# Aero modeller

JUNE 1981 60p
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MAP MODEL MAGAZINE

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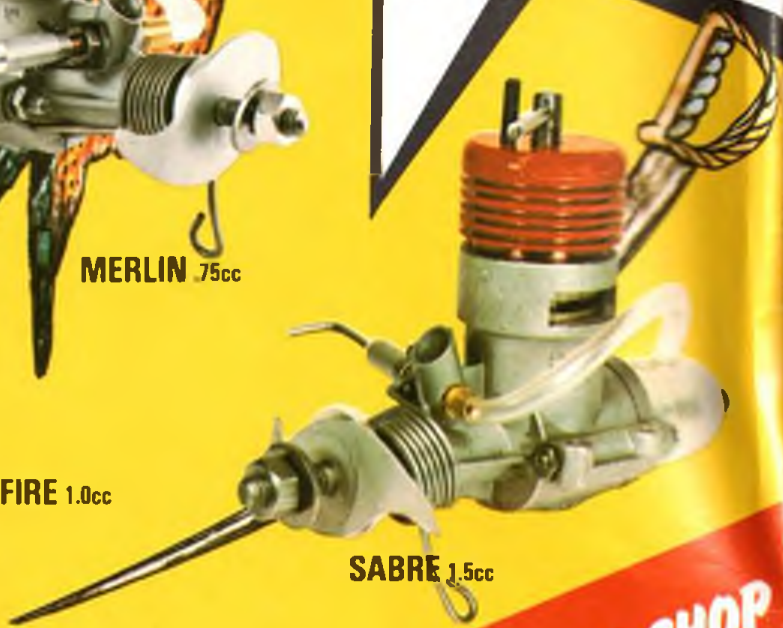

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# Aeromodeller

JUNE 1981

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MAP MODEL DIVISION MAGAZINE

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*Managing Director* RON MOULTON


## Comment

Old Warden Aerodrome, now well established as an Aeromodelling venue, will once again be the site for our 1981 All Scale Day. This will take place on the 20th and 21st of June. Gates open at 9 a.m. and close at 6 p.m., by which time the airfield must be cleared. The Shuttleworth Museum will make their usual charge of £1.00 per adult and 50p per child. This charge will give access to the collection of full size aircraft (and other vintage modes of transport) as well as the model flying event. By permission of the Museum, *limited* camping facilities will be available — for Friday 19th, Saturday 20th and Sunday 21st at £3 per night, but only by prior arrangement. (Phone Northill 288 and ask for the Museum Shop).

If you want to see the best scale models around, don't miss this two day event.

You will see radio controlled models giving incredible aerobatic displays as well as free flight, scale and vintage aircraft. If you're participating be safe and sure by using 35MHz.

August the 16th is the date to put in your diaries for the Vintage Model flying day at Shuttleworth, Old Warden. If you have been following with interest our new column, by Alex Imrie (Vintage Corner), and want to see these 'Old Timers' in action, this is a date not to be missed. New modellers are always welcome in all areas of Aeromodelling, and at any meeting, there is always someone with time to give help and advice to newcomers.

So lets see some new faces on the flying fields this year.

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### ON THE COVER

Solar Challenger flying totally by solar energy. See the full report by Martyn Cowley on page 280.

### NEXT MONTH

We have a superb R.T.P. model to build, designed by Martin Tuck, of the new B.A. 146 airliner. Martin has also drawn detailed scale drawings of this aircraft, and written a description for 'Aircraft Described' in this issue.

There will also be a full size plan to build a control-line autogyro R.D. 49 designed by John Stroud. Aero Aces continues with how to design your own models, and of course there is news from the free flight, control-line and vintage scene.


**Model & Allied Publications Ltd**

P.O. BOX 35, BRIDGE STREET, HEMEL HEMPSTEAD, HERTS HP1 1EE. TEL: 0442 41221

*Also publishers of:*
RADIO MODELLER — RADIO CONTROL MODEL & ELECTRONICS — POPULAR CRAFTS — SCALE MODELS MODEL ENGINEER — MODEL BOATS MODEL RAILWAYS — WOODWORKER MILITARY MODELLING — MODEL CARS MOVIEMAKER — PHOTOGRAPHY CLOCKS — PUZZLES DIGEST PUZZLER'S WORLD ART & ANTIQUES

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*Aeromodeller* Magazine (ISSN 0001-9232) is published monthly by Model & Allied Publications Limited, P.O. Box 35, Bridge Street, Hemel Hempstead, Herts HP1 1EE, England. Tel: Hemel Hempstead (0442) 41221. Second class postage paid in the U.S. at Milwaukee, Wisconsin and at additional offices. Distribution to North American hobby and craft shops by Kalmbach Publishing Company, Milwaukee, Wisconsin. Tel: 414-272-2060. Distribution to news stand sales by Eastern News Distributors Inc., 111 Eighth Avenue, New York, N.Y. 1011, U.S.A. Tel: 212-255-5620. Distribution to museums and bookshops by Bill Dean Books Ltd., 166-41 Powells Cove Boulevard, Whitestone, New York 11357, U.S.A. Tel: 212-767-832.





**Advertisement Offices:** Model & Allied Publications Ltd., P.O. Box 35, Bridge Street, Hemel Hempstead, Hertfordshire HP1 1EE. Tel: Hemel Hempstead 56117.

**Subscription Department:** Remittances to Model & Allied Publications Ltd., P.O. Box 35, Bridge Street, Hemel Hempstead, Hertfordshire HP1 1EE (subscription queries Tel: 0442-51740). **Direct subscription rate** £10.00 per annum, including index. Overseas subscriptions £11.00 or $25.00.

**Change of address U.S. Postmaster:** Send address changes to Model & Allied Publications Ltd., P.O. Box 35, Bridge Street, Hemel Hempstead, Hertfordshire, HP1 1EE, United Kingdom.





AEROMODELLER incorporates the MODEL AEROPLANE CONSTRUCTOR and MODEL AIRCRAFT and is published on the third Friday of each month prior to date of publication.

*Aeromodeller* is printed in Great Britain by Leicester Printers Ltd., The Church Gate Press, P.O. Box 20, 99 Church Gate, Leicester LE1 9FR. Mono Origination by Multiform Photosetting Ltd., Cardiff, for the Proprietors and Publishers, Model & Allied Publications Limited (a member of the Argus Press Group). Trade Sales by Argus Press Sales and Distribution Limited, 12-18 Paul Street, London EC2A 4JS.

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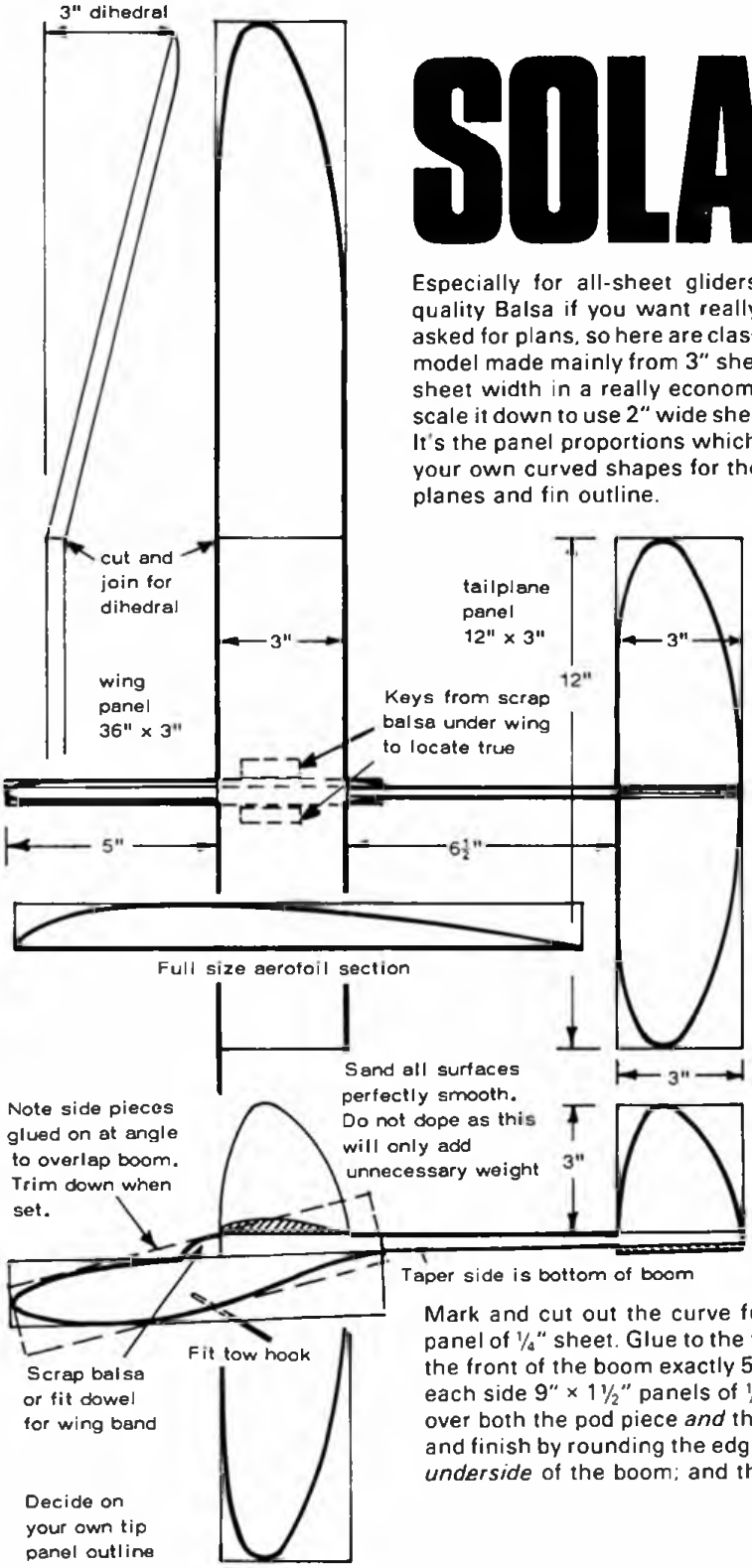
# SOLARBO


Especially for all-sheet gliders where you *must* use top quality Balsa if you want really good results. We are often asked for plans, so here are classic proportions for a 36" span model made mainly from 3" sheet . . . and using the available sheet width in a really economical manner. You could also scale it down to use 2" wide sheet; or up to use 4" wide sheet. It's the panel proportions which really matter. You can draw your own curved shapes for the outer wing panels and tail-planes and fin outline.




Critical part for weight — and that means ultimate flying performance — is the wing. A 36" × 3" × ¼" sheet is required. Select the *lightest* you can find. Not more than 1¾oz in weight (or 50 grams on a letter balance). Make sure the sheet is dead true (Solarbo sheet always is; other makes are often warped!). Mark off three 12" panels. Cut the outer panels to plan shape. Carve and sand the whole wing down to aerofoil section. Cut off the outer panels, chamfer the inner ends and rejoin to the wing centre with 3" dihedral under each tip.

The tailplane is marked out and cut to shape from a 12" × 3" × 1/16" sheet panel. The fin from a 3" length off the same panel, again shaped as you like. Use light Solarbo RIB STOCK for this. Taper off the edges lightly with sandpaper. You do not need to bother about forming a proper aerofoil section.

The boom is cut from *really hard* ¼" balsa sheet. Length 12½" exactly and tapering from ½" at the front to ¼" at the rear. Alternatively use really hard ½" × ¼" strip, cut to this taper.

Mark and cut out the curve fuselage pod from a 9" × 1½" panel of ¼" sheet. Glue to the tapered side of the boom, with the front of the boom exactly 5" back from the nose. Glue on each side 9" × 1½" panels of 1/16" sheet at an angle to cover over both the pod piece *and* the boom. Trim to outline shape and finish by rounding the edges. Cement the tailplane to the *underside* of the boom; and the fin on top.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# Hangar Doors

ONE OF THE WORLD'S most respected model engine designers has recently introduced a new design. Bill Brown, renowned for his ignition engines of the 1930s and later for his $CO_2$ powerplants, is now approaching his 70th birthday. Yet he remains as creative as ever, and is brimming with enthusiasm for the model aircraft hobby. His latest brainchild is a tiny $CO_2$ engine intended specifically for Peanut Scale models, which Bill considers a 'flying art form". Before releasing the new design, Bill personally tested one in a Peck-Polymers kit Piper Cub to be certain of its suitability. *"If it didn't work efficiently, it would not have been marketed"*, he explained. Happily, the engine passed all tests (including shunting off gymnasium walls during indoor flying sessions), and is now in production.

***The new Brown Jr. 'Campus A-23' Peanut $CO_2$ engine compared in size to the spark plug in a vintage Brown Jr. ignition engine.***

At a glance the new Campus A-23 is reminiscent of an earlier Brown design, the Campus A-100, *circa* 1948. However, a direct comparison reveals many differences and improvements. The older unit employed a difficult-to-use charging system and was prone to rapid crankshaft bearing wear, particularly if not oiled frequently. Modellers of the time, familiar only with traditional self-lubricating 'gas' engines, frequently overlooked this needed requirement! The new Campus employs the same charging system as the larger Brown $CO_2$ engines, and the crankcase has been completely redesigned for ruggedness and long bearing life.

The cylinder features an aluminium head equipped with a swivelling 'fuel' line to make speed adjustments easier. The fuel lines themselves are aluminium, resulting in significant weight savings over the previously employed copper tubing. Gone too are the solder joints of the earlier engines.

And whereas the A-100 was intended to be mounted via common straight pins pushed into the firewall, the A-23 has three crankcase lugs to accommodate tiny machine screws. All-up weight is less than 0.25oz and overall height is under one inch ... about the height of the old Brown Jr. ignition engine spark plug, in fact!

The engine is supplied with a 3cc capacity aluminium tank, which will yield durations well over two minutes. Optionally available, and seemingly a safer choice for outdoor flying, is a 2cc tank. 6cc, 10cc and 20cc tanks are also manufactured, suggesting practical possibilities for indoor control-line or R/C models. Surely the time is long overdue for some enterprising electronics manufacturer to produce a truly small guidance system suitable for such a purpose?

The A-23 engines are presently priced at US$39.95 without the charging unit and to date the demand is outstripping the supply. However production is being increased and in our opinion, such a jewel-like piece of craftsmanship is well worth the wait. Who will be the first to win a Nationals contest with a Peanut?

## Indoor World Record Flight

On 3rd February 1981, Hideo Enomoto, who has had experience in the F1D World Championship, made a new World Record of 25 minutes 24 seconds in F1D Category 1. The flight was made at the 1st Gymnasium of Seishonen Sogo Sports Centre in Yoyogi which has a height of 7.95m. Specification of his plane is as follows: total wing area, 11.38dm²; wingspan, 640m; wing chord, 190mm; wing weight, 0.35g; stabiliser area 4.21dm²; stabiliser span 380mm; stabiliser chord 190mm; fuselage length, 753mm (not including propeller); propeller D520mm × P800mm; weight (plane only), 1.03g; rubber weight, 1.32g (Pirelli — made in 1978); 1620 turns.

## Use of Cardington 1981

Confirmed Contest Programme

| | |
|---|---|
| 17th May | Hand Launched Glider/ $CO_2$ Duration/EZB/Manhattan, etc. |
| 14th June | Hand Launched Glider/ $CO_2$ Duration/EZB/Manhattan, etc. |
| 21st June | (Originally 28th June) Scale/Peanut/EZB/Film $CO_2$/Manhattan. |
| 5th July | (Originally 12th July) 1st FIA Microfilm team trials. |
| 29/30/31st August | Indoor Nationals, all classes including $CO_2$, Duration and Hand Launched Glider. Events per day to be published later. |
| 6th September | Final FIA Microfilm Team Trials. |
| 20th September | $CO_2$ and Hand Launched Glider Trophy finals. |

As previously published, it is vital to the interests of Indoor Flying, that good attendances be made during these dates at Cardington 1981 in order to defray the cost of hiring these facilities.

The SMAE predicts a cost of somewhere between £3 and £5 per head (or less if sufficient numbers attend), in order that they defray the daily charge for using the hanger. The more than turn up the cheaper it becomes. Spectators are to be charged approximately £1 which is well worth the entertainment value.

Organisers make a note of the two changed dates in the above programme to avoid clashing with outdoor events, and do come along and support the indoor committee and enjoy these magnificent facilities.

## Midland Family & Leisure Show

The Organisers of the Midlands Family & Leisure Show have regretfully decided to postpone holding this exhibition until 1982. Despite most encouraging response from many model firms who have booked stands, it became clear that in the present recession many other firms who would normally have exhibited, were not able to do so, and it was therefore felt better to postpone the exhibition until the business climate improves.

# What's Happening?

**May 17**
CROYDON & DMAC *FAI CONTEST F1A, F1B, F1C* Start 10.00am No rounds Venue Everleigh Contact Ray Elliott 01 997 1563
**May 17**
TYNEMOUTH MAC F/F RALLY *R1A (5 rounds) O/R, O/P, COMBINED MINI, HLG* Venue Albermarle Barracks (ex RAF Ouston) 15 miles west of Newcastle upon Tyne 10.00am start Contact Ron Pollard, 23 Ivy Road, Newcastle upon Tyne NE6 4PU Tel 0632 623737
**May 17**
*SAM 35 MEETING* Venue Biggleswade Common Beds
**May 18**
EAST ANGLIAN AREA SMAE *OPEN ½A COMBAT CONTEST* Start 10.00am Venue Changtry Park, Hadleigh Rd., Ipswich, Suffolk Limited pre-entry £1 (sae for map and rules) Contact A Malcolm Tel Ipswich 40896
**May 24**
THREE KINGS C/L SCALE FLY-IN *PROFILE AND CLASS 2* Trophies for all types 50p entry per flyer Venue Old Croydon Aerodrome, Purley Way, Croydon, Surrey Contact W Cordwell Tel 01 764 1661
**May 30/31**
HOLKER HALL Nr Grange-over Sands Open model flying rally R/C sport etc






**June 6 and 7**
MIDDLE WALLOP MFC *LARGE SCALE MEETING* Camping facilities Contestants pre-entry fee £3 refundable on the day or for cancellations received three days before the event Trade stands etc Contact N Sharp, Officers Mess, School of Army Aviation, Middle Wallop, Nr Stockbridge, Hants
**June 7**
BATH MAC *F/F O/P, O/R, O/G ALL IN FAI, ALL IN MINOR CO, AND HLG C/L FAI COMBAT, ½A COMBAT, TEAM RACE FAI AND ½A, POSSIBLY AEROBATICS* Venue Merryfield, Nr Ilminster, Somerset Contact E Burles Tel 331126
**June 14**
NANTWICH & DIST *WIGAN 70, HLG* 10am start Venue Three Sisters Site Contact Dave Allman Tel 0270 627116
**June 14**
FINCHLEY C/L GALA *F2B & FAI COMBAT* Venue Glebelands, Summers Lane, Finchley Pre-entry £1 — on day £2 Contact Paul Winter, Tel 01 958 6991
**June 20/21**
AEROMODELLER ALL SCALE DAYS — Old Warden Airfield, Biggleswade, Beds
**June 21**
CHURCH FENTON NORTHERN AREA *VINTAGE & PANNETT MEETING* with Jack Kay Memorial Trophy *F/F VINTAGE O/P & O/G R/C Class 2 Scale STD & SR AEROBATICS* SMAE ONLY Contact Tel 0532 864026
**June 21**
CROOKHAM F/F GALA *O/P, O/R, O/G, HLG ALL IN FAI (5 FLIGHTS — NO ROUNDS)* SMAE members please Venue Old Airfield, Beaulieu Heath, Hampshire Start 10.00am Contact P M Uden Tel 0734 51366
**June 21**
MORLEY & DIST MAC *VINTAGE PANNET KAY COMPETITION O/P, O/G, Vintage Duration* Venue RAF Church Fenton Contact Barry Judge Tel 0274 875976
**June 21**
SMAE SOUTHERN AREA - LEE BEES MAC — *F2B - NOVICE STUNT* VENUE HMS Daedelus Lee on the Solent, Hants Contact Dick Crark Tel 048-95-5726
**June 21**
*VMAS ANNUAL VINTAGE FLY IN* 10.00am onwards Insurance essential to fly at this venue Venue Chobham Common Contact Don Read, Tel Farnham 723400
**June 28**
NOTTINGHAM MAC OPEN COMPETITION *INCLUDES F2B, NOVICE, AND SCALE* Venue Basford Miners Welfare Club, Basford, Nottingham 10.00am prompt start Contact Steve France, Tel Nottingham 613089
**June 28**
RAFMAA DUCTED FAN FLY-IN *R/C, C/L and F/F, SCALE AND NON SCALE* No entry fee, spectators welcome Venue RAF Abdingdon Contact G E Whitehead, Officers Mess, RAF, Upwood, Huntingdon, Cambs Tel Ramsey 812092 Ext 242
**June 28**
*40TH ANNIVERSARY OF BRITISH JET FLIGHT FLY-IN* Venue RAF Barkston Heath, 10.00am start Fliers must be SMAE members Spectators welcome, entrance free Contact Abingdon 21288 ext 603/604 Flt Lt G E Whitehead
**June 28**
WHARFEDALE MINI GOODYEAR MEETING 10.00am to 6.00pm Entry £1 per team SMAE but no age limit Venue Dewsbury, Yorkshire Contact Jeff Smith, Tel Leeds (0532) 663432
**June 28**
COTSWOLD OLD TIMER R/C MEETING — details to follow
**June 28**
PETERBOROUGH MFC *½A COMBAT* Venue The Embankment, Peterborough Contact Neil Gill, 4 Beech Road, Glinton, Peterborough PE6 7LA Tel Peterborough (0733) 252645
**July 4/5**
BRITISH TWO DAY FAI COMBAT INTERNATIONAL Venue 'Dytchley's Manor' country estate only 20 miles from London Pre-entry is essential For full information and entry forms, send large sae to 'Combat International,' 89 Coldblow Crescent, Bexley, Kent Closing date May 1, 1981 Phone enquiries Pete Jayes 01 226 1249 or Paul Vallens, Crayford (29) 53401
**July 5**
SOUTH MIDLAND AREA C/L AEROBATICS *F2B & NOVICE* 10.00am Venue Stopsley Sports Centre, Luton, Beds Contact P G Rabjohn, 47 Hilleyfields, Dunstable, Beds LU6 3NS
**July 5**
WALSALL OLD TIMER R/C MEETING — details to follow
**July 11 and 12**
TWO DAY C/L EVENT IN CONJUNCTION WITH THE ST JOHN AMBULANCE GALA *SAT & SUN F2B CLAPA CHAMPIONSHIP (MEMBERS ONLY) SUN OPEN NOVICE STUNT, OPEN CARRIER, OPEN SCALE* ALL PRE ENTRY ONLY Venue The Essex Showground, Nr Braintree, Essex (on A130 between Chelmsford and Braintree) Contact Peter Burges, Tel 516881 or day 519719
**July 19**
DOUG BLAKE MEMORIAL TROPHY *OPEN AND NOVICE* Pre-entry Venue Radlett Contact Glen Alison, Rickmansworth 72675
**July 19**
PETERBOROUGH MFC *3RD ROUND CLASS 'A' DIESEL COMBAT* Venue 4 Beech Road, Glinton, Peterborough PE6 7LA Tel Peterborough (0733) 252645
**July 19**
*SHUTTLEWORTH MODEL GROUP OPEN DAY C/L, F/F* Special contests for STAND OFF C/L SCALE and F/F RUBBER
**July 19**
ELLIOTT SUMMER RALLY — *½A TEAMRACE, GOODYEAR, FAI TEAMRACE, ½A COMBAT, CARRIER/PROFILE 40)* Venue Marconi Avionics, Rochester, Kent Contact Peter O'Neill, Tel 0732 57899
**July 19**
*WHARFEDALE DIESEL COMBAT* 10.00am start Venue Dewsbury, Nr Wakefield Contact Jeff Smith Tel 0532-663432
**July 19**
BATH MAC *WESTERN AREA RALLY, F/F O/P, O/R, O/G, ALL IN MINOR CO, AND HLG C/L FAI COMBAT, ½A COMBAT TEAM RACE FAI AND ½A, POSSIBLY AEROBATICS* Venue Merryfield, Ilminster, Somerset Contact E Burles Tel 331126
**July 26**
SMAE 3RD CENTRALISED C/L EVENT GOODYEAR, FAI T/T, FAI SPEED *½A AND FAI COMBAT, AEROBATICS NOVICE AND F2B CARRIER O&P* Venue Fulbeck, Nr Barkston Heath
**July 29**
CROYDON & DMAC *CONTEST FOR A1 ½A/CD H CO, HLG* Venue Chobham Common, Surrey Contact R Elliott Tel 01 997 1563
**August 2**
SMAE LONDON AREA MEETING — *C/L SPEED ONLY* Venue Old Army Parade Ground, Bicester Contact Paul Eisner, Tel Lea Valley 760849
**August 16**
AEROMODELLER VINTAGE DAY — Old Warden
**Sept. 6th**
PETERBOROUGH MFC 4TH FINAL ROUND CLASS 'A' DIESEL COMBAT Venue The Embankment, Peterborough Contact Neil Gill, 4 Beech Road, Glinton, Peterborough PE6 7LA Tel Peterborough (0733) 252645
**Sept. 6th**
CHURCH FENTON NORTHERN AREA RALLY *ALL CLASSES F/F, C/L, R/C* SMAE ONLY Contact 0532-864026
**Sept. 13th**
BATH MAC *F/F, O/P, O/R, O/G ALL IN FAI, ALL IN MINOR CO, AND HLG* Venue Claverton, Nr Bath, Avon Contact E Burles Tel Bath 331126
**Sept. 20th**
SMAE LONDON AREA MEETING — *C/L SPEED ONLY* Venue Old Army Parade Ground, Bicester Contact Paul Eisner Tel Lea Valley 760849
**Sept. 20th**
THE WITCHFORD MEETING *F/F, R/C, C/L, GLIDER, COUPE D'HIVER, ½A POWER* Profits will go to charities for the disabled Watchford is 2 miles N of Ely, Cambs, and the site is a very large area of farmland with no crop problems, perimeter tracks and runways allow vehicle access to launch points for all models SAE to Martin Dilly, 20 Links Road, West Wickham, Kent
**Sept. 27th**
ROMANWAY MFS — *VINTAGE & ELECTRIC FLY IN/R/C ASSISTED) ALSO CONTROL LINE* Venue to be announced SAE to G Johnson 37 Oxford Road Kirtlington, Oxon
**Sept. 27th**
BATH MAC *F/F, O/P, O/R, O/G ALL IN FAI, ALL IN MINOR CO, AND HLG C/L FAI COMBAT, ½A COMBAT, TEAM RACE FAI & ½A, POSSIBLY AEROBATICS* Venue Merryfield, Nr Ilminster, Somerset Contact E Burles Tel 331126
**Oct. 11th**
CHURCH FENTON SMAE NORTHERN GALA *F/F, O/R, P/G, C/L, ½A, FAI CL B, R/C AEROBATICS* for SMAE Trophies plus other non SMAE Events SMAE ONLY Contact 0904-76794
**Oct. 18th**
PETERBOROUGH MFC *½A COMBAT* Venue The Embankment, Peterborough Contact Neil Gill, 4 Beech Road, Glinton, Peterborough PE6 7LA Tel Pboro (0733) 252645
**Oct. 18th**
CHURCH FENTON NORTHERN AREA FAI MEETING *F/F, FAI, B & C, C/L F2B & C, R/C F3A & B, F/F 2* (flights before 1 p.m. SMAE ONLY Contact 0653-2580
**Oct. 18th**
ELLIOTT AUTUMN RALLY — *B TEAMRACE, GOODYEAR, FAI TEAMRACE, ½A COMBAT, SPEED, AEROBATICS* Venue Marconi Avionics, Rochester, Kent Contact Peter O'Neill Tel 732 57899

## EVENTS

**June 28th**
MAIDENHEAD MODEL MAKERS CLUB EXHIBITION *R/C FLYING, MODEL DISPLAY, SLOT CARS* 1.00 p.m. start Entrance 50p Venue Braywick Road, Rugby Ground, Maidenhead
**Sept. 3-5th**
THE EIGHTH BUSINESS & LIGHT AVIATION SHOW AND CONVENTION SPONSORED BY FLIGHT INTERNATIONAL AND AVIATION MAGAZINE Venue Cranfield
**October 9-11th**
SCALEDOWN '81 EXHIBITION — 14 categories including two for aeromodelling 'Flying' and Static Venue Brian O'Malley Central Library and Arts Centre, Rotherham Contact R Milnes, 528 Retford Road, Woodhouse Mill, Sheffield S13 9WE

# Special Offer

**SLINGSBY EAGLE** with rudder and elevator control for slope and thermal soaring. Strong balsa and ply fuselage with moulded top deck. Clip-on canopy for access to radio. Kit includes die cut and pre-shaped balsa and ply parts, spars, canopy, wheel, all hardware and accessories and decals. Complete even to glues.

## CAMBRIA'S 70" span near-scale SLINGSBY EAGLE

*(normal price £21.50)*

***PLUS*** → **MEDALLION 2 COMPLETE OUTFIT**

*(normal price £34)*

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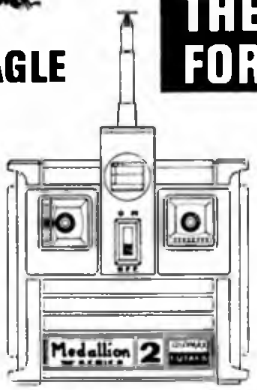


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# SOLAR CHALLENGER

By
Martyn Cowley

*Unconventional structure clearly apparent when seen overhead. Challenger set what is believed to be a new world record for electric flight, while on battery test, with a flight of one hour 32 minutes at 1600ft.*

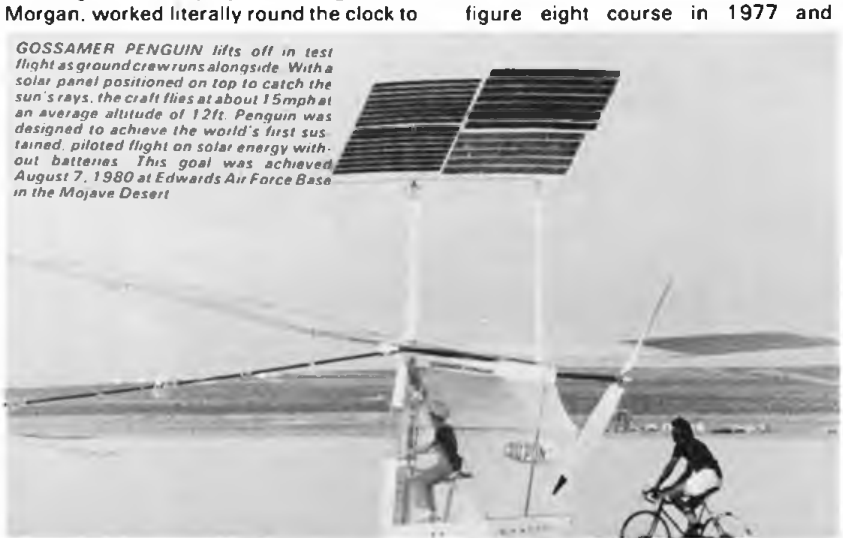
***Exclusive first hand report, of Paul MacCready's solar powered aircraft project***

A PIONEER of modern aviation, working on a new project, is certain to push forward the frontiers of achievement. Dr. Paul MacCready's vision was to make the World's first truly solar powered aircraft, the *Solar Challenger*. Strong enough, yet light enough to be capable of 100 mile plus flights at altitudes of 5-10,000ft. His consultant for the project, Bob Boucher, has the experience with electric powered flight and use of photovoltaic solar cells to help make the vision become reality. With financial backing provided by the DuPont Company, an enthusiastic and youthful team, guided by project manager Ray Morgan, worked literally round the clock to build the experimental aeroplane in the unprecedented time of just 4 months. During flight trials late in 1980, the *Solar Challenger*, piloted by Janice Brown, went on to establish an impressive performance, as a prelude to MacCready's ultimate goal for 1981 — a solar powered flight from Paris to London!

Paul MacCready, himself a World Soaring Champion in 1957 and a leader of the Hang Gliding movement during the 60s, is internationally famous as the "Father of Human Powered Flight". His *Gossamer Condor* won the first Kremer Prize of £50,000 for competing the 1 mile figure eight course in 1977 and his *Gossamer Albatross* collected the second Kremer Prize of £100,000 for crossing the English Channel in 1979, the pilot on both occasions being Bryan Allen.

Bob Boucher will be better known to model flyers through his company *Astro Flight Inc.*, which has promoted and led the field of electric powered flight since the early 1970s. Bob set World Record flights with electric powered R/C models and holds US patents for electrically powered R/C aircraft. In 1972 he achieved a flight of 19 miles in 29½ minutes at speeds up to 55mph and in 1973 his model carried a 6lb payload for a flight of 1 hour.

In 1974, Bob Boucher flew the World's first Solar Powered RPV (Remotely Piloted Vehicle) the *Sunrise I*, followed in 1975 by *Sunrise II*, which set an altitude record at 17,200ft. Boucher's concept was perpetual flight — to climb all day on solar power, glide all night, and still be above cloud base at dawn!



*GOSSAMER PENGUIN lifts off in test flight as ground crew runs alongside. With a solar panel positioned on top to catch the sun's rays, the craft flies at about 15mph at an average altitude of 12ft. Penguin was designed to achieve the world's first sustained, piloted flight on solar energy without batteries. This goal was achieved August 7, 1980 at Edwards Air Force Base in the Mojave Desert*

## A little history

Others too have made significant contributions over the years. Fred Militky developed electrical solar powered Free Flight and R/C models from the mid-60s, and made the World's first man carrying electric flight with a converted *HB-3* motor-glider in Austria in 1973.

In England Freddie To designed the *Solar One*, a motor-glider type aircraft powered

*Left first lady of solar powered flight, 95lb Janice Brown, with designer Paul MacCready*

*Project manager Ray Morgan wraps carbon fibre tube with heat shrink polypropylene tape. Rear spindle advances tape spool, as front carbon tube rotates*

by electric motor driven by batteries charged before flight by a solar cell array on the wing. Larry Mauro's *Solar Riser*, a converted biplane hang glider, later used a similar principle to make first man carrying flights in America.

## Gossamer Penguin

Paul MacCready's involvement in Solar Powered flight followed a series of tests on low speed flight for NASA which used his *Albatross II*, converted to battery powered electric flight to enable accurate computing of in-flight performance. This led to the conversion of the third cross-Channel back-up MPA, the *Gossamer Penguin* for solar powered flight, using a top mounted solar panel to generate power. The *Penguin* needed near calm conditions at dawn and utilised a tilting solar panel which could be aligned perpendicular to the rays of the sun low on the horizon, to maximise performance.

MacCready's 13-year-old son Marshall piloted the first flight on May 18, 1980 and woman pilot Janice Brown subsequently set official records on August 7th, 1980 of 1.95 miles during a 14 minute flight.

The solar powered *Gossamer Penguin* however, had many shortcomings. The added payload of 50sq ft of solar cells made control very difficult, there was insufficient power to take-off without a bicycle tow, and structurally the airframe was barely capable of supporting its own weight during flight, limiting it to a safe height of about 10ft.

Although the *Penguin* has no future, it served its purpose as a development prototype, providing essential information and experience in solar powered flight that ensured success for the *Challenger*.

## Solar Challenger

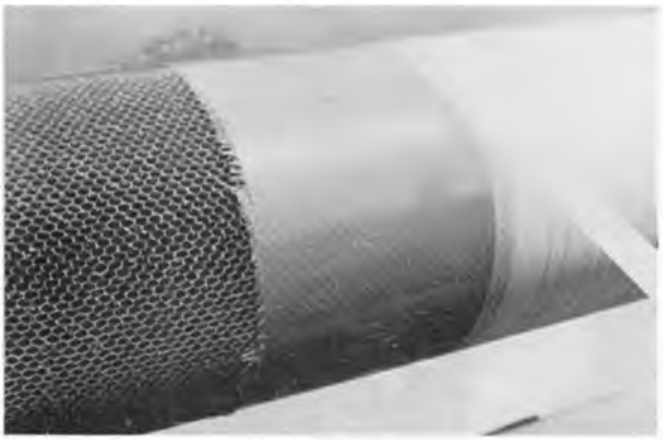
The designers and constructors of the *Solar Challenger* included two from the previous *Gossamer* projects, Blaine Rawdon, responsible for much of the structural design, and Ted Ancona. Others on the project owe more to their expertise as hang glider enthusiasts or model builders than to any formal education in aviation. After all, the *Challenger* is closer to being an outsize model than any regular aircraft.

The construction of the *Solar Challenger* is a masterpiece in fitness for purpose and use of materials, combining as it does, the strongest of man-made materials, *Kevlar*, and carbon fibres, with probably the weakest, expanded polystyrene. The main skeleton of the airframe is constructed from handmade carbon fibre tubes, using a technique evolved with MacCready's *Gossamer* aircraft. But because the *Solar Challenger* has a cantilever wing without the support of wire bracing, it requires stronger tubes of larger diameter. The main wing, spar and fuselage tubes are an ingenious sandwich of materials which result in an immensely strong tube, with the sandwich construction providing inherent shape stability and strength from it's structural wall thickness.

The fabrication technique consists of spiral wrapping two or three layers of pre-

*Outer wrap of Kevlar cloth being strapped in place with stretchy Tedlar tape while two part epoxy resin cures*

*Nomex honeycomb wrapped round fuselage boom and wing spar, to give thin wall carbon fibre tube thickness and rigidity improving strength*



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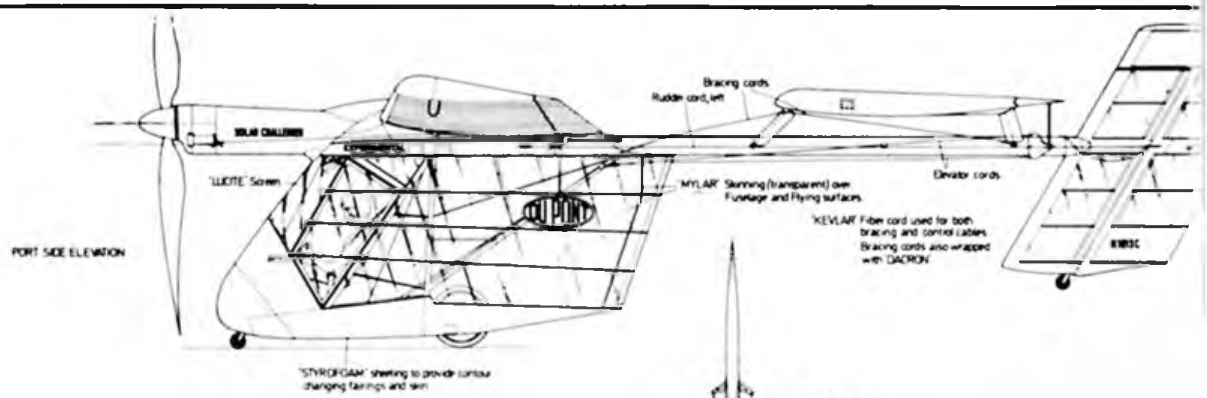
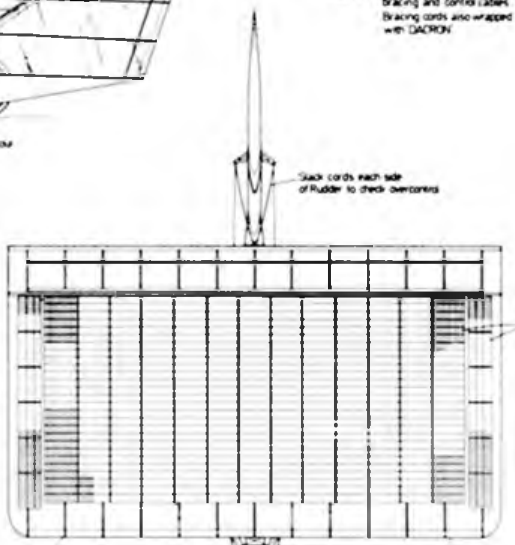
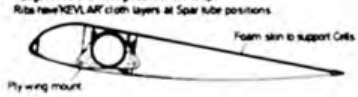
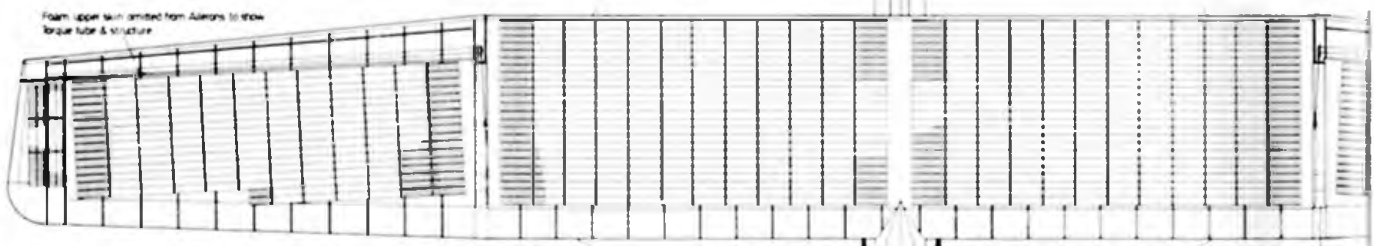


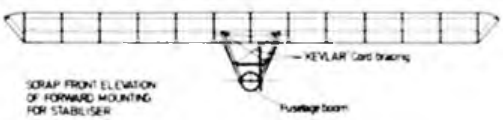



ENLARGED WING ROOT SECTION

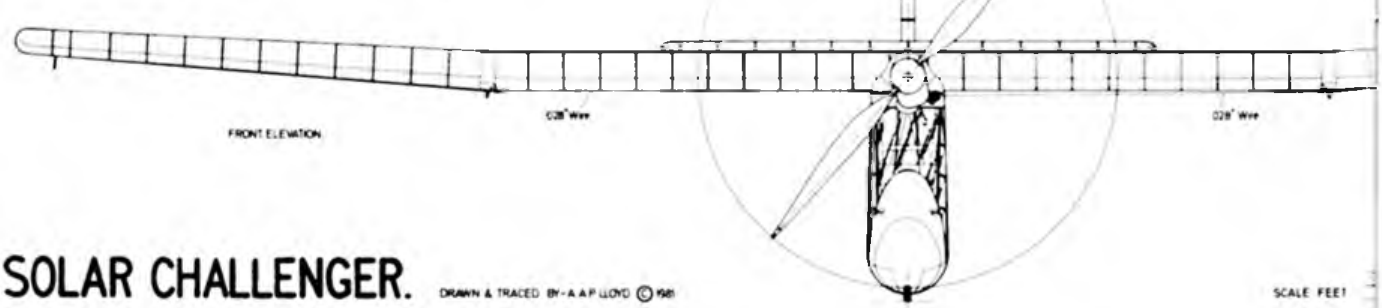
ENLARGED STABILISER ROOT SECTION



PLAN VIEW



SCRAP FRONT ELEVATION OF FORWARD MOUNTING FOR STABILISER



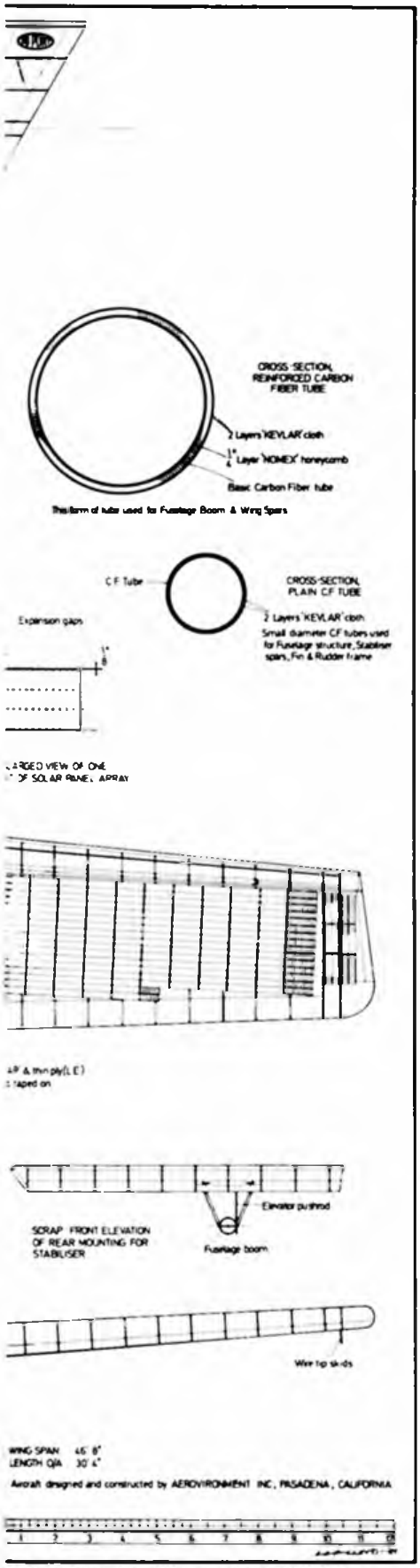
FRONT ELEVATION

# SOLAR CHALLENGER.

DRAWN & TRACED BY-A.A.P.LLOYD © 1981

SCALE FEET

Dyeline prints to the scale of 1 17 1 th of these 1 60th scale drawings are available as Plan No 3036, price £1 50 inclusive of VAT and 25p P&P from the Aeromodeller Plans Service, P O B




5, Bridge Street, Hemel Hempstead, Herts HP1 1EE

*Left: hang glider flyer Carlos Miralles (left) and model flyer Bobby Curtin, assemble fuselage frame tubes; junctions are well reinforced with extra Kevlar cloth and epoxy. Below: Blaine Rawdon, member of Cross-Channel Albatross crew, was responsible for most of the structural design on Solar Challenger, seen here on the tube wrapping machine strapping with Tedlar.*

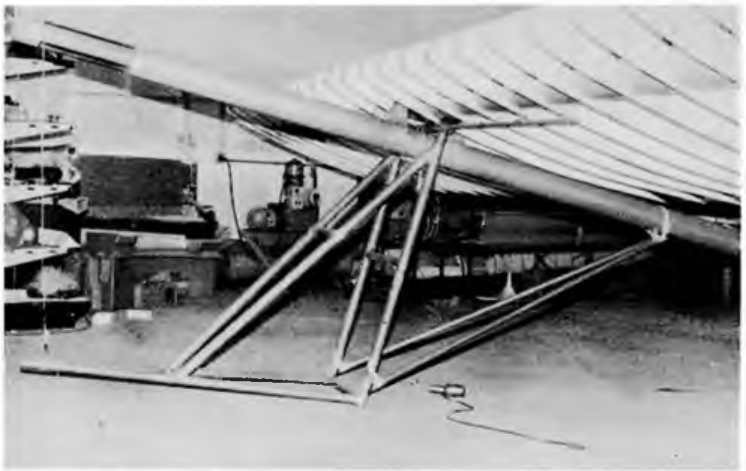
pregnated unidirectional carbon .005in thick, at 45° around a waxed aluminium tube mandrel and then adding linear caps, top and bottom, back and front, tapering in strength with diminishing laminations. This hand-assembled tube is then spiral wrapped with 1½in wide .001in polypropylene heat shrink tape, and cooked in a long oven (a converted helicopter blade box) at 250°F, which cures the epoxy impregnated carbon under pressure from the expanded aluminium tube and the contracting polypropylene tape.

The next stage, after sanding the carbon to ensure good adhesion, is to wrap the tube in ½in. thick *Nomex* honeycomb, bonded with epoxy and microballoons and held while curing with stretchy *Tedlar* tape pulled taut while wrapping. Finally, two layers of 1.7oz/sq yd woven *Kevlar* cloth, thoroughly impregnated with two part epoxy, form the outer skin, also wrapped while curing with *Tedlar* tape.

The use of these tubes and other composite epoxy and fibre components for brackets, mounts and fixings, accounts for the incredible strength and lightweight airframe, 145lb without cells.

Another unique feature of the *Solar Challenger*, certainly to the eyes of model flyers, is the flat-topped aerofoil. This was required in order that all the solar cells attached to the top surface of the wing and tail had the same angular orientation to the sun's rays, not possible with conventional convex upper surfaces. The aerofoil, computer designed by Peter Lissaman and Bart Hibbs at *AeroVironment Inc.* in Pasadena, has a curved leading edge entry shaped to give a docile stall characteristic, with the rear 80% of the chord perfectly flat! The underside has a convex curve to maintain laminar flow as far back as possible.

*"Have I got a story for the ½ scale brigade! My main responsibility was assembly of flying surfaces and fuselage fairing from the biggest kit of parts you can imagine." Martyn with wing centre panel (inverted).*



*Above: bare bones of fuselage, test fitted to tail boom and wing, early during construction. All carbon fibre tubes around pilot were encased in Kevlar to produce safer failure mode. Below: ¼ thou. inch heat shrink Mylar covering draped over underside of centre section by Ray Morgan, Steve Miller and Blaine Rawdon during covering.*

*Above: Paul MacCready attempts to break the wing! Once flat wing deflected 18ins at tips to support almost half a ton of sand during positive +6G test. Unique flat topped aerofoil allowed upside-down construction. Below: here ¼in. expanded polystyrene wing ribs are threaded onto main wing spar.*

The wing ribs are made from ¼in low density expanded polystyrene sheet, capped with ¼in .015in thick carbon, retained by 1in strips of 0.6oz/yd² glass cloth. Patches of *Kevlar* cloth reinforce the sides of the ribs at the leading edge and around the spar location, and ¼in ply blocks are set in the trailing edge to accommodate control surface hinges. The upper surfaces are sheeted with ¼in expanded polystyrene just in order to give support to the solar cells and prevent damage from flexure. The leading edge sheeting is also ¼in thick pre-shaped by hot wire cutting. All the sheeting fits between the ribs to enable the .005in clear Mylar heat shrink covering to adhere directly to the carbon rib caps for better transmission of loads.

The 5in diameter tip spars plug into the 7in centre panel main spar to give a dihedral angle of 3°. The tips are retained by a bolt through flange to allow disassembly for transportation.

The tailplane is built with two carbon tube spars at leading and trailing edges and is attached to the fuselage boom with two pin-jointed hingeing brackets. The brackets can move fore and aft on a parallelogram principle to increase or decrease tail incidence for in-flight trimming without the need for elevator deflection, thereby reducing drag during cruise on long flights. In practise this system has yet to be connected to the pilot's controls and it remains to be seen if this will even prove necessary.

Elsewhere, anything that is not contributing directly to structural integrity or pilot safety is made according to the *Gossamer* principle — make it as light and weak as possible and replace it only if it ever fails.

The 11 × 9 ft propeller blades designed in accordance with the theories of Professor Eugene Larabee of MIT, were constructed by R/C Sailplane and "San Fernando Valley Flyer" Mike Bame. As with previous *Gossamer* propellers, the core is hot wire cut from 2lb/cu ft blue *Styrofoam* in short segments, each incorporating the appropriate blade twist for each station. The assembled blade, which incorporates carbon tube hub spar and carbon caps, tapering from 21 to 3 laminations of .005in material ½in wide, is then covered with woven carbon fibre cloth before final surface finishing.

Each blade is a work of art, weighing just 1½lb, and is mounted on a ball race stub shaft, free to rotate in pitch. A perpendicular carbon bracket restrains movement, attached by a short yoke to a push-pull rod controlled by the pilot.

*Bob Boucher, consultant for solar cells and electric motor, fits Astro Flight motor. Lower rubber belt cog drives bicycle chain and spocket to give 23.1 reduction to propeller.*

## Just testing

Pre-flight tests were performed on the structure in order to check calculations and construction of the finished components. Sand bag static load testing was used to check the deflection and load carrying capacity of all flying surfaces for 6G positive and 3G negative forces. A similar practical test could prove most illuminating for aeromodellers for measuring the strength and rigidity of their designs. During the test, the wings were progressively loaded up with sand bags until they supported almost half a ton — equivalent to +6G which gave a deflection of 18in at each tip.

*Left: Heath Robinson take note. Paul checks out the controls during the 'first test hop' even before aircraft was complete at Santa Susana. Streamlined fuselage fairing added later, allowing full access to all controls during this phase. Below: Janice-eye-view of cockpit layout, showing rudder, pedals and joystick, with instruments held in place temporarily with adhesive tape during early flights.*

Further tests were performed by bolting the flying surfaces to the roof of a van which was then driven at high speed to test for deflection and flutter from air loads. The *Solar Challenger* was designed to fly at a maximum speed of about 35mph, but the wings, tail and fin reached 65mph in test with no ill effects. Finally the FAA inspected the airframe and certified it as an experimental aircraft. No prizes for guessing the significance of the registration — N181SC.

## First battery flights

To eliminate its dependence on midday sun during initial test flights, rechargeable NiCads were installed, which could provide up to 20 minutes of power from a 1 hour charge. Taxi tests and first flight hops were performed by experienced test pilot Steve Ptacek, who has over 4,600 hours of flying logged.

The first real test flights were performed at Shafter Airport near Bakersfield — site of the *Condor*'s Kremer prizewinning flight back in 1977. The C.G position was varied during these tests by adding lead weights to nose or tail. Moving the C.G. affected rotation at take-off, climb rate and control response. So the *Solar Challenger* was flight trimmed just like any Free Flight model aircraft!

After two days of taxi trials and brief flight hops, Steve Ptacek lifted off soon after sunset on the evening of November 8th for a 5:30 flight during which he completed one lap of the perimeter track, about 2 miles.

With the docile handling of the *Solar Challenger* confirmed, Janice Brown took over as official pilot for the project, and within a couple of days was achieving 20 minute flights, the limit imposed by the charge capacity of the 120 'D' size NiCads. The best of these early flights came on the morning of November 13th, when thanks to some thermal assistance, Janice was able to extend the flight time to 92 minutes during a flight that reached 1600ft above the airfield — believed to be a World Record for Electric Battery powered flight.

## Those solar cells

The *Solar Challenger* then returned to the workshop in Simi Valley just north of Los Angeles, where the battery pack was removed and replaced with the photovoltaic solar cells fixed to wing and tail in pre-assembled strings, using double sided transfer adhesive tape.

The photovoltaic cells, as used on space projects, are made from thin slivers of silicon crystal, grown in a cylindrical core, accounting for the circular shape of some low grade cells. Higher efficiency is obtained by trimming to square or rectangular shape, allowing denser mounting, thinner cells also being lighter but more fragile. One side of the cell is positive, the other negative, and when excited by solar radiation, a minute current flows. Each cell has a fine pattern of silver filaments on the upper surface to collect the charge to one electrode, the undersurface coated in solder being the other.

Coupling sufficient cells together in series parallel produces a usable power source. The *Solar Challenger* uses 16,128 cells, each approximately $\frac{3}{4} \times 2\frac{1}{2}$in to produce an estimated 3,800 watts power on a typical June day in California with the sun nearly overhead at noon. As the cells heat up under the sun however, they lose efficiency — but fly them high enough and the temperature drops, regaining power. Optimum operating altitude may be around 3,000ft. The cells used on the *Challenger* valued at one quarter of a million dollars, are on loan from the USAF and convert the sun's energy into electricity with an efficiency of just 13% — which is quite high for photovoltaic cells. Each had to be individually tested and wired in circuit, because a faulty, cracked or dirty cell can degrade the power of a whole string. Shading the solar cell arrays during flight was also a prime design consideration, partly accounting for the configuration of flying surfaces in relation to fin and propeller arc shade.

Unlike most vehicles, the solar powered aircraft has no throttle. Mother Nature decides how much energy is delivered as a product of haze, cloud cover, sun intensity and precise orientation. An early lesson of interest to aeromodellers was the need to exactly match the pitch of the propeller to the available power. On the *Penguin* this was achieved using a simple test dolly with pitch optimised following test ground runs, the propeller being clamped in place with pitch adjusted.

For the *Solar Challenger* the ingenious variable pitch propeller mechanism allows the pilot to continuously tune the propeller thrust approximately plus or minus 2ft pitch, and consequently alter the load on the motor to match the available in-coming

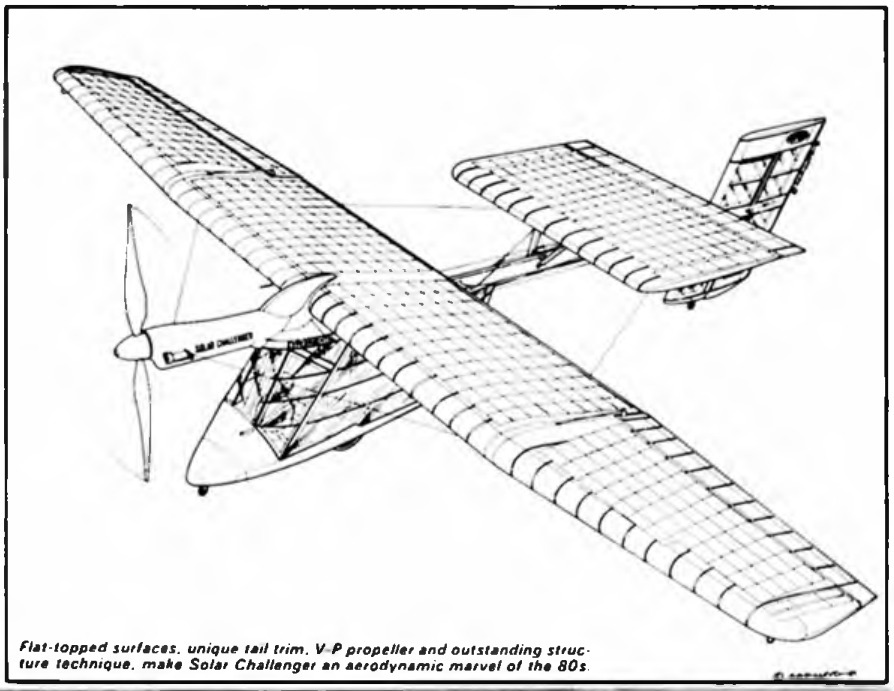
*Ray Morgan adds another string of photovoltaic cells. A total of 16,128 cells covered flat top surfaces of wing and tail.*

power, monitored on a watt meter. Adjustments by pilot to keep the meter needle pointing to the optimum setting is all that is required.

The electric motor used was a 2.75hp unit developed specially by *Astro Flight Inc.*, operating up to 70 volts 40amps and 7,500rpm. A *Kevlar* reinforced belt and bicycle chain sprocket produce 23:1 two stage gear reduction to turn the propeller at an average of 300rpm.

surprise that the *Solar Challenger* performed so apparently effortlessly under these extreme conditions. Other flights made later that afternoon, confirmed that the *Challenger* has a potential flight time of 5-6 hours, even on a mid-November day with the sun's path between 20° and 35° above the horizon.

High winds and bad direction in relation to the sun for take-offs limited the flights at El Mirage and resulted in some off-field



*Flat-topped surfaces, unique tail trim, V-P propeller and outstanding structure technique, make Solar Challenger an aerodynamic marvel of the 80s.*

## First solar flights

The high desert area of *El Mirage* Soaring Centre was chosen for solar test flights because of better weather prospects. However the first day, November 20th, started windy and cold, with ice on the ground from the previous night, and plenty of thin cloud high overhead impeding the sun's rays.

The *Challenger* was set up in readiness but midday passed without any chance of a flight due to cloud cover. Finally at 1.10 p.m. a small patch of blue sky permitted an attempt to be made, and into an 8mph head wind, Janice rolled forward in the *Solar Challenger* for take-off. The world's first exclusively solar powered lift off preceded a first flight of 2min 50sec which travelled the length of the main runway at heights up to 60ft. Paul MacCready is a super optimist, but even he admitted his delight and

landings in the nearby dry lake bed. The problem was how to get the machine back to the hangar 2 miles away! The answer was to walk it back through a maze of narrow sandy tracks between desert scrub and the occasional Joshua tree — an epic journey in its own right.

## Long distance attempt

Arizona, home of cactus and cowboys, was chosen as the location for the final phase of the project for 1980. Considering the time of year and low sun angle, Arizona offered better prospects for sun and fair weather. A route was chosen between Marana Air Park near Tucson, and Stellar Air Park, one of several landing sites near Phoenix, a distance of 63 miles with few obstacles in between except for the small Picacho mountain range and the 30ft high saguaro cacti. Any following tail wind would of course help the flight North, but needing to take-off away from the sun would then require a down-wind take-off!

One of the main problems facing the *Solar Challenger* so late in the year was that the extremely low sun angle not only reduced energy but also inhibited the direction of flight. The solar cells, being mounted on the sloping surfaces of wing and tail, are inclined 15° to the rear during flight — adding to the sun angle when flying North away from the sun, but reducing it when flying South. This meant in effect that the *Challenger* would be unable to fly circuits due to the requirement to only fly away from the sun. This would present no problem for the ideal straight line flight North under clear blue skies. But in order to gain sufficient height over the Air Park to guarantee safety over flying nearby ground obstacles or to navigate around cloud formations, the ability to fly circuits would be required.

The dilemma was easily solved by the innovative MacCready, who simply dispatched a van into the desert to drive round and round in circles. The result? Rising columns of desert dust lifted into the air, passing thermals on which the *Solar Challenger* could centre and maintain altitude in circuilts. The all-letter registration of the van in zany Californian tradition was GCONDOR!

The hurried nature of the project, literally chasing the sun as it sank lower each day of the year, finally brought the *Challenger* to the moment of truth on Wednesday, December 3rd. Under clear blue skies, Janice Brown contemplated take-off for a flight to Phoenix, some 20 times longer than any previous solar flight she had ever made!

*Left: provisional fuselage design — no, actually more high speed tests for 47ft. span wing, taken to almost twice the speed Solar Challenger will ever reach in flight. Janice Brown, strapped into Challenger; helmet is made from Kevlar for improved strength and less weight. Note also two way radio taped to Mylar covering.*

*Paul MacCready sits on top of van during 65mph trials to check structural integrity and flutter. Working elevator and rudder operated during tests.*

After five take-offs and landings due to insufficient height, Janice finally climbed out along the main runway gaining sufficient height to complete a circuit and maintain altitude in a rising dust cloud over the end of the runway. Several circuits later she was steadily gaining height, as the ground crew raced to their vehicles to follow the flight by road. Soon the *Challenger* was the highest it had ever flown under solar power as it headed North towards its destination. The long distance attempt was on, and soon Janice had broken her previous solar flight record of 14 minutes achieved in the *Penguin*. Regrettably, that was not all that was broken during the flight. A short one inch diameter pitch control pushrod buckled, and without full power, Janice was forced to land in the desert near Red Rock, some 5 miles and 22 minutes away from Marana.

Nevertheless, this first attempt had produced the best ever solar powered flight, with the advantage that they could try it all over again the next day . . . and the next day . . . So it was, during more test flying on Friday, 5th December, the *Solar Challenger* established another new record of 92 minutes at altitudes up to 3,500ft over Marana Air Park, flown under remarkable conditions of almost total cloud over at times. Even so the sun continued to produce some power, perhaps a third at times, which still enabled the flight to continue much to everyone's surprise.

With this latest success, the *Solar Challenger* was again prepared for a flight to Phoenix the next day. But this time it was the weather that played a major role. An hour after take-off, Janice found herself being surrounded by approaching rain clouds and losing height fast as she tried to circumnavigate them and stay in the sunshine. The accompanying party of light aircraft were soon radioing advice to the solar pilot, of cloud and thermal conditions to enable Janice to pick the best route. As rain started falling on the solar plane, the chances looked hopeless. Janice flew the *Challenger* towards the Picacho mountains in search of slope lift that might enable her to sneak through a pass towards the sunnier conditions further North. But she could find little assistance, and after 1 hour 55 minutes Janice finally conceded, to land near Picacho Peak, about 12 miles out from Marana. Her actual flight distance including dodging between the clouds, was nearer to 50 miles.

With bad weather forecasts and some doubts about mechanical reliability, Paul MacCready finally decided to settle at that, and pack up for the winter.

## Goal for 1981

Solar power will never become a reality for everyday flight — at least that is the opinion of Paul MacCready. Even if Solar cells were developed that were 100% efficient, there still wouldn't be sufficient energy available per square foot of solar wing area to make it really feasible. Where development of solar cells will bring benefits is not necessarily with improved efficiency, but in reduced cost per watt. The future of solar power is one of plentiful and cheap power for the more mundane earth-bound uses. Paul MacCready's purpose with the *Solar Challenger* flight programme is to draw attention to the application of solar power and lightweight energy efficient design to highlight other potential uses for the future.

Under summer sun, the *Solar Challenger* will be able to take-off and fly, without need for thermals, in any direction, irrespective of wind or sun direction. Flights could last up to 11 hours producing a range of 400 miles. The fact remains that even so late in the year, the *Challenger* was easily capable of flying from Tucson to Phoenix, a feat it will no doubt achieve early this year as a build up to the proposed Paris to London flight in the Summer. In June there will be more solar radiation at 9.0 a.m. in Paris than there was in Arizona in December at midday!

*Lift off at Marana Air Park near Tucson, Arizona. That total solar powered flights were even possible during December and January – which is the worst time of year for sun angle – is a tribute to Challenger's performance. Note external motor and 1ft extension to nose boom modified after first test flights.*

# Vintage Corner

By Alex Imrie


*The writer's 'King Burd' at the start of its take-off run and about to ROG on Old Warden aerodrome SVAS day July 15 1979. The model is powered by a GHQ of 8.5cc which produces just sufficient power (2000 rpm flat out on 12 by 6 prop) to fly the model, and take-offs from short grass are only possible because of the narrow profile wheels (William Bros.) fitted. When the 'King Burd' first appeared on the market in 1936 advertisements stated that modellers could fly the model with rubber power until they had obtained an engine!*

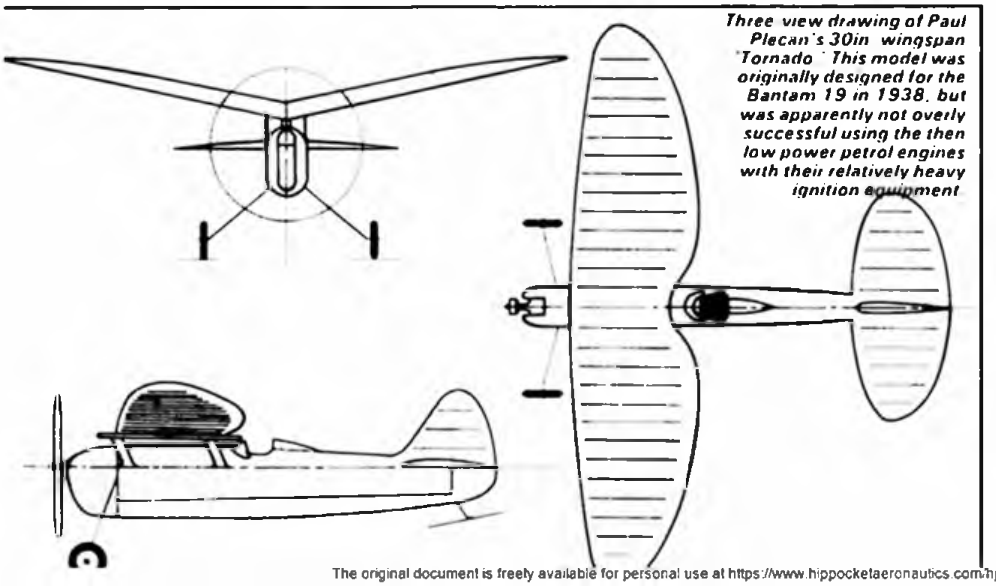
## SAM 35 SPEAKS

Issue number eight of this journal is to hand and it gets better and better. Free plan in this issue is for a 'Rise-off-the-Ground' tractor biplane by A. C. Horth and is a reprint from 'Junior Mechanics and Electricity' of January 15th, 1914. This is a real antique job, enough to get anyone reaching for the Honduras mahogany, gluepot and white holly! The eighteen pages includes instructions on how to make a Bowden type engine mounting, use of corrugated cardboard in model structures and a host of other contributions from the membership. Additionally much space is used to detail the season's projected meetings and competitions. The meetings of interest to vintage enthusiasts are given elsewhere in this issue. Of course the SAM 35 Nationals will be held in conjunction with the SMAE Nationals at Barkston Heath, Lincolnshire on May 23rd - 25th.

## SECOND 1981 FLYING MEETING AT BIGGLESWADE

The Biggleswade Common venues provide just the right conditions and atmosphere for vintage meetings, nice picnic spot, ample flying field plus the usual turnout of around fifty like-minded Vintagents. However, on Sunday March 8th, when SAM 35 held its second flying meeting of the year, the weather refused to co-operate, and the rain-filled gusts of wind from a laden sky, provided the other ingredients to make this a typical 'mad March day'!

Some of the enthusiasts, not being easily deterred by the anemometer's twenty odd knots, braved the elements. Mike Wittard repeatedly flew his R/C assist Southerner powered by an ED 3.46cc diesel, and Don Knight and son Chris were soon obtaining exercise when retrieving their two S-4 Abzug designs (DC Dart powered) after long downwind dashes. Paul Mardell had one brief flight from his beautifully finished Keil Kraft Ladybird fitted with the G-Mark Twin, before deciding that the conditions were perhaps not exactly ideal for such a model. Others also flew and the prize for sheer doggedness must go to Mario Gandolfi who flew a DC Dart powered Mam'selle, a Cloud Airmaster fitted with an Eta 5, and a modified Performance Kits Sunduster which used a 3cc Fram Italian diesel purchased by Mario way back in 1947. As was to be expected he broke all three machines, the first two in 'flying accidents', but the modified Sunduster, after performing several times, broke up in a particularly fierce gust when being retrieved.



*Three view drawing of Paul Plecan's 30in wingspan 'Tornado'. This model was originally designed for the Bantam 19 in 1938, but was apparently not overly successful using the then low power petrol engines with their relatively heavy ignition equipment.*

The enthusiasts then spent the rest of the day 'Hangar flying', where amidst much chin-wagging, latest acquisitions were passed around for all to see; plans, magazines and engines changed hands and new models were displayed. A particularly fine John Worth 'Cement Mixer' built by Derek Welch was on view, this example being powered like the prototype with a glow Arden .099. Pat Tranfield's rubber powered Frog Jupiter was also much admired, since the plan for this model came to light, after many years of search, a number of Jupiters are now under construction.

In view of the deplorable weather, it was planned to do it all again a fortnight later, hopefully under more suitable weather conditions. Unfortunately this was organisationally not possible, so the next Biggleswade meeting will not be until Sunday, May 17th.

## ROG (RISE OFF GROUND)

In the beginning all models were hand launched and as such, most did not have any form of undercarriage, except possibly a rudimentary skid to prevent damage on alighting. However, the trend for the future was clearly spelled out by V. E. Johnson M.A. writing in 1912.

"By far the most interesting models and the ones which have recently come into prominence are those which rise from the ground under their own power."

So the 'Self-Rising' model was born and it became necessary to use the qualification 'Off Ground' against a performance in duration or distance in order to differentiate between this type of take-off and the land launch. Later still the abbreviation ROG (Rise Off Ground) came into general use.

During the recent showing of some home movies of a pre-war gas model meet in America, kindly brought over by Danny Sheelds from Baltimore, one was struck by the fact that all of the models that flew had to take-off from the plywood and linoleum boards provided; none of the models were hand launched.

Here then is an area of very great difference between then and now. Today at our vintage meetings, it is most unusual to see a model do a successful ROG; what a lot of fun we are missing by merely heaving them into the air.

Taking off the ground was an important part of the pre-war scene, and undercarriages and wheels were designed to make the process a practical possibility. Thin streamline section wheels were soon in use on both rubber and power designs, since less power was required to push them along on take-off and they had less drag in the air. Although the doughnut type low pressure airwheel like the Trexler, so much used by present day vintage enthusiasts, looks right and provides excellent shock absorbsion on landing, it is not an easy tyre to take-off on through long

*Don Knight, prolific builder and regular attender at all vintage meetings, launching his Pfeffer diesel powered 'Tornado' at Biggleswade.*

grass, and many modellers will be surprised at the amount of extra power required to get airborne.

Pylonious, writing recently, commented on the reluctance with which the rise-off-ground rule is observed in today's vintage competitions, and that the smooth newly laid tarmacs of the pre-1950s have become the crumbling runways that vintage fliers are stuck with today! Well, I feel that the chance would be a fine thing. Usually vintage fliers now-a-days commit their aviation on tarmac free fields like Biggleswade Common, Halton and Old Warden aerodromes, but I take his point, and so should all vintage meeting organisers. Let's have some plywood or linoleum take-off boards to make it all more genuine and to enable us to reap some of the pure enjoyment from realistic take-offs (ROG) as they used to be.

## JUNIOR VINTAGE FLYERS

"It is the young chap we have always needed or there will be no tomorrow. A club or group that does not recruit young talent will be no more than an exploding star in the end". So wrote a truly vintage aeromodeller, Juste van Hattum, at the end of his historical coverage of the hobby in 'Those Early Days' in Aeromodeller some five years ago. Although van Hattum was speaking generally, much of what he said could be applied to the vintage scene.

We do have a number of juniors but they have been mostly introduced to vintage modelling by their own family circle or close acquaintances and since the old type models are so attractive, it is no wonder that the juniors desire to join in. However, how do we reach the young man hovering on the brink, he who is about to take up aeromodelling? How can we make him a vintage devotee before the other branches of the hobby recruit him?

It is the expectant desire of the writer to increase the numbers of vintage juniors. There is no reason why newcomers to the hobby should not be reared on fine vintage designs that have always been good models for the beginner, like the Keil Kraft Ajax for example, which is still available in kit form today, forty years after it first appeared. To quote van Huttum again, "A beginner's model may sometimes be more important than a world championship design. Do we really look after the aeromodeller who flies for fun and does not want to reach the top? When we introduce a new simple class, it soon becomes sophisticated and scares off the tyro".

The vintage movement will not scare off the tyro, nor quench the spark of enthusiasm that brought him to us. Our aim must be to gain his attention and interest and a fine balance must be struck between assembly (which the present day youngster accepts) and construction. The vintage modelling scene is very much a make it all yourself game with the emphasis on make. I am sure that this is a youngster's natural desire and his appteite and ability have merely been somewhat dulled by feeding him assembly thinking these past years.

Let us awaken the latent interest in him to really create a model with his own hands. He must realise that the Rip Van Winkles, and the middle-aged modellers who build the vintage models today, because of their connections with the dim and distant past, must surely fade away. The onus will not only be on him then, it is on him now, and the movement needs his support to survive.

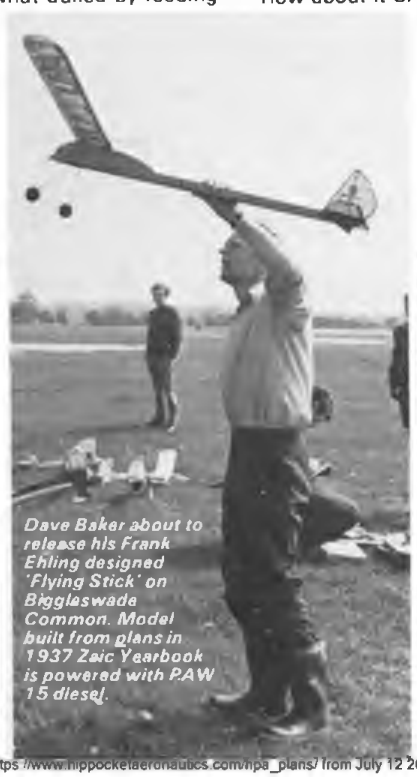
It is appreciated that modern youth seek the thrills and demands of competition flying. Well, they can have plenty of that too in the vintage environment, and don't have to stick to the staid circuits of underpowered oldies from the Thirties. Yet, when they really get the vintage bug, this is the sort of flying that will please them most.

It has been said that many clubs have long since abandoned their junior sections, and that this might have something to do with the so-called change that has come over young people in the last twenty years or so, caused possibly by the effects of pop music and television. Grown-ups have been expressing the same doubts for a variety of other reasons for generations, but the youngsters have never let them down yet.

It is suggested that SAM waive the Junior membership fee completely for under sixteens. If the response makes this a financial burden, perhaps an increase in senior membership fees will balance things. It should be understood that if juniors avail themselves of such an offer, they will be expected to maintain a reasonable level of activity in the building and flying of vintage model aeroplanes. Other incentives for the juniors could be cheaper engines and building materials, free full-size plans, and help with transport to and from the various SAM 35 flying meetings. How about it SAM?

*Far right: Ben Buckle (Editor of SAM 35 SPEAKS) launching his 1947 Chester Lanzo 56in. wingspan, lifting fuselage design 'Swayback.' Model powered by Elfin diesel.*

*Jim Travers has a whole family of different sized 'Scorpions,' here he is at Old Warden launching the most popular size (44in. wingspan) which was kitted by Keil Kraft in 1946.*



*Dave Baker about to release his Frank Ehling designed 'Flying Stick' on Biggleswade Common. Model built from plans in 1937 Zaic Yearbook is powered with PAW 15 diesel.*

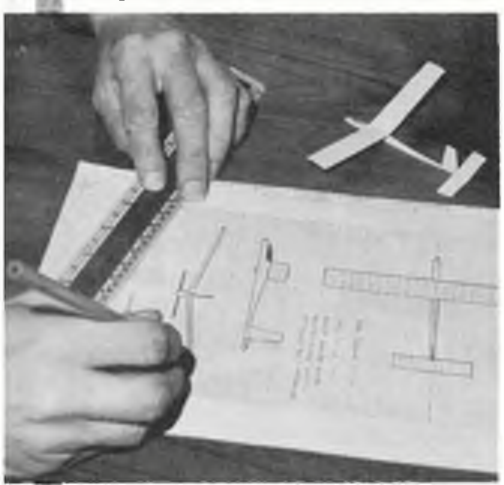
# FLYING HIGH

## Designing your own free flight models

by Ian Barrett


EVERY AEROMODELLER will, at some stage in his hobby, be tempted to produce a model of his own design. The success of the outcome will very much depend upon both the amount of practical experience he has accumulated in building proven designs from kits and plans, and his understanding of the basic requirements for flight. The models that have been built previously by the intending designer will have given him an insight into the type of structure required for various components, and the sizes of materials to be used. A sound structural design, however, is of no use if the aerodynamics of the project are unsatisfactory, and it is my intention to give some guidelines to lead to a successful model aircraft design.

Although it is a great boost to your ego to see your own design taking to the air, it must be admitted that very little of the design will be completely unique. Each 'new' model is really a development of what has gone before, and will incorporate the ideas of many other people. Styles may change, and many well-established designs have an 'old fashioned' air about them. A modern styling trend is the use of swept fins; this makes no apparent different to the flight performance, and may even add a little structural weight, but it looks good. Curvaceous, 'streamlined' fuselages have gone out of fashion, as they were difficult to make, and did little to help the efficiency of the machine. Simple lines can still be pleasing to the eye, and it is here that a good designer can produce an easily made, high performance, yet attractive model.



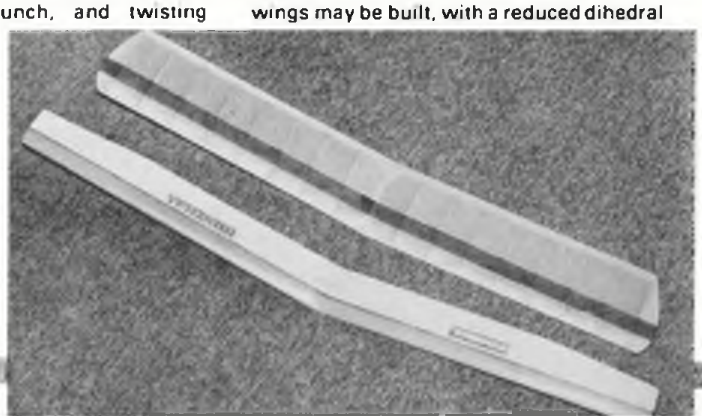
Let us first examine the fundamental components of a conventional model aircraft, and, without delving too deeply into the theoretical aspects, see what size relationships there are for the various components. The basic unit of any flying machine is the wing, which must generate sufficient lift to support the complete model, and also be strong enough to withstand all flying (and landing) loads. To design a wing that performs efficiently, several factors have to be considered. Long thin wings require less effort to push them through the air than short stubby ones of equal area. This is because of the relative losses incurred by spillage of the high pressure air from underneath the wing, round the wing tip to the lower pressure top side. This shape configuration is called the aspect ratio, and in simple terms is the number of times the wing chord (leading edge to trailing edge distance) will divide into the span. On average models, this number will be about 5 or 6, with high performance glider wings going up to about 10 or 12. Lower aspects ratio wing shapes are more likely to be found on control-line models. Wings with a relatively low aspect ratio can be made quite stiff and strong, and are to be found on power models, which have a wide speed range and are generally heavier than gliders and rubber models. Narrower wings, as found on gliders, present difficulties in flexure, both bending during the tow launch, and twisting (leading to wing flutter) during fast flying. The high speed flying can occur during the tow launch, or perhaps in the recovery dive from a stall. Stiffness in twist can be provided by diagonal braces, often in the form of the ribs themselves.

Bending loads in the wings can be quite high, and strong spars must be provided at the highest and lowest points in the wing section for optimum benefit. For some high aspect ratio wings subject to high loads, such as on radio gliders, these spars may even have to be made from spruce. Thin wing sections can present difficulties in strength, and may require substantial leading and trailing edges for adequate stiffness. Remember that when you do use spars, they should be deep rather than wide to give the best resistance to bending.

Wing tips must be kept light, yet strong enough to react against the shrinkage of the covering tissue. Wing tips are also very vulnerable to damage in hard landings, and should be of a simple design so that easy repairs can be made.

For lateral stability, free flight models require a certain amount of dihedral, and a suitable amount for a high wing model is to raise the tip not less than one tenth of the half span of the wing i.e. a one metre span model should have the tips raised at least 50mm above the wing centre. Mid and low wing models will require a greater amount of dihedral. If preferred, poly-dihedral wings may be built, with a reduced dihedral

*Above: drawing a scale general arrangement of 'Bursar' before starting full size plans. Note the paper version in heading photograph. Below: various fuselage construction techniques. Right: examples of high and low aspect wing.*



*Left launching a paper glider to check the centre of gravity (CG) position. Right a lot can be learned from making these small paper gliders*

on the centre panels, and more at the tips. Dihedral joints carry high loads, and should have adequate keepers fitted, usually cut from thin plywood. Even with a good design of joint, sloppy workmanship can dangerously reduce its strength. Triangular gussets should be fitted into the corners at wing tips and all dihedral joints.

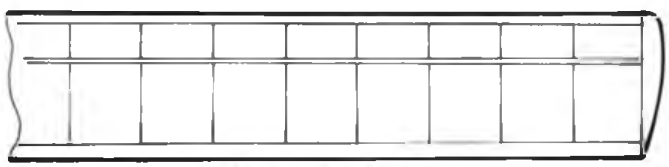
One decision that must be made is what aerofoil section is to be used. Previous experience helps here, and suitable sections can be cribbed from equivalent designs. Rubber and glider models can have fairly thin sections, sometimes with undercamber, while power models will have thicker, flat-bottom sections. Ordinates for various aerofoils will be found, with the dimensions quoted as percentages of the chord line. These enable the section to be drawn to the size required for the new model. Sections in common use are the Davis and the Clark Y, but there are many alternatives.

The plan form that you select is a matter of taste. A rectangular outline is obviously the easiest to construct, using ribs of all the same length. Tapered wings, with the taper starting either at the root or at about two-thirds out towards the tip, are a little more elegant, but require ribs of graduated sizes. The most difficult of all is the elliptical outline, which also introduces curved leading and trailing edges. It is always better to design your wing structure so that use can be made of stock sizes of pre-formed balsa.

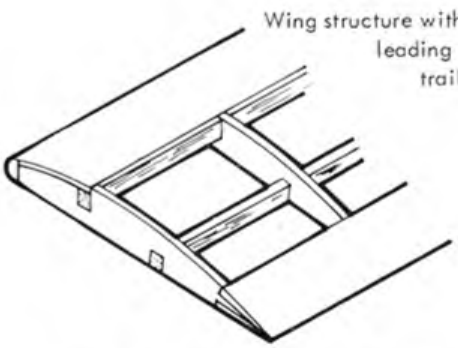
Rib spacing is something of a compromise; a large number of ribs maintains the aerofoil section accurately, but involves a lot of wood and thus extra weight. A wide spacing is certainly light, but tissue sag between the ribs spoils the section, and renders the covering more prone to damage. An optimum distance between ribs is about 50mm, adjusted as necessary to space the ribs neatly in the desired span.

Sheet balsa can be used to good effect in wing construction. The upper leading edge, back to the highest point on the section, can be covered with 1.5mm sheet, which will give a smoother contour and add torsional stiffness. Filling in the centre panels of the wing, top and bottom, will give added support at the wing mounting platform, and resist the comprehensive forces of the rubber mounting bands.

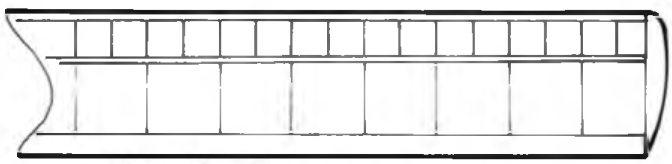
Having considered the wings, next time we will look at the other components of the aircraft, before discussing how to marry them all together into a new design.



Conventional Wing

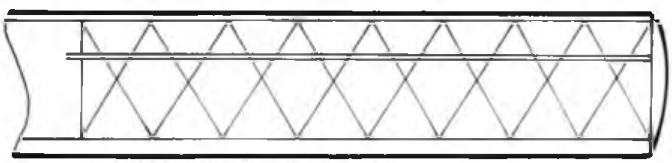


Wing structure with built-up leading edges and trailing edges



Wing with riblets:
Maintains aerofoil shape better

The final full size model at Bursa



Wing with Geodetic ribs:
Resists wing twists

WING STRUCTURES



*See Aero Ace Letters on page 311.*

# FROM THE HANDLE

# STUNT

## Glen Alison

*Victor Tan sent this photograph showing a well laid out combat circle, on the football pitch of this Singapore academy.*

IN DESIGNING the tapered wing for a new stunt model, the old problem arose of producing a set of wing ribs of accurate constant airfoil section but of differing lengths from the root to the tip. The usual method is to make a master root and tip rib from plywood or formica and then sandwich a stack of blanks between these, equal to the number of ribs. These are then carved and sanded to shape forming a perfect blend from the root rib to the tip. The major problem with this system is that it causes the edges of each individual rib to be tapered quite sharply. During the actual wing construction, this can lead to inaccurate joints and a spoiled appearance.

As an alternative to this I have used the following photographic method of projecting a transparency photograph onto a screen and then moving the projector backwards in small increments to get larger images of the wing section.

I first produced a master drawing of the wing section with a clear hold outline and took a transparency photograph slide of it using a long lens to minimise any distortion caused by being too close.

Using an ordinary slide projector, the image was projected at a piece of paper with vertical lines on it set at distances apart corresponding to the chord length of each rib. The distance between the projector and paper was adjusted until the image length just fitted between a pair of lines. The section was then traced onto tracing paper for transferring to balsa for the rib. This was repeated for each rib, taking care to ensure that the projector always remains dead square to the screen, to avoid distortion. In my case each rib was 4mm longer than the next.

The same method can be used for enlarging or reducing whole model shapes. Who will be the first with a 60 powered 'Nobler' at about 1500mm span?

## FAI COMBAT RULES CHANGES

Reports from the Paris meeting indicate several very constructive changes to the rules. They appear to be intended to become effective in 1982. If this is officially confirmed through the national aero clubs, these rules should be used in team trials of the 1982 World Championship.

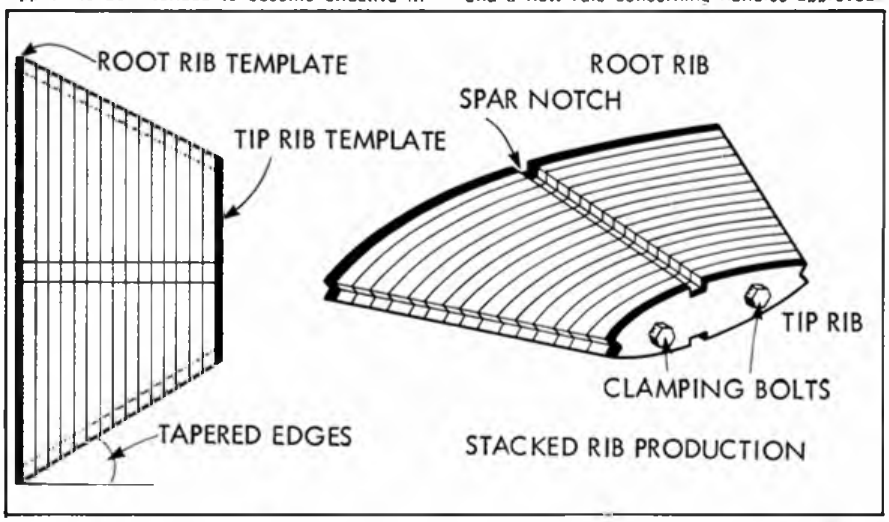
Circle markings have been changed from two outer circles, 19 and 22 metres, to a single 19.5 metre pitting circle. The pilot's circle remains at 3 metres. This will decrease the work load for the organisers and the confusion as to the meaning of the 19 and 22 metre circles. Under the new rules the mechanics will enter the 19.5 metre circle only to retrieve a downed model. The pilot must now step outside the 3 metre circle for the takeoff. This arrangement ensures that the mechanic will be outside the flight path of the airborne model.

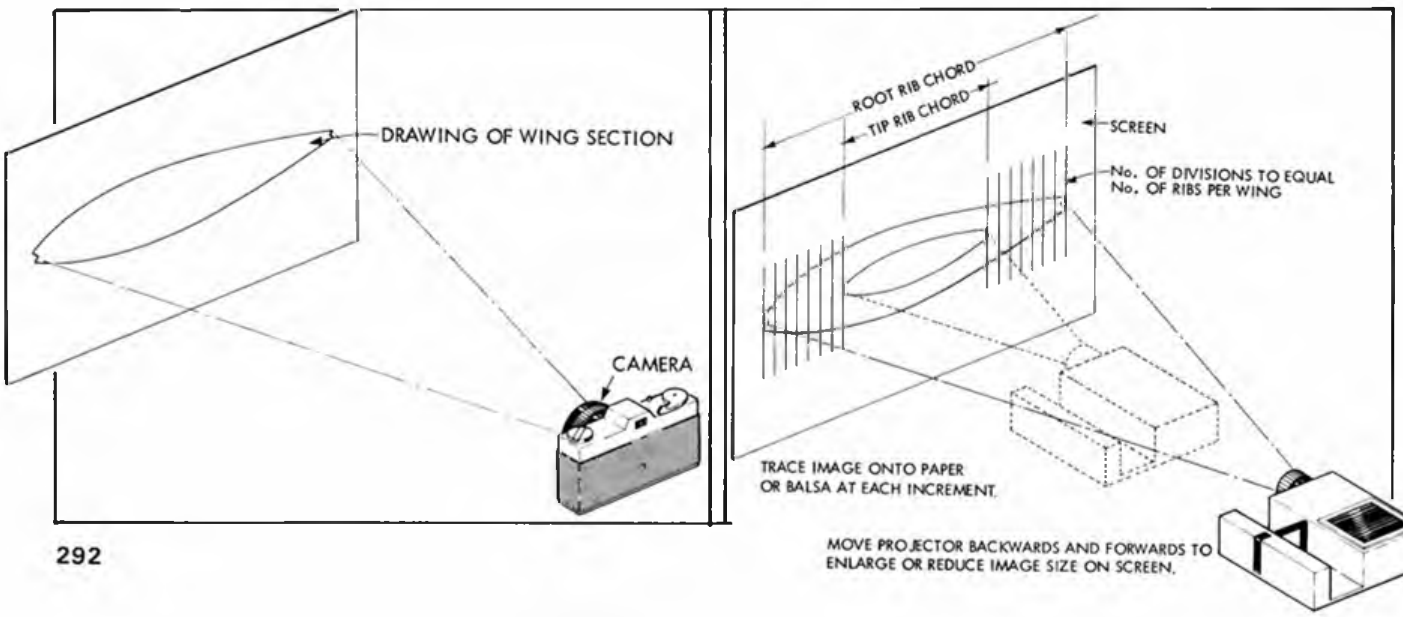
Scoring has been aided by adding the requirement for the pilots and mechanics to wear colour-coded vests, as has been the practice in F2C in the past. This new provision will help avoid scoring errors due to the scoring of the wrong contestant.

The "point of flexibility" rule has been dropped and a new rule concerning handles approved. Next year "open ends" of wire will be forbidden, thus making official the common practice of covering the clips and terminals with rubber tubing.

These changes are a step toward a good set of F2D rules. Several sources of trouble in the past have been eliminated without making any existing equipment obsolete.

Conquest 15 are to become available again soon, but under the K&B name rather than Cox.



Both of these engine makers were taken over by the conglomerate, Leisure Dynamics. K&B has always had a good reputation for high performance engines, so the new "K&B Conquest" should be a good solution to the shortage of FAI combat engines.

I have been corresponding with Victor Tan, a young combat flyer from Singapore over the past year. He has sent me some rather long lists of questions about combat that indicated a rather high level of competition in his country. A package of photos he provided show a large, well-organised control-line contest on the football field of a very nice academy. Singapore is not yet a member of the FAI. Hopefully they will soon join and send teams to the future world championships. Judging by the pictures they would certainly be in contention.

*Note crash hats, worn by the young Singapore combat flyers, obviously safety is a high priority.*

## Correction

Page 87 of the February issue states that there were two hundred entries in ½A combat at the US Nats. The actual number was twenty. ½A (with .049 in³ glows) is still an unofficial event over here, so twenty entries is pretty good at this point.

# STUNT
## Davė Day

Having recently returned to the world of competition Stunt (sorry — Precision Aerobatics) flying after some years spent on other branches of the hobby, I have found several differences today from the scene as it used to be. In fact, the situation could be summed up by saying "20 years ago I knew all there was to be known about Stunt but now I know nothing!"

Way back in the late 50s and early 60s it was a very rare event indeed which drew more than 6 entries. There was a well established 'pecking order' and you could look around to see who had turned up and then estimate your placing fairly accurately. Not until around the mid-Sixties did an established 'fashion' begin to emerge in model designs. Prior to that, almost anything could be considered to be competitive, the overriding maxim being "Build a reliable model and then learn to fly it!" The 2.5cc diesel still had its adherents (notably Gig Eifflander), as did the Frog 500 (a superbly handling motor, but not renowned for leaving skinless rice puddings lying around!), while Brian Brown from the Midlands made many people sit up with an ETA 29 on crankcase pressure.

When the fully-flapped glow motor powered model began to emerge as the standard, the motor size varied from .15s to .60s and many people attempted to produce models based on particular full size aircraft. Ultimately the .35cu in motor began to take over from all the others but model designs separated into two distinct schools, these being presided over by Bob Palmer and George Aldridge.

Palmer's approach was developed over many years and through various models culminating in the 'Thunderbird' Marks I and II. These had sharply tapered flaps which were eventually reduced to only part of the wingspan and the elevator had more movement than the flaps, typically 45° each way on the elevator and 30° each way on the flaps. This produced a very 'twitchy' model which was not to everyone's taste. The Mark II version of the Thunderbird introduced 'differential flaps' in which the inboard flap had slightly more throw than the outboard one. This was claimed to improve line tension. My own successes prior to semi-retirement were gained with a modified version of this design.

The George Aldridge philosophy was conceived virtually overnight in the form of a modified Palmer 'Chief' which had a longer tail moment and increased flap movement. This was followed by the prototype of the famous 'Nobler', the immediate ancestor of virtually every model flying today. Models of this layout are rather less manoeuvrable and fly much more smoothly. This again is not to everyone's taste, but it does need less practice to produce acceptable results!

In the early sixties, your truly attempted to combine the virtues of each of the above approaches into one aeroplane. By means of a sliding link in the flap linkage, I managed to contrive a set-up whereby the flaps had more movement than the elevators when close to neutral, whereas when approaching the limit of the control movement, the elevators had more movement than the flaps. Amazingly enough it did actually work! The snags were that it took a lot of practice to learn to fly it properly, only to find that a conventional model immediately *felt* far better!

The situation today is quite different. In terms of numbers, things are much more healthy, with 12-15 entries being considered a poor turn-out, and 6-8 fliers capable of winning. Instead of a single judge who covered virtually every contest (where are you today, John?) we have a small group of individuals available which allows some variation. From the model point of view, the situation is far less healthy: most of the models are 'stunting machines' with little, or no, resemblance to a real aeroplane. Very few people are willing to try anything different (Brian Dyke being a noteworthy exception) from the accepted norm from fear of wasting time on an uncompetitive model. All the designs are more or less direct descendants of the Nobler although the basic design has in most cases been enlarged to cater for the now fashionable .46 size engine.

This trend to the larger size engine comes, like most things, from the USA where the trend for many years has been to fly slower and slower. At one time it was considered to be desirable to aim for lap times around 5.2-5.4 secs. Nowadays the target seems to be 6 secs. or more. Interestingly enough, the trend in the States is now to go down slightly to a .40 size motor; this is due to the fact that a modern .40 has more power than existing .46 size motors and can fly on thinner lines.

With the modern generation of look-alike stunt models, the whole emphasis is on 'trimming'. Models are built with every possible item made adjustable so that it can be trimmed for optimum

*Left: progress in stunt design. Can anyone guess when and where this picture was taken. Answers from Tom Jolley will not be accepted. Solution in July issue.*


*Right: author's model from mid-60s with exponential flap linkage.*


*Bob Palmer with kit prototype of Mark 2 Thunderbird. This design was the last of the short coupled Palmer type models.*

performance. Whether anyone actually tries progressively changing each of the variables singly and in combination, and then collating the results into a useful form, seems to be very doubtful. Experience indicates that a mere change of propeller can completely change the handling of a model, as can a very small change of CG position.

As a result of this 'trimability', the actual *design* of the model has completely stagnated as already indicated. However, there is some hope for the future. A small group from CLAPA recently consulted an aerodynamicist from the Cranfield Institute of Technology for some guidelines on Stunt model design. The result was a set of formulae relating to the aerodynamics involved and certain suggestions of things worthy of investigation. Ironically all of the formula had already been published in AEROMODELLER — but not within the last 25 years! (You saw it first in AEROMODELLER!) The pointers to design modifications have, likewise, all been tried and discarded as giving inferior performance. Could it be that centrifugally supported aerodynes operating mainly in ground effect, don't obey the laws of aerodynamics? Perhaps the currently fashionable model really is the ultimate!

When you see Tom Jolley and myself flying Noblers this year, remember that sometimes it is necessary to go back to first principles. If we appear with a Genesis or Stiletto next year, it will be a product of despair and your sympathy would be appreciated.

## THREE SISTERS INTERNATIONAL

Entry at this event will be restricted to 30, due to the limitations of the site. Arthur Eves informs me that after the closing date, entries will be allocated on the basis of dividing the number of *countries* who have entered, into 30 to give the maximum number of entries per country (hope it gives a whole number, Arthur!). If any country submits fewer entries than the maximum, the number will be made up from extra British entries. Entries for each country will be on a first come-first served basis. What this boils down to is — if you haven't already entered, you are probably too late.

## FILM (RE)COVERING, EPISODE TWO

At the end of the notes in the April issue about film covering, I mentioned that the model was about to be recovered. This is now well under way, but not exactly as I had originally intended.

The film had adhered to the fuselage much more firmly than expected. This is somewhat surprising in view of the fact that after all the film had been pursuaded to come off, it was found that about 90 per cent of the structure was saturated with castor oil. The only area which had escaped was the rear top decking and the fin and rudder. As I had not been looking forward to recovering the wing and tail which would have involved some means of threading the covering through the flap and elevator hinge lines, I decided to leave these items alone and concentrate on the fuselage.

In order to remove the oil, I purchased an aerosol tin of dry cleaning fluid (the particular one used going under the name of Goddards, but there are several others). This was sprayed onto the bare wood and allowed to dry. The areas which had a light oil deposit became covered with a white powder which, when brushed off, revealed dry wood! Where there was a heavier oil soakage, a yellowish putty, not unlike un-cooked pastry, formed which had to be scraped off. In some areas, several applications of fluid were required to reach the powder stage, and I did eventually use up the whole tin.

I then went over the entire fuselage using the toilet tissue and iron routine described previously and then sponged the whole structure with water to remove any remaining powder.

Due to its light weight, the model has always been nose heavy. As a new cowl was needed anyway, I removed the front bulkhead, remounted it ¼in. further aft, and drilled new engine mounting holes ¼in. behind the original ones. The nose was similarly shortened and recontoured to suit.

One characteristic of the Nobler which has bothered some people, is a tendency to turn much tighter on inside corners than outside ones. This does not appear on every example built, and does depend on CG location. If set up in a noseheavy condition it can appear as a very marked sluggishness on the first bottom corner of square bunts. This particular model has always suffered badly in this respect and I was determined to take this opportunity to rectify matters. An access hatch was cut in the rear fuselage side to reveal the elevator pushrod. This was cut through, the ends overlapped about ⅜in. and then bound with fuse wire and soldered together. This meant that both flaps and elevators were now depressed about 10°-15°.

Then, taking a deep breath, both flaps and elevators were firmly forced back to neutral (you have to be brave!). A hole was then cut in the cockpit floor for access to the flap pushrod which was then cut and a piece soldered in to bring the bellcrank back to neutral when the flaps and elevators were at neutral.

The total of all this hard work is that the flap horn is now raked *back* and the elevator horn is raked *forward*.

Now for those of you who are still with me — the explanation! The result of displacing the horns as described is to introduce differential into the control movement so as to give both flap and elevator more *down* than *up*. Therefore, when giving *up*, the flap will move further than the elevator, giving a slower turning more sluggish response, while giving *down* will produce more elevator than flap giving a sharper response.

Will it work? Well, if I can build a new cowl and recover the fuselage in time, we will all find out at Cosford on April 12.

*Happy group from 1960 Team Trials. Standing left to right: Barry Corden (with 2.5cc diesel and .35 Glow models!), Pete Ridgeway (2.5cc diesel), Brian Brown (ETA 29 Lightweight), Frank Warburton (Fox .35 'Nobler'), Dave Day (OS .35 'Chief' and Merco .35 'Thunderbird'); kneeling left to right: Ray Brown (Merco .35 'Coy Lady'), Gig Eifflander (2.5cc diesel) and Tom Jolley (Fox .35 'Nobler').*

# DER ADLER

*Designed by Godfrey Knight*

*This model has been designed around the new Keil Kraft Arden rubber powered motor. The unit has a geared propeller drive and a plastic tube to house the rubber. One of the advantages of this is, that all the weight is located at the front of the model. This makes it ideal for First World War types or semi-scale models like Der Adler that have a short nose.*

## FUSELAGE

Trace fuselage formers onto medium grade balsa, using carbon paper and a sharp pencil, and cut out. A good method to make this process easier and more accurate is to photocopy the parts to be cut out. Stick the photocopy of the parts to the balsa sheet using a spray contact adhesive such as 'Scotch Spraymount'. The part may then be easily and accurately cut out using a *sharp* balsa knife. The paper templates are easily removed from the balsa part if the Spray Mount is lightly applied.

**1** Build the two side frames on the plan selecting the harder wood for the longerons and the softer for the verticals and diagonals. Use PVA glue or Balsa cement.

**2** Clean up the sides with a sanding block, tapering the inside face at the stern post end. Once again the Spray Mount can be used to stick sandpaper to a balsa block to make an excellent sanding block. Assemble the two sides and formers F1, F2 and F3 inverted on the plan and allow to dry. Pull sides together and glue at sterm post, making sure that the sternpost is square to the drawing. Cut and fit all cross pieces and triangular skid support.

**3** Try the ARDEN unit, sanding the frames where necessary to obtain a reasonably snug fit. Glue the three plywood motor mounting pads into position. When dry, mark the three screwholes from the unit. Drill with $\frac{1}{16}$in (1.6mm) drill and test screw the unit in position. Make sure that it can be removed readily without snagging any of the frames. Remove the ARDEN unit.

**4** Bend undercarriage from 20 gauge piano wire; place undercarriage into position and block into place with 2.5 × 6mm balsa and gussets at lower longeron. Bend tailskid and glue into position with 5 minute epoxy glue. Use a few dabs of the glue to secure the main undercarriage.

**5** Fit formers F1a, b and c; F2a, b and c; F3 and b; F4a, F5, F6 and F7. Add stringers fitting former FA1 at the same time. Fit 8

*The cowl held back to reveal the fixing of the Arden unit. Our cowl was made from ABS plastic, but the plan shows an alternative balsa construction. When fitting the propeller, make sure there is enough play for the free wheel to work in reverse when winding with the key.*

*Initial glide flights should be made over soft ground. Pack the rear of the tailplane to increase lift, or the front if the model tends to stall. This is of course, assuming the CG is in the correct position.*

*The model needs holding securely while winding, as there is considerable torque from the eight strands of 6mm flat rubber. Give only 30 turns for the first few flights, until the model is trimmed, and the rubber is broken in.*

*Coming in for a perfect landing after a good 30 second flight. Although the motor can take over 100 winds of the key, we found 90 turns gives very good flights and also prolongs the life of the rubber.*

dowel gussets, drill when dry and fit forward dowel as this helps to retain the undercarriage.

**6** Sand the fuselage smooth and cover with lightweight tissue of desired colour and water shrink. Dope with two coats of 50:50 thinned shrinking dope. The radial engine cowling may be covered with art card or 0.8mm thick balsa sheet.

**7** Make a circular front of cowling from four layers of 1.5mm balsa sheet or from light 6mm sheet. Hollow out to reduce weight. Fix four locating dowels; drill centrally to clear Arden unit housing and drill hole for winding handle shaft. Attach front cowling using a small elastic band and hooks.

## WING

**1** Cut out wing ribs either individually traced or prefereably by the plywood template method.

**2** Sand the 2.5 × 8 trailing edge to its triangular section, and also sand the scallops and cut out notches.

**3** Cut right hand and left hand main spars from 2.5 × 5.0 hard balsa, tapering where shown. (Two laminations of 2.5 × 2.5 may be used).

**4** Build wing halves on drawing; packing under main spar to bring it up to the correct height.

**5** Place the two wing halves on the drawing with the ribs at the centre section at the correct distance apart, keeping the wings in line; pack up the tips to give 35mm dihedral at tip. Fit and glue the trailing edge section, the 2.5 × 2.5 leading edge, the two spar reinforcing pieces and the triangular gussets.

**6** Build up cockpit coaming using 0.8mm sheet and 1.5mm balsa formers as shown on drawing.

**7** Sand curves at wing tips, radius the 2.5 × 2.5 leading edge and cover wing with lightweight tissue of desired colour and water shrink. Dope with 50:50 thinned shrinking dope.

## TAILPLANE AND RUDDER

**1** Trace and cut out T1, R2, R3 and R4 from medium grade 2.5mm balsa sheet.

**2** Cut, fit and glue parts on plan to make tailplane and rudder.

**3** Sand smooth and round off leading and trailing edges.

**4** Cover with lightweight tissue, water shrink and dope with 2 coats of 50:50 thinned shrinking dope.

**5** Glue rudder to tailplane making sure that the parts are square to each other.

## GENERAL FINISHING

**1** Cut and glue remaining three fuselage dowels in place

**2** Cut and fit two rubber band guide dowels to tailplane

**3** Cut and fit two rubber band guide dowels at wing centre section.

**4** Make card or ply templates of the German crosses. Press a stack of 4-6 layers of black lightweight tissue between the template and a cutting board and cut round the profile with a *very* sharp knife. The tissue crosses thus produced may then be doped into position on the fuselage and wings with thinned dope.

**5** Cut a pilot from polystyrene sheet (or use the head and shoulders from a plastic toy providing that it is not too heavy) and stick into position. If desired, machine guns may be made from balsa and glued into position. The guns and the engine cowl should be painted black.

**6** Fit wheels and retain in position by either soldering a small cup washer onto the end of the axle, or pushing a small piece of plastic or rubber electric flex insulation.

**7** Fit Arden unit and clip front cowl into position, fit wings and tail unit to the fuselage using elastic bands.

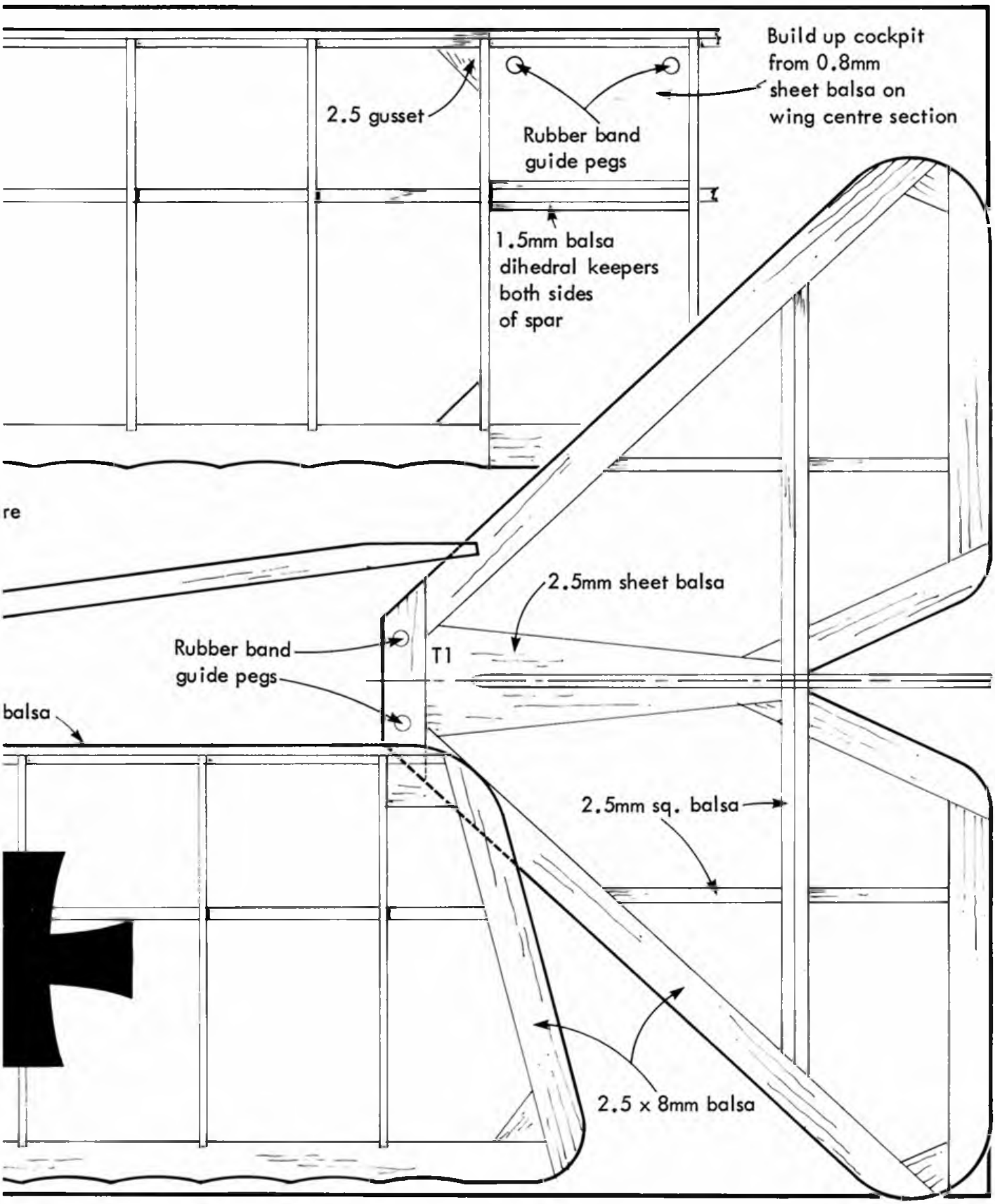
**8** Check that the plane balances at the position shown on the drawing; if it doesn't then add plasticene ballast to nose or tail as required. **The plane is now ready for test flight.**

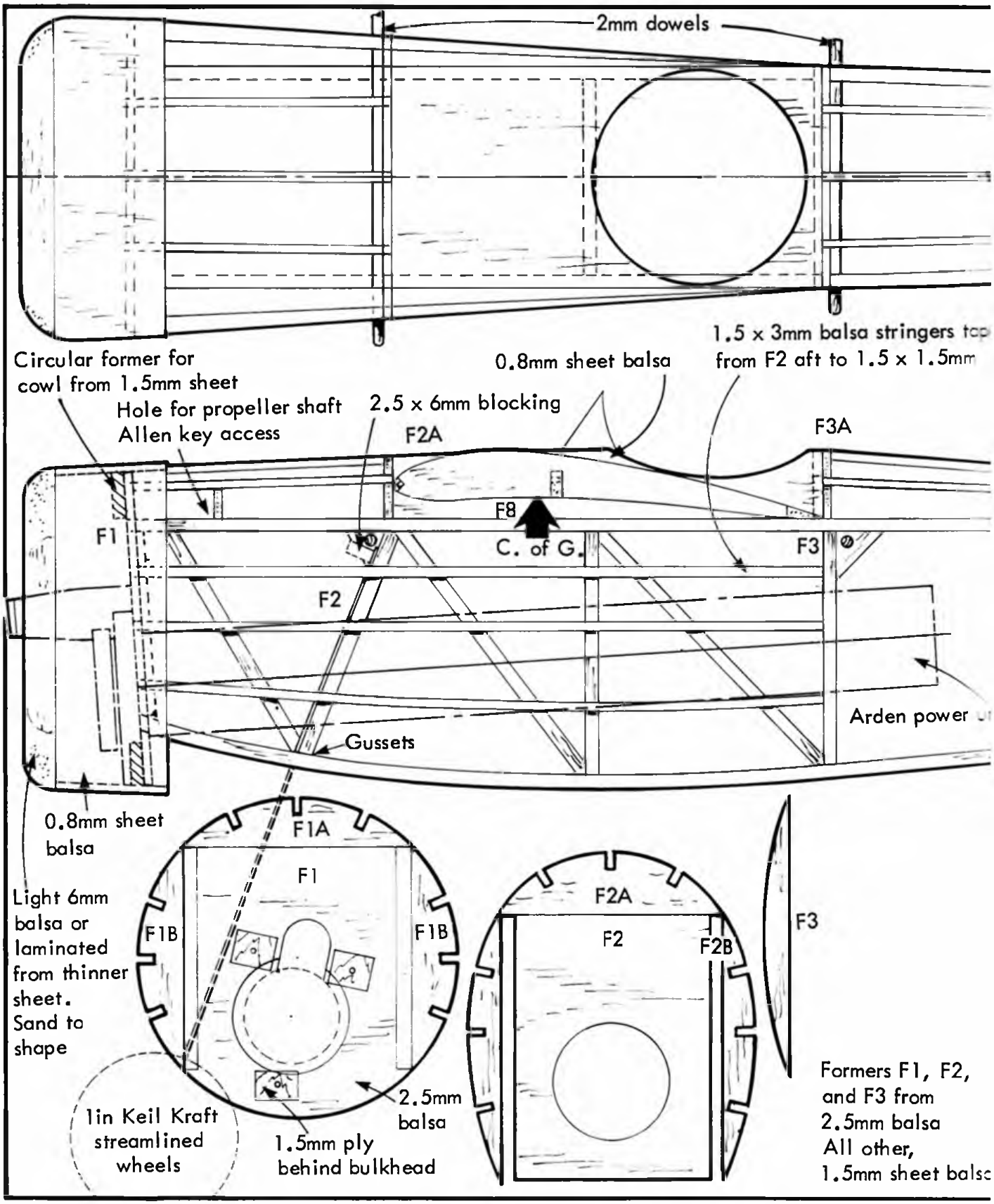
## FLYING

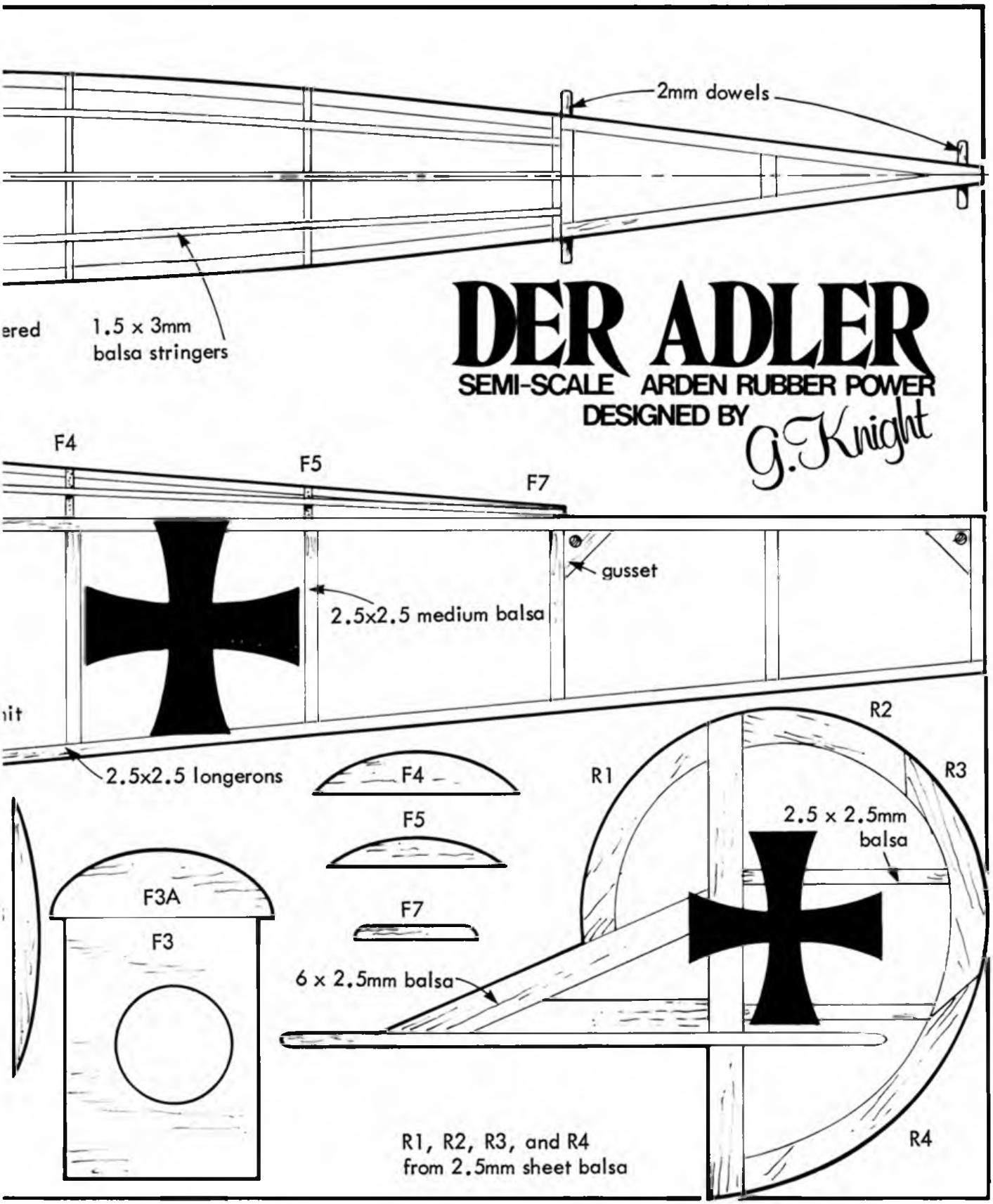
**1** Test glide first, packing the back or front of the tailplane with 0.8mm balsa scrap to correct nose heaviness or lightness respectively. The glide should be reasonably straight, only correct it if excessive left or right turn is noticed. The tail unit should be biased one way or the other to correct this. After all trimming has been completed, the triangular locating piece and any packing should be glued into position to ensure consistent location of the tail unit.

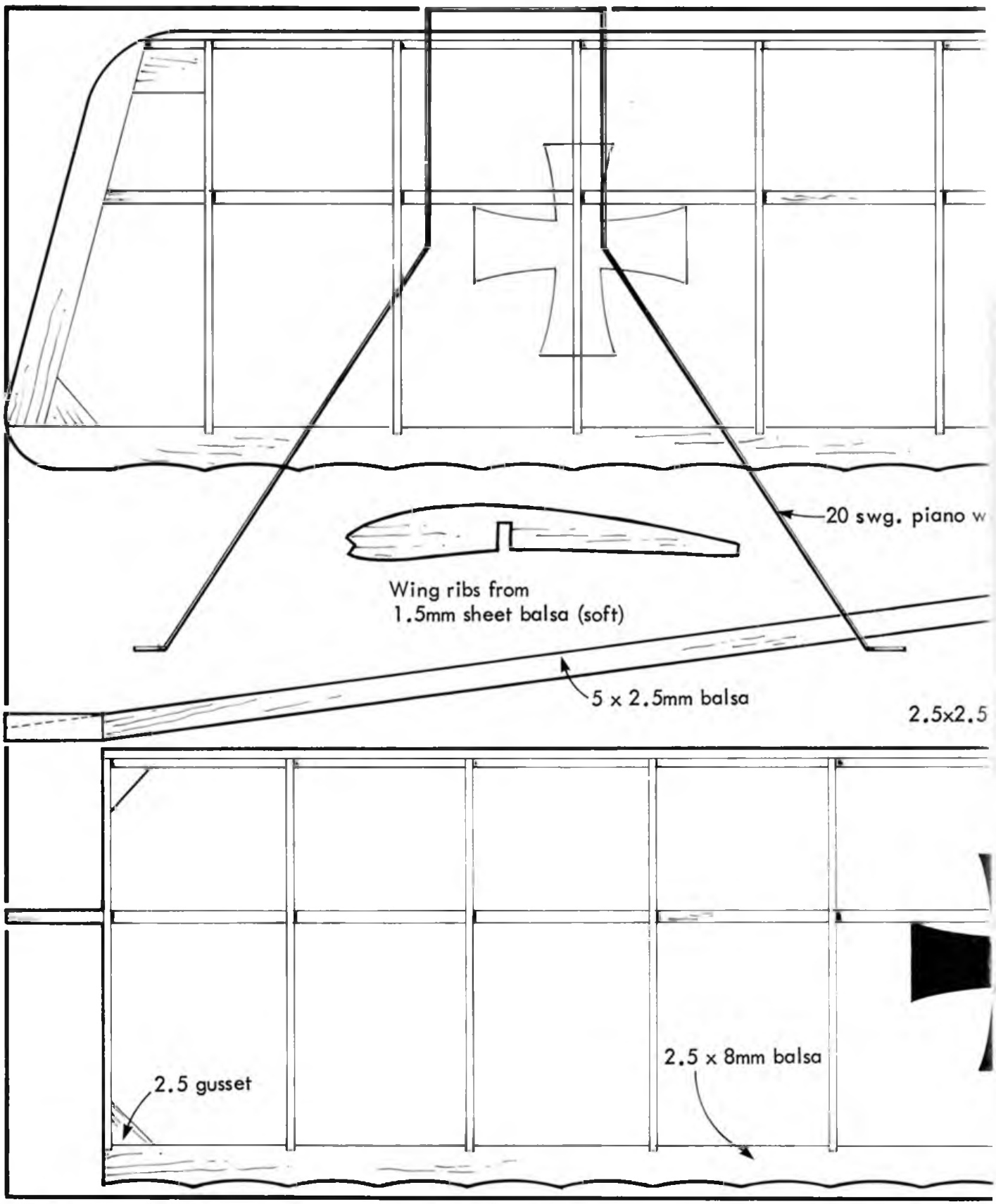
**2** Wind about 30 turns onto the ARDEN unit, fly the plane noting whether it turns left or right under power. The number of turns may be increased steadily correcting excessive left or right turns by giving appropriate side thrust to the Arden unit, i.e. packing the LH side of the housing to correct left turn and the RH side for right turns. Note — owing to the gyroscopic effect of the rotating propeller, a LH turn will lift and a RH turn will lower the nose of the plane. This action may be used to advantage when trimming the plane.

**3** Although the Arden unit will take an absolute maximum of 140-150 turns, I find that 90-100 turns give very satisfactory flights and have the advantage of a long rubber life. If the motor breaks due to overwinding, lack of lubrication or plain old age, always replace it with *Pirelli* rubber. There is no really suitable substitute.









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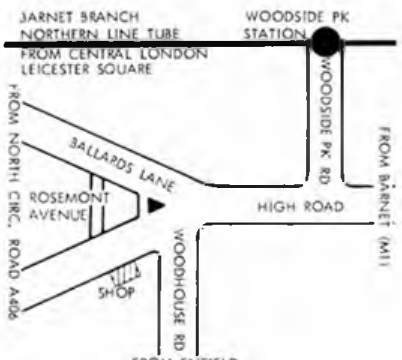


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*This well-detailed Aeronca C2 is for $CO_2$ scale by Doug Sheppard. The smaller Antoinette Latham is Peanut Scale and features scale dihedral!*

## A new rubber drive unit

THE *ARDEN* rubber drive motor unit is a new powerplant the like of which I do not recall having seen in production before despite having read many volumes of model magazines from both the UK and abroad.

The name has no connection with the legendary American designer of spark-ignition and glowplug motors, Ray Arden, but stands for **A**dvanced **R**ubber **D**rive **EN**gine according to the box artwork. The unit consists of a 5:1 ratio injection-moulded plastic gearbox combined with a tubular cartridge that contains an eight-strand rubber motor made from 6mm Pirelli, and it is intended for use in small models or conversions of existing flying scale and other kits. The propeller is a standard Keil Kraft 7in. unit, and the whole assembly comes complete with a special winding crank, a phial of lubricant, some very good rubber, and full assembly and installation instructions. Wound up to 150 turns on the winder, the motor will run for approximately 35 seconds at a very steady rate although power dies away very swiftly towards the end of the run.

The cartridge can be extended in length very easily to accommodate longer motors in exactly the same manner as the now obsolete Jetex Augmenter Tubes, but in standard configuration, complete with rubber, the whole thing weighs approximately 30 grams.

It remains to be seen whether the Arden can find a niche alongside normal rubber power, $CO_2$ motors, and small diesel or glow engines since it is very easy to operate and wind without a 'stooge' or helper.

*The component parts of the new Arden rubber drive unit distributed by Keil Kraft. The propeller is 175mm (7in) diameter. Photo A Callaghan*

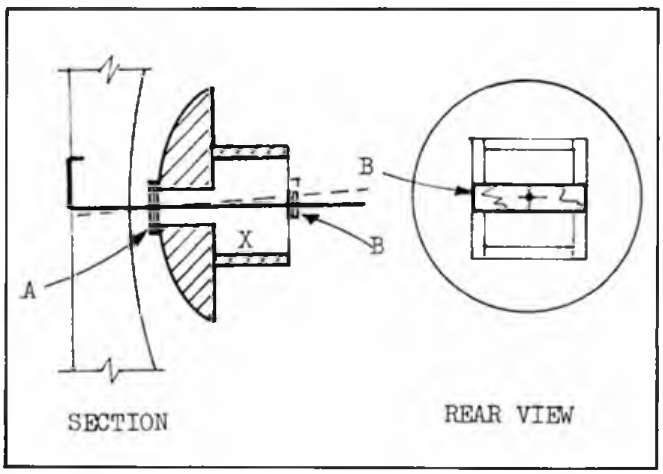
Although it is claimed to be suitable for models up to 660mm (26ins) span, its weight will not be in its favour as many builders can produce entire models of this size to a *completed* weight of 30 grams, and of course, indoor enthusiasts can aim much lower. Many would blanch at the thought of putting eight strands of 6mm Pirelli into such a small model, but rest assured that with the motor being fully contained within the plastic tube, a breakage would cause no damage at all to the model itself.

For scale modellers the unit is too large to suit the Keil Kraft range of Flying Scale Models, but some of the larger Steriling or Guillow kits could make use of it.

The best application would be in a short-nosed subject such as a WWI biplane where a lot of weight is needed at the front, but for the more ambitious, the Arden could be used for larger twin-engined subjects where short engine nacelles preclude the use of a normally proportioned motor. Again it must be borne in mind that the power dies away abruptly towards the end of the run, unlike a $CO_2$ motor which will slowly throttle down to a tick-over before stopping.

Some of the development work of the Arden was shared by Godfrey Knight, whose Arden powered model is featured in this issue. Coincidental with its arrival on the market are the continuing experiments being carried out by Mike Hetherington with the very lightweight geared rubber motor drive units purpose built for his paper Focke-Wulf Stossers and his latest creation, a Fokker DVI which by all accounts performs very well.

Any news of a successful application of the Arden unit in a good scale model, will be most welcome in this column.



*G. Andrieson's Vought XF52 is Peanut Scale and features two separate motors for the contra-rotating balsa props - a very challenging subject.*

## Thrustline Adjustment for Rubber Models

Very few models — scale or otherwise — fly perfectly well straight from the drawing board. Some need a great deal of trimming using elevator, rudder, aileron, and nose-weight, before they begin to settle into a reliable flight pattern.

The indoor model, being flown in usually quite perfect conditions compared to its outdoor cousin, has shown us that models can be trimmed to degrees of accuracy that are very fine indeed (and to limits that are meaningless ourdoors because of the way in which a model is at the mercy of any breeze, however light, when flown in the open air.

A most important part of good indoor trim is to get the motor thrustline right. Unfortunately there are few hard and fast rules. Some models will naturally turn left under power, whilst others can be made to turn right with great success, unlike an outdoor model. Consequently, easy adjustment of the thrustline is a very welcome feature to have on a model. One noseblock design that I have used for several years consists of the following.

Unlike normal practice, the prop shaft does not run in a tubular or plastic bearing, but is simply located by a thin (0.8mm) plywood disc 'A' at the front, and a similar plywood strip 'B' at the rear, with no support (and less friction) in between. The rear strip 'B' is glued to a simple sheet balsa hollow box on the back of the noseblock, which acts as the locating block in the front of the fuselage. Strip 'B' can be moved and re-set at any position to alter the line of the prop-shaft — without the need for unsightly packing at the side of the scale noseblock — once the correct alignment has been established. The two-point bearing gives a very steady prop-shaft and any noseweight required may be installed within the box at point 'X' where it has little chance of becoming dislodged. When fully trimmed out, a model using this type of arrangement has the scale noseblock sitting fully square onto the fuselage for best scale appearance, yet the actual shaft will be correctly aligned according to the trim that the model requires, and small pieces of loose packing become quite redundant.

## Bristol Indoor Meeting

In early March I was able to take up an invitation by Doug Sheppard of the South Bristol club to attend an informal indoor flying meeting at a school sports hall on the outskirts of Bristol. The meeting was experimental in trying to judge the type of response one might expect from the local area and also to test the suitability of the available hall.

Measuring approximately 100ft × 60ft × 25ft high, this was not quite up to the dimensions required for a large and well-publicised gathering, but was quite ideal for a relaxed three hour evening flying session where new models could be tried free of pressure, and old ones flown simply for the fun of flying them.

Some interesting new models were on hand and the prize for the most unusual and ambitious would certainly go to the Vought XF52 'Flapjack' by G. Andrieson. This tricky subject was built to peanut dimensions and incorporated much scale construction including the large contra-rotating props. The slim form of the motor nacelles greatly limits the amount of rubber that can be housed and this had its effect upon the model's flying performance. Doug Sheppard brought two more unusual subjects, his $CO_2$ powered Aeronca C2 and his peanut Latham Antoinette. The latter was an extremely advanced aircraft for 1911, and although it is featured in the small book on Pioneer Aircraft by Kenneth Munson published by Blandford, Doug had acquired some splendid documentation from the French magazine 'L'Aerophile' through the Musee de L'Air in Paris. Coming bang up to date on the time scale, Peter Frostick was trying out an all foam Rutan Quickie built during an office lunch-hour, which shows signs of being a surprisingly steady performer despite the tandem wing layout — so different from any other aircraft yet built. Flying a Comper Swift built from an Andrew Moorhouse kit, 13 year old Simon Rider took the top Junior placing in the contest that was run, with Andrew himself being present to help with some trimming advice. It seems that peanut models just aren't small enough for some as demonstrated by Peter's Piper Cub and Lacey, together with Dave Hank's DH6, for placed wingtip to wingtip the total span of these three models might just make 600mm!

It is hoped that another meeting at the same venue will be possible later in the year, so anyone interested and within reach of the area should try to contact Doug through the South Bristol Club.

*Simon Rider won a Bob Peck Gypsy Moth kit at Bristol flying his Andrew Moorhouse Comper Swift. All graphs by Alan Callaghan.*


## Andy Crisp reports....

### 35th COUPE D'HIVER DU M.R.A. 22nd FEBRUARY 1981 Report by Andy Crisp

Up until the Thursday before this contest, it seemed as if the 'Old Country' would not be represented at all in what is supposed to be an international event. As it happened this was our school half-term so a long weekend in France seemed a good idea especially as, at long last, I had some passable Cd'H models to fly. A few hasty telephone calls secured accommodation and in no time I was joining the queue for the overnight boat train at Victoria station. This is where the hippy spirit of '69 lives on except that I had a 4ft model box among the rucksacks! A boat journey, a connecting dash across the Paris Metro and several train changes later, I was met at Bourges and entertained as only the French can by Messieurs Boutillier and Nikitenko, whose command of the English language was far better than my smattering of French gleaned from 'Vol Libre'.

The rest of that Saturday was spent sightseeing, visiting vineyards and sampling their wares etc. and it occurred to me that most of France is one ideal F/F flying site — flat fields and no hedges!

Sunday dawned cold and snowy but mercifully calm. The airfield was one normally used for gliding, miles from any habitation but apparently not far from Issoudon.

Three contests were run: 100gm Cd'H (3 flights, R.O.G., 2 entries allowed), 80gm Cd'h (5 flights hand launch) and ½A Power (3 flights, 7 second motor run). There was a good turnout considering the weather with some 50 competitors in each of the Coupe classes, but ½A was a bit thin on the ground, it being a relatively new venture in France.

As to the conditions, it snowed most of the time, with perhaps an hour of mild sun at midday when a little weak lift was about, deteriorating to drizzle with absolutely no wind at fly-off time. There was little tactical flying, it being more important to keep the models dry than to hang around for lift.

As we all know, the French, especially Boutillier and Matherat are no slouchers when it comes to Cd'H designing and flying. Bernard had a new 80 gm model built especially for Halton which is a complete reversal of current French trends. It was very small, perhaps 32in span, with a short powerful climb to a great height, but of course, it suffered on the glide. Georges on the other hand, flew a new model to his well known layout in size somewhere between his Trumeaux and Supertrumal designs. About 56in span (!), it had a cunning, all-wire 'Montreal Stop', sheeted front fuselage, double-covered inner panels to the wings, and was still light enough to carry a d/t timer! It had rather a small tail for the moment arm and a corresponding forward C.G., surprisingly the tail was symmetrical in section. The performance and flight pattern (R/R) were very impressive, the model wafting up on a very long run like an indoor job. There was in fact, a fly-off for 2nd place in 100gm between these two fliers (although Boutillier flew a different model to that just described) and Georges did 130 seconds in not very inspiring conditions. It would not be unreasonable to suppose a dry still-air time of over 2½ minutes.

The actual '100gm' contest was won by Nomain with two maxes following an initial 103 seconds. He flew a distinctive model with a narrow, deep fuselage, in profile not unlike the A.P.S. 'Tadpole' glider. The model displayed the typical French habit of sticking the tail fin in an illogical place! It also featured pretty swept-back eliptical tips to the wings and stabilizer with the multispars all curving in proportion.

The winner of the '80gm' event was M. Brand with 564 seconds. He flew a very conventional model rather like an enlarged A.P.S. 'Nikolina' with very fancy tissue trimming.

One of the nice things about French competitions is the large number of what used to be called 'unorthodox' models which one sees on the field. They may not win, but show a strong, creative streak which is not always evident this side of the Channel.

There was a low-wing entry from old time modeller Rene Jossien. Jaques Delcroix, whose complete stable of models appears to be Jedelsky winged, displayed a Cd'H version with the cross-sectional area hatchet-like at the nose (in the manner of Callegari's Italian champion). It had a delayed propeller release, yet was flown R.O.G. There must have been some pushing somewhere! Another entry featured a complete 'sculptured' wing-moment arm and fairing over the basic motor tube, rather like the front end of a modern, cowled F1C model. A protege of Matherat flew a new model that was at least A/2 size! That it could glide was never in doubt, but it actually climbed well on a couple of occasions when it was trimmed. Perhaps the most bizarre creation was a high-thrust-line coupe with a hunched-back motor pod, tissue covered, underslung boom with the wing somehow mounted halfway down the cabane connecting the two. It also featured an auto-rudder but was handicapped in flying by its obvious great weight ($\frac{3}{16}$in.sq. longerons!)

My efforts with a more conventional approach were modest enough — 508 seconds for 8th place in 80 gm and 287 and 285 for 19th and 21st in 100 gm.

Finally there was the ½A power event. Most of the French models patterned beautifully but were too heavy, perhaps influenced by F1C practice, to really score on the glide. Louis Dupuis had an interesting model with high thrust line and egg-box tapered wing that climbed as straight as a die, but I think he dropped his last flight.

There was a three-man fly-off held in the gathering gloom between the mighty trio of Georges and Bernard and myself. Georges flew a very simple model with a fibreglass rod fuselage, keel under the pylon, and a very low aspect-ratio tailplane. Bernard flew a standard Ken Faux 'Swift Half' with V.I.T. and two piece wings. I flew a standard British type ½A with multispar surfaces and which weighed only 5½oz; of course all used Cox motors.

The F.O. was an anti-climax for me as my motor cut immediately after launch due to grit in the works through landing in a ploughed field on the previous flight. There was some discussion among the organisers as to whether I was allowed another go in what remained of the 4 minute F.O. period, as it was an international contest, but not an international class. Any way I was urged to fly again and this time all but did the 3 minute max, the other two meanwhile having done 143 seconds and 121 second respectively. On returning from retrieving, the organisation had reversed their decision, so I was given a rightful third!

The prize-giving was not the usual drawn out French affair; no doubt due to the sub zero temperatures and the bleak surroundings.

The following day of course, was fine and sunny and was well spent taking in the delights of the Paris art galleries before catching the boat train home.

### SMAE MIDLAND AREA INDOOR MEETING MARCH 8th — KELHAM HALL, NEWARK Report by Mike Coomes

A new site was used to try and extend the number of venues available through the country suitable for all classes of indoor flying. Kelham Hall was a monastery and is now the headquarters of Newark District Council.

The dome is 85 feet high and 62ft × 62ft. First impressions were pretty unanimous that it looked ideal for good competition flying, but on the day the unpredictable drift proved tricky for EZB. However it was very damp and windy outside when many high ceiling sites suffer from damp under these conditions.

All the others coped very well, especially HLG, the potential for 60 seconds+ flights is quite a challenge. To use the dome to maximum advantage, a flight pattern of Right, Right or Left, Left must be used. The HLG competition proved very close with G. Davitt and Ron Green together throughout. With only one flight left, Graham needed 38 seconds to win and that's exactly the time his model achieved.

EZB, despite the problems with drift, proved an interesting contest. Bernard Hunt set up two good times very early and then watched all the opposition slowly improve their times. Up to 14 models were in the air together looking almost like a F/F fly-off situation. Bernard Hunt decided it was time to try and better his earlier scores, setting a hall record with 11.18 which confirmed his lead.

Manhattan managed 5 entries with Henry Tubbs winning with a 2 flight aggregate of 6:31.

An extra award was given to M. Cooling of Wigan for obtaining the highest cobweb of the day.

Everyone agreed that this site was a real find for indoor flying probably second only to Cardington and it is to be hoped that more events can be held in the future.

Results: HLG 1. G. Davitt (Jnr) 73:00, 2. R. Green 72:00, 3. S. Philpott 63:00. EZB 1. B. Hunt 22:00, 2. N. Aikman 20:26, 3. G. Davitt (Jnr) 19:26. Peanut Scale 1. B. Hadland, 2. L. Barr, 3. M. Hetherington. Manhattan 1. H. Tubbs 6:31, 2. M. Hetherington 4:48, 3. K. Bates 4:22.

## Dave Hipperson reports....

### The Open Rubber Trophy

This year it is to be flown on October 18 probably at Hemswell although the venue still has to be double checked. There will be the usual arrangement of flights made to either an increasing max or 'sensible' one if conditions are difficult and flights will be in ever shortening rounds. Additional to this a one off Champagne fly-off event is also planned for later on in the day. This

will have a nominal on the field entry and it is hoped that it will be run in such a way as to tempt those still in contention to spoil their chances on an extra flight! Entries for the Trophy event close on October 9 and are Senior £1.50 and Junior £1. Entry on the field also available at twice the price. Pre-entry as soon as you like to me at 35 Anthony Road, Boreham Wood, Herts., enclosing two SAEs, one for return of entry confirmation and last minute info, and one for return of complete results soon after the event.

Entries are also being invited from Europe and USA and it is expected that a number, if not all of these, will require proxy fliers. If you are experienced in such matters and would like to look after a foreign charge perhaps, as well as your own please let me know.

If sponsorship proves no problem then prizes should be along the lines of previous years and a proper prize-giving party will be given somewhere close by that evening.

### Contests — Help?

Are SMAE free flight events how you want them and are the events flown the ones you are interested in? The statistics would suggest not. We are short of suitable flying sites, yet in the face of evidence that things are unsatisfactory, the SMAE steadfastly refuse to modernise their contest structure despite advice and guidance from a number of experienced fliers. In the August 79 issue I suggested a far more workable system that would free up aerodromes for essential and worthwhile local events — no reaction. Others have made similar suggestions too — no reaction.

Whilst the Technical Committee writes itself into a corner and consequently all sorts of trouble over the Trials this year my remarks in January 81 are ignored. As they were postscripted by an offer to actually run the Trials for them next year we must assume that members of said committee are falling over themselves to run the event next year. That would be a change. The important aspect of attracting competitive blood at ground level is being overlooked. Properly run local contests could help solve this — Area events don't. In the first Area event this year held in March — on a day that was surprisingly flyable throughout the country considering the weather for the previous week — two of the eight Area sites were closed to all but the actual Area they served and one of these was a virtual secret until a week before the competition anyway. Another site was not officially nominated by the Area Committee responsible and this could have resulted in people not knowing where to go to fly and worse the scores could have been invalidated! Of the other five sites at least one is not 'substantial flat' and contravenes the rules in that respect not to mention giving the people that fly there a disadvantage on a windy day of huge turbulence. I don't see potential free flight contest fliers being encouraged to come and fly when things are as slapdash as this.

Each year the SMAE donate very impressive hardware for a succession of Area events that judging by their rapidly dwindling attendance record are not what you want. The very handsome Frog Senior Trophy for Open Power at the first Area event attracted 20 entries Nationwide when more than four times that will fly in a similar event at the Nationals. I can see the day is not far off when the SMAE decide that these valuable trophies would be better off donated to an expanding sport which has got its house in order such as thermal soaring. They don't have Area centralised meetings and entries are oversubscribed to all their main events. Further evidence to suggest apathy towards our present Area system is that if few bother to fly then even fewer are interested in the results. Last year I sent out 75 sets of results after each event to individual SMAE members who had sent me SAEs at the start of the season, not very many but this year that number has dwindled to 25!

Now not all the blame can be laid at the SMAE's doorstep. This hobby desperately needs well organised centralised events from the small local event — Wigan 70, Junior events and Mini events to the full blown works of the Nationals. They need to be advertised well in advance but more than this, at each one somebody needs to be in charge. One person needs to take just one day a year off flying and put his back into running the contest and worrying about it enough to ensure that it is a 'contest' no matter what the weather. The site problem is very real but it is being compounded by a more serious disease inside our own system. You just can't be bothered!

Already this year a number of fliers have approached me saying it would have been nice to have had an event or two in January and February particularly as the weather was so mild in the south at least. But why ask — why not run one — just one. Barkston was actually available for a date in February and no one contacted Mike Coomes to use it.

I am offering sound advice and if necessary the manpower to run some if not all of the SMAE's 82 contest schedule if they approach me for my ideas and promise to give it a reasonable try. But if I do this then I'll need your back up the year after to keep things going. The future of contest free flight rests with you — without your organisational assistance there will be no such thing within a couple of years.

### SMAE 1st Area Centralised Free Flight (Results)

#### A2 Glider — FIA — KMAA Trophy

| | | | |
|---|---|---|---|
| 1 | C Edge | Welland Valley | 15 00 + 4 19 |
| 2 | D Greaves | B and W | 15 00 + 3 19 |
| 3 | G Beal | C/M | 15 00 + 3 15 |
| 4 | A Cordes | Whitefield | 15 00 + 2 55 |
| 5 | M Coomes | Grantham | 15 00 + 2 10 |
| 6 | P Putnam | St Albans | 15 00 + 0 58 |

#### Open Rubber — no trophy

| | | | |
|---|---|---|---|
| 1 | J. Cooper | Biggles | 9 00 + 11 48 |
| 2 | J O'Donnell | Whitefield | 9 00 + 7 32 |
| 3 | C Chapman | B and W | 9 00 + 6 28 |
| 4 | G Ferer | Leicester | 9 00 + 6 20 |
| 5 | P Ball | Grantham | 9 00 + 6 03 |
| 6 | J Carter | Falcons | 9 00 + 5 55 |
| 7 | T Grey | Brighton | 9 00 + 5 01 |
| 8 | D Davitt | Leeds | 9 00 + 5 00 |
| 9 | T Chambers | Darlington | 9 00 + 4 59 |
| 10 | I Davitt | Leeds | 9 00 + 4 34 |
| 11 | K Athwell | Calderdale | 9 00 + 4 28 |

#### Open Power — Frog Senior

| | | | |
|---|---|---|---|
| 1 | P R Harris | Birmingham | 9 00 + 5 30 |
| 2 | J Hopper | Stanstead | 9 00 + 5 29 |
| 3 | A T. Smith | Bac | 9 00 + 5 09 |
| 4 | F Chilton | Crookham | 9 00 + 4 15 |
| 5 | J Bailey | Biggles | 9 00 + 3 20 |
| 6 | A G Jack | Tynemouth | 9 00 + 2 27 |

#### Plugge Totals (after one event)

| | |
|---|---|
| Grantham | 273 |
| Liverpool | 215 |
| Biggles | 214 |
| Birmingham | 192 |
| Whitefield | 185 |

### CARDINGTON 81 DATES

More news — when the Indoor Technical Committee picked the dates for this year, the only contest calendar available was sadly out of date. Hence clashes with two SMAE F/F events have occured; this is due to insufficient co-ordination/co-operation in publishing dates.

We have therefore decided to remove the clash with SMAE events by the following changes:

1. The event scheduled for June 28 will now take place on June 21 to avoid a clash with the centralised mini.
2. The event scheduled for July 12 will take place on July 5 to avoid a clash with the two day open/FAI event.

Clashes no doubt will occur with area contests; there is no way the Indoor Technical Committee can allow for these — there wouldn't be any dates left for indoor at all!

### Charges

Previous announcements have indicated that £4 will be charged per head per day for fliers. Recent events like the Chancellor's iniquitous and universally condemned extra 20p tax/gallon of petrol — of which 85p now disappears into the insatiable maw of the Government — have forced the Indoor Technical Committee to review the charge. It is likely that less than £4 a head will be charged but this has not yet been decided.

### SLAITHWAITE MARCH 1, 1981

This was effectively the last low ceiling Northern event with the usual formula of HLG and EZB for duration events. This was my first view of the 1·2g EZB rule — very interesting. There is a wide diversity of designs which is a refreshing change. It seems to be important to have a very stiff model i.e. built up to weight and a slightly lower pitch prop than might be used on lighter models i.e. not more than 28in. For events where ceiling scrubbing is possible, the flight timers are just as high as before, possibly because the models are stiffer and more efficient.

Bernard Hunt's model has adjustable rudder, CG and tail incidence to allow tuning up' in terms of efficiency. Plenty of rubber goes in (~1·1g) of a motor about the same size as for a VP FAI model — about 55thou wide taking about 1600 turns with at least 20 per cent backed off to slow the climb. Bernard's model also features maximum area tailplane (30sq. in.) with about ten per cent camber.

Ron Green flew his long moment arm model to very useful effect (third place) — this features a lower pitch (around 26in.) and I think needed a very small amount of ballast.

John O'Donnell employed the tactic of whacking his model into the roof and got away with a hang up which lasted several seconds for a fortunate ten minute flight. A good back up showed consistent flying.

HLG saw more Upstart 4s, varying in weight from Ron's 3·8g to Bernard Hunt's 8g. Six flights were used to select the top five for a further three flights. I just made the fly-off having had some problems with the transition and turn on the only model which survived.

Ron went into the lead and increased it with a superb 37·3 last flight — a new hall record. I just managed to pip Bernard into third due to a misunderstanding in the scores when he thought he was second, wasn't and went for a bust in the fly-off!

#### HLG (15 entries)

| | | |
|---|---|---|
| 1. | R Green | 34.2 + 37.3 = 71.5 |
| 2 | R Bailey | 30 4 + 30 55 = 60 95 |
| 3. | B Hunt | 30 15 + 29 4 = 59 55 |

#### EZB (17 entries)

| | | |
|---|---|---|
| 1. | B. Hunt | 10.55 + 10 58 = 21 53 |
| 2 | J. O'Donnell | 10 05 + 9 31 = 19 36 |
| 3 | R Green | 9 32 + 9 19 = 18 51 |

*Continued on page 308*

# PRACTICAL AERODYNAMICS

## PART 3 OF MARTIN SIMONS' APPROACH TO MODEL AERODYNAMICS

AS EXPLAINED IN PART 2, thin plates, curved or flat, can be used successfully for model wings and tails in some circumstances. For indoor duration models in particular the curved plate or very thin membrane is also found to be aerodynamically efficient although requiring very careful trimming. Each such profile has an ideal angle of attack at which it creates least profile drag. If the angle is not quite right, the drag will rise fairly sharply and the model's performance will suffer.

### BEING PRACTICAL

For almost all other models such thin profiles are not useful for wings since they are not capable of being made strong enough to withstand the normal loads of flight and even if they could be stiffened in some way, the air is usually too rough and the actual angle of attack at which the wings operate tends to fluctuate. This means, whatever sort of wing profile or aerofoil is used, the ideal angle of attack cannot in practice be held perfectly. Aerofoils are needed that enable us to increase strength and stiffness without excessive weight, and also which give less critical trimming. Fortunately both can be achieved by making the profile somewhat thicker. With such thicker profiles, designed properly, all the same principles apply as with the very thin ones. There will still be an 'ideal' angle of attack at which the minimum profile drag will be found. With thick symmetrical profiles this will be at the zero angle of attack, when no lift is developed. Cambered profiles will still have an 'aerodynamic zero', the negative geometric angle of attack at which they develop no lift. All wing profiles will stall if they are set at too great an angle of attack so that the airflow separates.

### PRESSURE DRAG

The resistance caused by any object pushing through a real fluid, will on the whole tend to increase as sections become thicker simply because the air has to be moved further out of the way to let the wing through. This will almost always be the case at the ideal angle of attack. If the camber is the same, at the minimum drag angle, the thinner profile will create less resistance. At other angles of attack this will not necessarily happen, for one of the advantages of thicker profiles is that they do retain good airflow for a little way on each side of the best angle and so it is very likely that in practical flying operations the average profile drag of the wing in a turbulent airflow will work out less if it is of a moderate thickness than if it were a plate. Consider **figure 1b.** Here a symmetrical aerofoil is shown at a small angle of attack. The air flows round it in the familiar curved pattern that means some useful lift is being generated. Since the wing nose or leading edge is not a hard, sharp corner but rounded, the air passing over it has a little longer to adapt to the curve than it would if the angle were very sharp.

This gentler curve continues right over the upper side of the profile, so there is less risk of flow separation. The result is that the wing will not develop such high pressure drag when it is lifting, as the thinner, flat plate does. The final breakaway or stall, will also be postponed to a higher angle of attack so in a flow of the same speed, the symmetrical aerofoil will be capable of carrying more load. Within certain limits, the thicker the profile, the less critical it will be to changes of angle of attack, and the later the stalling angle will be, i.e., the more total lift it will be able to generate, at a given airspeed. Thick profiles thus make for easier trimming, smoother control response and mild stalling characteristics, which are all highly desirable in any model.

### AEROBATIC TYPES

Whether control line or radio controlled, they have the additional advantage that when the model is flying inverted, a symmetrical wing profile will behave just the same as when right way up, indeed, for such a wing there is no right way or wrong way up, it is only that the fuselage and tail, and undercarriage, tend to be mounted one way rather than the other. These advantages ensure that symmetrical profiles will be very popular for such models. They are also particularly useful for fins and tailplanes which should normally operate close to the zero angle of attack and should not carry much load.

### YOU CAN GO TO FAR

Still, if these profiles are thickened up too much the pressure drag does begin to get out of control. Obviously a profile that was so thick that it became nearly circular in section, would not be of much use since there would certainly be extensive flow separation behind it and a very turbulent, churned up wake. In practice, usable aerofoils rarely exceed 20% thickness (i.e., 20 parts thickness to 100 chord, or 1 to 5 thickness to chord ratio). Modellers who build true scale models of full-sized sailplanes of the 1950s era, such as the Skylark 1-4 series, will find profiles of 21% on the prototype, but this was for special reasons and such profiles do not work well on models unless very large or fast. The reasons will appear in a later article. For most models profiles of a moderate thickness will give good results. Thinner ones generally used for small, slow flying types, or somewhat thicker, if easy trimming and smooth control are required.

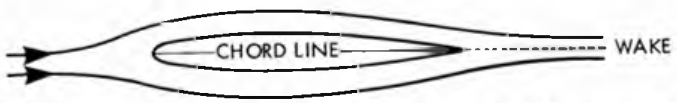
### BE POSITIVE

Since no model can fly without some supporting force and hence a wing operating at a positive angle of attack (measured from the aerodynamic zero), profiles with some camber will usually be most efficient since they produce lift at their minimum drag or ideal angle of attack.

### CAMBERED AEROFOILS

It is necessary to clarify what is meant by a cambered aerofoil since some modellers become rather muddled when discussing these. Some strange terms creep into the conversation and into some written materials and as a result mistakes can be made. An important point to remember is that the air is a fluid. This means that it is

**Fig. 1 Airflow around a symmetrical profile (a) zero angle of attack.**




**(b) Moderate angle of attack (Note curvature of flow upwash and downwash).**

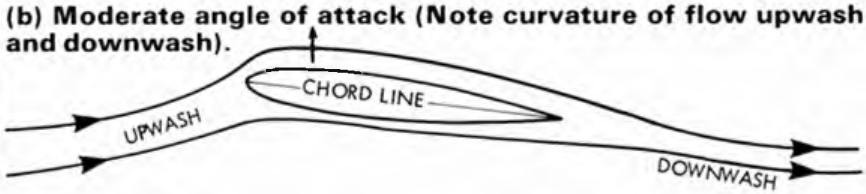
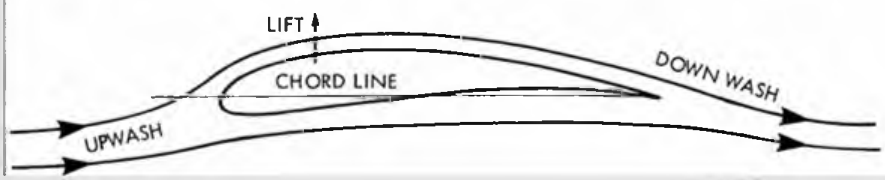



**Fig. 2 Airflow round a cambered profile at geometric zero.**



continuous, changes in one place in the fluid are capable of being felt some distance away. Something happening underneath a wing, for example, can and often does change conditions on the upper surface and vice versa. The shape of the profile has to be viewed as a whole in the light of this knowledge. For instance, as shown in Part 2 of the present series, ahead of a lifting wing there is an upwash effect and behind it, downwash. A change in the downwash behind is very likely to change the upwash in front even though it would seem at first sight that what happens behind the wing cannot affect what happens to the air that hasn't yet arrived. The fact is, in the neighbourhood of a wing in a fluid airflow, the entire system combines and such influences are definitely felt **(Figure 2)**.

## AEROFOIL DESIGN

The simplest way of considering any wing section is to see it as a thickness form combined with a camber line. Modern profiles are usually worked out from first principles with the aid of computers but this need not worry us at present. To design a new profile, one simple way of doing it that any modeller can try, is to choose first a camber line, and then fit a desired thickness form to it. This is done by first drawing the camber line to a chord as long as required, as shown in **Figure 3a.** Then whatever kind of thickness form is preferred may by united with the camber line as follows. If, at the halfway or 50% position on the chord, the thickness of the wing profile is to be one tenth or 10% of the chord, a compass with radius set to half the required thickness, is used to draw a circle centred on the camber line at the 50% position. Then, at each similar station similar circles are drawn with radii determined by the thickness at each place. This is suggested in **Figure 3b.** Finally, a smooth curved line is drawn, with the aid of instruments such as 'French' or ships curves or one of the various kinds of flexible drawing gadgets available from draughtsman's shops, so that the line just touches each circle **(Figure 3c).** The very first circle of all at the leading edge gives what is known as the leading edge or nose radius, and this should be carefully chosen and accurately drawn, because in flight it will be the part of the wing that air meets first. At the trailing

**Fig. 3a Camber lines.**


**Fig. 3b Circles drawn for thickness.**

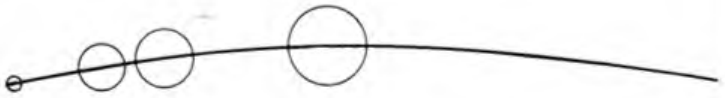
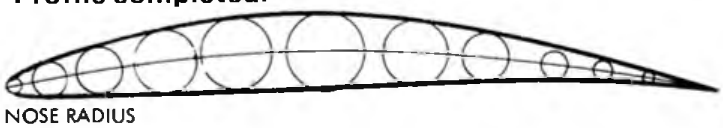


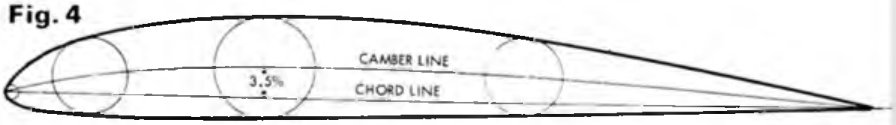
**Fig. 3c Profile completed.**




edge the usual thing is to bring both upper and lower surfaces to a point, but quite often in practical aerofoil design, the trailing edge is allowed to have some thickness for the sake of structural stiffness.

Any wing profile can be considered as having been built up in this way, even though most modellers will not bother to design their own but will use profiles already tried in existing models. The exercise is useful, nevertheless, for it shows what the camber of such a profile is actually like. To measure the camber it is obviously no good looking only at the upper surface or the lower surface. The camber line is what counts. In **Figure 4,** the very well-known Clark Y wing profile has been plotted and the camber line shown. This profile has a flat undersurface over the rear three-quarters of its chord and for this reason is often used for simple models where ease of construction is of primary importance. Note that the flatness does not extend all the way to the leading edge. The camber line on which the circles are drawn, runs to the true leading edge. The true chord line of the profile also runs from trailing edge to the leading edge although most modellers tend to use the undersurface chord line when considering the angle of attack of such a profile.

**Fig. 4**



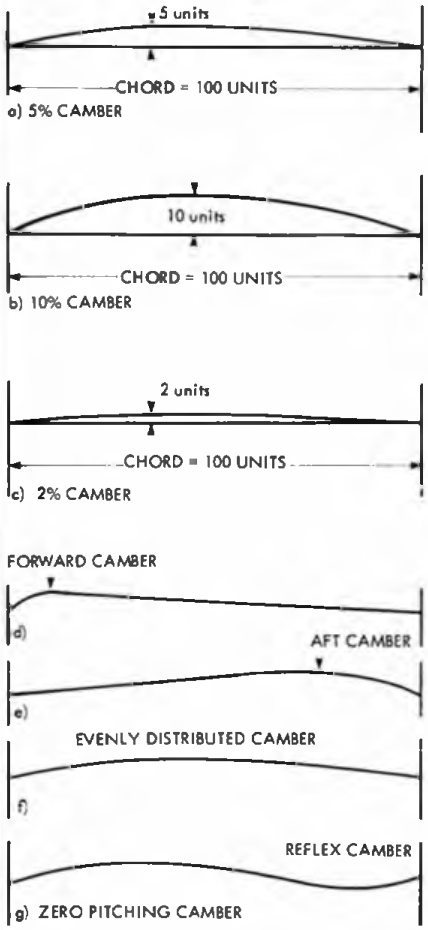

The true camber of this section is measured from the camber line to the true chord line, and it comes out at approximately 3.5%, i.e., three and a half units of camber in a hundred units of chord.

## MODS TO CLARK Y

A great many modellers use Clark Y sections but thin them down or, less often, thicken them up slightly for various reasons. What is done is to plot the thinned profiles in exactly the same way as the normal one, but to scale each vertical measurement down by some factor, to yield a so-called 5% Clark Y, or whatever thickness the modeller requires. However, when the camber line for such a thinned profile is worked out, it is clear that the thinned section has less camber than the original. So long as the modeller realises this all is well. But strictly, a 'thinned Clark Y' would retain the same camber line and simply have all the circles drawn with smaller radii. This has been done in **Figure 5a,** and the outcome is no longer a section with a flat underside, but an under-cambered profile. On the other hand, if the modeller wished to have a thickner Clark Y, with larger circles on the same camber line, he would produce a section like that shown in **Figure 5b.** Most modellers would call this a 'near symmetrical' or even 'semi symmetrical' profile. Yet the sections of **Figure 5** have identical camber to the original Clark Y section. That means they would reach their aerodynamic zero angle of attack at the same point, which in the case of Clark Y would be close to -5.5 degrees.

**Fig. 5 Thin and thick 'Clark Y' profiles, constructed on the same camber line. 3.5% cambered.**

**Fig. 6 Camber.**




## MAXIMUM CAMBER POINT

There are many forms of camber line and thickness and the number of possible combinations is unlimited. Dealing first with camber lines the most important variable is the actual amount of camber **(Figure 6)**, but its distribution over the chord of the profile has a considerable effect on the behaviour of the wing. If the point of highest camber of the camber line is nearer the leading edge than the trailing edge, the aerofoil usually is better able to cope with high angles of attack since the air is, so to speak, led more smoothly round the leading edge and there is less chance of separation **(Figure 6d)**. Such forms may be very useful if flight at very low speed, and high angle of attack, is required. From the drag point of view, it is better if the camber is more evenly distributed with the maximum close to the half way position **(Figure 6f)**. This helps to keep the flow smooth at the ideal angle of attack and reduces the minimum drag. Many existing wing profiles offer a compromise between these two positions so the maximum camber point comes out fairly close to one third of the chord. There are some profiles which incorporate some information about this feature in their numbering system and it is worthwhile finding out about this when planning a new models. Otherwise the only means of discovering the form of the camber line used is to plot the profile and fill it with circles, then finding the curve that runs through the centres. This is the true camber line.

## DISADVANTAGES

All cambered profiles have one very serious disadvantage. In flight, at all normal angles of attack, they produce a pitching force which tries to turn the model nose down. If the wings are not very stiff, this may even twist them to a different, more negative angle of attack over the outer panels. This is especially likely at high speeds, which, quite apart from the drag question, is another reason for preferring very slightly cambered profiles for fast-flying aircraft. The nose down pitching force created by the camber has, normally, to be resisted by the trim setting of the model. If it is not balanced out the model will not merely dive, but may very well continue beyond the vertical and take up an inverted position, for when the camber is reversed, as it is in a wing inverted, the section becomes stable and will fly steadily, though not efficiently, in that attitude. It has been found that a wing with a reflex profile such as that shown in **Figure 6g**, will fly without a tailplane or any other stabilising device, providing the centre of gravity is well forward. Such profiles thus offer hope for the tail-less or all-wing aircraft designer, but since the camber is not designed to reduce drag to its minimum, the reduction of resistance caused by getting rid of the tail may be offset by an increase of wing profile drag.

## THROUGH THICK AND THIN

Thickness forms also vary greatly. They may be thick or thin, have their maximum thickness well to the front or further aft, and other detailed variations are introduced to produce control of the way the air pressures over the surface change in detail. Typically, profiles with the maximum thickness too far forward tend to produce too much drag and if the thickness is too far aft, there may be flow separation near the trailing edge, so as usual, compromise results and most profiles have the maximum thickness point about one third to one half of the chord from the leading edge.

Some profiles have been designed with steps and kinks on one surface or both, and tried on models and most modellers will have seen or used 'turbulators' on or near the wing leading edge, on model sailplanes or duration models. The reasons for these devices will be discussed in a later article.

The practical modeller rightly wonders whether much trouble needs to be taken to get the aerofoil profile or his model exactly right. For slow flying models, built, as a rule, lightly with tissue or film covering over ribs and spars, it is obvious that the aerofoil will only roughly approximate the original intention. With faster models where the wings are built from foam plastic with veneer covering, it is not only easier but much more important to get the shape right, for as a subsequent article will show, profile drag for fast flying models is very high indeed and every care should be taken to reduce it by careful choice of aerofoil and accurate construction. For model sailplanes and duration types, the correct camber is of great importance, but the details of thickness distribution turn out to be less significant.

*Continued from page 305*

## Martin Dilly reports....

### A new departure for free-flight

October 25th sees the first of what we hope will become a British rival to the French Free-Flight date at Poitou. On that date over 500 acres of open farmland have been made available through the courtesy of the owner, and a contest for the three FAI free-flight classes, plus A/1 Glider, Coupe d'Hiver and ½A Power will take place over the fields at Witchford, south-west of Ely, Cambridgeshire.

Witchford is a former World War II airfield with much of the perimeter track and runway still usable; because of the resulting wide choice of launch points with vehicle access it looks ideal for free-flight, and at the date of the contest there will be little or no crop problem, even outside the flying site itself.

Organisation will be not by one club or area, but by several free flight enthusiasts; appropriately in the International Year of Disabled People we have been asked to make a donation to local charities for the disabled, instead of being charged a fee for the use of this excellent site. The farmer is a former model flyer himself, and understands the needs of free-flight. This first meeting is in the nature of a pilot event; subject to the satisfaction of the competitors and, most importantly, the owner and his neighbours, it is hoped that the Witchford Meeting will become a future FAI Open International. Your support is invited, together with suggestions for organisation and offers of assistance.

Witchford lies about two miles south-west of Ely, in the angle between the A10 and A142 road intersection; access, which will be signposted, will be from the A142, about midway between Ely and the village of Witchford.

Those involved in the initial concept have been Newham Beaumont, Peter Carter, Martin Dilly and Ian Kaynes, but they again emphasise that the aim is for a contest run by model flyers from a number of clubs and areas, appropriate for an event in a fairly central location.

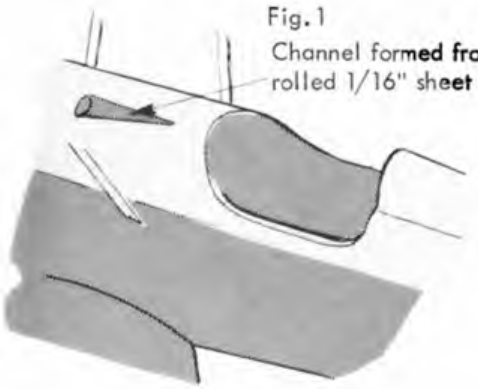
Please contact Martin Dilly, 20 Links Road, West Wickham, Kent BR4 0QW, enclosing a stamped addressed envelope for further information; because of the importance of the site for free-flight and its strictly limited availability please *do not contact* the owner with a view to its use for future events.

# R/C Sport Flyer

## by Chris Pinchbeck

OUR SUBJECT MATTER this month is to be Sport Scale. I would agree with Gordon Whitehead that this is a more acceptable description than semi scale, near scale or even class two scale with all that this latter title infers. Incidentally I would thoroughly recommend Gordon Whitehead's book Radio Control Scale Aircraft to anybody interested in scale modelling.

There are several ways of approaching this aspect of our hobby. Building from a




plan of a proven design, drawing up your own plan of the subject to be modelled, building from a kit, or modifying a kit built model. Later in the series, we will discuss drawing up your own plans, but this month we will look at modifying a readily available kit.

To some, a .60cu.in. engine is a basic requirement for any scale subject. I personally do not subscribe to this belief and have therefore, chosen for our subject the Keil Kraft SE5A kit. (Our thanks are due to Keil Kraft for supplying this kit for review). The miniature Futaba Fd30M servos used were supplied by Ripmax and have assisted greatly in 'adding lightness' by replacing the standard Futaba servos which I normally use.

The object of sport scale is to construct a model which resembles its full size counterpart as closely as possible but without prejudicing it's 'sports' flying characteristics. The kit as designed is indeed very close to 1/8th scale, the only departures that I could find being an increased wing thickness (to make building easier and stronger) and an increased fin area (to aid directional stability, especially important when ailerons are not fitted). The plan is on two sheets, wings on one and fuselage and tail feathers on the other. On this latter sheet, the centre is given over to a very useful 1/48th scale line drawing which has assisted greatly in identifying and reproducing the additional scale detail. Further help was drawn from Profile Publications number 1 which gives a coloured three view of F943 upon which the Keil Kraft kit is based. A trip to the RAF Hendon museum was made to clarify further details, especially the size and shape of the cutout in the top fuselage decking port side where the barrel of the Lewis gun fits. Incidentally if you have not yet visited this RAF museum I would thoroughly recommend a days outing. One can approach very close to the exhibits which are well set off in pleasant carpeted surroundings, and although the World War II annexe costs £1 per adult, the main hall has free admission.

Back to business, the kit as presented is very complete, only glue, dope and finishing paint required to complete the model as designed. The balsa die cutting could be better and the plywood parts need to be fretted out, but all components are cut and ready for construction after only one evening's work.

### Fuselage

The basic fuselage has sheet sides with 1/16in ply doublers at nose and tail with a fully sheeted top to the fuselage forward of the headrest and stringers to form the rear decking. The preformed wire centre struts are fitted at an early stage and accuracy is achieved by using a card template (each side) which can be taken off the drawing on the plan. The only major modification to the fuselage construction was to cut a different former at stage 6 to make provision for fitting the Lewis gun. Once the top deck had been sheeted, a V cut was made and a piece of 1/16in soft sheet which had been dampened and rolled around a 5/8in dowel until dry, was fitted to form the gun channel **(Fig. 1)**. The engine cowl is made up from formers and sheet balsa with a 3/8in sheet piece which is carved and sanded to shape before glueing on the moulded plastic louvres supplied. This front former is cut to accept the engine of your choice and to ensure a good supply of cooling air. Unfortunately there is no outlet shown for the hot air, but the full size had ventilation slots cut in the floor of the engine compartment so this scale detail was faithfully reproduced! Surprisingly no silencer is shown on the plan but the one supplied with the Irving 20 which I used does fit quite nicely and unobtrusively at the position of the exposed dummy cylinder blocks, paint it matt black and it hardly shows.

### Tailplane and Fin

The tailplane and fin plus respective control surfaces are made up from 1/4in balsa sheet, but to add scale appearance, these were discarded and the following method used. An outline was cut in 1/16in medium sheet, then framed with 1/8in × 1/8in strip. The centre of the fin and all corners were of 1/8in sheet. Ribs and riblets were then made from 1/8in × 1/16in strip and fitted to represent their full size counterpart. By pinning the outline sheet to your building board, then constructing one side, turning the assembly over and fitting the outer side, a strong but light construction results. **(Fig. 2)**. This can then be carved, planed, and sanded to round off the leading edge and chamfer the elevator to provide a close resemblance to an aerofoil section. The tailplane and elevator are then separated using a metal straight edge and a sharp knife. Blocks must be fitted at hinge points, and since I intended reproducing the tail support wires with thin shirring elastic, blocks were also fitted at the various attachment points. Both tailplane/elevator and fin/rudder assemblies can be made in this way although with the SE5A, the fin and rudder were constructed as separate items.

Fig. 2A

***Left: structural modification made to the tailplane of the SE5A to enhance the scale appearance. Right: the wing under construction, note the riblets that were added to increase the scale effect of the wing.***

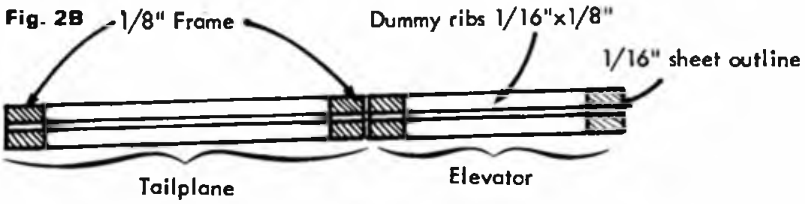


Fig. 2B

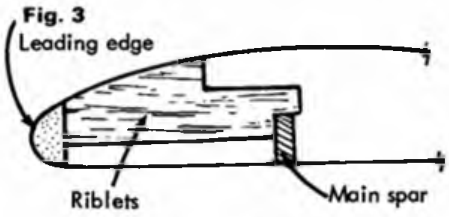


Fig. 3

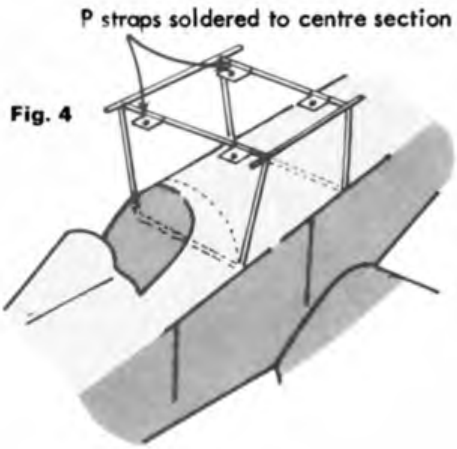


Fig. 4

## Wings

The wings were next on the list and the only changes made were to fit riblets between the kit ribs and to do away with rubber bands and bolt both wings on.

A plywood former was made to the shape and size of the required riblets and these were then cut from 1/16in balsa sheet using the former as a guide. **(Fig. 3).** It was apparent from the scale line drawing that the riblets would not extend back to the main spar, neither do they show on the underside of the wing, hence the shape.

The lower wing was fitted with a ¼in dowel peg and a locating crosspiece glued to the fuselage. Nylon bolts were then fitted to threaded brackets at the trailing edge position in the normal way. The upper wing was slightly more complex. There are several ways of fitting a top wing to wire centre section struts using tubes and bolts but I elected to fit P straps to the cross members then use four 6BA nylon bolts screwed into blind nuts fitted inside the wing **(Fig. 4).** One advantage of this system is that any alteration of rigging angle to the top wing can be made by packing the bolts with washers at suitable points. The interplane struts were fitted into drilled location blocks as per plan, and were made from ⅛in dowel streamlined to shape with ⅛in × ⅜in balsa strip.

The engine hatch is removable and on the plan it is shown as being retained by a dowel and 6BA bolt into a metal strap. Since I wanted to keep the top clear of obstructions the dowel was used at the rear and small self-tapping screws at the sides at the front. To avoid a hole for access to the plug for starting, leads were fitted to the top of the plug (via the female half of a snap fastener) and to the engine hold down bolts, then to a sub-miniature jack socket under the fuselage. A jack plug with leads coupled to the starter battery completes the system which works very well.

The model is now ready for covering in the tissue supplied and I shall be reporting later on completion of this sport scale model.

## SLOPE GLIDING AEROBATICS

If you are now proficient at launching, flying a safe pattern, and landing your model in one piece, no doubt your thoughts have turned towards the possibility of how best to go about controlled aerobatics. With a glider of course, there is no powerful fan up front to pull your model through the manoeuvres, so positioning of the model relative to slope and wind direction is important.

### Loops

Perhaps the easiest move is the loop. This should start with a shallow dive to gain speed. Do not suddenly put the nose down for a near vertical dive of fifteen feet or so before pulling in up elevator. Because of the sudden change of direction into the loop there is a high increase in drag, thereby losing the momentum built up in the dive, resulting in the model screwing out and perhaps even stalling. So use a gentle but long dive starting high and well back from the slope face. Keep the entry smooth and make the loop big so that an undue amount of speed is not lost. The figure should be to one side of you, directly into wind, and in the slope lift area. If you wish to do consecutive loops, it is important that they are kept within the lift coming up the slope to help you maintain some altitude. Another tip is to ease off the elevator three quarters way round the preceeding loop to gain a little extra speed ready for the next.

### Stall turns

These always look attractive when performed smoothly. These moves should be carried out across the slope and therefore cross wind. Depending upon the height you wish to attain, entry can either be from level flight or after a shallow dive. Ease into a vertical climb and as the momentum dissipates, the wind will tend to weathercock the model with the nose pointing away from the slope. A touch of rudder to assist this natural move and your model will do a 180° turn and dive along its previous path. If you are flying left to right, then pull into a vertical climb and just before the stall, apply full left rudder, ease out of the resultant dive across the slope and up into a right hand stall turn. Always remember to turn out or away from the slope. It is an advantage to have ailerons in the stall turn, but not essential, so that at the top of the manoeuvre you have control over the yaw characteristic when the model is close to the stall.

*Continued on page 321*


*Left: the tailplane and fin as supplied with the kit. This could be improved by laying thin strips of balsa to the surface to represent ribs and spars, and then covering with tissue.*

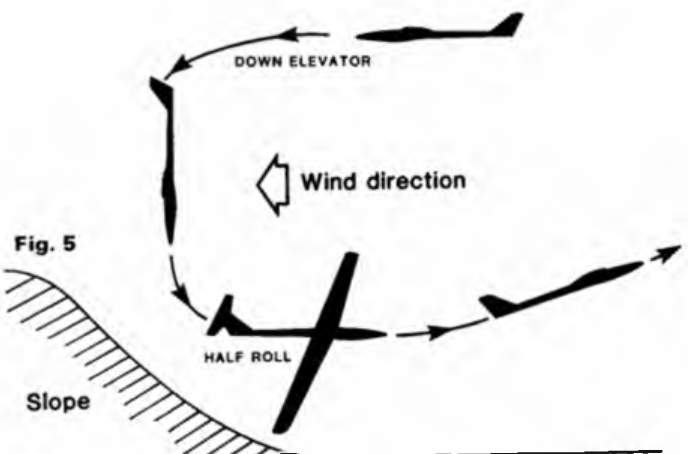


Fig. 5

# READER'S LETTERS

Dear Sir,

I am a keen modeller and purchase your magazine monthly. I happen to own a small glo-plug engine and in the interests of economy want to mix my own fuels. I was wondering if you could possibly supply me with the constituents of different types of fuels and their proportions, for which I would be most grateful.

*Banstead, Surrey.* Peter Dix

*Standard Glow Plug fuel is 80% Methanol 20% Castor Oil. To this, various proportions of Nitromethane can be added to substitute for the Methanol - 5% for large motors, 15% for small motors, 30% for contest use. Always mix in the open air, and beware of fire risk when storing chemicals or mixed fuel. Nitromethane makes the motor more manageable, less critical on needle valve setting and produces more power. The chemicals are available locally through industrial pharmaceutical suppliers found in yellow pages, or are available from Model Technics Ltd., Vanguard Way, Shoeburyness, Essex.*

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Dear Sir,

I am writing to ask if you know anywhere I could obtain a spray bar for a FROG Diesel engine. I am not certain of the engine's exact size but it is between 1 and 1½cc. I would appreciate any information.

*Gosforth, Newcastle on Tyne.* B. Howson

*Unfortunately FROG have been out of production for about 15 years, so you will be unlikely to find any spare parts but in fact many other manufacturers' spray bars will fit your motor as this part is not critical. Single hole spray bars should be fitted facing down into the engine, twin hole spray bars should be fitted one hold facing forward and one facing backwards.*

---

Dear Aero Aces,

Could you please tell me if there is a certain and reliable method of getting the tail and wings on a model square to the fuselage, or is the only way of doing by sight.

*Stockport, Cheshire.* Edward Beardwell

*Super accuracy is not critically important with Control Line models as the elevator will control the model in flight and correct minor misalignments, and on a Free Flight model, normal trimming adjustment will overcome any inaccuracies. If you cannot see it is wrong by eye, then it should be O.K.*

*Simple measurements should be taken during assembly, using a setsquare, ruler or strip of balsa marked to length, to ensure components are square before the glue dries.*

Dear Aero Aces,

Thank you very much for your previous reply which I received with many thanks. I have followed your advice of switching back to profile balsa training models before trying to fly Combat type flying wings but I hope you can solve one more problem for me. I would like to build the APS *Tough Cookie* as you have suggested and to make sure that I have complete and reliable strength, I should like to cover it in nylon. I have just purchased some, but unfortunately it does not contain instructions on how to put the nylon onto the wing and I have now realised that I can also cover my combat wing in nylon. Please could you give me details for fixing nylon to a wing. One more thing, please could you tell me what a 'pacifier' or a 'pacifier tank' is as I have come across the word several times before but I have no idea of what this is.

*Twickenham, Middx.* Tim Anderson

*For built up wings, firstly dope the framework several times and while the last coat of dope is still wet, apply the nylon dampened with water, pulling tight to remove wrinkles and doping through the nylon on the framework where necessary to stick in place. Thick dope is required to stick or fill nylon, so if necessary leave the top off your dope jar for a day or so, to thicken it up first. As the water dries the nylon will shrink drum tight and is then ready for 3 or 4 coats of dope to seal the surface. Don't worry if at first the nylon dries with white blemishes, this is the effect of dampness on the dope as it dries; however these will disappear when the next coat of dope is applied.*

*For sheet wings, dope once or twice first, then lay dry nylon over sheet part and simply dope through, pulling out any air bubbles or wrinkles that may occur.*

*Finally in reply to your pacifier question, these are balloon type fuel tanks used only on racing glow motors which are inflated with fuel, thereby providing pressure fuel feed with no possibility of air bubbles in the system.*

---

Dear Sir,

I recently purchased Plan G876 Rolling Stone. The plan states that 6¼ inch dihedral on the wing tips. Will you please advise whether this is total dihedral or if it is with the centre panel flat as this is not indicated on the plan and there is no drawing of the dihedral braces from which to work it out.

*Benson, Oxford.* Alan Bogg

*The dihedral on the plan refers to the total packing under each wing tip otherwise you would end up with nearly 9 inches of dihedral! To achieve the correct dihedral, pack up tips 3½ inches with centre panel flat, then bend centre wing joining wires sufficient to give 1½ inches dihedral under each tip dihedral break, or 3 inches under one panel with the other flat.*

Dear Aero Aces,

I have just joined the Aero Aces club. I am writing to find out if I can do very tight loops with my control line model because when I do a loop it is always very wide and when it pulls out it is only a few feet off the ground. The plane I am flying at the moment is called the Mini Lord for a 1.5cc engine.

*Beverley, North Humberside.* Simon Jefferies

*The tightness of loops depends upon the design and balance of the aircraft. You could try adding some weight near the elevator to move the CG balance point progressively further back, which will make the model more aerobatic until it eventually becomes uncontrollable. The* Mini Lord *was designed for 1/2A combat and has insufficient wing area, and a poor aerfoil section for performing really tight manouevres and I suspect your model may be overweight. Longer control lines will also give you more room to manouevre, 10-14 metre lines are best.*

*For your next model I suggest you try another larger design for your engine such as Dave Clarkson's* Tamerlane, *presented free with the August 1979 Aeromodeller, or available as Plan CL/1374 price £1.50p including post and packing.*

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Dear Aero Aces,

Here is an item which may interest other readers. Due to non-availability of small fuel tanks for sports models, I have found that by cutting the top off a used 9 volt dry battery, the metal case can be re-used. Clean the paint from the metal and then solder end plates of thin tin cut from soft drinks cans. Run solder down the folded metal seam and add brass fuel and vent tubes. I can make a fuel tank cut to what length I want for next to nothing.

*Burnely, Lancashire.* A. Healy

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Dear Sir,

I have heard from one of my fellow aeromodelling enthusiasts that a catalogue from which to choose model plans can be obtained from you.

At the moment I have a PAW 2.49cc (diesel) engine so perhaps you would recommend some plans which would go well with this sort of engine. I am fairly new to this hobby so fairly simple plans would be more suitable.

*Fleet, Hants.* John Diver

*The Aeromodeller Plans Hand book No. 1 has just been reprinted to bring it up to date, and it now lists literally hundreds of model aircraft plans of all types, both free flight and control line. Each plan is star graded for difficulty as a guide for beginners or experts so you should have no difficulty in selecting designs to suit your motor. Handbook No. 1 is available from your local model shop price 75p or apply to Aeromodeller P.O. Box 35, Bridge Street, Hemel Hempstead, Herts HP1 1EE. Including 25p P&P.*

# TOPICAL TWISTS

*by Pylonius*
*illustrated by Sherry*

## Chequer-ed Career

Over the past few years aeromodelling has undergone a dramatic, if not all that welcome, change. That 'Engineer' appellation of which some are justly proud and others thought somewhat overstated when applied to mere balsa bashers, can now be entirely eliminated thanks to radio control and modern technology. At one time the commercial interests, who had not quite taken over the hobby as they now have, just could not produce a ready made or near ready made model that would fly for more than a few uncertain seconds. On the local common or contest field the home made balsa model reigned supreme — you just could not fabricate a model that light and that efficient out of cardboard and bakelite. But came radio control and weight watchers incorporated was a dead duck. After all, what difference did a few ounces make when the model did not have to fly itself? Also to the rescue came foam cored wings and fibre glass fuselages, not to mention not too weighty but very sleek plastic.

The upshot is that no longer do you have to undergo a long apprenticeship via beginners and intermediary models to become a high grade contest flyer. The assemble-it-in-an-evening kit you buy today is no kiddies introduction project but a top line contest model. Indeed the greater part of the instruction leaflet is taken up with the how's and why's of contest flying. So, there you have it, a fully fledged contest flyer mainly through a magic wave of a cheque book. After twenty years of modelling experience and months of dedicated commitment to your latest piece of development, you could be ignominiously beaten at that big event by someone who had never touched a model plane until the week before, and whose engineering was confined to squeezing a tube of glue. Not fair really. Not after so many years of aeromodelling being the one hobby you could not buy your way into.

## Old Hack

For those prepared to do things the hard way, model building is not the simple, kitchen table business that it once was. And we are reminded of this in a recent article on modern building techniques, in which it is said, "Gone are the days when you could build a model with the use of only a broken razor blade, some pins and a tube of cement — if they ever existed." Well, I am happy to say, on behalf of all those non-practical people like myself who took to model flying just because it involved nothing more technical in the way of tools than a razor blade, some pins and a tube of balsa cement, that such days of basic model building have not yet been eclipsed by scientific advance. I am proud to say that I have just completed a large radio glider with just these same homely tools.

Over the years I have tried to come to grips with more sophisticated means of production but have lost, discarded or just plainly abused the gleaming new tools. Even such a relatively primitive piece of weaponry as a balsa knife falls apart in my unskilful hand, and I reach again, with relief, for the old backed razor blade. Come to think of it, though, we old razor blade brigade have, over the years, turned out quite a useful stock of models, and all produced with nothing more technical than what you might find in the kitchen drawer. We did it all without kits, plans and other technical aids, and the bushes, bobbins, wheels etc., which we obtained from the local model shop all came out of little wooden drawers under the counter.

We, no doubt, are the last of our breed. Kitchen tables are a thing of the past, anyway — its all gleaming working surfaces these days upon which the only chips are not the balsa ones. You now get the two extremes: on the one hand the super technician with his fully equipped workshop, and the cheque waving dilettante gloating over the goodies. What is more they do not seem to make razor blades any more.

## Time Travel

At one time we used to be aghast at the vast motoring distances covered by our American friends. "Fancy travelling a hundred miles just for a one day model meeting!" we cried in amazement. On our roads it took best part of the day to get to the common on bus or pushbike, whereas the Americans had wide open roads and equally wide open exhausts. Moreover, their petrol was so cheap it came free with the CB radio. But now that our sophisticated models have outgrown the local common and there is more motorway than countryside we think nothing of a mere hundred miles as we rush along to the distant venue — and not always for some special event, but just for somewhere to fly.

*"I don't know whether to put the model in the car or the car in the model."*

What adds to our problems is the startling way the family car is rapidly diminishing in size. From a quite spacious affair, allowing for ample model stowage, you now have what is hailed as the car of the year looking like a skateboard with a shoe box on it — miniscule motoring at its most miniature.

I suppose that, over the years, we model flyers have been spoiled. We have come a long way from the days when you motor-cycled it with a model box on your back, doing more actual flying on the journey than on the model field. Some can even remember humping the model box on train and bus, but mostly our memories are of largish cars stacked out with all the modern accoutrements of model flying, including ladders, bubble machines, retrieving bikes etc. But now, with the huge distances involved and the soaring petrol costs it is goodbye to all that solo motoring, it is now a case of a get-together journey cramped in the family mini car, with just room for a P 30 rubber model or a Wigan 70 glider.

What, though, is to be the fate of the large scale model so popular today? Though usually depicted in the 'cuddle' position I doubt if the proud owner is prepared to stagger to the distant flying field in that attitude. If he put the huge model on top of a modern mini car he'd probably find himself coming under London Airport traffic control at the first big bump in the road.

# S.M.A.E. NATIONAL CHAMPIONSHIPS 1981

## *FREE FLIGHT*
## *three days 23/25 MAY*
## *RAF Barkston Heath·Grantham*

One again we have the use of the superb facilities at R.A.F. Barkston Heath and the Free Flight National Championships will take place during the second May Bank Holiday weekend. We extend our usual invitation to S.M.A.E. and non-members to join us in what is always an exciting and interesting event, and this year the Nats have even more to offer to you. As well as the usual competitive programme, there will be Special Children's Events every day, a vintage Wakefield Event to pre-1954 rules, demonstrations of Indoor Microfilm and other models daily, a Free Flight Seminar and light-hearted and 'fun' events for everyone.

### *HOW TO GET THERE . . .*

R.A.F. Barkston Heath lies to the North East of Grantham in Lincs., within a short distance of the A1. There will be AA signs to direct you to the airfield. If you are travelling North on the A1, a very good route is to turn right at Colsterworth onto the B.6403 (before you reach Grantham) and this road passes the site.

### *CAMPING AND ADMISSION . . .*

Camping for the whole weekend is £6 per person (children under 14 free) and you can arrive any time from 18.00 hrs on Friday the 22nd May. There are full facilities for campers with a proper camp-site, water, toilets, etc. It is usually a very nice way to spend the Bank Holiday weekend with so much going on and something for the children to do without you worrying about them.

Daily admission (fees are already included of course if you are camping) are £1 per person or £2 per car (up to 4 persons) — car parking is free. If you come on a motor-cycle, please remember that you and your passengers must wear crash helmets on site when driving, as we are subject to the requirements of the Road Traffic Acts.

### *SPECIAL EVENT – SUNDAY 24th MAY – 'CHUCK FOR BRITAIN EVENT'*

This is a fund-raising event to help to fund the British Team attending the forthcoming World Free Flight Championships this year in Spain. All you do is to get someone to sponsor you at a mutually agreed rate for every 10 seconds flight duration. You then take part in the competition on Sunday with your chuck glider (some people actually build them on the Saturday), and you can win a prize for the top duration and most money raised. Entry Form is in the March issue of the S.M.A.E. Publication — 'Model Flyer' or you can get a form from the S.M.A.E. Control on the day.

### FREE FLIGHT EVENTS:

**Saturday, 23rd May**

| | | |
|---|---|---|
| *Start* | *10:00* | Coupe D'Hiver, A/1 Glider, ½A Power |
| *Finish* | *19:00* | CO2 Duration, Hand Launch Glider |
| *Fly-offs* | *19:15* | CO2 Scramble (17:00 Approx.), Vintage Wakefield Event |
| *Evening* | | Prize Giving, Rules Seminar |

**Sunday, 24th May**

| | | |
|---|---|---|
| *Start* | *10:00* | Open Rubber, Open Glider, Open Power |
| *Finish* | *18:30* | Tailless, Vintage, Frog Junior, Junior Kit |
| *Fly-offs* | *18:45* | Womens Cup, H.L.G. Scramble (17:00 Approx.) |
| *Evening* | | Prize Giving, Hangar Events |

**Monday, 25th May**

| | | |
|---|---|---|
| *Start* | *09:00* | FIA (Glider), FIB (Rubber), FIC (Power) |
| *Finish* | *16:30* | Five Flights in 1½ Hour Rounds |
| *Fly-offs* | *16:45* | 45 Minutes FIA, 45 Minutes FIB + FIC |
| | | Prize Giving as soon as possible after the Competitions |

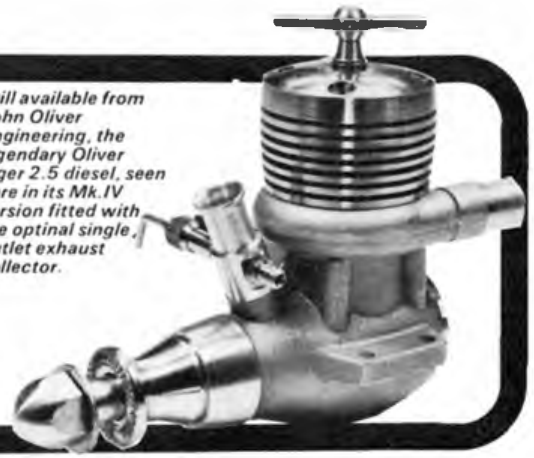
THE RADIO CONTROL AND CONTROL LINE NATIONALS WILL BE HELD AT R.A.F. BARKSTON HEATH AND CRANWELL ON THE 29/30/31st AUGUST 1981. YOU CAN PRE-BOOK CAMPING FOR THIS EVENT AND ENJOY A REDUCTION IN CAMPING PERMIT FEES. YOU WILL FIND AN APPLICATION FORM IN THE LATEST EDITION OF 'MODEL FLYER' OR CONTACT THE SMAE AT THE ADDRESS BELOW.

*Join the S.M.A.E. today. We represent all Model Flyers*

**SOCIETY OF MODEL AERONAUTICAL ENGINEERS** Kimberley House, Vaughan Way, LEICESTER.
**Telephone: Leicester (0533) 58500 (24-hour Ansafone Service)**

# Engine News

by Peter Chinn



*Still available from John Oliver Engineering, the legendary Oliver Tiger 2.5 diesel, seen here in its Mk.IV version fitted with the optinal single outlet exhaust collector.*

## OLIVER NEWS

Quite frequently, over the last few years, we have been asked: *'What happened to the Oliver Tiger?'* The question usually comes from older, radio-control fliers who remember Olivers from their days in free-flight and/or control-line. Because these engines are not seen in advertisements or on model shop shelves, there is a tendency to suppose that Oliver diesels, like so many others made twenty or more years ago, have faded from the scene.

The truth is that Oliver diesels, the very first one of which was made back in 1946, are still being produced. The most famous engine of the range, the 2.5cc Tiger, is still being manufactured in the Mk. IV version which, in 1967, succeeded the Mk.III that had been introduced in 1954 and which subsequently achieved considerable success in world championship F/F and T/R events. Likewise, the 1.5cc Tiger Cub Mk II is still in production, but this is now also available in a new version with Schnuerle scavenged cylinder.

A small batch of experimental 2.5cc Schnuerle scavenged motors has also been made but, in the words of John Oliver *'... there is no plan to produce this motor at present.'* This being so, we are indebted to Cliff Petty of Walsall, who is the owner of one of these rare Olivers, for allowing us the opportunity of giving it a quick look over.

As the photos show, this motor follows the usual Oliver formula insofar as it employs a sand-cast crankcase with screw-in backplate and an integral front end containing a twin ball-bearing crankshaft. Induction continued to be via a front rotary-valve and there is the familiar Oliver machined aluminium finned cylinder jacket and extended machined aluminium prop driver.

The main differences, of course, are centred around the new Schnuerle scavenged cylinder. Oliver enthusiasts will recall that the Mk.IV has four radial exhaust ports spaced at 90 degree intervals around the bore, with steeply inclined transfer ports between them, fed from transfer channels in the wall of the surrounding crankcase casting. In contrast, the 2.5cc Schnuerle engine's cylinder has a single rectangular unbridged exhuast port of relatively small area on the left side, with two small angled transfer ports, placed fore and aft but biassed towards the right side and towards the third port, which is quite large and steeply inclined.

These changes mean that the cylinder is no longer located in the crankcase by a flange at the exhaust belt. Instead, it is flanged at the top and is located in the case by the top of the cylinder jacket, which is now separate from the head, and three long screws tie the complete assembly to the crankcase. There are three large transfer channels machined in the casting to align with the cylinder ports and the piston crown and contra piston are now flat, instead of conical. The piston is, of course, ringless, made of an innoculated cast-iron and has a pressed-in tubular gudgeon-pin. Incidentally, the Schnuerle scavenged Tiger 2.5 has a stroke/bore ratio that is lower than that of the Mk.IV. Bore is increased from 0.552in to 0.575in, which means that the engine has an almost "square" cylinder, compared with the 1.13:1 stroke/bore ratio of the Mk.IV.

The engine has a short venturi insert with a 3.4mm i.d. choke (9sq.mm area) held in place by a tangent spraybar. Checked weight of the motor examined was 178 grammes, or just under 6.3oz.

The current Oliver range consists of three basic models. They are the Tiger Cub Mk. II, priced at £28, the Tiger Cub Schnuerle, at £35, and the standard Tiger Mk. IV, at £29.50. The latter engine is also available in three other versions. These are: (a) the Mk.IV Combat Special with hard-chromed cylinder and cut-away exhaust collector, at £35; (b) the Mk.IV Modified (tuned for maximum power), at £38, and the Mk.IV R/C with throttle and single outlet exhaust collector, at £36.50. U.K. postage and packing is an extra £1 25 per unit.

*Not yet a production engine: an experimental Schnuerle-scavenged Oliver Tiger 2.5. This example owned by Cliff Petty.*

Keen observers at last year's Old Warden Vintage Day will remember a large American pre-war type high-wing cabin model (a 9ft span scaled up 'Scram') flown by Lynn Walters and powered by a prototype twin-cylinder Oliver diesel.

This engine was based on two Oliver Tiger-Major 3.5cc cylinder assemblies in an inline, alternative-firing layout. The engine used a built-up crankshaft, splined and pressed together and supported in four ball-bearings. Reed-valves were used in place of the Tiger-Major's crankshaft valve, there being a separate reed-valve to each crank chamber, fed from a manifold with a single carburettor on the right side of the engine. The engine ran extremely well, was pleasantly quiet and, quite obviously, had plenty of power.

John Oliver tells us that, as a result of continued development work, power and throttling have been further improved and the Twin-Major, as it is called, is now the next Oliver engine that is likely to be put into production. The single-cylinder Tiger-Major is not at present being made, but it hoped also to produce a few more of these later this year.

Oliver engines are sold direct to the customer, not through shops. Readers interested in the purchase of any Oliver are recommended to check with the manufacturer for delivery dates. The address is: John Oliver (Engineering), 248 Ringwood Road, Ferndown, Dorset.

## COLLECTORS' CORNER

R.J. Cooper of Farnborough writes that his particular interest is large capacity glowplug engines of the late 'forties and early 'fifties (a popular period with collectors) and mentions that he *'would like to know how the Nordec 60 compared with the American McCoy 60 of the same period'*.

The short answer to this that the Nordec was substantially inferior to the McCoy. However, as several versions of the Nordec appeared in little over a year, this remark needs some qualification and we need to take a brief look at the history of these two motors.

The McCoy, of course, had the advantage of having been under development for several years before the Nordec appeared. Dick McCoy had designed and made the first McCoy 60s during the Second World War, mainly for the sport of 10cc model car racing. (At that time, of course, the cars

*Prototype 7cc Oliver Twin-Major, here installed in Lynn Walter's scaled up 'Scram' vintage model. A production version is, hopefully, in the offing.*

were not radio-controlled, but they were very fast: they were either tethered to run in a circle or in some cases — mainly in California — ran on special 'rail' tracks built for the purpose). In 1946, the production of McCoy racing engines on a larger scale was undertaken by the Duro-Matic Products Company, then of Hollywood. Two models were produced, the Model MCCR for cars and boats and the Model MCCA for the then fairly new activity of control speed model aircraft. These engines, incidentally, had a natural aluminium casting finish.

In 1947, the 'Red Head' series was introduced (identified by black finished castings, except for the cylinder head which was colour-anodised red) and it appears that it was on this model that the original Nordec engines were based.

The Nordecs were made by the North Downs Engineering Company of Whyteleafe, Surrey, known to the sports car fraternity, at the time, as the manufacturers of Nordec superchargers.

The first Nordecs did not appear until the end of 1948 and, by this time, the McCoy had had another year of development behind it and was just going on the market in the United States in a new model, called the 'Series 20', which was vastly superior.

We had most of the Nordecs on test at various times, but it was quite evident that the stock production engines varied somewhat and would need to be 'breathed upon' with a few tuning modifications to produce competitive speeds. For example, at a time when the 1947 spark-ignition McCoy Red Head was rated at 0.9 bhp at 13,000 rpm on straight methanol and castor-oil, the best we could obtain with a stock 1948 Nordec R.10 was 0.74 bhp at 12,500, while the glowplug-ignition RG.10 was well down at 0.63 bhp at 12,200.

For many years after the end of the war, import licencing restrictions prevented the commercial importation of model engines for sale in the U.K., so the Nordec was, to some extent, protected from the obvious challenge of the more powerful McCoy and Dooling 10cc engines made in the U.S. In 1949, a new piston and cylinder head were adopted for the Nordec, which gave an improved combustion chamber shape and also allowed a lengthened period of sub-piston supplementary air induction through the exhaust port. In this form, known as the Nordec Special, the output of the RG.10 was raised on test to 0.75 bhp at 13,000 rpm, using a moderately nitrated fuel.

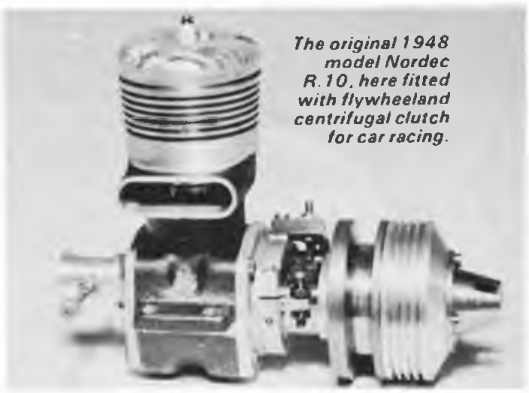
The fact that American control-line speed engines could not be purchased through normal trade channels in the U.K. did not, of course, prevent the small number of really dedicated speed flyers (and model racing car enthusiasts) from making their own arrangements to obtain McCoy and Dooling engines privately and when we acquired a 'Series 20' for examination and test, it became abundantly clear that the Nordec would only get within striking distance of the McCoy with a major redesign. This, in fact, was done and early in 1950 the Nordec-Special 'Series II' glowplug engine was announced.

The Series II had a completely new full length main casting (instead of the short block and separate fins of the previous models), the main advantage of which, like that of the Series 20 McCoy, was its greatly enlarged transfer passage. The carburettor choke area was increased by more than 40 per cent and the exhaust and transfer port areas enlarged. The rotary-valve port areas were also substantially opened up.

The overall effect of this (possibly with the help of some subtle improvements in engineering quality) was really quite remarkable. Using the same fuel as had been employed for the previous model, an increase in power output of no less than 64 per cent was recorded, raising the peak figure to 1.23 bhp at just over 15,000 rpm. Overall handling and running qualities were also much improved.

Alas, the improvement came too late. It would seem that the disappointing showing of the early models probably put prospective purchasers off the idea of buying a Nordec and the Series II never really got off the ground. The manufacture of Nordec engines ceased shortly afterwards following a total production period of less than two years.

It has to be admitted, however, that, even if the North Downs Engineering Company had persevered with the Nordec, they would, almost certainly, have had an uphill struggle in trying to compete with the McCoy 60 'Series 20', for this, as it turned out, became the most successful 10cc C/L speed engine ever. On test, ours delivered a highly impressive (at that time) 1.52 bhp at just over 16,000 rpm and the Series 20 went on to dominate 10cc C/L speed flying for no less than fifteen years. In fact, it was never really beaten. When the Testor Corporation (which had bought the Duro-Matic Products company some time earlier) finally stopped making high performance engines, the McCoy's successor was the first Rossi 60 — an engine that, quite clearly, was closely (and very competently) modelled upon it.



*The original 1948 model Nordec R.10, here fitted with flywheeland centrifugal clutch for car racing.*

*Left: parts of the 1949 Nordec-Special R.10 C/L speed motor. This had a revised head and piston.*
*Below: the final model Nordec, the 1950 Special 'Series II' (right), with the pace-setter of the 1948-63 era, the McCoy Red Head 'Series 20.'*

# SHOP TALK

**The latest in products for the modelling scene**

## DRILL

The Drillmaster range embraces two drills — Drillmaster Junior and Drillmaster Senior — and a comprehensive range of accessories for drilling, grinding, polishing, cutting, shaping, carving, engraving, deburring and similar operations. Both drills are fitted with the latest telephone-type, 'curly-tail' flexible cords, and are suitable for battery or transformer operation. Distributed by Microflame Limited, Vinces Road, Diss, Norfolk IP22 3HQ.

Drillmaster Junior has a unique, 'curved triangular' shaped body which fits comfortably into the angle between the base of the user's thumb and forefinger, and close control is aided by the provision of a detachable chuck finger-shield. A chuck with 4 precision cut steel collets, 0.6mm, 1.2mm, 1.8mm and 2.4mm is fitted as standard, whilst an automatic, 3-jaw chuck may be purchased as an optional extra. Price £11.50. Drillmaster Junior Drill Stand has a powerful magnifying glass attachment built-in. Price £7.88.

Drillmaster Senior is supplied with an automatic 3-jaw chuck as standard, and a precision chuck with a set of 5 steel collets, 0.6mm, 1.2mm, 1.8mm, 2.4mm and 3.2mm is available as an optional extra. Price £19.95. Drillmaster Senior can be quickly converted into two other useful tools by fitting the Drillmaster Senior Jigsaw or Orbital Sander attachments.

In addition to a robust Drill Stand for the Drillmaster Senior, over 100 accessories are available for use with either the Junior or Senior Drill, including a variable Speed Transformer — Rectifier and a Flexible Shaft attachment.

## MICRO MOLD

It is always good to see new free flight model kits. This range from Bentom, imported by Micro Mold Ltd., Station Road, East Preston, Littlehampton, W. Sussex BN16 3AG, are more than welcome.

There are three categories of models. The simplest range, which are all rubber powered with 19 inch span, and constructed from expaned foam, have a very novel method of construction. All the components are stuck together with double sided tape. The fuselage is made by sticking two hinged sides together with tape, forming a motor tube with integral fin. The propeller is of a paddle type with a diameter of 230mm! This is powered by 4 strands of 1mm × 4mm rubber with a total length of 1400mm, giving the model a considerable performance potential. Thin sheet lead is included in the kit for trimming, plus a set of very colourful decals. In this range there are three designs 'Rocky' and 'Andes' both low wingers, and 'Alps' which is a high wing design. All three models have the same type of construction and are suitable for the absolute novice. Price £2.49 each.

Slightly more advanced, although still simple to assemble, are the 'Skyboy', 'Schweizer', 'Skykid' and 'Stork' range of rubber powered models. These are also made of expanded foam, the fuselage being moulded in two separate halves and glued together. Glue is supplied in the kit for this job, and also for sticking the fin and tailplane. One of the main features of these kits is the Bi-Matic geared drive mechanism, which also incorporates a freewheel. A most impressive set of models, ideal for the beginner. Price 'Skyboy' £4.25, 'Schweizer' £4.96, 'Skybird' £3.95 and 'Stork' £4.81.

Now we get to the real aeromodelling goodies! The 'Piper PA18', 'Zero', 'Pampas 20' and 'Skypal' are all of traditional balsa construction. All of the kits have beautifully die cut parts, and good quality balsa. The 'Pampas 20' has a span of 20 inches, and the others 16½ inch span. The 'Piper' and the 'Zero' could well be converted to r.t.p., in fact we will use them for that purpose at next year's Model Engineer Exhibition. All four models should be capable of a very good performance if built carefully, and flown in calm conditions. Price 'Piper PA18' £4.75, 'Zero' £4.86, 'Pampas 20' £3.75 and 'Skypal' £3.65.

## SUHNER

Two new special offers are now available to users of small electric angle grinders from Finishing Aids and Tools Limited, Little End Road, Eaton Socon, St. Neots, Cambs. PE19 3JH U.K. representatives of Suhner, Switzerland, portable power tool manufacturers.

The Company is currently offering the UWB7 angle grinder at a special discount price. The 260 watt universal motor with built-in overload protection produces a no-load speed of 7000 rpm and makes this machine ideal for sanding, cutting, grinding and wire-brushing. Weighing 1.45 kgs, it is designed for single-handed operation. The machine is packed in an impact-resistant plastic carrying case and in addition to the normal tool set and operating instructions, one backing pad, one fibre disc and one paper sanding disc are included free of charge.

A second special offer is also available covering the new Suhner Combi-pack, a versatile flexible shaft kit, consisting of a sturdy shaft, type BKP6 — with an inner core 6mm in diameter and an overall length of 1250mm. Fitted with integral ballbearings and chuck, it is rated for a maximum speed of 10,000 rpm and is therefore suitable for use with the UWB7 angle grinder.


For this purpose, an adaptor is included which screws onto any M10 threaded spindle. Alternatively, the drive end of the shaft may be clamped into the chuck of any electric hand drill.

The UWB7 Special is priced at £39.95, the Combi-pack at £19.95 or as a twin set at a price of £58.50 plus carriage and VAT. All are available ex-stock from the above address.

## R.M. TRADING

R.M. Trading Co., 646 High Road, N. Finchley, London N12 0NL, sell a wide range of brass, aluminium and copper tube to suit most modelling requirements. They also sell sheet brass, copper and aluminium, plus various sections of strip, which includes square and streamlined forms. A full price list of this stock is available from the above address.

R.M. Trading also sell a useful tube cutter

at £3.95 and a tube bending kit, which is a set of springs that are inserted into the tube prior to bending. This stops the tube from collapsing while being formed. Price per set of five springs £1.50.

The final item is the K&S V block and clamp. This is made from plastic but nevertheless is most adequate for holding small tube sizes for drilling or cutting. Price £3.95.


## EME

The EMCO BS-2 Bandsaw is distributed by EME Ltd., BEC House, Victoria Road, London NW10 6NY. The saw incorporates three cutting speeds 120m/min for metal, 750m/min for plastics and 1200m/min for wood. It has a table size of 40mm × 400mm and is powered by a 370W single-phase motor. Six different types of bandsaw blades are available for cutting wood/plastic, metal/plastic, etc., and there is also a sanding belt. Accessories include a rip-fence, mitre gauge, pliers, file, trueing stone and non-adhesive lubricant. Cost £247.

## TRANSATLANTIC

We often get requests for suppliers of plastic sheet. Transatlantic Plastics Ltd., Garden Estate Ventnor, Isle of Wight, produce a wide range of plastic products. Of particular interest to the modeller is the range of Transglaze acrylic sheet. There are three thicknesses available — 0.15mm, 0.3mm and 0.5mm, sold in rolls 3 feet wide × 10ft, 15ft, 20ft or 30ft long. The cost of a 0.5mm × 3ft × 10ft roll is £5.75. This would give enough material for moulding

canopies for at least 30 models! The material is also sold in 51in widths.

'Savoglaze' which is a thin polythene sheet, would satisfy the needs of all hot air balloon and airship enthusiasts. Sold in rolls 60ins × 30ft at £1.27 or 60in × 100ft at £3.71. Transatlantic also sell much thicker coloured acrylic and styrene sheet; write to the above address for further details.

## STEAD

A new range of Screwmaster ratchet screwdrivers, designed for smaller screws, is now being marketed by J. Stead & Co., Greenland Road, Sheffield S9 5EW. There are four fixed blade and four adaptors/kits in the range.

The selector ring has been modified to meet the need for greater emphasis on 'spinning' the blade of this type of screwdriver.

Model RRL5/100 — $\frac{3}{16}$in × 4in blade has a list price of £2.85p (ex. VAT)

Model RRL5/S100 — as above but with plastic sleeve £2.90p (ex. VAT)

## BARRUS

A new range of woodworking power tool attachments called 'Shapercraft' are being marketed by E.P. Barrus Ltd., Launton Road, Bicester, Oxon OX6 0UR. The hand-shaper, shown here, turns an ordinary power drill into a woodworking centre, capable of a wide variety of shaping and cutting jobs. It comes complete with a saw blade and a selection of five different shaping cutters. Price £6.50 plus VAT.

# Club News...

ONE THING YOU CAN say about the model scene is that it is never static; there is always some new facet of interest opening up to stimulate and divert. At the moment I am thinking of 'Peanut' modelling. Who would have thought that, in these highly technical times, the small rubber powered model would become so popular. But taken away from the turbulent air outside, these small models do perform well in all the diverse configurations in which they come — low wing, high wing, biplane etc. Not only that, they also give opportunity for the application of realistic detail and pleasing finish on a small scale and with modest cost. It is worth a visit to an indoor meeting just to see these little craft in action. Who knows? You, too, may get the bug.

Our first report comes from John Morris, the P.R.O., of **H.O.R.S.E.,** otherwise the Hill or Ridge Soaring Enthusiasts. The club, which is centred on the Stoke on Trent area, was first mentioned in our March issue. Now, we are told, a new phase has been opened up in the acquiring of a local hall — on quite reasonable terms — for Indoor flying. For a start it is hoped to hold fortnightly meetings for R.T.P. and EZB. In order to tone up the muscles other than those used for trudging up the mountains, some members have taken to free flight. At least it must be a relief to get away from all those frequency problems with which radio control is currently plagued. Not that the main source of inspiration is being overlooked, for members have been doing extremely well on the hilly contest field, having featured prominently in a national cross country event and holding pleasant memories of some hotly contested local derbies. Not all radio gliding on the club comp. list, though. There is, for example, an Open Rubber event, and even a chuck glider competition. The club logo is the term 'HORSE' in the shape of a shaggy shire. *H.O.R.S.E., PRO. John Morris, 128 Eaton St., Hanley, Stoke on Trent ST1 2DP.*

Stuart V. Tucker, Hon. Sec. and Treasurer of **Leatherhead M.F.C.,** has sent along the latest club newsletter together with a short report. Main item of news concerns the club's efforts to obtain the use of a piece of land the local council have set aside for sport and recreational purposes. Trouble is that the council is not all that certain that model flying fits into the intended scheme of things, but the club hopes that two forthcoming demonstrations of R/C flying will suitably disarm the objectors. Well silenced, well behaved models to be the order of the day. Having secured your flying field, though, just how safe are the models with all that newly unleashed CB all around? Seems there is a lot of illegal transmitting on the 27 MHz AM frequency, particularly on the truck calling slot. Safest thing is to convert to the new exclusive model aircraft band of 35 MHz and fly happily ever after. Another possible flying site, Wisley Aerodrome, has been much in the news of late — the locals objecting to a proposed take over by executive jets. Not much hope there, and even Effingham common, where members still fly, is being gradually ploughed up. Still hope springs eternal and all that. *Leatherhead MFC, Sec. Stuart Tucker, Fairways, The Warren, Ashtead, Surrey.*

It is all down on the farm these days, if anywhere. Model flying, which, for many years, was enjoyed on urban open spaces, is now mostly a deep rural activity, relentlessly pursued by urban sprawl. This situation is highlighted in the February issue of Flying In-Formation, the newsletter of the **Northampton M.A.C.,** sent along to us by Roger Brown, P.R.O., and Journal Editor. There is an item concerning the right way to use the new electric fence, and what entrances to use to the farm field. Whether or not the radio flyers are driven home at sundown by the herdsman we are not told. *Northampton MAC, Sec. B. J. Baker, 29 Woodhill Road, New Duston, Northants.*

If life gets more rural for the modern radio club, it also gets more complicated. The **Ashford** (Kent) Radio Aeromodeller's newsletter is full of all that frightful frequency fretfulness, indicating an accelerated move towards that ultimate flying field horror: the computorised peg board. There is also much talk of Proficiency Grading Schemes, with some ten grades in Thermal Soaring alone. More problems here for the bucolic bungee practitioner in the now familiar rural scene. A deep-in-the-heart-of route to the club flying field looks very much like a moto-cross course. And, if sheep are to safely graze, let them not ingest rubber bands and other modelling detritus, members are warned. In lighter vein the club is truly with the Woolwich, since being approached by that August building society for a static display. Let's hope its customers do not elect to build on the club's green flying fields, of which it has three for power flying, two for glider and electric, and even a useful slope. *Ashford RA., Sec. R. Mercer, Elmwood, Sains Road, Tenterden, Kent.*

Farm flying is no solution to the where-to-fly problem if you control by handle rather than box; you need the firmer sort of terra to fly Goodyear for instance. And very much in the Goodyear scene is the **Wharfedale & D.A.C.,** of which Jeff Smith is one of the leading lights. He sends along the March edition of the club newsletter, 'Circle', which includes a report on the F.A.I., Team Race at R.A.F. Church Fenton in late January. Nine teams competed in a day of lively flying, made livelier by the absence of a jury. One was hastily formed, however, for the final, and a clean, close race was won by Langworth/Broadhead. Question asked in the newsletter: is Goodyear suitable for beginners? Seems a bit complicated to me, but depends on the beginner. *Wharfedale & DAC, Sec. John Broadhead, 3 Low Fold, Settle, N. Yorks.*

Problems of communication and integration in these times of high cost travel is discussed in the **East Anglican** newsletter. This is already a somewhat bifurcated area, with the clubs in the Western half opting to fly at the London Area venues; so the question is raised: should it be split in two? It certainly covers a large area of country with parts thinly populated, though the developers are doing their utmost to rectify this deleterious situation. Usual Area venue, at least for free flight, is Watton, though power flying is excluded. There is not another suitable field available in all that vast area. Undaunted the Area flyers have been seeking fame and fortune further afield.

To my mind the most attractive form of C/L flying is the large stunt model, gracefully executing its demanding schedule. This has now become so specialised that the exponents of the art have formed themselves into a group known as the Control Line Aerobatics Pilots Association. The newsheet unflatteringly calls itself **'Claptrap'.** It contains among other pieces of information useful to the stunt flier, a list of the 1980 Stunt League positions, with well known Stunter, Pete Tindall, at the head of the field, with a small margin over equally famous Bill Draper. 63 names in all recorded. Featured also is a plan and very fetching photograph of a Claus Maikis design based on a 1930's Stunt Messerschmidt. The ringed cowl gives the model a dis-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tinctive appearance.. *CLAPA, Sec. Pete Tindal, 67 Grosvenor Drive, Hornchurch, Essex RM11 1PJ.*

If Sam wouldn't pick up his old fashioned musket, the modern **SAM** does at least wield its archaic models, for SAM stands for the Society of Antique Modellers (sic). Much of the interest displayed in the newsletter 'SAM 35 Speaks', centres upon the gas buggy which has a certain tubby, plug-ugly appeal, rather like an overweight mongrel, but I was fascinated by the feature on a Tractor Biplane reprinted from Junior Mechanics of 1914. It is like building with a blowlamp — more a piece of modernistic sculpture than a model plane.

Straight from that bout of nostalgia I read in the 'Hot Air' newsletter of the **Grantham & D.M.A.S.,** that Vintage is Booming. It is not that they are building 'em to break the sound barrier, but that everybody's doing it. But why? Well, its all deeply psychological — a reversion to the days when contests for balsa and tissue models were won by old Charlie so-and-so, who always wore a knotted handkerchief on his head, and not as today won by professors of aerodynamics flying mechanical masterpieces. One thing I do agree with the writer and that is that Vintage is at least a do-it-yourself thing, and not merely playing around with the commercial toys that seem to be all too much in evidence these days. What we could do with, though, is some of that vintage weather. Typical of today's outlook, where the only consolation is that it would be even wetter if the clouds weren't moving so fast as was the wet and windy Northern Area Winter Rally at Church Fenton. Grantham got little out of it but some wreckage, although it did provide an early in the season workout under trying conditions. *Grantham & DMAS, John Ashmole, 8 Harrox Road, Moulton, Spalding, Lincs.*

The newsletter of the **Watford Wayfarers M.A.C.,** suggests that the club is faring to some purpose with negotiations under way for five separate flying sites. All are within a ten mile radius of Watford, but for one of the most promising, police permission is being sought as it is adjacent to a piece of road noted for its high accident rate. Could be that model flying might provide a further distracting hazard as the drivers frantically twiddle their CB radio controls in order to get a hit. Outside the ever vexing problem of flying space the club has a few lively events lined up for the season ahead. One is a flying display at Leverstock Green, booked for the fourth year, and the other is a possibility of a float at the Watford Carnival on the Whitsun Bank Holiday. In the meantime flying still goes on over the Moor.

Radio flying is not the fun it was, is the opinion expressed in the newsletter of the **Enfield M.F.C.** What with the atrocious weather blighting every week-end, and the CB addicts lying in wait for the unwary, the flying field is fraught with hazards. To add to all that, they've discovered another menace: the radiation from electric power lines, more deadly, apparently, when conditions are wet and the air humid, which is most of the time. Heedless of all these besetting dangers, though, the members have continued to risk all just for the sheer joy of flying a model plane. *Enfield MFC, Sec. R. F. Flaxman c/o 33 Uvedale Road, Enfield, Middx.*

Rotten news for readers of 'The Informer', the newsletter of the **Long Eaton M.A.C.,** for it contains a stop press report of the club field farmer putting the prized patch under the plough. As if the club did not have troubles enough, trying to recover from the shock of the first serious accident in its 30 year history. Reaction among members varied, from demands for a complete overhaul of the club's safety regulations to the more philosophical, 'Let's not over re-act' attitude. Accidents, of course, cannot entirely be ruled out, only the possibility minimised. And one thing a model flying accident does is to make everyone sharply aware of the dangers inherent in the flying of heavy, powered model planes. A nice sense of self preservation on the part of all involved, plus spectators, is worth all the rules and regulations ever devised. *Long Eaton MAC, Sec. Dave Hodgson, St. James Church Hall, St. Johns Street, Long Eaton, Notts.*

A general turndown in modelling activity, partly due to the unrelenting bad weather, and not a little influenced by that other dismal climate, the economic one, is reflected in the relatively low entry received in the celebrated Winter Building Competition staged each year by the **Leicester M.A.C.** Only 15 entries this time, according to the newsletter, but, even so, there is a nice range of lively craft to engage the interest at the uncovered stage. There is a twin engine ducted fan project, a Sirocco, a V2 (?) and even a small rubber powered scale model. Top scorer was M. Russell with his Eidelweiss. A turn up, though, for the Winter League Open Glider event at Wymeswold. The weather, wonder of wonders, was highly flyable, with low drift and low lift making for an enjoyable event. *Leicester MAC, Sec. I. McKeggie, 12 Pochin Drive, Burbill Park, Mkt. Harborough.*

Yet another soaring club has come to our notice: the **Meon Valley Soaring Association.** It operates in deepest Hampshire, mainly around a nice piece of ridgery called Butser Hill. Only intrusion on a perfect way of life is a training centre for hang gliders, for there is nothing more offputting than the sudden implanting of a size 12 boot in your unsuspecting ear. Any aerodynamic note in the newsletter tells of how some West German visitors outflew all other soarers in sight. Their secret? A rough upper surface on the wing. Perhaps the gliding fraternity should follow the free flight example and use turbulators.

Slightly more power minded is another countrified club new to these columns. The **Blackdown Radio Control Flying Club,** operating in the Taunton, Somerset area. Between Spot Landing events they indulge in Skittles at a local pub and the cooking of other things than solarfilm, for the newsletter carries a mouthwatering recipe for chocolate caramels. Flying field mentioned is Smeathorpe. *Blackdown RCFC, Sec. C. A. Rimmer, Brookside, Corfe, Taunton, Devon.*

Well, its all about frequency conversions in the **Hemel Hempstead M.F.C.,** newsletter, but all might be in vain for one of the club spies has located the very latest in C.B. covering all the bands including 35 MHz. But as the writer says there's always C/L and free flight. He must be joking. *Hemel Hempstead MFC, Sec. Russell Attwood, 63 Crouchfield, Boxmoor, Hemel Hempstead, Herts.*

Main item of news in the **Loughborough M.F.C.,** newsletter is of the availability of the Fulbeck Airfield in Lincolnshire. Ideal for f/f contest practice, particularly as it allows unmuffled engine operation. *Loughborough MFC, Sec. R. Satterthwaite, 20 Golden Square, Hathern, Loughborough.*

Published in the South Bristol M.A.C., newsletter is a map of one of the club's venues. Azamghur Barracks — on the road to Chippenham. Other sites in use during the f/f flying season, now well under way, are Merryfield and Whitchurch. They also seem to have a couple of sites for indoor flying. *South Bristol MAC, Sec. Gordon May, 4 Birchells Ave., Kingswood, Bristol.*

That's all we have space for this month.


*This month's winner managed to recognise the chap in the water! It was Harry Hundleby who was the editor of Aeromodeller in 1955. The photography was taken by Ron Moulton. Peter Holland tells me he was also there with a free flight float plane powered by a D.C. Merlin, that on take-off managed to make Harry duck under the water complete with camera! Runners up were: "CONFOUNDIT ... SWAMPED THE D.T. AGAIN!" Will Knight, Chippenham; "THE RADIO SAID HEAVY RAIN BUT THIS IS RIDICULOUS." R. Palmer, Eaton Bray, Beds.; "JUST APPLYING SOME 'WASH IN' TO THE TAILPLANE OF HIS TOY AEROPLANE SON." J. Cuthbert, Scunthorpe; "WHY CAN'T YOU PLAY WITH RUBBER DUCKS LIKE EVERYONE ELSE?" G. Green, High Wycombe.*

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*R/C Sport Flyer continued from page 310*

## Roll

The next basic manoeuvre is the roll, and for this it is almost mandatory to have ailerons. It is possible to perform a barrel roll with rudder/elevator only but let us not make life any harder than it already is! Rolls should be performed across the slope preceeded by a long shallow dive to build up speed. Level off, then apply full aileron (either way), as the model inverts, a touch of down elevator is required to keep the nose up. When completed, level off. If your speed is too low on entry, you will find that a greater amount of down elevator is needed in the inverted position. So that on consecutive rolls, if you have enough space, and as the speed drops off, each inversion will require a little more down. A deliberate barrel roll can be carried out by starting the figure on a slight climb and maintaining a little up elevator all the way through.

There are times when after completing one of these manoeuvres, you may find yourself in one of those nasty situations where you are heading towards the slope with insufficient air speed for a proper control response. Since you probably do not wish to dig holes in the slopeside with your pride and joy, what to do? One very effective way is to push the nose down with full elevator, then roll out at the bottom of the bunt or inverted loop, thereby facing back into wind albeit with some loss of altitude. It is preferable to perform the recovery this way round, since there is an immediate improvement in speed and therefore control, rather than half roll and loop with up elevator. **Fig. 5** explains all. Not for the faint hearted, but practice the move, you never know when it may come in useful.

Next month we can complete the slope soaring aerobatics, and I will report on the progress made with the Keil Kraft SE5A 'conversion'.

Happy Landings.

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**BOURNEMOUTH** Tel (0202)
R F AUSTIN, MODEL SHOP 424038
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SOUTHBOURNE BH5 2JA
Open 9 am-5 30 pm Mon Sat
Closed 6 pm Thurs -Fri
Half day Wed

**BOURNEMOUTH** Tel (0202) 517032
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MOORDOWN, BH9 2BA
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**BOURNEMOUTH** Tel (0202) 763480
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Thursday 9 30 am-1 pm

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Closed all day Tuesday

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Closed all day Wednesday

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5 30 pm, Monday 8 pm Closed Wed

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Late Friday 8 pm

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Sat 9 am-5 30 pm
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Closed Wednesday

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★ *Shops offering a mail order service are denoted by an asterisk.*

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63" span fully aerobatic R/C sailplane with rudder, elevator and aileron control (3-channel radio). Thick semi-symmetrical wing ensures good lift in all manoeuvres — including inverted flight. Wing area 390sq. in. The kit is specially designed for fast, easy assembly with veneered foam wings, pre-cut balsa and ply parts, plus hardware items including radio linkages and horns.

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67" span intermediate semi-aerobatic soarer for the not-so-expect pilot. Stable flat-bottom aerofoil and generous 490sq. in. wing area gives a smooth flying docile model — yet aerobatic at your command. Equally at home for bungee launching or slope soaring. The ideal sports/trainer glider. Kit content as for Shikari.

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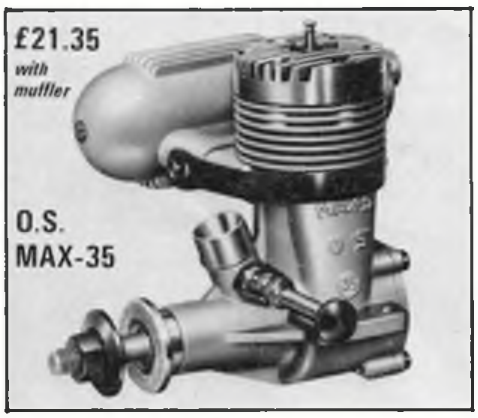


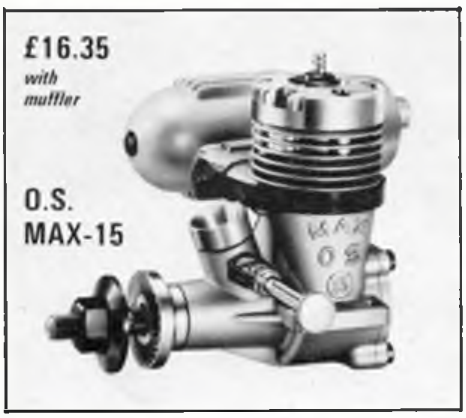





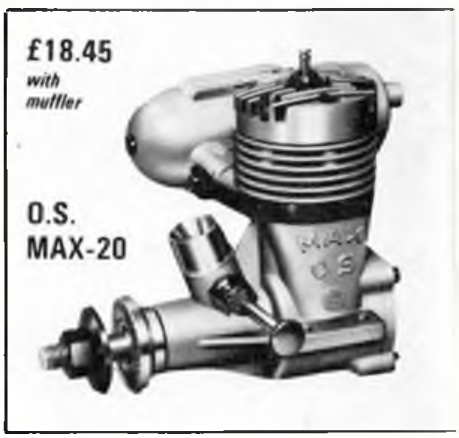


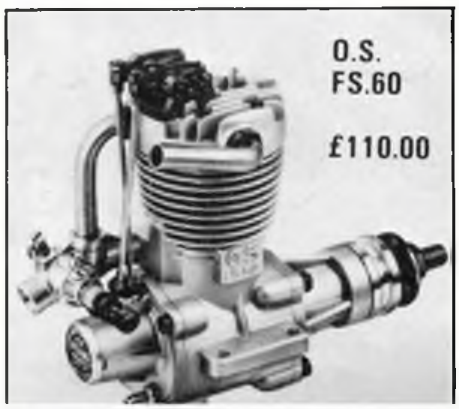


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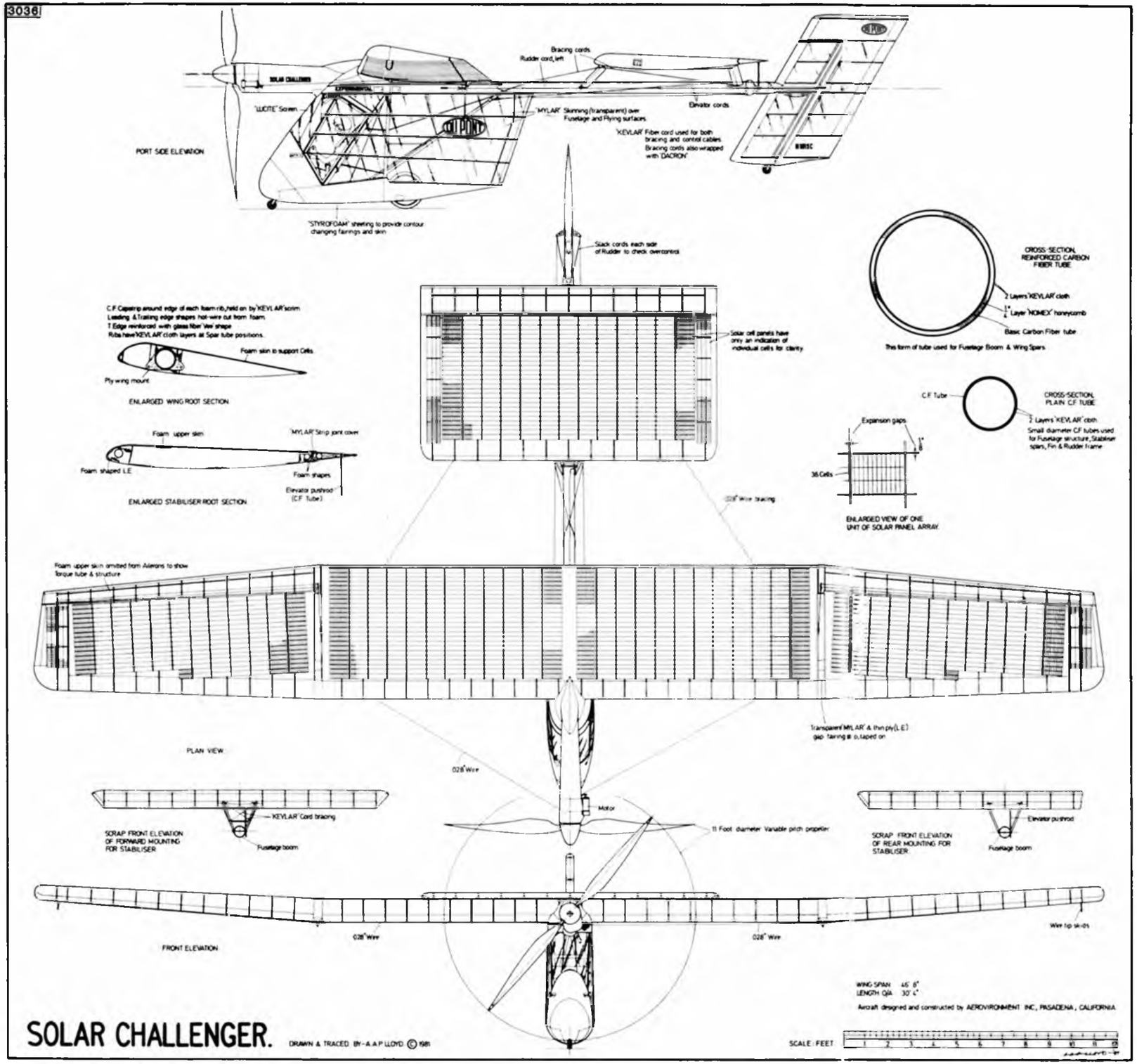
3036




Dyeline prints to the scale of 1/17.1 th of these 1/60th scale drawings are available as Plan No. 3036, price £1.50 inclusive of VAT and 25p P&P from the Aeromodeller Plans Service, P.O. B... 5, Bridge Street, Hemel Hempstead, Herts HP1 1EE.

*Left: hang glider flyer Carlos Miralles (left) and model flyer Bobby Curtin, assemble fuselage frame tubes; junctions are well reinforced with extra Kevlar cloth and epoxy. Below: Blaine Rawdon, member of Cross-Channel Albatross crew, was responsible for most of the structural design on Solar Challenger, seen here on the tube wrapping machine strapping with Tedlar.*

pregnated unidirectional carbon .005in thick, at 45° around a waxed aluminium tube mandrel and then adding linear caps, top and bottom, back and front, tapering in strength with diminishing laminations. This hand-assembled tube is then spiral wrapped with 1½in wide .001in polypropylene heat shrink tape, and cooked in a long oven (a converted helicopter blade box) at 250°F, which cures the epoxy impregnated carbon under pressure from the expanded aluminium tube and the contracting polypropylene tape.

The next stage, after sanding the carbon to ensure good adhesion, is to wrap the tube in ¼in thick *Nomex* honeycomb, bonded with epoxy and microballoons and held while curing with stretchy *Tedlar* tape pulled taut while wrapping. Finally, two layers of 1.7oz/sq yd woven *Kevlar* cloth, thoroughly impregnated with two part epoxy, form the outer skin, also wrapped while curing with *Tedlar* tape.

The use of these tubes and other composite epoxy and fibre components for brackets, mounts and fixings, accounts for the incredible strength and lightweight airframe, 145lb without cells.

Another unique feature of the *Solar Challenger*, certainly to the eyes of model flyers, is the flat-topped aerofoil. This was required in order that all the solar cells attached to the top surface of the wing and tail had the same angular orientation to the sun's rays, not possible with conventional convex upper surfaces. The aerofoil, computer designed by Peter Lissaman and Bart Hibbs at *AeroVironment Inc.* in Pasadena, has a curved leading edge entry shaped to give a docile stall characteristic, with the rear 80% of the chord perfectly flat! The underside has a convex curve to maintain laminar flow as far back as possible.

*"Have I got a story for the ... scale brigade! My main responsibility was assembly of flying surfaces and fuselage fairing from the biggest kit of parts you can imagine." Martyn with wing centre panel (inverted).*