KWATZ

IT'S SMALL, IT'S LIGHT, AND IT LOOPS IN ITS OWN LENGTH. JOHN RUTTER SLAPS THE FACE OF CONVENTION WITH HIS LATEST LITTLE TAILLESS TRICKSTER

Test flying new designs is always an interesting prospect - no less so when they've got no tail!

With 1999 drawing to a close, I found myself mysteriously doodling so-called 'fun-fly' designs on bits of scrap paper. (Personally, I find the term 'fun-fly' rather strange because, to my mind, all model aeroplanes should be 'fun to fly'). Typically for me, the design had to be a bit different, and since I was thinking of bolting an O.S. 26FS up front, it had to be light, too.

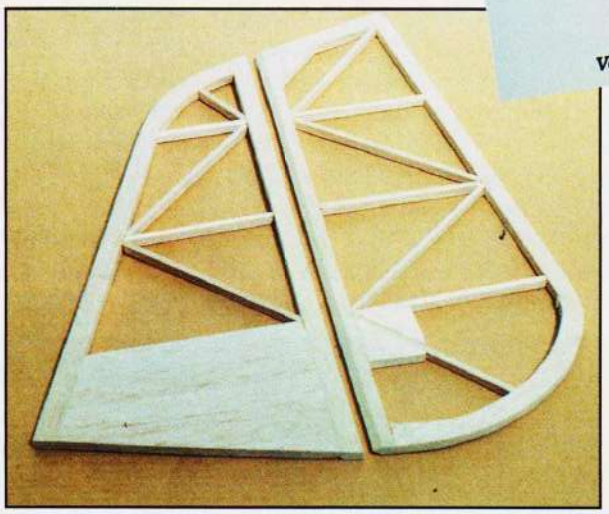
My last couple of models used an old control-line stunt type rib construction, which provided very strong and stiff wings, with very little weight; a well proven concept, and I decided to use it once again. Previous attempts at fun-fly models with parallel chord wings had displayed a less than perfect roll rate, so a tapered wing was called for in order to speed things up a bit.

Most regular fun-fly types use very simple, built-up flat plate section tail and control surfaces, that seem to work well at low speeds. They also avoid flutter, so if it's good enough for them...

As various bits of the puzzle fell into place, I realised that my design was beginning to look a little like all the others. Then, with a flash of inspiration, I came up with a good way to save a few ounces. Leave the tail off! Hmm... One less servo, a lot less building, and a probable saving of 4 - 5 ounces in total. Oh, and it looked different, too!

Very forgiving, yet incredibly aerobatic - that's Kwatz!

Fin and rudder. Note the solid sheet sub-fin.



The final piece of the jigsaw, and one that put the proverbial seal on my design spec., arrived when a friend showed me his Just Engines newsletter. There, I found an article promoting the Leo range, which includes their 'thirty-seven' - a near 40, producing (apparently) 1.2 hp from its shoe-horned, 25-sized crankcase. Great! And, it's reasonably cheap into the bargain.

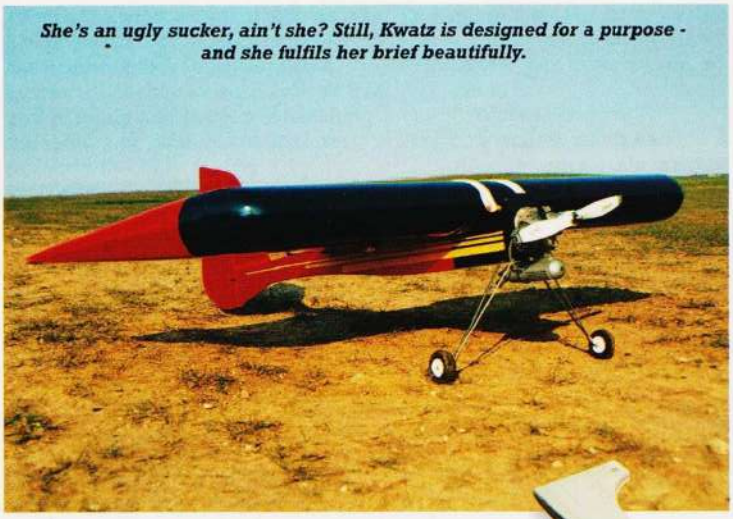
On reflection, I reasoned that this would give far more power than the four-stroke. Since I can't resist a bargain, I ordered one straight away,and began building.

WOODEN WALLS

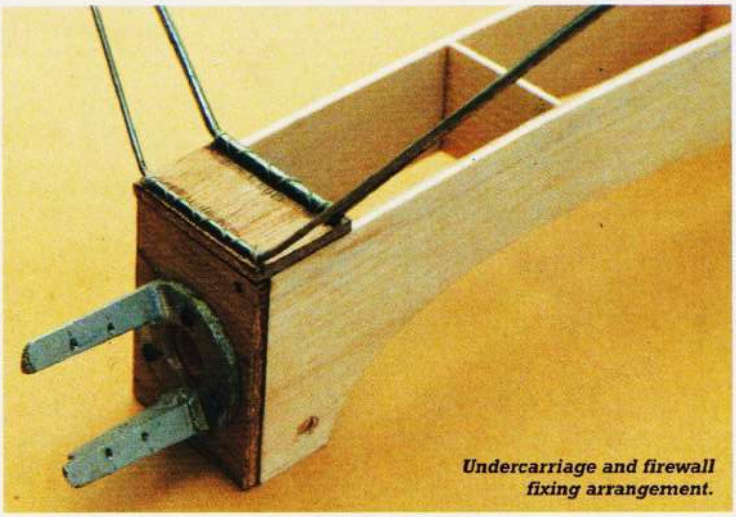
I started by constructing the fin and rudder. Both are built over the plan from strip balsa, with a solid sheet sub fin; the latter is designed to accept a tail skid, and forms the major joint between the fin and fuselage sides. I suppose, if you really wanted to save the last fractions of an ounce, this could possibly be lightened further between the fuselage sides.

As you'll doubtless notice from my photos, the rudder has a vee-shaped chamfered leading edge for hinging (with Mylar strips added later on), whilst the front of the fin is rounded off to make it look nice. Simple, eh?

Next, the fuselage. Cut a pair of sides from medium 1/8" (or 3/16" if you want the model to be a little stronger) balsa, and glue your 1/32" ply reinforcements in with impact glue (remember to make a handed pair!). I taped mine together at this point and smoothed them on a disc sander; unfortunately, I got a bit over-enthusiastic, and the tank bay shrank a bit!



She's an ugly sucker, ain't she? Still, Kwatz is designed for a purpose - and she fulfils her brief beautifully.



Undercarriage and firewall fixing arrangement.

While the sides are still locked together, drill some holes for the wing retaining dowels.

SHAPING UP

Cut out the various formers, and decide how you want to mount your motor. In order to leave the option of fitting a pipe, in case there wasn't enough power, I fixed mine around 30° from horizontal; this allows my exhaust to run along the underside, on the centreline.

One minor engine modification is worth a mention here: I rotated the throttle arm, so that it operates 'above' the silencer. This has the effect of positioning the snake in one corner of your tank bay, where there's room for it, rather than under the tank, where there isn't!

A slight break from convention occurs at this point. Usually, you would now glue the front section together, and then pull the tail in; but, I used the 'glider guider' method, which dictates that you glue the fuselage sides to the fin (easier to get it straight). When it's set, you carefully slide the rest of the formers in place. Be warned - even with this method, it's still possible to end up with a banana fuselage, so make sure you check it over a straight line on the board.

The last two formers added are the engine and undercarrige mounts. These are both glued onto, rather than into, the fuselage, and overlap at the front; later, the joins are further reinforced with triangular gussets. 10 swg piano wire is used for the undercarriage (to fit the light foam wheels), whilst the supporting wires are cut from 14 swg. Invariably, single leg undercarriages bend backwards, so the idea was to produce a fairly bouncy version that wouldn't have to be tweaked after every landing.

Time to add the rudder and throttle servos. These are simply screwed to a couple of 1/8" ply bearers, which are glued into the fuselage. The throttle uses a thin (SLEC) snake, whilst the rudder pushrod is made from pine and piano wire, with just the merest hint of a bend in the rear section (to allow easy movement).

When you're happy that all is satisfactory, the rest of the fuselage decking can be added, using a combination of length-wise and cross-grain balsa. On mine, I faired in the fin and sub fin with lightweight filler - admittedly, it's optional, but I couldn't help myself, because I just love the stuff!

Don't glue the wing retaining dowels in place until you've covered the fuselage; trust me, it's much easier that way.

IN THE PINK

Now for the real fun! Yes, it's time to build your wing. Unfortunately, I quickly discovered that my lightweight rib construction wasn't suitable for such a fat and well-rounded section; as a compromise, I looked again at the merits of a parallel chord foam wing. If the ends were cut off at a sharp angle, this would effectively give me less area at the tips, similar to taper in function - and, if I used a harder-than-usual foam, I would be able to cover directly onto the surface (no veneer or glue), thus saving weight.

So, after convincing myself that this was the way to go, I got my hands on some pink (flooring quality) foam, that's manufactured locally.

I then attempted to produce a lightweight wing by cutting each panel in two halves (top and bottom), before removing most of the central core. In this way, I managed to reduce nearly 4 lb. of foam blank to 12 oz. of finished wing! All right, the dedicated balsa basher could probably better this with a built-up version, but it would take a lot more time and effort (which could be wasted on a more or less 'expendable' model such as this).

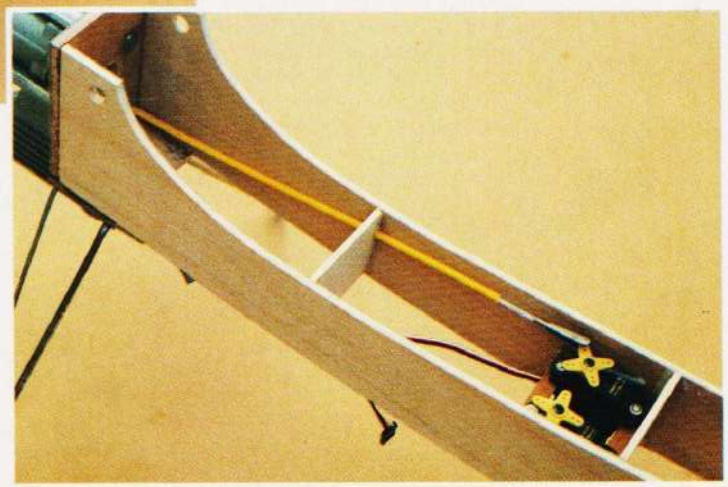
Gluing fuselage sides to the fin, 'glider guider' style.

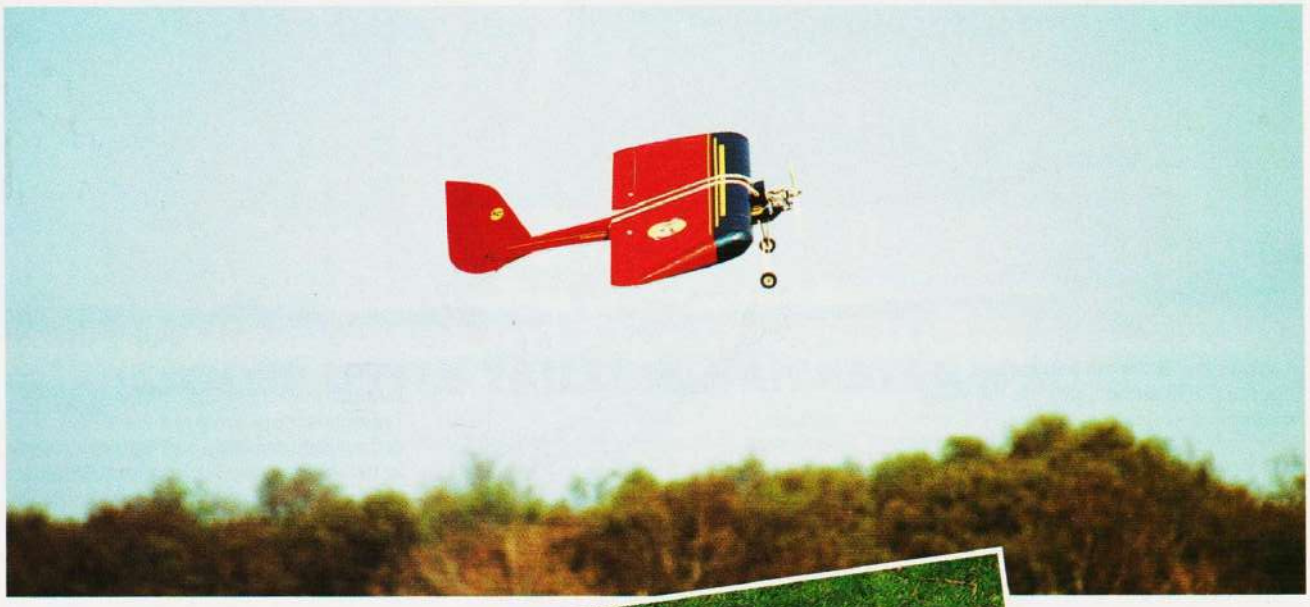
A small tip - when using this type of foam, cut away the outer skin before you start. This is denser than the rest, and seems to retain some 'tension', which makes it curl very badly. As a result, it can curl your wing blank, too!

Begin by making two sets of wing templates - one pair for the inside of your section, and one for the outside. The idea is to cut the inside profile first, before removing the 'plates and replacing them with those used for cutting the outside.

John's Leo .37 - nice engine, nice price, good performance.

Protec mini servos are employed for all functions although, obviously, you'll need a computer radio to cope with mixing the wing mounted jobs.





Up and at it. Kwatz is one of those models you'll want to take wherever you go, and being small, you'll be able to!

Whilst rubber bands retain the wings, when they're off, the tailless fuselage is probably one of the easiest you'll ever have to store.

In order that the 'outside' template can be positioned in exactly the same spot as the 'inside', it is important to ensure that the retaining pins (I use sharpened $1\frac{1}{2}$" panel pins) are in identical positions, relative to the two templates.

Starting on the inside allows your un-cut foam blank to provide a flat and steady surface from which to work. I started at the back and worked my way forward, but this probably isn't critical. Repeat the process until you have four hollow sections, but don't throw away all the waste; bits of it will be helpful later.

Don't worry if you get a ripple on the outside, because lightweight filler sticks reasonably well, and the foam itself sands nicely with sharp wet 'n dry paper. If you end up having to sand, do remember to support the section by replacing its cut-outs temporarily.

Tape the front edge of a pair together, fold back, apply glue (contact adhesive or possibly white glue), and stick back together when the 'contact' has dried. Either use your cutter or a sharp knife to trim the trailing edge square, and to the right chord.

Cut another panel of foam, using only the outside template - this will be used for wing tips. Mark out two 45mm strips, angled at 25° to the chord, and cut two handed blocks. These could be hollowed out before gluing together, but to be honest, I didn't bother.

Now, use the triangular waste section from your tip blocks to help cut the wing panel ends. Glue the tip blocks in position, and carve / sand to the required section.

If necessary, trim the root-section joint dead square, in a similar manner to the above. Go back to the waste from your wing, and cut four pieces, 90mm in length - two from the front section, and two from the rear. Glue the corresponding halves together.

When inserted, these 'fillers' effectively reinforce the centre-section, and stop the wing from snapping in half. They also prevent the retaining bands from crushing the foam.

Your servo leads need to pass easily through the wing, so cut a groove in the bottom of one filler piece. Make a corresponding access hole in the wing skin, so that your lead can pass into the radio bay.

Mark the centre of each filler piece, and glue them half into one wing panel; they might not match exactly (don't forget, the cutting process melts a bit away), but they'll certainly help to stiffen the whole structure (by the way, don't be tempted to fill any gaps with 'orrible, heavy glue!). Now, at last, you can throw all the waste bits away.

Glue the 1/2" square balsa trailing edge to your wing (hinges don't stick well to foam) and, if necessary, sand the trailing edge to fit. While you're at it, taper the strip to about 1/4" at the extreme edge, to match the elevons.

Other than the leads, you'll have noticed by now that there has been no mention of servos in the wing. Well, I didn't forget them (for once!)... and no, this isn't a 'rudder only' model! I used thick card as a template for some wing cut-outs, one of which incorporates a mount for the aileron servos. Used in conjunction with a small (electronic type) soldering iron, templates make the hole-cutting process very easy; this doesn't seem to weaken the structure particularly, and saves a few ounces in weight, in addition to allowing easy wing interior access.

Cut a couple of servo mounting plates from liteply, and epoxy-glue them in place. When the servos are mounted, they finish up virtually flush with the wing skin, and look quite neat. If you wish to give the servo mount a little more rigidity, epoxy-glue a piece of balsa between the plate and centre spar.

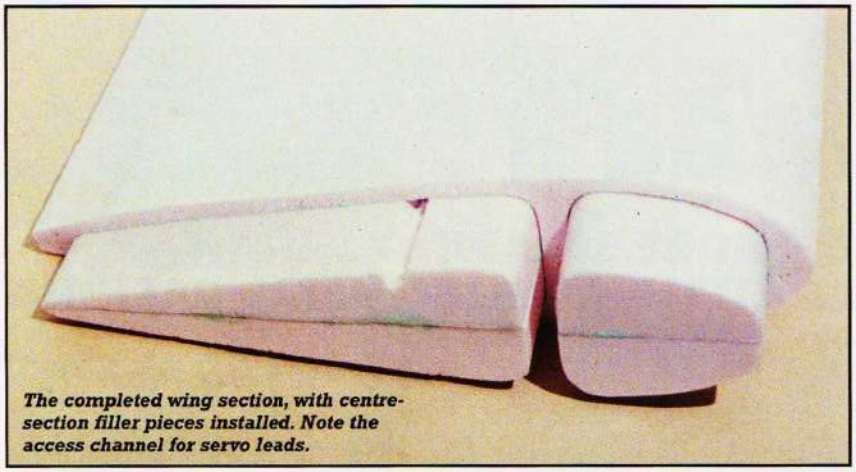
Make some ailerons from 1/2 by 1/4" strips. Leading edges should be planed to a 'V', but everything else left square. The hinges are Mylar, control horns plastic, clevises metal, and pushrods threaded metal.

CLEARCOAT OVERCOAT

In order to aid adhesion of the Solarfilm, and to fuel-proof the wood, I gave most of the fuselage a coat of Clearcoat. The entire model was then covered in film, mainly because it's light, but also because it's quick. You should have no trouble ironing onto foam, providing you don't press too hard - I did, and ended up with 'flat spots' where I had to work film around the wing tips' compound curves.

Push the wing retaining dowels in place, give them a coat of paint - and she's pretty much ready for flight. Before you let her loose, do check that you've made a sound job of installing the radio gear, and that everything moves in the right direction, by the right amount, and isn't likely to fall off.

If the model balances where shown, then you might like to start with reduced throws for a first fright... sorry, flight! Bike clips at the ready? Then off we go...



The completed wing section, with centre-section filler pieces installed. Note the access channel for servo leads.

FRIEND, OR FEARSOME BEASTIE?

Whilst a new model's first flight is often scary, taking up a new and somewhat unconventional design is two or three times as bad. To make matters worse, Kwatz looks particularly risky, and with a high power-to-weight ratio, it could quite easily, and quickly, have ended up as a huge pile of bits. Luckily however, you won't need the bike clips; indeed, the model looks a lot more fearsome than it is.

Test flight day, and the wind was stronger than I would have liked (nothing new there). Still, at least we had some sun! One bad omen was that son James had forgotten the camera - dare I risk a new model before taking photos? Oh, to heck with it!

With Kwatz fired up, she was directed towards the oncoming wind, and given a blast of power. Time to let her go and cringe! Luckily, she powered away straight as a die, needing only a slight amount of right trim to bring her steady. By now, the model was about 100ft. up, so I rolled her right (very nice), then unwound by rolling left (also nice). Loops were easy, bunts no problem and, with growing confidence, I spent the next few minutes stirring my sticks in every conceivable combination - BRILLIANT!

On landing, the very thick wing slows Kwatz down lots, so I found myself a bit too far down-wind, and had to drag her back to the strip at slow speed before touching down.

Fortunately, I don't live far from the strip - so, off we went to fetch the camera. For the second flight, Kwatz was given a little more control movement and, as a result, she really did come alive. With this new level of response, and improved pilot confidence, I proceeded with the photo session, flying a succession of low-level, low-speed passes. In performing one fairly low inverted pass, I got things a little wrong, and had to instantly roll the model upright, before half-looping it. "Sorry dad, I missed that" said James. "Not to worry son, so did I..."

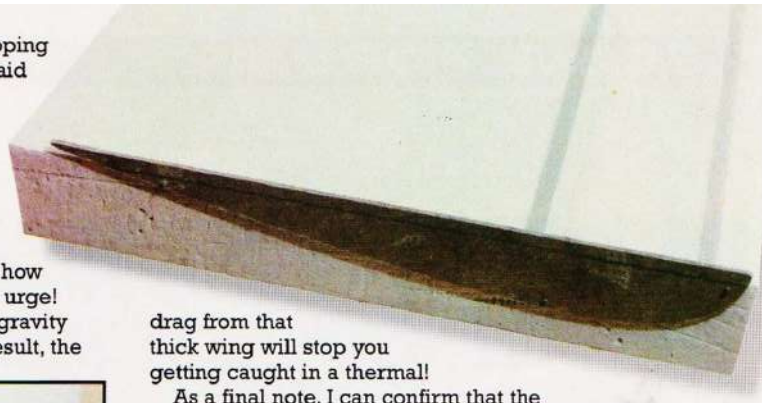
Where power is concerned, Kwatz had already proved that it would happily perform rolling vertical climbs forever. But, I just couldn't help wondering how she'd go with a little bit more urge! Risking a rearward centre of gravity shift, and the fun that could result, the standard silencer was removed, and replaced with a cheap pipe. Now, the motor seemed smoother and crisper on the ground... but what would happen in the air?

No problem. The extra power and smoother running is nice, and the model is still stable, but she'll now bunt in her own length! I kid you not, it just seems to rotate around the wing. Great if you're in a 'loops per minute' competition! Kwatz recorded 27 in under 30 seconds, before the motor cut - incredible. At about 4ft. radius, loops are a little larger, but more fiddling with control surfaces might solve that.

In most cases, take-off involves very little ground roll, whilst feather light landings don't take up much room either. As you might expect, with a wing loading of around 7oz. / sq. ft., and a low aspect ratio wing, there isn't really a stall to contend with; she just sort of - well, mushes around. The glide isn't bad either, but don't worry - drag from that thick wing will stop you getting caught in a thermal!

As a final note, I can confirm that the construction has proved to be quite tough, even in a crash. Yes dear reader, I made the mistake of believing my test meter thingy, rather than giving the battery a good charge and found, to my cost, that 'hydride batteries seem to go from 'okay' to 'totally flat' within about two seconds! Sadly, the model rolled into the deck at high speed, with zero control.

Still, the resulting pile of bits has now been stuck back together, and she's flying as well as ever.



Cutting template for the outer profile.

Just goes to show what can be done with a block of old foam and a hot wire cutter. Try it, it's good fun.

KWATZ THAT?

Intrigued about the name? Well, Kwatz was the equivalent of a laughing sound made by a manic 'machine mind', or 'artificial intelligence', in a sci-fi book I read recently. It seemed quite apt - kwatz, kwatz, kwatz! (Ha, ha, ha!).

DATAFILE

Name:	Kwatz
Designed by:	John Rutter
Aircraft type:	Tailless fun-fly
Wingspan:	50"
Wing area:	800 sq. in.
All-up weight:	3 lb
Wing loading:	7 oz / sq. ft.
Engine range:	.25 - .37 cu. in.
C of G:	4.1/4" - 4.3/4" from l.e.
Rec'd no. channels:	4
Control functions:	Rudder, elevon, throttle

Kwatz II, with 'pipe'. If you decide you're going to wait for the stall, just remember - you'll need to be patient!