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AERO

MODELLER

September 1984

Volume 49
Issue No. 584

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Cover:
Two versions of the De Havilland Chipmunk. The main photograph shows the aircraft known to thousands as a training machine par excellence. Inset is an aerobatic special created by the late Hal Krier of U.S.A. Aircraft Described this month brings you detailed scale plans of this well loved machine.

Subscriptions:

Annual UK subscriptions, £11.40 Overseas £13.00 or \$26.00 Send remittance to Model & Allied Publications, Subscription Department, P.O. Box 35, Wolsley House, Wolsley Road, Hemel Hempstead, HP2 4SS. (subscription enquiries Tel: 0442 (51740). Change of address US Postmaster send address changes to Model & Allied Publications, PO Box 35 Wolsley House, Wolsley Road, Hemel Hempstead, Herts HP2 4SS, United Kingdom. U.S.A. subscription agent Joseph J. Dailedu, 4314 West 238th Street, Torrance, CA90505

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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 Ebony Typesetting, Liskeard, Cornwall for the Proprietors and Publishers, Model & Allied Publications (a member of the Argus Press Group). Trade Sales by Argus Press Sales & Distribution Limited, 12/18 Paul Street, London EC2 4JS

This periodical is sold subject to the following conditions that it shall not without the written consent of the publishers be lent, hired out or otherwise disposed of by way of the Trade at a price in excess of the recommended maximum price and that it shall not be lent, sold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade, or affixed to or as part of any publication of advertising, literary or pictorial matter whatsoever.

Aeromodeller Magazine (ISSN 0001-9232) is published monthly by Model & Allied Publications, P.O. Box 35, Wolsley House, Wolsley Road, Hemel Hempstead HP2 4SS, England. Tel: Hemel Hempstead (0442) 41221. Second class postage paid in the U.S. at New York, NY USA Mailing Agent Eastern News Distributors Inc. 111 Eighth Avenue, New York, N.Y. 10011. Distribution to North American hobby and craft stores, museums and bookshops by Bill Dean Books Ltd, 186-41 Powells Cove Blvd. Post Office Box 69, Whitestone, NY 11357 USA. Tel: 1-212-767-8632. Distribution to news stands sales by Eastern News Distribution Inc. 111 Eighth Avenue, New York, N.Y. 10111 U.S.A. Tel: 1-212-255-5620.

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

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HANGAR DOORS

Howard Boys Memorial

Many modellers have asked whether a memorial event will be established in the name of Howard Boys. We are pleased to announce that spring of next year should see this event take place. Some 35 years ago Howard won the Pterodactyl Trophy with an outstanding performance at the Sportsdrome, Eaton Bray. This splendid silver trophy has been kept in excellent order and by agreement with his sons, Trevor and James, will be presented annually. The event will probably be at Eaton Bray and bearing in mind Howard's interests you had better start thinking about tailless radio control models!

10 - 15 A.M.

Older modellers will remember the Allen Mercury diesel engines of a few (well perhaps 10+) years ago. Well, soon they will again be seen on sale at your local model shop. *Forest Engineering Services* of Clifford Road, London E17 will be producing *A.M.10* (1.0 c.c.) and the *A.M.15* (1.5 c.c.) very shortly. Sadly the crankcase dies were lost for the larger versions and it is unlikely that their larger brothers will ever appear.

Free Flight Nationals Raffle

Team travel funds seem to abound these days and a lot of hard work goes into various ways

of fund raising. This year's Free-Flight Nationals saw two such efforts, a sponsored chuck glider event and a raffle. Glenda Bracken who so ably ran the raffle, informs us that some prizes were not collected! The 'missing' winning tickets were: Mauve 73, Yellow 23, Yellow 284 and Yellow 388. If you have one of these phone Glenda on 01-263-9849.

The Jaguar Stampe

Flown by Brian Lecomber, the 'Jaguar Stampe', is sponsored by *Jaguar Cars* as a new venture this year. The 'Stampe' is a vintage biplane designed in the 'barnstorming' era of the 1930's. Originally licence-built in Algeria from a Belgian design, the 'Jaguar Stampe' has recently been extensively restored and re-engined with a *De-Havilland 'Gypsy Major'* of 145hp.

Although of fabric covered wooden framework construction, the 'Stampe' is an extremely strong aeroplane. In his display Brian will be stressing the airframe to plug 6G and minus 3G. Performances will include all the traditional aerobatic manoeuvres plus various 'combination' figures of rolling, looping and snap-rolling.

Brian, who is 38, is one of perhaps a dozen professional aerobatic pilots in the western world. He has lead a varied life: at different times he has been a racing mechanic, a journalist, a



The Free-Flight Nationals were wet, wet, wet. Even so that great couple Janine and Dave Rawlins of DPR Models still managed to get plenty of youngsters flying in their Chuckie Competition - here are some of them in the DPR Junior Workshop.

flying instructor on a Caribbean island, a wing-walker in a flying circus and a bestselling author of aviation novels.

He has won a number of national aerobatic competitions and will be flying the 'Jaguar Stampe' in the next British Aerobatic Championships.

The 'Jaguar Stampe' can be seen in action at the *Rochester Air Show* in Kent on 19th August and also at the *Andover Air Display* at Middle Wallop, Hants on 2nd September.

The Ever Ready Nationals

All roads will lead to Grantham over the August Bank Holiday weekend for anyone with an interest in model flying. From August 25-27th the *Ever Ready National Model Flying Championships* will feature 29 contests for F/F Scale, R/C and C/L classes at RAF Barkston Heath, with R/C Soaring all at RAF Cranwell, five minutes drive away.

Sponsored by *Ever Ready*, the British battery manufacturers, the Championships will have a wide range of trade exhibits, a sky-diving display on the Saturday and fly-pasts by both the *Battle of Britain Flight* and the *Red*

Arrows, weather and military commitments permitting. The opening will be by the Royal Air Force's astronaut candidate, Sqdn./Ldr. Nigel Wood at 2.30 p.m. on Saturday, August 25th.

Moving with the times

How is your local model shop? Alive, well and thriving? If not, why not? Could it be that you do not support it as much as you should? Buy some balsa ... build a model, chat up 'old John' in the model shop. Be his friend and perhaps he will be yours too ... then he may have those small parts that he used not to stock. Some model shops have a bad name — if it isn't prepackaged in plastic, they are not willing to stock it. Remember: it takes 'two to tango' ... you buy and he'll sell it!

We've recently heard of three model shops where the rapport with their customers has obviously worked.

First there's 'The Model Shop', Newcastle — there they are celebrating 60 years in the business (one of their staff has been giving advice on all types of models for the last 50 years — keep it up Mr. Kennedy!) They even advertised in issue No. 2 of *Aeromodeller* back in 1935.

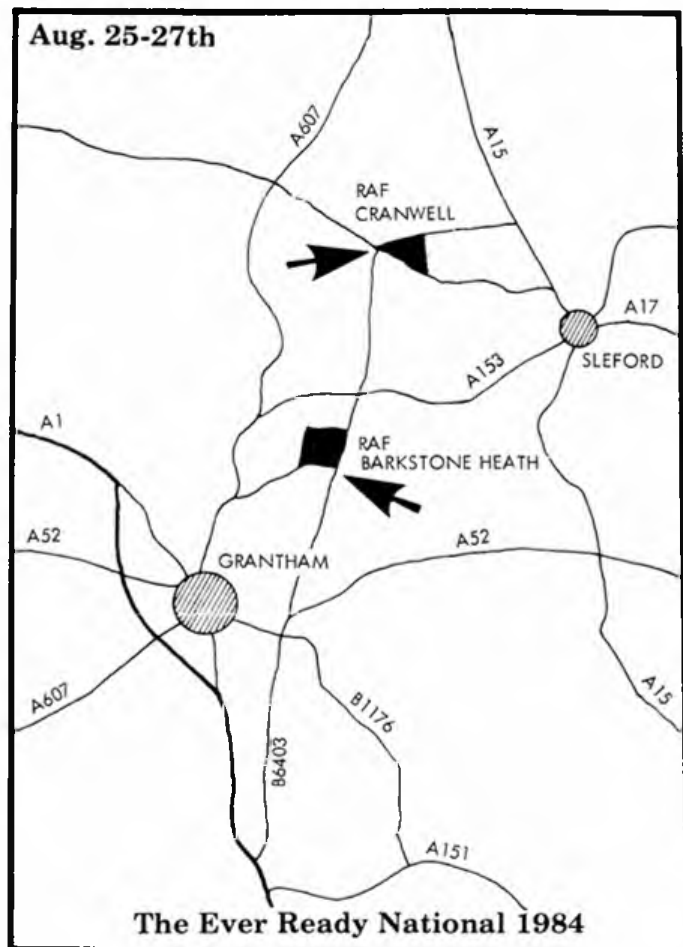
The Stampe SC4 is a proven aerobatic biplane and has been seen at air shows around the World - performing nearly every manoeuvre possible. The Jaguar Stampe may be seen at special 'car shows' and air displays around the U.K. in 1984 ... keep your eyes up!



Aeromodeller



The old and the new, an interior shot of 'The Model Shop' in Newcastle - 60 years old and below, the new home of 'Punctilio Model Spot' at Hinkley.



Second, there is the Bradford 'Modeldrome' over 40 years of selling modelling to allcomers — and what a good relationship they must have with their customers . . . earlier this year they had to move their shop to make way for yet another petrol station — who moved them but Bradford Aero Model Club. In two hours flat . . . stock, counters, the lot! Finally, we have 'Punctilio

Model Spot', quite the youngster here with only 10 years but they too have had to move to larger premises to enable the customers room to move.

So it is not all gloom and doom as some would have us believe but don't forget . . . **'SUPPORT YOUR LOCAL MODEL SHOP'**.

Going to the *Ever Ready National Model Flying Championships* will certainly let you

see how much more there is to our sport than you imagined and is a fine opportunity to find out just what those other branches of model flying that you don't fly yourself are all about. Organised by the *Society of Model Aeronautical Engineers*, flying will start at 10 a.m. every day and around 700 entries are likely. Car parking is free and there is a special 3-day pass for *SMAE*

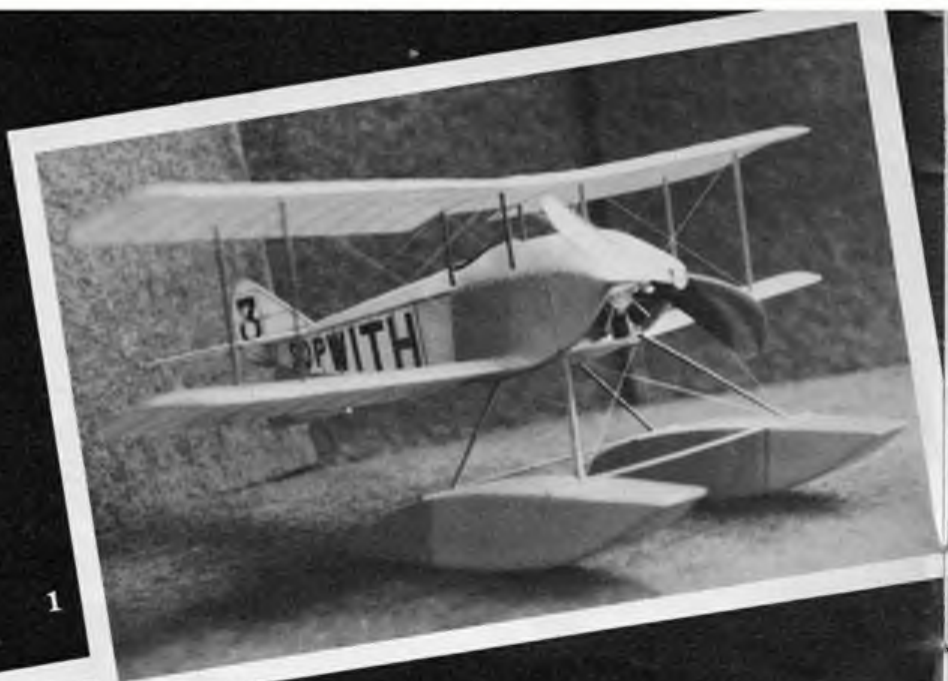
members at a reduced rate of £4.00

Admission will cost £2.00 for an adult, £1.00 for under 16s, (under 10s — free). A mini-bus and passengers — £18.00 and a coach and passengers — £50.00. A stamped addressed envelope to *Ever Ready Nats, SMAE*, Kimberley House, Vaughan Way, Leicester should accompany any further enquiries.

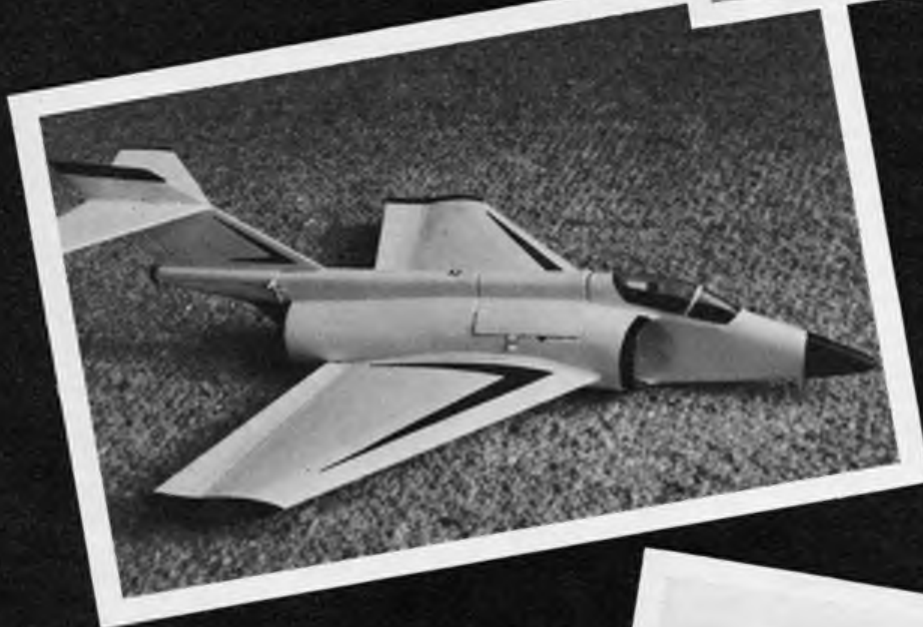
What's On . . .

August 17	OUTDOOR CHUCK-GLIDER COMP Venue Littleton Road Playing Fields, Salford Contact M.C. Reeves. Tel Rochdale 44999. Friday evening — 7.30 p.m. start	August 26/28/27	SOARING NATIONALS OPEN, 100s, F3B, HL R/C, CLUB TEAM, S.C.A.L.E., CROSS COUNTRY, ELECTRO. Venue Cranwell Contact Richard Douglass 87 Scartho Road, Grimsby, S. Humberside Tel 0472 71246
August 18/19	PLUMPTON MODEL SHOW — R/C Aeroplanes and boats, cars and steam trains, traction engines and helicopter rides, powergo hang gliders, plus dutch 300 m.p.h. pulse jets Camping facilities available Venue Plumpton Racecourse — 10 miles from Brighton, Sussex Contact Dave Bishop Tel Tatsfield 550	August 31	Control-Line Speed Comp. Venue Littleton Road Playing Fields, Salford Contact Andy Brough Tel Rochdale 59603 Motors up to 1.5cc — plain & bearing diesel only 42ft Light Laystrate lines — 7.30 p.m. start
August 19	AEROMODELLER VINTAGE DAY Venue Old Warden Contact Aeromodeller Tel 0442 41221	Sept 1, 2	Indoor Nationals — EZB 1.2g INDIVIDUAL (HOULBERG TROPHY), AGM TROPHY (NOVICE/EXPERT), PAIRS FINAL, MANHATTEN, CO. (SPARKLETT'S TROPHY), 13in PEANUT DURATION, 35cm, 65cm FID (AEROMODELLER TROPHY), OPEN MICROFILM (HUMBROLD PLATE), ALL-IN E2B. Venue Cardington Contact Laurie Barr Tel 0628 25595
August 19	INDOOR UNIVERSAL CONTESTS AND FUN FLYING Venue Cardington Contact B Hunt Tel 0480 862353	Sept 2	HOLKER HALL MODEL AIRCRAFT RALLY
August 19	VINTAGE FLY-IN. Venue Newbigging Contact Bruce Duncan, Burrelton, Perthshire PH13 3PL Flying starts at 12.30 p.m.		

Sept 2	SOUTHERN AREA SMAE INDOOR MEETING PEANUT, M.G. OPEN SCALE (R and CO.), EZB. Venue, H.M.S. Deadelas, Gosport, Hants, Contact M. Leach, 14 Birchtree Drive, Emsworth, Hants, Tel, Emsworth 5364 Comps and Fly for Fun — names and car reg numbers must be given to M. Leach A S A P	Sept 9	IVINGHOE SOARING ASSOCIATION — 2 METRE. Venue: Eaton Bray, Beds Contact S. Bannister, 12, Beeton Close, Pinner, Middx. Entries: £2.00 + SAE + Frequency (even 35 Mhz channels only).
Sept 9	SHUTTLEWORTH MODEL GROUP SILENT FLIGHT DAY Venue Old Warden, Biggleswade Contact M. Staples Tel 0223 241978 Rubber Glider, Electric, CO ₂ — Free flight and R/C No. I.C. engines	Sept 16	CONTROL LINE SPEED COMPETITION — ALL CLASSES. Venue Old Parade Ground, Piddington, Near Bicester. Contact Dick McGladdery Tel 01-994 8320
Sept 9	SHEFFIELD AERONAUTICAL RC SOCIETY R.C. VINTAGE COMP AND FLY-IN. Texaco, Walsall rules. Full details from D. Hanson, 23 Meadowhead, Sheffield S8 7HA	Sept 16	4TH ROUND CLASS 'A' BRITISH DIESEL COMBAT CHAMPIONSHIPS. Venue, The Embankment, Peterborough Contact B. Waterland Tel: 0778 343722
		Sept 23	SMAE 6TH AREA MEETING — F/F: O/R (Team: Farrow Shield, Plugge), FIA (SMAE Cup) 1/2 A POWER Venue Local Area Venues Contact Area Comp Secs. OR SMAE 0633 68500
		Sept 23	CONTROL-LINE SCALE COMPETITION — TO CURRENT RULES. Venue, Broomwade Sports and Social Club, Hughendon Road, High Wycombe Contact Ron Truelove Tel 049481 5300 Silencers and insurance compulsory



1



2

SPECTATORS WATCHING an aeromodeller "in action" — adding a detail here, a tiny adjustment there, sometimes ask, "Why pay attention to such trifles?" Asked a similar question about his art, the 16th century artist Michelangelo replied, "Trifles lead to perfection — and perfection is no trifle." Perhaps we mortals cannot achieve perfection *but* this months models come pretty close to it!

Photo 1

What wonderful flying machines the old ones were — just look at those floats! The model is of the *Sopwith 'Tabloid'*, winner of the 1914 Schneider Trophy. From Roy Ashby of Rochester, Kent, who sends the following details. Span 25in. Power: 4 strands of $\frac{3}{16}$ in. flat F.A.I. rubber. Floats from $\frac{1}{4}$ in. sheet. The *Gnome* engine rotates with the $\frac{8}{16}$ in. diameter mahogany carved prop.

Photo 2

Displaying sleekness and efficiency in every line, is this most interesting ducted fan free-flight semi-scale model by Mr. Eyre of Epsom, Surrey. Powered with a *Cox T.D. 020*, driving a $2\frac{1}{4}$ in. diameter glass fibre bladed fan. Span 14in. Wing area 55 sq. inches. Weight $5\frac{3}{4}$ ozs. Flies well — very fast and smooth!

Photo 3

A well chosen background and photographed from a low view point, imparts an added touch of realism to a scale model. This is demonstrated in this photo of his $39\frac{1}{2}$ in. span *Sopwith 'Pup'* by Mr. Juggins of Lichfield, Staffs. It has made over 60 flights. Fliar Phil wishes Mr. Juggins all the best with his next 60.

Photo 4

This most attractive photo, taken by renowned aeromodeller John O'Donnell, is of a *Fokker D8*, belonging to that master of the scale model John Watters of Prestwich, Manchester. John describes it as a "labour of love." With that complicated lozenge colour scheme over all, it certainly was John! Details: span 54in. *Merco 35* power, four function R/C. The very beautiful young lady was "put in the picture" by John O'Donnell. Alas Fliar Phil was not given any vital statistics — not even her name!! However a big "thank you" to her — and to you John.



3

4





Photo 5 — Winner

Well friends, it's a lovely day and the *Cessna* "Bird Dog" stands waiting, with cabin door open, so lets climb aboard for "a flip" into the wild blue yonder! Ah! — sorry but it happens to be a *model*, would you believe. Sent to Fliar Phil by David Ward of Hornchurch, Essex. Built from a *Marutaka* kit, it is 1/8th scale; OS 'Gemini' powered, with *JR* radio. David has returned to aeromodelling after twenty years! For this fine photo David receives this months camera — and welcome back David!



Photo 6

Our Canadian aeromodelling brothers certainly can build scale jobs! Here is a fine example from Carl Small of Ontario, Canada. It is his R/C *Fairey* "Firefly". Built from "Best of Scale" by Bob Holman, U.S.A. Details: 61in. span. Weight 11lbs. Power. *Webra* 'Speed' 61. Canadian Navy colour scheme of WWII. Superb model Carl — and thanks for your other fine pix.



Photo 7

Andrew Hamilton-Smith of Bassington, Oxford, did not send any details with this excellent photograph, except to inform Fliar Phil it was taken at a "fly-in" at High Wycombe in April. F.P. recognises it as a control-line model of the *Miles* "Satyr", probably built by Alan Callaghan. Anyway, the owner is to be congratulated on a fine model of an attractive biplane, not often seen in model form.

Stay around friends! More model masterpieces next month — could one of them be yours?

Win a bumper bundle of balsa wood

All entries should be good quality black and white or colour prints. Your name and address should be on the back of the print. Details if possible should be given about the model and its construction. Send all entries to: Aeromodeller, Photo prize Feature, PO Box 35, Wolsey Road, Hemel Hempstead, Herts. HP2 4SS. Photos will be returned after publication.

SCALE MATTERS

Free Flight with Bill Dennis

Rubber powered scale models continued from August issue

(5) Choice of Subject

The range of subjects tackled by the rubber scale modeller is probably the widest of all the scale disciplines — often to the detriment of flying performance! However, the same criteria for stability apply to the rubber model as for the power and I see no reason to use other than +3° wing incidence, 0° tail, and a forward CG. Keep to a conservative design as regards tail area and dihedral.

Attention should be paid to the ultimate CG position and obviously a long nose is beneficial. It is undesirable to extend the motor too far back, since a change of motor size, or bunching, will have a great effect on CG position. Without much experience, or any hard data, my hunch is that a ratio of 1/3:2/3 is the maximum advisable.

If you want to take a short cut, several APS power designs could be easily converted to rubber by altering the wood sizes, for example the *Auster AOP9*, *Cessna 'Bird Dog'*, *Piper 'Super Cruiser'*, *'Tipsy Nipper'*, *'Stosser'*, *Sopwith '1½ Strutter'*, *Avro 'Avian'*, *SE5a* and *BE2e*. I don't think that the extra drag of a biplane is any handicap but instead serves to keep the flying speed low — many clean monoplanes fly noticeably too fast.

(6) Structures

Once you have decided to build a model of reasonable size and not be too paranoid about weight, then a scale structure is perfectly feasible. The same philosophy of a flexible, strong structure as I have outlined for power models can easily be extended to the rubber model. Since we are unlikely to be flying the model in anything stronger than a light breeze, we can put up with the slight loss of strength inherent in a lighter structure.

Rubber powered scale models come in all sizes, typical of the 'medium' size model is the authors DH 60 'Moth' seen at last years Walsall scale meeting.

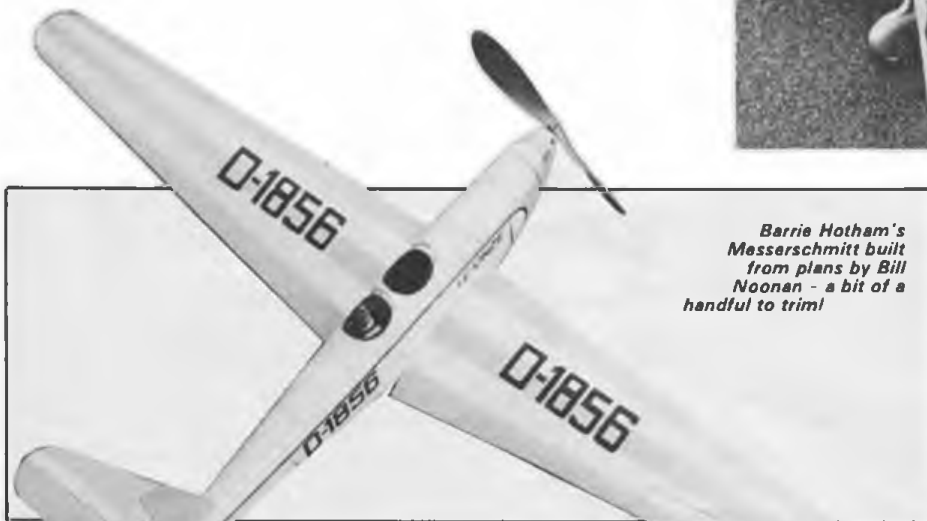


It is preferable to use large section wood that has been carefully selected for lightness and strength. For a 36in. model, wing spars can be ¼in. × ⅛in. and ⅜in. × ⅛in. Trailing edges laminated from ⅜in. sq. will be stronger and stiffer than one-piece members. Wing attachments should still be of the wire in tube variety but reduced to 16 or 18swg in aluminium tubes, spars can be locally reinforced with ⅛in. ply to great effect.

Very light and realistic tail surfaces can be made from three laminations of ⅛in. × ⅜in. basswood. It is a pity this material is so ridiculously expensive. If you retain the tail-surfaces with an internal band, they will be unlikely to get damaged, so you can build them very light. Of all the components, weight saved here will be the most valuable, in terms of nose ballast.

For a basic square box fuselage I would use ⅛in. square medium grade, with light ⅛in. × ⅜in. spacers aft of the CG. If it is to be sheeted with ⅜in. balsa, the internal structure can be of light grade ⅜in. square. Speaking personally, I find representations of Spitfires and the like with stringered fuselages rather unconvincing, although I realise they are very popular.

Right, Mike Hetherington specialises in models built from doped paper fitted to a minimal balsa framework, here is his Mitsubishi 'Claude'.



Barrie Hotham's Messerschmitt built from plans by Bill Noonan - a bit of a handful to trim!

(7) Finish

All the rubber scale models I have seen have been covered in tissue, and this is what I have used until now, but unfortunately the covering very quickly becomes punctured and tatty. For my future models I shall use silk on tissue as on power models. In fact Doug Sheppard is currently building a *Polikarpov PO2* using silk and it will be interesting to see the results.

Having seen a lot of excellent flights put in by fully-painted models, I can see no excuse for the feeble, 'flying stained glass window' rubber model. This type is popular in the USA, where out-and-out duration seems to be the aim and many models are built, I suspect, simply as a vehicle for a shiny pair of *Hungerford* spoked wheels, which would never be seen on the original!

I know of two ways of getting a good, lightweight finish. The first is with an airbrush and although I have no experience of these, I would refer you to an excellent book by Ian Peacock. I use car aerosol paints, which are available in a vast range of colours — PC10 excepted! — and are compatible with cellulose dope when repairs are made. The metallic aluminium colours are particularly effective for civil aircraft.

(8) Trimming

I found that my 'Moth' flew best to the right in a wide circle, but I do not know if this is generally applicable. The safest trim is with near zero deflections on both rudder and elevators, adjusting the fore and aft trim by altering the incidence of the whole tailplane and/or ballast. The reason for this is that the effects of the control surfaces vary greatly with airspeed and you may find the model turning in when you put a few extra winds on. If you have a slight left glide turn, this will progressively counteract any tendency to wind in to the right speed.

AIRCRAFT DESCRIBED

De Havilland

CHIPMUNK

No. 261 — The De Havilland DH C-1 Chipmunk described by Charles W. Cain and drawn by G. Campbell-Thomas, and A. A. P. Lloyd



Air to air shot from the 1950's R.A.F. Chipmunk T Mk. 10 in silver with yellow (trainer) bands

WE RECKONED that the best person to thrust our brand-new investigative pocket recorder at — to get the magic of a 'Chipmunk' taped for our select readership — would be a 'One-ton Budgie' owner who just also happened to be a practising aeromodeller. Wouldn't that be something to crow about?

"So, Mr Ralph Steiner of Arkley, Herts., owner of 'Chipmunk' Bravo-Bravo-Mike-November, Founder and Secretary of the international *Chipmunk Club* and lapsed aeromodeller, the question is: Why the 'Chipmunk'?" The owner of G-BBMN (construction no. C1-0300, ex-RAF serial WD359) answered in a trice: "A 'Chipmunk' carrying an instructor and pupil can take-off and climb to 4,000 feet, execute two spins, two loops, two rolls and two rolls off the top all above 3,000 feet and then land all within 19.5 minutes using 2.75 Imp. gallons of fuel. And that's official from the makers" Hmmm! But investigative journalism is all about fearlessly exposing frailties; the hand mike waved accusingly. 'Vices?' the tone was forgiving of such brashness, "None to speak of; a very forgiving aircraft with early warnings if one is a naughty boy. It's got the ideal character for a good primary trainer."

Taking a realistic view of things, to start knocking the 'Chippie' would be to take on not only the *Chipmunk Club* but also the countless ab initio pilots who now have greying temples and uniforms heavy with Service authority. And, by no means least, those thousands of young hopefuls in cadet forces for whom the 'Chipmunk' has provided them with their very first taste of 'real flying' — and is still so doing. "It's getting on for 40 years since the first

'Chipmunk' flew. And, in one form or another, it's going to be flying happily into the twenty-first century!" says Ralph Steiner and he should know. Quite a thought, eh?

The Chipmunk arrives

If Chief Designers play a critical role in the creation of new aircraft, then the 'Chipmunk' owes much to W. J. Jakimiuk who was born in the Polesia region of Poland in 1902. Majoring in mathematics at Wilno University, W. J. Jakimiuk then went to France's École Supérieure d'Aéronautique and gained his diploma in 1929. From 1931 and until the German invasion of

September 1939, he worked in the design bureau of P.Z.L. and, progressively, on the famous gull-wing fighter monoplanes, the P.7 (production engineering), P.11 and export P.24 series (development engineering). He was also involved in the 1938 two-motor transport prototype, the P.44, and the radial-motor, low-wing monoplane prototype fighter, the P.50.

From Poland, W. J. Jakimiuk joined France's S.N.C.A.S.E. plant, travelling there via Romania, Yugoslavia and Italy. With the fall of France imminent, in June 1940, he made the sea journey to join the design office of *De Havilland Aircraft of Canada*. Immediately, he was involved in



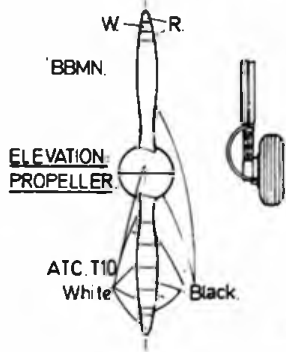
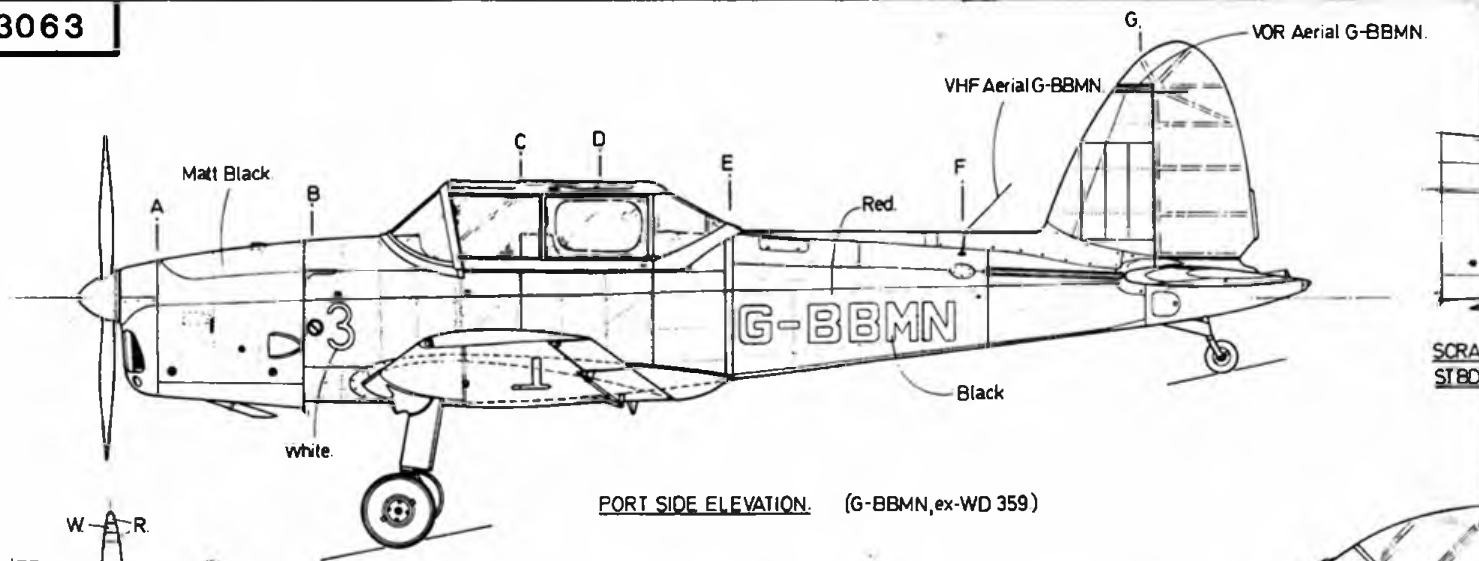
Fully aerobatic, bubble-canopy DHC-1-1B-2 Chipmunk Mk.2 CF-FHY, in November 1949.

'Mosquito' production engineering problems at the Downsview plant, Toronto.

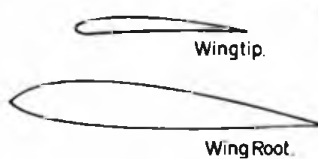
When the prospect of creating a replacement for the doughty but obsolescent DH.82 'Tiger Moth' was first mooted, W.J. Jakimiuk must have recalled his P.Z.L. metal-airframe philosophy years. For this was to be something new at Downsview where, between 1940-45, deliveries attained were 1,747 'Tiger Moths' and 1,135 'Mosquitos' (wooden construction) and 375 'Ansons' (mixed metal and wood). In the event, the DH C-1 was to be of all-metal construction with stressed skinning and only the control surfaces (wings and tail assembly) and the mainplane sections aft of the generously skinned leading-edges were

Canadian built DHC-1B-2, with Gipsy Major 10, full aerobatic clearance to 9g stress factor.



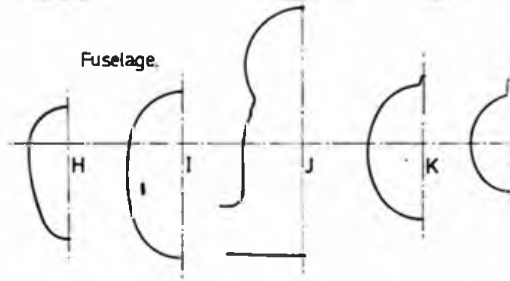
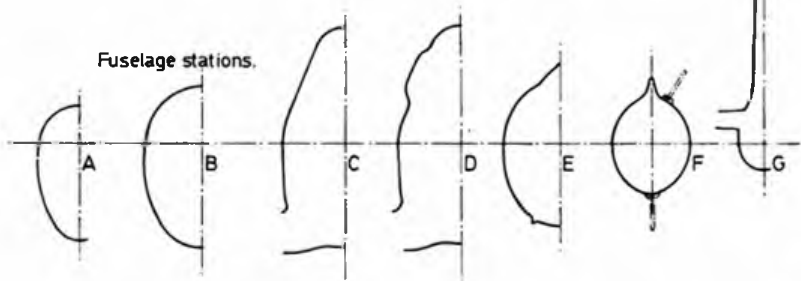


REAR VIEW: U/C LEG

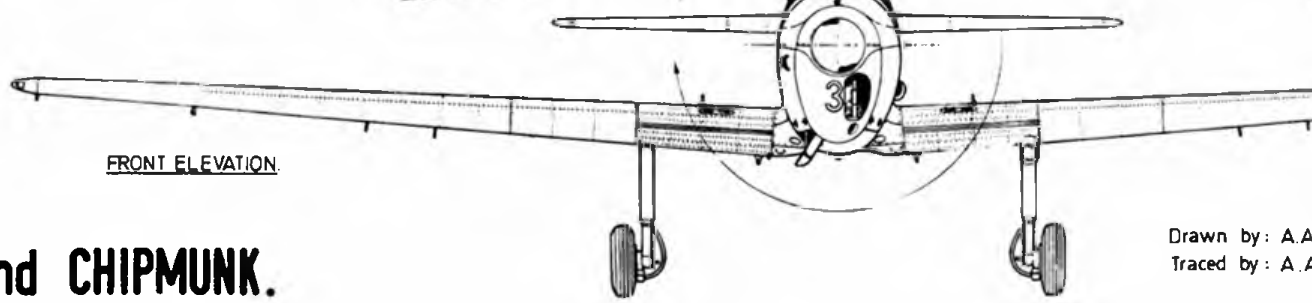
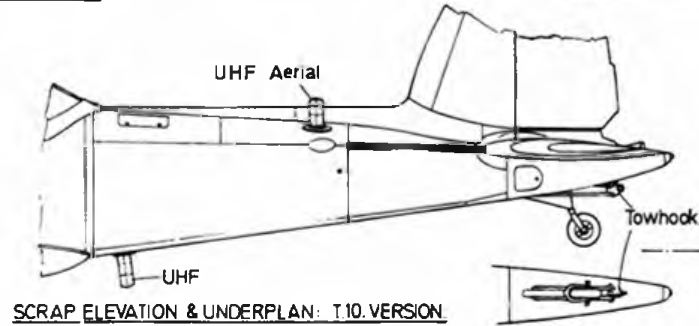
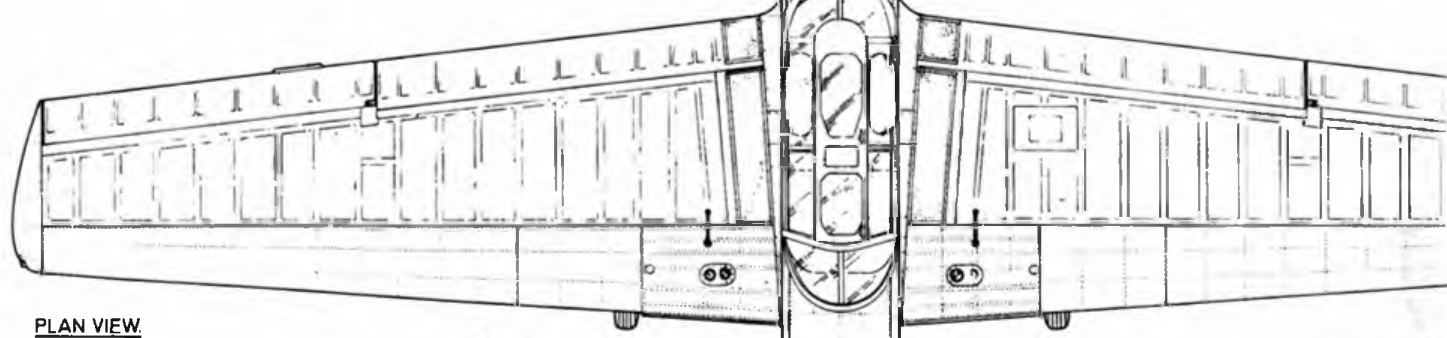


CROSS-SECTIONS: STANDARD AIRCRAFT

CROSS-SECTIONS: HAL KRIER'S Ex-DHC-1 A/C



A 1/24 scale dye-line drawing is available from modeller Plans Service, Wolsey House, Wolsey Hempstead, Herts. HX1 2AA. Price £1.85 plus 50p postage (Price Code C). Please quote No. 3063 when ordering.



De Havilland CHIPMUNK.

Drawn by: A.A. Traced by: A.A.

PORT SIDE ELEVATION: MODIFIED DHC-1.
Aircraft modified from DHC-1A-1 version of CHIPMUNK for Aerobatic work by U.S.Champion Art Scholl N13A

PORT SIDE ELEVATION: MODIFIED DHC-1.
Aircraft modified from DHC-1A-1 version of CHIPMUNK for Aerobatic work by U.S.Champion Art Scholl N13A

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FRONT ELEVATION: MODIFIED A/C

PLAN VIEW: MODIFIED A/C

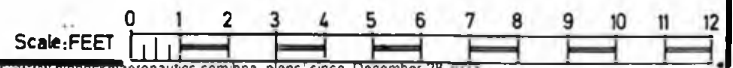
Zippered access points.

COLOUR NOTES: G-BBMN.

Fuselage lower half incl. root fairings, wing tips, upper & lower Ledges (wing & tailplane) tail tips, : RED.
Anti-glare nose area, spinner, propeller & registration. BLACK. Remainder of aircraft: SILVER.

N.B. Air Training Corps T.10. WZ856 Had BLACK/WHITE Spinner & propeller.

LLOYD & G.CAMPBELL-THOMAS.
LLOYD.



to be fabric-covered. Metal covered detachable wingtips were also incorporated.

With the approval of the parent British company, from preliminary drawings of October 1945, in just over seven months the prototype CF-DIO-X was hand-built in record time. From England, DH's chief production test pilot, W.P.I. (Pat) Fillingham flew in to undertake the initial flight-test programme. The first flight took place from Downsview Airport on May 22nd, 1946. Pat Fillingham submitted reservations about longitudinal control and for a brief period a chunkier fin and rudder was tested. The familiar 'Mosquito' shape was reinstated after minor engineering changes.

After the loss of the second prototype (CF-DFJ-X) on January 19th, 1947, during spinning trials and despite the adoption of a bigger area rudder (noticeable because of vee cut-out at the base of the curved trailing-edge), the legend persisted. As the *Chipmunk Club's* Secretary puts it: "The spin recovery query was finally dispelled by the addition of strakes on the side of the fuselage like those on the 'Tiger Moth'. This was followed by a complete programme of test flying, all carried out in Australia."

Crossing the Atlantic

The 'Chipmunk' was more than a local 'all-metal' milestone for *DH Canada*: it was to become the first Canadian design to be selected for manufacture overseas, first in England and then in Portugal. The first steps were taken by shipping to the parent *DH* factory at Hatfield the tenth and eleventh examples. By November 1948, the pair (now G-AJVD and G-AKDN) were being subjected to RAF service trials with 'local preference' instrumentation and Gipsy Major 10s in place of the *DH* Canada-installed Gipsy Major ICs.

Those Aeroplane & Armament Experimental Establishment tests at Boscombe Down resulted in the basic Anglicised 'Chipmunk'. The Gipsy Major was to be a Mk.8 in place of the Mk.10 Srs.2 which would be applied to the Mk.20 export version of the RAF's standard 'Chipmunk' T.Mk.10.



Later, Gipsy Major 8s were to be brought up to the Mk.10 Srs.2 standard for the Air Registration Board's approved and subsequent civilianised variants, the 'Chipmunk' Mk.21, 22/22A and 23. For the RAF, who would then order an impressive 740 T.Mk.10s out of a total Hatfield and later Chester production of 1,000 Chipmunks, there were to be a few changes. Chief of these were to be a reinforced centre section and wing main spar to permit a maximum 10g stress (9kg in Canadian versions) for aerobatics, and a slight forward resiting of the main undercarriage legs — and a provision for a built-in landing light on the port leg's sleeve.

Whereas the RCAF's *DHC-1B-2 Series 2 & 5* 'Chipmunk' 2s (only three RCAF Mk.1s existed to DHC 1A-1 limited-aerobatics specn.) were to be fitted with the delightful bubble or blown cockpit canopy, the RAF's T.Mk.10s and the export T.Mk.20s had to be content with the original built-up 'glasshouse'. By now it was too late as the blown canopy was not compatible with the British airframe. Following the release in 1956 of RAF-surplus T.Mk.10s, *Bristol Aircraft Ltd.* made a brave attempt to encourage civilian operators to indulge in a 'glamour kit' comprising a one-piece canopy and smart accessories like spats of glass fibre for main and tail wheels. The company gave this facelift to a surplus T.Mk.10, G-AOTM, and this encouraged a second (G-APOY) to be *Bristol* refashioned in 1963. The latter was sold to Norway and the



Above, the Aero Bonner Chipmunk 200, winner of the 1973 Kings Cup Air Race, photo from M. J. Hooks.

former is currently N122DH and owned by a *Chipmunk Club* member of Bedford, MA. Other blown canopy variations have existed in North America and Australia.

What happened to Chief Designer W. J. Jakimiuk? He was invited to join the Hatfield team to smooth out any wrinkles in the production of the RAF 'Chipmunk'. In Canada he left a further legacy because he had been in at the start of *DH Canada's* second highly successful local product, the *DHC-2* 'Beaver' light cargo plane. With his work on the T.Mk.10 concluded, W. J. Jakimiuk went back to France and *SNCASE* (Sud-Est) and designed the S.E.5000 'Baroudeur' swept-wing interceptor which was flown for the first time on August 1st, 1953. When the Anglo-French 'Concorde' programme was set in motion, W. J. Jakimiuk served as one of the eight French directors towards the end of a distinguished career in aviation.

Of the Portuguese 'Chipmunk' production there is little to say. The government

The De Havilland T.Mk.10 standard Chipmunk in close-up: 1 — showing fully open cockpit, 2 — dorsal fin and anti spin strakes, 3 — landing light only on port undercarriage leg, note root-stall inducing strip on wing leading edge, 4 — wing-root fillet and rivet pattern on fuselage, 5 — elevator trim tab on starboard side only.



factory, OGMA began turning out T.Mk.20s under licence in 1952 and produced at least 60, some of which remain in service with the Air Force today. The first T.Mk.20s were UK purchases in 1951; all 10 being allocated to the Army.

Civilianising the Chipmunk

With the advent of RAF-surplus T.Mk.10s in 1956 there came the need to have Air Registration Board Certificates of Airworthiness. Four civilian marks came

Below, one of the few crop-spraying conversions, the Agricultural Chipmunk Mk.23. Note outer wing leading edge slots and single seat canopy.

There have been three mid-1950s bubble-canopied *Sasin Aerostructures SA-29 'Spraymasters'*. As *Aerostructures*, the company then began a programme of replacing Gipsy Major engines with *Avco Lycoming O-360 'flat-fours'*. Not approved was their installation of wingtip tanks but a belly tank seems to have been successful.

In England, too, engine power has occupied 'some attention. As already mentioned, the RAF GSA (RAF Gliding & Soaring Association) has advanced the use of the *Avco Lycoming O-360 'flat four'* to give the 'Chipmunk' more pull as a glider tug. However, the sprinkling of tow-equipped T.Mk.10s of the RAF's Air Experience Flights have remained Gipsy Major-powered. The 13 Air Experience Flights in the UK and N. Ireland² have around 50 'Chipmunks' to give air experience to the nation's ATC/CCF cadets. Two novel

Design data:

De Havilland DHC-1 'Chipmunk' T.Mk10 (NB: Data generally as supplied by DH Hatfield for 1956-57 Jane's All the World's Aircraft.)

Category: Enclosed, all-metal, enclosed tandem-seat primary trainer will full military aerobatic stress factor to 10g.

British Services use: Initially for RAF University Air Sqns. from 1950; also Reserve Flying Schs. of the RAF Volunteer Reserve; pilot training of National Service pilots of the RAF: Primary Flying Training Sqn, Light Communications Flts., Air Experience Flts. and other misc. units. Also Royal Navy's Britannia Naval College AEF and Army Air Corps.

RAF Serials: WB549-WB768 (200 a/c); WD282-WD397 (100); WG271-WG491 (150); WK506-WK643 (100); WP772-WP988 (150) & WZ845-WZ884 (40). Last T.Mk.10 (WZ884) delivered October 1st, 1953. (Note: These RAF serials are for both Hatfield & Chester production runs; the serial batches have built-in 'breaks' so that straightforward subtraction would not arrive at the final T.Mk.10 production total of 740).

Powerplant: One *De Havilland Gipsy Major 8* air-cooled, four-cylinder, inverted inline delivering a max. of 145-hp at 2,300 rev/min (direct-drive) at sea-level. Fuel grade AVGAS 100/130 Octane. Propeller by *Fairey*, LHT (left-hand tractor) metal blades, diameter 6.75ft & pitch 5.01ft. Spinner Type FC2 Mk.2 (later, modified Mk.5) by *Fairey*.

Dimensions: Span 34ft 4in; length 25ft 5in; height (top of windshield) 7ft 0in; wing area 172sq.ft; tailplane span (incl. elevators) 11ft 11in (area 17sq.ft); elevators 14sq.ft; rudder height from base 4ft 2in (area 6.8sq.ft); fin area 5.9sq.ft. Main wheel track 8ft 11in.

Weights: Empty 1,425 lb; loaded (normal) 2,014 lb, (max.) 2,100 lb.

Performance: (Max. permissible 2,100 lb) Max. at sea-level 138 mph; cruise 119 mph; climb rate 840 ft/min; Service ceiling 15,800ft; range (18 Imp. gal capacity) 280 miles at 116 mph at 5,000ft; endurance 2.3hr; (quoted for T.Mk.20).

Acknowledgements

For those eager to have closer acquaintance with currently flying 'Chipmunks' in the UK (but seek airfield/owner permission first!), the best source of reference is the *Air-Britain* 280-page 'United Kingdom & Ireland Civil Registers 1984'. And for the military examples, past and present, seek out J. J. Halley's 114-page *Air-Britain* 'ROYAL AIR FORCE Aircraft WA100-WZ999' published in 1983.

To those patient helpers who have responded to often impossible questions, the author extends his most grateful thanks: Messrs J. F. Brindley, B. Martin, B. Rigelsford and J. J. Halley, M. J. Hooks, J. D. Oughton and 'Mr Chipmunk Club Secretary', Ralph F. Steiner.

FOOTNOTES

¹ Several sources inadvertently carry forward '735' and 1,014'; the 'Chipmunk' saga is a veritable quicksand of 'facts'.

² No. 13 AEF in N. Ireland originally had a 'Chipmunk' but servicing problems have led to its replacement, uniquely for these Flights, by a BAe 'Bulldog' T.Mk.1.

into being. The Mk.21 is the ARB-approved civil mark of the export T.Mk.20 of which G-AMUF, G-AMUH and G-ANWB are the only current British register examples. The dozens of Mk.22s with current Cs. of A. are all RAF-surplus with Gipsy Major 8 engines brought up to Major 10 Srs. 2 standard. The Mk.22A sub-variant indicates replacement of the two mainplane 9 Imp. gallon fuel tanks with two for 12 Imp. gall. each. Our drawings show a Mk.22 in G-BBMN: about a dozen Mk.22As are listed in the current Civil Register (examples being G-ALWB and G-ARMC). The Mk.23 was an attempt to create a single-seat crop duster/sprayer in the late 1950s. Five T.Mk.10s were given Mk.23 status of which two crashed, two are now glider tugs with the RAF GSA (G-AOTF and G-ATVF) and one, the original prototype sprayer (G-APOS) was eventually sold in December, 1968, to become N8345 and is at present owned by yet another *Chipmunk Club* member who lives in Stone Mountain, GA.

Australia, too, has tried to make a market for a 'Chipmunk' agricultural aircraft.

powerplants are worthy of note. The first is the 118 shaft-hp *Rover TP-90* turboprop seen in G-ATTS at the 1966 SBAC 'Farnborough Show'. Having been reconverted to Gipsy Major, G-ATTS is now resident in Waco, TX, as N2247. The second powerplant is the turbocharged, liquid-cooled, 200-hp 'Super Sapphire' in the Shoreham-based *Aero Bonner 'Chipmunk 200'*, G-ARWB, which was first flown on July 2nd, 1979.

And finally, more Lycomings

The Royal Thai Air Force may seem to be an exotic note to end on but the RTAF has been a good customer, having purchased at least 22 *DH Canada 'Chipmunks'* between 1949-50 and more than 40 British export T.Mk.20s. Of these, 15 are currently in service with the RTAF and civil pilot training with the new designation of RTAF-4 'Chandra' (Moon). In addition to converting to 180-hp *Avco Lycoming IO-360 'flat-fours'*, these RTAF-4s have bigger and more angular vertical tail surfaces. Truly, the 'Chipmunk' story has still a long way to go before it is complete.

“NOT ANOTHER Indoor class!” might well be the initial reaction to this topic. Nevertheless, Peanut Duration (PND) has been the success story of last winter’s Northern Low-Ceiling Indoor Contests. Entries have exceeded those in the other categories — and there have been new names in the results list.

The concept was promoted (and “pushed”) by Bernard Hunt and was intended to “bridge the gap” between duration and scale and hence appeal to a wide audience. There have been similar attempts in the past, with Manhattan and Bostonian, well publicised on the other side of the Atlantic. The former has been tried and “found wanting” in Cardington, and gives models too large and fragile for more restricted sites. Bostonian is smaller but heavier and the models would appear unlikely to “bounce” off the walls and other obstructions.

Hence it was decided to write a new specification. Whilst choosing Peanut size might well be construed as a gimmick, it

The first step was to abandon the double-surfaced wing (intended to improve rigidity) and build a replacement in the normal indoor style. This was followed by a new propeller assembly with a higher pitch (fig. 1). Both changes improved the model — to the tune of an extra 40 seconds or so. Certainly the design as presented has a potential of three minutes under a 25 feet ceiling. Contest scores have not quite reached this figure but have been sufficient to win the February and March events by a comfortable margin.

Flying technique has been similar to that used for EZB — comparatively thick rubber, wound to capacity and then “backed-off” (unwound) typically up to 10%. This throws away the power burst and enables the model to be flown on the “flat” part of the torque curve, giving a slow r.o.g. and climb, fol-



CAGEBIRD

Build this contest winning indoor Peanut Duration model by John O'Donnell



Top. Propeller assemblies and undercarriage. Very positive location using bamboo pegs on noseblock. Above, simple function lines of “Cagebird”, note wing braces on starboard side only.

rendered some of the implications a little more predictable. The rest of the numbers were chosen to suit the idea of a box fuselage model, light enough to fly for a couple of minutes, strong enough to survive both collisions and handling — and maybe even of “realistic” appearance (whatever that is)!

My attempts to design a model intended to win under these rules all seemed to lead to diamond pylon layouts. This approach shortens wing mounts and undercarriages, whilst utilising all of the limited wing area as efficiently as possible. Realising what my sketches were starting to resemble, I bowed to the inevitable and used my normal outdoor style of fin shape!

Not knowing just what was needed, my model had most components plug-in and/or adjustable. This makes for easy trimming and encourages trying out new components.

In fact the prototype “flew off the board” and displayed a very nice power pattern right from the start. On the other hand, its performance was a little disappointing. The first two or three contests showed that 2:15 was about my limit — and I needed more duration if I was going to win anything.

owed by a long cruise and slow descent. Could I emphasise that this is essentially a low-ceiling technique and inappropriate elsewhere!

Future programmes for Cardington include PND events — so a few pointers might well be worthwhile. For flying in this site, with plenty of available height, I would recommend a finer pitch prop, a long thin motor and flying without back-off. I would not expect problems on power burst with these changes, indeed they should make the model easier and safer to fly. Prophecy is

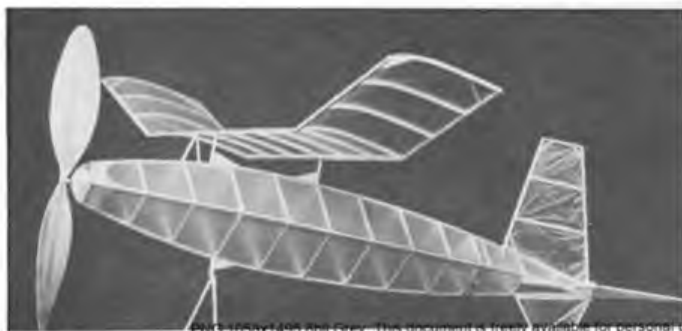
always dangerous but I would expect to see flights in the four to five minute region.

Materials

As with all indoor models it is necessary to select the wood pretty carefully in order to produce a strong light airframe. Nevertheless there would seem no need to resort to using special “indoor” grade supplies for most items, unless of course, you have them already.

The fuselage and tail unit call for 0.060in. balsa — which translates as “thin 1/16in” — and the required material should be stripped from sheet. Most commercial 1/16in square strip is too large, hard and heavy.

For the basic airframe, balsa cement is a more-than-adequate adhesive and lighter than many of the more modern alternatives. Chose a thin, runny cement and don’t use too much! Epoxy can have its uses for parts of the propeller assembly.



“Cagebird” follows the not uncommon ‘indoor’ practice of covering only one side of the flying surfaces — if John can win with a few wrinkles showing I’m sure you can!



The main structure is straightforward enough and should present few difficulties to those with some previous experience with lightweight construction. The various components — fuselage, wing, tail unit, are built and covered prior to final assembly.

Fuselage

Two sides are built on the plan, one on top of the other and subsequently joined in the usual manner so as to form the basic box fuselage. The easiest way to ensure that it is square and straight is to cut three extra sets of spacers whilst building the first side and to mark the spacers to ensure that they are fitted the correct way round. The nose is sheeted in for the first inch and the scallops cut and sanded afterwards.

Flying Surfaces

Wing and tail construction is conventional enough, apart from the diagonal braces at the corners of the tips. These braces serve as gussets but are much lighter. Those at the wing tips need a bit of curvature to match the top camber — so are best made from short lengths of rib. The ribs themselves are sliced using a (metal) template. If the sheet



Plenty of pins used again as propeller pitch is "set". Note sticky tape and small wooden "Clamp" hold prop. shaft in position.

is cut to the right length ($2\frac{5}{16}$ in.) first, then all the ribs will be the same length. To assemble the wing, pin down the L.E., and then use the cut sheet to position the T.E. at the correct distance before pinning down. Finally glue in the ribs without any need to trim them to length. The end wing ribs are leant outwards so that they are more-or-less vertical after the dihedral has been fitted. This technique stiffens the last rib against being knocked-in.

Undercarriage

The legs should be cut from medium-hard stringy balsa. Assemble on the plan and add the wire axles later. Round the corners of the

It is important that propeller blanks conform closely to the jig and that each blade is identical, plenty of pins and balsa clamps ensure this . . .

DIMENSIONS FOR HELICAL PITCH

PITCH	R	W	D
10	4	2	0.8
11	4	2	7/8
12	3.82	2	1

INCHES Suggest 10" pitch for Cordington
fig. 1 12" pitch for low ceiling

legs and bind the joints with a few turns of very thin thread. A strand of nylon extracted from an old pair of ladies' tights is ideal!

The $\frac{3}{16}$ in. diameter wheels look ridiculously small but are perfectly adequate (for both r.o.g. and "wheeled" landings) provided they are bushed. Either metal or plastic tube can be used — employing bits of hypodermic needles and cyanoacrylate applicator tubing respectively.

Prop Assembly

The blades are moulded on a carved wooden block, which also serves as a jig for setting the correct pitch. The original used a wedge-shaped offcut but a rectangular block (fig. 2) is probably more convenient. One corner is marked out to the sizes given in the sketch. Although only a 6in. diameter propeller is allowed for PND, a longer block might be an investment as it will accommodate larger props for other models! Carve the corner of the block "flat" (no camber) from LE to TE.

Cut a $\frac{1}{16}$ in. sheet blank to the blade shape and carve to a section like a chuck-glider wing but with a sharp LE. This is then twisted and tack-glued to the block in the place where the blades will go — so as to enable them to be cambered as required.

My propeller consisted of two layers of "thick" $\frac{1}{64}$ in. sheet, sandwiching a piece of very thin glasscloth and glued together with epoxy. This might well be overkill, but the blades do not split when banging against walls and ceilings! Obviously, a single layer of $\frac{1}{32}$ in. or 1mm sheet can be used for the blades but will be more difficult to twist.

I also used a bamboo spar, but almost any convenient hardwood would make an adequate substitute. Do not use balsa if a broken propeller is to be avoided! Drill the spar for the wire shaft and glue it in place.

The blade blanks are soaked in boiling water for a few minutes, then twisted on the block, held in position and baked in an oven until dry. All this is standard indoor duration practice. Since the twist is quite

considerable, four layers of $\frac{1}{64}$ in. (plus an additional sacrificial top layer) need a fair amount of restraint. I found it necessary to pin lengths of scrap wood over the blades to hold them in position — see photographs.

When dry and cool, remove the blanks from the block, pair off the blanks, laminate up one blade and pin back on the block to dry. Then cut out a thin wedge to fit the spar (cricket bat style) — still on the block. Glue the spar in place ensuring that the shaft lines up with the edge of the block. This automatically ensures correct pitch. When dry, remove, laminate the second blade and finally glue in the spar to give a complete propeller. Then carve to airfoil, clean-up and sand. Almost any form of talc-and-dope style of filler can be used to deal with the pin-holes.

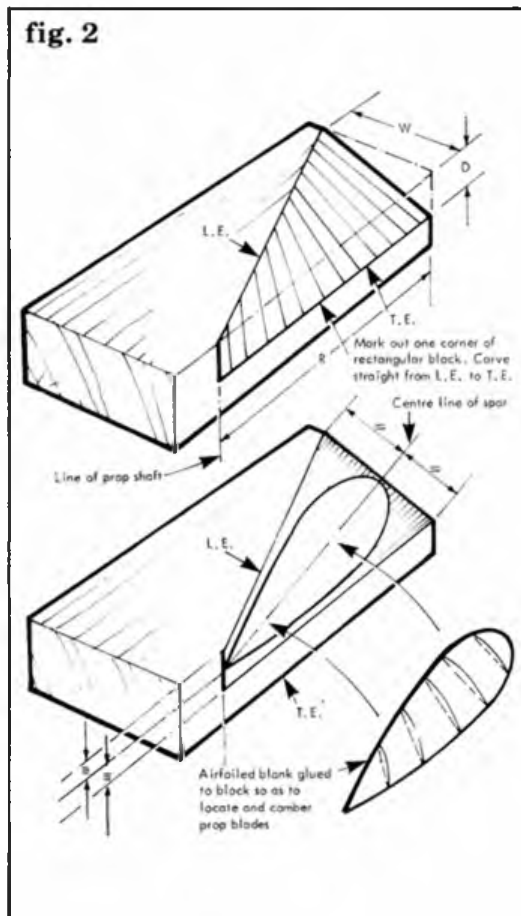
The noseblock uses scraps of brass (or tin-plate) as bearings. The four pegs provide a long spigot at minimum weight. Use metal or PTFE washers (or even the proverbial glass beads) between the prop and noseblock and ensure that there is sufficient clearance. Bend the hook for the rubber as close to the noseblock as possible.

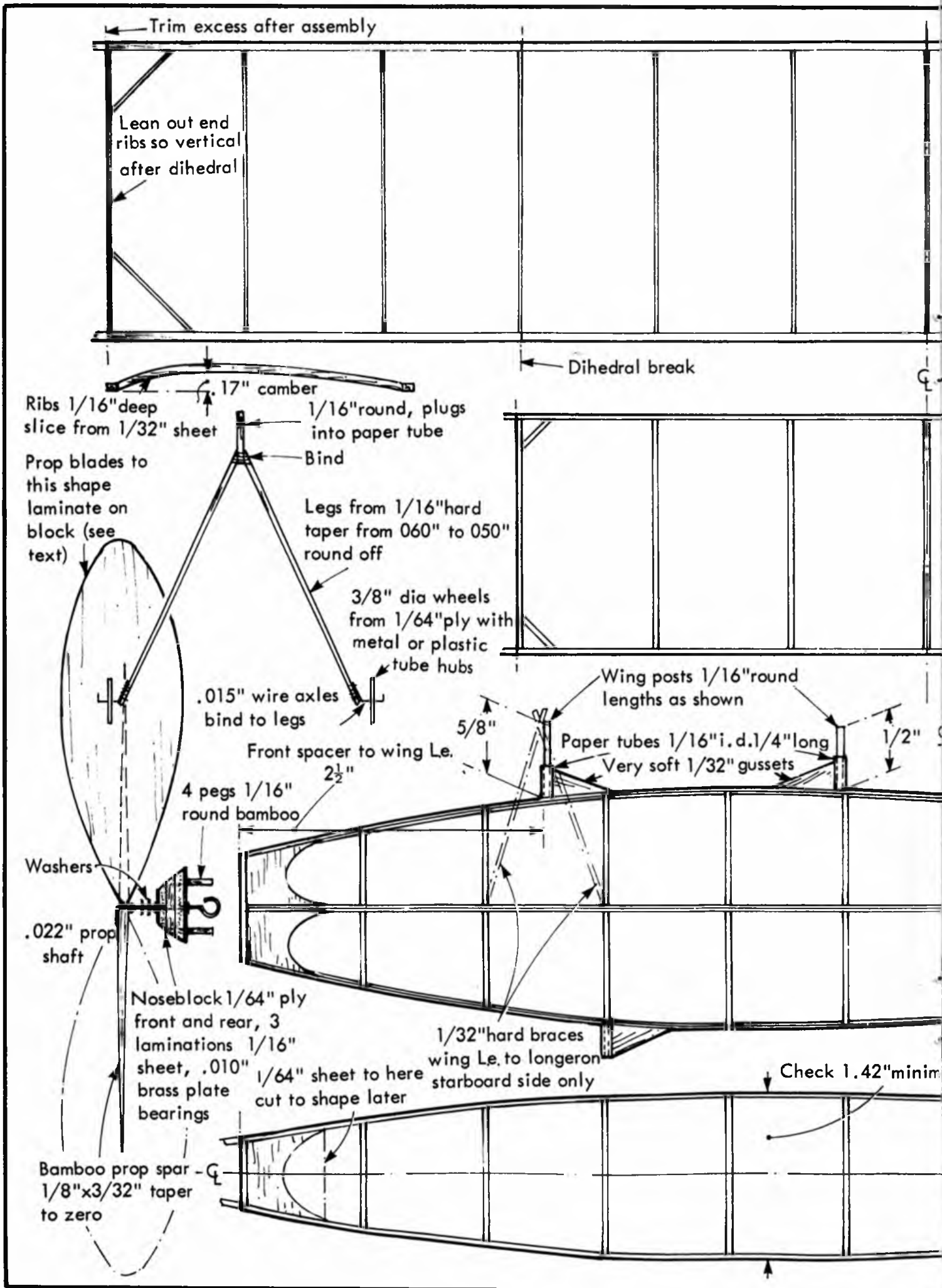
Covering

The photos will probably give away the fact that my model had the tail unit covered in mylar (and double surfaced at that!). Nonetheless "standard" condenser paper should be adequate for the whole model. The wing and tail unit are covered on top only and the covering should be left unsprayed and undoped. The fuselage covering can be shrunk using "meths" and given a coat of very thin dope.

'Cagebird' plans overleaf, text continued on page 461.

fig. 2





Span 13½" with tips flat

L.e. and T.e.
1/16"x3/32"

Corner braces
use pieces of
1/32"x1/16"
ribs

2½" max.

1⅛"

Flat centre section

Dihedral break

Tip dihedral 1.35" gives
a projected span of under 13"

All tail
.060" sq.

CAGEBIRD

designed by John O'Donnell

Flat plate section
no camber

Trim excess after assembly

All fin and
underfin .060 sq.

Sideways peg into
tube on longeron
for adjustment
(see sketch)

C.G. 13/8" behind L.e.

1/8" long paper tube
for fin L.e.

Cut away bottom
longeron to fit tail

.060" packing to give
negative incidence

Uncovered here

Longerons and spacers .060" sq.

Bevel ends, trim later

1/16" i.d. alloy tube peg

1/32" sheet anchorage

Aeromodeller SCALE DAYS '84

Date: 16th, 17th June 1984
Place: Old Warden Aerodrome
Action: Scale Fly-For-All

WHAT WONDERFUL WEATHER — well Saturday was! Sunday sadly was marred by several very heavy thunderstorms. Outside the brief 'monsoon periods' the weather was just the ticket for scale models. Not too much breeze and reasonably steady. Saturday saw a host of free-flight scale peanuts and CO₂ models most of which were flying extremely well. The flight lines for radio control were thronged as always and special mention must be made of the smooth operation at R/C control and the 'tongil bending' performance of Dave Bishop who kept up a non-stop commentary throughout the two days. Control-line, although not so well supported managed to thrill the crowds with some exciting flying on the Sunday. We hope the selection of photos here will convey some of the pleasure we experienced at Old Warden over this weekend.

Scale model? Certainly not for the purists, but Robin James of Hayes Club has a sense of humour in addition to being a good scale modeller - Aeromodelling is FUN.

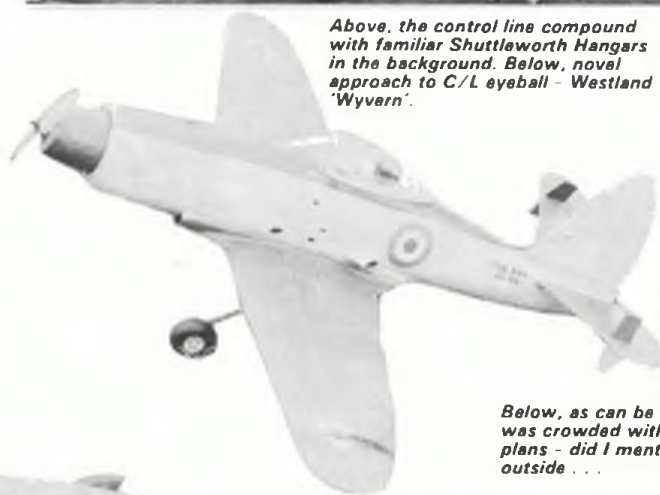


Yes - it will fly! The P.38 'Lightning' has a reputation for being difficult but Richard Falconer of Glos. showed how that awkward launch can be managed.

Unusual, but a terrific flyer - Arthur Evans chose yet another novel subject in the Marcel Beson 411 for his Indian Mills 75 and it alighted perfectly on Old Warden's soft grass.



Above, the control line compound with familiar Shuttleworth Hangars in the background. Below, novel approach to C/L eyeball - Westland 'Wyvern'.



Below, as can be seen here - the M.A.P. tent was crowded with modellers buying mags and plans - did I mention it was pouring with rain outside . . .





Chris Strachen's rubber powered Lockspeiser LDA-01 had perfect weather on Saturday to prove its unorthodox layout.

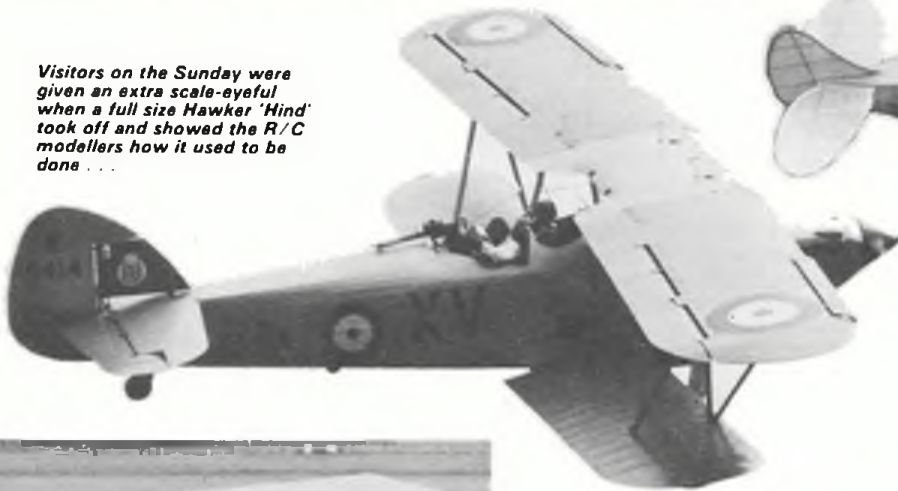
Above, Derry Eggs got 3rd place trophy in free-flight with his D.C. 'Spitfire' powered 'Monoplane' - flew beautifully.



Left, Mike Sharp had a neat electric winder for his Pietenpol - rubber tension stalls motor when fully wound!



Visitors on the Sunday were given an extra scale-eyeful when a full size Hawker 'Hind' took off and showed the R/C modellers how it used to be done ...



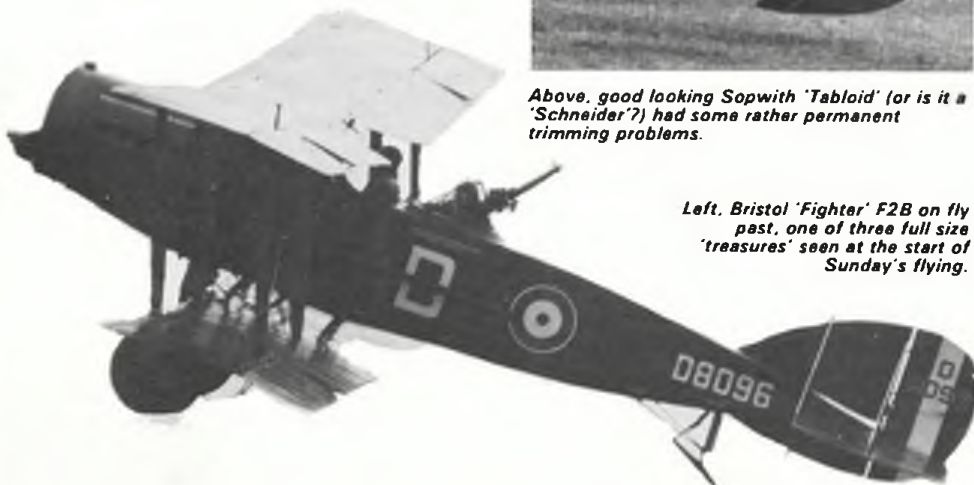
Vic Dubery relaxes with rubber scale and still gets high performance as befits his duration contest expertise. The Waco YOC 'Custom Biplane' flew like a charm, it's from May '36 'Flying Aces'. He bought the mag 48 years ago when the model was too costly to build.



Left, what an umbrella! Jim Shelley's half scale Auster flew circuits with a cine camera strapped to the side! Power - 96 c.c. lawnmower engine.



Above, good looking Sopwith 'Tabloid' (or is it a 'Schneider?') had some rather permanent trimming problems.



Left, Bristol 'Fighter' F2B on fly past, one of three full size 'treasures' seen at the start of Sunday's flying.

Trophy winners

Free Flight

- | | |
|---------------|-----------------------|
| 1 A. W. Evans | Marcel Beson 411 |
| 2 Vic Dubery | Waco YOC |
| 3 Derry Eggs | Blackburn Monoplane |
| 4 R. James | Flying Fiea & Bathtub |

Control-Line

- | | |
|------------------|---------------------|
| 1 Alan Callaghan | Miles Satyr |
| 2 Geoff Burkett | Fokker Dr1 Triplane |
| 3 Jim Leddy | Douglas Dakota |
| 3 David Leddy | Waco Hadrian |

Radio Control

- | | |
|------------------|---------------------|
| 1 John Ranson | Bristol Beaufighter |
| 2 Fred Barnsley | Fieseler Storch |
| 3 Martin Fardell | Nieuport Nighthawk |
| 4 Ray Godfrey | Avro D |

Shuttleworth Trophy

- | | |
|------------|----------------|
| Vic Wilson | Miles Magister |
|------------|----------------|

Carter Memorial

- | | |
|---------------|---------------------|
| Geoff Burkett | Fokker Dr1 Triplane |
|---------------|---------------------|

Austrish



Build this simple free-flight sports model for 0.3 to 0.75 c.c. motors by Vic Smeed.

VIC SMEED has an almost unbelievable record of popular models to his credit. They stretch back into the distant past — all seem to fly well, almost regardless of how they are built! This Austrish looking model should provide hours of pleasure either as a simple free-flight sports model or with the now popular radio-assist. Radio-assist tends to be used not as a means of making a model gyrate around the sky but more for keeping a naturally stable model out of the local woods! Whichever way you decide to build your model, let's cut the cackle and get down to Vic's building instructions . . .

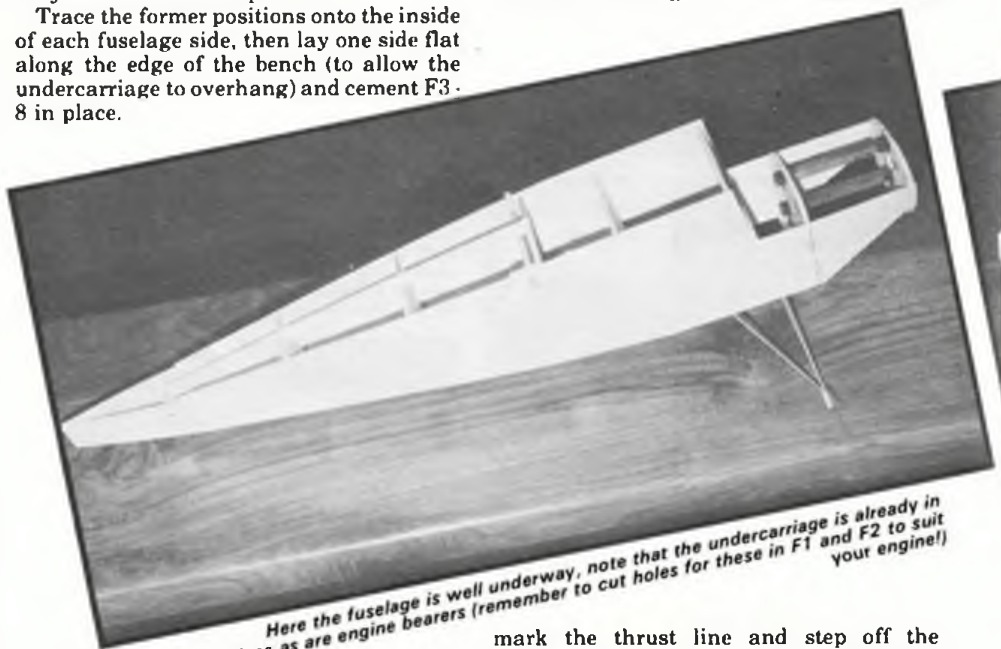
Fuselage

Trace and cut the fuselage sides from medium light $\frac{1}{16}$ in. balsa sheet. Note that the cabin windows are *not* cut out. The depth of the sides in the underwing area is a shade over 4 in., so either a narrow strip must be added to a 4 in. sheet in the affected area or two 3 in. sheets must be butt-joined. It will be found easiest to cut as much as possible of a side from 4 in. sheet, then place the piece on the plan and butt part of the cut-away scrap in position and trace off the missing portion. If one side is completed first it can be used as a template for the second. The shape is simple to cut, using a steel rule, since all lines are straight.

The sides have to be assembled on F4, F7 and F8 initially, and since F4 carries the front leg of the undercarriage and it is far easier to sew this in place before assembling the fuselage, F5 and F6 may as well be fitted, with the undercarriage rear leg already sewn to F6. Cut out the formers, bend the undercarriage parts to shape (note that each part is flat, except for the slight angle in the last $\frac{1}{2}$ in. of the rear leg), drill the formers as

indicated and sew the wire in place with Terylene thread or carpet thread.

Trace the former positions onto the inside of each fuselage side, then lay one side flat along the edge of the bench (to allow the undercarriage to overhang) and cement F3 - 8 in place.



Here the fuselage is well underway, note that the undercarriage is already in place as are engine bearers (remember to cut holes for these in F1 and F2 to suit your engine!)

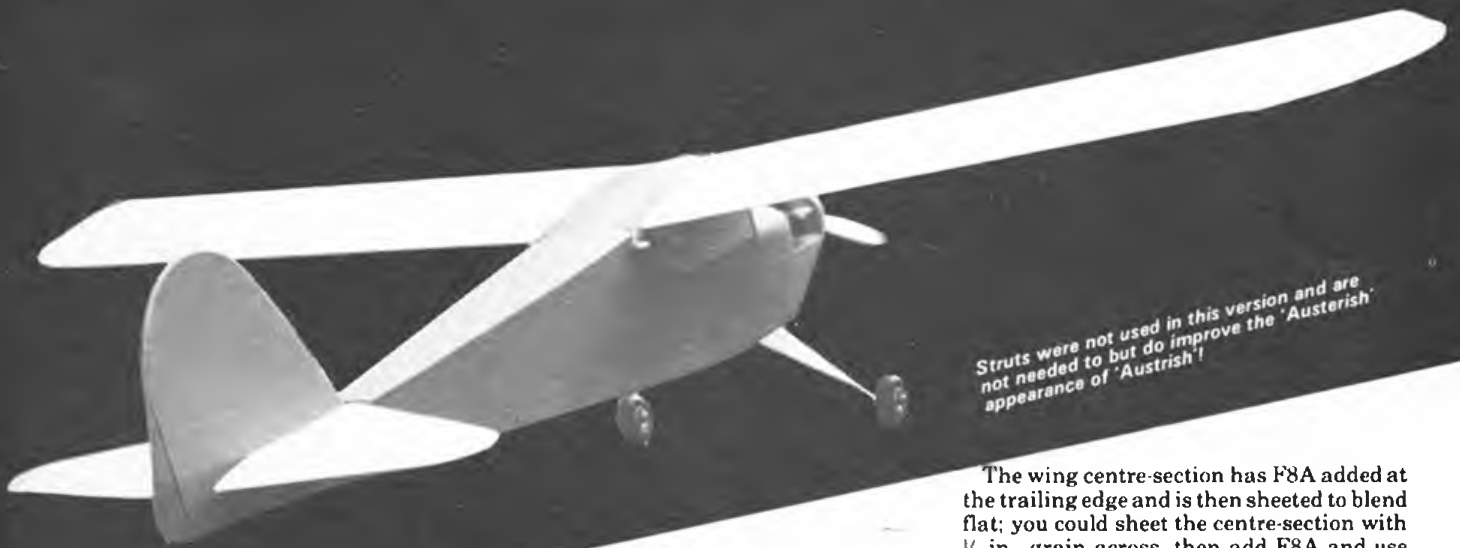
Check that each is square to the side and leave to set. Now add the second side, checking alignment at the tail, and again leave to set thoroughly. Then gently draw in the tail ends and add F9 to F11; cement the tail ends together and pin or clamp lightly till dry. Fit the softish $\frac{1}{8}$ in. \times $\frac{3}{16}$ in. spine from F8 to F11. Draw in the nose the small amount necessary to fit F2 and hold with rubber bands till set. Note that F2 needs to be slotted to receive engine bearers to suit your engine, but the bearers can be inserted later, using a card template to get them angled correctly. Everything forward of F2

hangs on F2, so that in a bad crash the former will break away, limiting the area of damage.

Clean up the wire areas, bind with thin copper wire and solder the undercarriage. Sheet the top (aft of F8) and the bottom (aft of F2) with short lengths of $\frac{1}{16}$ in., grain across the fuselage. Trace and cut out F1,

mark the thrust line and step off the appropriate bearer spacing. Fit the bearers using a template, then cut and cement the near-triangular $\frac{3}{16}$ in. side panels between F2 and F1. Plank the underside with softish $\frac{3}{16}$ in. or $\frac{1}{4}$ in. strips. The top of the nose is planked with moderately hard $\frac{1}{16}$ in. strips from F1 to F3 (glued to F4). Plank the cabin windshield — it could be acetate sheet but sheet balsa with a painted or Fablon representation of windows etc. is recommended.

Cut the top planking to form a hatch between F1 and F2 which probably need only be slightly less than half the width but will depend on engine and tank access requirements. Small part-formers inside the



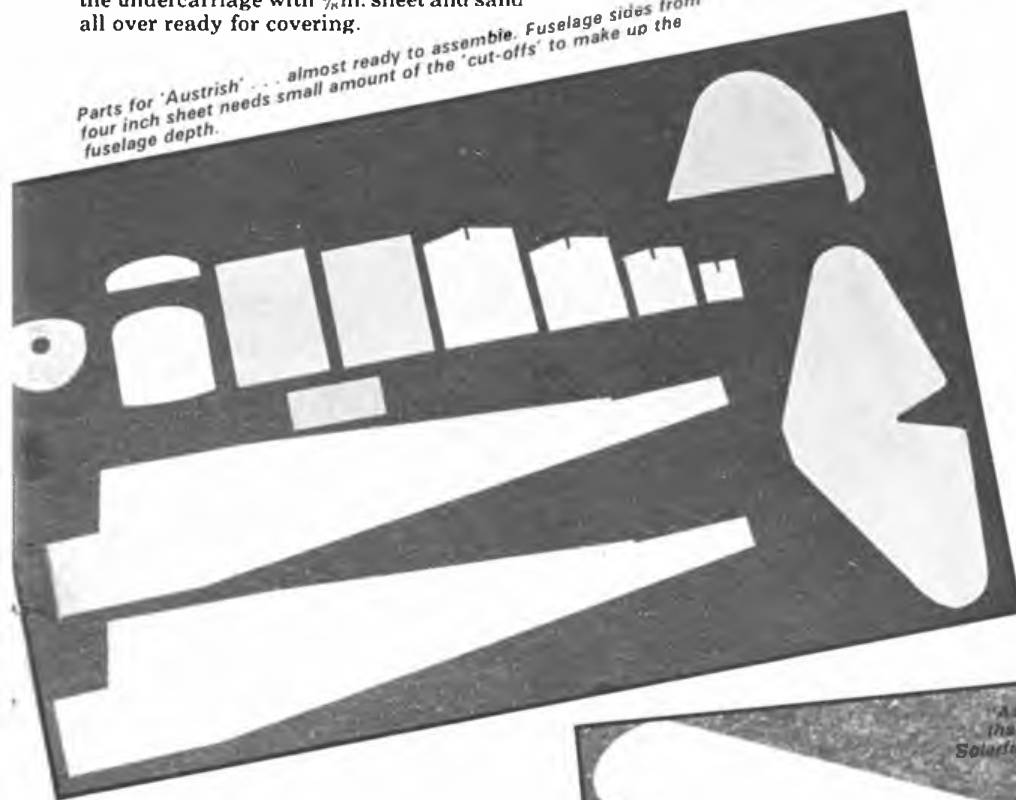
Struts were not used in this version and are not needed to but do improve the 'Austerish' appearance of 'Austrish'!

Wing

planking matching the curves of F1 and F2 are desirable to maintain the hatch shape, and the detachable part can be hinged with tape or Mylar along the upper line. A wire catch to hold it closed against vibration is simple to arrange. Add wing dowels, tailwheel and, if required, epoxy a stub of tube either side for the lower end of the wing struts if fitted. Fill the triangular spaces in the undercarriage with $\frac{1}{8}$ in. sheet and sand all over ready for covering.

This is entirely conventional, but use hard mainspars, spruce if desired, and don't forget to notch the trailing edge for the ribs. The struts are unnecessary for normal flying but add to the appearance of the model. Stubs of brass or plastic tube can be epoxied to the $\frac{1}{16}$ in. panels shown, the panels being flush with the wing under-surface and the tubes projecting on the outside. The balsa struts have wires which just slip into the tubes on the wings and fuselage.

Parts for 'Austrish' . . . almost ready to assemble. Fuselage sides from four inch sheet needs small amount of the 'cut-offs' to make up the fuselage depth.



The wing centre-section has F8A added at the trailing edge and is then sheeted to blend flat; you could sheet the centre-section with $\frac{1}{16}$ in., grain across, then add F8A and use postcard to make the fairing. If this is assembled with the wing held on the fuselage a smooth line should result. Note that there are "windows" to be painted or filmed on top.

Covering

This can be tissue/dope or film and colours can be as you wish. Austers were seen in all colours, but you may like to look up some particular machine (the public library should have something) so that you can follow the general colour(s) and registration lettering. Tissue or film letters and numbers will certainly enhance the appearance. You could also use sand and spinach camouflage, if desired. This is *not* an accurate scale model but can be made to look quite scale-ish!

Flying

For free flight, balance on the mainspar and check glide. Use the rudder shown as a trim tab, with soft iron wires to hold it in place. Use a tweak of right tab and run the motor very rich initially, leaning out as confidence grows. A small tab of aluminium from a milk bottle top can be cemented to the tailplane t.e. to give a little down or up elevator; it is more consistent than warping the tailplane provided it is checked before each flight. Slight right thrust may be desirable with more powerful engines.

If a radio is fitted, the fuselage has a false floor (F5) and a servo can be mounted in a servo clip (athwartship) on this. The battery pack should lodge against F4, wrapped in foam rubber, and the receiver can sit on top of it. A piece of $\frac{1}{8}$ in. sheet cemented across the cabin will prevent battery or Rx interfering with the servo.

Note that if rudder-only lightweight radio is to be fitted, cut-outs are marked on the formers for a push-rod. (Only a very small rudder is necessary, incidentally). The push-rod etc. should be installed before sheeting the fuselage top.

Tail Surfaces

These are simply medium/soft $\frac{1}{8}$ in. balsa and may be cemented to the fuselage before or after covering.

September 1984



'Austerish' prior to test flights - looked much the same after 100 miles. This one covered in Solarfilm.

VINTAGE CORNER WITH ALEX IMRIE

Model Engine Collectors' Association

Keith J. Harris, who is the UK Regional Director of MECA has kindly submitted the following information as an introduction to this very worthwhile group of enthusiasts. It is hoped that this will help to strike a balance between the views currently held by some vintage fliers, who feel that old engines should only be flown and a number of engine collectors who see the ancient motors more as "glass case" objects that should certainly not be hazarded in flight. "The Association was created by an American, Joe Wagner, in 1962, when a newsletter entitled *The Engine Collector* was circulated among a number of enthusiasts with whom he had been corresponding. Edited by Wagner, it ran for only four issues before ceasing publication due to other pressures on his time, but another American, Tim Dannels took over the reins as editor in August 1963, upgrading the publication to a proper magazine, renaming it *Engine Collectors' Journal* and it is still published from Tim's Colorado address today. This journal contains articles on model engines of all types, including technical data, stories of the designers, research, case histories of engine development and names and addresses of original and reproduction parts suppliers.

MECA was organised in October 1963 as an International Group, enthusiastically interested in all aspects of the subject, they produced their own newsletter called *The Bulletin* and used the slogan "Dedicated to the Preservation of Model Engines" which is not dissimilar to the motto adopted by SAM when it was formed some three years later! MECA Areas are known as Regions, there being eleven in the United States, Region 12 is Canada, Region 13, the UK and Region F (for Foreign) encompassing all other countries. Current membership exceeds 2200, Region 13 has at present 30 active members with a number of applicants being processed for 1984 membership. The need to "process" requires explanation: MECA has a code of conduct

Right, No need to tell you what engine is fitted to Brian Hewitt's control-line model which won the "Gold Trophy" at the 1949 British Nationals. Below, George Fuller with his model at Fairlop in 1949 shows what a burst rubber motor will do, note the St Albans club shirt decoration used by the 'Cement Squeezers'!



which states that the member agrees 1) to protect the interests of fellow members, 2) to be fair and honest in all dealings (my word is my bond), 3) to give a 10 day satisfaction guarantee on all sales and trades, and 4) to uphold and practice MECA codes of ethics at all times. To become a member of Region 13 the applicant must satisfy the Director and the membership that he will comply with the rules and should preferably be known to one or more members who will vouch for him and guarantee his dealings! Some people have actually been refused



membership on the grounds that they are known by other members to be "less than fair or honest" in their dealings. It goes without saying that it pays to deal with bona-fide MECA members.

One of the major attractions to join is the receipt of the bi-monthly literature. *The Bulletin* gives information of a similar nature to the *Engine Collectors Journal* which is now a separate commercial venture while the *Swapsheet*, regarded by many as the highlight of the month when it is pushed through the letterbox, contains many adverts by members wishing to sell, trade or acquire model engines, parts, books, kits and magazines. The contents of the advertisements show that even at today's exchange rates, the prices asked are much lower (sometimes half as much) than asking prices of some dealers to be seen at certain model meetings and it is also noted that MECA members are prepared to exchange parts for engines, engines for books, kits or magazines and vice versa. The great benefit to the member is that when the item arrives if it is not up to expectations, there is a ten day period during which it can be returned for complete refund or renegotiation.

MECA heartily endorses the vintage flier's abhorrence of the hoarder, the rackateer who thinks he may get rich by sales of vintage model engines and in particular the minority of unhelpful characters who will not spare time to help others. Many MECA members are also members of SAM, on both sides of the Atlantic, and will observe the codes of conduct laid down by both organisations.

How many types can you identify? Diesel, glow and petrol engines, some of them multi-cylindrical can be seen in this view of part of the Keith Harris collection (see text).



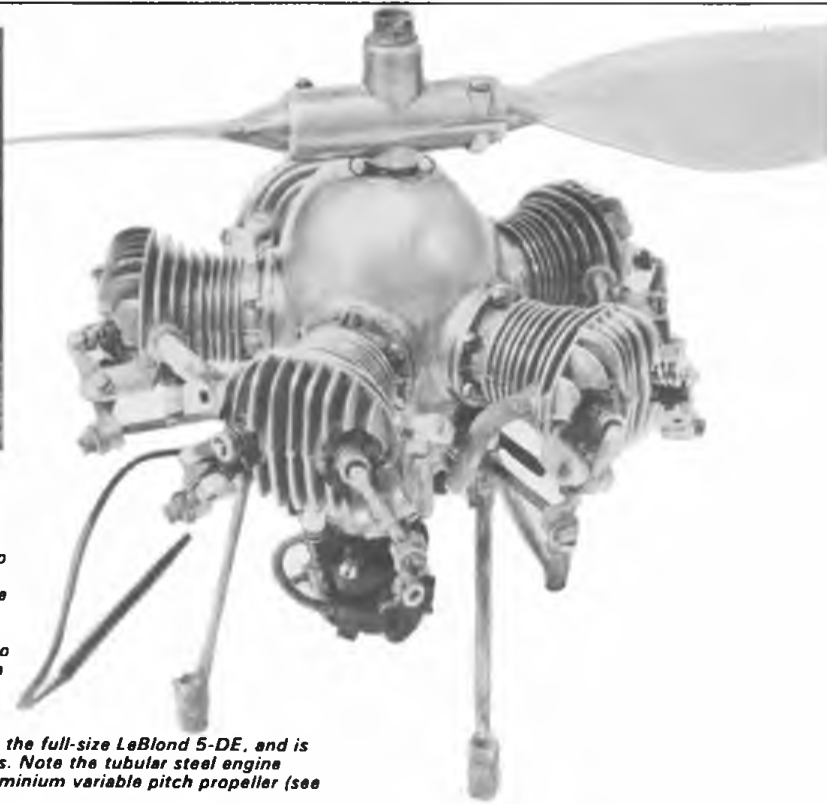
Aeromodeller



Many build and fly model aeroplanes as well as collect engines. Curiously enough, in the UK it was the original *MECA* members who first put their old time engines to use in vintage models in the 1960's and were the first to join *SAM* when that organisation came into being. Many *MECA* members also have machining facilities at their disposal such that if you cannot obtain a particular spare part, asking a member can result in someone being able to make you an accurate reproduction. In the USA *MECA* is regarded as a kindred spirit to *SAM* and one would like to think that the same could apply here in the UK. We are all dedicated to the preservation and promotion of this most interesting era in aeromodelling."

I can personally confirm that *MECA* is one of the most helpful groups that I ever encountered. Over the years I have had many dealings with these friendly enthusiasts and never ceased to be amazed at the trouble they took to be of assistance to me, then an outsider. In this day and age when people generally are less helpful to each other than they were some 30 years ago, it was always a revelation to find that

John M Larsen of Denmark with his two appropriately marked Wakefield models (see text). Right, Multi-cylinder engine collectors often aim to have a Morton M-5 in their collection. This five-cylinder radial produced in the 1940's was based on the full-size LeBlond 5-DE, and is owned by Keith Harris. Note the tubular steel engine mounting and the aluminium variable pitch propeller (see text).



MECA members really did care. What a splendid PR job this attitude performed, needless to say, I am now a member. If this is "your thing" you owe it to yourself to join, send for details including an SA£ to:- Keith J. Harris, *MECA* Region 13 Director, 21 Burns Lane, Warsop, Mansfield, Notts., NG20 0PA.

As mentioned above the *Engine Collectors' Journal* is a separate entity and \$ 10.00 (US) brings you six issues, order direct from *The Model Museum, PO Box 15162, Lakewood, Colorado, 80215, USA.*

Victory and Liberty Wakefields

Early in 1940 John M Larsen of Farum, Denmark was a student and a keen model builder. Being an avid reader of *Model Airplane News*, he digested the articles by C H Grant and when he designed a Wakefield in April 1940 it incorporated certain Americanisms like a single-leg snap-up undercarriage, a folding propeller and as might be expected used a Grant X-8 aerofoil. Presumably this was John's 14th design since it was simply named 'JML-14', it was a success from the start and was capable of good performance. Following the German

occupation of Denmark, it was forbidden to display any names or slogans of a derogatory nature towards the occupation forces and it was in keeping with John's nature that he decided to name his model 'Victory', whether the large white letters of this name were applied to the red fuselage at this time or not is not known but let John tell the story:-

"In 1941 it placed me in the Danish team which should have taken part in the Nordic Champion Competition in Sweden but the team was not allowed to go. In September 1942 'Victory' took part in two Danish National competitions and won the Danish Championship on the second Sunday in September, a fortnight later it won the Championship for Zealand, which was held at Hillerød. At the beginning of 1944 I started building another example, really a 'Victory Mk II', but the Gestapo came into the picture before I could finish it, so I had to leave it on the building board, unfinished. There it remained for a year, until Monty came along with his British Army on 5th May 1945. I was lucky enough to return to my home on the 6th May, although I was in a bad state. As soon as I recovered from a long illness I finished the model and called it 'Liberty'! Thanks to you British people. (What John merely hints at above was a period of concentration camp internment and it was the terrible conditions that he experienced that undermined his health during the 12 month "enforced stay". Ed) In July 1945 we had a Danish team in Stockholm, Sweden, for the first time after the war and I was able to be there with both models.

In August 1946 I joined the International Meeting at Eaton Bay bringing the models along but did not have much luck, I broke my best "Brown-rubber" motor during the test flying and was unfortunately not able to get 'Victory' back into trim after a difficult over-night repair. 'Liberty' was in reserve, but had a motor of German substitute rubber

Vic Dubery, present Chairman of SAM 35 makes a first class ROG in the Weston Cup at RAF Rufforth near York, some 35 years ago.





Jim Fullarton of Victoria, Australia made this replica of his 1935 Wakefield design and tells that it flies just like the original (see text).

called "Buna", so it did not get a real chance, although your take-off picture is among the finest ever made. (See the frontispiece of October 1946 *Aeromodeller* for this splendid action photo, Ed.) A change in the rules meant a new tailplane for 'Liberty', which was flown by proxy in the 1952 World Championships at Stockholm, but originally the two models were identical."

John's two models still exist and he drew the attached working drawings in January 1976, copies of which have found their way to places as far apart as Japan, USA, Sweden and UK. This has resulted in the appearance of several replicas, the best known one here being the excellent example made by Peter Michel, the SAM 35 Membership Secretary, photos of which have appeared in previous Vintage Corners (September 1981 and 1982).

A Pioneer's Replica

Jim Fullarton of Victoria, Australia has been an active aeromodeller for over 50 years and it is most fitting that he contributes regular articles to the vintage column in Australia's *Airborne* model magazine called "For Old Timer Sake". In a recent letter he tells us about his 1935 Wakefield model and the replica that he made last year.

"My 1935 Wakefield model won our eliminations in that year with a best time of 15 minutes 28 seconds OOS (No D/Ts or maximums then). This time stood as an Australian record for 4oz. models and is recorded in the 1937 *Zaic Yearbook*. Plans were published at the time by the late Norman Lyons and fortunately I have retained a copy.

My main design aim was to obtain a good power/weight ratio and as I then had no knowledge of rubber tensioners, I opted for a 40 inch long fuselage, thus putting it right in your "Flying Whale" class. In the event, this vast fuselage paid off, as the second man, H J McKay had a time of 10 minutes and I am sure that the extra visibility of my model gave it the winning margin. The replica seems to perform very much as I remember the original, with a still air time of around two minutes. Power flight is quite impressive but the glide is another matter and illustrates what a big improvement was made with the introduction of folding propellers a few years later.

The original was sent to England in a team of six to be flown by proxy and as far as

I can recollect, it placed fifth, the event being won by Gordon Light of the USA. However, I have nothing to confirm this and if any of your old time readers could assist, I would be more than pleased to hear from them. Another of our team to place well up, was Milton Boss, who had the second best individual time of the day with a flight of 3 minutes 23 seconds. Plans of his model were published (without acknowledgement, I am afraid) in *Newnes Practical Mechanics* for November 1935. To save return freight, the models were left in England after the contest, money being scarce in those days."

It appears that full details of this

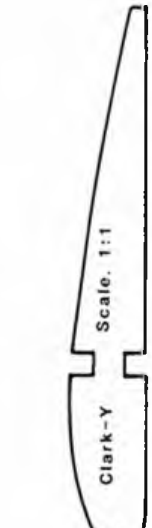
competition were never published, although one would have thought that SMAE records for the event would have been preserved, apparently this is not so. In searching for information over the years the only account of the 1935 Wakefield in any detail that I have found was the article by Harry York that appeared in the old John Hamilton magazine *Wings* for September 1935 from which the following notes have been taken.

Jim's model was proxy flown by L Walker and apparently it did not place in the first six. Fifth place man was H Milton whose best flight is given as 3 minutes 33.5 seconds proxy flown by S R Crow. Maybe Jim will be able to tell us whether Milton was this entrant's first or second name? The *Practical Mechanics*' article that he mentions does not help since the model is merely known as the 'Milton Special'. As regards the lack of acknowledgement in *Practical Mechanics* this was that magazine's usual "modus operandi" and material was culled from every available source without any acknowledgement or recognition!

I have sent Jim a copy of the *Wings* article but more information is needed especially photographs, the loan of which would be of great assistance in trying to put the 1935 Wakefield into the history books in the detail that it fully warrants. Jim's address is 17 Ian's Grove, Lower Templestowe 3107, Victoria, Australia, while the writer can be contact via the *Aeromodeller* Offices. Any material loaned will be carefully handled and returned after use.



Arne Ellila from Helsinki won the 1949 Wakefield International Trophy Contest at Cranfield with his twin return geared slabsider, a 10 year old design that he could trim perfectly for any sort of weather conditions.



Make 19 ribs from 0,8mm medium balsa & 2 endribs, from 3mm. hard balsa.

Wingmount: 2 each, 3mm. Balsa.

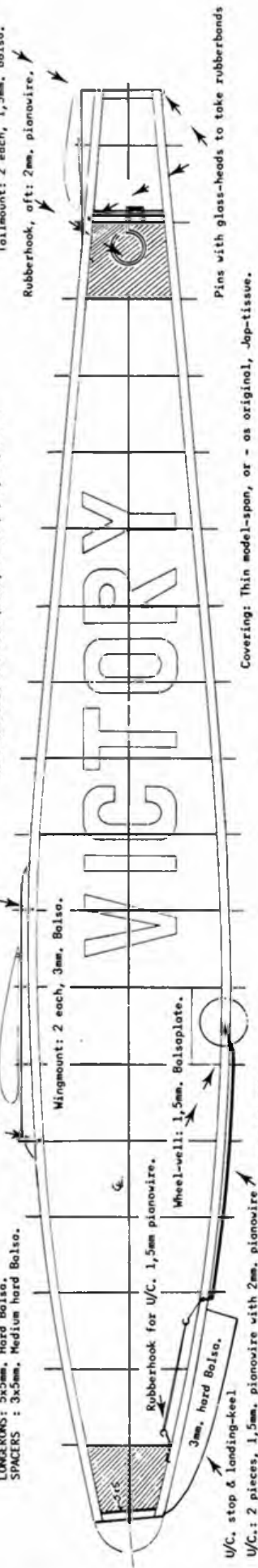
Nome-letters: Cut from plain, white paper, doped-on.

Grant-X-8 Scale: 1:1

Make 31 ribs from 1mm. medium balsa, reinforce with 1mm. balsa - as shown.

FUSELAGE : 5x5mm. Hard Balsa.
LONGERONS : 3x5mm. Medium hard Balsa.
SPACERS : 3x5mm. Medium hard Balsa.

Pins with glass-heads to take rubberbands.



Pins with glass-heads to take rubberbands.

Covering: Thin model-span, or - as original, Jap-tissue.

Fuselage length: 93,7cm.

Half Wingspan: 62cm.

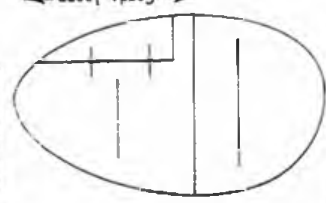
L/E.: 5x5mm. Hard Balsa
MAINSPPARS: 3x5mm.
T/E.: 3x10mm.
WINGRIBS : 1mm. Medium hard Balsa.

Trimtop: Right fin only.

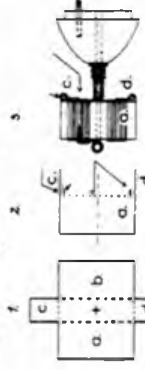
Tailplane: Full-span, 50cm.

TAILPLANE: L/E.: 3x3mm. Hard Balsa. MAINSPARS: 3x3mm. Hard Balsa. T/E.: 3x10mm. Hard Balsa. RIBS: 0,8mm. Medium Balsa.

Frame with 1mm. plywood to take noseblock.



Prop-block: Hard- to medium Balsa. Propshaft: 2mm. pionovire.



Prop-system.

1. Make 1. plate from 0,8mm. tinned ironplate (Mustard-box) - according to template.
2. Drill 2mm. hole in plate center.
3. Bend lap a. & b. 90° and glue to propshaft with balsa cement.
4. Bend lap c. & d. in right angles and place 2 pieces, 1mm. brass tube in corners and solder. Fold around tubes, down along the back of hub, and solder again.
5. Pass the propshaft through unit and wrap as shown, with strong cotton thread and glue.
6. Place spring, ballrace & shaft in the 2mm. brass-tubing in the nose-block and form a rubberhook from the free end of shaft, allow spacing for stop-arrangement on back of block.
7. Make two hinges from 1mm. stainless steelwire and pass through tubes in hub, bend ends, and place propblades in right position. Press wire-ends into balsa and glue. When glue is secure, wrap even with cotton thread and glue well.

"VICTORY" WAKEFIELDMODEL
by J.M.LARSEN, DENMARK. ©
DESIGNED 1940

Scale: 1:4

Drawn by: John M. Larsen. Folehaven 11 3520 FARUM. Denmark. in January 1976

FREE FLIGHT SCENE

Dave Hipperson reports

More on Rubber Motors S Hooks, Bobbins and Pegs

If the choice of prop assembly is wide then the varieties of device designed to attach it to the motor are even more varied. We will for simplicity, presume your prop assembly has a wire hook protruding from the rear. Therefore any loop or hook has to have a lug or loop in it that is a snug fit on this prop hook. A machined component would be the best solution but not the simplest and if you are into such sophistication already, you may not need this article. I recommend a wire hook with a small diameter loop bent into one end to engage with the prop hook itself. The motor end of this component can either finish in a bobbin, a double loop or an S configuration.

The 'S' Hook

The 'S' hook (fig. 1) is so named because of its similarity in shape to an S (or to be precise a reverse S) when viewed from the end. This is true of course for a prop assembly which runs off anti-clockwise when viewed from the front. If you are left-handed and carve your props the other way, then the hook too will have to be bent in reverse. The 'S' Shape very effectively controls that annoying habit rubber motors have of climbing up around the hook and the long shank on the illustration also assists the self-centering effect.

The Gray Hook

The other popular hook in current use is the double loop or Gray hook (named after its inventor and at one time mass produced). This unit is very compact (Fig. 2) and cannot come undone accidentally when transferring the wound motor from winder to prop as can the 'S' hook if you are very unlucky. However, the Gray hook does not combat climbing nearly so effectively and I have found it a considerable embarrassment when used in models where a great deal of rubber is being 'shoe horned' into a short fuselage (Vintage Wake). Despite its greater length the classic 'S' hook is recommended for all such models. The Gray hook is quite suitable for modern layout models with comparatively long fuselages. Both types are absolute blighters to bend — if you have trouble don't worry — everyone does!

The Bobbin

The Bobbin (fig. 3) system is very popular with those using pre-tensioned motors as it keeps the ends from unravelling. The bobbin rides in a yoke which simplifies the wire bending and dispenses with any need for neoprene tubing. The motor can then be transferred from winder to prop when wound by passing a thick steel wire (screw-

driver) through the bobbin hole which should be large enough to allow this and the yoke. Also, the bobbin system offers a very large radius to the tight motor thereby reducing the chances of chaffing and the deep sides combat climbing. Once again the small wire loop should be a snug fit on the prop hook and always bent in the direction as shown if using conventional prop rotation. Bend it the wrong way and it will be forced undone by the torque of the motor while you are holding the prop!

Pegs

Rear pegs should be of as large a diameter as possible to spread the load both on the motor and into the airframe. However, if you insist on a bobbin at the back then of course the peg has to be of sufficiently small diameter to pass through the bobbin! My preference is for a rear peg made from an arrow shaft. This can be either high tensile aluminium alloy or better, glass-fibre. My favourite size is the biggest you are likely to find, about $\frac{3}{16}$ in. diameter. Hollow rear pegs also allow an anchoring shaft to be passed down them for easier attachment to winding jigs and also safer winding when hand-held.

Storage or motors and recording of data

Large motors, that is anything 40gms or over, should be stored individually in sealable bags preferably with 'write-on' panels. Such items are available from *Transatlantic Plastics*. Ventnor, Isle of Wight. The ideal size being 8in. x 5in. With such bags it is possible to list the length of the motor, its weight, rubber type and of course its history. Recording of turns achieved and numbers of times used for any motor is best not carried to excess. However, it is invaluable to record every wind up so that you know how well used the motor is and thus how likely it is to shed strands at what could be an awkward moment — like a fly-off. To know the maximum number of turns ever reached is also useful gen but it is pointless to detail flight information.

As you get down to the smaller size, briefer notes are acceptable. Coupe motors in particular have a very short life expectancy and lower cost, so therefore data is minimal. I usually know how long they are and what type of rubber... then I wind to destruction! If they don't fall apart on the second wind-up then you are not winding them up enough!

When not in use all new rubber and made-up motors should be stored with like types together in large fairly airtight tins and in as cold and dark a place as possible. I know one modeller who has bought a special fridge which he keeps in his garage for his rubber, film and cyano.

Number of turns possible

The maximum number of turns possible on any motor is proportional to its aspect ratio. That is to say, long thin motors take more turns than short fat ones. In the days when rubber was of a consistent cross-



The all too familiar figure of Russell Peers with Woodpecker 12 (plans overleaf) about to win yet another Open event.

section and we could confidently talk in numbers of strands then the rules of thumb was that a 16 strand motor of $\frac{1}{4}$ in. x $\frac{1}{2}$ in. would take somewhere near 20 turns per inch. Obviously it's not so easy now. I have the following data (Table 1) on which you can base your own calculations and approximations, remembering that these figures apply for *Pirelli* of various types. *FAI Supplies* rubber would probably be happier with at least 10% less turns in each case. The only criteria here are weight of rubber and length of made up motor. The third column represents the absolute maximum the fourth column the figure I would normally wind to.

motor weight	made up length	max turns	DH winds to:
10gm	12in.	420	380 - 400
40gm	22in.	480	450
60gm	40in.	1150	950
100gm	40in.	750	700
100gm	44in.	1000	950
130gm	56in.	1100	1000

It will not be noticed from Table 1 that I tend to thrash Wakefield 40 gram motors above all else. If you have ever flown that class you will know why. The theoretical maximum for the 60 gram open motors is never attempted as these motors are used in small open models designed only to make the flights on the day (and prior to the fly-off!) which *should* be a formality.

If you wish to make your own calculations from scratch you can do so with the Nomogram (Fig. 4). This is a reprint from *Aeromodeller* Sept. 1966 and with it went a most useful article — worth looking up. Remember however the *actual* cross-section of your strip must be known before you can use this. Don't assume $\frac{1}{4}$ x $\frac{1}{2}$ in. because it is certain to be almost anything *but*.

Fig. 1

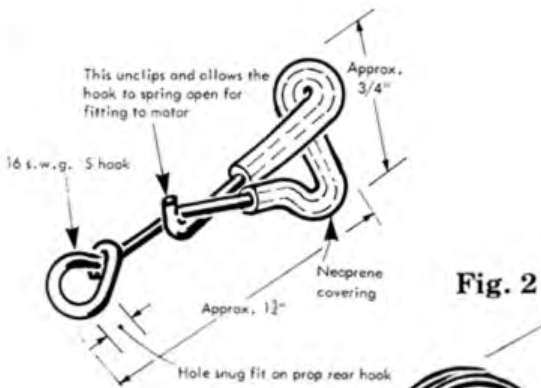


Fig. 2

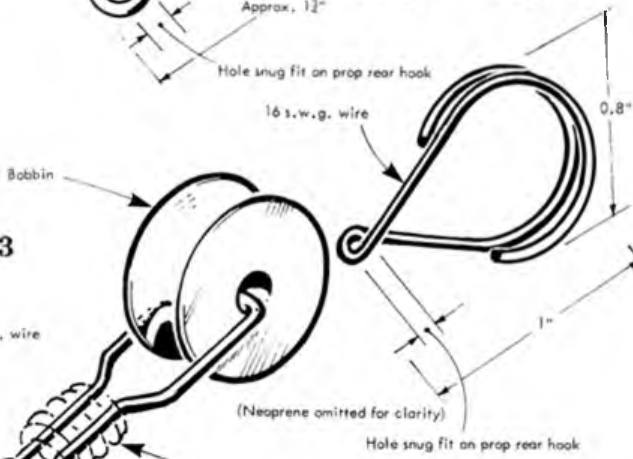
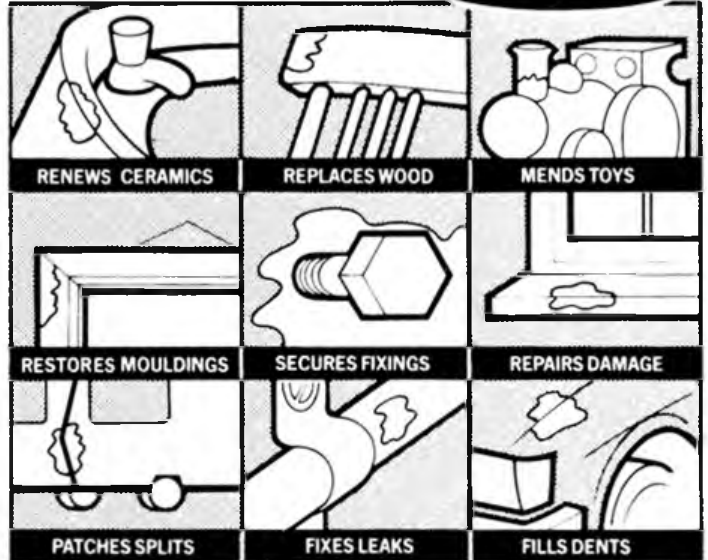


Fig. 3



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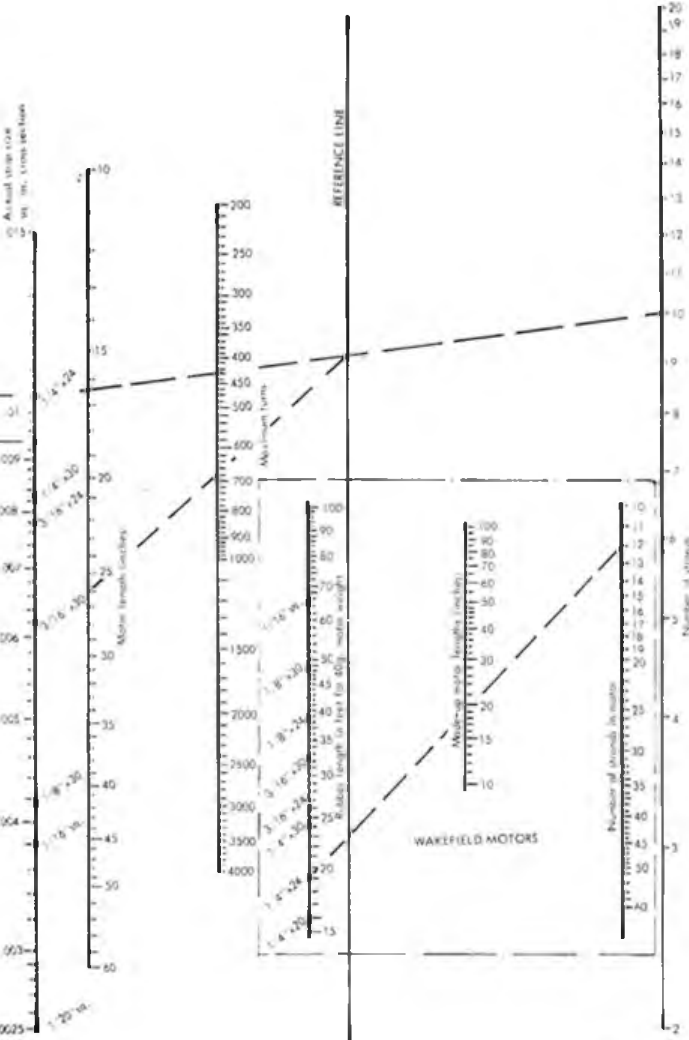
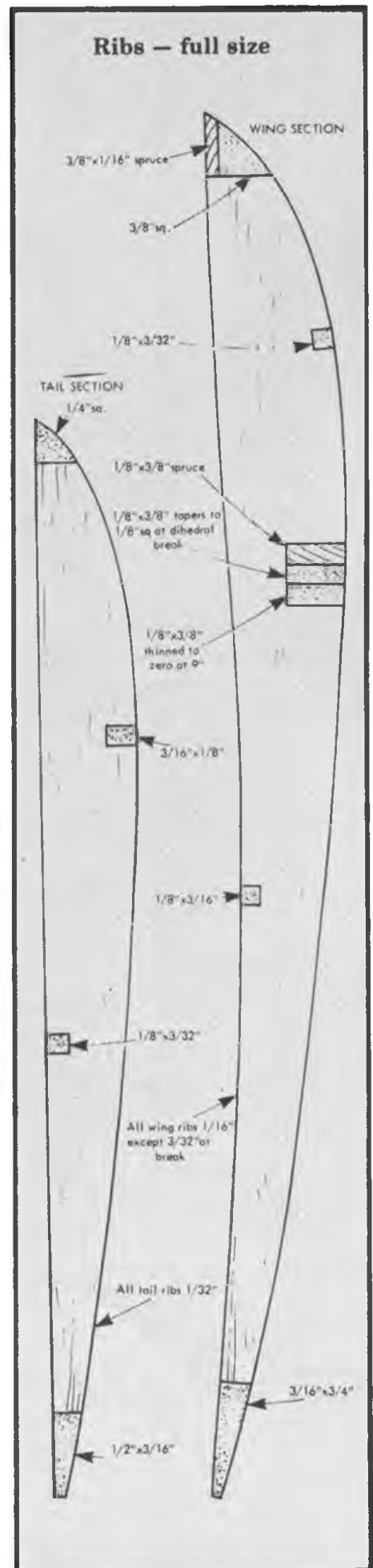
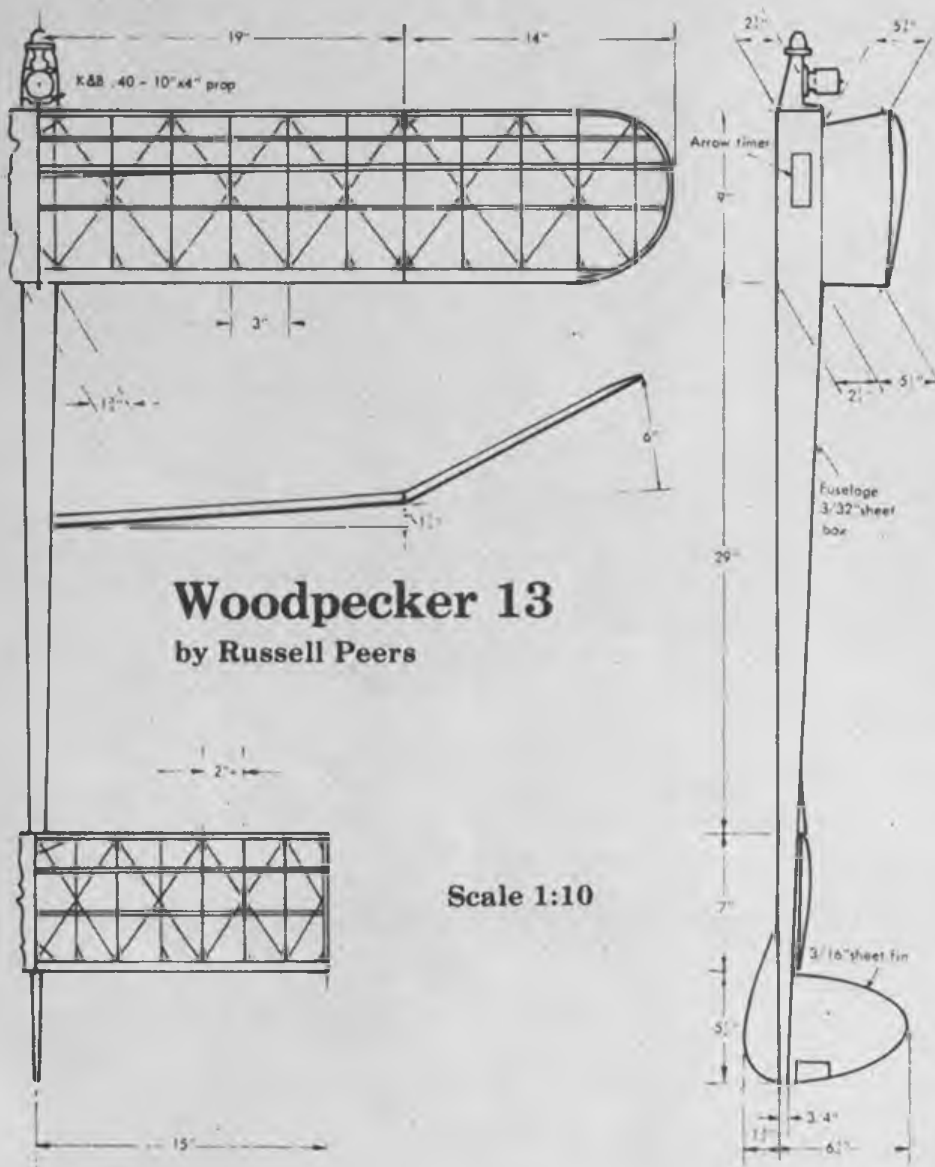


Fig. 4



Woodpecker 13 by Russell Peers

Mike Gaster was the first person I remember expounding the theory that contest models were built at least a year before they were required and left to cure. He believed the structures would settle and lessen the chance of annoying trim changes later. I had been contest flying a mere few months when he told me this and a year seemed a long time . . . I thought he must be exaggerating but he wasn't — it works. I rarely fly a model in a contest until it is at least a year old.

Russell Peers' case here may be a little extreme however. This Mk 13 "Woodpecker" was built in 1976 and remained unflown until July '83! He insisted that this was nothing to do with the superstitious Mk number but rather than it had been built with a slightly non-standard and fatter than usual fuselage and was therefore

frequently passed over when out trimming. The seven years curing could well be responsible however for its extraordinary consistency since its trimming. When this model is used for making contest flights — consistency is the keyword. Since its trimming it has been flown in 10 contests and recorded a perfect compliment of 30 maxes in conditions ranging from flat calm to the 30 mph gale at last years Northern Gala. You can't improve on that. It is the model that has contributed most to Russell's current high standing in the Championship table.

The K&B 40 is run on 45% nitro and a 10×4 prop. The Arrow timer operates auto-rudder, VIT, prop brake and flood off in the usual sequence. It usually executes one complete turn in the course of its near vertical power spiral and the glide is capable of looking after itself, often sniffing out lift on the rare occasions when Russell doesn't actually launch it into a thermal!

FROM THE HANDLE

CONTROL LINE NEWS

Racing with Jim Woodside

Comment

Some years back our Control-line committee formulated a neat system for the running of centralised meetings. Those fliers who had won selection for the Euro/World Championships would stand down to run a contest in their discipline. In return for this "sacrifice" an automatic invitation was given to the next selection trials.

However the meetings run by the SMAE have seen two degenerations: a) the organisers designated to run F2C have been saddled with *all* the scheduled events and b) the organisers have flown in the event. The result has been that the meetings, particularly the Hullavington one where only one circle was in use for most of the day, have dragged on until early evening. I would like to suggest two simple changes — more correctly returns to the old system:

a. team members run one meeting in their discipline; no participation.
b. the other events ($\frac{1}{2}$ A, G.Y. etc.) are put up *on offer*: no organiser means no event. In the case of the domestic events the volunteer organiser could compete.

I am sure that all fliers would welcome more strictly run meetings in adherence to the rule books. After all there are not so many of us now flying competitive C/L. Surely we can do better than of late, where semis have been cancelled and reasonable standards of jurying have not been applied in some events.

Hullavington Centralised Meeting

Two things stay in mind about this contest. First of these is Clarkson-Needham's new heat record in Goodyear of 3:53 and second is Horton-Haworth's unofficial $\frac{1}{2}$ A race in a remarkable 3:37.

The new Goodyear record is a testament to Dave and Ed's refinement on the pressure fed Rossi theme. The intake on the current model is no less than 10mm in diameter — more like a length of drainpipe really. Full details on the model and fuel system appeared in Dave's 'Old Blue Revisted' (AeroModeller Oct '83) and interested readers are referred to this article. On the subject of *Rossis* I noticed that Catlow-Jephcott used a dieselised MKIII in the Three Sisters G.Y. '500' (10th June). Performance was on par with good MKII's so it looks as if the malined latest Rossi does indeed have performance — it just needs coaxing out!

Don Haworth's 1.5 special is another engine with performance quality. In a two-up race John and Don trampled the old record into the ground by some 15 seconds. Sadly though they will have to wait for a three-up race to set an official record. In the final, having passed the half way distance

in 3:33 the record was denied when Dave Clarkson's model collided with John Horton's. Dave's was destroyed but only minor damage was inflicted on the second. So it looks like a 7:06 final's time is possible.

The liner in Don's motor is AAC, being machined from 'Mahle 124'. The piston is made of 'Mahle 244'. This pairing of metals from the famous German piston company is used by a number of the fastest diesels known, including the *FMV* and *Suraev* specials. Unusually for the present style of motors the induction system in the Haworth special is via a *Cox* type reed. Although this obviously reduces internal friction the penalty is that the engine can run backwards unless primed properly. An impressive engine, which at the moment is giving 100 m.p.h. airspeed for 55 laps on 14m lines of .010 and six ccs of fuel.

One area of $\frac{1}{2}$ A racing which is definitely getting better is the availability of good props in pitches to suit higher revving 1.5's. In my opinion the best currently available come from *Visionregal*, who can supply 6 x 6, 6 x 7 and 6 x 8 in either carbon or glass. Both Dave Clarkson and myself have found the 6 x 6 to suit very well the *Sesqui* engine rebuilt with an ABC piston-liner. Laps have not proved problematic on these fine pitches with 45-50 being easily obtained using a 3.2mm carb. For windy days it is worth mentioning the *Graupner* glass-filled nylon 6 x 6 which will give excellent acceleration for the take-off at the cost of some loss in range and speed. It also means that a race can be completed even if a prop is touched on take-off — normally the end for a glass or carbon prop.

The *Graupner* 6 x 6 is about 75p at model shops. *Visionregal*: 21 Rochester Crescent, Hoo Rochester, Kent ME39JH. Glass: £1.25; Carbon: £2.50 plus 50p postage per order.

Results

$\frac{1}{2}$ A T.R.

1 Hill — Metcalfe	S Clams	3 47	8 00
2 Horton — Haworth	Wharfedale	3 37	RTD
3 Clarkson — Needham	Stockport	3 45	RTD

Good Year T.R.

1 Andrews — Horwood	Bristol
2 Clarkson — Needham	Stockport

FAI T.R.

1 Sladdin — Ross	Novos
2 Wilson — Campbell	Novos/Grantham
3 Grey — Haycock	Feltham

Aero Modellers visit China

It is said that travel broadens the mind and in this sense I am grateful to my hobby for providing the stimulus to visit many foreign places. However I cannot match the journey undertaken by a group of Italians and French control-line enthusiasts to the Chinese People's Republic. I vividly remember first seeing the Chinese team at the 1980 Championships in Poland. Their excellent results in aerobatics came as something of a surprise — clearly the stunt team would have to be taken seriously. In order to improve their competitiveness in racing and speed some notable European fliers were invited to not only compete but also pass on the benefit of their long experience. The whole affair seems to have been a great success — so much so that it is likely to be repeated again this year. Now if some far flung country would like to have a visiting T.R. enthusiast . . .

Nelson Competition Engines

Change of Address: To accommodate not only a growing business but also a growing family, Henry has moved to new premises. All correspondence should now be directed to: *Nelson Competition Engines*, RD 2 Box 233, Ramsey Road, Zelenople, PA 16063, USA. Shop phone no.: (412) - 538 - 5282.

From the International C/L contest, Salzburg, Austria. Top is the winning model in stunt by Dr. Geza Egevary powered by a ST46. Below are two engines seen in the stunt circle. Left, a home-built 50 by Avi Messinger of Vienna and right a Saito 40 four-stroke used by Eric Jansen. Photos by Claus Maikis.



SHOP TALK

NEW MODEL HOBBY PRODUCTS REVIEWED

Sparking in the 80's

Electronic ignition has been around for some time in the automobile industry, now you can reap the benefits of modern technology for model aircraft engines too. *World Electronics* have introduced such a system compatible with all *Supre Tigre* engines. Conversion to spark ignition could well be considered in a number of cases, running costs are reduced and spark ignition can give a greater flexibility in throttle control especially at the lower end of the r.p.m. range. Spark ignition units are also available from *World Electronics* for other engines (phone Watford 42859 to check on your conversion). The system has been designed by Peter Valentine and utilises a Hall Effect transistor (a device that detects changes in magnetic fields) in place of the conventional contact breaker. For £35.00 for the *Supre Tigre* system, you get a pretty comprehensive bag of bits including ready built electronics package, ignition coil, magnetic coupled rotor, complete wiring harness, sparking plug and full installation instructions. The unit is supplied for use on other engines less the *Supre Tigre* specific parts at £30.00. *World Electronics*, Unit 10, Paramount Estate, Sandown Road, Watford, Herts WD2 4NV.

Super de luxe pins . . .

Have you ever had one of those glass headed modelling pins break and end up with half a glass bead surgically implanted in your thumb? Fortunately it happens very rarely but . . . *The Balsa Cabin* have recently acquired some super modelling pins of a slightly different design which are worth investigating — be warned, they are not cheap at £2.30 a box of 50. The plastic heads are pretty massive compared to the normal types but because of their size they are easy to handle (will also suit the vintage flyer of extreme age and failing eyesight!) The pins themselves give the impression of very good quality and have very fine, sharp points. Altogether to

be recommended once you can equate £2.30 for a box of pins.

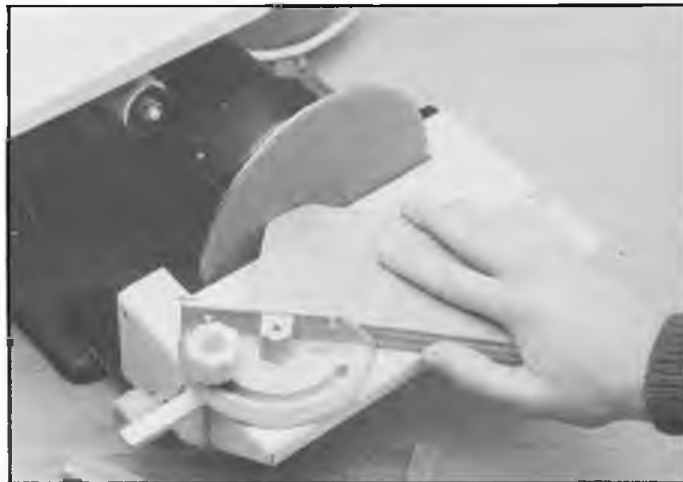
The Balsa Cabin also have another goody (cheap this time!) hidden away in their present price list — *Swann-Morton Disposable Scalpels* at 22p complete with either a number 10a or 11 blade. Presumably they are listed as disposable because they are made of plastic but the blades are replaceable so . . . *The Balsa Cabin* also sells the blades at a very reasonable 30p for five. Postage and packing of 50p adds to the price so why not buy two — they really are good value.

A bag of peanuts

Walt Mooney, well known as an original American peanut has put together a baker's dozen of his peanut scale model plans together with a couple of all sheet designs. They come complete with building instructions for two of the models (from which you should be able to infer how to build the rest of the batch). In this country a baker's dozen is 13 . . . in Walt's bag we count 14 scale models plus the two sheet jobs! They always say America is *big* in every way . . . Just to whet your appetite, the selection includes: the *Meyers O.T.W.* (Out To Win), *Fokker V-23*, 1930 *Laird LC-DE 'Speedwing Junior'*, *Piper P.A.15 'Vagabond'*, *Andreason BA-4B, DH-6* and the *Druine 'Turbulent'*. One of the sheet/block plans is for a 680mm wingspan *Slingsby T51 'Dart'*. When one considers the price of any plans today, this little lot at £3.99 plus 75p postage/packing has got to be worth a second look. Bag of Peanuts is available from *SAMS*, 2 The Drive, Blackmore End, Wheathampstead, Herts.

Saw, fret, sand . . .

There are many tools that we would like to have in our workshops, some need a bit of saving to get but once we start using them we realise that it was worth the effort. *Burgess Power Tools* bandsaws are such tools.



BK3 Bandsaw costs £118.65; *BK3 Plus* (with fretwork/jigsaw attachment) is £136.91 (both plus V.A.T.) and should be available from department stores, DIY shops, etc. The disc sanding attachment including worktable, backing plate, two discs and all necessary fixtures and fittings will cost around £20 and will be available from September.



They have been on the market for some time but the new upgraded *BK3* bandsaw with a newly developed fractional horsepower motor means that this version can sustain a significantly higher workload. What is even nicer is that *Burgess* have developed a disc sanding attachment together with an adjustable worktable to run off the *BK3*. Disc sanders are very useful items — shape 20 odd ribs at once, produce hardwood templates for forming laminated wing tips with ease — definitely a plus on the workbench.

Powermax bites back . . .

Thought to be extinct, the *Powermax Shark CO₂* motor (circa 1979) has again been sighted in British waters! Although stocks seemed to dry up for some while, it is our pleasure (wellikeCO₂) to report that three versions of the *Powermax CO₂* motors are again available: the *PMS1 Single Cylinder Engine* at £9.95, *PMS4 Twin Tank* version at £10.50 and the *PMS5 Twin Cylinder Engine* at £25.00. Get them from either your local model shop or direct from *Powermax*, Millett Street, Bury, Lancs BL9 0JA.



Above, the *Powermax PMS4* twin tank CO₂ motor. Right, keep a sharp lookout for these useful items from *The Balsa Cabin* - cheap scalpel . . . pricey pins!

Aeromodeller

Going Solo

Part 6
Rubber Models
from kits
a practical approach for the beginner
with Trevor Faulkner

D.P.R. Hyper Club

In this instalment we shall examine the factors involved in the assembly of a kit model of the type likely to be attractive to beginners (or to gift-buying relatives!).

By following the stages described in the instructions and making some constructive (we hope!) comments, the article will double as a Kit Review. It should serve to help modellers with the simpler type of kit to solve some of the problems which cause confusion.

Just a short historical note. Many years ago a tradition in the model-kit industry was that boxes carried dramatic multi-colour art-work showing the featured prototype in action, (often a dog-fight). Dreams being easier to sell than reality, thousands of kits were sold, almost all of which must have resulted in disappointment for the purchaser when opened and the contents examined.

This criticism cannot be levelled against the presentation of the "Hyper Club". The attractive box shows a colour photograph of the finished model and also lists those extras necessary to make the model look like the version on the lid. An accurate description of the *type* of model, (free-flight sports) is clearly marked on the box-top and descriptive paragraphs of the contents are similarly listed. The fact that the model can be fitted with a *Telco* motor, (and that the

inclusion of a sheet of plastic for laying over the plan to prevent cementing structure to plan.

Instructions: An excellent booklet with clear descriptions in text and photographs begins with the advice to familiarize oneself with methods and sequence of construction prior to beginning assembly. This makes sense no matter what kit or component is concerned. Words are not wasted and it is true to say that every sentence in the DPR booklet matters. I couldn't agree with the statement describing plywood and chipboard as building boards which would 'easily accept pins'. This has not been my experience, although the flatness of chipboard in its thicker versions is a great convenience. (Adding a sheet of insulating board to a sheet of chipboard gives the best of both worlds.)

In the introduction, comment is made regarding the removal of die-cut components from the sheet. In some cases it is possible to use a knife to cut adjacent parts of the parent sheet, (i.e. the waste) so that the required bits become more easily removed. If a section of a marked component is broken off, glue it back immediately. This avoids loss and inconvenience.

"Short grain" is explained in the sketch, (fig. 1) *This always indicates* vulnerable areas.

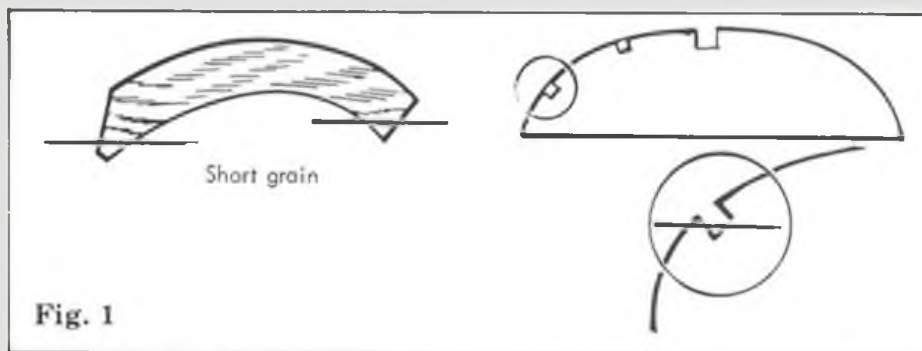


Fig. 1

motor is *not* supplied) is also legibly displayed . . . in other words, anyone bothering to read what has been written should be under no illusions as to what they'll get for their money.

Most kit manufacturers adopt this approach nowadays . . . perhaps the Trade Descriptions Act may have had some bearing on this). This kit is *not* a disappointment. There is quality and thoroughness in packing, materials and descriptive matter. The gearbox, 'triple-accelerating' . . . (three-to-one ratio) is well-made and will probably find a market if sold separately. One very nice touch is the

The note about pre-cementing is well made. However, the amount of cement provided was a little inadequate: it is likely that some builders will run out of adhesive well before the model is finished.

As the wing-joints were all very close, pre-cementing in this instance was very sparingly carried out and may not be necessary particularly in view of the sound advice given later which deals with the doping of the structure before covering.

This process seems to soften the outer skin of the cement fractionally and increase the depth of cement penetration into the balsa around the joint. (One device I have used in

the past was to take a half or two-thirds empty cement tube, open the crimped end and fill it with thinners plus a tiny spot of coloured dope or enamel . . . just enough to tint the thinners. The tube is then re-sealed and allowed to stand. The result is a tube of cement (slightly tinted) which is ideal for pre-cementing and which is 'colour coded' to indicate where it has been used.)

The Fuselage: This is designed along conventional lines but as the technique has not been covered in the "Going Solo" articles, some notes are in order.

First, wood selection. p193, (April) shows how the stiffest strips are chosen from amongst a selection of 36in. pieces. In the "Hyper Cub" kit all the strips are 18in. long and the system doesn't work so well. However, you will by now have a pretty good idea about the relative strengths of strip and a careful flexing of individual pieces will soon lead you to choose the stiffest strips fig. 2. (If you made the balance described in the first article, you could test its sensitivity by weighing the strips one against another. With the balance accurately set up, it is possible to compare them . . . the heavier are usually the stronger.)

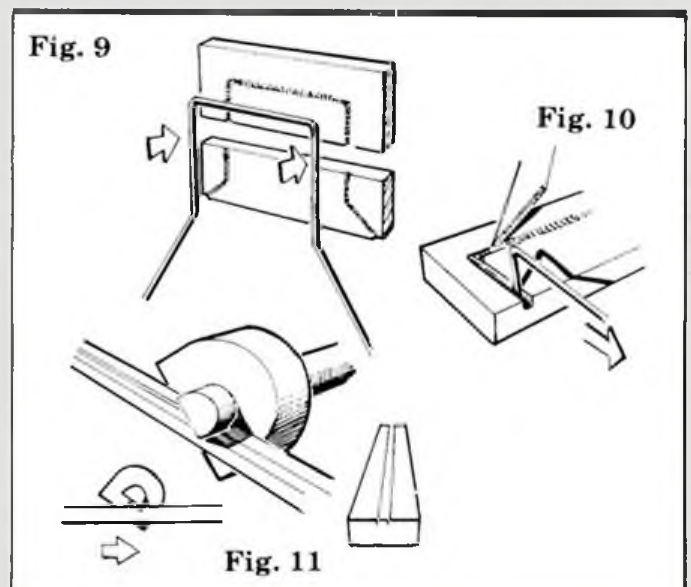
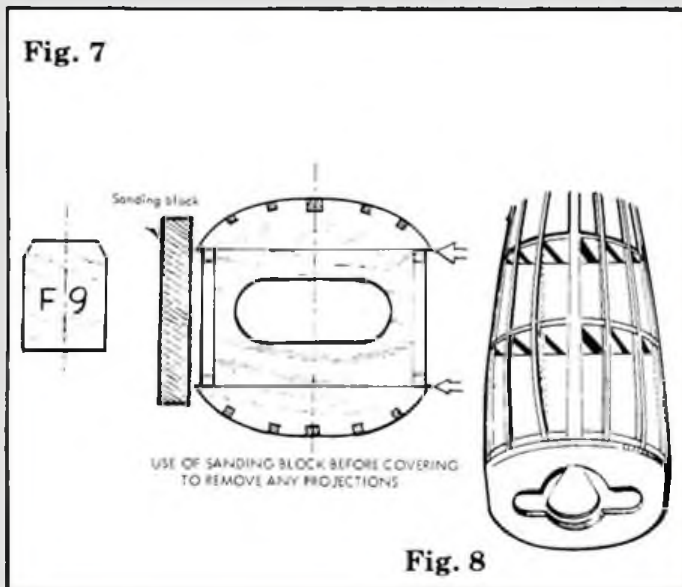
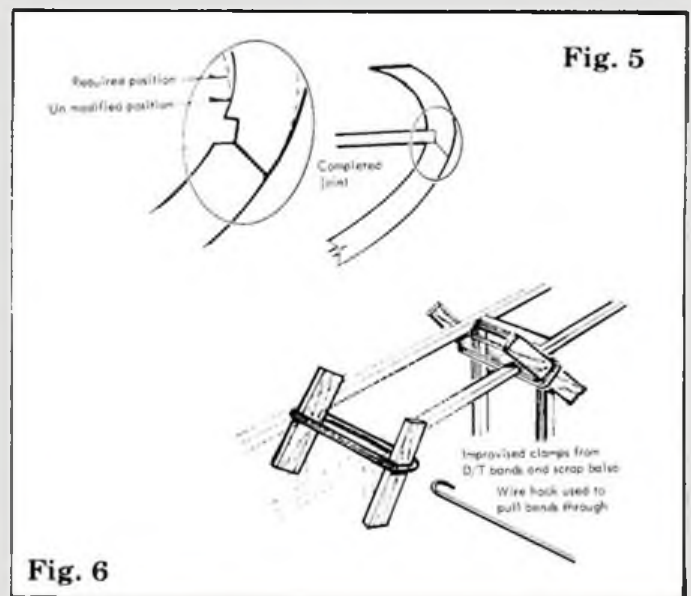
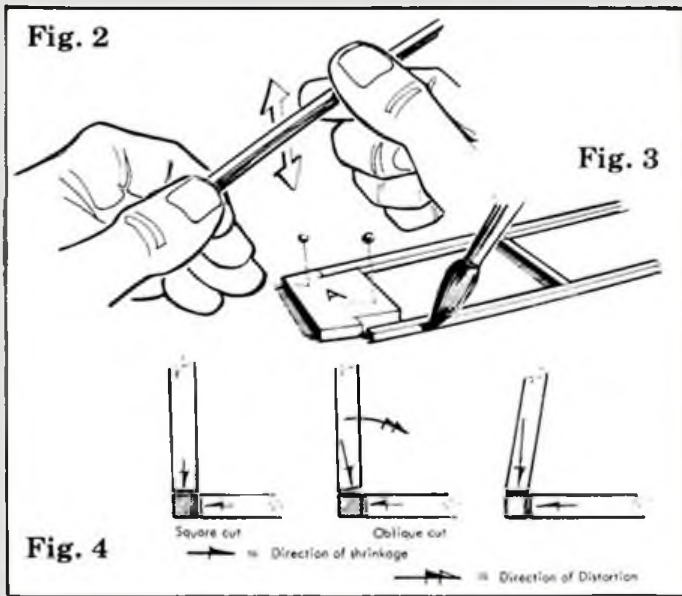
If a plan is creased, iron it flat before taping down onto the building board and covering with the plastic sheet. The next stage is to pin down several of the printed parts. Accurate location is necessary and this may cause a little trouble as the thick outline used in the drawing, whilst making the plan beautifully clear, can worry the intending perfectionist because the parts can be moved a little and yet still remain 'on the line'. The best advice for anyone trying to get the perfect position is to make sure that one's head is *directly over* the area of location. This will assist in getting an even margin of 'surplus outline' to surround the parts. The front of the lower longerons may seem difficult to bend up to meet the nose area sheet 'A'. Damp the outside of the strip with a little water (fig. 3) then carefully ease the strip into place, prior to cementing and pinning. *Don't* get the parts cemented and *then* start trying to force a reluctant longeron into position before the stuff sets. Make sure it will fit *first*.)

The uprights and diagonals should have accurately cut ends. Always cut them on a cutting pad, (a strip of card for example), to avoid damage to the plan. Get into the knack of cutting at 90° . . . perhaps in the early stages you could do worse than cut a strip for each upright about 1/8in. oversize, then examine the end of the cut part. If it's nice and square, cut it to exact length with equal accuracy; if not, at least you'll know

which way your cut is biased and you'll take greater care next time. (This is important where 'shrinking' glues such as balsa cement are being used. Although they are "gap-fillers", and will produce strong joints even where the joint is not perfectly made, the gradual shrinkage of the glue causes it to pull the gapped side closer (fig. 4), so distorting the structure.) Pre-cementing of all the fuselage joints and particularly those of uprights to longerons is *important* if you

have included a piece of suitable abrasive paper in the kit. It would be *advisable* to glue this to a block of scrap hardwood, using contact glue or PVA, for ease of handling. It's a nice thought to include sandpaper but a proper sanding block of perhaps four or more times the area is worth making for this and other building jobs. The advantage of the larger block is that it can overlap the component being sanded and thus avoids snagging and breaking adjacent parts.

The "Hyper Cub" uses three 'master' formers to ensure that the sides of the fuselage are held correctly see also fig. 6. The examples in the review kit were of firm balsa, beautifully die-cut and fitted the completed sides almost like *Lego* components, just clicking into place. Similarly, all the other formers fitted very neatly, resulting in an accurate, strong structure with the minimum of trouble. Former 9 has two small chamfers at its upper side:



want your model to last *and* remain in good condition.

The trick of folding the polythene sheet back to cover the first completed side before the second side is built 'on top' is a simple and elegant solution to a problem most modellers have solved in the past with a carefully-handled razor blade. Thank you, *DPR!*

Tailplane assembly: Here I found that some of the angles of the sheet components were just 'off' so that the parts did not quite line up.

It's better to try a 'dry' assembly of these parts over the plan before cementing. (Fig 5) Sanding the mating surfaces can produce the perfect fit. (Talking of sanding, *DPR*

It was thoughtful of *DPR* to suggest, via the sequence of instructions, that the tail is built after the fuselage. The technique of cutting strip accurately is important in both components but more critical in the stab. As both square and angled cuts have to be made, the practice on the fuselage will have been invaluable.

When the sides of an open-frame fuselage have been completed, the usual procedure is to sand them lightly on both sides before adding any spacers or formers. It is for this job in particular that the above comments regarding a larger sanding block are made. (Of course, if you're a diligent reader of 'Going Solo' you will have set yourself up with such aids by now and be aware of their use.)

fortunately the lettered was printed right way up and this guaranteed that the part would be fitted properly as the chamfers could be easily overlooked due to their small size.

This underlines a general point regarding kits. Any letters or numbers are likely to be printed 'right way up' and should prevent incorrect assembly simply by this convention. However, if the manufacturer has done his bit, don't overlook the need to do yours (fig. 7).

This model has a "real" undercarriage, accurately formed and ready for fitting. The system of holding the wire component is that of sandwiching an inverted U-shape of wire between Former 4 and a block of balsa which has to be grooved. By pressing the

balsa block hard against the wire (held in the correct position) a slight impression of its siting can be seen (fig. 9). This is then developed into a groove by means of cutting carefully at either side of the impressed shape to a depth of about $\frac{1}{16}$ in. and then clearing out the waste. (The end of the undercarriage legs can be used as a primitive form of router to scrape out the gap (fig. 10).) The same technique, more or less, can be used for the groove to match undercarriage fairings to the wire legs. This time the drawing (fig. 11), shows how a marking gauge can be employed, as could a pair of dividers or calipers.

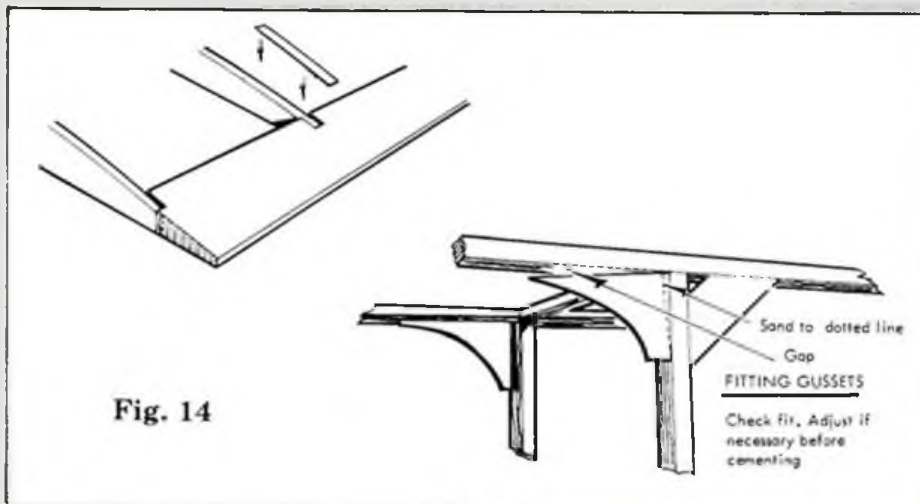
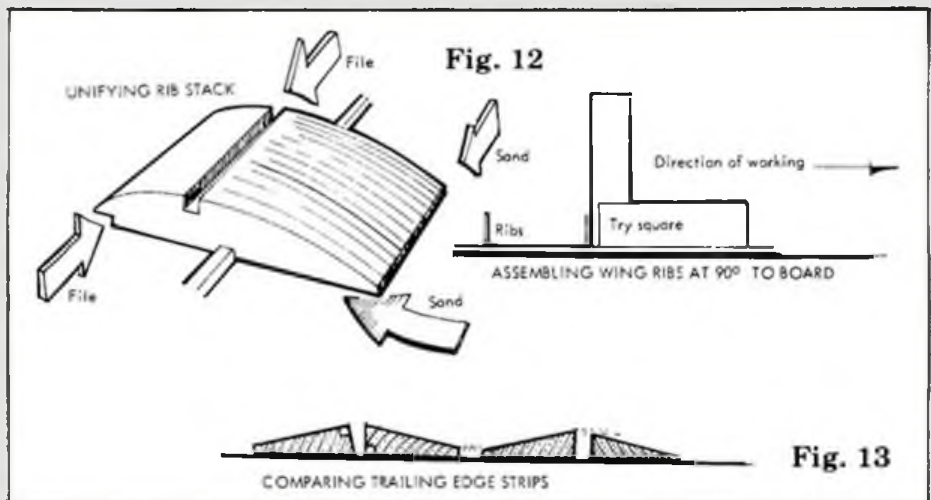
Where a small model, (and in particular scale or semi-scale examples) is being kitted, there will in all probability, be a number of curved surfaces and these are likely to be built up with sub-formers and stringers. These are almost by tradition, $\frac{1}{16}$ in. sq. strips fitting into notches cut into the sub-formers (fig. 8). Occasionally, small corners of the wood next to the notches do not come away cleanly because of the 'short-grain' effect. Don't bother to replace these tiny fragments of wood; in fact, an excellent effect in a completed model often results from the use of stringers lying *on top* of notch-less formers. The other point which has greater significance is the misalignment of stringers, (or more usually, one or two of them) for whatever reason. The way round this is always to try a dry assembly and look very critically at the path each stringer follows. Any sudden diversions are not required and a modification must be cut in the former to allow the stringer to follow a smooth curve without bulges. A couple of the "Hyper

fraction. (This is only a very small amount and frequent checks against a section of spar stock should be made.) With two spar sections in position in the 'eased' slots, the rib undersides were lightly sanded (on a sanding block, resting on a bench or table) and the leading edge recess and trailing edge extremities matched very carefully.

The trailing edge sections need to be notched and it was here that the first real snag was met. The two strips supplied were not identical, one being a sturdier version of the triangular strip. This had to be reduced to match the smaller of the two and a study of fig. 13 is recommended for anyone dealing with pre-formed Trailing-Edge stock whether kitted or bought separately. Again the correct form of sanding-block proved

measure, (literally) and that careful checking *before* assembling should prevent such problems.

Cockpit glazing: The acetate sheet provided is very accurately cut. Its appearance also spoils very easily if subjected to cement blobs and dope splashes! The lower front edge fits over the 'scuttle', an area covered by a paper shape cut from the plan. The advice given is that the acetate should be fitted before covering if plastic film is to be used and *may* be fitted first with tissue covering to follow. If either a plastic covered job or a painted finish are planned, access to the *inside* of the scuttle-dashboard area will be restricted once the windscreen is in place. In addition, the



Cub's" formers needed to have a modification to one notch each, after which the stringers fitted perfectly.

Wing construction will present no difficulties to anyone having built either Solo 1 (built up version) or the last 'Stick' model, Solo 2. The important thing is to ensure that the spars will fit easily, not tightly, into the wing-rib slots. One slight criticism of the review kit was that the ribs were a push-fit on the spars, (admittedly much better than a sloppy fit) and pre-cementing made this push rather more of a shove! It was decided that to get the best results possible from a most attractive kit, the ribs would be 'blocked' (fig. 12) and a small file used to open up the spar slots a

invaluable, (it's impossible to shape strip in a controlled manner if the abrasive is floating around the block or is only 'finger-fast'). As it was, the two trailing edges were eventually matched but a thought crossed the writer's mind that perhaps somewhere out there would be some poor chap who had, as a result of gluing up a 'big' trailing edge, finished with all his ribs recessed below the top surface. (You can imagine how unsightly wrinkles will form in the covering from such a series of 'steps').

Fig. 14 shows how the difference in height between the top of the trailing edge strip and the upper surface of the rib can be made up. A sliver of $\frac{1}{16}$ in. sheet is glued to the rib and sanded flush when dry. It must be emphasised that this is a 'stop-gap'

acetate sheet is not going to stick with cement to film plastic covering material. In this case it would make sense to have the required 'finish' applied to the paper after sticking the acetate into place.

The paper was found to wrinkle a little when doped and to remain so. Otherwise the fit was good, particularly after the corners of the upper front cross brace (next the forward wing dowel) were carefully sanded *round*. (Failure to sand these two corners will prevent a really nice fit being made.)

The strut system is ingenious, (the struts having a purely cosmetic role to play) but the instructions proved rather clearer than the drawing (which goes to show the importance of reading every word in the booklet carefully).

An interesting insight into DPR's understanding of the young modeller is the caution not to fit the rubber motor before covering the "Hyper Cub". The temptation to do this is easily forgotten as one grows older and yet beginners *do* become impatient to see the job complete with motive power unit and perhaps put on a few turns just to see what happens!

Covering: The instruction booklet advises that the 'wet covering' technique is used if the decision has been made to build a lighter version of the "Hyper Cub". The alternative, (plastic film) is described as heavier and although this is not mentioned, it does not have the same effect of stiffening up the structure as will doped tissue.

In the earlier articles, wet covering was referred to and as this model is an ideal subject for this treatment, it seems appropriate to blend both instruction and review.

The material provided appears to be *Modelspan* tissue, or at least a closely related product. It is *wet-strengthened*, that is it retains its strength even when wet and can be handled easily in this condition. The instructions advise cutting tissue panels oversize (1in.), crumpling them up slightly to make a lightly compacted ball and then dunking them in a bowl of water. This works very well and ensure adequate wetting.

The framework of course has been sanded and doped thoroughly prior to covering and will also have been lightly sanded again to remove the effect of 'raised grain', the slight roughness associated with this process. The dope used was the castor-oil dope mixture, preferably *thicker* than the 30/70 dope/thinners mix as we need to have a reasonably substantial film of dope where wet tissue and wood are to meet. The wet tissue is then laid along the component to be covered and gently manoeuvred until the creases have dispersed. "Even but not tight" is the best description. When the tissue has been positioned, one end or edge can be slightly raised and a little of the dope mix introduced between tissue and wood. The same is done at an opposite side or edge, eventually working around the complete panel. The tissue can be smoothed back into place with the finger as work proceeds; this will give a clear indication of how effectively the dope is penetrating the tissue, which in turn shows how likely it is to adhere properly. The surplus tissue can be trimmed after drying.

The surfaces were not pinned down whilst drying. It was found that there were no problems with warps, providing opposite surfaces were covered consecutively (i.e. top surface if the lower was covered first).

As a first attempt, the rudder blade could be covered. If any faults become apparent, it is very easy to remove the used piece of tissue by dissolving the dope adhesive with thinners and then re-covering. The kit provides ample tissue to allow beginner's errors. An equally good alternative would be to cover the top panels of the fuselage aft of the wing seat. In this case, there would be no need to equalize matters by covering the underside because of the strength of this component. It is always a good idea to leave your first wet-covering job to dry, simply so that you know how well (or badly) you've done.

It was found possible to cover the wings in four panels, the upper panels including the tip double-curvature. Admittedly, there was a fair amount of adjusting to be done before doping down the tissue but by dint of careful inching into place, the result was a wrinkle free tip. If it seems difficult to get the tissue laid properly then settle for the upper panel ending at the outer rib. A supplementary piece is then cut and laid on the tip... much easier but not quite so neat.

There may be some confusion when dealing with the front section of the fuselage as reference is made to 'several strips' of tissue. In practice, the tissue is so good natured that a single piece can be used for the windscreen-to-noseblock section and another single piece running from noseblock to stern-post on the underside.

Covering is the process likely to make or mar the model's appearance. Skill increases with practice and there should be no hurry to finish any model by trying to save time spent on covering. As mentioned earlier, if

something goes sadly wrong, remove the offending bit and try again. This is much better than trying to avoid looking at a reminder of something badly done.

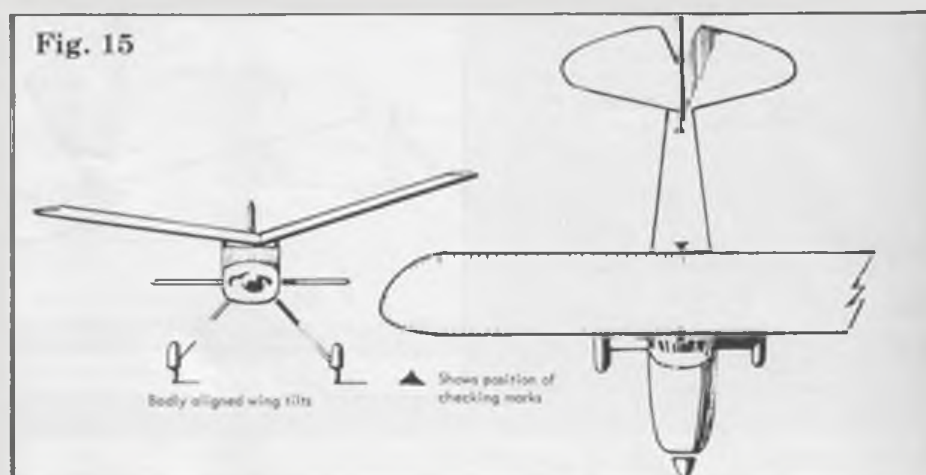
For doping, a 30/70 mix was used, applied very quickly. If you slow down the speed at which your brush travels, dope will start to run through the tissue and hang around inside the component in the form of small pools or even gussets. The effect of this is that dope, being capable of dissolving cement, will gently soften any cement with which it comes into contact. As dope dries by evaporation, the enclosed units of the structure will be filled with a solvent in the form of a heavy vapour. Not only will this be softening the cement joints but it will *delay drying in a specific area*. As this area then remains flexible whilst other areas are drying and shrinking, a situation arises which provides perfect conditions for warps to occur.

time. A small patch, neatly cut out, wet, then doped through will give a strong unobtrusive result.

Second, coloured tissue can be applied in this way to provide decorative trim effects, (just so long as the coloured tissue is wet strengthened). Some of the tissues available from craft shops are attractive but fall apart when damped. They may respond to simply being doped on the original layer but an experiment should be carried out to test the material.

The following can be an effective check on the possible reaction of an 'unknown' tissue.

Fasten a piece of smooth card onto a flat board with masking tape. Give it a coat of clear dope and allow to dry. Cut strips of tissue such as you aim to use and dope them down onto the card. Let them dry and examine the result. If it's satisfactory, then the chances of success are high when applying to the model.



So, when the water-wet tissue has dried, apply your dope fast and evenly. The writer has always found it satisfactory to allow dope to become dry before pinning parts down as the shrinkage continues well after the initial drying and tightening have taken place. On the test model, the initial coat of shrinking dope (30/70 and no castor oil) was followed by a similar thin mix but with castor oil added. At the stage of initial drying, a check for warps was made. If all seems to be in order, the parts can be left flat, weighted where possible to keep them in contact with a level surface.

At this point, a reference to *double covering* is in order. This is a method of doubling the thickness of the tissue used and although there is a weight penalty to be paid, the addition of, say, nose weight is much better done by something which contributes to overall strength. The nose area is ideal for a little extra treatment of this kind as it is likely to need a degree of weight to produce the CG position shown on the plan.

The panel is cut and wetted as before and laid smoothly in place. A coat of thin shrinking dope is then applied to the wet tissue penetrating and bonding it to the first layer. When dry it is very strong and will withstand handling more effectively than a single layer. Of course there is no need to double cover the whole model but the method is worth mention for two reasons other than the increase of strength which results. First, repairing. Small punctures in the tissue are bound to occur from time to

The "Hyper Cub" may be painted but the danger here is that unless the builder is very careful, pigments build up to give a considerable penalty very easily. The model is no lightweight, having a substantial structure. The addition of unnecessary weight is detrimental to performance no matter how stylish the colour scheme. As in many other matters, a sensible compromise is usually the best.

When the model is completed, spend a little time checking out that it fits together consistently. As it is a pretty sturdy machine, its flying speed will be quite high by comparison with the 'Stick Model' in the last issue. Higher airspeeds mean that variations in trim from one flight to another will be more noticeable. Simple checking marks (fig. 15) can be made on fuselage, wing and stabilizer and will help to detect any slight movement of parts which must be corrected before launching.

The flying instructions in the booklet are clear and should help anyone with a little experience, (preferably gained on a simpler model), to get airborne. The review model will be tested and reported on in the next instalment, together with some handy, easy-to-make aids for the single-handed flier.

Two notes of warning. If the rubber motor attempts to "climb" around the motor hook, don't persist with the original but make a revised version from 18g. wire with a larger loop for the rubber whilst keeping the same size for the gearbox hook loop. Second, wind your drill *backwards* to ensure that the prop. rotates in the correct direction.

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Cagebird — continued from page 433.

Assembly

Paper tubes for the wing and undercarriage are cemented (in the positions shown) after the fuselage is covered and should be lined up carefully so they are vertical in both front and side views. Use lengths of wood plugged into the tubes to assist in this. Add the gussets later.

Cement the underfin to the bottom longeron and check line-up. Remove the last spacer on the two bottom sides of the fuselage. Then cut the bottom longeron free at the extreme rear and chamfer, leaving space for the tailplane to be slid into position. Note that fragments of 0.060in.sq. are cemented between the tailplane LE and the side longerons so as to provide some negative incidence. Check for unwanted tail tilt.

The upper fin is adjustable for turn. The LE plugs into a short paper tube stuck to the side of the top longeron — whilst a peg attached to the TE slides sideways in another tube mounted on the top longeron.

Wing posts are made from 1/16in. round balsa, cut to the lengths specified and cemented to the LE and TE. The wing then plugs into the fuselage tubes in the manner characteristic of all indoor duration models. Push the posts into the tubes as far as they will go and measure the distances of LE and TE from the top longeron. There should be 1/8in. difference. Cut down the posts as required.

Now check the line-up and wing warps as deformation is easily produced by posts and tubes being out of parallel. If need be, soften the wing/post joint(s) with acetone or M.E.K., and twist until everything is correct

with the model assembled.

Finally add the biped wing brace to the starboard (right hand) longeron. Mine was simply cemented to the wing LE — but a tube could be provided if the wing is to be removable. The model will fly without this brace — but the wing mount is then very vulnerable in collisions with walls and ceilings!

Rubber

For contests flown under a 25 feet ceiling I have used 19in. or longer loops of orange *Pirelli*. The strip width was a nominal 0.075in. and it checked out at 1.78gm/metre. Best score so far is 2:54 r.o.g., using 2100 less 200 turns on a 24in. motor and with a 12in. pitch propeller. It wasn't quite helical but I doubt if the difference was significant.

For Cardington I would drop the rubber size to 0.055in to 0.060in (say about 1.4gm/m) of more normal *Pirelli*, use about 10in. prop pitch and trim to use the power burst to gain all the height possible.

Trimming

This design is flown in right hand circles like an outdoor model! First check that the incidences are correct and that the top fin is offset about 1/8in to the right. Flying surfaces should be un-warped except for very slight wash-in (more incidence) on both wing tips. This discourages the wings from washing-out and fluttering.

Start with about 1/32in. down and side thrust, either by chamfering the fuselage nose or the more normal use of packing to offset the noseblock. Mark the noseblock to

ensure it is always fitted the same way round!

My model has the CG (balance point) at 55% (i.e. 1 3/8in. aft of the wing LE) when using a 19in. long motor.

For first flights, use low turns with some back-off to eliminate the powerburst, hand launch and *observe* what happens. Aim for a tight circle (say 20 feet diameter) in small halls. If all is well, increase turns and repeat. Adjust as appropriate using all the normal methods!

The motor size (cross section and length) and type of rubber are other variables and will need tailoring to suit model, prop and flying site. The general aim is to have the model land with only a few turns left on the motor. What else is there to say? Keep notes as to what you do — if only to ensure you know which motors you have used — and *always* use a winding tube! Best of luck!

Peanut Duration Rules

- 1) a) Rubber powered monoplanes only.
- b) Wing span 13in. maximum projected. Wing chord 2 1/2in. maximum.
- c) Tail span 7in. maximum. Tail area 14 square inches maximum.
- d) Overall length, including propeller 13in. maximum.
- e) Propeller 6in diameter maximum.
- f) Cross-section of fuselage 2 square inches minimum.
- g) Airframe weight (without rubber) 4gm. minimum.
- h) Two wheel undercarriage required. Flights must r.o.g.
- 2) Best single flight from six attempts.

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We don't have space to tell you all about it here, but be sure to look out for it on September 21st. **Your Model Railway** – simply the best.

Out Fri. Sept. 21st

An Argus Specialist Publication

Your MODEL Railway

NEW



BETTER advice on modelling for the enthusiast with special features for beginners.

MORE information on locos, rolling stock and scenics.





IMPROVED coverage of news and new products.

PLUS far more features and improvements than we can tell you (or our competitors!) about here.

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9 am-12 noon Sat

SOUTHAMPTON Tel (0703) 617849
EASTLEIGH MODEL CENTRE *
2e HIGH STREET, EASTLEIGH
Open 9 am-6 pm.
Closed all day Wed

AVON

BRISTOL Tel (0272) 694541
THE MODEL AIR PORT
134 GLOUCESTER ROAD NORTH,
FILTON *
Open Mon-Sat. 9am to 5pm.

HERTFORDSHIRE

ROYSTON Tel (0763 45375)
MODEL WORKSHOP *
31 KNEESWORTH STREET
SG8 5AB
Open. Tues.-Sat. 9.30 am-6.00 pm
Late night Friday 9.30 am-8.00 pm

BERKSHIRE

WINDSOR Tel (07535) 56321
WINDSOR MODEL SHOP *
45 ALBANY ROAD
Open Mon-Sat. 9 am-6 pm
Late night Fri. 7 pm
Half day Wed 1 pm

HONG KONG

HONG KONG Tel: 3-680507
RADAR CO LTD *
3 OBSERVATORY ROAD
TSIMSHATSUI, KOWLOON
Open 10 am-7 pm. Closed Sundays

CAMBRIDGESHIRE

CAMBRIDGE Tel (0223) 359620
MODEL MANIA *
17 KING STREET
Open 9.30 am-5.30 pm
Mon-Sat Inc Lunchtime

HONG KONG Tel 3-684184
WINNING MODEL & HOBBY
SUPPLIES *
2a AUSTIN AVENUE
KOWLOON, HONG KONG
Open 10 am-7 pm. Closed Sundays

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SALE Tel (061 962) 4561
HOBBYWORLD *
200A MARS LAND ROAD
Mon-Sat 9.30-6.00
Closed all day Wednesday

KENT

BEXLEY Tel (0322) 522308
BEXLEY MODEL CENTRE *
18 BOURNE ROAD
Mon-Sat 9.00-5.30
Thursday closed all day

DEVON

TORBAY Tel (0803) 521767
MANSEL'S MODELS *
PALACE AVENUE PAIGNTON
Open 9.15 am-5.30 pm Mon-Sat
inclusive. Closed all day Wed
Late night Fri 7 pm

TUNBRIDGE WELLS Tel (0892) 36689
E M MODELS *
42 CAMDEN ROAD
Mon-Sat 9 am-5.30 pm
Closed Wed.

DORSET

BOURNEMOUTH Tel (0202) 424038
R F AUSTIN MODEL SHOP *
156 SEABOURNE ROAD
SOUTHBOURNE BH5 2JA
Open 9 am-5.30 pm Mon-Sat
Closed 6pm Thurs. Fri. Half day Wed

LANCASHIRE

FARNWORTH Tel (0204) 74688
JOYCRRAFT *
3 BOLTON ROAD, MOSES GATE
Open Mon-Sat 9 am-6.30 pm
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ESSEX

CHELMSFORD Tel (0245) 352553
CHELMSFORD MODEL CO LTD *
204 MOULSHAM STREET
Mon-Sat 9.00am-5.30pm

LIVERPOOL Tel (051 709) 8039
STAN CATCHPOLES *
MODEL WORLD
85 BOLD STREET
9.30 am-5.30 pm. Six days

HORNCHURCH Tel (040 24) 40016
RADIO ACTIVE *
94 ARDLEIGH GREEN ROAD
Open Mon, Tues., Thurs. & Sat
9 am-6 pm. Fri. 9 am-7 pm
Half day Wednesday

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THE MODEL SHOP *
(MANCHESTER)
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Sat 9 am-5 pm

HAMPSHIRE

FAREHAM Tel (0329) 234136
G M H BUNCE & CO LTD *
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Open 9 am-5.30 pm. Closed Wed

PRESTON Tel (0772) 51243
PRESTON MODEL CENTRE LTD *
(Opposite Polytech)
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NOTTINGHAMSHIRE

NOTTINGHAM Tel (0602) 412211
GEE DEE MODELS LTD *
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OFF GOOSEGATE
Open 9.30 am-5.30 pm
Early closing Thursday

WIGAN Tel (0942) 45683
G FORSHAW & SON *
58 MARKET STREET
Open 9.15 am-5.45 pm
Early Closing Wednesday

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PUNCTILIO MODEL SPOT *
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Mon 9.15 am-7 pm Tues., Wed.,
Thurs 2pm-7pm Fri. 9.15 am-7 pm
Sat 9.15 am-5 pm

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OXFORD Tel (0865) 42407
HOWES OF OXFORD *
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Open 9.00 am-5.15 pm
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LONDON

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WOLVERHAMPTON Tel: (0902) 26709
WOLVERHAMPTON MODELS & HOBBIES *
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Closed Wednesday

HARROW Tel 01-863 9788
THE MODEL SHOP *
190-194 STATION ROAD
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Wednesday 9.30-5.00

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KINGS LYNN Tel: (0553) 62439
BARNEY'S MODEL SHOP *
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PE30 5DA
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Sat. Closed Monday.

NORWICH Tel: (0603) 42515
GALAXY MODELS *
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Open 6 days a week

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DONCASTER Tel (0302)
EVANS MODEL CENTRE 27255
D C EVANS & CO (HOLDINGS) *
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Closed all day Thursday

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SOUTH GLAMORGAN CF1 2BW
9 am-5 30 pm

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AIREDALE MODELS *
156 STATION BRIDGE
BRADFORD ROAD
Mon - Sat 9 30-6 Tues closed
Thur 9 30 am-7 pm

NORTH YORKSHIRE

KNARESBOROUGH Tel (0423)
JH AERO MODELS 866096
57A HIGH ST (above Kitchen Centre)
Mon -Fri 9.30 a.m - 5.30 p.m.
Sat 10.00 a.m - 1.00 p.m.
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WEST MIDLANDS

CRAWLEY Tel (0293) 21921
HEATHER CRAFT *
9 SOUTHGATE PARADE
SOUTHGATE RH10 6ER
Open 9 am-5 30 pm Mon - Sat
Closed all day Wednesday

BIRMINGHAM 10 Tel 021-772
BOB'S MODELS 4917
520 522 COVENTRY ROAD *
SMALL HEATH
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Early closing Wed. 1.30 pm

LEEDS Tel (0532) 646117
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88 CROSSGATES ROAD
CROSSGATES
Mon - Sat 6 am-6 pm
Sun. 8 am-1 pm

* Shops offering a mail
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WILTSHIRE

EAST GRINSTEAD Tel (0342)
SOUTH EASTERN MODELS 21750
5 THE PARADE
LONDON ROAD, FELBRIDGE
Open Mon -Sat 9.30 am-5.30 pm
Closed Wednesdays

MELKSHAM Tel (0225) 703311
MELKSHAM MODELS
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Mon., Tues. and Thurs. 9 a.m.-
5.30 p.m. Wed. closed all day Fri
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General

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Terminal Building, Shoreham Airport,
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Tel: Shoreham by Sea 61616

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Wanted

WANTED:

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Ask to see them at your model shop

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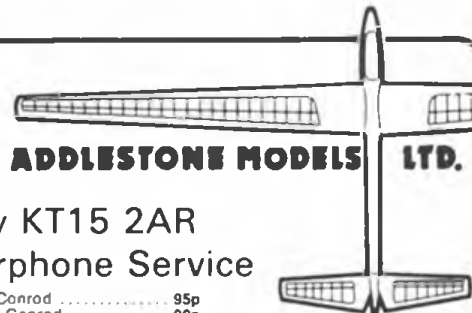
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Balsa wooden props 10"	99p
Balsa Wooden props 12"	£1.15
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CO₂ ENGINES	
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S.E.5a by **J. D. McHard**. Famous WW1 fighter in full detail on specially printed plan with photo illustrations and instructions. Fine and tough performer. Span 27 in. (686mm). Also for R/C. Uses 0.5-0.8 cc motors.
FSP/682 Price £2.75



PZL WILGA 36 by **P. Hayward**. Very stable 1/12th version of the Polish glider tug, this 36 in. (914 mm) span model's high wing and large tail is an ideal Free-Flight layout. Uses 0.5-0.8cc engines.
FSP/1178 Price £2.75



SOPWITH TABLOID by **K. McDonough**. A diminutive 1/12th model, span 25 1/2 in. (648mm). For 3 to .8 cc motors.
FSP/810 Price £3.25



HANDLEY PAGE H.P.42 by **Cpl. S. Newton**. The famous *Hannibal* airliner. Very detailed drawing for this 65 in. (1651mm) span model uses two 0.8-1cc engines.
FSP/615 Price £4.35



D.H. TIGER MOTH by **A/M Staff**. A magnificent 44 in. (1118 mm) span model of one of the best-known aircraft ever. Flies well and realistically. 1/8th scale. For 1-1.5 cc engines.
FSP/656 Price £3.95



SOPWITH CAMEL by **D. M. Collin**. Fine flying, 28 in. (711mm) span version of the WW1 favourite. This 1/12th scale, free flight model is designed for 0.5-0.8 cc engines.
FSP/1143 Price £1.65



BRISTOL BULLDOG by **P. J. Ailnutt**. A 1/12th scale model which uses some spruce and ply in its rib for rib, stringer for stringer construction. Full colourings and markings. Canadian competition winner. Span 33 1/4 in. (857mm). Engines 1-1.5 cc.
FSP/762 Price £3.25



BLACKBURN 1912 MONOPLANE by **A. M. Finucane**. 1/8th scale, 48 in. (1219mm) span, pioneer monoplane; flies as well as its modern counterparts with 0.8-1 cc motor.
FSP/567 Price £3.95



SUPERMARINE SPARROW by **G. F. Elsgood**. 1/12th scale of 1920's light racing aircraft designed by R. J. Mitchell; 34 in. (864mm) span model features scale rib spacing and pendulum rudder/aileron controls. For 0.3-0.5 cc motors.
FSP/1408 Price £1.65



COLONIAL SKIMMER by **E. Fearnley**. For flying scale enthusiasts who want something different. Span 47 in. (1194mm); for 0.75-1 cc engines.
MA/250 Price £2.75



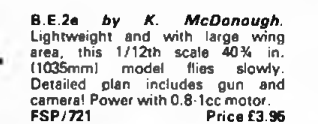
JODEL D9-BEBE by **Hoh Fang-Chiun**. Neat replica of famous French light plane with fixed rudder. Detachable 38 1/2 in. (978mm) span wing, super flyer. 0.5-0.8 cc motors.
FSP/691 Price £2.10



SOPWITH SWALLOW by **John Darnell**. A 1/8th scale version of a little-known 1918 lighter. Span 41 in. (1041mm), it is fine for the beginner scale enthusiast.
FSP/625 Price £3.25



D.H. 80A PUSS MOTH by **J. M. Greenland**. An accurate replica with a scale area tailplane. Excellent performance. Span 30 in. (762mm).
FSR/256 Price £2.10



B.E.2a by **K. McDonough**. Lightweight and with large wing area, this 1/12th scale 40 1/4 in. (1035mm) model flies slowly. Detailed plan includes gun and camera. Power with 0.8-1cc motor.
FSP/721 Price £3.95



FAIRCHILD ARGUS by **E. J. Riding**. Authentic appearance makes this a winner. Span 37 in. (940mm).
FSR/272 Price £2.75



CESSNA 172 By **W. P. Holland**. This 72 in. (1829mm) 1/6th scale model of the popular American light-plane is the answer to those who want an easy-to-build large model for radio conversion. Knock-off wings and shock absorbing trike u/c. For 2.5-3.5cc engines.
FSP/668 Price £3.95



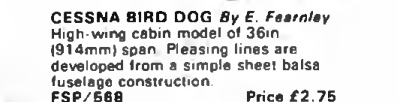
D.H. MOTH MINOR by **G. W. Day**. A handy size, low-wing model, well suited for the beginner. Span 35 in. (889mm).
FSR/168 Price £2.10



P-61D MUSTANG by **C. Chapman**. The famous WW2 American fighter at 26 in. (660mm) span is a faultless performer.
FSR/1441 Price £2.10



CURTISS-WRIGHT JUNIOR By **J. Headley**. Free-flight scale model of an unusual subject. Very stable, powered by 5-1cc engines 48 in. (1219mm) span.
FSP/1043 Price £3.25



CESSNA BIRD DOG By **E. Fearnley**. High-wing cabin model of 36 in. (914mm) span. Pleasing lines are developed from a simple sheet balsa fuselage construction.
FSP/688 Price £2.75



DORNIER 27 by **D. Garrett**. A 27 in. (686mm) span model of modern German light plane. Plans include modifications to take .3-.75 cc engines.
FSR/798 Price £2.10



AUSTER A.O.P.9 By **R. G. Moulton**. 36 in. (914mm) span version with all sheet fuselage and tail assembly simple wings. Flies like the real thing, aerobatics or sport flying with 0.5-0.8cc engines.
FSP/580 Price £2.75

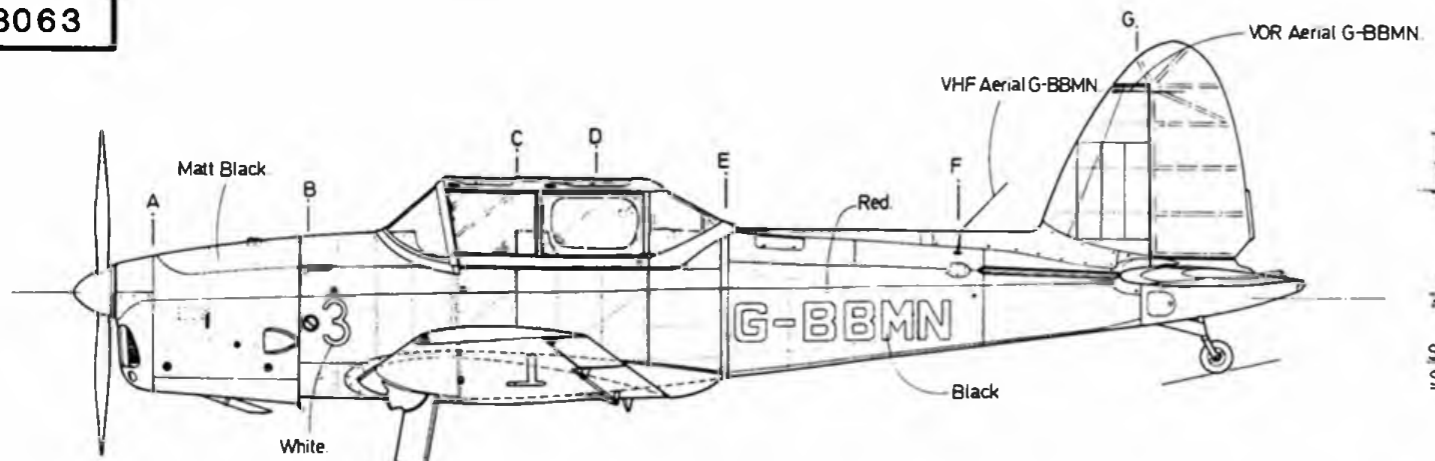
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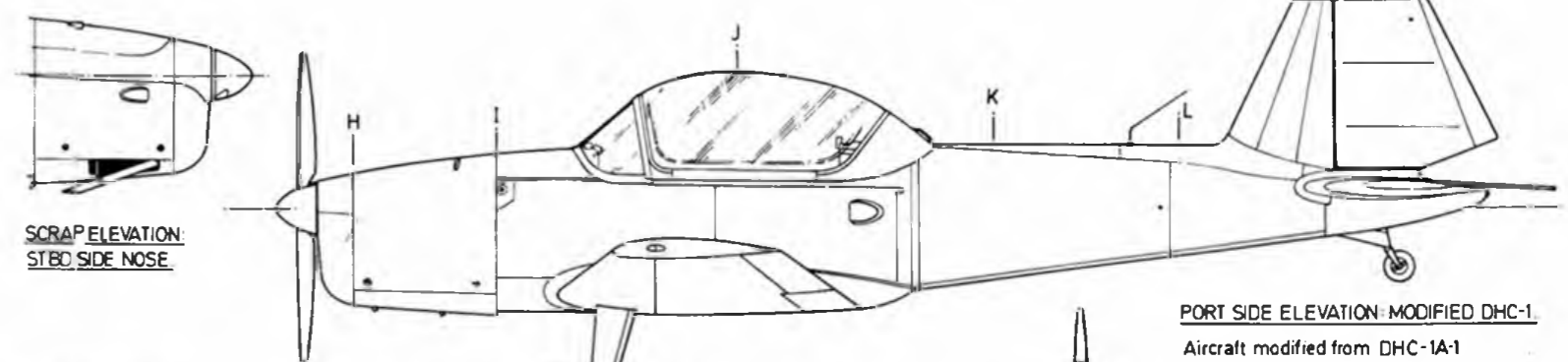
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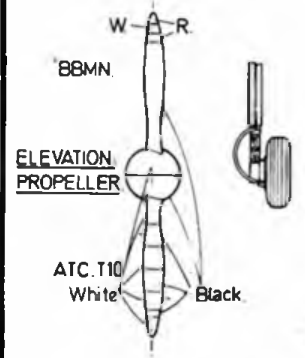


PORT SIDE ELEVATION. (G-BBMN, ex-WD 359)



PORT SIDE ELEVATION: MODIFIED DHC-1

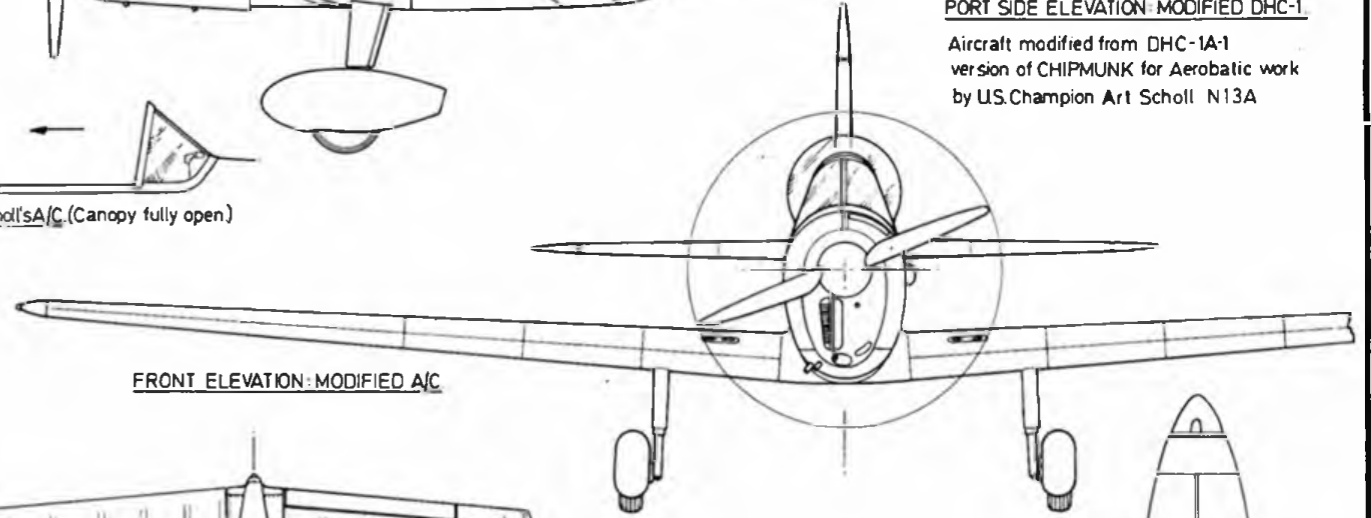
Aircraft modified from DHC-1A-1 version of CHIPMUNK for Aerobatic work by U.S. Champion Art Scholl N13A



REAR VIEW: U/C LEG

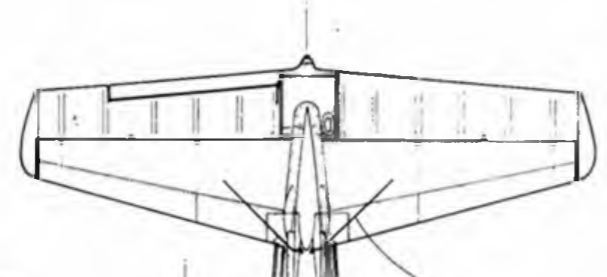


SCRAP ELEVATION: Art Scholl's A/C (Canopy fully open)



FRONT ELEVATION: MODIFIED A/C

A 1/24 scale dye-line print of this drawing is available from Aeromodeler Plans Service, PO Box 35, Wolsey House, Wolsey Road, Hemel Hempstead, Herts. HP2 4SS, price £1.65 plus 50p postage and packing (Price Code C). Please quote Plan No. 3063 when ordering.

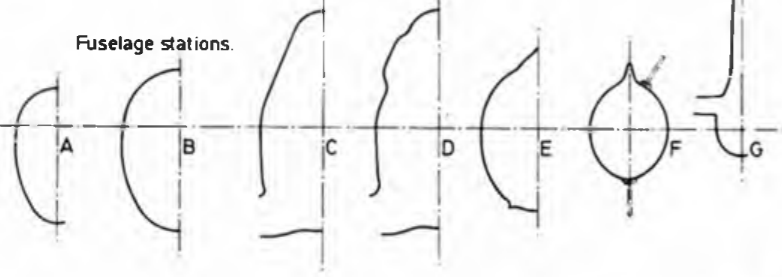


Wingtip

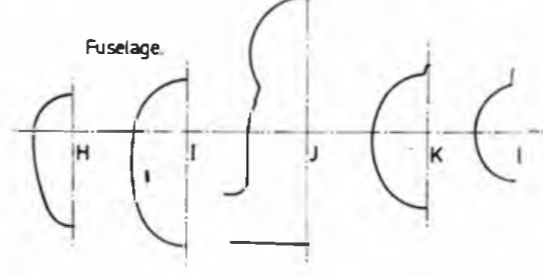
Wing Root

CROSS-SECTIONS: STANDARD AIRCRAFT

CROSS-SECTIONS: HAL KRIER'S Ex-DHC-1 A/C

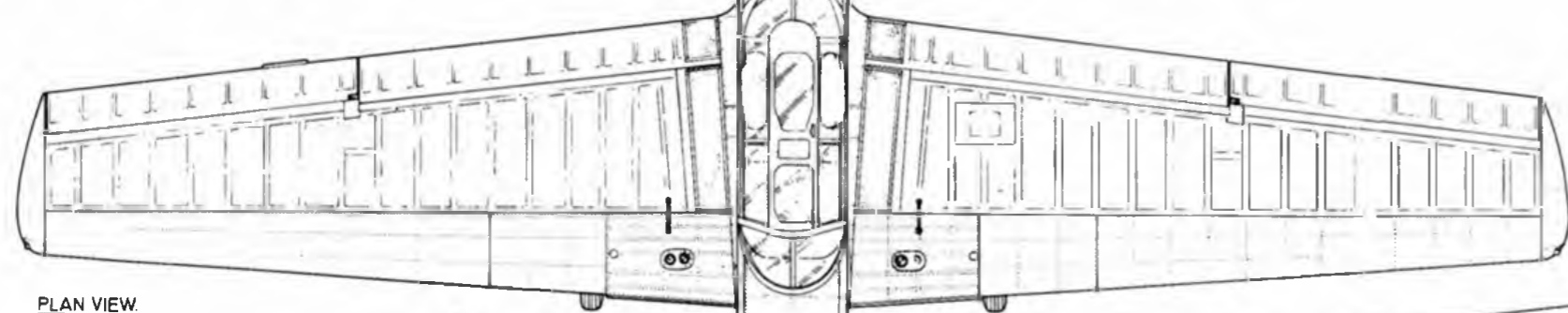


Fuselage stations.

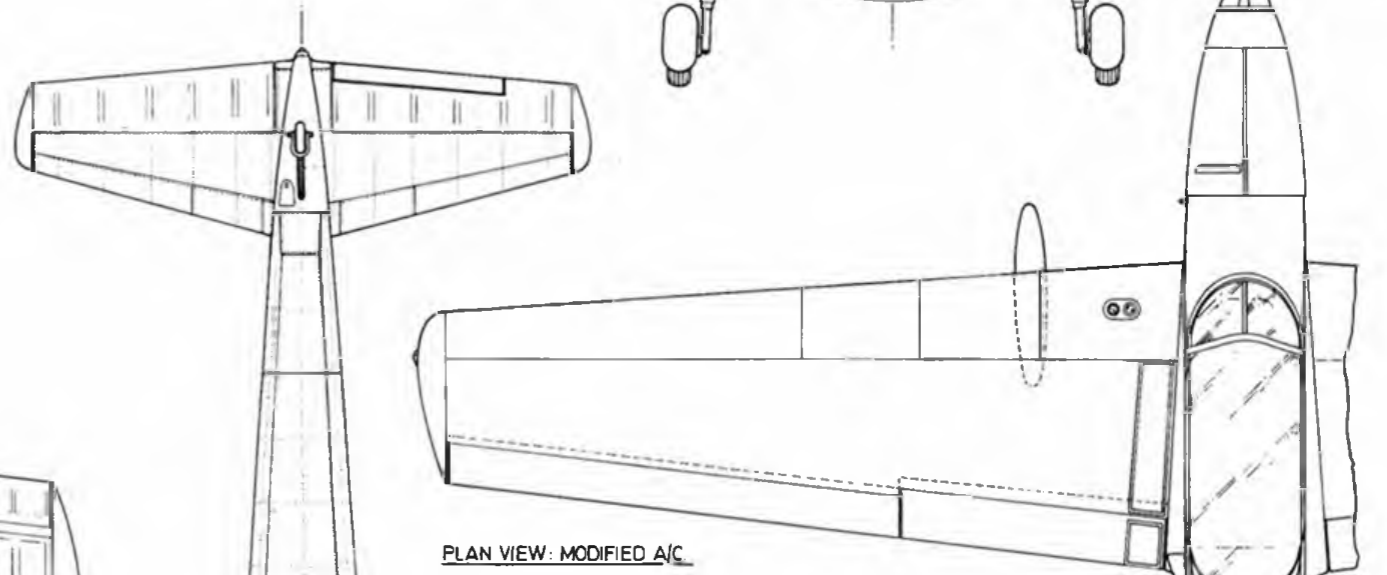


Fuselage

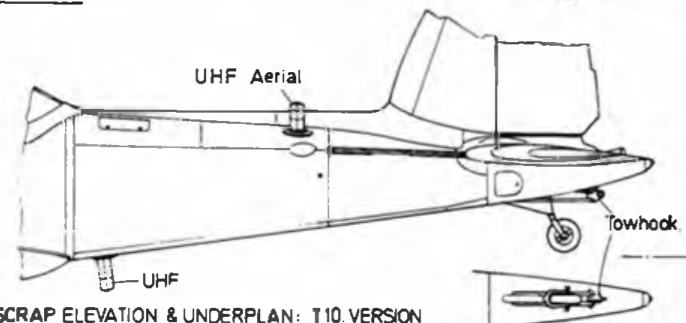
Aerials: BBMN only.



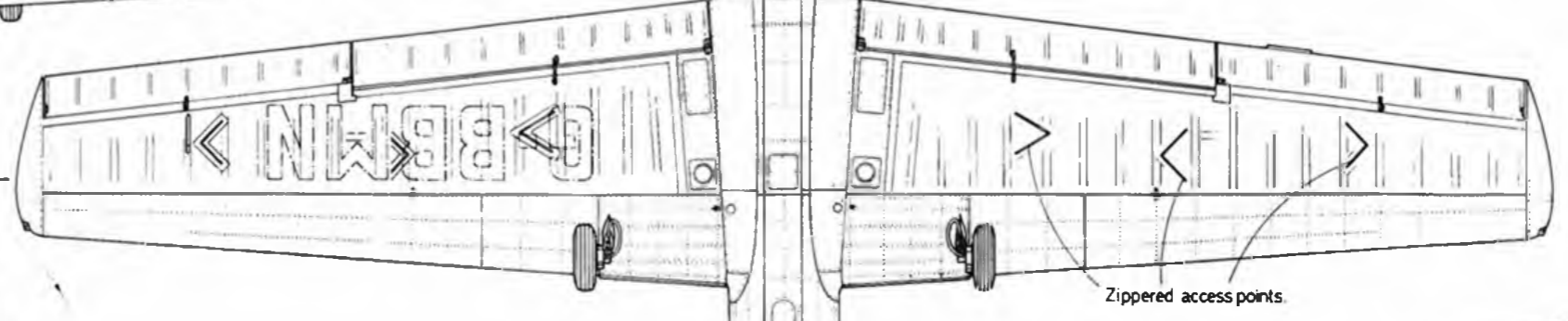
PLAN VIEW



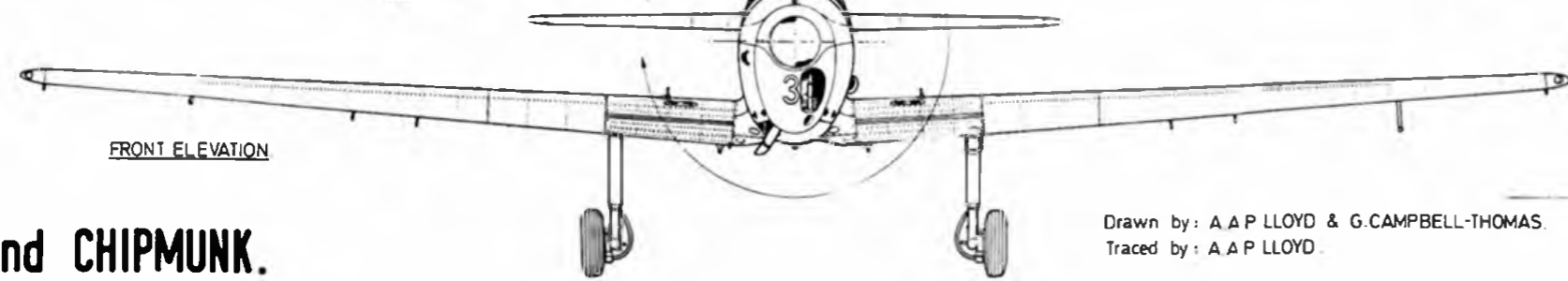
PLAN VIEW: MODIFIED A/C



SCRAP ELEVATION & UNDERPLAN: T10 VERSION



Zippered access points.



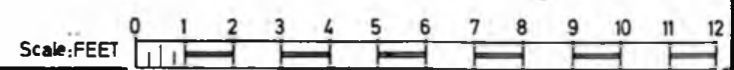
FRONT ELEVATION

COLOUR NOTES G-BBMN

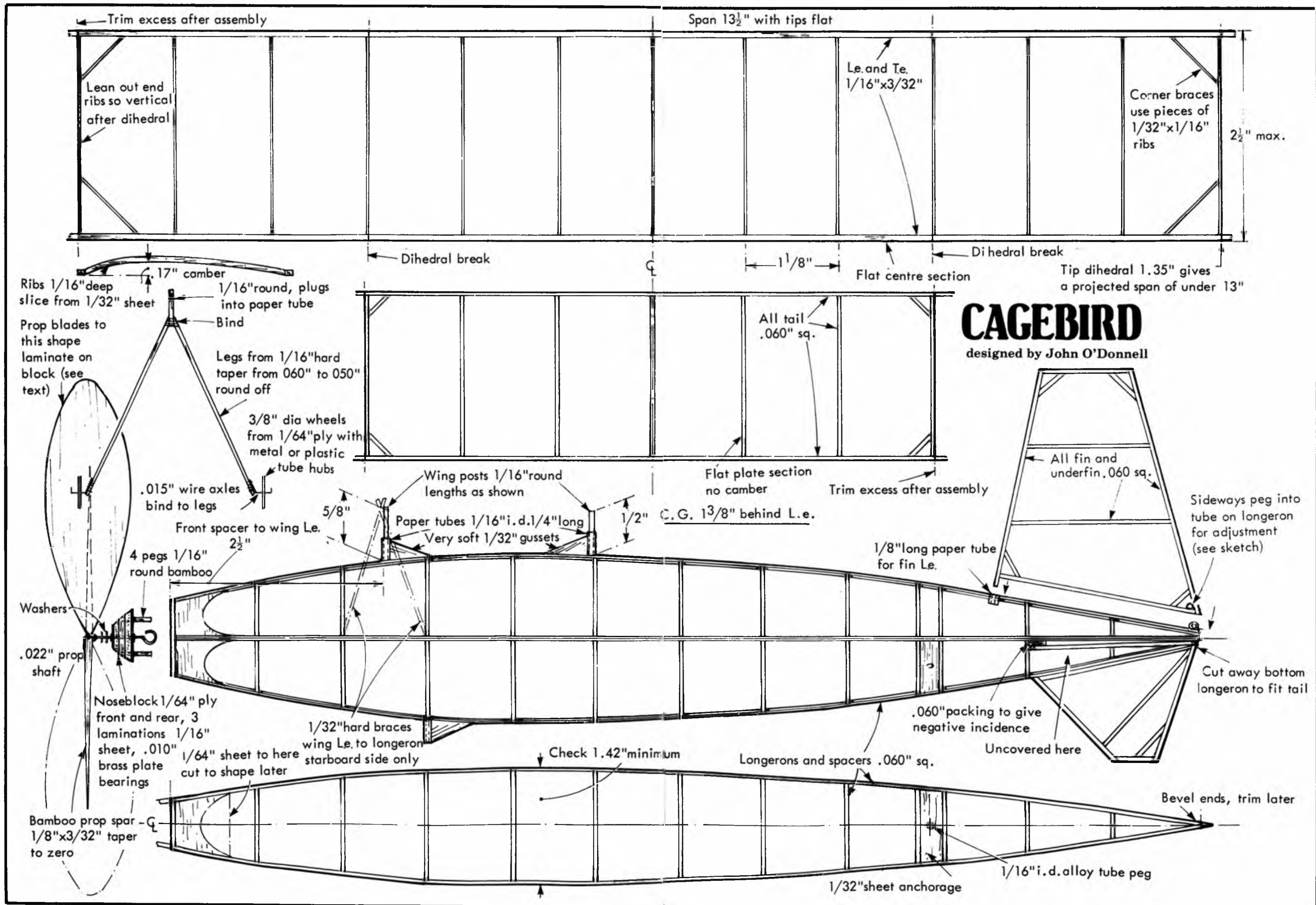
Fuselage lower half incl. root fairings, wing tips, upper & lower ledges (wing & tailplane) tail tips, : RED. Anti-glare nose area, spinner, propeller & registration, BLACK. Remainder of aircraft: SILVER.

NB. Air Training Corps T10. WZ856 Had BLACK/WHITE Spinner & propeller.

Drawn by: A A P LLOYD & G. CAMPBELL-THOMAS
Traced by: A A P LLOYD



De Havilland CHIPMUNK.



APPENDIX - LINKS TO THE PLANS

The original magazine comes with a free plan (Austriish) printed front/back on a pull out banner of four sheets. The banner is not included in the document.

AIRCRAFT DESCRIBED #261 - De Havilland C1 Chipmunk by C.W. Cain, A.A.P. Lloyd, G. Campbell-Thomas

Text by C.W Cain; drawn by G. Campbell-Thomas & A.A.P. Lloyd; traced by A.A.P. Lloyd

[Union Page: 45](#)

[Document Page: 11](#)

Cage Bird by John O'Donnell

FF Rubber Peanut

[Union Page: 46](#)

[Document Page: 16](#)

Austriish by Vic Smeed

FF Power Model

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