Extreme Hollow Building—Experiences and Explosions

Text and photos from Tapani Salmi

Some years ago there was a challenge on Clark´s classic rod page to make a 7' long #3-4 line weight rod with mass of less than 2 ounces (57 grams). I decided to try. Thereafter I have tried to find simple hollow building techinques for hand tool rod building.

To make any cane rod lighter it is common to use hollow building. The elasticity "power" of bamboo is very high in longitudinal direction as we all know. In the formula of MOE (moment of elasticity), the diameter (D) affects the elasticity at the power of 4 and to the mass at the power of 2. Therefore if we take 50% of the thickness of material away from inside, the mass is the 25% less and the MOE is diminished only 6%. To make the rod significantly lighter we have to take as much as easily possible away and this is called extreme hollow buiding.

The material we take away is the soft and weak pith part of cane and we want to exclude most of the surface material, the power fibers. These are the strongest part of our raw material. The extreme hollow structure has been connected to competition rod building to achieve a long, strong rod for long distance casting.

But we have here some problems - the longitudinal elasticity and strength of power fibers is high but there are only a few circular or oblique fibers in bamboo. We all know that the bamboo strip is very easy to split even by hand with very weak force. If we make a hollow rod with extremely thin walls it may explode when there is a combination of bending and twisting of the structure. This has to be avoided.

In most of techniques there are some "bridge" material left inside the rod to increase the circular strength of the structure. For hollow construction there are several methods like scalloping, fluting, etc. to construct these "internal bridges" to support the rod. In addition to that mechanism, we have a very old method using dense intermediate wraps to support the rod. I have modified this further using a spiral silk wrap for the continuous support along the rod.

I have tried to make triangular (TRI) bamboo fly rods for some years for several reasons:

- The physical properties of TRI rods (Moment of Elasticity, MOE) give clear advantages for long rods.
- TRI construction results in lighter rods.
- TRI construction is especially advantageous for two-hand rods.
- Hollow triangle structure gives wider glue lines and it is more as a stabile hollow structure than hex or quad hollow.

I here describe some of my experiences, both successes and failures during learning the extreme hollow building methods using hand tools.

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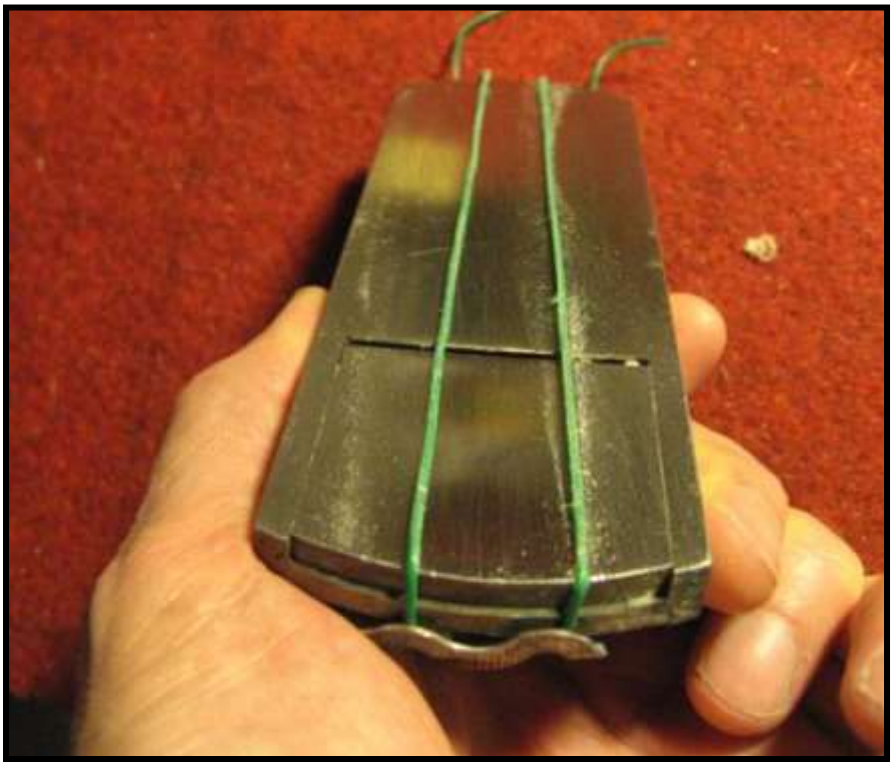
Baginski method for internal bridges

In autumn 2014 at European Rod Makers Gathering, in Waischenfeld, Germany, Rolf Baginski (German professional rod maker) demonstrated a very practical method to make hollow built rods using artificial, very light bridges inside the hollow tube. He took some cotton balls, moistened them with water and added then some drops of common PU glue (like Gorilla, Bison, Cascol etc). This results in foaming and swelling "balls" which are then inserted inside the rod. The foam and cotton swells, strongly forming a very hard composite-type structure inside the rod resulting in "bridges" to support the hollow structure. This results in same sandwich structure as used in manufacturing of skis, using layers of graphite, wood and other materials.

I planed the strips quite thin. The thickness of the strips for the tip part of rod was 1.3 – 1.4 mm and for the butt 1.4 – 1.8 mm.

I make this planing simply using my hand plane.



Simple modification of my plane to make 1.4 mm thick strips.

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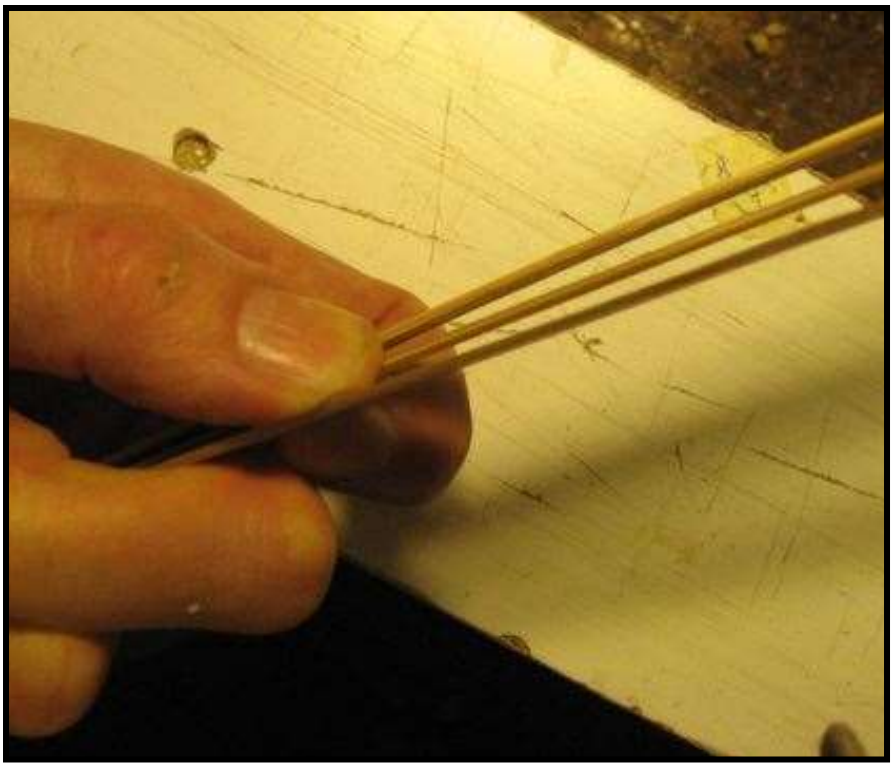

Three strips for a triangle rod.

Thickness of the strip is here 1.37 mm (= 0.054").

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Baginski beveller for 120 degree corners for the triangle rod.

Triangle hollow-built rod cross section.

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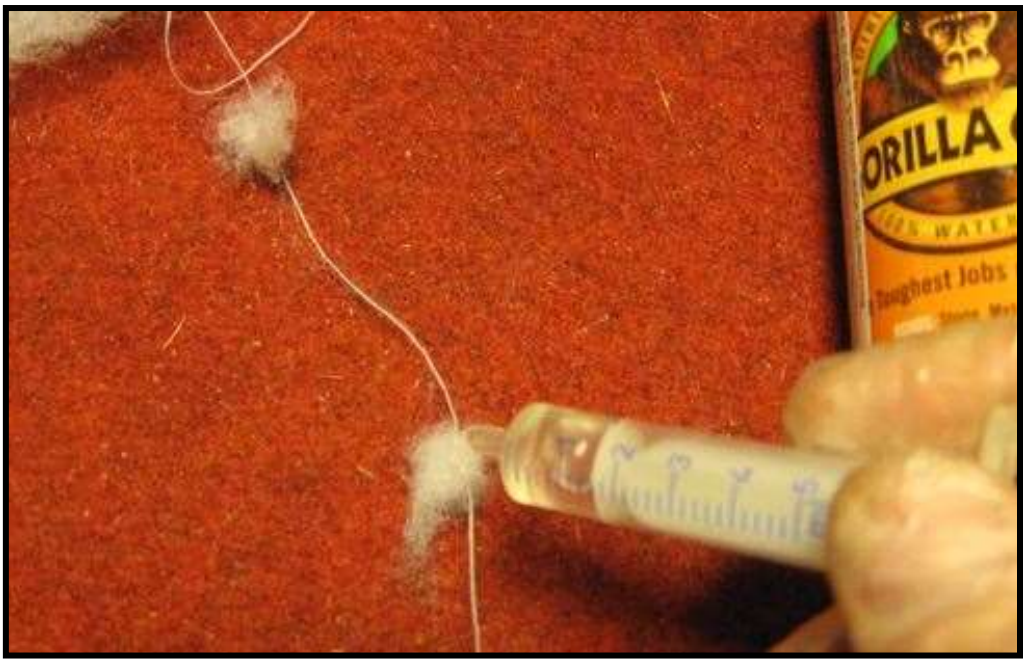
For the internal bridges you need some cotton-type soft fibers, PU-glue and water. I have used polyester wadding, like that used in pillows and blankets.

To insert the foam balls inside the rod easily and fast I tied the wadding balls with a thread 10-12 cm apart from each other.



Here I have the thread and cotton balls tied to a thread.

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Then you add some water to each of them using small syringe and then add some drops of PU glue to the balls.

Here you absolutely need protective gloves because PU glue makes your fingers black!

After applying the glue to the strips I simply set the thread with PU balls on the strips and bind the rod to have the wadding balls inside the rod.

The fiber - glue composite is very light but quite strong and much stronger than PU foam alone!

The foam makes firm bridges inside the hollow rod to support the structure and increase the stiffness.

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Here you see the foam inside the hollow scarf joint ferrule.

Is This Possible" -7' #3-4 rod weighting 2 oz (57 gram).

On Clark's Classic Cane Rod site there was a theme "Is This Possible" asking if it would be possible to make a 7' #3-4 rod weighting less than 2 Oz (57 grams).
http://classicflyrodforum.com/forum/viewtopic.php?f=68&t=83322

This certainly is a hard challenge for an amateur rodmaker using hand tools and I decided to try using this very simple technique.

I started by selecting a straight taper, changed the taper into triangle and got a taper with WIDTH of the strips as following (in mm's):

2.06 (.081)
2.54 (0.1)
2.98 (.117)
3.49 (.137)
3.97 (.156)
4.45 (.175)
4.95 (.195)
5.46 (.215)
5.97 (.235)
6.45 (.254)
6.95 (.274)
7.46 (.294)
7.94 (.313)
8.45 (.333)
8.92 (.351)
9.46 (.372)
10.0 (.394)

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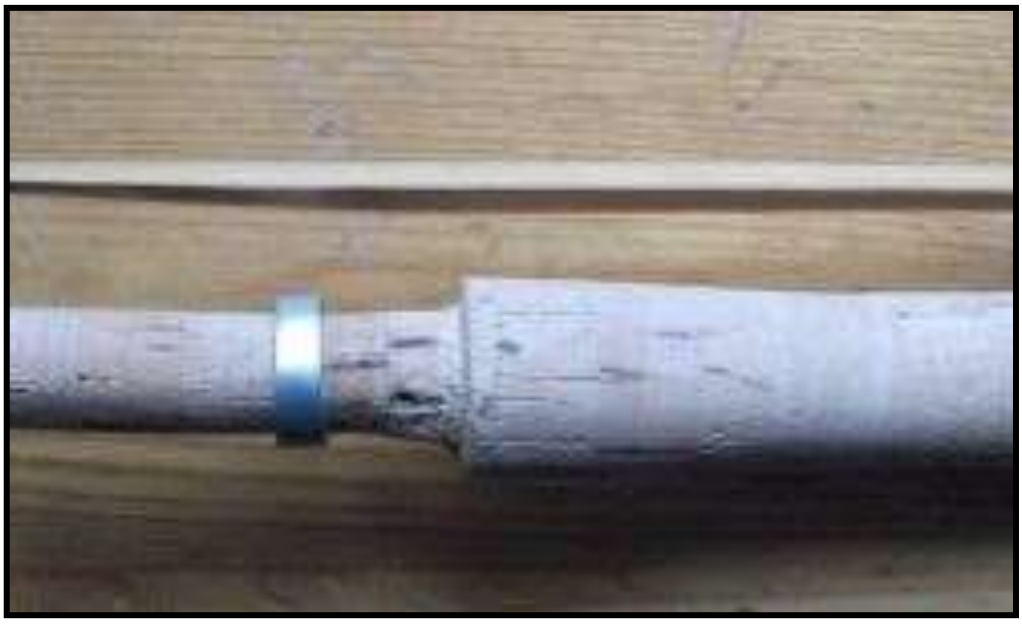
I planed the strips and the planed them into 1.3-1.4 mm thickness. This decreased about 50% of the weight of the strips. To change them into 120 degree corners I used my Baginski beveller to sand 60 degree corners into 120 degrees.

For the bridges I took polyester wadding balls, moistened them using water and added Gorilla glue as described above. I used UHU300 epoxy to glue the strips. The wadding and glue added only about 3 grams to the total weight.

I finished the rod with a single thin layer of PU varnish and I had a 7' rod blank which weighed 45 grams.

To keep the weight low I decided to use scarf joint ferrule. As the hollow scarf joint is not very strong I put a longer part of wadding composite into scarf area.

The blank seemed good but to my surprise cork, reel seat and even line guides are quite heavy. The obvious method to reduce weight was to make a small grip, make the reel seat with aluminum rings and use thin wire line guides.



Here you see the small hand grip and very light hardware.

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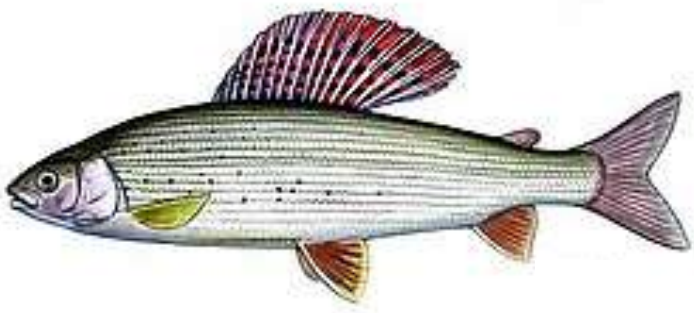

The result was a 56.8 gram rod casting #4 line.

Experiences:

Thereafter I made some heavier rods like #6 trout rod and #8 line weight #10' single hand salmon rod and thought that I had found the Graal Bowl. The success changed to failures. The big rod really exploded in two days fishing, the thin cane did not endure the bending and twisting.

To my surprise even one smaller rod got some longitudinal breaks in fishing. The PU and cotton bridge is not elastic, it does not support the strips in long term repeated stress.

I have not tried any other glue material instead of PU. There are elastic light PU foams and glues which could work. I suggest that you should try those materials to produce a sandwich structure inside the hollow rod!

Exploded rod with PU balls inside.

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AFTER TOTAL FAILURE BACK TO START LINE

After these experiences I had to try something else. It is always a good idea to look back to history. I found the intermediate wraps and other techniques, like graphite rod building, to find circular and spiral fibers of the hollow rod.

Intermediates of a classic Hardy rod

Circular fibers of typical graphite rod

I decided to try dense intermediate wrappings to support the rod. I had some hollow built rods with PU internal bridges and I was afraid to break them. I then made quite dense intermediate wraps on the rod, I then put some cyanoglue (superglue) on the wraps and it did not break in my fishing.

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So, instead of INTERNAL bridges it was possible to use EXTERNAL bridges. To make all those dense intermediate wraps is not the most pleasant work. The next generation of support for the hollow rod will be to use spiral wraps.

Spiral wrap

The spiral wrap is very fast to make, it takes about 10 minutes. I started with silk thread with good results. Then I found a very thin monofilament thread which is used to sew the transparent curtains or "light curtains." The monofilament has a good UV protection and it is really thin. The spiral wrap requires an extra varnish layer to hold it and the final surface is not smooth. I have now used this spiral wrap for my one hand rod and also for the big two hand rods for two seasons and it really seems to work: no failures so far.

HOLLOW RODS AND JOINTS/FERRULES

The joints or ferrules are the weak point of any hollow rod, especially in long and two-hand and spey rods. To make the scarf joint stronger I have put some extra cane and even short pieces of graphite inside the hollow end parts of the sections at the joint.

Typically we just use electrician tape to secure the scarf joint. It is possible to give extra support to the scarf joints externally also. I have used graphite or polyester tube laminated with epoxy or other glues to make a firm tube or sleeve around the joint area. These structures seem to give the extra strength to the joint/ferrule area much more than the simple tape.

In conclusion, it seems that the extreme hollow building may be achieved using simple hand tools. The challenges get harder when we want to make long and two-hand rods in which the hollow building is the most useful feature. By combining old ideas (external intermediate support) and new tools and glues it seems to be possible.