Indoor Carbon Balsa Sandwich Builds

by Arend Borst Dec ‘24

Carbon offers advantages when trying to build multiple parts from a single laminate package. A cured 20mm spread tow & balsa package turns into 20+ ribs within an hour of cutting

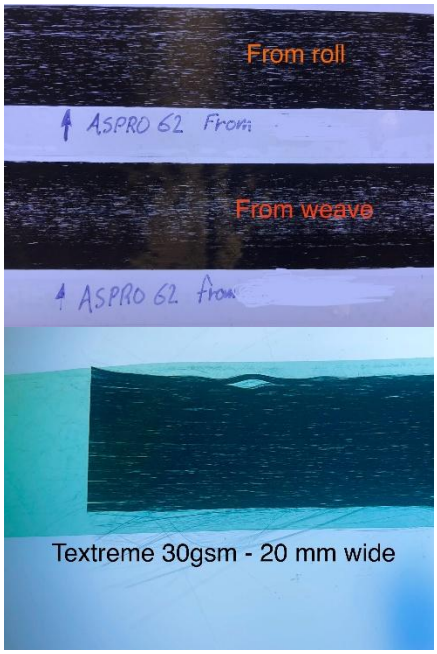
Choice of Balsa

For spars, ribs and outlines I use (4.0#) 64kg/m3 or less. The grain is not too important therefore you can use the balsa that was not good enough for other purposes providing it has low enough density. The only applications that favors higher density balsa core is for reasons of handling. I use (4.5-4.7#) 74kg/m3 balsa for wing and stab posts.

Foam core sandwiches make for difficult and heavy repairs in case of a fracture because the foam cells collapse. Balsa fibres usually only separate and reconnect well with just a small drop of glue.

Carbon and resin choice

Spread tow needs to be light. The only two suitable types I am familiar with is High Modulus Aspro 32 gsm, and Textreme 30 gsm. (I have tried spreading an M60J tow, but getting good results is fun for another day). The Textreme is easily available from .....*Indoor free flight supply*..... Aspro makes a 28mm and Textreme a 20mm spread tow.



Textreme 30gsm - 20 mm wide

For resin I have used Mgs L285 with H285 hardener for many years, and it works well for this purpose. Do not use thinners in your resin.

<u>Preparations</u>

The base material is not critical, but smooth bendable and self-releasing material is preferred. I try to avoid using release wax and film. Mylar film is epoxy non-stick, and I was handed a roll of translucent type which is great for marking the place of your carbon spread tow to have them exactly positioned in relation to each other on top and bottom of your balsa. (use a bright coloured marker instead of black)

The Layup process

Cut your two pieces of spread tow and cut two pieces of mylar, larger by about 6-8mm all around. Then cut your selected balsa piece again slightly larger than the mylar. You should accurately weigh and record weights for all these individual pieces for the resin to fibre ratio to be determined later in the process.

Now place the mylar sheets on your workplace with the markings placed facing down (epoxy otherwise will dilute your markings and they will disappear) Temporarily secure them with some masking tape on a few corners. Place your dry spread tow on the mylar. Mix your epoxy and let some resin drip on the carbon. After it starts saturating the carbon it will not move around anymore, so you can add more resin with a small very soft brush. Too much resin will cause the carbon to "float" and move around, so .....try to evenly spread the epoxy. When all carbon seems saturated turn around the mylar to check for air bubbles by looking from the underside if you have clear mylar. Otherwise just make sure there are no dry spots. Now it is time to remove the excess resin. I use soft toilet paper or kitchen roll paper. Place three layers on top of your laminate, then put the mylars in a food saver vacuum bag. Two minutes under vacuum is ample for the resin to come out. If you see a lot of saturated absorbent paper, then you may have to repeat this, but first check the weight of your mylars with carbon and aim for 65-70% resin to 100% carbon weight. It is easier to re-apply vacuum for more extraction than having to re-apply more resin in an even manner, therefore do not apply vacuum for too long. The disadvantage of a layup with insufficient resin is poor adhesion. There is no good way to fix that, so take your time to do this properly. Removing resin by pressing with the palm of your hand or a paint roller works too. The important part is extracting the resin evenly from entire surface.



Figure 1 Raw Rib Form Layup

The resin to carbon ratio is not super critical, but a dry layup will inevitably show it's ugly face by having the carbon pop loose. If this happens on carbon spars and it repeatedly happens in the same location, then you know that something was not done right, but this is

easy to fix with thin Duco or CA. I have experienced this delam problem, and therefore upped my resin content. (For solid carbon prop outlines I use a different ratio 50:100 resin).

Despite doing everything right, delamination can still happen when you trim your components to length with a diamond disk. To reduce that from happening, apply a tiny bit of thin CA on the spot on each side. Then make the cut.

To the vacuum bag

Before placing the balsa between the mylar sheets I poke 4 small holes through the balsa as a reference for where to place the carbon. This helps to assure that both spread tow pieces are in line and exactly placed above each other.



Figure 2 Rib Forms Vacuum bagged

Then secure the mylars to the balsa or to each other with a few pieces of masking tape. In case of making ribs, tape the ends of the package over your curved rib block. In case of flat components like spars, outlines etc, just tape you package to a flat surface that fits in the vacuum bag. Securing with tape prevents it from shifting from position when the bag starts to deflate. It is also possible to keep your rib block or flat block outside the vacuum bag, but then you need to apply pressure by means of weight on top. This adds more risk for the process to fail. I used to make use of an industrial vacuum pump with vacuum switch and buffer tank. Nowadays I find it more convenient to use a food saver system, providing it pulls a good vacuum and makes a proper seal. Then Cure in a warm place.

Component cutting

The cutting of your components is best done with diamond coated disks in an accurate running Dremel or milling machine. My setup is on a small metal lathe with a Dremel, but it is not ideal. Unless a lathe is all you have there are better, less complicated ways to do it.

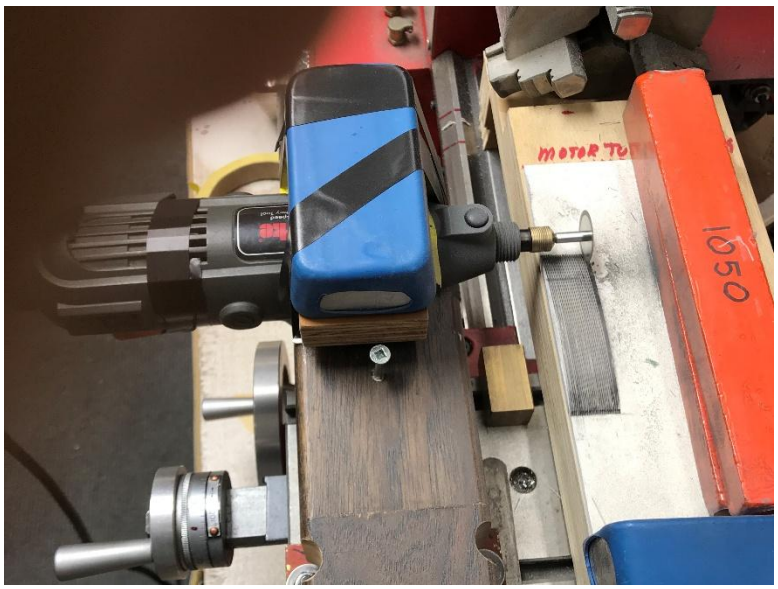


Figure 3 Rib Cutting Rig

A horizontal mini mill is the nicest, and most accurate way to do it. Or you can make a setup by using an engraving tool on a ball bearing guided slide, in combination with a balsa stripper setup with two micrometers. Also a mini table saw can work well. All these carbon components can be sanded to final thickness if you desire to reduce the size of your cut on a later date.

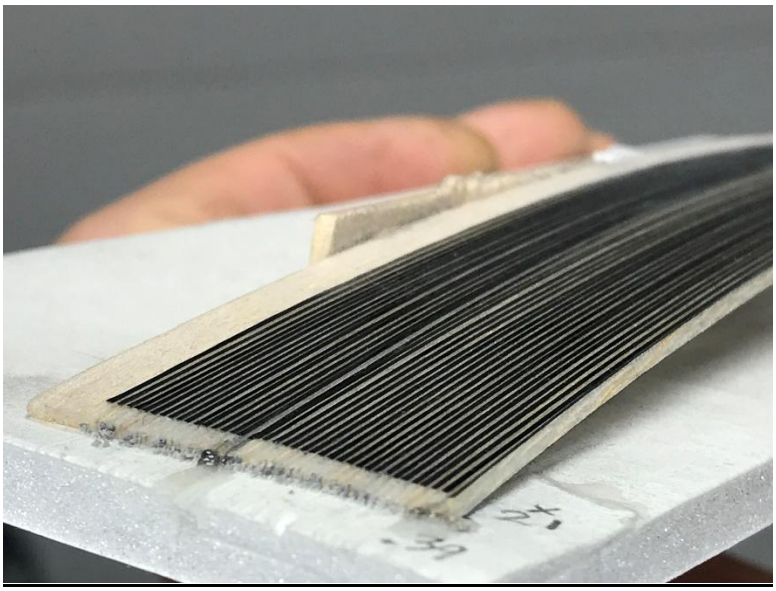


Figure 4 Cut Ribs

My Component sizing

Prop rib balsa is 0.4mm thick and cut 0.25-0.35mm wide.

Wing ribs (banana ribs) 1.2mm height at each end and 2mm in the middle. Cut 0.4-0.46mm

Wing spars balsa 1.6-1.7mm in middle to 1.0mm at end of the spar at the dihedral break.

Wing tip outline forward curved section and along outer edge, starting at dihedral break 0.65 tapering down to 0.45 along the tip straight. Cutting width starting at dihedral break is 0.65mm. the rest is sanded tapered down to final thickness of o.4mm along outer tip.

Wing tip trailing edge, dihedral break to rear corner 0.8-0.5mm cut to 0.33-0.36mm.

Horizontal stab spar balsa 450mm long x 1.2mm in middle to 0.56mm at tip, cut and final sand tapered from 0.5-0.55 at center to 0.36 at the tip.

Stab rib balsa 0.6mm at each end, 0.7mm in the middle. Cut width is 0.28-0.32mm

Stab tip outline balsa 0.6mm, cut width to 0.35mm

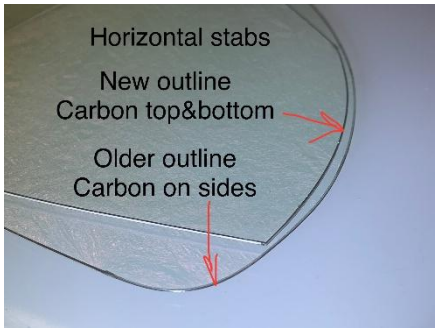
Finished Weights:

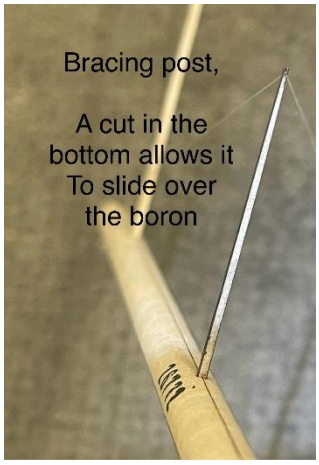
Wing , spar 46-47mg/ea, complete tips 25mg/ea, ribs x 4 =72mg

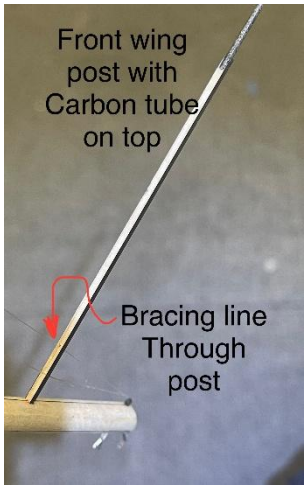
Complete wingframe before covering 220mg.

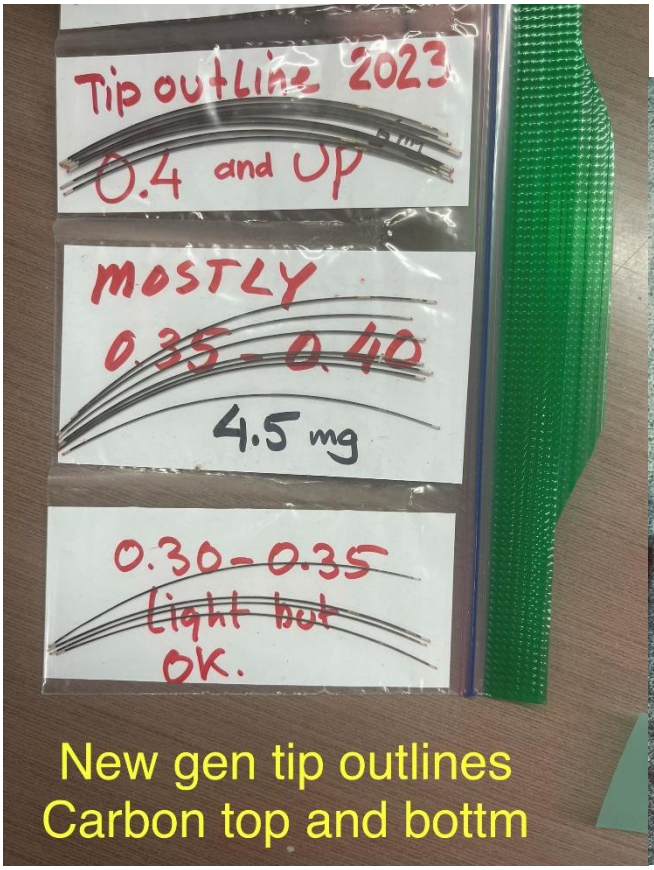
Stab, LE spar 32mg, TE spar 35.5mg, ribs x 3 = 18.5mg, tips x2= 8mg

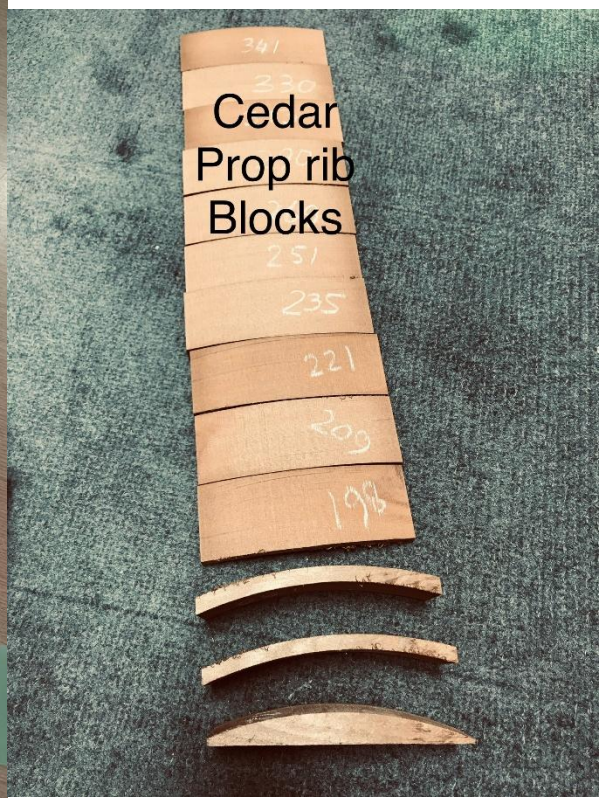
Although building with just balsa and boron is maybe a more enjoyable and relaxing experience, I hope this info if not for you to build carbon components will be at least a good read for this winter of '24.

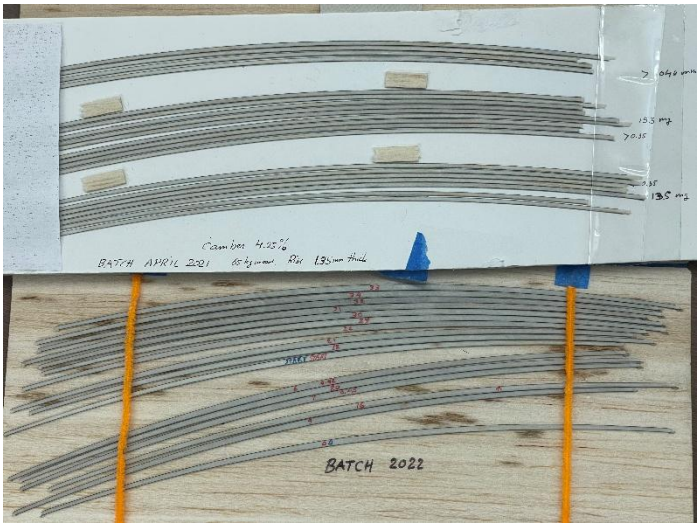







Tip outline 2023
0.4 and UP
MOSTLY
0.35 - 0.40
4.5 mg
0.30 - 0.35
light but
OK.
New gen tip outlines
Carbon top and bottm


Cedar
Prop rib
Blocks
341
330
251
235
221
209
198


BATCH APRIL 2021
BATCH 2022