PSS Tornado Lost Foam Version

By Peter Garsden

Because 2014 was the 40th Anniversary of the Tornado, a few of us in the Power Scale Soaring Association (www.pssaonline.co.uk) decided to do a mini mass build of this wonderful Jet. After I saw Phil Cooke (also an LMMGA member) struggling with the Andy Conway traditional construction balsa built plan version, so unconventional is the shape, and armed with some experience of fibreglass construction from repairing the Willow F3F (now deceased) , and the Alpha Jet (for which see December 2014 LMMGA Newsletter), I decided to embark upon a lost foam version, which is a lot easier than it sounds.

The full building blog with multiple pictures can be seen on RCM&E at http://www.modelflying.co.uk/forums/postings.asp?th=102829&p=1 Other examples of Tornado builds can be read on the PSS section of Model Flying at http://www.modelflying.co.uk/forums/threads.asp?t=401 I will also put the photos up on the LMMGA website.

Paul Janssen from Belgium did have a very good webpage on his site which used to sell a very wide range of plans but it seems to have disappeared. Fortunately, I have printed off a copy at home, which I can supply to anyone who wants it. I notice, however, that is described in an article by Alan Hulme on the PSSA site. Basically it involves making a mould out of blue foam, coating it in packing tape, then wax, 3 layers of fiberglass, then dissolving the foam core with acetone leaving a hollow shell. To say it is easy would be misleading, It is messy, uses many pairs of rubber gloves, but not difficult.

The Andy Conway Plan is available through the PSS website, and proceeds go the Association – it is free to join, so a worthwhile investment. I studied the plan, which I had to adapt to suit lost foam. The formers had to be redrawn so that they came up to the outside edge of the fuselage in that the fibreglass is only about 1.5mm thick. Andy Conway obliged and even sent me a reduced scale plan of his pivoting wing version – too ambitious for me.

The Wing

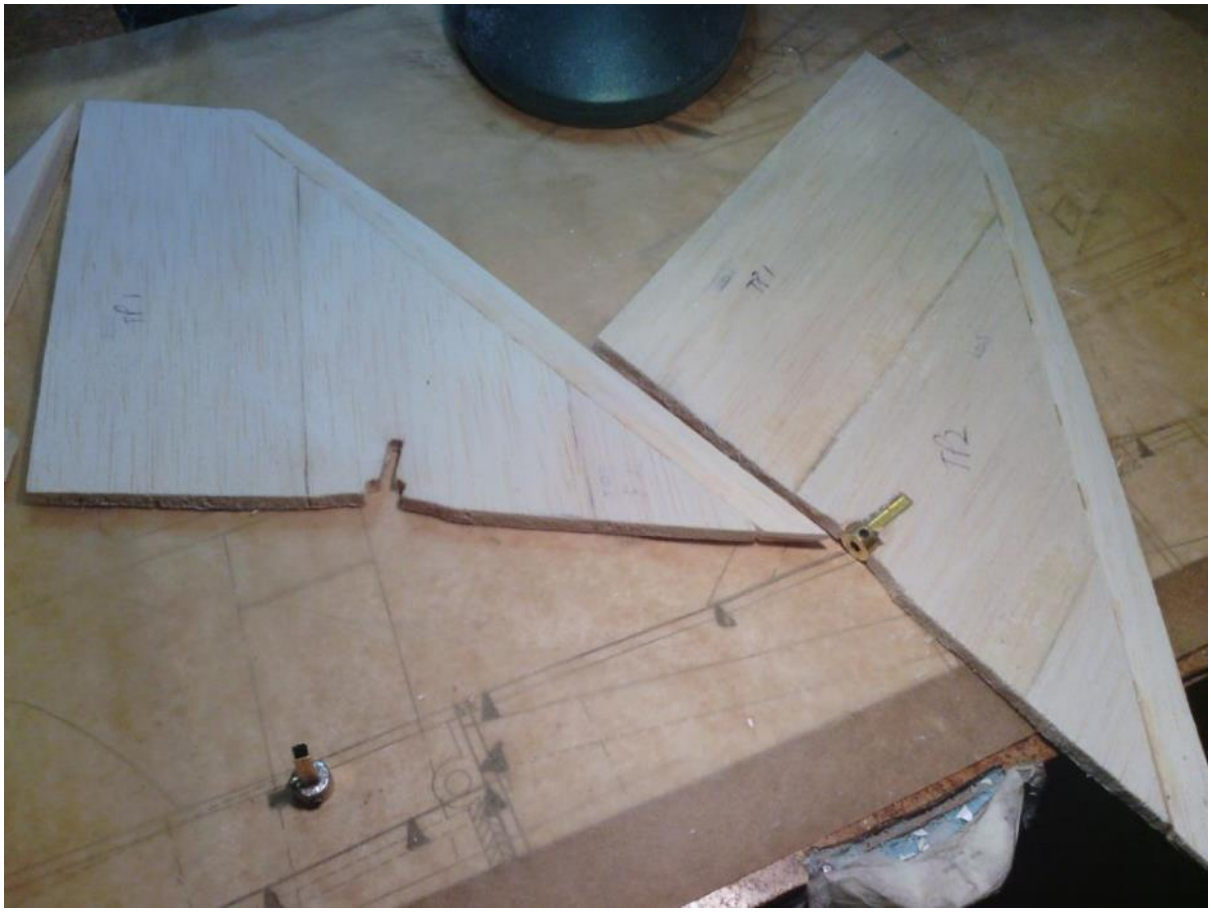
Although I do have 2 foam cutters (50 inch and about 30 inch), the long wing version is underpowered at 12 volts, and Barry at Foam Wings in Edinburgh makes a much better job than I could muster with fibreglass reinforcement at the trailing edge all bagged and sealed accurately.

The wings arrived in double quick time and only needed the ailerons cutting out then lining with 3/16th square balsa spars for the facings. As it is a “scale” model one does not put servos in the wings, which are quite thin anyway, so I used the usual method of metal rods bent over at 90 degrees and fed through the trailing edge to the aileron. I wanted to have the option of spoilerons, so used 2 servos rather than one. I needn’t have bothered because I haven’t used them in landing which is relatively straight forward.

Phil Cooke specified the wing to a more scale sweep and width with a SD6060 profile. I don’t know what section the original used but it was very similar. I didn’t realise until the wing arrived that it was narrower at the root by about half an inch which meant it was more scale but the wing area was less, which makes the oz per square foot higher, so this is a plane which needs not necessarily lots of wind but good lift such as the Orme.

The Tailplane

This is an all moving tail pivoted by metal rods which slide into brass tubes inset into the tail plane halves. Because the moment arm on these jets is so short, they often don't loop very well, and lots of movement is needed. Indeed, if wings are swept back it would almost turn into a delta shape.

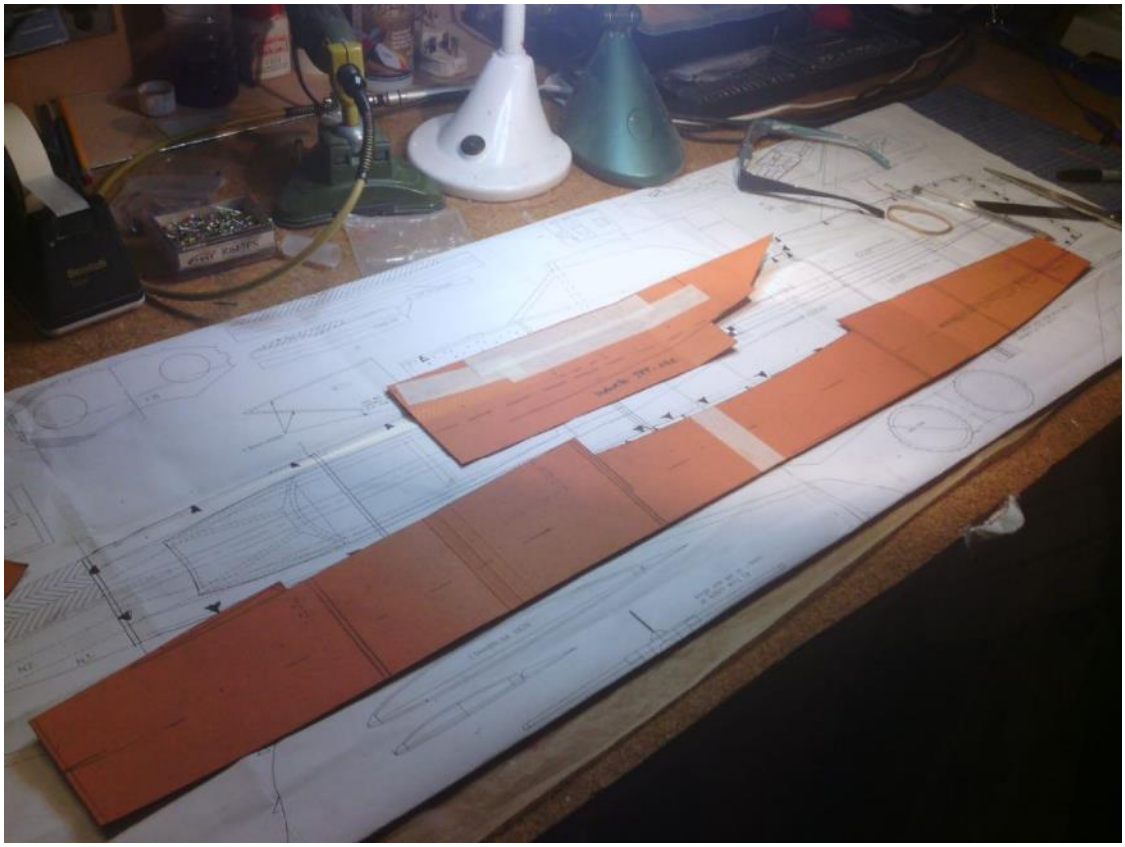


So, construction of the pivot and the position of the holes in the fuselage side has to be accurate. Some builds used a carbon rod instead of steel, which is lighter but not necessarily stronger.

My version used a steerable nose wheel horn which I glued and grub screwed to the steel rod. The stub axles fitted into square brass tubes soldered onto brass wheel collets let into the tailplane halves. To fit the tailplane halves one has to push fit them onto the stubs, then lock them with the grub screws, which makes them prone to movement and difficult to set up. I have marks on the fuselage sides and flats filed onto the rods.

The enclosed nature of the fuselage made working out how to fix everything in position tricky. In the end I opted for a long allen key screwdriver through the rear jet vents.

The Fuselage.



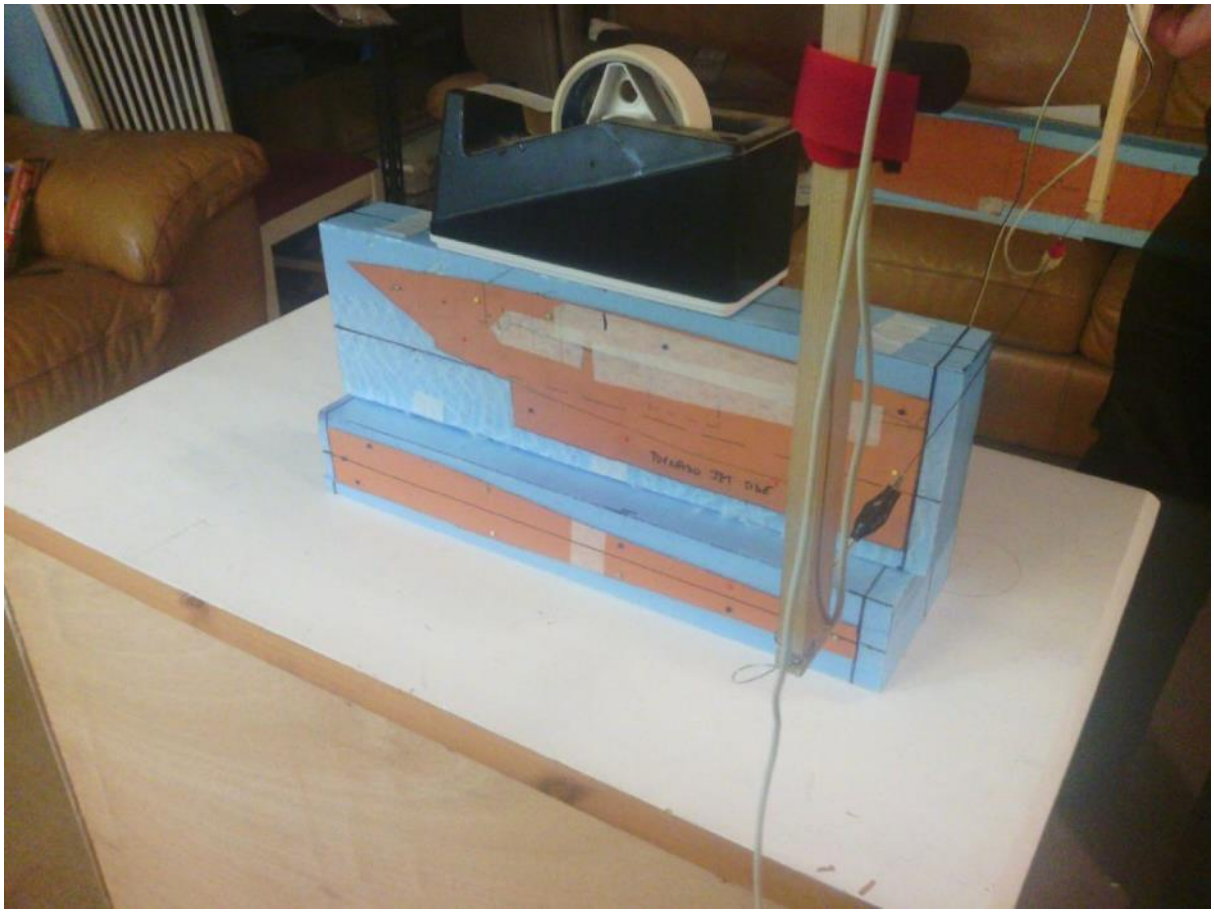
Definitely the most demanding part of the build. I had to work out how to produce the complex shape of the jets and the wheel doors out of fibreglass. As with the Alpha Jet I decided that the jets had to form separate moulds which would attach somehow to the fuselage sides. I looked at various pictures of the real thing banked over in the sky and eventually worked it out. Other RCM&E Build Blogs also helped a lot.

First thing was making top and side views of the fuselage shape out of cardboard. I use old file covers from work (now redundant due to our paperless office), but cereal packets are just as good.

The fin is a separate balsa build in the conventional sense as is the nose block. It is possible to make fibreglass go round a nose cone but very difficult. Corners definitely have to be done in 2 pieces as the cloth won't stick round bends.

First I cut the blue foam block to roughly the right shape with the hot wire cutter. I then used carbon paper (not easy to get these days) to mark the side and top profiles onto the card, which usually has be joined with tape. One has to be careful not to create snags for the hot wire.

One then draws a start line for the front of the fuselage, another line down the middle, then repeats this with the sides. I pin the cardboard to the foam. One has to be careful not to leave another snag for the hot wire. Obviously the templates have to be in line from all angles.



I used the same system as for wings, namely making marks at 1 inch intervals and numbering them so that both sides are cut at the same speed. I have a friend who cuts with me (Keith). It is really difficult to do it alone, but there are systems with pulleys and weights out there.

Once the shape is cut the blue foam is quite easily sanded to shape. I have 3 shapes, the fuselage and 2 jets.

Next comes the wrapping in brown parcel tape which does not have to be smooth and is assisted with a warm solarfilm iron. The purpose of this is to firstly provide a smooth inner surface to the resin, and secondly to make the removal of the acetone laden blue foam goo from the inside.

One then covers the whole surface with floor wax – I invested in wax from Easy Composites in Stoke – I can recommend them for any supplies of glass fibre products. The purpose, of course, is to ease removal.

The next stage is the trickiest, mainly due to gravity. I recommend making a spit type of cradle to hold the fuselage. I use 2 lengths of wire filed to a point which are pushed into the blue foam at the nose and tail. This supports the fuselage and frees up your hands to apply the cloth. I clamp the supports to the bench.

To help the glass fibre stick, I sprayed the fuselage with contact adhesive, for only the first of the 3 layers of course.

I use laminating epoxy resin but you can use polyester which sets much more quickly. I find polyester sets too quickly to work with. One has to wrap the fuselage with glass fibre and make it stick. Ideally you would do the top, bottom and sides separately and let them dry with gravity, but I don't bother.

You apply 2 layers of 160 gram followed by a final layer of 80 gram cloth (more difficult to source). I usually reinforce stress critical areas such as the nose and under wings or indeed the full length of the fuselage with carbon tape of varying widths to suit on top of the first layer.

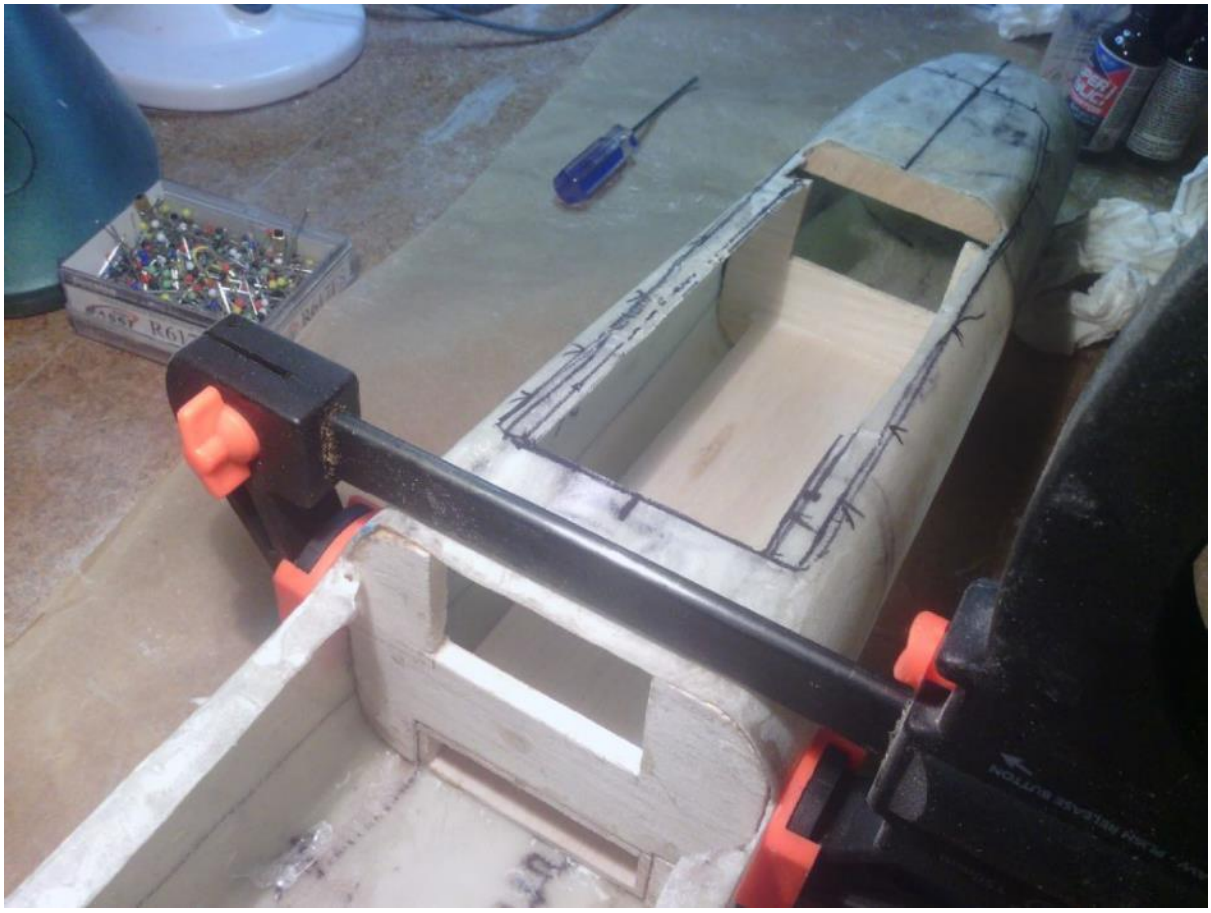
I wet out the cloth with a roller, and use a brush to apply a thin adhesive layer. Then dab the cloth with paper towel to remove any excess resin before it sets.

I use a rough sanding between layers, then finish up with a thick mixture of microballoons and resin to give it a smooth outer surface. I use my Bosch sanding shoe to finish off. You can use the conventional method but it takes ages, and will help your upper arm fitness in the process.

The final stage I hate, because if there are sharp edges to the glass fibre it can give you a nick, which then is made worse when the acetone gets into it. One pours Acetone into a hole in the blue foam –

usually the wing saddle – and let it melt the foam, when it is all done just pull out the brown parcel tape filled with goo, which leaves a smooth surface underneath, to which you can apply formers.

Because the structure is so robust, I only inserted one former at the leading edge of the wing. The tail end of the fuselage needed to be open to help install the elevator push rod. It is much more difficult to after fit parts to the inside of the fuselage. I use a handy profiler which cost about £1.50 in Aldi.



There are then various jobs to do such as gluing on the nose block and fashioning to shape, and creating from the inside out, the cockpit bucket with scale instrument panels. Here scale detail ended for me but not for other PSS buffs.

The top fuselage fairings I made from balsa block and ½ inch laminate leaving a slot to take the fin. I also had to create the top of the wing fairing, and glue on the jets. I used special fibre glass resin called Aeropoxy which is part of the Deluxe Products range. I would advise against using conventional epoxy for fibreglass. The bond tends to brake away even if roughened up first. There are other options in the Deluxe range such as Super Crylic. All of them are a bit pricey.

A potentially tricky area is the setting of the tailplane halves at the correct angle of droop. I made a jig out of ¼ inch balsa which worked a treat. Phil Cooke worked out the amount of droop they would need mathematically – 10mm.

Finishing and Covering

As a group we commissioned Real Model Pilots to make us some 1/12 scale pilots with seats attached which one could either paint or have painted by them. I opted for the latter. Under the full

height cockpit, I made a battery box as per the plan as one can see in the picture. Andy Conway kindly supplied the canopy. Real Model Pilots also made some Jet Exhausts using 3D printing. Phil found some fake jet exhaust flames and cockpit detail which I printed off on photo paper and stuck with card glue as appropriate.

My decals came from Tim Calvert at Real Model Pilots but others used Phoenix Models who have a very large range.

Many didn't think Solarfilm would stick to fibreglass, but I have much success with it. One has to make sure it is free of wax and dust, as one would balsa, but it sticks very well. I opted for the prototype colours of white and red, firstly because it looks good, and secondly because the whole scheme can be done in film.

The main topic of debate on the forum was whether it would weigh much heavier than balsa. If the resin is laid on too thickly that can happen, but I was quite careful not to over apply it. The eventual weight was 3lbs 7oz which compared favourably with Phil Cooke's balsa version 3lb 2oz. At the end of the day, more weight in slope soarer terms just means more momentum, stronger winds, and faster flying speeds.

Flying

Because the wings looked so small in comparison to the body, I was doubtful if it would fly. The fuselage, however, is very wide, and tailplanes are huge, so the wing area is in fact deceptively large.

As with all PSS models they need a good slope like the Orme for lift rather than wind speed.

I worked hard to finish it for the April meeting to good effect as the wind was 50mph at the lip. Phil flew his identically liveried version very successfully, but I was delayed by a repair to my Red Arrows Hawk (the subject of another newsletter article).

The compression at the Orme is so intense at the lip, that most people venture down to the lower ledge where the wind speed is less. John gave me a good heave ho. I marvelled at how well it flew straight off the board. The tailplane setting up is a bit tricky. Get it wrong and it sinks or blows back. Like I said, I use marks on the fuselage. The tailplane halves still flap around in the wind before launch but are fine in the air.

It rolls effortlessly. I didn't fit a rudder but one could. Try as I may it won't loop no doubt due to the non-existent moment arm. The stall is just a mush, but it flies fast due to the thin wing and sharp nose. Inverted flight is not possible due to shape of the air intakes we think.

Low fast passes look great, the model cuts a tremendous shape in the air, and receives admiring comments even from ramblers on the Orme. Once the momentum is going it flies on rails.

I haven't tested it above 50mph, but I would have thought it would cope without any ballast. So if you like something less samey than mouldies, that flies like a real Tornado, take the trouble to build something which flies, it is much less fiddly than shoe horning servos into microslots, and much more rewarding. Somehow, at LMMGA, I think I swim against the tide of some, not inclined to the PSS discipline…

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