YOUR TWO FREE PLANS !

Designed by
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& John Daly

a pair of control-line Goodyear class team racers for 2.5-3.5 c.c. engines, with a proven contest performance

The Cassutt 'BooRay'

The full-size *BooRay* is a Jim Cassutt design, built and raced by Marion Baker, in whose hands it has proved to be the fastest *Cassutt* built to date. The builder removed many of the curves from the basic design which is why this particular *Cassutt* has been selected for control line racing. The basic three-views used to build this model were found in the *Racing Planes Annual* for the Cassutt I.I.M. and these have been modified to *BooRay* after studying the numerous photographs of this aircraft in this publication.

Three replicas of this model have been built by fellow club members and all proved to fly very sweetly off the club field, which consists of short grass, when a conventional mono-leg undercarriage was used (as shown on the *Little Gem* plan). However, future development of this very successful model proved that pit-stops could be improved by fitting a rearward wheel and prop. skid, and this arrangement is shown on the plan. When this undercarriage layout is used, it has been found that cutting the motor (via the fuel shut-off) three-quarters of a lap from the pit man, the model can be 'greased-in' half a lap out, then an application of full down elevator quarter of a lap out moves the model firmly on to the outboard tip and nose skid. This slows the model considerably as well as stabilising it on the ground so that it arrives at the pitman firmly and at a comfortable speed – no danger of taking his hand away! However, the designer stresses that while take-offs and landings are trouble-free in calm weather, an experienced pilot could be a considerable asset under inclement conditions. If you lack this confidence, then you would be better advised to fit the *Little Gem*'s forward-raked unit.

'Little Gem'

Originally built by Jim Miller in 1949 as the *Miller Special*, it was subsequently re-built to its present form after a major crash. As the *Miller Special* (and later known as *Little Gem* and *Ole Tiger* as re-named by different owners) it has proved to be one of the fastest Goodyear midgets ever built. As *Ole Tiger* it has appeared with a slightly higher fin and for this reason the *Little Gem* plan has been selected. The basic three-view used is also from the *Racing Planes Annual*, increased over-scale to bring it it line with the current S.M.A.E. rules.

Construction

Two forms of wing construction are shown following the designers' personal preferences. Both feature buried leadouts and controls to give a 'clean' appearance and also to allow the unconventional 'catch' mentioned later.

The *BooRay*'s wing is assembled using a $\frac{1}{2}$ in. x $\frac{1}{4}$ in. spruce leading edge, a 1 in. x $\frac{1}{4}$ in. hard balsa trailing edge and medium $\frac{1}{4}$ in. sheet in between. The lead-out ways should be cut out from top to bottom before shaping the wing. The centre portion of the wood cut out should be removed and the top and bottom pieces re-installed together with the lead-out guide tubes. The wing is now shaped to a semi-symmetrical section using a razor-blade plane and sandpaper – care should be taken not to make the leading edge too sharp. After shaping, install the lead-outs and the circular bellcrank and cover the centre section with 1 mm. ply, leaving suitable holes for the pivot bolt and the pushrod. Glue on 1 mm. tip protectors and dope lightweight tissue on to the top and bottom surfaces.

The *Little Gem* wing is built-up using a $1\frac{1}{2}$ in. x $\frac{1}{8}$ in. trailing edge, a $\frac{1}{4}$ in. square spruce plus $\frac{3}{4}$ in. x $\frac{1}{4}$ in. medium balsa leading edge and ribs cut from $\frac{1}{4}$ in. x $\frac{1}{8}$ in. strip. Glue in the lead-out tubes and the 1/16 in. ply bellcrank mounts and when dry install the lead-out wires, bellcrank and pushrod. Make sure that the controls are completely free and then sheet top and bottom with 1/16 in. sheet balsa. Shape to a symmetrical section as previously, then tissue cover. When dry epoxy into place the tin-plate tip protectors and the tank.

Fuselage construction on both models is identical. A strong 'core' of two $\frac{1}{2}$ in. x $\frac{3}{8}$ in. hard balsa strips and one $\frac{3}{8}$ in. x $\frac{1}{8}$ in. spruce strip is used, to which the bearers are glued. The profile is achieved by adding soft $\frac{3}{8}$ in. sheet. The fuselage should be built in two halves split at the wing to allow the fuselage halves to be securely glued on to the wing. The nose block is now glued into place and 1/16 in. ply doublers are added. A scrap sheet inboard side cheek is shown, this makes the front end very rigid. The cheek/wing joint should be a very good one to preserve this rigidity throughout the life of the model. Now shape the fuselage, rounding off all the edges and tapering the width at the rear to $\frac{1}{8}$ in. wide using the razor-blade plane and sandpaper. The tail and fin may now be installed together with the 14 swg wire tail skid. The fin and tail are made from $\frac{1}{8}$ in. medium sheet with hard $\frac{1}{8}$ in x $\frac{3}{8}$ in. strip glued across the core grain for strength and to prevent splitting. Cover both with lightweight tissue before glueing into the fuselage.

Finishing

The purpose of the next task is to impart an attractive, durable, yet light-weight finish to the model. It is recommended that all surfaces should be sealed with three or four coats of clear dope, rubbing down between each coat with wet or dry paper. When the surfaces have been adequately sealed and smoothed, colour may be applied. Two well rubbed down coats of car-type enamel paint should be sufficient to give a proper coverage. Now apply trim and numbers and fuel proof thoroughly. Remember that the SMAE rules call for an attractive scale like finish with scale height numbers (1½ in.) in the correct places.

When the finish has hardened-off properly (it takes two to three days in a warm room), connect the push rod giving equal amounts of up and down, form the lead-out loops to be equal at neutral elevator, bolt on the undercarriage (single 10swg leg, 1-1½ in. diameter wheel and doubled tin-plate clips soldered onto the leg), install the fuel cut-off and connect the cut-off to trip between 10 deg. and 20 deg. down elevator. Now bolt on the motor (and tank for *BooRay*) and test the centre of gravity.The most rearward CG position allowed is 15 per cent mean chord, add lead to the side cheek via the engine bay to give this. *BooRay* should not require the addition of lead, but *Little Gem* certainly will.

Hardware

MVVS 2.5 TRS motors have been used up to date. The only tuning performed has been to free the shafts and to use an 8mm i.d. venturi. Delaquering after each competition (as described in the Heaton/Ross article. July 1971 *Aero Modeller*) is essential.

Both suction and pressure feed have been used, both have advantages and disadvantages but the end results have been similar. The suction tank shown for *BooRay* is a conventional 'uniflow' tank of 30cc capacity which gives 60 or more laps. The pressure tank shown for *Little Gem* is of the 'Marriott's Bottle' type and has a 58cc capacity which should give more than 100 laps. These designs have been adopted to ensure constant motor runs with these relatively large tanks.

For the MVVS 2.5TRS a 7 in. x 6 in. Tornado nylon prop is recommended, and as long as the model all-up weight does not exceed 20 oz., an airspeed of over 85 m.p.h. should result.

And so to the flying site

Both planes are easy to fly provided that a close-coupled handle is used and also provided that the C.G. is in front of the position stated. Because both models sit nearly parallel to the ground, take-offs are trouble-free and little or no bouncing is experienced even on high speed landings.

Catching these models at pit-stops did give great difficulty until the *inboard* wing catch was adopted. Once the necessary mental adjustments had been made, missed and slipped catches disappeared and now catching is trouble-free. One advantage of the inboard wing catch is that the natural tendency of the plane to slide through the hand away from the body is prevented by the fuselage meeting the hand.

These two models are distinctively different from the two most popular contest designs (*Jinny* and *Shoestring*) in that low-aspect ratio wings are used. Experience has indicated that low-aspect ratio wings are no disadvantage to flying, gliding or pitting and that the reduced frontal area of these models does confer a significant speed increase, given the power.

READERS LETTERS . . .

Dear Sir,

I feel that the letter by D. H. Stapleton published in the January issue regarding 'glass fibre' props must not go unanswered.

The letter is, unfortunately, couched in the most exaggerated sensational terms, which give an inaccurate impression of the situation. It only needs the lay press to pounce on such a letter to create adverse publicity.

The sensational and exaggerated terms to which I refer are, of course, 'razor sharp, harder than steel, finger removing tools' and 'suitable surgical instrument', a most unfortunate choice of words which are completely untrue. *'Razor sharp'* – does D.H.S. shave with one? *'Harder than steel'* – which grade of steel? Must be a poor one, and one which I hope I never come across. I really must be present when D.H.S. cuts through a bar of *mild* steel with a G.F. hacksaw blade! *'Finger removing tool'*, etc. – from his portfolio of case histories, perhaps D.H.S. would quote a few instances of this actually happening. Please, Mr. D.H.S., let us stick to the *facts*.

In referring to glass fibre props, I assume that D.H.S. really means glass fibre reinforced plastic props. Glass fibre is silky soft, and I know of no method of making this into an airscrew without the addition of a resin.

GFRP is a complete material – consisting of strands of glass fibre in a matrix of what are usually cold-setting polyester or epoxide resins. The function of the resin, which is of relatively low mechanical strength, is to transfer the stress from one filament of the fibre to another, and to give form to the product.

What D.H.S. is in reality objecting to is the resin content of a GFRP prop. Whether the laminate contains glass fibre, carbon fibre or any of the other materials used, such as cotton, linen, paper, asbestos, rayon, etc., is beside the point. I assume it is the hard, unyielding nature of these materials that is giving cause for concern. We must therefore include other materials, such as resin-impregnated wood, Tufnol and some of the harder nylons, which virtually eliminates all except the soft, flexible nylon and wooden prop, which could be said to be hard and unyielding!

Why use GFRP props? Simply because the modern engines prefer high rpm and this alone has rendered some materials obsolete. In the search for efficiency a more rigid material is advantageous. Nylon props are noted blade shredders – quite a hazard, Mr. Stapleton – when I see anyone using a nylon prop at 19-20,000 I keep out of the line of fire! GFRP provides the necessary tensile strength to make the risk of blade shredding virtually nothing, and this is a big step forward.

With any airscrew on a motor, there is risk to both operator and spectator. As far as the operator is concerned, the choice of prop is entirely his, and he must accept the risk – he has no one to blame but himself if he sticks his fingers in the way, if we are to have all elements of risk removed, where do we draw the line? At the i.c. engine itself?

As far as the risk to spectators is concerned, since GFRP props are in question, let us restrict ourselves to this aspect only. It is of no use to make mild assumptions without facts – let us have from the Society a categorical and proven list of injuries to *spectators* involving the use of a GFRP prop, where, *without any doubt, the injuries would have been minimised or avoided had the prop been in another material*. Props in this material have been used in sufficient numbers for long enough for any menace hazard to have become obvious.

As might be expected, I use and like GFRP props, and I do not want to have the choice of prop material dictated to me. The odd injuries I have sustained with these props have been of a mild and superficial nature. My worst incident, requiring three stitches, was when running a vintage McCoy 19 at 17,000 r.p.m. on a *nylon* prop.

I am aware of the injuries which Ray Collins suffered, and he has every sympathy. At the same time, I am sure that Ray would not wish to deny the use of such props by others. Should an individual decide that the risks are not acceptable, then the choice is his, and his alone – after all, no one forces anyone to fly powered models.

It is an unfortunate trend these days for a minority to attempt to enforce their opinions upon the activities of others, when quite often the minority are non-participants, and I would welcome the end of this cult of *'minding the other person's business'*.

It would be interesting to know of D. H. Stapleton's aeromodelling activities – the types of model he flies, the motors he uses, their operating r.p.m. and, more pertinent, the type of props that are used.

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