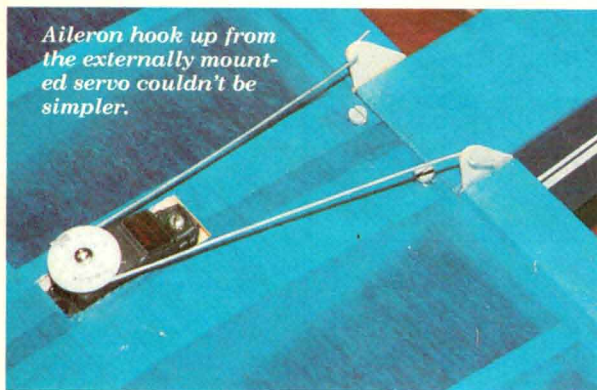


Roof Raiser and

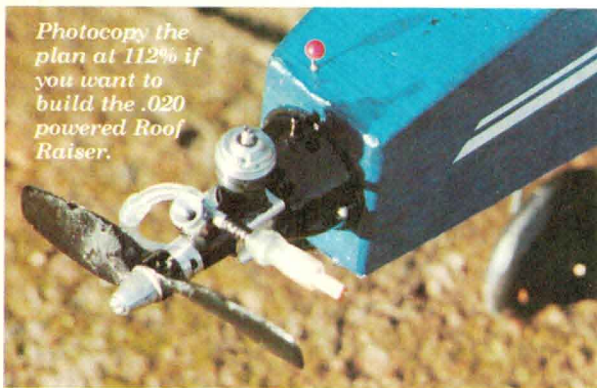
Beam Bender



"An indoor R/C aerobatic duo, equally at home outdoors in calm conditions. Roof Raiser is a 31.1/2" wingspan low winger for .010 cu. in. engines or, if the drawing is increased by 112%, it produces a model suitable for .020 cu. ins engines. Beam Bender is an aerobatic biplane of 31" span for 0.5 cc or .049 cu. in. engines. Two or three function micro radio equipment is required." - David Boddington

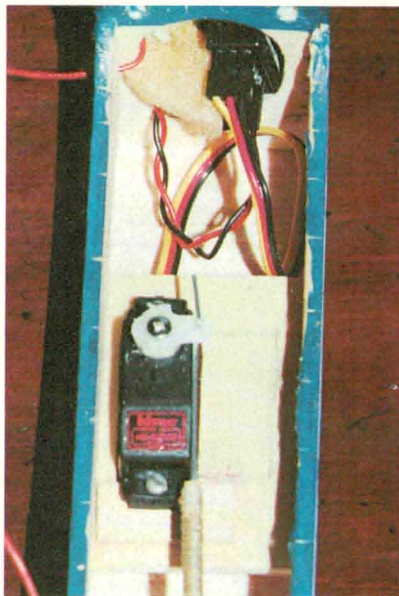


Aileron hook up from the externally mounted servo couldn't be simpler.



Photocopy the plan at 112% if you want to build the .020 powered Roof Raiser.

Challenges are a vital part of any hobby or sport if the enthusiasm and interest is not to decline. Personally, I have never found any problem in finding new challenges in the field of aeromodelling. Just the opposite in fact, there has never been sufficient time to



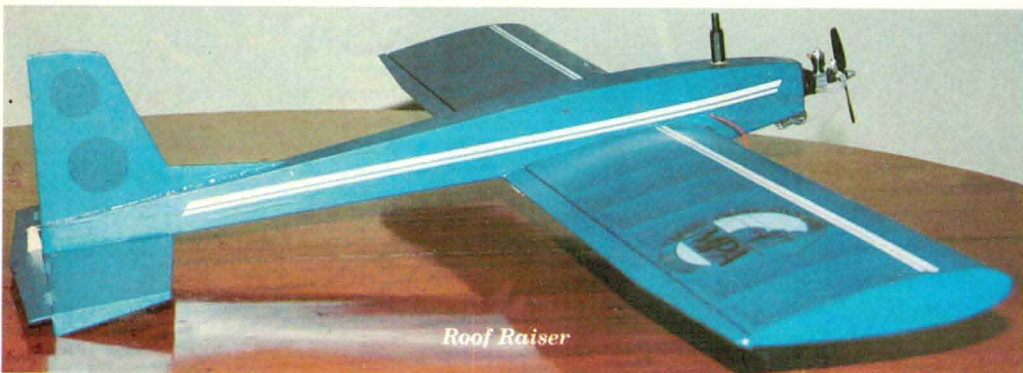
accomplish all the intended projects. However, a new and different concept will occasionally come along which really stirs the imagination and cannot be ignored. So it was with the prospect of flying, on a daily basis, indoor R/C models at the Model Engineer & Modelling Exhibition in the National Hall at Olympia. The meeting and the prospects for further indoor R/C models and flying are covered elsewhere in this issue of RCM&E, this article deals with one of my approaches towards the challenge of flying in this marvellous facility.

From scratch

Although I had limited experience in flying the 'Micro Barnstormer' (RCM&E Dec '93) and the Handley Page Sayer powered glider model indoors, there was no immediate precedent for an indoor aerobatic style model. I say 'style' because it was by no means certain that aerobatics were going to be possible within the limited confines of the hall with an I.C. powered design.

Electric power had been used for aerobatic aircraft, notably by Robin James with his biplane series, but this power source and the resulting propeller/rpm combination gives a different style of flying to that with high revving I.C. engines. It was a case of breaking some new ground and all the more exciting for that.

One of the biggest enemies when flying in confined areas is speed - an excess of it for the model and a lack of it as far as the pilots reactions are concerned. The faster the model is going, the sooner the obstructions are reached. Moderate flying speeds were, therefore, an important part of the specification for my models - and reactions!



Roof Raiser

Beam Bender



To get out of trouble, when the model is rapidly approaching one of the liberally distributed cast iron structural elements, the model must have excellent control responses, these also being necessary for executing any aerobatic manoeuvres in the limited space. Over control can also get the pilot into trouble, so there has to be a fairly fine balance between good control and 'twitchy' movement.

Aim light

To achieve a high degree of control at sensible speeds invariably leads to a lightly loaded airframe and with pretty well constant R/C equipment and engine weight (the latter will not vary enormously over the size range we are considering) it also points to a reasonably large model - for indoors. Assuming that simply because the model is to fly in a small space that the model also has to be tiny is wrong. We could not cope with giants - the turning radius would be too large - but ultra small models will inevitably have a high wing loading, fly fast and... well, perhaps your reactions are better than mine!

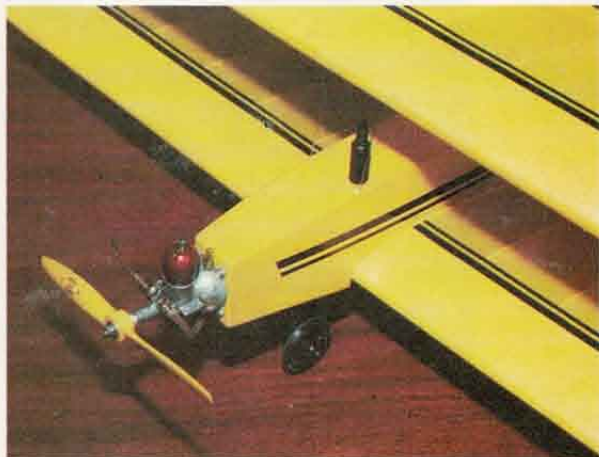
For the model to be truly aerobatic a symmetrical section, or near symmetrical, would be sensible, with a fairly thick section to slow things down. A 'slippery' and aerodynamically clean aeroplane might not be an advantage in this case. Lightness also equates to simplicity, so I had no intentions of using a throttleable engine, just two function control, elevator and ailerons. Two servos only limited the radio weight, allowing the use of 50 mAh batteries to give a reasonable operating time, and keeping

the airframe and radio weight low reduced the engine power requirement.

No exotica

Being a realist (for some of the time), I knew that I would have limited time to design and build the model and there was no point involving sophisticated structures - plain and simple was the answer. After a few 'doodles', I set about drawing the 'Roof Raiser' monoplane with a wing span of just less than 36 ins and a chord, including ailerons, of 7 ins. 250 sq. ins. of wing is not that small and I decided that a 0.5 cc 'Dart' diesel would be adequate power (bearing in mind that Club 20 racers, with 300 sq. ins. of wing area used engines of 3.2 cc capacity). A built-up wing, of course, for lightness, a sheet fuselage from 1/16 in balsawood and sheet tail surfaces, with lightening holes, formed the basis of the structure. It was unlikely that take-offs would feature in the flying programme, so a monowheel would be sufficient for landings, with the tailplane tip fins acting as the second and third supports for the model on the ground.

With the model drawn-up, all I had to do was to wait until after the Christmas festivities before making a start on the construction. It took just over two days of fairly concentrated building to complete the model, allowing for the occasional surfacing for the social niceties required over the festive period. The model looked quite promising - you get a gut feeling about the models when they become three dimensional.



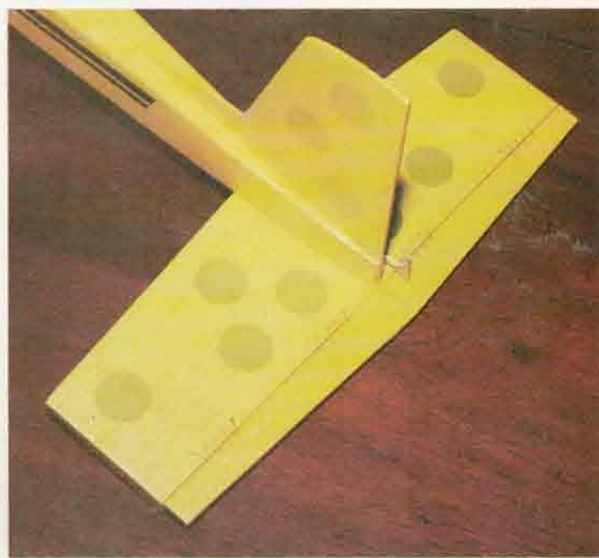
Diminishing returns

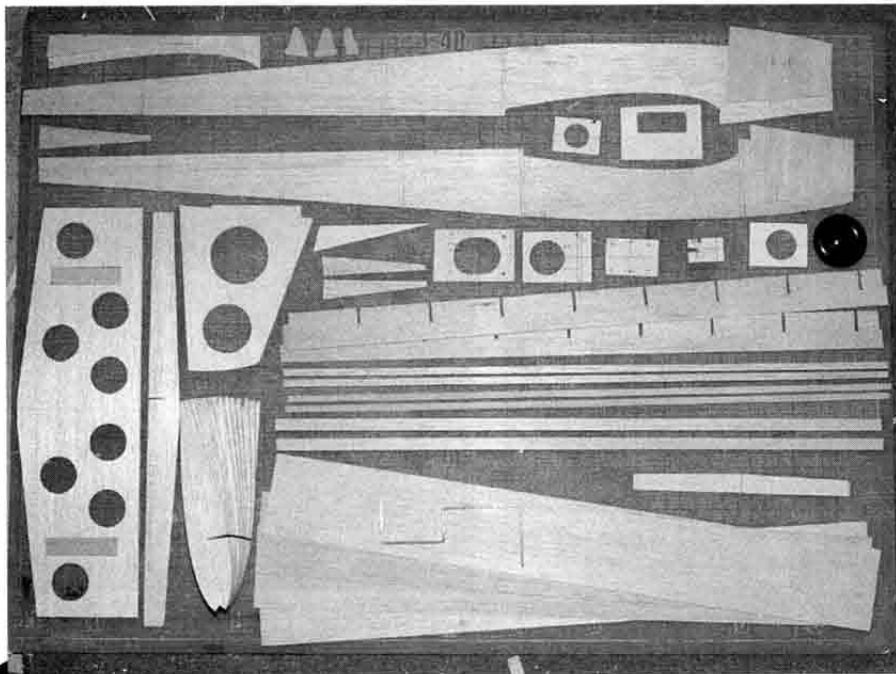
After flying the HP Sayer models for the Handley Page Trophy contest in '94 - over which a veil will be drawn - it was time to check out the 'Roof Raiser'. The choice of the 'Dart' diesel was partly made because diesels are much easier to regulate, for rpm, than glow engines. By reducing compression and adjusting the needle valve you can obtain reliable slow running. The idea of the first flight (no, I hadn't had time to flight test outdoors and, yes, I should have done) was to have just enough power to fly around and test the general handling and control responses. This was duly carried out, with the model eventually coming to the floor after a tight turn. What was required, I decided, was a little more aileron movement, plus more power.

Although slow flying is an attribute, too slow and there is little airflow over the control surfaces and less slipstream effect from the propeller over the surfaces. Up with the compression, lean the fuel supply and with the Dart singing beautifully on a 6 x 4 ins propeller, away she went. Response from the controls was now

0.5 cc Dart diesel is well suited to Beam Bender. An .049 Cox glow will, however, be the first choice of most modellers.

Building Beam Bender will give you the chance to try your hand at old skills such as making thread hinges. Note the lightening holes to keep the weight down at the rear end.





Raiser' and that it would be interesting to try a biplane, using the same basic constructional techniques, for greater wing area and drag. The 'Dart' would be a more suitable power plant for this biplane version.

The theory of the TD 020 having enough 'poke' proved to be correct when the 'Roof Raiser' was again flown at the MEE later in the week. Even with the prop on backwards there was still ample power to make flying interesting and you still needed your wits about you to avoid the six faceted obstacle known as National Hall. Unfortunately a ruptured fuel tank eventually curtailed flying just as we were getting the hang of this indoor affair.

You can read about the flying of the 'Beam Bender' at the end of the article.

Construction

The free pull out plan shows the smaller .010 powered version of the 'Roof Raiser'. To bring it to the original size, have the drawing enlarged by 112%. The instructions cover this version.

One word of advice, if you need a full and detailed set of instructions to build these models, don't even start. **You do need experience to fly indoors.** If you haven't done a lot of building and R/C flying, be content with going along to the next MEE and have fun - and a few laughs - watching the others.

Selection of wood is, of course, very important. As an R/C flyer you will be used to larger sizes of balsa wood and there is a natural tendency to select the tougher - and heavier - grades of balsawood in the thin sizes used on these designs. Avoid this inclination, medium grades will be more than adequate, providing 'carrot' wood is avoided.

Wing panels are built over the plan by pinning the full depth main spar to the board and the trailing edge to a 3/8" packing piece. The 3/32 in. sq., which helps to locate the rear end of the ribs, is glued to the trailing edge before fitting. On the prototype 'Roof Raiser' the leading edge was from 3/16" x 1/4", let in to the ribs horizontally but this necessitated the 1/32" leading edge sheeting being wrapped around, from spar to spar, in one go. I have revised the design to use a 3/16 in. sq. leading edge, on

very positive and the speed build up was also impressive! The next 90 seconds or so was some of the most hectic and concentrated in my sixty plus years. Had I kept in a steady 'race track' pattern all might have been well, but no, I have to find out what she's like looping and half rotating. Once out of position it was a matter of time before contact was made with an immovable object. The flight pattern before the inevitable meeting was truly impressive and I was only about a half a second behind the model!

Forget the macho business

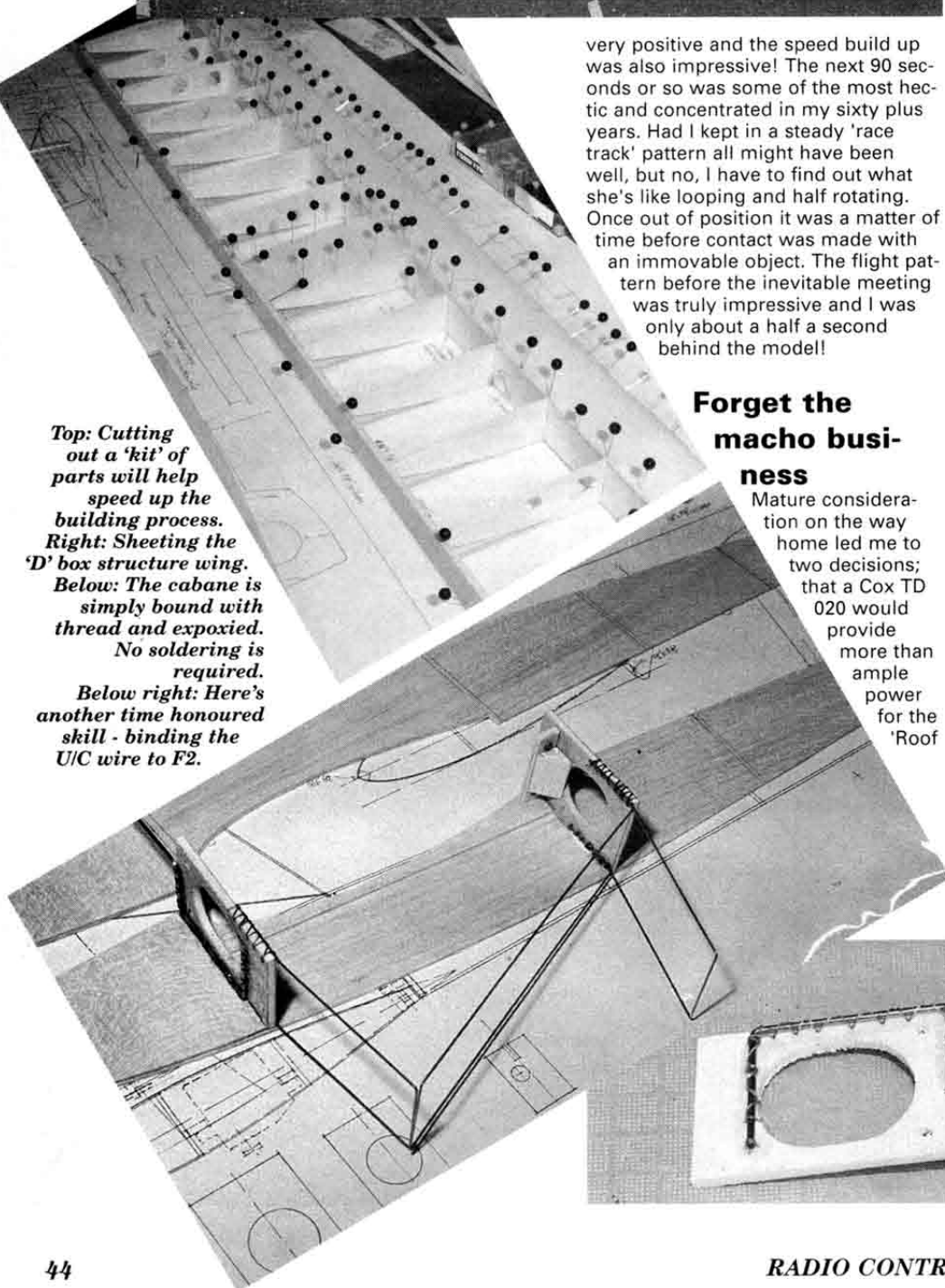
Mature consideration on the way home led me to two decisions; that a Cox TD 020 would provide more than ample power for the 'Roof

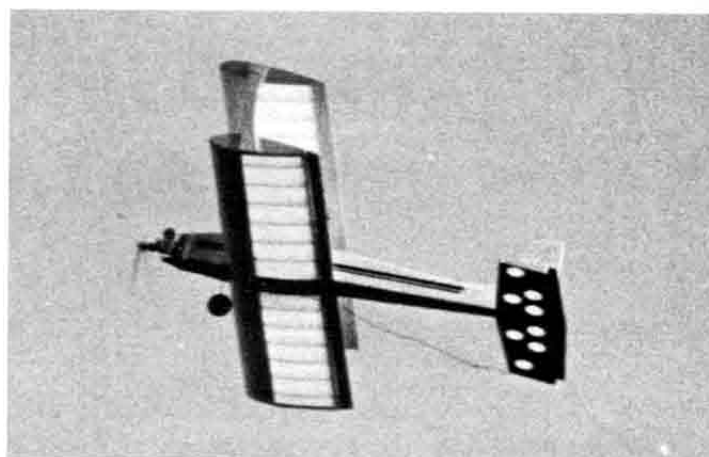
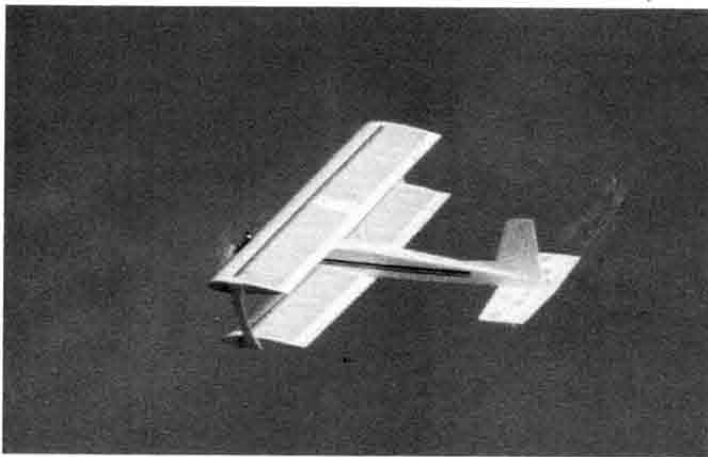
Top: Cutting out a 'kit' of parts will help speed up the building process.

Right: Sheeting the 'D' box structure wing.

Below: The cabane is simply bound with thread and expoxied. No soldering is required.

Below right: Here's another time honoured skill - binding the U/C wire to F2.





edge. This allows the top 1/32" sheet to be added to the top of the wing before removal from the building board.

There is only one basic difference between the structure of the wings for the monoplane and biplane. The former, because of a larger span and being unsupported, has capping strips to the rear of the ribs to stiffen the complete wing panel. The 'Beam Bender' biplane, with the added strut arrangement, does not require this and so the ribs are cut to full aerofoil at the rear. With the sheet spar and 1/32" sheeting forming a 'D' box, the wing structure is amazingly rigid.

Back to basics

The fuselage is a basic box structure. You could cut a few holes in the rear end sheeting but you might then have to add ballast to the tail for a correct balance (this is not an excuse to use 'heavy balsawood' for the tail surfaces). There is room for two micro servos, side by side, in the fuselage if you wish to fit throttle control and in the 'Beam Bender' there is sufficient internal fuselage height to fit mini servos.

The tailplane tip fins are not there simply as ornaments or for aerodynamic reasons. They, together with the sheet inserts, help to prevent the tailplane from warping. It might be interesting to try a similar tip on the fin (an arrow shape on plan-view), although I haven't encountered problems with warping of the fin.

Covering

No preparation was made to the airframe apart from sanding and applying fuel proofing (Clearcote) to the nose and wing cut out area of the fuselage. Litespan is an obvious material to use for covering, as it is light. The adhesive (Balsaloc) is only applied where adhesion is actually required and it is fuel proof, for both glows and diesels. You could also try the new Airspan from Solarfilm. Remember that you will be flying in a relatively dark hall and that light

colours are easier to see. The yellow of the 'Beam Bender' is the better of the two in this respect.

Radio

The new 60 and 100 mAH battery packs (available from Overlander) are a good compromise between size, weight and capacity. The weight of the other components will be as supplied but, as mentioned in the main indoor article, you can eliminate the switch but do try to include an external charging point. A miniature two pin plug and socket is a suitable alternative.

Linkages to the control surfaces should also be as light as possible. There are only light loads on the surfaces.

Two wings

The central cabane structure of the 'Beam Bender' is very light. I used 22 swg piano wire, with outrigger struts to take a lot of the loads. I only bound, with thread, and epoxied the wire cage, no soldering was used. Fixing the lower wing for either model is with 1/8" dowels at the front and 6BA bolts at the rear (sleeve the holes through the wing with aluminium tube and reinforce around the tubing).

I was fortunate in having some small 6BA brass insert nuts (the sort they use for moulding into plastic components) but a nut soldered to a piece of thin brass plate would suffice. The top wing is held on to the cabane cross pieces with miniature brass turn keys.

Outdoors first

Forget what I did and do as I say - you should have more time before the MEE - and carry out the first test flights outdoors. I was a good boy and did this with the biplane. You must wait for calm weather and then carry out all the normal checks.

Expect something lively and don't let the model get too far away from you.

Once familiar with the flying characteristics plot out your imaginary hall and see whether you can keep within bounds. It will seem smaller when you have solid walls, roof and floor around you.

Having now carried out quite a lot of flying, indoor and out, with the 'Beam Bender' biplane, I would have no hesitation in recommending the fitting of a PAW 55 R/C engine. The wing loading would take the extra servo without any problem and having the ultimate control of the model (stopping the engine) would be an advantage. ●

"Carry out the first test flights outdoors in calm weather. Expect something lively and don't let the model get too far away from you!"

