Simple Fin Jig for Thin G10 Finned Models – Dan Wolf

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In NAR Competition Rocketry, thin G10 material (fiberglass) is a popular fin material. It is stiff, doesn't warp like thin plywood and can be sanded to a smooth finish without filler material. Typical G10 fin thicknesses are .010" for events like A payload, .015" for events like A Altitude, and 0.02" for events like B Streamer. Thin G10 sheets for fins can be purchased from ASP Rocketry (asp-rocketry.com).

The challenge comes when attaching these fins to a body tube. Balsa fins can be attached with yellow glue. Double glue joints allow you to move and align the fins while the glue is drying. G10 fins cannot be attached this way. The most practical way is to use cyanoacrylate glue, sometimes called "Super Glue", or just "CA". Most hobby stores carry the Bob Smith Industries and other brands of CA in various types. I use the "medium" version, called Insta-gap+ for attaching fins along with the Insta-set accelerator. However it can get tricky holding the fin on the body tube on the fin line with one hand while spraying the accelerator with the other. Even if your hand eye coordination is better than mine, you still are lining up and attaching the fins by eye. Your calibrated eyeballs may be better than mine too, but if you are younger or just starting out, it can be hard to get all three fins attached perfectly straight.

I ran into this when my daughters started using G10 fins for their competition rockets. My solution was to develop a simple fin jig to use to attach the fins. Some of you may be aware of the late Art Rose's fin jig. I have talked to a number of NAR competitors who own one. This is a precision machine that can insure your fins are attached straight. It has also been hit or miss for availability but may be available now. Search the NAR Facebook page for a post about it. The other downside of Art's jig is the cost. It is in the $400+ dollar range. Because of those factors I looked into a simpler and more affordable way to align and attach fins.

Below is a picture of various fin jigs I have used over the years. I started out by taking balsa or basswood sheets of various thicknesses and placing one piece of the material on top of the other so that the top piece was offset slightly more than the radius of the tube. The top piece also would have a thickness of slightly less than half the diameter of the tube. As time went on, I made newer jigs with metal for the top piece so that CA could be removed when it stuck to it. I started with square bar stock from Home Depot. ¼" for attaching fins to 13mm tubes, 3/8" for 18mm tubes, and ½" for 24mm tubes. A picture of some of the jigs my family used over the years is shown in figure 1. At the top left is a jig for 18mm tubes and the top right is a jig for 24mm tubes. Both of those use a metal top piece. At the bottom left is a jig for 13mm tubes made from ¼" balsa. The bottom right is my latest incarnation. This one uses a 0.250" gage block (sometimes called a Jo Block) on top of a "tight tolerance" 1/8" thick stainless steel flat.

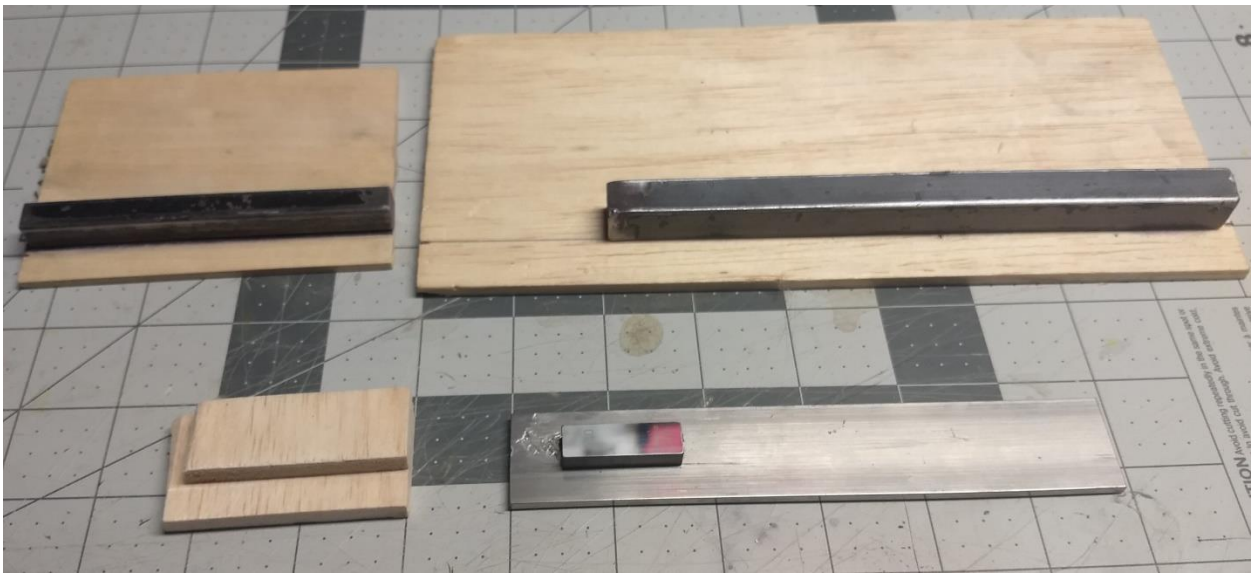

Figure 1 The author's assortment of fin jigs through the years made with balsa, steel, and stainless steel and for different body tube sizes from 13mm to 24 mm.

The key concept to this jig is that the lower surface of the flat plate and the top surface of the gage block are parallel. I was concerned this may not be the case with the other jigs so I spent about $50 at McMaster Carr for these two metal pieces. To make this jig, I placed the gage block on the steel flat so it was 3/8" from the edge of the flat and then I "CAed" it in place around the back side. The gage block has a tolerance of +/- 0.000006". The stainless steel plate has a tolerance specification of +/- 0.002". That is the thickness tolerance, which isn't critical to us. We just want the surface to be flat. Anyway, with these tolerances, the alignment of the fins to the body tube is certainly to be better than attaching them using the eyeball method.

To use the jig, first the body tube is taped to the jig as shown in figure 2. The plate is wide enough so the bottom side of the body tube rests on it, yet the edge of the tube sticks out far enough that there is clearance so that an earlier attached fin can descend down past the edge of the jig when the final fin is attached (more on that later).

Figure 2 The body tube is secured to the fin jig with tape.

One other concern I had was how to insure the tube was round and not deformed when taped in place. I've been using a 13mm engine or Balsa Machining long engine block tubes to stiffen up the body tube and keep it round. A steel or aluminum mandrel may be better. As you can see in the figure, the tube is taped securely in place and is resting on the plate. The fin will be placed on the gage block, which is precisely parallel to the body tube at quarter inch elevation from the stainless steel plate the body tube is resting on as

shown in figure 3.

Figure 3 the 1st fin is put in position on the fin jig for attachment.

To attach the fin, a thin line of CA is run along the fin body tube joint and then sprayed with accelerant so it set instantly. I find an old X-acto knife blade works good for this. I first put a few drops of medium CA on an index card and then dip the knife blade in it and run it along the fin/body tube joint. The fin must be held down tight on the gage block against the body tube as shown in figure 4 while the CA is applied. Continue holding until the accelerant has been sprayed and the CA is set. It can be done by one person after a bit of practice.

Once the CA is set, remove the body tube from the jig. The fin will be perfectly aligned in the vertical or thrust axis which is what we want. However, it may not be extending perfectly straight out from the body tube. Usually the fin can be moved into the right "yaw" orientation since it was only CAed on one side. If it doesn't want to stay there, a drop of CA can be placed on the non CAed side to keep the fin perpendicular.

Figure 5 shows the fin after attachment.


Figure 4 Fin held in place to stay flat against the body tube. The CA is put in the fin joint with the other hand.

sequence is repeated for the other two fins. For the second fin, I usually rotate the body tube so the 1st fin is sticking "up". The 3rd fin is a little trickier. To attach it, I had to elevate my jig so the fin on the bottom side will not bump into the table. See figure 6.

This also shows why the spacing of the gage block or other top piece from the edge of the bottom plate is critical. Too close to the edge and the bottom of the body tube will not be able to fully rest on the plate. Too far from the edge and there will not be clearance for the bottom fin to clear the plate. See Figure 7 to see how the bottom fin just clears the jig base plate when the final fin is attached. Note that this jig would not work for 4 finned rockets. Fortunately, those typically not used for rocketry competition. Once all the fins are attached, fillets must be applied, typically CA or epoxy fillets. I prefer epoxy as I struggle to get nice clean fillets with CA. Your mileage may vary.


Figure 5 The first fin is attached.

Figure 4 Attachment of 3rd fin. Note fin jig is raised so the "bottom" fin has room to extend below jig.

That's the simple Wolf fin jig concept that has been used for building NAR competition rockets for over 20 years. I hope you can use this idea or that it will inspire you to come up with your own method for fin attachment. If you do, please share it with others.

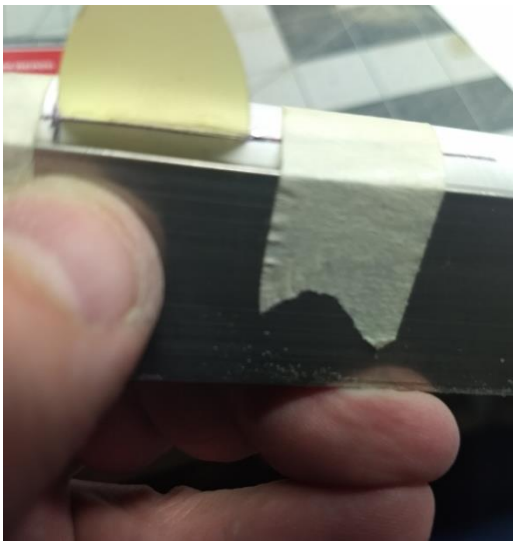

Figure 7 Bottom view of fin jig showing how the bottom fin just clears the jig while attaching the final fin.