

# The Trouble with Twins

Father' David Sawers solves the problems of having two

**DUET** – an ideal twin trainer and sports model. 74in. wing span for two .25-.35cu.in. engines and four function radio.



**T**HERE ARE TWO SCHOOLS OF THOUGHT about twin engined models. Some say's 'easy' and some say 'it's impossible'. After some experimenting, I say it's inbetween. It is certainly possible for a pilot of average ability to fly a twin but there are some things to watch out for. It's always useful someone pointing out what these dangers are, but really there's no substitute for experience. The intention of this article is to introduce you to "Duet", a trainer for twins which is easy to build, sufficiently forgiving to let you make mistakes and that should stay in one piece long enough for you to learn from them. Anyone with a little aileron experience will be able to fly "Duet", but it also has enough features to interest the more experienced pilot. All in all, "Duet" is an ideal introduction to multi-engined flying.

My first encounter with twin engined models was when one of our club members brought a De Havilland Hornet along to the flying field one summer afternoon. As soon as the engines were beating in tune, I knew I was hooked; the sound was beautiful. This was something I wanted to try. However, this model just would not fly and after spending ages trying to set up the engines, a dolly launch was attempted on a rather rickety dolly. It meandered down the strip, eventually executing a graceful arc to the left which unceremoniously dumped the model in the rough. After several attempts on the dolly with similar results, hand

launching was resorted to. This was even worse, on leaving the hand, one or other of the engines surged, causing the model to cartwheel across the ground. After a couple of attempts, the inevitable happened and out came the bin bag. The plane had apparently flown successfully on at least one previous occasion but its ignominious demise was not mourned by its owner who pronounced it more trouble than it was worth. Bearing in mind that the Hornet's pilot is considerably more skilled than myself, I should have quit then, but no, I relish a challenge.

Talking to several people about the problems with twins, the general consensus

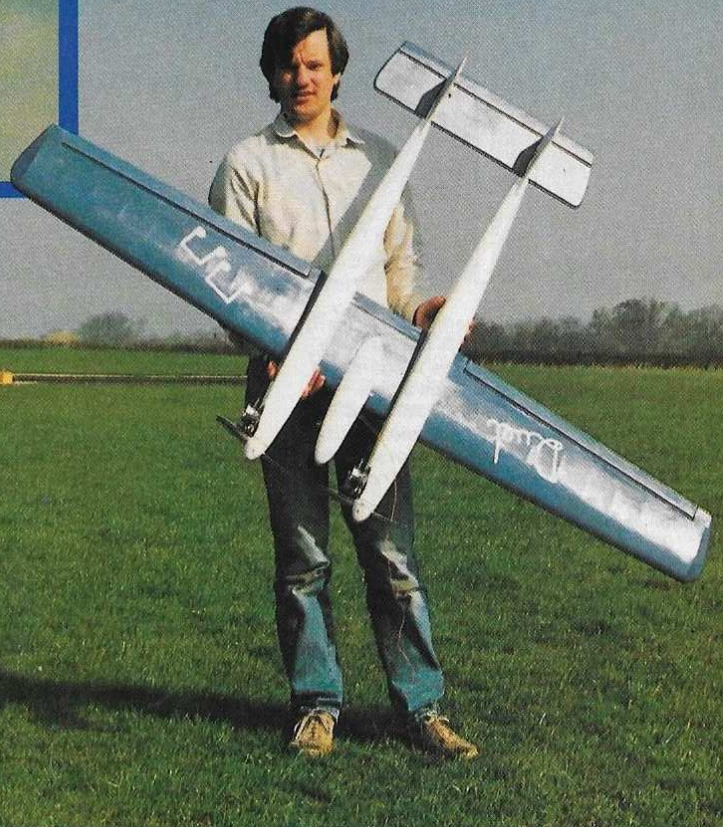
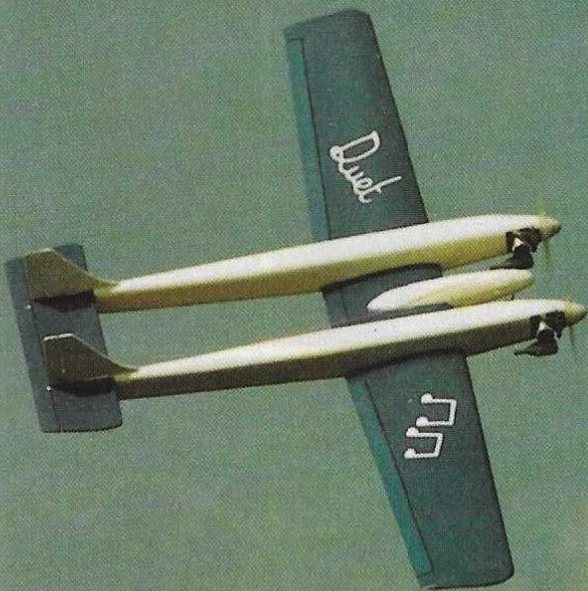
was that the asymmetric thrust, generated when one engine faltered or cut, was the worst problem. This is particularly disastrous on take-off, of course, since the plane is quite close to the stall – and the ground! So, I looked around for a plan or a kit I could build with two engines close together. There may well be one out there somewhere, but I couldn't find it, so I designed my own.

## Design Criteria

Apart from having the engines close together, I had several other design considerations in mind.

1. The engines must be easy to start and reliable. I had a Super Tigre S29 that fitted that bill, so only needing one more helped to keep the cost down. As a general rule, larger engines are easier to start and in my experience more reliable. For this design, the Super Tigres provide plenty of power, although I wouldn't want to have much less.
2. The model must be capable not just of single engined flight but have enough power in one engine to get it out of trouble. So, not too large or heavy a model. Conversely, larger models tend to be smoother and easier to fly. I decided on a 6ft span, which eventually turned out at 73in. I didn't pay too much attention to the weight whilst building but it came out just a shade

David brought along the DUET to Old Warden on Easter Sunday and thrilled us all with a display of aerobatic flying. Single engine performance has to be seen to be believed - aerobatics are still possible and you can turn in either direction. Why not build the DUET and then move onto the YAK-4, as featured in last month's RCM&E.



over 6lb, which is not bad for a model of this size with two lumps of metal up front. 3. Since I feared that the model would not last too long, it had to be of simple construction and strong.

4. The model must be aerobatic. I quickly get bored just pottering around the sky.

Putting these requirements together, I came up with a Mark 1 design. Basically, the Mark 2 as presented here is the same but slightly prettier, sleekified someone called it. I wouldn't have bothered for myself, but the editor insisted. Twin booms with twin fins has the additional advantage that there is a rudder in each propwash which is useful in trimming for single engine flight. I listened to a lot of arguments about the best thrust angles (out thrust, in thrust, up thrust and down thrust) but since this was inconclusive, I decided to ignore the lot. Consequently, all the incidences are set at zero degrees. It works fine, so I guess its okay.

## Construction Notes Fuselages

Each fuselage boom is built on top of a 1/4in. x 3in. sheet. Draw a centre line down the sheet and glue the formers vertically. Add the 1/2in. triangular between the three formers and the fuselage top. Clue the

1/32in. ply doublers on the front fuselage sides. I notice that virtually every constructional description I've read in this and other magazines reminds builders about getting a left hand a right hand side. I always scoffed at this, and anyway, with four sides to do there's two changes to get it right. I still managed to end up with three rights through! Anyway, glue the fuselage sides to F3 and F4 and to the 1/4in. sheet between them. When dry, pull in the front and back using the centre line as a guide and there you have it; nice and square without a jig. Add the rest of the triangular section strips and you're almost there. The engine installations are completely separate with one tank and one throttle servo for each. This proved straightforward to set up so that now, after a little practice, I can get the engines running at the same speed from idle up to full throttle. This I hasten to add is without the aid of a fancy transmitter. The plan indicates upright engines and this is how they were in the Mark 1. For maximum reliability, I would recommend this position. The Mark 2 has the engines at 90°, but any angle is possible with this design of front end.

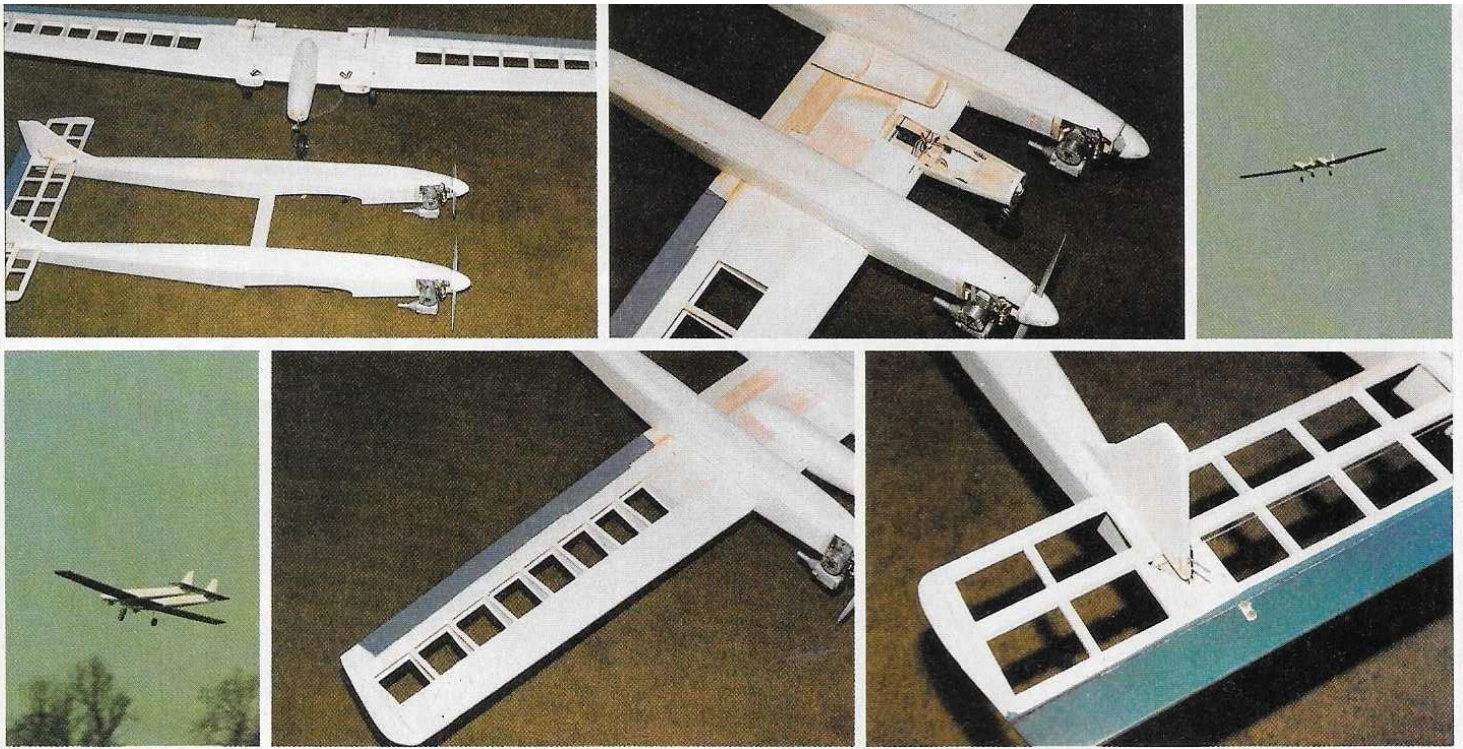
A servo is installed in one fuselage for the rudders and in the other for the elevator. I mounted mine on a piece of 1/8in. ply glued vertically down the centre of the wing opening and this is quite stiff enough.

Pushrods were left over 1/4in. square spruce which are fine, I guess snakes would be alright too.

## Wings

Ribs for the outer wing panels are made using the sandwich method, hence only root and tip ribs have been drawn. Build each panel by pinning down the bottom spar and packing up the leading and false trailing edges as shown. I didn't build in any washout and although there is just the hint of a tip stall, it occurs very close to the stall of the rest of the wing. However, if you want to be really safe, 1/4in. washout should remove tip stall risks completely. Add the ribs, followed by the top spar and then sheet over the leading and trailing edges where indicated. The trailing edge sheeting is extended over the false trailing edge and sanded down afterwards to the correct section. Adding the 1/16in. webbing between the spars gives a very strong wing that, so far, has survived a vertical dive into the ground, a slow speed disagreement with a tree and a cartwheel on landing; with only a few patches.

The centre section of wing is built in a similar way, but without any sheeting yet, and the outer wings joined to it using the ply dihedral braces only at this stage. The leading edge of the centre section is



*Construction and assembly methods are clearly shown in these illustrations, note the fuselage joiner between the fuselage at the wing trailing edge. Two Super Tigre 29s provide ample power, as a purely training model '25' sized engines would be adequate. Experimenters might like to adjust the shape of various airframe components but, remember, any major changes and you are on your own! Construction techniques are conventional throughout.*

notched and the 1/8in. ply plate for the centre nacelle glued in place. The centre nacelle is very strong as all the parts interlock. The ply plate passes just below the top spar and far enough back to overlap the undercarriage mount. The ends of the undercarriage legs thus pass through it,

locking everything together. After fitting the undercarriage mount, install the aileron servo, pushrods and bellcranks. Since the centre plate is quite high up in the wing, mount the aileron servo under the plate as shown. The pushrod between the bellcranks is in one piece with a "T" soldered onto the middle, over which the servo horn fits. The pushrods from the bellcrank to the aileron torque rods pass between the spars, over the main dihedral brace and then over the rear brace. Since there isn't a lot of room between the components, fit the rear brace afterwards. It is possible to arrange all this so that these pushrods are straight. The key to smooth flight is minimum slop and no unnecessary bends in pushrods that could deflect under load. The rear dihedral braces are run in one piece from the outer wing panels and recessed into the centre section

ribs as necessary. Once all this is set up, run the extension wires for the fuselage mounted rudder and elevator servos and the "Y" lead for the throttle servos just behind the leading edge. Add the wing mounting dowels and main undercarriage legs and the centre section can now be sheeted. The centre nacelle is planked with pieces of 1/8in. strip and is fairly straightforward. Cut out the radio hatch after planing and sanding. I designed the centre nacelle to just cover my receiver, battery and aileron servo and it's a tight fit. Check it out before going too far.

## **Tailplane and Fins**

The only thing to remember here is to notch the tailplane ribs for the rudder joiner before gluing them in. Cut out the fins, not forgetting the tongue that protrudes through

the tailplane, and mount the rudder torque rods. Sew and epoxy a piece of brass tube to the fins and run the rods through the tubing. The joiner is connected up and the fins glued to the tailplane before any other assembly, as this gives plenty of room for adjustments and getting it square. Unless you are planning prolonged knife edged flight, a bit of slop in this linkage isn't going to matter very much.

## Assembly

Before joining the fuselages together permanently, bolt the completed wing to them and make it true and square. Those flat fuselage tops come into their own here as laying them on the kitchen table gives a quick and easy indication of how good the set-up is. When satisfied with the arrangement, glue on the tailplane and the centre section trailing edge and leave it to dry. If you make the wing fit too precise at this point, it could end up very tight after covering, so don't try and be too clever.

Build up the wing fairing under each fuselage from 1/8in. sheet and 1/2in. triangular. It is easiest to do this with the wing bolted in position, but take care not to glue anything to the fuselage units. Don't forget to leave a small gap at the leading edge as the whole wing has to be tilted down to ease out the dowels. Apart from looking smooth, the fairing neatly hides those unsightly wing bolts.

Now is the time to get the razor plane and glass paper out and make the fuselages nice and round and then finish to taste.

The radio installation is simple enough, there being plenty of room. I would recommend you make sure that the engines

stop when the throttle trim is closed as this may get you out of trouble one day.

## Flying

Flying "Duet" is a delight, although my first few sorties came close to disaster. I believe that the problems I had would have proved terminal on any more conventional twin. However, now I have the experience and the confidence, I am ready to tackle something a little more difficult.

The date for the test flight of the Mark 1 was set in advance, a strategy that invariably leads to bad weather. There was snow on the ground and a very low cloud base at 200-300ft. Anybody with any sense wouldn't hve got out of bed. Still, I thought I'd run up the engines and perhaps taxi around a bit. After setting everything up, the engines were running sweetly and the cloud had lifted a little - so I couldn't resist it. Down the runway, straight as a die, into the air and start climbing when one engine died. Foremost in my mind was the asymmetric thrust problem so I immediately cut the other engine and glided back down. That was enough for one day. The problem on this and the next couple of flights was that I was setting the engines for maximum power and concentrating on getting them running at the same speed. Since there is plenty of power available and the asymetry is not a serious problem, this is unnecessary. If each engine is set to run reliably, at whatever speed that is, this is quite sufficient. Admittedly, getting them beating together sounds best but may not produce the best flights. (It may be possible to achieve both reliability and a common 'beat' by experimenting with different propellers

- Ed). One of the most important rules that I have learned about twins is get to know your engines. My next twin-engined model will use different engines which I will certainly install in "Duet" first, until I am used to them.

As my experience increased, I became more adventurous. Rolls are quite slow, compared with my other models anyway. Inverted flight is a delight, just a touch of down to remind you which way up you are. Knife edges are possible, but not for long. Single engine performance is much the same as with two engines, except that everything is slower. Pilots have been known to lose an engine and not even notice for a while. Most manoeuvres are possible on one engine, including take offs, although plenty of room is required for this and you need to take your time and watch the stall.

My confidence with "Duet" has now grown to the stage where it is one of my regular Sunday fliers and is certainly the nicest to fly. Many modellers who hear it and see it fly take an interest because not everyone has a twin and they do sound good.

In conclusion, I have made many mistakes flying this model when a less forgiving design would not have survived. My confidence with twins has grown to the point where there is a 1/8th scale Lockheed P38J Lightning on the drawing board that I **know** I will be able to handle. If you want to try a twin but don't know if you can, make your mistakes on a "Duet" and then decide.