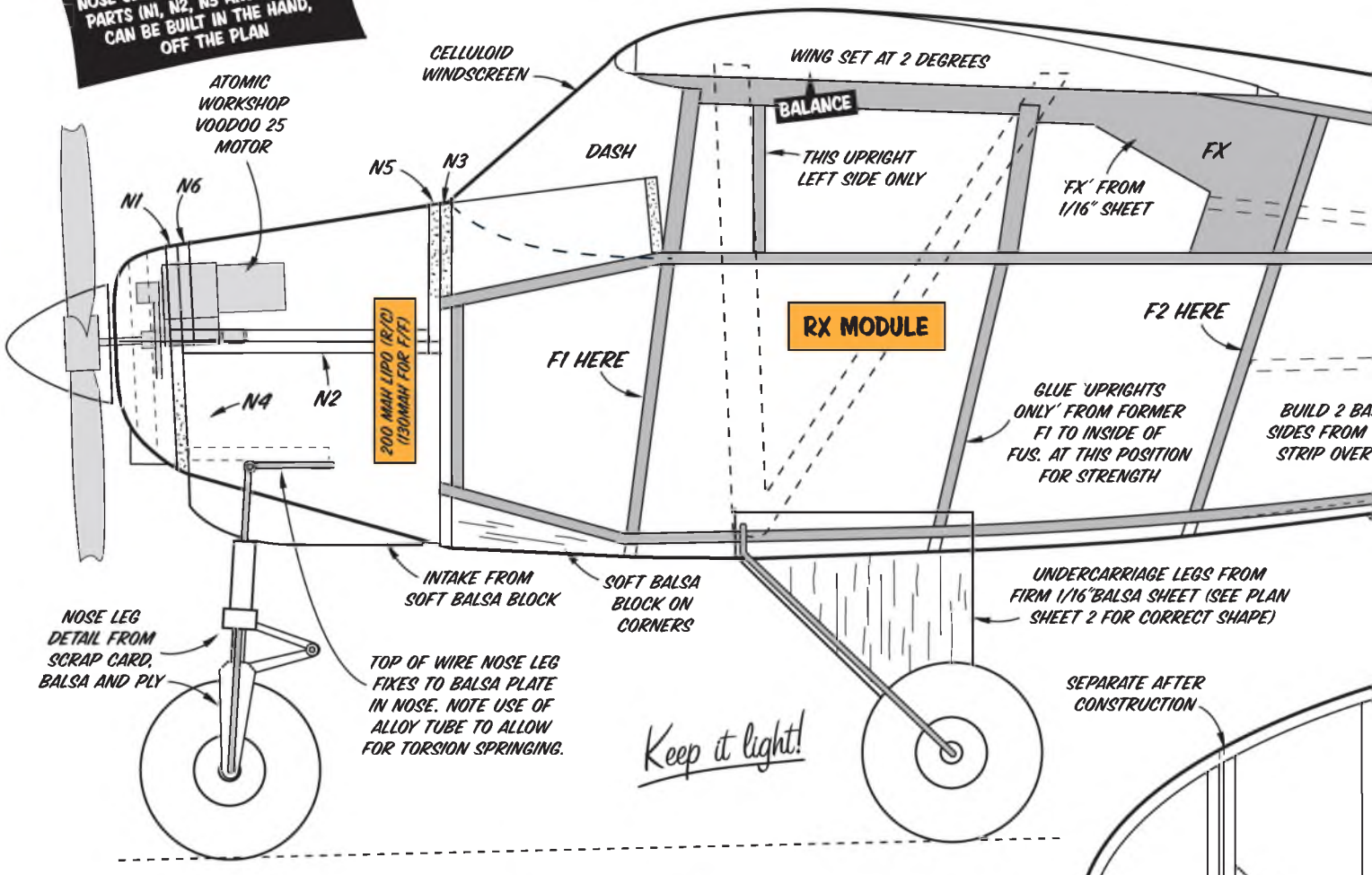
Richard Crossley

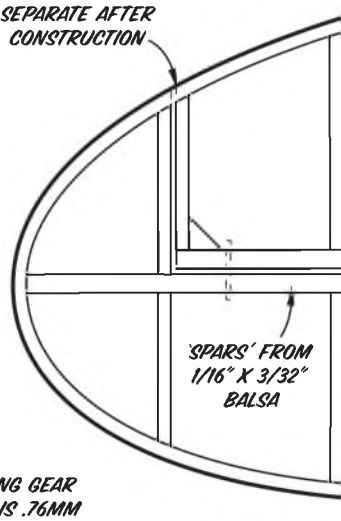
Piper

ENGINE HATCH

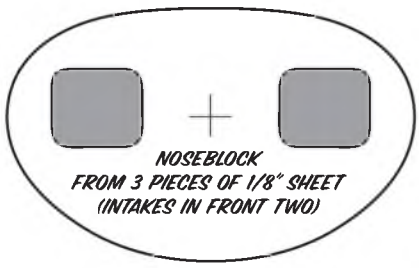
YOU WILL NEED EASY ACCESS TO UNPLUG THE LIPO CELL AS THERE IS NO ON/OFF SWITCH. THE TOP OF THE ENGINE COWL IS DESIGNED TO BE DETACHABLE, SEPERATING ABOVE N2. SEE MODEL PHOTOS FOR MORE DETAILS

NOSE SECTION HAS INTERLOCKING PARTS (N1, N2, N3 AND N4) AND CAN BE BUILT IN THE HAND, OFF THE PLAN





SET UP ENGINE WITH 2 DEGREES SIDE THRUST AND 2 DEGREES DOWN THRUST



PIPER COLT CONVERSION

THE PIPER COLT WAS A LOWER POWERED, 2-SEAT VERSION OF THE 4-SEAT TRI-PACER. TO BUILD YOUR MODEL AS A COLT YOU WILL NEED TO MAKE THE FOLLOWING MINOR CHANGES TO THE FUSELAGE: DELETE THE 2 REAR SIDE STRINGERS (SHOWN DOTTED ON PLAN). DELETE THE 2 REAR 1/4-WINDOWS. LASTLY, THE SLIGHTLY CURVED 'SPINE' SHOWN ON THE PLAN SHOULD BE STRAIGHT.

1/16" SCRAP GUSSETS WHERE SHOWN

LAMINATED BALSA OUTLINES FROM 2 OR 3 STRIPS OF 1/32" X 1/16"

FIN

RUDDER

CONTROL HORNS FROM 1/64" PLY

SPINE FROM 1/16" SHEET

FAIRING FROM 1/16" SHEET

'SPARS' FROM 1/16" X 3/32" BALSA

'RIBS' FROM 1/16" SQ. BALSA

1/16" BALSA SHEET

TAILPLANE POSITION (-1 DEGREES)

TAPER STRINGER TO STOP HERE

1/16" STRINGERS

RUDDER HORN RIGHT SIDE

SIC FUSELAGE 1/16" SQ. BALSA SHADED LINES

2 UNDERSIDE STRINGERS STOP HERE

2 STRINGERS UNDER FUSELAGE

TARGET FLYING WEIGHTS:
FREE FLIGHT - 42 GRAMS
RADIO CONTROL - 49 GRAMS

F1

MAKE UP FORMERS F1 AND F2 DIRECTLY OVER THE PLAN FROM 1/16" BALSA.

IT IS IMPORTANT TO USE HARD BALSA ON THE UPRIGHT SECTIONS OF F1. CUT AN EXTRA SET OF UPRIGHTS AND GLUE THESE TO THE INSIDE OF THE FUSELAGE SIDES AT POSITION MARKED ON PLAN - TRIM ENDS TO FIT.

LAMINATED BALSA OUTLINES FROM 2 OR 3 STRIPS OF 1/32" X 1/16"

TAILPLANE

1/16" BALSA SHEET

'RIBS' FROM 1/16" SQ. BALSA

THIN WIRE JOINER

ELEVATOR

ELEVATOR HORN LEFT SIDE

LAP ALL JOINTS ON F1 AND F2

F2

USE LIGHT WOOD FOR F2.

REAR SIDE STRINGERS IMPART A CURVE TO THE SIDES OF THE FUSELAGE (NOT SHOWN FOR CLARITY)

CROSS BRACES TOP AND BOTTOM. FROM 1/16" SQ.

2 UNDERSIDE STRINGERS STOP HERE

VE INTO POSTION

SHEET 1 OF 2

PIPER PA-22 Tri-Pacer

An accurate 21" span model desi
for indoor R/C fun or competiti
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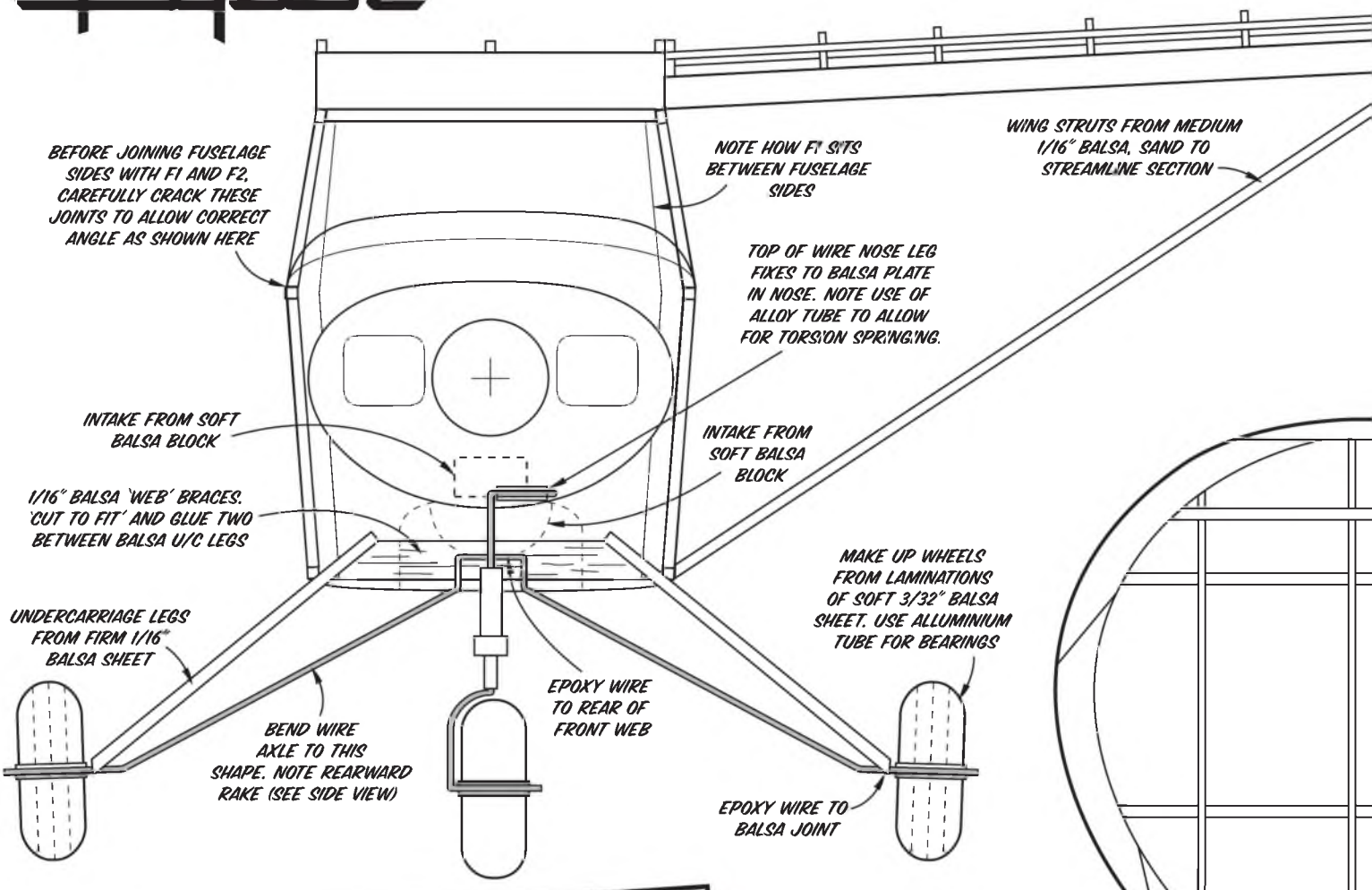
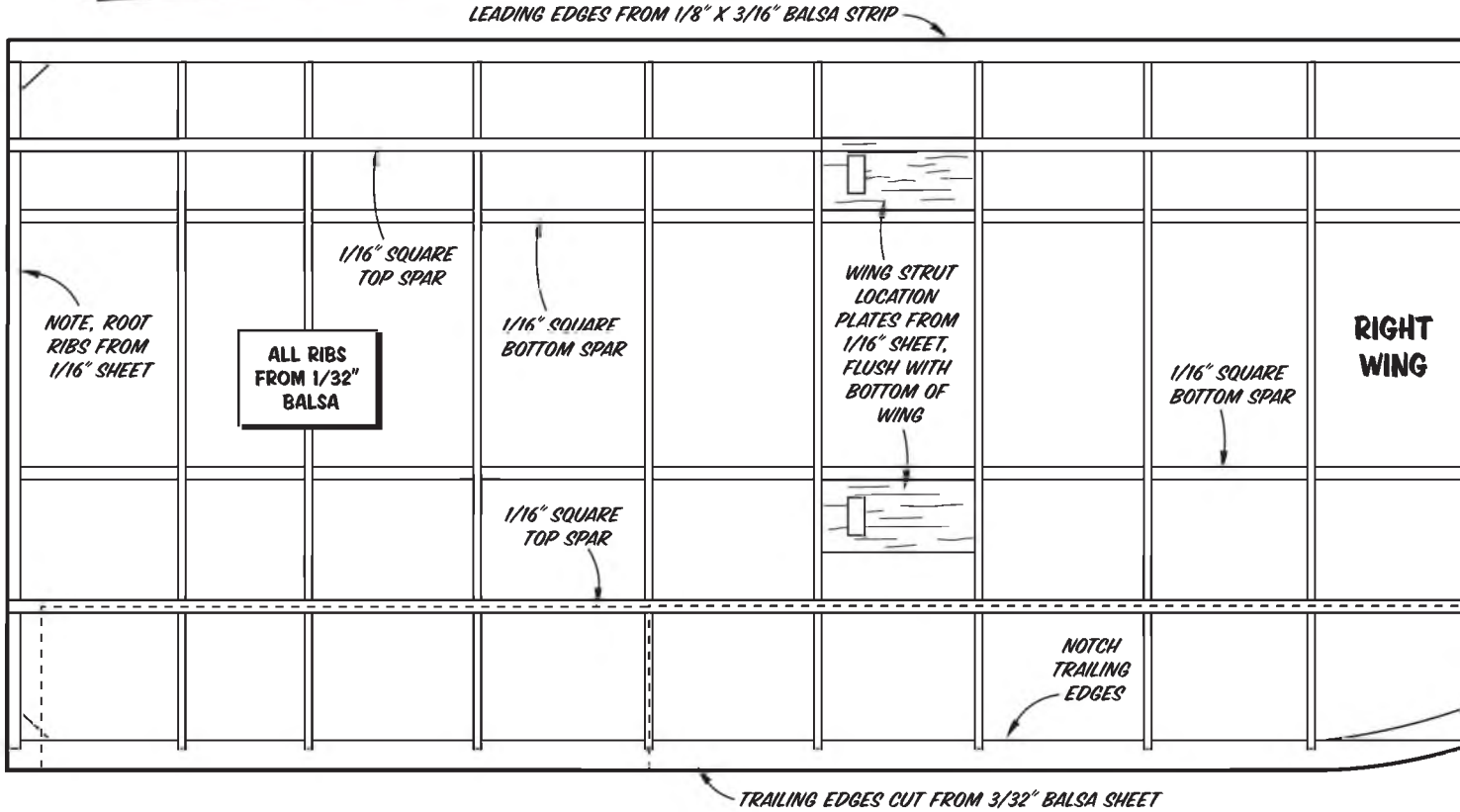


NOTE:
WITH THE INCIDENCE ANGLES SHOWN, THE MODEL WILL LIFT OFF WITH A LIGHT PULL BACK ON THE 'STICK' WHEN FLOWN R/C. FOR A FREE FLIGHT MODEL IT MAY BE NECESSARY TO INCREASE THE LENGTH OF THE NOSELEG BY 1/16" TO ALLOW THE MODEL TO FLY ITSELF OFF THE GROUND.



through 'FX' on the dashed stringer line shown on the plan, and remove the 1/16" wide strip of balsa. Glue the 1/16" sq. upper side stringer in place noting that it tapers to the rear. Now pull 'FX' up to and glue to the stringer. This will form a very shallow 'V' shape to the rear edge of the side window, giving extra rear seat shoulder room on the real aircraft. The lower of these 2 side stringers glues against the rear and front faces of the relevant fuselage uprights, this imparts a curve to the stringer. Sandpaper the entire structure, paying attention to the cowl, ensuring nice smooth curves. When dry carefully cut out the cowl hatch. I also included a small section of the nose block over the prop so that I could remove the engine if required (see photos of model). Make a 1/32" ply engine mount for the Voodoo 25 motor, and install the motor with two degrees right thrust and two degrees down thrust.

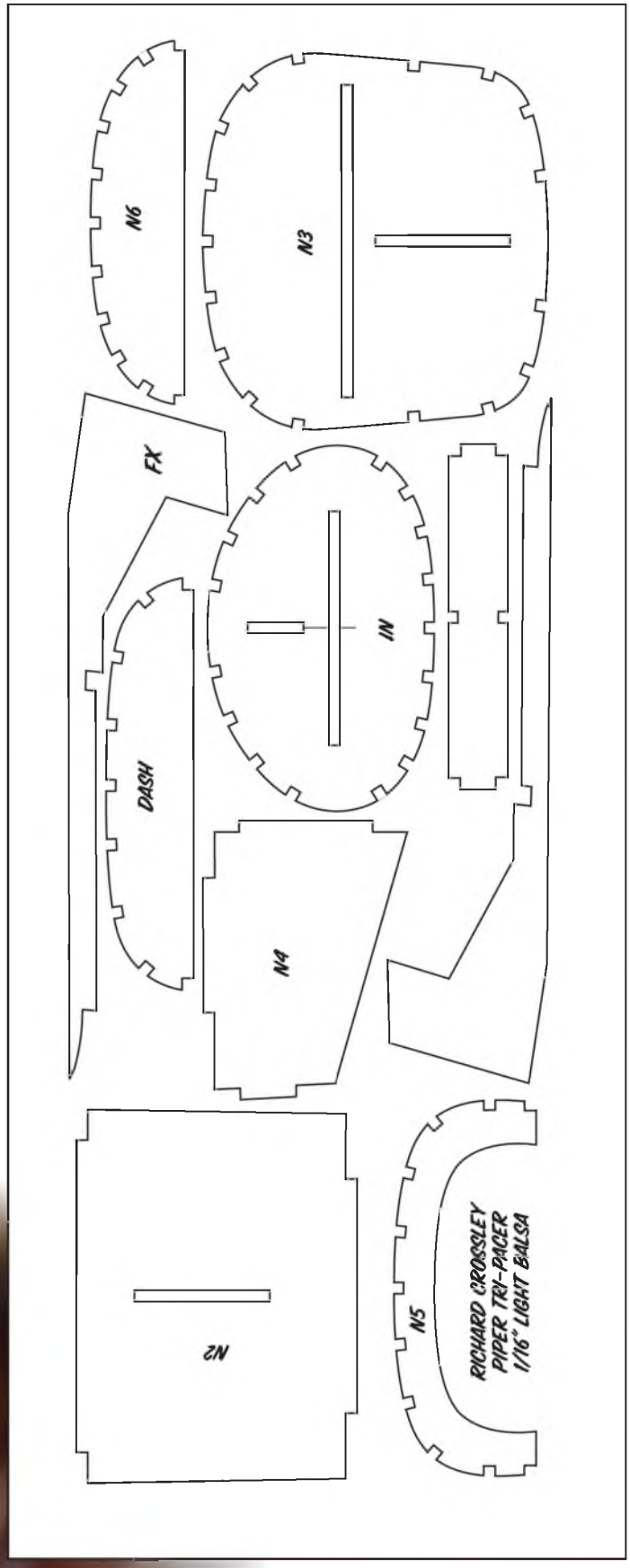
WINGS & TAILS

The wings are built directly over the plan in the normal manner. Build the right wing first. Note that the trailing edges are notched to accept the wing ribs. It is a good idea to carve and sand the trailing edge to a tapered section before building the wing, as this will prevent the risk of 'snagging' the ribs once the wing is built.

The wing tips are angled upwards, so these should be assembled over the plan from 3/32" sheet parts. When dry, remove from plan. Pin in place the leading and trailing edges, then glue in place the assembled wing tips, propping them up under the extreme tip (see front view of wing on Plan 2). Now ad all of the wing ribs, noting that the root rib is angled slightly, and that the Tip Rib is raised off the building board. Glue the 1/16" square top spars into the notches in the ribs. When dry remove the wing from the building board and add the lower 1/16" square spars, the strut plates and the gussets at the root rib position.

Build the centre section over the plan in a similar manner to the wings, noting that the front piece 'CS' is cut from the pattern on the plan. Join the wing panels to the centre section, being careful to obtain the correct dihedral shown on the plan.

The tailplane and fin are built up over the plan from strips of medium density 1/16" square balsa. Note that the outlines are best (lightest) laminated up from strips of 1/32" x 1/16" balsa. This is quite easy to do, and well worth the effort. Soak the wood strips, and then glue them together with white glue, and whilst still wet, bend and pin them around a waxed balsa former. When set, pin them into position on the plan and build up the tails in the normal manner. Don't forget the wire joiner on the elevators, bent from the thinnest wire, and also the



Left: the appearance of my model was greatly enhanced with this little chap. I carved him from white extruded foam and painted him with artists oil paints.

Most Tri-Pacers do not feature wing codes. There are plenty of colour schemes to choose from, and hundreds of photographs can be found on the internet. You can see that my model flies with some 'up' trim on the elevator.

larger gussets that act as a base to glue the control horns to.

RADIO INSTALLATION

Pushrods can be made from the very lightest 1/8" sq. balsa strip. Wire ends are then bent to shape and bound to the rods with thread and balsa cement. Leave the wire ends over-length until the tails are assembled to the fuselage. Use thin wire, typically about 0.45mm dia. You can also use very thin carbon tube for the pushrods (1mm dia. external, 0.5mm dia. internal) this is very light and easy to use, and the wire can be cyanoed into the ends.

I used a 200mAh Lipo cell installed under the cowl. There is no on/off switch, the cell is simply disconnected and removed for charging. A 130mAh cell would suffice for shorter flight sand is 1.5g lighter. Make up a small pouch for the cell from 1/16" sheet balsa and fix in place under the cowl. Before covering test the radio gear to make sure everything works as it should, as you will not have direct access once the model is finished.

I printed the Piper logo on my laser printer. The paper panel was cut out and the white edges of the paper touched in with a red felt pen and glued in place with spray glue. This looks effective and the slight miss-match in the red tones does not notice once fixed in place.

COVERING AND ASSEMBLY

Carefully sandpaper the entire airframe with medium and then fine paper. When you are happy, cover the model with lightweight *Esaki* jap tissue. For tissue paste I use *'Solvite Border Adhesive'* which is obtainable from DIY shops, and the large bottle contains enough paste for dozens of models, so it is quite cost effective. At this stage, cover the top of the rear fuselage from the rear of the wing back (you may prefer to glue in place a couple of balsa supports across the fuselage at the TE position to anchor the tissue to). When covering the wings and tails, always apply tissue paste to every rib as well as around the edges, This will go a long way to preventing warps, and will greatly increase the strength. Full size fabric covered aircraft use this practice - the fabric being stitched to each rib.

Water shrink the tissue. Be especially careful to avoid warps in the tailplane and fin: I prefer to hold these parts over a steaming kettle, if you do this a couple of times the tissue will shrink just enough without warping the structure. Apply a couple of coats of thinned cellulose dope or banana oil to the tissue. Hinge the elevators and rudder using very thin strips of mylar, or short lengths of fishing line. The control surfaces need to move very freely. Glue in place the tailplane and the fin, hinging the lower part of the fin to the fuselage stern.

Study photos of Tri-Pacers and add any small details that you desire - foot step on U/C leg, exhaust pipe, aerials, nav lights etc.

Now is the time to spray the model if that is your intention. I use humbrol enamel paints, thinned with cellulose thinners. I tried a masking tape called 'Frog Tape' for the first time. This is available from DIY outlets, and gives superb results. Go for the yellow 'low tack' variety. I found the *Frog* tape gave really sharp masked edges with no bleed.

Next glue the wing into position, and when dry add the acetate side windows and windscreen. Use paper templates until you are happy with the shape and then transfer them to acetate. Add the remaining section of 'spine' that sits on top of the wing, then cover this section before painting.

Wheels: the wheels are made up from laminations of soft balsa sheet as shown on the plan. A 'circle cutter' is invaluable for cutting out the wheels parts. Sand to shape, apply a couple of coats of dope to seal them, then epoxy in place the aluminium tube axles. I drew up the hubs on my computer and printed them out. After cutting with the trusty circle cutter these were then applied to the black painted wheels using spray adhesive. This is a simple but effective method of getting a neat pair of wheels. Use the outer plastic stripped from thin electrical wire to hold the wheels in place.

Struts: these are all made from firm 1/16" balsa strip, cut to the right width and then sanded and sealed with dope. Fix in place to the lower fuselage and into the holes in the strut plates in the wing and then paint. Note the rigging on the tailplane/fin.

FLYING

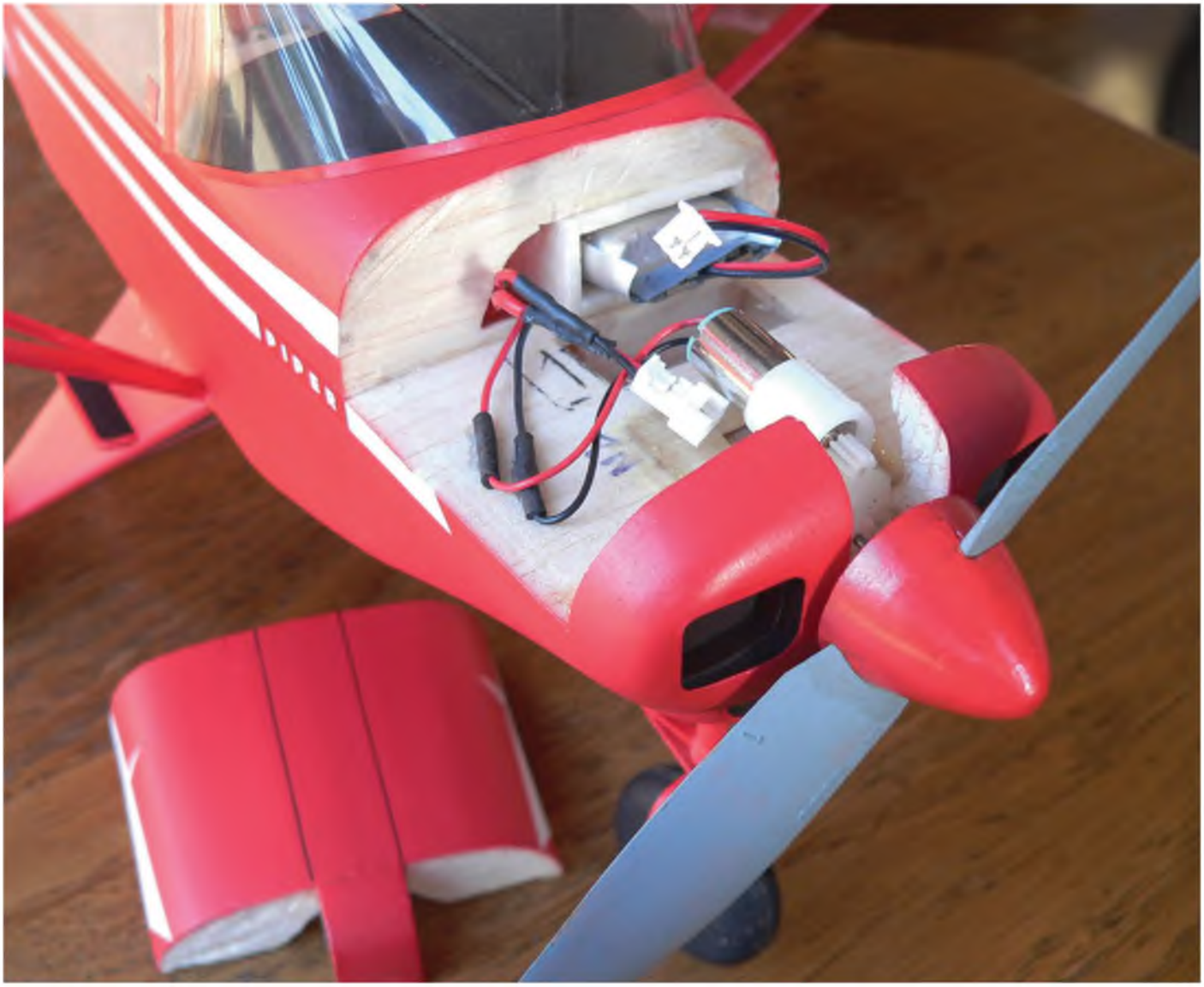
Before you start, check that the balance position is close to that shown on the plan.

This model flies superbly, just like a basic trainer in fact. The elevator is powerful, so its a good idea to limit the throw initially until you are familiar with the flying characteristics. The model takes off very realistically, full rudder is needed initially due to torque, until the model is moving and the rudder becomes effective. When up to take off speed a slight pull back on stick is needed to unstick. Surprisingly tight left and right turns can be effected, and the model can be made to fly quite slowly and realistically. With the *Voodoo 25* motor installed there is no chance of any aerobatics, but that's not what this model is about, its much happier stooging around in a scale-like fashion. Landings are a joy to perfect, holding the model off the deck with elevator as the speed bleeds off until the model is almost stalled at the point of touchdown will put a smile on your face when you get it right!

The final flying weight of my model is 48 grams, giving a wing loading of about 10.2g per Dm2.

I powered my model with a *Voodoo 25* electric motor, running off a single 200mAh Lipo cell, both available from *Atomic Workshop (www.atomicworkshop.co.uk).* You could use a 130mAh cell if you fancied saving a little weight.

The RX 6ch module used is a *Spektrum AR6400*, available from Robot Birds (robotbirds.com). This works fine, but I did have trouble setting this up, as the allocated 'steering' channel is through one of the onboard plugs, and not through one of the two built-in servos. This is fine if you are flying using ailerons with a separate plug-in servo, but very annoying if you require a 3ch set-up as the rudder will be on the wrong stick on your transmitter! I did manage to get around this after a lot of head scratching by using the 'mix' function between rudder and ailerons on the TX, and allocating all of the travel to the required stick. I think an easier option may be to try the 'Vapor' unit from Micron Radio Control *(www.micronradiocontrol.co.uk)*, this is simply a 3ch unit, so should work fine, and its slightly lighter too. ■



With the engine cowl removed you have full access to the cell and engine. There is no on/off switch, the battery is just unplugged when not in use. The cut out section at the top just behind the spinner allows the engine to be withdrawn easily. The Voodoo 25 motor comes complete with prop. The spinner ins made up of balsa discs, then sanded to shape. It needs to be cut up and fitted around the prop.

Tri-Pacer

A DECADE OF COLOUR

Factory Butyrate dope external colours and patterns used on the PA-22, 1951 to 1960

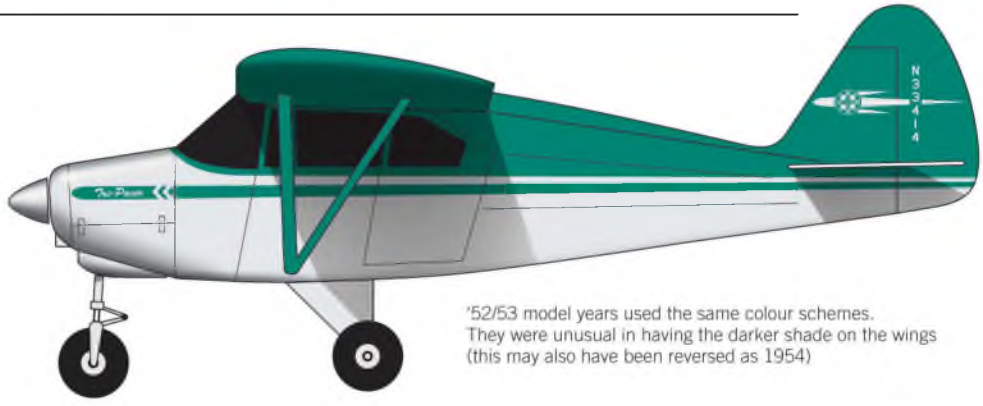
1951

Polar Grey and Tennessee Red

1952 & 1953

Polar Grey and Tennessee Red

Polar Grey and Sacremento Green



'52/53 model years used the same colour schemes. They were unusual in having the darker shade on the wings (this may also have been reversed as 1954)

1954

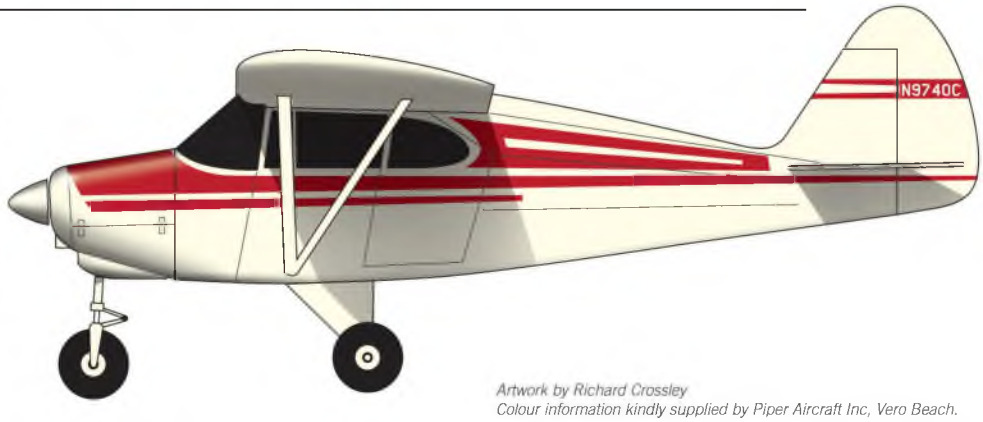
Forest City Green and Tampico Green

1955

Sun Valley Ivory and Tennessee Red

Sun Valley Ivory and Miami Blue

Sun Valley Ivory and Forest Green



Artwork by Richard Crossley
Colour information kindly supplied by Piper Aircraft Inc, Vero Beach.

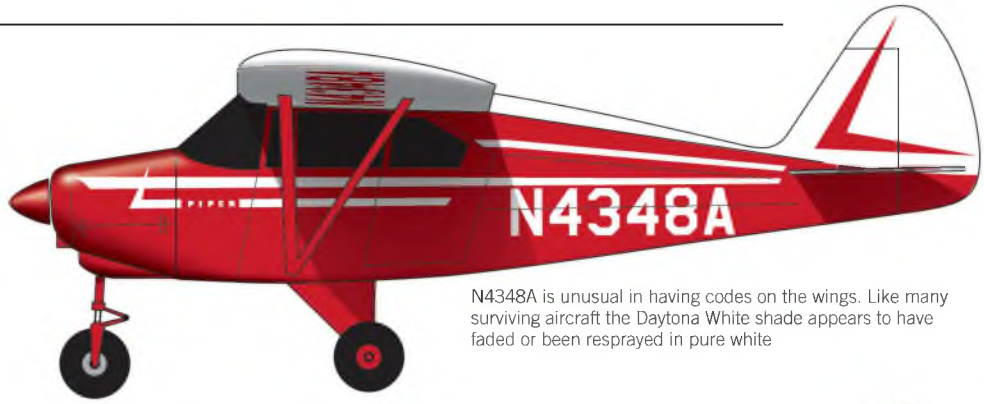
Optional colours available at extra cost over the years:

Adrondak Gray, Lock Haven Yellow, Boston Maroon, Hickory Brown, Pasadena Rose, Phoenix Tan, Portland Green, El Paso Brown (metallic), Tampa Green (metallic), Newport Blue (metallic), Juneau White, Lemon Yellow, Cream Yellow, Sportsman Biege, Tuscon Cream, Boston Maroon,

1956

Daytona White and Cadilac Red

Daytona White and Key West Blue

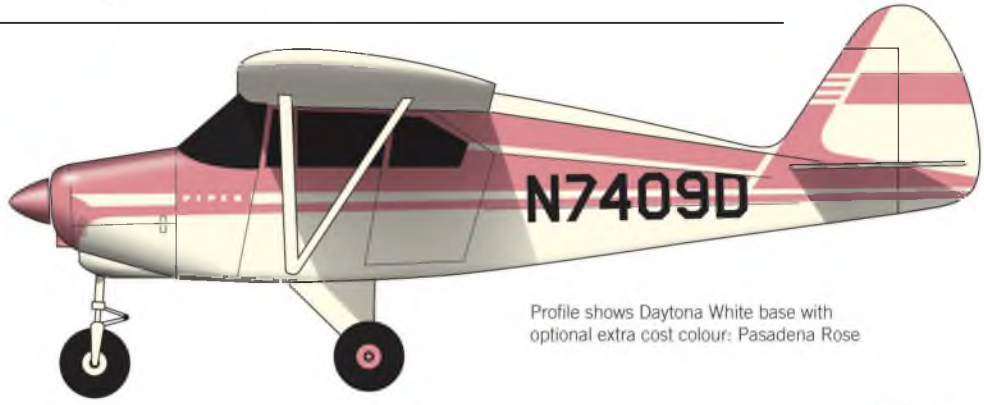


N4348A is unusual in having codes on the wings. Like many surviving aircraft the Daytona White shade appears to have faded or been resprayed in pure white

1957

Daytona White and Cadilac Red

Daytona White and Key West Blue



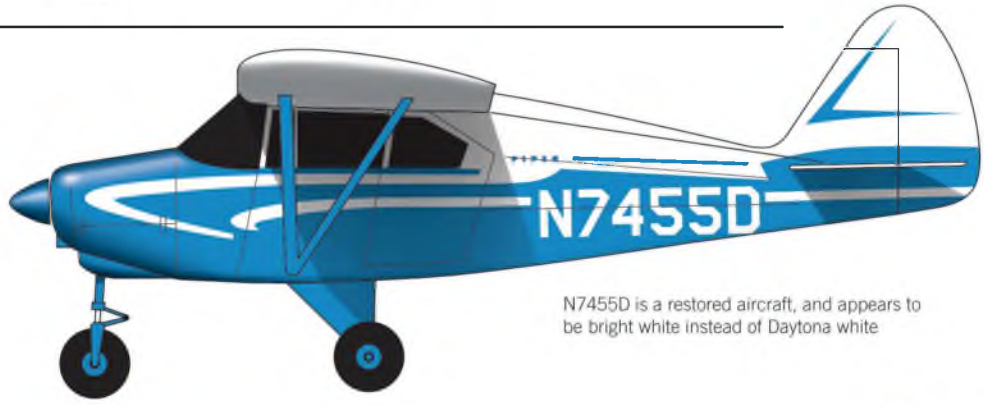
Profile shows Daytona White base with optional extra cost colour: Pasadena Rose

1958

Daytona White and Santa Fe Red

Daytona White and Bahama Blue

Daytona White and Hershey Brown



N7455D is a restored aircraft, and appears to be bright white instead of Daytona white

1959

Daytona White and Santa Fe Red

Daytona White and Bahama Blue

Daytona White and Hershey Brown

Daytona White and Montego Green

1960

Daytona White and Santa Fe Red

Daytona White and Bahama Blue

Daytona White and Hershey Brown

Daytona White and Montego Green

Wheel spats were offered as an extra cost option

Fairey Fantome

For purity and elegance of shape, the Fairey Fantome could be regarded and the most attactive biplane fighter of all time

There can be no doubt that, very often, aesthetic appearance very is a major attraction for scale modellers when selecting a new subject to model. Conversely, maybe perversely, there can be an equal attraction for an aircraft that one might describe as '...so ugly, it's beautiful'! Scale modellers can be an obtuse bunch sometimes!

When it comes to the era of the fighter biplane, surely there can be no one who would deny the pleasing lines of the Fairey Fantome. One might say that for purity of shape, it compares for top honours with the other outstanding shape of that era - the Hawker Fury.

However, it would be a mistake to regard the Fantome as an exact contemporary of the Fury which, having first flown in 1929, predated the Fantome

Straight from the assembly workshop, the first Fairey Fantome prior to application of final selver/gey overal finish.

ABOVE: Fairey Fantome iwth UK civil register markings and BELOW, after transfer to the Royal Air Force for tests. *(Photos: Richard Riding)*

Aparently devoid of any identification marking, what can be senhere is the cannon barrel at the tip of the propeller spinner and the barrels of the two 0.30" machine guns in the lower wing leading edges. *(Photo: Richard Riding)*

by several years. The latter first flew in 1936, which actually makes a much closer contemporary of the RAF's last fighter biplane, the Gloster Gladiator.

The Fantome was designed by Marcel Lobelle to a requirement drawn up by the Belgian Aeronautique Militaire which issued the specification in anticipation of holding an international competition for a replacement for their Fairey Firefly II designed and built in 1929, in competition with the Hawker Fury. It lost out to the Fury for RAF service, but did achieve an order of 25 machines from the Belgian military, serviced through Fairey Aviation's Belgian manufacturing subsidiary Avions Fairey.

Like the Firefly II before it, the Fantome was made in UK by the parent company Fairey Aviation, the prototype first flying on June 6th 1935. However, it did not last long, crashing at Evere, near Brussels on July 17th. By then, Fairey Aviation in UK had already produced component parts for three additional examples that were shipped to Belgium the following year and assembled under license by Avions Fairey as the Fairey Feroce at there Gosselies base. Of these, two were sold to the Soviet government, which subsequently passed the machines to the Spanish

The UK civil registered example of the Fantome shows no sign of armament. *(Photo: Richard Riding)*

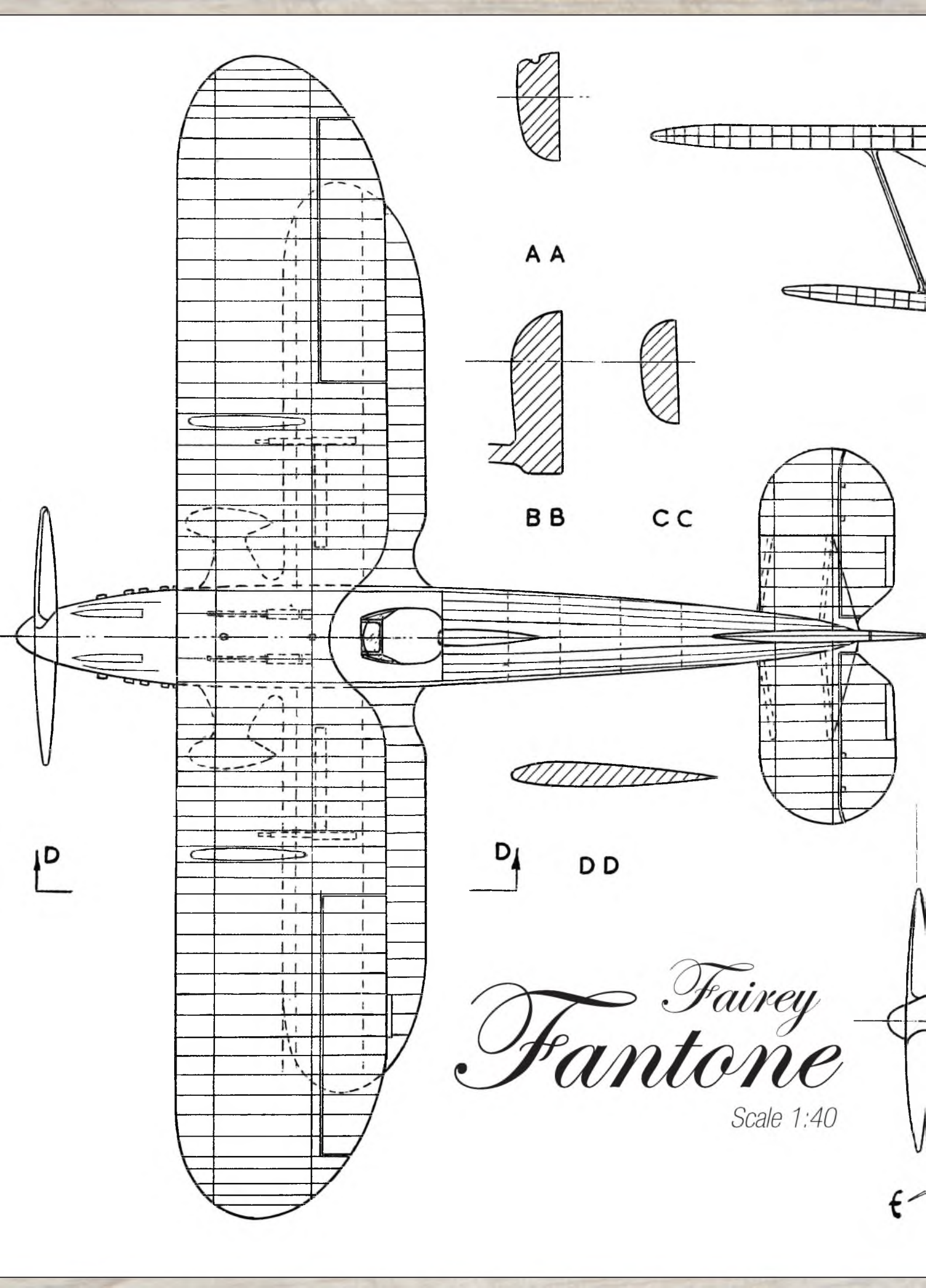
Republican Air Force during the Spanish civil war. The third Feroce was passed back to UK from Belgium and acquired by the British Air Ministry for tests.

The Fantome/Feroce featured all-metal construction, with fabric covering on the wings, tailcone and on the fuselage from the cockpit position rearward. Powerplant was a 925 h.p. Hispano-Suizza 12-cylinder inline liquid cooled engine and armament consisted on of two wing mounted 0.3" Browning machine guns, plus a single fuselage mounted 20mm Oerlikon cannon, installed between the two engine cylinder banks to fire through the centre of the propeller spinner.

The Feroce the returned to UK first carried the civil registration G-ADIF and was finished overall silver-grey, with registration letters in black, while for military tests, it carried the serial L7045, plus the standard RAF pattern roundels of the period. The eventual fate of this example, nor of those of the two that found their way to Spain, is unknown as is any record of air combat action there. ■

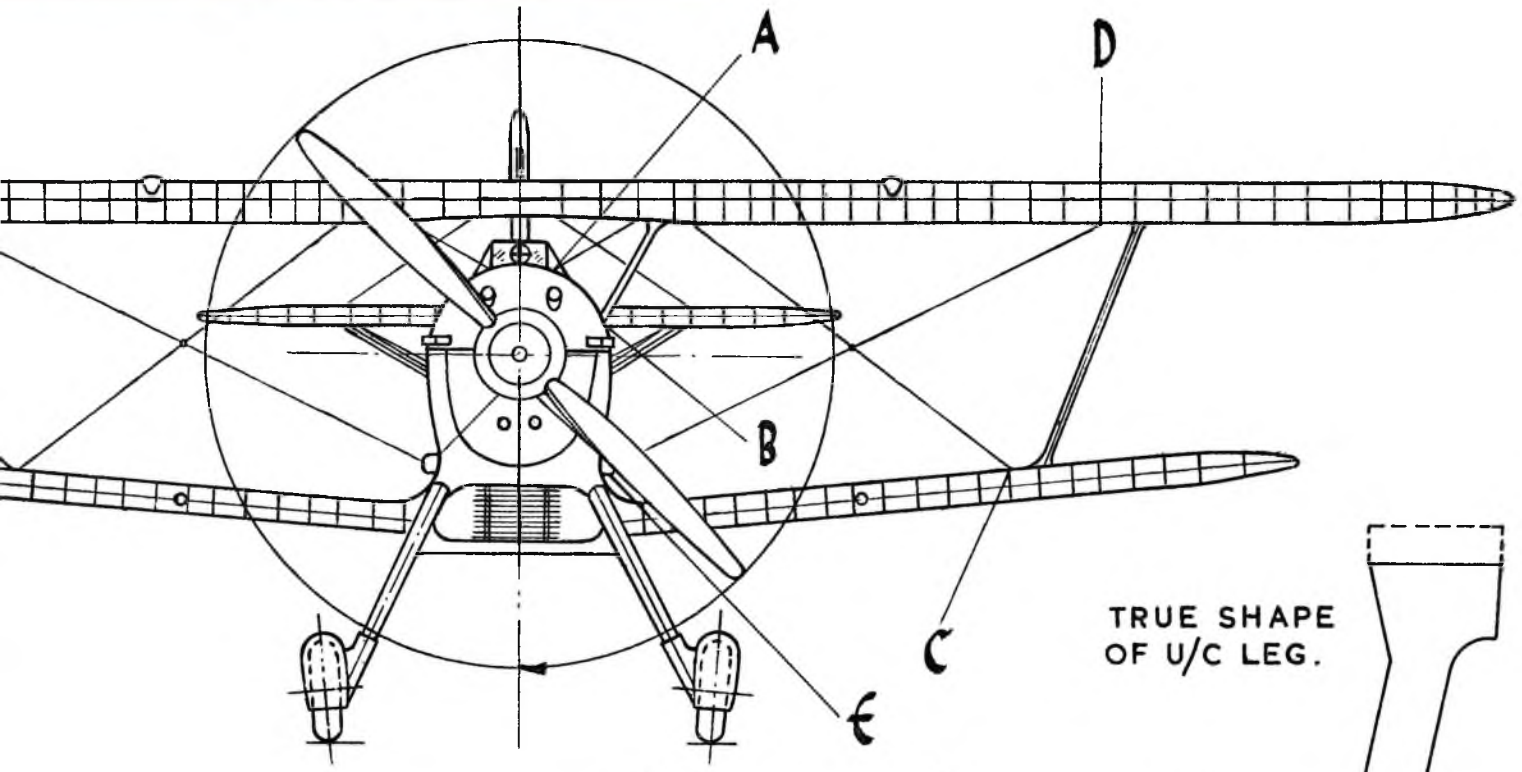
SPECIFICATION

Length:	8.4m (27 ft 7 in.
Wingspan:	10.52m (34 ft 6 in.
Height:	3.45m (11ft 4 in.
Powerplant:	One Hispano-Suiza 12 cylinder inline, watercooled, 925 h.p.
Max. Speed:	270 mph (435 kph)
Cruising speed:	217 mph (350 kph)
Endurance:	2 hrs.
Armament:	One 20mm Oerlikon cannon two Browning 0.3 in. (7.62mm) machine guns.

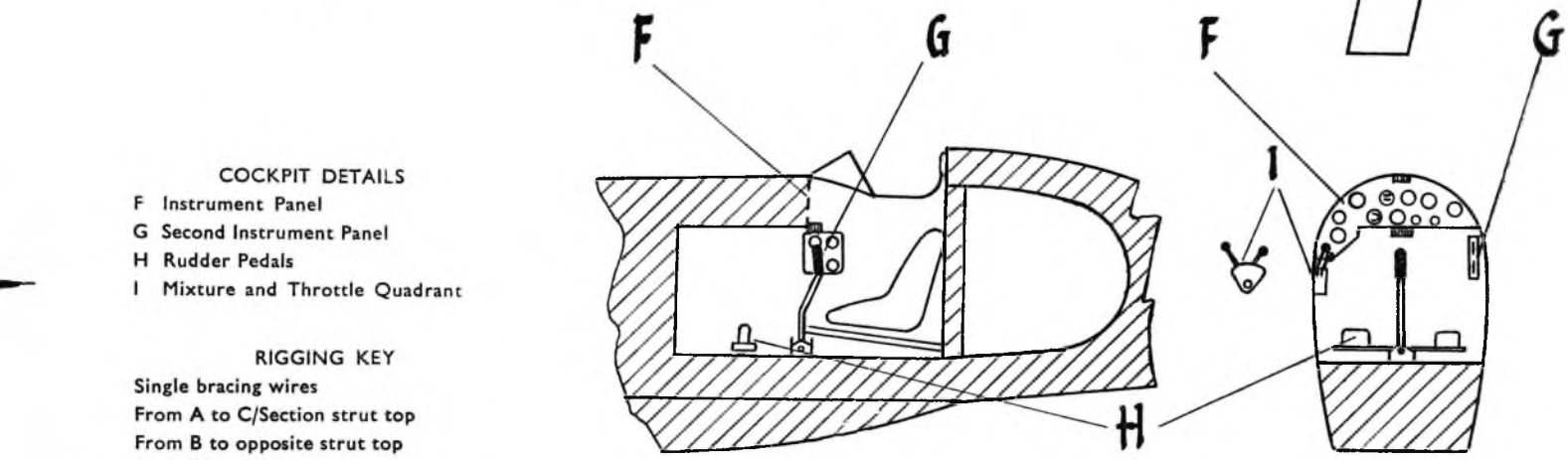


Fairey Fantone

Scale 1:40



TRUE SHAPE OF U/C LEG.



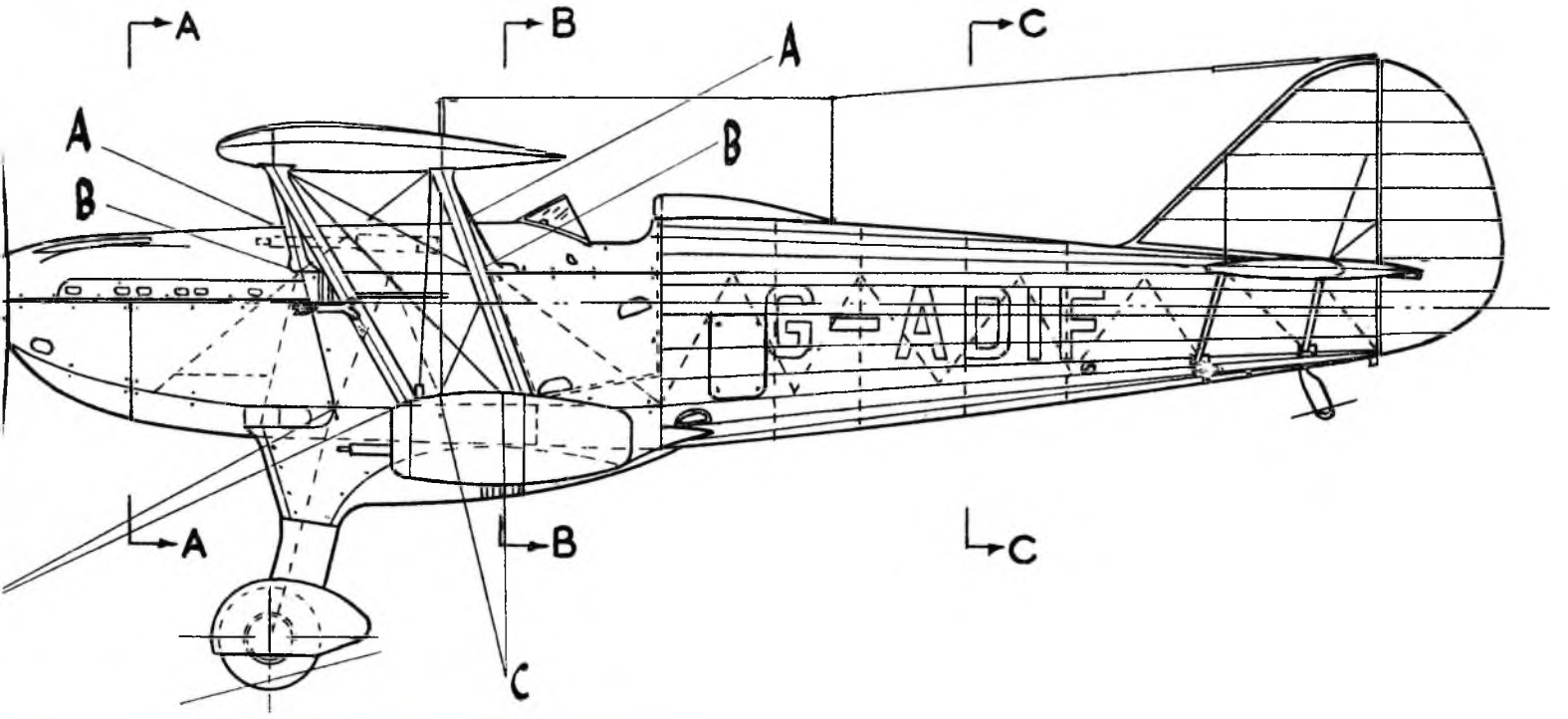
COCKPIT DETAILS

F Instrument Panel
G Second Instrument Panel
H Rudder Pedals
I Mixture and Throttle Quadrant

RIGGING KEY

Single bracing wires
From A to C/Section strut top
From B to opposite strut top
From C to C/Section strut top
From D to E
From C to D between struts

COCKPIT DETAIL



WIRE IN THE WIND

GARY SUNDERLAND PRESENTS DETAILED ADVICE ON REPLICATING BRACING AND RIGGING

PART 1:

In generall, since scale modelling is very much just a 'skin-deep' repication of the external suface, modellers are usually concerned with the external rigging wires. But these are actually just the tip of a very large iceberg. From the pioneer era through to 1939, most aeroplanes had wire braced structures to achieve the necessary strength and rigidity with light weight.

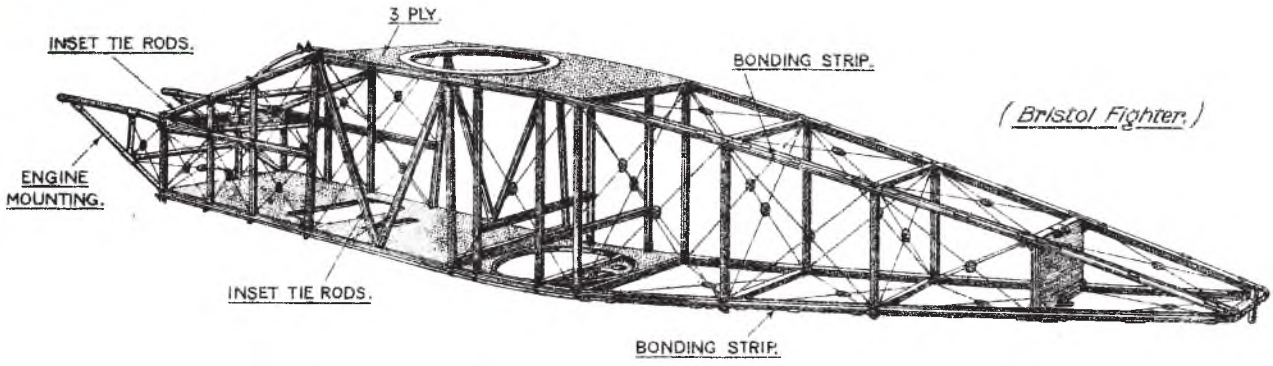
Figures 1& 2 show the complicated internal structure of a typical wire-braced fuselage, in this case a WW1 Bristol F2B Fighter. Note that there is a mixture of materials and methods in this structure, reflecting the design loads and the preference of the designers. The forward engine mounting is fabricated from steel tubes, bolted and riveted together. Some early aeroplanes had fuselages made completely from wire-braced steel and aluminium tubes, for example the German A.E.G. and Fokkers and the French Bréguet.

Many wire braced fuselages were, like this one, combined with plywood panels in many areas, as on the RAF BE2c and the SE5a. The Airco DH4 had the forward part of the fuselage, including the engine mounts and cockpits made as a wood and plywood box structure. Other German aeroplanes, notably the Albatros adopted wood stressed skin structures throughout, but there seems to be no clear advantage either way.

Wing structures were also braced internally by wire, when it became clear

PHOTO1

Fig. 1.



A typical wire-braced fuselage. (Bristol F2B).

that there were large fore and aft loads. Two-spar wings are normally held apart by reinforced 'compression' ribs or, alternatively, internal drag struts of timber or metal tube, as shown in **Figure 3**.

Wire

Bracing wire was drawn from good quality low-carbon steel through an oil-cooled die. With an ultimate strength of 50 to 60 tons per square inch, the wire was tough and could be formed easily, similar to high tensile fencing wire and was similarly supplied in coils.

Also, like fencing wire, the end attachment loops could be formed by hand, with four to six turns back around itself to provide a secure joint. Reporters commented at the ease with which pioneer aviation/designer Samuel Cody formed the wire rigging to the British Army Aeroplane.

Even so, it is not always possible to form the wire ends in this way and a convenient alternative is to loop the wire through a short length of copper tube. The tail was then cut off and bent back to fix the joint. The Caudron G3 in the Musee de l'Air near Paris has most of its rigging attached in this manner.

The problem with the latter method is that the copper tube will retain moisture and, being a dissimilar metal, corrosion will occur, often resulting in failure of the joint. The solution to this problem was to replace the copper tube with a coil of closely wound wire, the wire end attachment being formed and secured as previously described. This became virtually the standard method of forming hard wire attachments during WW1 and for long afterwards. The Rubery Owen company was a major supplier of these wire coils, used in bracing British aeroplanes.

When subjected to test, all of these end terminations had a joint efficiency of about 60%. That is, a formed bracing wire would fail at about the equivalent of 30 tons per square inch. A designer could easily calculate the strength of any given bracing; for example, the bracing of a Maurice Farman varies from 16 SWG to 12 SWG. A simple calculation shows that a brace made from 16 SWG will break at approximately 4,200 pounds.

During the WW1 period, the tremendous expansion of the aircraft manufacturing industry and its suppliers led to the development of government standards to ensure quality. In Britain, these were issued first by the Admiralty and the War Office, and in 1918 these standards were taken over by the Air Board when the air services were amalgamated. The Air Board specification W.1 applied to solid wire, W.2 to stranded wire rope, W.5 to wire strainers, and so on.

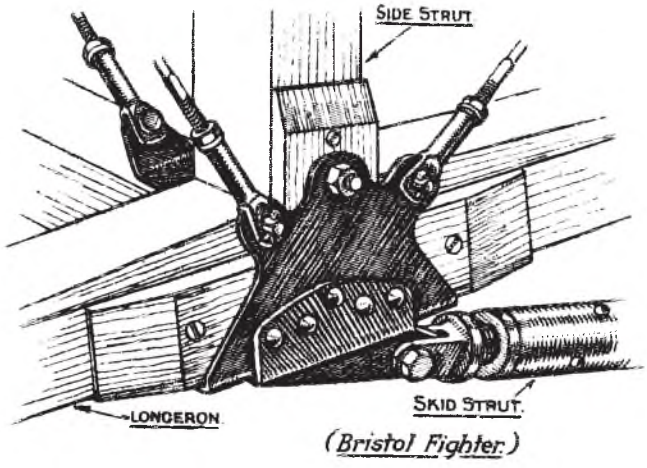
Between the wars, there were major developments in metallurgy and quality control, leading to improved performance. By 1930, high tensile steel wire to 3W.1 now contained nickel and chromium which not only doubled the ultimate strength, but also was resistant to corrosion.

Steel rod

As the weight of aeroplanes increased significantly during the first war, the traditional wire sizes and attachments were no longer adequate. The solution was to introduce solid rod bracing, made from the same steel, but in short lengths to suit the application, as in British specification W.3. The ends were threaded with left- and right-hand threads so that, with matching fork ends, the rod itself became

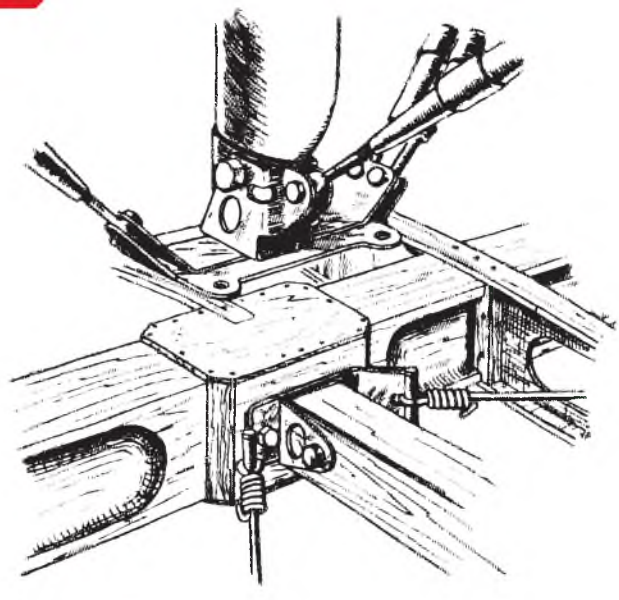
PHOTO 1: One aeroplane which had the fuselage bracing in full view was the Bleriot XI. This example is flying in New Zealand and is similar to the 1914 model 'looping' or aerobatic Bleriots. The 'Boucle' or looping Bleriots produced in 1914 had a tall centre pylon and the wings were braced with stranded wire cable. One example is at the NASM in Washington and another is located in the Power House Museum in Sydney.

Fig. 2.



A typical fuselage fitting. (Bristol F2B).

Fig. 3.

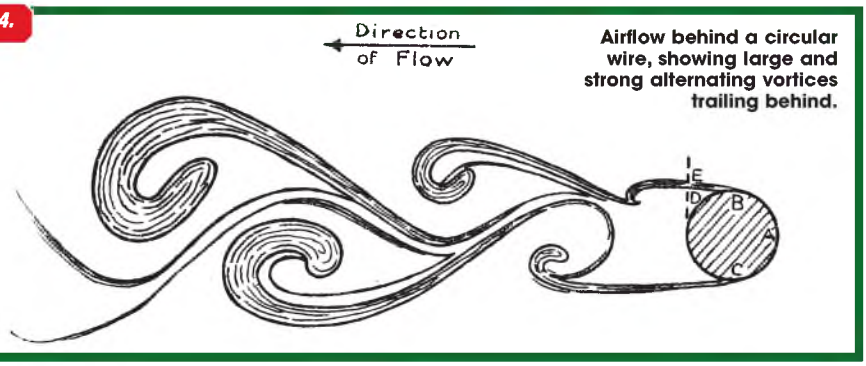


Internal wing structure, showing a wooden spar and drag strut with wire bracing.

PHOTO 2

PHOTO 3

Fig. 4.



Airflow behind a circular wire, showing large and strong alternating vortices trailing behind.

the tensioner.

This solved the structural problem, but the aeroplane now contained hundreds of differing parts and introduced a massive supply problem. Incidentally, the between-the-wars corrosion resistant steel was extremely durable. A RAAF Hawker Demon went down in the bush during WW2 and lay in the open for thirty years, after which time most of the aircraft disappeared. Only the steel rod bracing was left to identify the remains.

Stranded wire rope

Very early in aircraft development, it became obvious that solid wire external wing bracing was liable to premature failure, due to vibration and if a major wire broke, the wing structure would probably collapse. For this reason, multi-stranded wire rope was used in bracing wings and also in control circuits where the cable has to bend around a pulley or fairlead. The rope was assembled from a number of fine wires to form a strand and a number of strands then wrapped to form the finished cable. Thus, a 7 x 7 cable is formed from seven strands, each of which has seven wires.

There was no clear distinction between rigging wire and flexible control cable at first, possibly because in a wing warping aeroplane these functions are shared. These days, control cable has a steeper angle of lay and consequently is more flexible with increased extension under a tension load.

The end attachments of cables were invariably made by hand-splicing. (Mechanical swaging of aircraft cable seems to have been introduced during WW2.) Wire for standard rope is usually 80 ton plain carbon steel, which has better wear resistance than stainless steels.

Drag

The pioneers were well aware of the considerable air resistance due to external wire bracing. During gliding flight, the distinctive hum of the rigging could be heard. Wind-tunnel tests, using smoke to render the airflow visible, confirmed that a cylindrical body created an alternating vortex stream as shown in **Figure 4**. Shedding this alternating wake would force the bracing to vibrate. The early Bleriot monoplanes had flat metal strip for lift bracing but this was unreliable and was soon replaced with stranded cable.

A more sophisticated bracing was developed by the Royal Aircraft Factory in

PHOTO 4

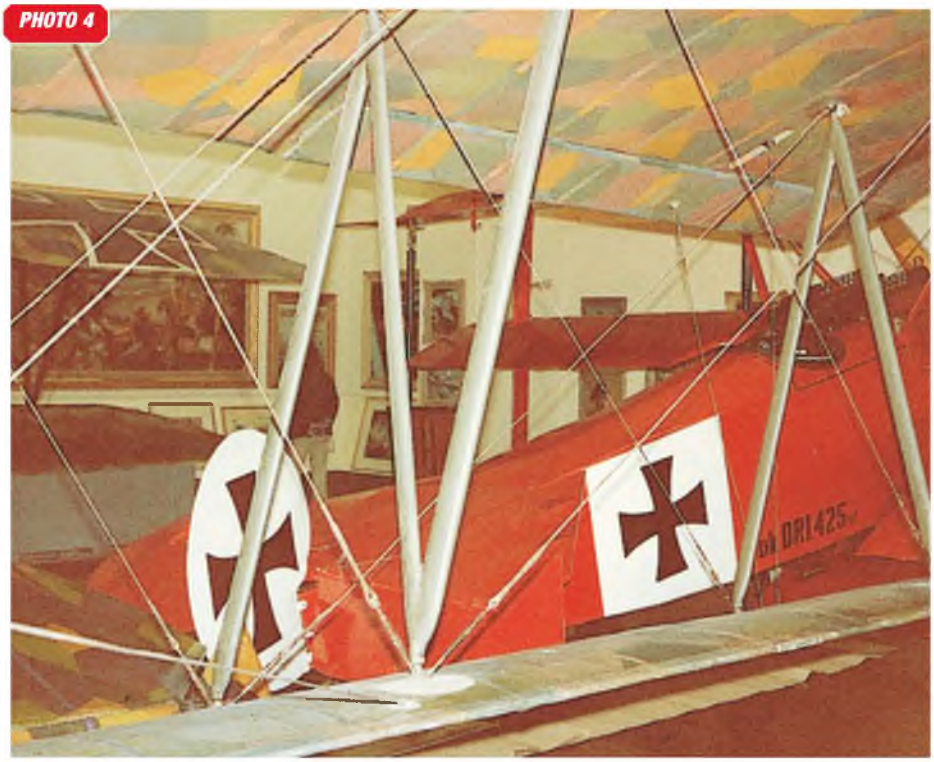


PHOTO 2: Typical of French practice is the rugged SPAD VII; this one was at the Fighter Museum in the USA. The bracing is all stranded wire rope, spliced onto the turnbuckles. Note the duplicated flying wires. These were originally spread with a timber separator or fairing, the whole being wrapped in fabric. In practice the doped fabric would have absorbed moisture which would have rapidly corroded the wire beneath and, being covered in fabric, the damage would not have been seen readily by the rigger. Because this is a flying aeroplane the American operators have installed metal spreaders as an alternative.
PHOTO 3: Close-up of SPAD centre section illustrates the relatively heavy stranded wire bracing and the delicate turnbuckles and metal fittings. Note also the plywood so-called 'vibration preventers' fitted at the junction of the wires. The main purpose of these was to keep the wires from chafing against each other. PHOTO 4: Typical of German practice is the delicate rigging of the Pfalz D.XII, seen here at the Australian War Memorial in Canberra. The 'N'-struts are welded steel tube and the rigging is steel wire stranded cable with fine turnbuckles, at the lower ends for the rigger to access.

1914. The 'RAF wires' were not really of streamlined shape but were actually circular rods forged between rollers to an approximately elliptical cross-section. The RAF wire retained the left-and right-handed threaded ends but with the added complication that they needed to be tightened in increments of one half turn.

External bracing wires are likely to be scratched or nicked by sharp debris blown back by the propeller, and any such damage may form a crack which will quickly propagate across a solid wire under stress and vibration. For this reason the flying wires of many aeroplanes are duplicated, so that the failure of one wire will not lead to an in-flight collapse of the structure.

Maintenance

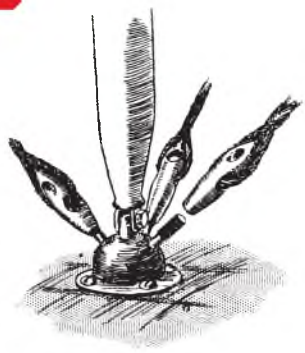
The job of the rigger was to check and adjust every wire in the aeroplane, ready for the next day's flying. The first task was to wipe all the external wires with an oily rag to remove any moisture and dirt. The rag would also snag any broken wires in stranded cable. Single wire breaks were accepted, as they could be present at manufacture, but several broken wires in the same location indicated a damaged cable that would have to be replaced.

Loose wires were a constant problem and could have a multitude of causes, from a hard landing to just flying fast. Early aeroplanes had crude control systems, without mass balancing, which were liable to flutter at any speed and would certainly flutter above 150 m.p.h. Pilots reported that the flying wires would go slack and flap about in the air! This would stretch cables and rigging wires, damage attachment fittings and could extend into the fuselage, in which case the covering would have to be unlaced and the internal wires checked for slackness.

The favourite lubricant for control cables was whale oil, which was also in demand for machine guns (and pilots' faces!) due to its ability to resist freezing in the below-zero temperatures at altitude. All the other wires were kept greased or oiled to exclude moisture and thus prevent corrosion.

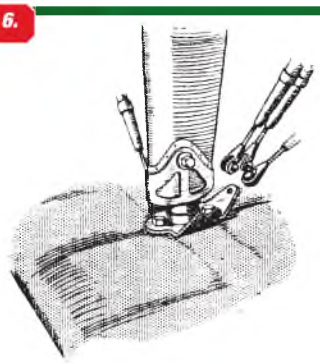
By the 1930s, the rigger's task had simplified somewhat, because designers knew how to prevent flutter, and corrosion resistant alloy steels were used in rods and wires. Control cables were still from plain carbon steel and were replaced at regular

Fig. 5.



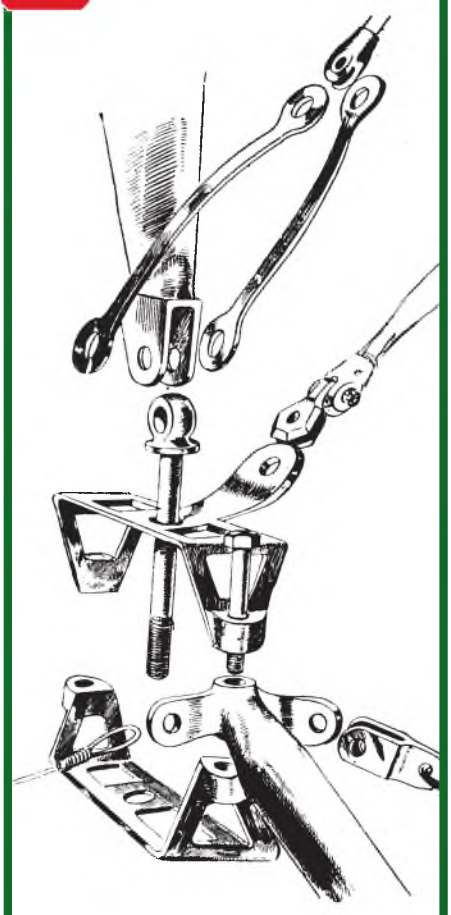
A typical German-style installation of WW1 wing bracing. The pressed steel strut fitting also retains the threaded parts. Note the ingenious design of the tensioners which differed between manufacturers and also aircraft types, creating problems of supply in the field.

Fig. 6.



An early French- or British-style wire attachment used standard turnbuckles as wire strainers, which improved the supply situation, later negated by the change to 'streamlined' RAF wire.

Fig. 7.

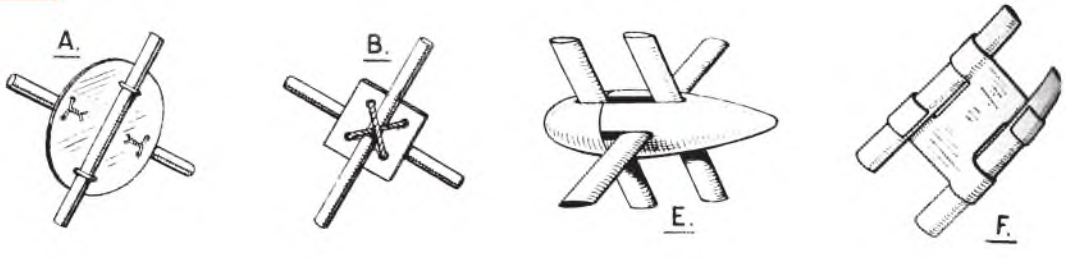


An exploded view of strut and wire attachments to a wooden spar.

PHOTO 5

PHOTO 5: The Shuttleworth LVG, photographed by the writer at Old Warden, is a rebuild to flying standard and contains a lot of British hardware. The substantial bronze turnbuckles and thimbles are obvious. The originals were likely to be from steel and smaller, given that copper was in short supply in Germany during WW1.

Fig. 8.



'Vibration preventers', so-called, stopped rubbing and cable wear as well. 'A' and 'B' are simple plywood shapes between wires, external and internal. The 'acorn' fitting 'E' was made of wood or cast aluminium. Steel clips ('F') were used along pairs of flying wires.

PHOTO 6

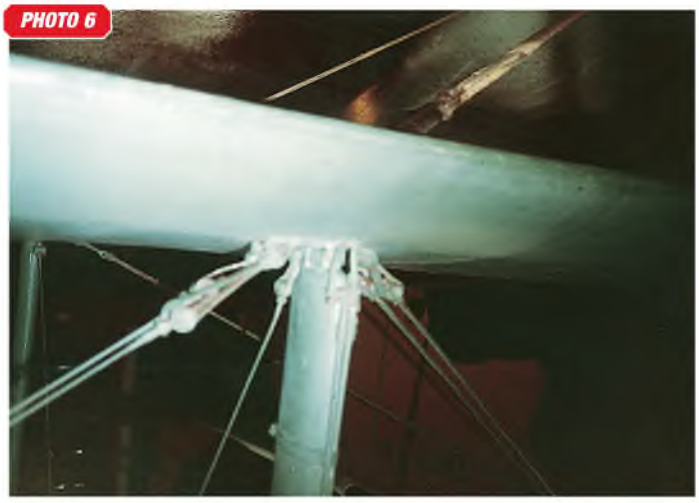


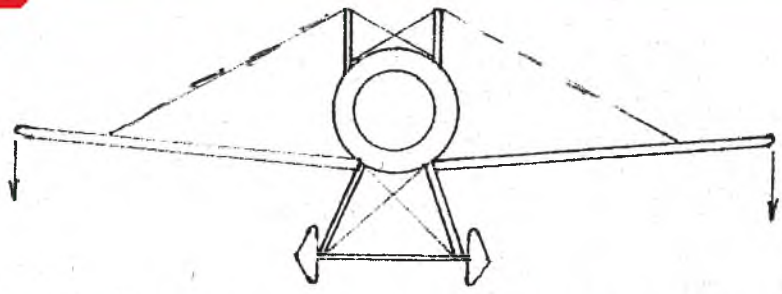
PHOTO 7

PHOTO 6: Fittings on the Bleriot XIV, photographed at the Musee de l'Air in Paris during writer's visit BACK in 1996, are massive by any standards, and seem to be of British design, if not manufacture. The bracing is of RAF wire outboard, and inboard of this inner strut pair the bracing is wire rod about 6 mm diameter. PHOTO 7: Typical British 'Factory' practice is this SE5a, with RAF wire wing bracing throughout. Note that the 'vibration preventers' are missing.

PHOTO 8

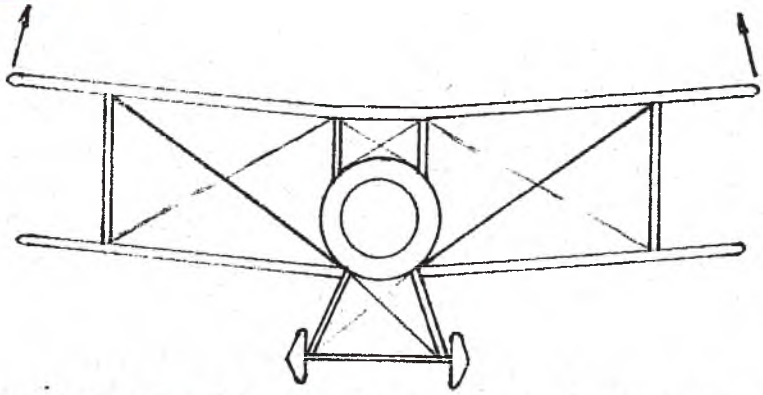
PHOTO 8: This Qantas rebuilt/reproduction Dyak-engined Avro 504 is typical of Australian 504s, and civil 504s generally, in having stranded wire bracing and the necessary wire straining turnbuckles. Actually, the original military 504 had stranded wire rigging and only later production aeroplanes such as the Avro 504K had RAF wires. Once again, the 'vibration preventers' seem to be missing!

Fig. 9.



Landing wires prevent the wings from falling off on landing but not much good for flight.

Fig. 10.



Flying wires prevent wings from "clapping " over the fuselage on take off.

intervals. Soon, the new light alloy structures would be introduced and the riggers would become airframe mechanics.

Model rigging

These days, the ARTF brigade are flying many so-called scale models of aircraft, like the Ryan STM and the Boeing P-26 Peashooter, with thick, cantilever wings and either no bracing or a pathetic attempt to drape a limp representation somewhere near the correct position. To the purist, this is nearly as bad as building a model of a flat wing aeroplane such as a Fokker or a Spad with dihedral cranked into the wings! They all look terrible!

Just compare a typical ARTF Ryan with a real scale model of an STM, as constructed by Don Strachen **(photos 9 and 10)**. This is not just a matter of detail, but the very character of the aeroplane is all about a thin and fragile wing, firmly held in place by taught wires. I only ever had one flight in a full-sized STM, but the wire bracing definitely made an impression, such that a cantilever model looks unsafe, even sitting on the ground!

Before we start to consider wing bracing, it may be in order to define the terminology, because so many modellers, and others, get things confused. Ross Woodcock has provided some simple diagrams to show why the various wires are named in **Figures 9, 10** and **11**, which is a good starting point.

This is a single bay biplane structure, with just one set of wires and struts outside the fuselage - that is, one 'bay'. A two-bay configuration is shown in **Figure 12**, as for the classic WW1 two-seaters like the BE2c, DH4 and the Bristol Fighter.

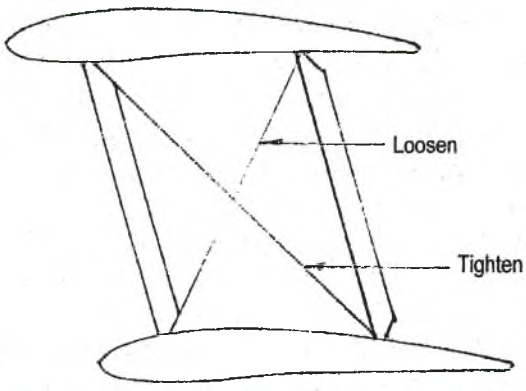
To say that the landing wires are not important for flight is an over-simplification due to the terminology used. In fact, the complete wing truss has to resist large twisting loads in flight, as for the torsion box of a cantilever wing, and the landing wires do act with the flying wires to provide a rigid box structure.

The wings may be attached to a fuselage which fills the gap between the wings, as in the Beech 17 and Waco cabin biplanes, but most early aeroplanes of the open cock(pit variety had a centre section, consisting of a small section of wing braced by wires and struts. Getting the fuselage

PHOTO 9: This ARTF Ryan STM is very clean and fast but looks naked without any scale bracing wires. Bracing wires would slow the model down and steepen the approach angle, which would make for more realistic flight characteristics.

PHOTO 10: Scale bracing and other detail on this superb 1/4 scale STM by Don Strachen is not just for show. The full-size wing structure is relatively fragile and in the air the occupants really appreciate the strength of the rigid wire bracing. Note that the wires also brace the undercarriage against side loads.

Fig. 11.



Incidence wires loosened and tightened in this manner induce washout.

PHOTO 9

PHOTO10

and centre section exactly lined up is obviously vital to subsequently rigging the wings.

Cabanes, centre sections and pylons

Some people refer to the centre section as the *cabane*, which is a different structure altogether. A cabane is the bracing applied to an extension of a wing panel past the struts, as on a Curtiss Jenny or an RE8. The *Royal Flying Corps Rigging Notes* for the RE8 have this to say about the wing 'overhangs' or extensions:- *"The overhang of the Upper Main Planes is supported by two bracing wires, which pass over Cabane Struts, fixed above the interplane struts. These Cabane bracing wires should be tensioned so as to keep the outer portions of the Upper Main Plane ... (straight)".*

'Aeroplane Design' by Andrews and Benson (1920) further provides the example of the Antoinette monoplane (see **Fig. 13**) and indicates that ALL of the overhang bracing constitutes the 'cabane', made up of cabane pylons and cabane wires. Note that single struts braced by wires are called 'King Posts', while two or more struts joined together are called 'pylons', but they essentially serve the same function.

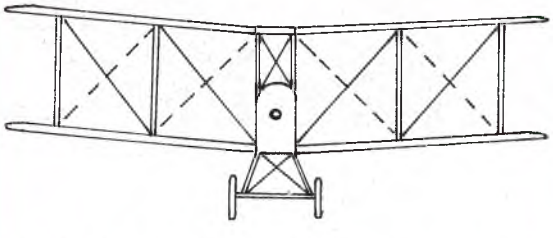
The late Harry Woodman, the esteemed historian and modeller, once accused me of being a pedant, to which I plead guilty. My argument is that if someone calls a centre section a cabane, then what do they call a real cabane when they meet one?

What follows is a brief summary of the model hardware that is available to brace your model. While this is based on the proposition that the rigging will perform the primary task of resisting flight loads, it will also be appropriate to dress up an ARTF or kit-built model which has been modified to cantilever wings. It is worse than useless to string strands of elastic, plastic or slack wire which dangle uselessly from the model. To look realistic, the rigging must be tight, which means you need some decent terminal fittings and some means to adjust the wires to tension them.

Before you start, it will be necessary to check where the wires actually terminate on the full-size aeroplane. Be aware that this may not always be indicated on the model drawings, or on the three-view scale drawing of the full-sized aeroplane. For example, the SE5 is a popular subject for scale because it has a simple airframe, but the rigging is actually quite complex. The forward centre section bracing wires terminate at the top longeron as usual, but the rear bracing goes down to the bottom longeron, presumably so that they can clear the Vickers gun. Then again, the rear flying wires also are braced to the lower longeron, and they actually pass through the lower wing to get there!

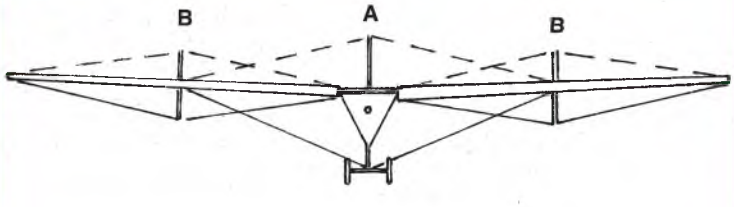
In many cases the draughtsman has

Fig. 12.



A two bay wing structure. The solid lines represent flying wires. The landing wires are indicated by the broken lines.

Fig. 13.



Antoinette monoplane bracing. Solid lines indicate flying wires. Broken lines indicate landing wires. A= Centre pylon or king post. B= Cabane pylons

PHOTO 11

PHOTO 11: The author's SE5a is rigged throughout with .032" piano wire, but with single landing wires and duplicated flying wires. Note the wire vibration dampers, made from small pieces of tin-plate soldered to the flying wires. Note also the rear flying wires passing through a slot in the bottom stub wing. Wire tensioners are installed inside the fuselage. This 1/5th scale model is available as an MAP plan.

PHOTO 12: The automatically stable products of the Royal Aircraft Factory in WW1 make excellent free-flight models, as shown by my BE 12A. The rigging is all C/L wire sprung with small rubber bands. Note the cabane pylons and cables to brace the upper wing overhangs. The 1/8th scale model was powered by a 2.5 cc diesel engine.

avoided all this complication, which is difficult to convey, simply by leaving it off the drawings altogether! Most people do not notice a few wires missing from the drawings. To understand how the aeroplane is rigged, a careful look at the real thing will reveal all you need to know. Failing this, the excellent FSM *'AeroDetail'* photo collection series will answer most questions. The RAF Museum 'Rigging Notes' and publications such as the Albatros Data Sheets are usually sufficiently detailed as to provide much of the information we need.

Streamlined wires

'Streamlined' wires, so-called, are near oval in section because they are adjusted by turning in 180 degree increments. These days you can buy scale section wire from Europe and from the USA to suit the larger models. As noted above, Clive Butler purchased some from Switzerland to suit his one-third scale Stearman. A complete set of flying and landing wires, twelve in total, made to exact dimensions cost about A$200, which I thought was very reasonable.

The Swiss-made wires had a copper tinge to the steel so they are probably a feritic corrosion-resisting steel. The ends and matching fittings are cut with left- and right-handed threads, so they are 100% scale and do not deviate from the real thing. Actual streamlined wires are the optimum answer, but are not a realistic option in many cases.

The cost is dependent on the number of wires, so they were not really a proposition for my Bristol Fighter, for example. The alternative is flat section stainless steel strip, as provided by Proctor in the USA, or Mick Reeves in the UK. The flat strip is a bright feritic stainless and, at five metres judging distance, is a reasonable representation of streamlined wire. The feritic stainless and corrosion-resisting steels are alloys suitable for use in models and full-sized aeroplanes, because they are stronger and can be brazed and soldered easier. Check them with a magnet, which will attract the feritic steel, in contrast to austenitic stainless steels as used in cutlery and some marine applications. Your magnet will not work on an austenitic steel.

Proctor suggests soldering the strip to a Du-Bro quicklink, which is a method I have used for a landing wire attachment to a centre section, as at **Figure 14**. The attachment of the landing wire is not that obvious under the upper wing root. However, the fittings are relatively large, even for a quarter-scale model; for the attachment of duplicated flying wires their alternative suggestion, of using two turnbuckles, is even worse. In this situation the fittings available from Mick Reeves are much smaller and consequently far more

PHOTO 12

realistic. The only problem with the Mick Reeves fittings is that they only adjust from one end. The other end merely rotates.

This means that we have half the adjustment available so the length of the wire is just that more critical. On the other hand, it is a reasonably easy matter to remove the wire, and shorten it to suit, when you have run out of adjustment. Wires always have to be shortened in practice, because the inevitable hard landings tend to stretch fittings and wear attachment holes.

Before making up the final rigging, it is a good idea to rig the model completely with hard wire. In fact, it is possible to carry out the initial test flights with piano wire rigging. The final flat strip wires can then be fitted when you are confident that the lengths are correct. This was the procedure I adopted for my Bristol Fighter test flying. Piano wire bracing is covered in more detail below.

Before we leave streamlined wire, there is one more important detail which is often neglected by modellers, and that concerns the adjustment of duplicated flying wires where these are replicated on the model. Usually the front wire is installed and tensioned first. The problem then is to install the duplicating wire to the same tension. As usually happens, we finish up with the second wire, according to Murphy's first law of rigging, at right-angles to the potential airflow!

Now this is highly undesirable, for all sorts of reasons, so we back off the wire one quarter turn, or 90 degrees. We now have a rear wire of the pair which is distinctly slack. Even after fitting the acorn, at the place where the flying and landing wires cross, the rear wire may still appear slack, particularly when the engine is running.

In the full-sized aeroplane this was prevented by installing small metal clips at intervals to the wire pairs, such that the rear wire is firmly anchored to the front wire. This is not just a cosmetic treatment, either at full-size or on a model, as vibrating slack wire can fatigue-crack end fittings in a relatively short time if left to itself.

At small model scales, one-sixth and less, even Mick Reeves' fittings and the smallest flat strip start to look large. A useful alternative is to make your own streamlined wires by soldering two piano wires together, usually from .025" (near 22 SWG). This was the practice of the best modellers who built down to suit the 6 kg. weight limit before 1995. My own practice at these scales has been to rig the model with single piano wires of .032" (near 20 SWG) in the belief that at three metres the difference is hardly noticeable, as shown in **PHOTO 11**

Stranded cable

Cable bracing was a feature on all the pioneer aeroplanes and also the aircraft of the Central Powers (Germany and Austro-Hungary) to 1918. After that, it was sometimes used to brace civil aeroplanes, where speed was less important than cost. At large scales there is no option but to mimic the original and, at one-half scale, I have seen 3/32" (approximately 10 cwt.) aircraft cable installed, and on a one-third scale model, one sixteenth of an inch stranded aircraft wires did an excellent job. Unfortunately, the builders of these models did not attempt to splice the ends, as per the original practice. The nickopress swages looked ugly and obvious, which rather spoiled the result!

For one-quarter scale models, my preference is for good quality 'shark trace' from a deep sea anglers' supply house. This is a bright feritic stainless steel flexible cable of 7 x 7 construction. This is seven strands of seven wires and a nice tight lay. The diameter is about one thirty-second of an inch, or 0.8 mm. Some trace is less densely woven and consequently has a bigger diameter. The breaking load of a joined cable is about 120 pounds by my measurement, so the bare cable is probably good for something like 160 pounds.

You can buy swages to suit, which resemble small nickopress swages, but these are a bit obvious. The alternative is to make your own swages from copper tube. I have tried disguising swages by wrapping them with fuse wire, or similar copper wire, and coating the ends to a taper with a quick-setting epoxy resin. This is then painted silver to represent a tapering splice, but the result still appears too bulky to be convincing.

It is curious that the Germans usually failed to install acorn fittings or similar devices to prevent the bracing cables rubbing together where they crossed. One of the few exceptions was the Fokker D.VII, which featured a welded steel tube cross to separate the undercarriage bracing cables. On my model Fokker, I copied this with a fitting soldered from copper tubes and it works well. My Albatros D.V model wing bracing suffered from the wing cables rubbing together in flight, with most of the wires in one strand broken. When replacing the cables I pre-coated the wires in the area where they might touch with a layer of epoxy glue. This is not obvious to inspection but provides some separation to the wires and does not seem to wear itself to any great extent.

The German aeroplanes of WW1 must have suffered rapid wire wear in service, or had some means to prevent it which is not obvious from photographs. Upon reflection, I can only guess that the wear problem could have been prevented simply by lashing the crossing point with cord or twine so that the wires were held apart. This is a simple and cheap fix which would not be visible except by a very close inspection.

A similar practice could be used on a scale model with cotton button thread knotted about one wire first, and then the other so that the wires never touch. A dab of instant glue will complete the job.

Incidentally, one more bit of full-scale aeroplane practice is worth mentioning. Do not go looking for broken wires in cables with your bare fingers because the blood makes the cables go rusty! Always use a rag to wipe the wires clean of dust and excess oil.

Proctor Enterprises distribute a range of cables and flexible wire rope suited to models in a range of sizes, as well as the flat flying wire mentioned above. The rigging cable is mainly seven-strand with a bronze finish and the flexible control cable is bright stainless 7 x 7 wire construction. You can use the flexible wire for rigging, of course, but the price is more than double. They also supply swages to suit the wire and various control fittings, including pulleys, of which more later in another article.

Fig. 14.

Proctor method of rigging with flat strip.

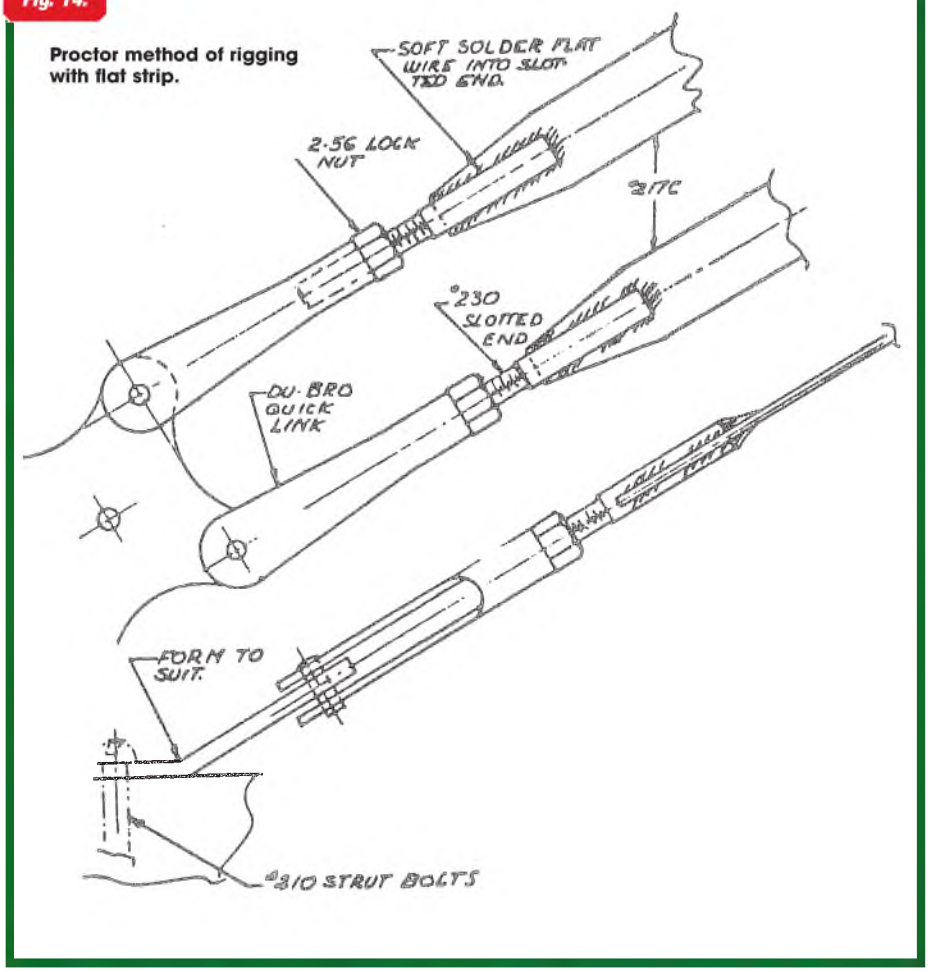
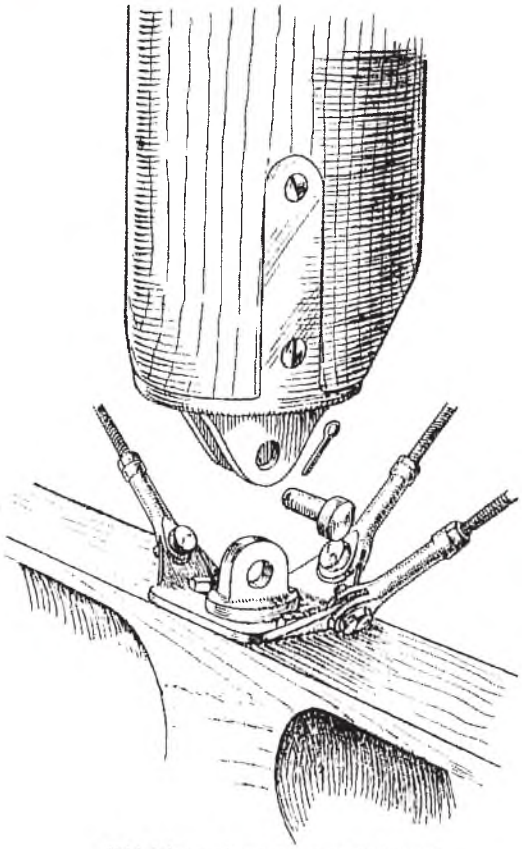
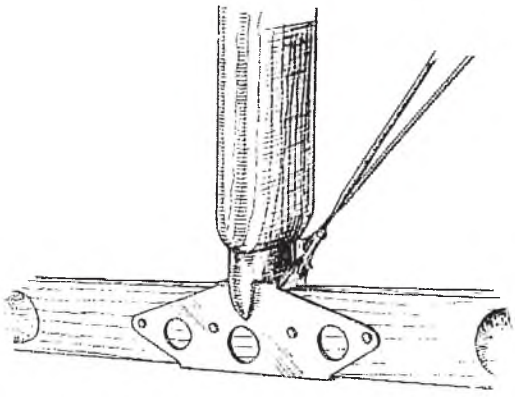


Fig. 15.



DH 9 interplane strut attachment.

AVRO 504K interplane strut sockets.



Sopwith interplane strut sockets.

Full-sized struts and fittings

I have used the larger size rigging cable, of 90 lb. nominal strength, on quarter-scale models, and also the 60 lb. nominal nylon-covered control cable likewise with complete success. Not surprising, considering they also distribute a quarter-scale model kit of the Albatros D.Va. Smaller cable sizes presumably suit their smaller kit models. The magnet test reveals if it is all feritic stainless.

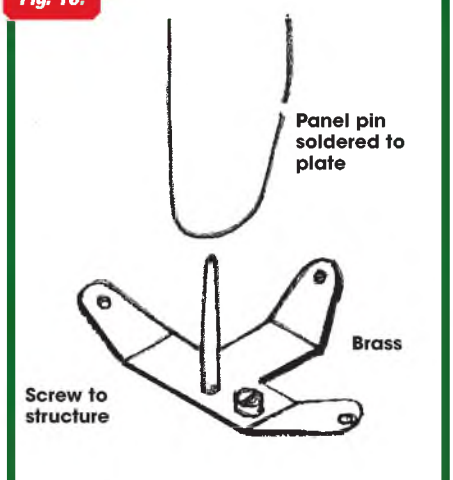
Fishing trace

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

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

To start with, the outside coating increases the appearance or bulk relative to its actual strength, which can be a problem, particularly for smaller models. One way to avoid this may be to use trace coated with a clear plastic. The soft plastic coating is also vulnerable to abrasion and wear against any metal or wood contact, including even balsa. This will require some extra work to avoid any contact with sharp edges. The preferred application is a straight control run, without any change of direction. I seldom use trace for rigging even small models because hard wire or stranded cable are better alternatives.

Fig. 16.



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

Control-line wire

Essentially, C/L wire is seven-wire, non-flexible stainless steel cable in at least two sizes and strengths of about 30 to 60 pounds. This is my preferred rigging for small models of one-eighth and one-twelfth scale. In the case of F/F scale models, the rigging is not intended to be rigid, and passes across as many bays as possible, which are then tensioned by small rubber bands (photo 10). This 'sprung' rigging normally holds the wings firmly in place during flight, but free to flex on landing.

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

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

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On Silent Wings by Chris Williams

SCALE SOARING

After the completion of the Spatz glider project, I started to cast around for a follow-on to my K11 electric motorglider, a model of which I am inordinately fond. Having now had a good taste of the cleanliness and convenience of electric flight, it's unlikely that I will ever go back to petrol power, but there does seem to be a size cut-off point in electric flight where the cost/power ratio graph suddenly spikes upward.

The power train in the K11 is moderately priced. The 5s battery required to feed it is still relatively affordable, and doesn't need a power station to charge it. The K11 is to one-quarter scale, so I was looking for a motorglider at the same scale, and hopefully one looking just as pretty.

Alas, this is not an easy task, because although there are many purpose-build and retro-modified motorgliders out there, most of them are so ugly that when they were born, the midwife clucked her tongue and slapped the designer.

To my mind, this leaves only Rene Fournier's range of aircraft, of which the RF-4 is the most well known, and the most modelled. It was when I saw some photos of a one-off modified RF-5b that my interest sharpened: here was a machine that was pretty, yet at the same time completely different. The sticking point lay in the retracting undercarriage: my workshop is not short of woodworking tools, but engineering outside the range of a bent pin and a pair of pliers is very much a no-no for me. I decided, therefore, to take the only course of action possible; disregard the retract, and instead fit a fixed u/c and just pretend that the retract servo was a duff 'un.

So, back to the electric bit... according to the info on the box that the K11's motor came in, it was capable of powering models of a weight up to and including 12lbs. The RF-5 is a two-seater of course, and liable to be bigger than a one-seater, so a start was made by tracing the plan view of the latter in a CAD programme on the PC, and dropping it over the former for the purpose of comparison. Yes, it was bigger, but not inordinately so: if I could keep the weight down, perhaps the same inexpensive power train would suffice for this project? With these essential preliminaries out of the way, design work began, and before too long

What electric motorgliders are good for: consistent low-level flight. This is the author's 1/4 scale Fournier RF-5b modelled with a one-off open style twin cockit arrangement. (Geoff Crew pic).

View of the Fournier's fixed u/c.

Basic fuselage structure before being braced up in a jig.

asic structure, ready for covering.

Barry Cole gives scale to the RF5b.

the dust began to fly.

Two things are at the top of the list when the design process gets underway; first, I like models that are easy to rig, with wing joiners through the fuselage and plug-in wings retained with elastic bands. (A carry-on from my slope based designs, where the ability to absorb rough landings is essential) This required some simplification to the wing/fuselage interface .

Secondly, access to the LiPo is essential, so a large hatch incorporating one of the canopies and the front of the fuselage was envisaged. To keep things nice and simple at the field, the hatch is retained with a bunch of 6mm circular magnets, something I learnt to appreciate with the K11. As the build progressed, I kept a wary eye on the ever-increasing weight., with ever-growing apprehension. By the time the wings and tailplane were film-covered, and the fuselage 'Texed and painted, the AUW came out at a disappointing 17lbs avoirdupois (or 16 lbs depending on which of my scales I used). This made her six or seven pounds heavier than the K11, but still with the same motor. On the plus side, I was now using a 6S LiPo and a bigger prop - so what would be the outcome?

Come the big day, I lined her up at the top end of the County Model Flying Club's patch, facing slightly downhill, and with a slight valley ahead that might of help to an aeroplane should it happen to be in dire difficulty due to a possible lack of power. I should point out that there was no wind, either.

With the customary pre-flight salutation to the Gods of Aeronautics, I broke the throttle seals and gave her full military power. I had never before realised the efficacy of prayer in these circumstances, because before you could say Heath-Robinson, she was off the deck and heading skywards at a pretty impressive lick. Further flight trials showed the RF5 to be a thoroughly practical and attractive machine, and if it ever stops raining, I look forward to many more quiet, oil-free flights...

To see the RF5b in action, just Google FOURNIIER RF5b 1ST FLIGHTS

Anorak time

When you are an electric neophyte, like myself, trying to source a suitable power train for the design you have in mind can be a veritable minefield. If you are building a motorglider, then different factors apply compared to, say, a warbird or aerobatic machine. A glider has, perforce, a lot of wing and therefore a lighter wing loading, added to which is an increase in aerodynamic efficiency. As the foregoing shows, less power per pound is required, and one big consideration is how much ground clearance the prop will have, given that you need to fit the biggest you can. For anyone who might be interested, I'm listing the gear used in my Fournier RF-5b to act as a design baseline.

Motor: E-Max BL 4030
ESC: Hobbywing 80 Amp Opto ESC
Prop: 6.5" x 12" folding
Battery: 6S 4000 MaH Gens Ace LiPo
Rx Power: 4.8v Eneloop

The ESC was somewhat over-specified, as the motor measured around 36 amps at full throttle. The whole lot cost around £160, which I reckon doesn't fare too unfavourably with the cost of a suitable four-stroke, especially when you compare the cost of electricity with the cost of glow fuel.

A different way to fly...?

Still on the subject of electric motorgliders, my eyes have recently been opened to a way of flying from the flat hitherto only possible slopeside. From a very early age my most urgent desire, when any flying was taking place, was to get as close as possible to the action. (Aged 10, I was given a definite flea in the ear by two

Plenty of room for the occupants of this Slingsby T49 Capstan.

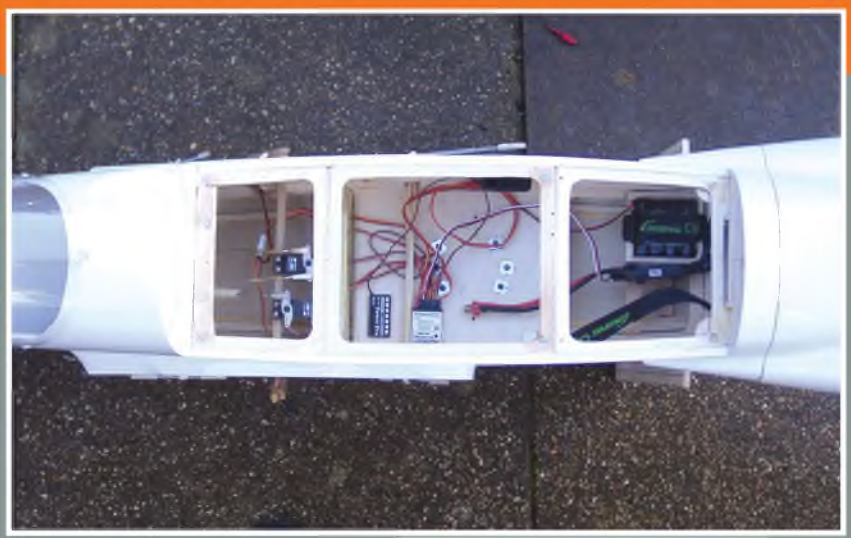
Unusual Kranich 3 at the VGC rally.

older boys flying a control-line Spitfire, as I tried to worm myself right underneath it's flight-path, the better to appreciate the experience). As a lad attending an airshow with my father, we were able to stand right on the edge of the runway as a squadron of Lightnings took off, a thrill a young lad would never get to experience these days. On a sparsely occupied slope, you can fly a large scale glider at low altitude and in close proximity to the pilot for as long as the wind keeps blowing in the right direction, which goes a long way to explain why I do so much of it. Now I have discovered that with an electric motorglider, some the same thrill and satisfaction can also be accomplished. Given the instant access to power bestowed upon the electric powered machine, it is now possible to fly a large glider, from the flat, at low altitude, and close to the pilot, with brief bursts of throttle, all the better to appreciate your creation in its natural element. (A motorglider with the power off is a glider in my book!) Of course, you have to get up early whilst all your fellow club members are munching their breakfast toast, but believe me...it's worth it!

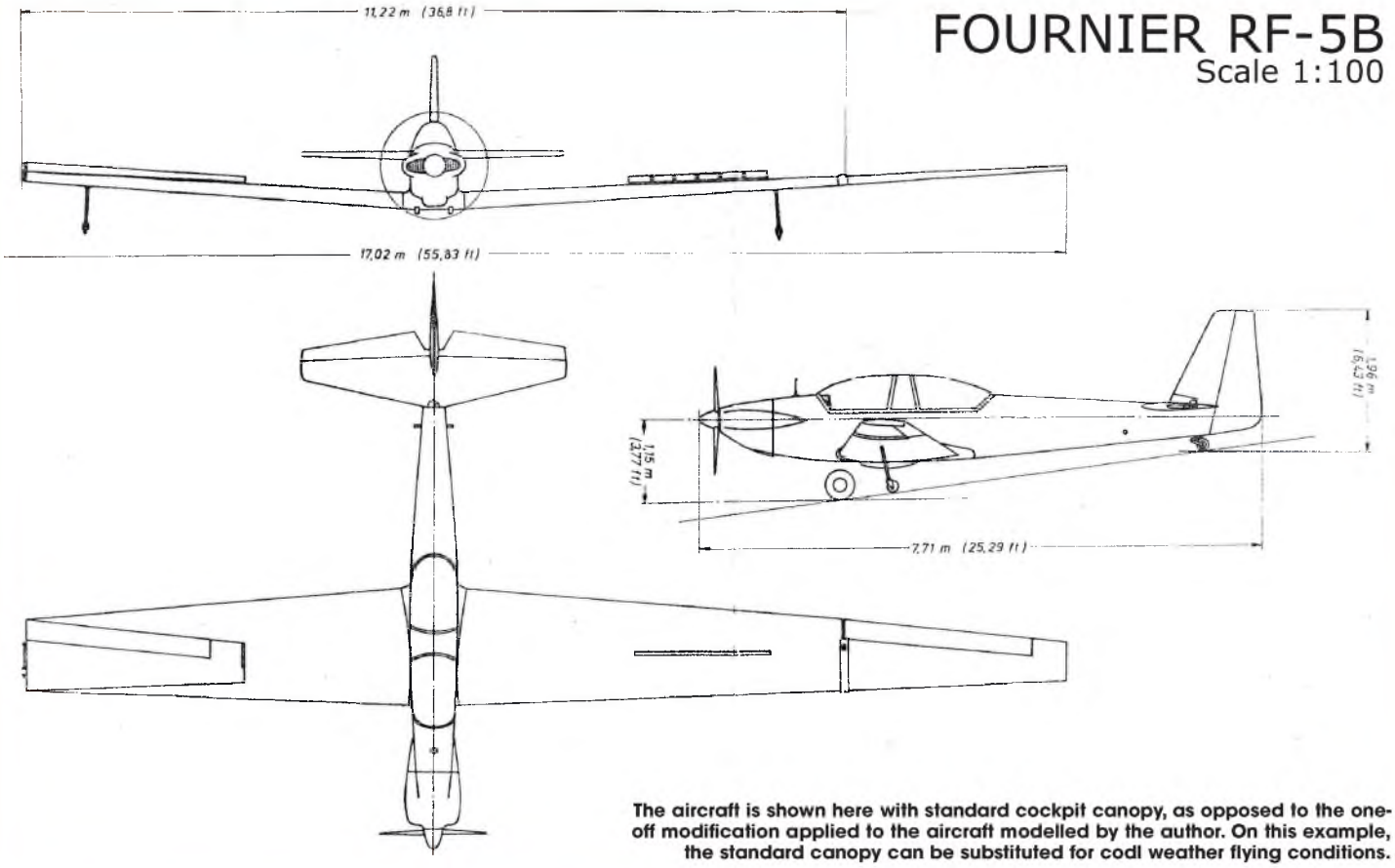
No such thing as a free lunch...?

When my current transmitter became acutely short of model memories recently, the choice was a stark one: get another tranny, or get rid of some models. The latter obviously being out of the question, I was about to buy another identical Tx, when a forum discussion alerted me to the possible benefits of the *FrSky Taranis*.

The RF5b displays its attractive planform (Barry Cole pic).



Plenty of room under the hatch.



The aircraft is shown here with standard cockpit canopy, as opposed to the one-off modification applied to the aircraft modelled by the author. On this example, the standard canopy can be substituted for codl weather flying conditions.

Slingsby Eagle on the winch.

Modernistic Standard Austria under tow.

FrSky's modules and receivers have been around for a while, but when I looked into this new Tx it seemed impossible that so much could be offered in functionality for so little pain to the wallet. The real icing on the cake for any guider of gliders lies in the availability of telemetry at a price that would allow a fleet owner such as myself to have a Vario plugged permanently into each model.

Cutting to the chase, I had myself put on the waiting list, and just after the Xmas festivities, the postman delivered the goods. So far, I've only had the opportunity to use this gear once, but I was suitably impressed. The Vario can give altitude-by-voice and this, and the Vario tones, are relayed to a speaker in the transmitter, with the added option of using an earpiece. When you consider that this Vario costs around 1/25th of the current top-of-the range units, it must be of interest to any serious scale glider enthusiast. Rest assured I will be examining this hardware closely and I'll pass on my eventual conclusions...

Finally, I'm including some more photos from last year's VGC International rally at Lasham to act as stimulation for the season (hopefully) to come... ■

c_williams30@sky.com

Not just aeromodellers have wonky tailplanes!

THE QUIET ZONE

R/C SCALE ELECTRICS BY PETER RAKE

PETER RAKE CONCLUDES THE CONSTRUCTION OF HIS 17.5"(445MM) SPAN INDOOR-SCALE WHITE MONOPLANE FROM THE FULL-SIZE PULL-OUT PLANS THAT APPEARED LAST MONTH.

Here we are again, back for another dollop of electric flight nonsense. I'm sure you've all been awaiting this month's issue with bated breath. If not, why not? Even if larger models are what float your boat, there's been nothing preventing you enlarging the plans you got last month to whatever size you fancy. Since it was actually a scaled down version of a 45" span model, with only minor alterations along the way, it's a highly practical way of acquiring a much larger model. Enlarge the drawings by 300%, reduce the thickness of the ply parts and wing ribs and you have the basis of a very nice 54" model.

Because nothing much aerodynamically has changed from my own larger version, you can expect your enlarged version to be a smooth, gentle flyer. My original model only met its demise when, flying in the evening, I lost orientation as it passed across the low sun. I thought it had turned one way, but it had actually turned the other way. The result was that I put in the wrong correction and the model promptly shredded itself through a barbed wire fence.

Getting on

Anyway, that's enough inane rambling for the time being. As we left things last time I was detailing how I printed the tissue for my model. All well and good, of course, and extremely interesting stuff, but no use whatsoever unless you have a model to attach it to. That being the case, let's take a look at actually building the model.

Wings

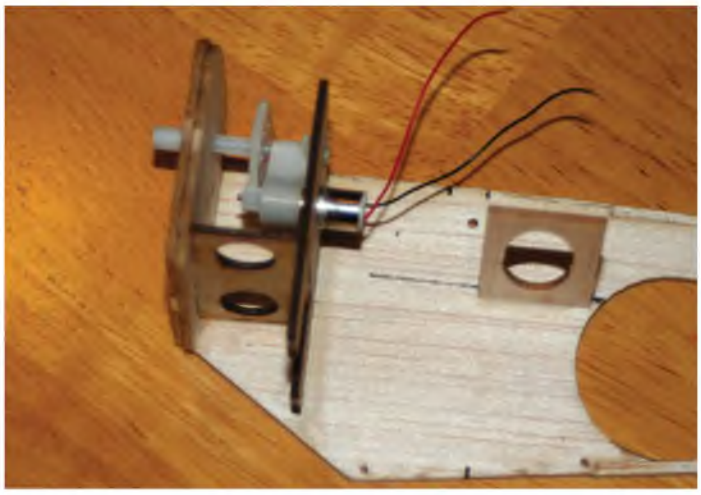
There's nothing particularly complicated about building the wings; pin down the spar and trailing edge and glue the ribs in place before fitting the leading edge. However, there are some points worth mentioning.

As you may be able to see from the photos, I adopted a couple of 'belt-and-braces' techniques while building my model. Having previously seen just what damage water shrinking tissue can do to these little lightweights,I gusseted the ribs at the trailing edge. I was using laser cut parts to build from and decided the ribs might just be a little on the soft side for my liking. Similarly, and for the same reason, I didn't want the root rib to bow inwards as the tissue shrank. Therefore I trimmed it by 1/32" so I could add some sheet balsa reinforcing. I was watching the weight, so only 'capped' that single rib. There's nothing to prevent the entire root bay being sheeted, but it isn't essential. The partial sheeting on my model worked just fine, so it should work for you if you are watching the grams.

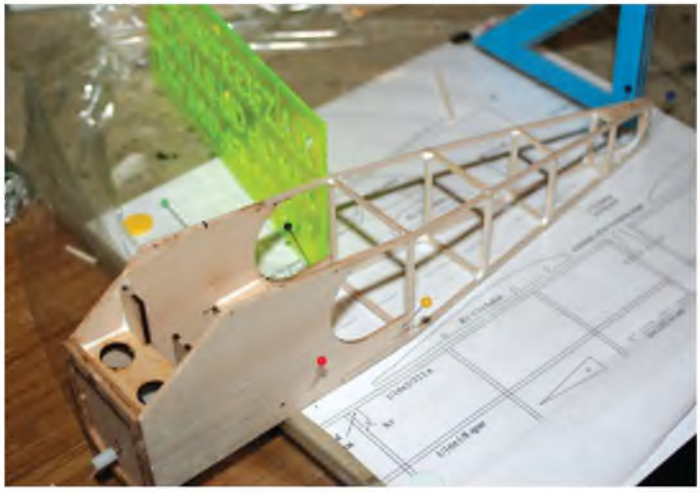
It is quite important that the root rib doesn't bow inwards because that's the bit you'll be gluing to the fuselage when you attach the wings. These lightweight models don't need hugely strong structures, but it is awfully nice if it's more than just the extreme leading and trailing edges that are glued to the fuselage. The struts do add a little strength, but are intended to be far more cosmetic than functional. Given flat root ribs, and a thin coat of epoxy retaining the wings, my model has proven more than strong enough - even, I might add, in some less

COVERED USING PRINTED TISSUE TREATED WITH EZEDOPE THE LITTLE WHITE MONOPLANE IS ALL READY TO COMMIT AVIATION.

Starting in the traditional manner, two fuselage side frames are built over the plan.



The motor goes in quite early in the construction, along with ply formers, battery tray and a plate to mount the receiver brick to.



With the second side added the longerons are cracked, the tail pulled in and cross braces fitted.

Once the decking is added it's time for some sanding - followed by a final reinforcing of glue joints.

than perfect landings. True, a full power dive into the ground, and ensuing cartwheel, would probably do severe damage but in normal use the low inertia of a light model does very little by way of harm.

Tail surfaces

Building the tailplane and elevator is simplicity itself. If you need instructions to glue a few balsa sticks together I would suggest that just possibly aeromodelling isn't the best hobby for you. They tell me that stamp collecting is quite relaxing.

What I will say is that, once again, I deviated slightly from the plan. Although the sewn hinges shown work very nicely, I'm not that good at them. Therefore, I opted for small strips of sanded floppy disc material and hinged the elevator in the usual way. Any thin, flexible material will work, but I had the discs available, so that's what I used.

Something I have found really good for fitting this type of hinge is a tube of CA gel type glue. The one I actually used is from *Deluxe Materials*, but I suppose others are much the same. What I like about it is that it has a specified ten seconds setting time; just long enough to partially slot in the hinge, apply a spot of gel and slide the hinge into place. Once you have all the hinges glued to one part, the tailplane say, you can position the elevator just onto the hinges, apply a spot of gel to them all and then slide the elevator home. The beauty of it being a gel is that it can't run where you don't want it - like along the hinge line.

The hardest part of building the rudder is probably laminating the outline. For this I used a continuous strip of 1/16"x1/32" balsa with one end sanded so it feathers to nothing. This will allow the strip to simply be wound around the former (2mm Depron) without forming a bump. The outside 'step' can be sanded away during the final shaping stage. So, the outline strip was well soaked in warm water, had white glue applied along one surface and was wrapped round the former and allowed to dry completely. The excess strip was then trimmed off and the rudder built over the plan.

It's worth mentioning that I rub the edge of the former with a candle, to prevent the laminated outline sticking to it. I'm not keen on using pins to hold the laminations in place while they dry because wet balsa tends to be very soft and is likely to be marked by the pins. To hold it tight to the former I use scraps of balsa strip, which are also waxed, pinned against the laminations. Although it takes a bit of care on this particular model, it helps if you keep the strips under tension as you work around the former. By pulling them around the former, as opposed to pushing them against it, pinning scrap bits of balsa as you go (yes, I do think only having two hands is a design flaw when it comes to modelling) it helps getting the strips around tight curves without them cracking. Even if you do get the odd one crack, the stresses on this type of model aren't likely to make it a problem; it's just much nicer if you can avoid the cracks.

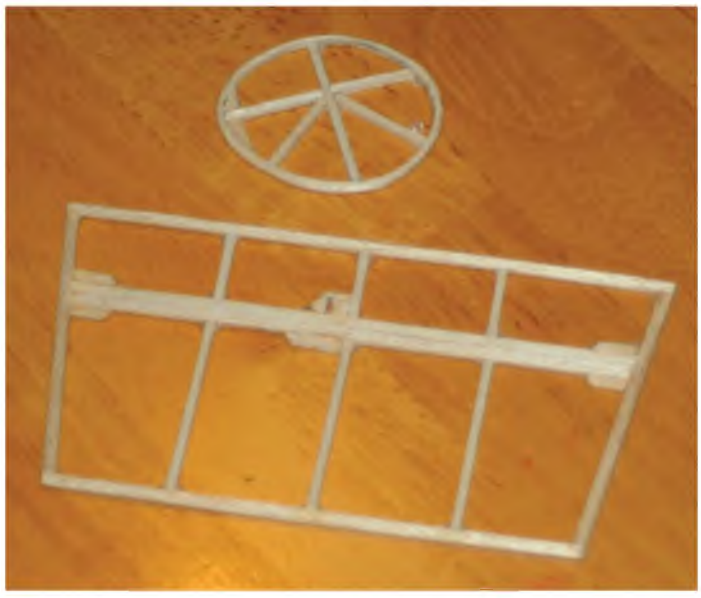
The other part that needs care is drilling the rudder to accept the 0.7mm carbon rod hinge post. I did this before finish-sanding the rudder and then used CA to glue the rod in place. A 1/32" drill and a pin vice gave the control needed to keep the hole central in the outline. If you're very sure of your drilling skills the carbon rod can extend into the cross piece. I'm not, so just drilled the outline and glued the rod to the upright.

The control horn gets glued to the hinge post after the rudder is covered, so you can still pin it down while the dope dries.

Fuselage

Okay, with the easy stuff out of the way, let's take a look at building the fuselage. No, no need for panic, it really is very straightforward. The only things you really need to watch out for involve positioning the receiver brick as shown and getting the pushrod exits in the correct place. As shown, these were worked out to be precisely right so the pushrods don't bind as they exit the fuselage, so you have been warned not to play around with the receiver location unless you want to work out where the pushrods will exit on your particular model.

The wings are easy to build but if your ribs are soft you'll need to reinforce them with gussets at the thinnest point.



The only difficult part of the tail surfaces is the laminated rudder outline - and drilling it accurately for the hinge post.

You just have to have at least one naked model photo in a construction article, so here it is.

Begin by building two side frames over the plan and allowing the glue to dry. When doing this, I like to build one side, allow it to dry and then turn it over before building the second side over the first. Balsa is well known to be only approximately the claimed size, so it's quite likely that the surface that wasn't against the board will be less than completely level. If you just build directly onto that, your second side will end up with both sides uneven. Theoretically, by turning over the first side, you'll have a completely flat surface onto which the second side can be built. By making these the inner sides, all glue fillets will be away from the surface you need to sand and any unevenness can be sanded away when you finish-sand the fuselage.

I'm sorry if this is all 'old hat' to many of you. There's just a chance it may be new and useful to less experienced builders. The model is certainly simple enough to appeal to just such neophyte modellers.

From here on, it's all basic building. Mark the former and receiver tray positions onto the inside of both fuselage frames. Score and crack the frames as indicated on the plan (where they suddenly bend inwards) and glue the formers, receiver plate and battery tray to one side. Fit the second side, ensure everything is square and join the sides at the tail. Don't fit F1/N until after you have your motor fitted or you won't get it in. These steps can be accomplished with the fuselage inverted over the plan - the beauty of having a perfectly straight fuselage top line. While the fuselage is pinned down, you may as well fit the 1/16" sheet at the undercarriage position and the tailskid mount.

When it comes to mounting the motor, you'll notice that no down thrust is shown. With the relatively high thrust line it isn't needed and could actually prevent your model flying. The first White Monoplane I built, a 30" version, had down thrust initially and point-blank refused to do any more than a protracted glide to earth. No amount of up elevator or tail weight would persuade it to do more. Then the penny dropped that the centre of thrust is above the centre of drag, so I added about half a degree of up thrust and the model was totally transformed.

Once your motor is installed (I epoxied mine in place), the F1/N assembly and battery tray can be fitted. Follow that with F2, the 1/32" sheet decking and TP and you have a basically finished fuselage. Now you just have to finish sand all the components and get your model covered.

More on covering

Last month we looked at how I print the tissue used to cover the model, now let's consider applying it and finishing the covering. Until recently I've been using a glue-stick to attach the tissue, but this can be a little imprecise when trying to line up printed tissue panels. It can be done, but tends to become something of a chore to get right. Since the tissue I use has wet strength, and is printed using waterproof ink, good old tissue paste is a much better option. It allows a certain amount (quite a bit actually) of 'slip', allowing accurate alignment and precise location of the various pieces of tissue. You can also tease out all the wrinkles, so that your tissue goes on very smoothly even before you do any water shrinking or doping. The more evenly you get it onto the model; the better will be the end result.

Cover the entire model, but leave the fuselage bottom until after you have your receiver and pushrods installed.

A real boon to 'coffee table modellers' that I recently discovered is a product called *EzeDope* (another *Deluxe Materials*

product). Unlike smelly old cellulose dope, that really does need to be used outdoors, *EzeDope* is virtually odour free and can be used in the house with impunity. I absolutely hated the product when I first tried it, but now use nothing else. The secret is to thin it at least 70% with water, and then apply it using a sponge 'brush' about an inch wide. Take care not to leave any droplets or runs on the surface and it gives really good results - without stinking out the house.

The *Oracover* irons onto it very nicely.

Installation

As described last month, the pushrods are 1 mm carbon rod with ends Z bent from pins (being the mean so and so I am I use modelling pins that are bent or have lost their head). These pins are secured to the carbon rod with a piece of heat-shrink tube and a spot of CA. However, I like to leave the rods very long, and fit the horn end pin after they are installed in the model. I make one rod longer than needed and the other a lot longer than needed and trim them to length once the linkages are completed and adjusted.

So, begin the installation by fitting the pushrods to the receiver brick and, working from the fuselage bay immediately aft of where the sides break inwards, slip the very long pushrod through the fuselage and out of its' exit plate. Because it was so much longer you can work it into place without the risk of putting the other pushrod through the covering. Now, with the first rod safely located, you can repeat the process with the second pushrod. Apply a small amount of Uhu Por to the brick, taking extreme care to keep it well away from the servo gears, slip it into the fuselage and attach it to RT. Allow the glue to dry completely before proceeding.

Swooping in (?) for a low pass the model shows off its' simple, but attractive lines.

Slip the heat-shrink tube onto the pushrods, but don't glue them yet. Fit the control horns (epoxy) and insert the Z-bent pins (the rudder needs to be in its' hinge tube for this). Slip the heat-shrink over the pins, centre the servos and control surfaces and apply a spot of CA to secure the pushrod ends. Now trim off the excess carbon rod. I find nail clippers extremely handy for this task because they can work in restricted spaces and cut the rod cleanly.

Now you can finally cover the lower fuselage and fit the u/c to complete your model.

Flying

Well, what can I say? Being just a reduced size version of a proven design, the model flies much like its' larger sisters. There's ample power available for gentle cruising around and, despite that strange rudder (about the only curve in the entire model), it responds well to control input.

It isn't, or intended to be, aerobatic, but does put an interesting, unusual shape into the air. It may well be suitable for indoor flying too, but that rather depends on how big your flying venue is. The one we use is nowhere near big enough for anything much more than a Vapor or Nano Stik, so I fly outdoors on calm days. ■

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