Discoverer

More for less! John Ralph's 72in. span canard design for 2- 3-function radio and .5-.8cc engines – it's efficient and fun!

THIS MODEL EVOLVED from just a couple of basic requirements: it was to be essentially a smallish powered sailplane; and above all it was to stay clean! Memories of "adding on" engines to various sailplanes in the past were of general grubbiness soon building up after the engine was fitted. The latter was usually by nose mounting; over the wing, or in one case in a detachable power egg on top of the fin. The rear mounting kept the model clean but the extra ballast needed to re-trim was, I felt, inefficient and furthermore the pitch change between power on and off was large.

Musing over the matter a couple of years ago, thoughts of pusher canards started to emerge. Now, in spite of years of modelling I'd never built a canard let alone designed one so I thought I had better try to read a bit about the beasts!

Historic research

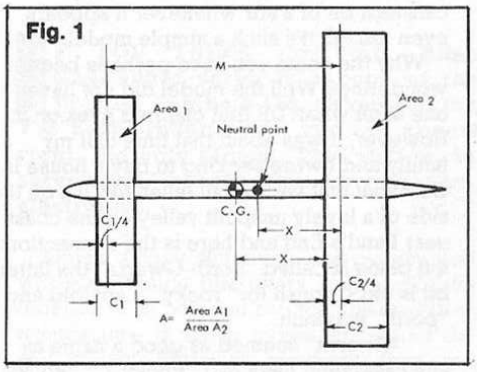
"Nothing's new" as they say and that's certainly true of canards. Searches through old (some very old!) Aeromodellers and Model Aircraft magazines soon revealed various rubber-powered versions, etc and general opinions and guidance on what was important for the breed. Incidence difference between the two lifting surfaces is probably at the top of the list, closely followed by fin and rudder or lateral area moments about the C.G. Dihedral on the foreplane also seemed to have met favour with past designers. Eventually after a fair amount of mulling over all I had read I sketched out what you now essentially see as "my" canard.

I would be the first to admit the model is a bit of a "bean pole" fuselage-wise, which means there is not too much room for the radio gear. However, there is sufficient and ample for modern 2- or even 6-8-channel sets with 500 mA/HR Nicads "up front".

How to find the C.G. position for what I had drawn up was my next worry, but this as it turned out was pretty simple. The

principle is much the same as that use for balancing a beam balance, only the "weights" are areas of the two lifting surfaces and they are considered to act at their respective 1/4 chord positions.

Fig. 1



Referring to fig. 1: The position of the aerodynamic centre is found by means of a simple formula:

$$X = \frac{MA}{1+A}$$

where M is the distance between the wing and leader-plane quarter-chord lines, and A is the ratio: leader-plane area divided by main plane area.

It should be noted that X as calculated gives the position of the neutral point forward of the quarter-chord line of the main plane or the position of the design C.G. forward of the leading edge of the main plane.

That's about where the C.G. came out on my model, which was a bit of luck since no ballast was required. So one of my hopes of keeping added weight to a minimum had been met straight away. In the event a few degrees up trim was required on the original for best performance. "Up elevator" by the way causes the model to dive and vice versa which is logical if you think about it, so make sure the elevator moves DOWN when you pull back the Tx control column. If you use larger motor than the 0.5cc DART diesel on the original you may need a little ballast in the nose. However, since I have never experimented with moving the C.G. it's worth trying with a more rearward point should it come out that way.

Petite power

I think I would set the upper limit of about 1cc for power but now that the 'DART" is being manufactured again I would certainly commend that engine. The one fitted to my model is of early 1950s vintage and still going strong. When "on song" it provides ample power and is very economical on fuel. The small tank (about an ounce) I made up gives about 10 minutes' engine run and total flight times can be typically up to 15-20 minutes depending on the flight pattern. The all up weight came out fairly low a just over 2 lb. which no doubt helps to give the model its good glide and overall performance.

However, I didn't know all this as I prepared for the first flight of my creation. I crept down my local flying field when I thought no one would be there to witness the possible disaster and after a brief systems check, started up the "DART". The conditions were a bit breezy but it was now or never, so I launched off into the blue. Only a minimum of up stick was needed to nudge the model into a shallow straight climb and that is how I kept it until it was a couple of hundred feet up. Being a bit surprised that it appeared to be flying so well I gingerly tried a turn, automatically correcting in the usual way to keep the nose up. No bother at all it seemed so I was soon tempted to start throwing it around a bit, realising that if anything it was easier to fly than most conventional layouts. However, the throwing about soon cut the engine, long before the fuel was exhausted (I decided to alter the tank installation to improve that; it's now cusped shaped with a low point take off) but the transition to glide was smooth with sure handling right to touchdown.

I was very pleased with myself, with a lot of help from articles from all those past enthusiasts; a bit of additional thought and as usual, some luck, it had worked!

I've flown the model quite a bit since that first flight with essentially no changes apart from the fuel tank. I've had great fun with it for a minimum of fuss and bother; it's that sort of model. I would recommend sticking to diesel power since then all you need is a can of fuel and your Tx when you fly. It's the ideal model to take on holiday (if you dare!) it will even slope soar well, if you wish, on quite a gentle rise.

Build, build, build

Building the model is quite straightforward but I guess since the aim is to attract relative beginners to enjoy its docile nature, a few comments are in order.

The wing is of conventional construction; the like has been used in countless gliders etc, over the years. The ribs are easiest made by cutting the root and tip as shown from 1.5mm ply templates and then sandwiching rectangles of 1/16in. medium balsa sheet between them. Bolt or clamp the pack for one wing and use a razor plane and sanding lock to shape a smooth taper. The original used a slightly undercambered section but a flat one of similar thickness would do just as well and eases construction and covering somewhat. You may also prefer to use capping strips of 1/8in. or 3/16in. width to match the leading edge sheet rather than undercutting the forward position only of the ribs. Make sure you beef up the wing tubes by gluing 1/32in. ply webb either side of them filling above and below with balsa.

It's best to trial fit the wings together with the joining wires loose in the fuselage before you finally glue in the tubes and wires. Any misalignment can then be rectified. The correct angle for the root ribs is also best left to this stage.

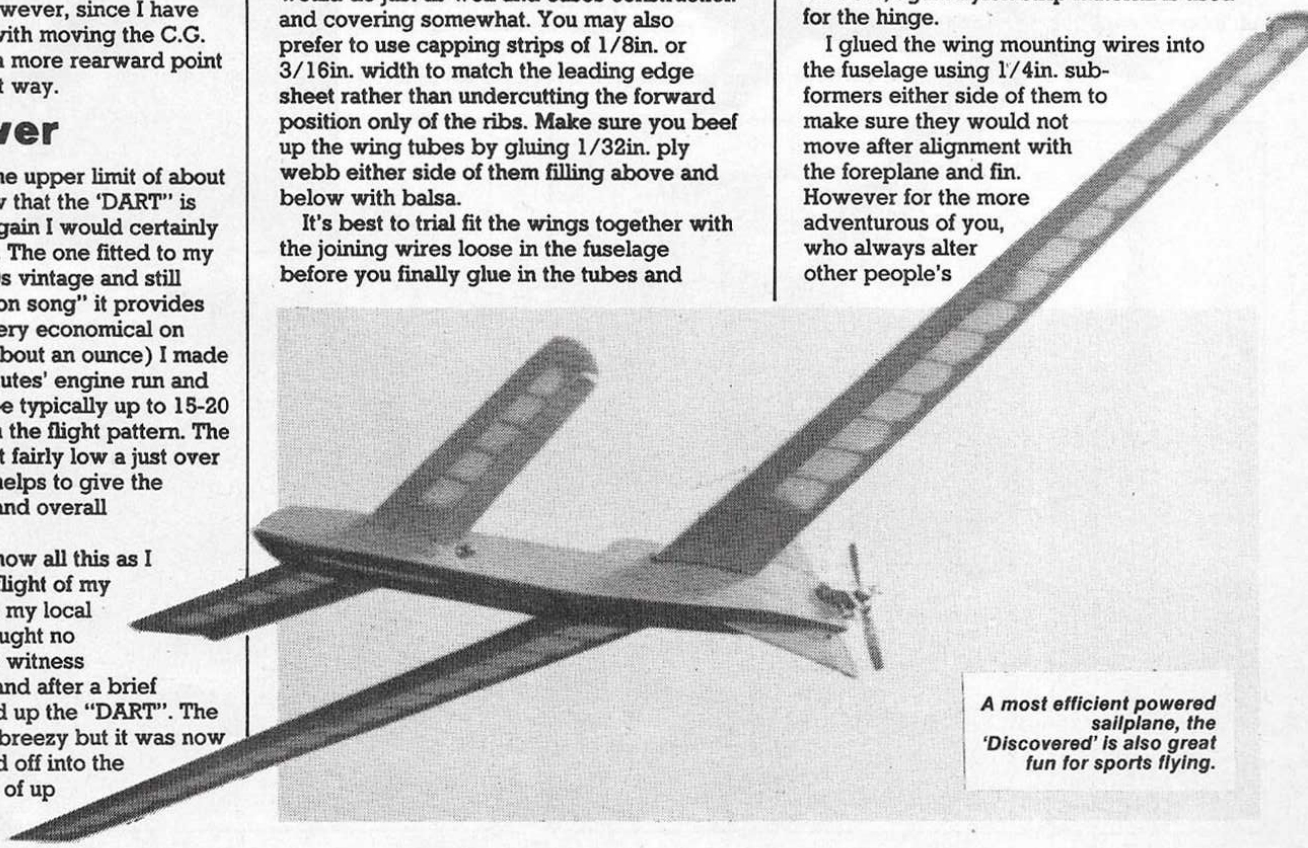
The front plane is of similar construction to the wing but you will have to do a little more work with the elevator and servo connection. I used ball-ended connectors on the operating levers to accommodate the awkward angles resulting from the dihedral. Nylon strip hinge material was used for the elevator which should have about ±3/8in. movement at the trailing edge. I mounted the elevator servo upright which does mean it sticks out into the Rx bay somewhat. You may find a neater way perhaps by mounting the servo on its side.

Slab sider

The fuselage is a simple slab sider made from 3/32in. balsa with a nearly full length thin (~ 0.4mm) ply doubler. It needs wood about 40in. long to avoid a join which is, in hindsight, best made in the vicinity of the main (rear!) wing where the fuselage is deepest. A few 1/4in. or 3/16in. rectangular formers are placed in the positions shown with F11 being cut away to allow for a set of 4-500mAh nicads to pass through into the front bay, The cut outs in F2 for the engine bearers should be made to take 1/4-5/16in. square hardwood and be spaced to suit the engine chosen. On the original the fuel tank was home made to fit between the bearers; about 1 1/2in. gap behind the engine being allowed for it. Use 1/32in. or similar ply facing for the tank gap and fuel proof well when finishing to keep the dreaded diesel fuel creep to a minimum.

The connecting torque rod for the rudders passes through the bearers and it is the lower one which is connected to the closed loop wires which are passed through the fuselage at the rear end up to the rudder servo before the bottom sheet is glued on. You may prefer a push rod or "snake" which of course are quite acceptable alternatives. Try for about ±1in. TE movement on the rudders, again nylon strip material is used for the hinge.

I glued the wing mounting wires into the fuselage using 1/4in. sub-formers either side of them to make sure they would not move after alignment with the foreplane and fin. However for the more adventurous of you, who always alter other people's



A most efficient powered sailplane, the 'Discovered' is also great fun for sports flying.

designs, (and why not!) a lot of transporting space could be saved if the fuselage as well as the wings was fitted with tubes. They would need setting at the correct dihedral angle and be staggered by a 1/4in. or so to pass right across the fuselage. You would then use six straight joining wires which you would almost certainly leave at home some time!

The forward plane was located with 1/8in. dowel at the front and bolted down using a 4mm nylon bolt. The nut for the latter being held captive below a 5/8in. wide-1/8in. thick ply bridge glued across the fuselage.

To make sure the main wings did not work off in flight a couple of hooks were glued in the roots and bands passed across the inside of the fuselage. Cut outs are made in the fuselage sides to clear the hooks.

Finish to taste

As for finishing, again I'm sure you will have your own preferences but mine had a tissue covered and doped fuselage (shrinking plus colour coats). Both front and rear planes were covered in Micafilm. It is a bit difficult to get the hang of putting it on but well worth the effort. The likeness to tissue with the added strength and bright colours is very appealing I think. An alternative now available, and highly suited to this type of model, is the Solarfilm Litespan.

Oh yes, you will need a pusher prop if your engine won't run backwards. They can be obtained at the more enlightened model shops but don't be too surprised if your "local" hasn't got one. If you get really stuck you might like to carve your own. It's not difficult and since it will be unlikely to get broken it's well worth the effort. That's another advantage of a pusher.

One quite important point regarding the reversed thrust load with a pusher is that you might find it necessary, or at least worthwhile for added efficiency, to fit a thin steel disc washer behind the prop driver. Otherwise friction could occur due to aluminium alloy to alloy rubbing on unsleeved crank cases. I fitted such a disc to my "DART" and it appears to do a good job.

Well I guess that's about it, why not send off for a plan and start work on a "DISCOVERER" straight away? You will be glad you did, it's great fun and always causes a bit of a stir whenever it appears even though it's such a simple model.

Why the name you have perhaps been wondering? Well the model did not have one at all when DB first clapped eyes on it. However, it was about that time that my family and I were seeking to buy a house in Cornwall that we had all fallen for. It's on the side of a lovely unspoilt valley on the coast near Land's End and here is the connection: the place is called "Porth-Gwarra" the latter bit is old Cornish for "rocky", I am told and "porth" is beach.

"Gwarra" seemed as good a name as any (we could have had "Rocky 1", "Rocky 2" etc). I am sure it has never been used on a model aeroplane before – and then the editor went and changed it to "Discoverer". I don't know why we bother.

Highly controllable, an elderly "Dart" .5cc diesel provides adequate power. Far from having any vices, it eliminates those you expect from a powered glider type of model. The two inset pictures show the front wing linkage and rear underwing radio installation.