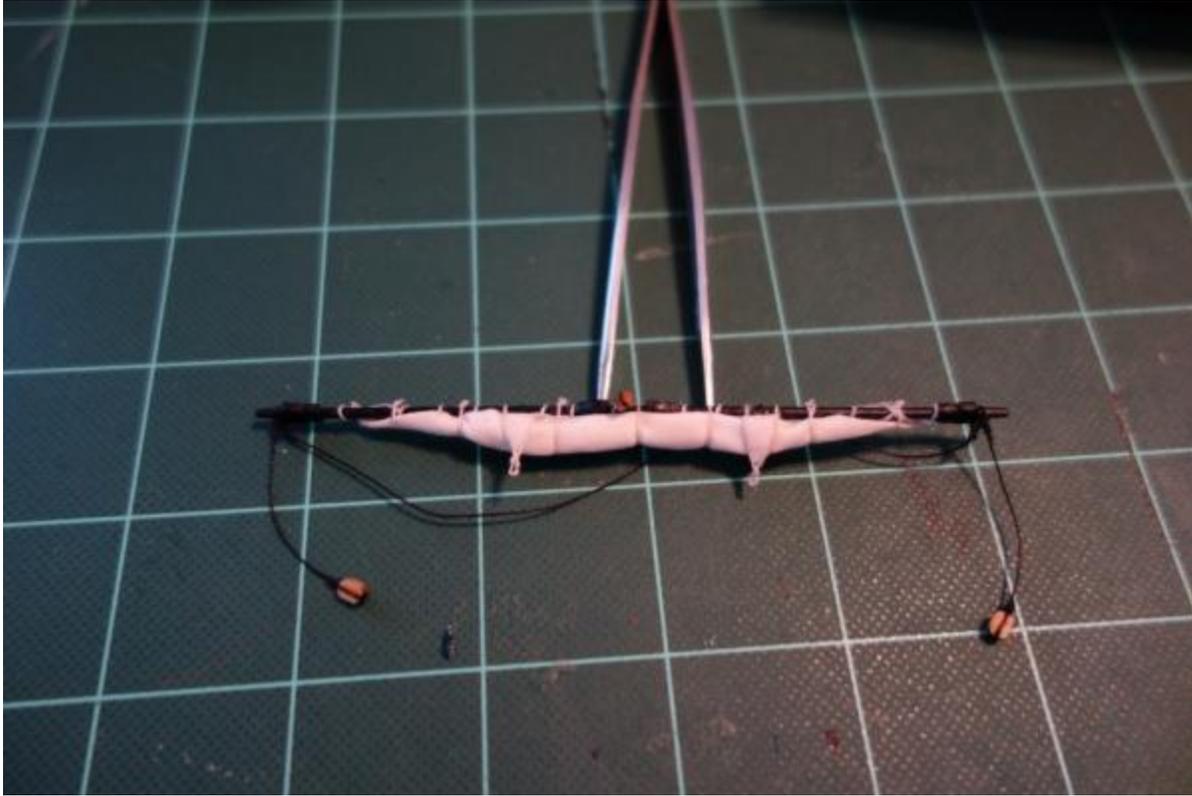


FURLED SAILS

Hi everyone, I started working on furled sails on my Badger build and posted a mini summary on my Badger build log. At the suggestion of a couple of friends, I thought it might be helpful to repost my technique here on this forum, instead of it possibly being buried in my build log.

Here are the pictures of the topgallant yards, which still can use a bit of tweezer work before being set with diluted PVA. I think there's some room for improvement, but overall I was pleased with how the furled sails are coming out. I'd love to hear of other techniques or possible suggestions for enhancements. Thanks!

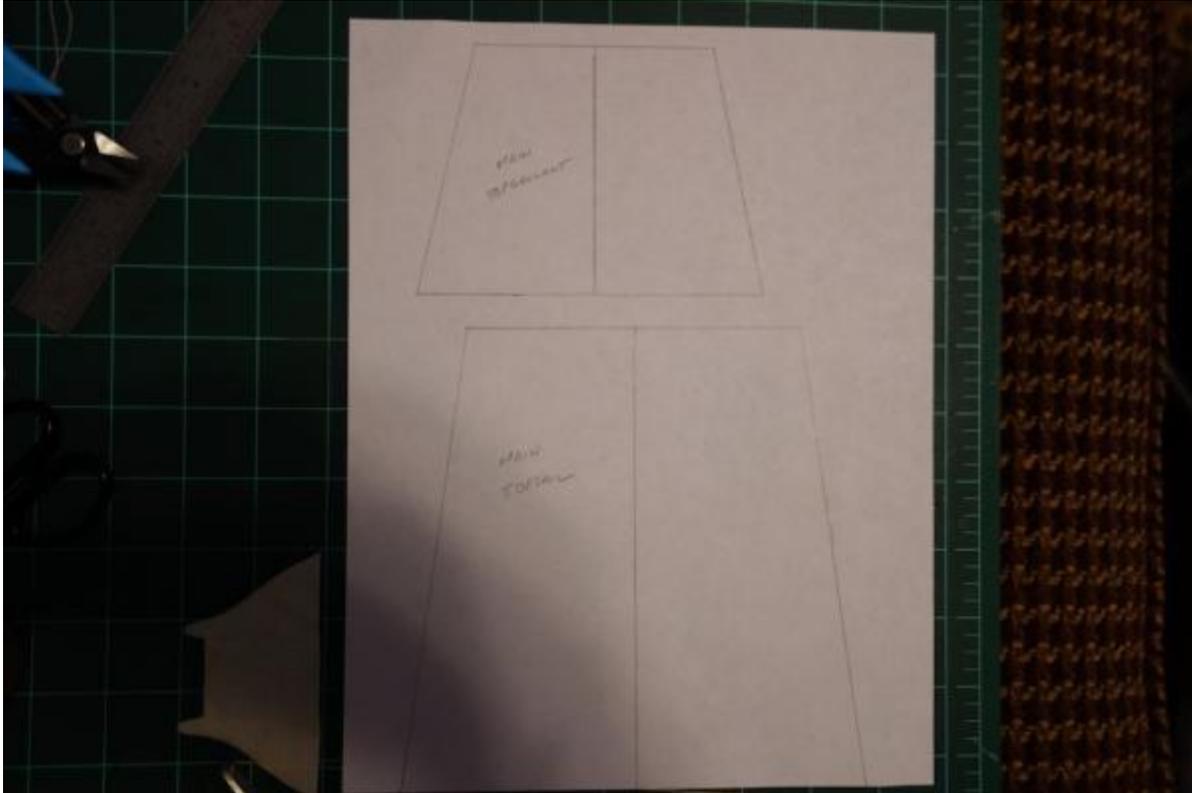




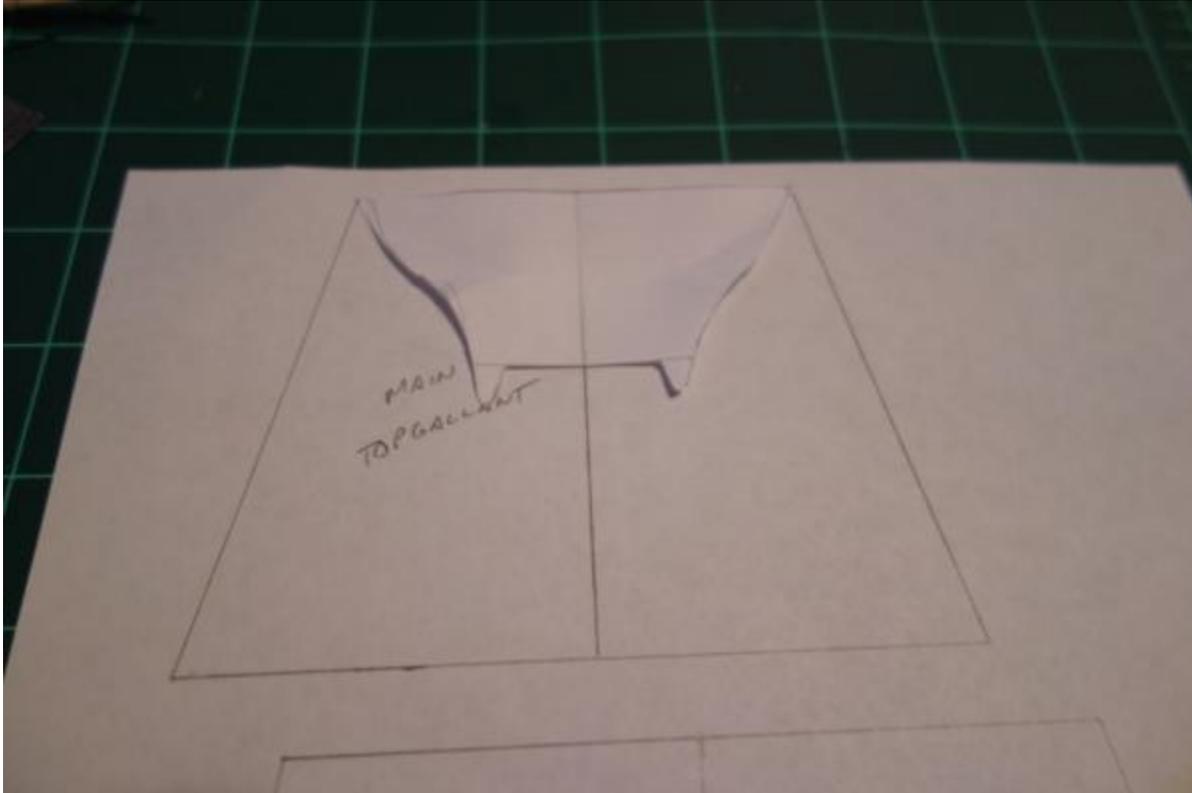
Here is a pictorial of how I proceeded. I wanted to find a way to furl the sails without needing to do any sewing - given that the sails are tightly furled, I think you can drop off a lot of the lines (hems, reef, etc.) which was why I went the furled route. Hopefully this looks convincing. Also, please excuse the pictures against my hobby cutting mat, which has seen better days 😊

The cloth I used was the thinnest weight cotton (muslin I think) that I could find at JoAnn's Fabrics. Frank (riverboat) was very kind to send me a sample of the cloth he used on his Supply, which I was able to find at my local store. After washing and ironing, it was soft and thin enough to use. Thanks very much Frank! Others use tissue paper and silkspan which are thinner, but likely need to be painted afterwards. I wanted to avoid using paints, and thought that the fabric I found had a nice natural color that worked for my build.

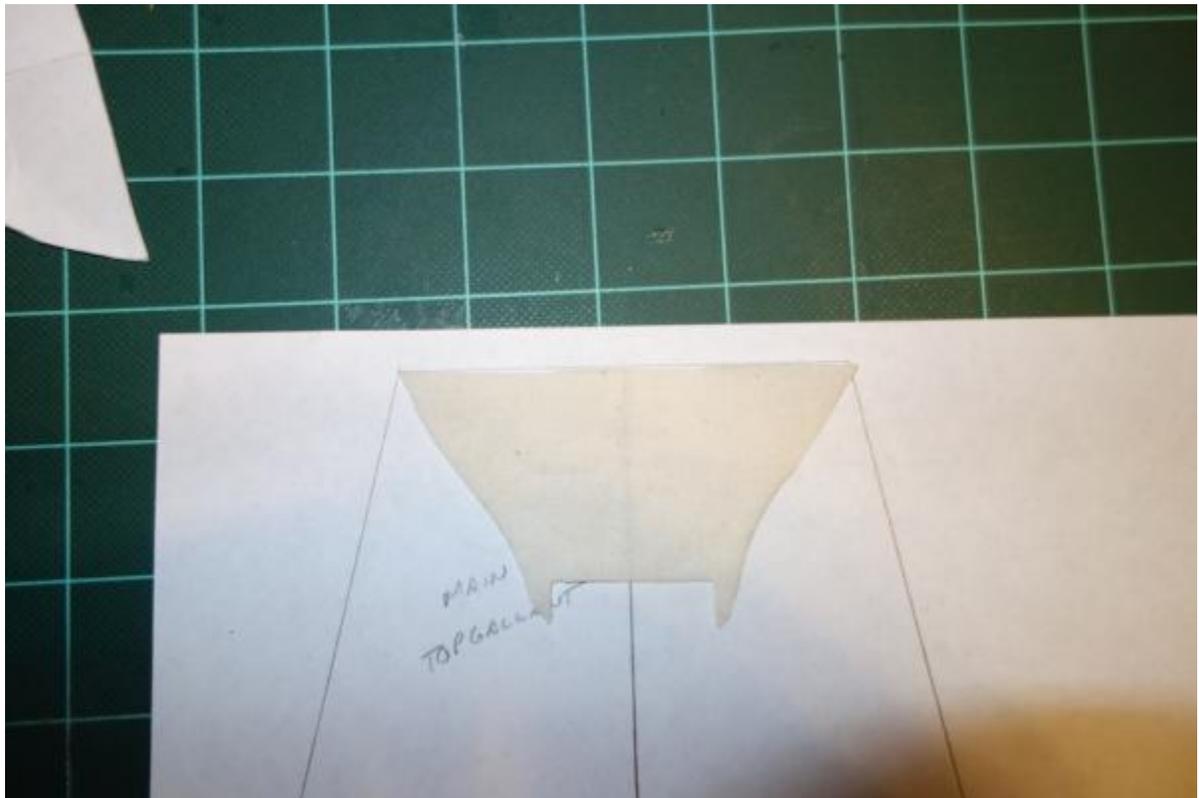
The first item was to draft the sail plan for each of the sails. Much of this was guesswork from using the plans with distance between the yards. The Caldercraft plans have the topmast and topgallant yards in the lowered position (note, however, that the lower yards are always fixed), so to I had to draw the plans with the yards in the raised position to create the plan for the full sail. These were sketched out on paper.



Next step was to reduce the size of the sails to avoid them looking too bulky. Tightly furled sails should be about the size of the yard, so resources I've seen said to reduce the sail by $\frac{1}{3}$ to $\frac{1}{2}$ or more. As you'll see, I ended up reducing the sail to probably only $\frac{1}{3}$ of the full sail volume. The shape may seem a bit odd, but it's intended to reduce the sail volume as you get closer to the ends of the yards, as well as include the clews which are the dog ears on the bottom. The sails will be folded twice to not only get the dog ears to the top of the sail, but also to pull more volume of the sail to the middle of the yard. The pattern is folded a bit as I practiced how those two folds would work.

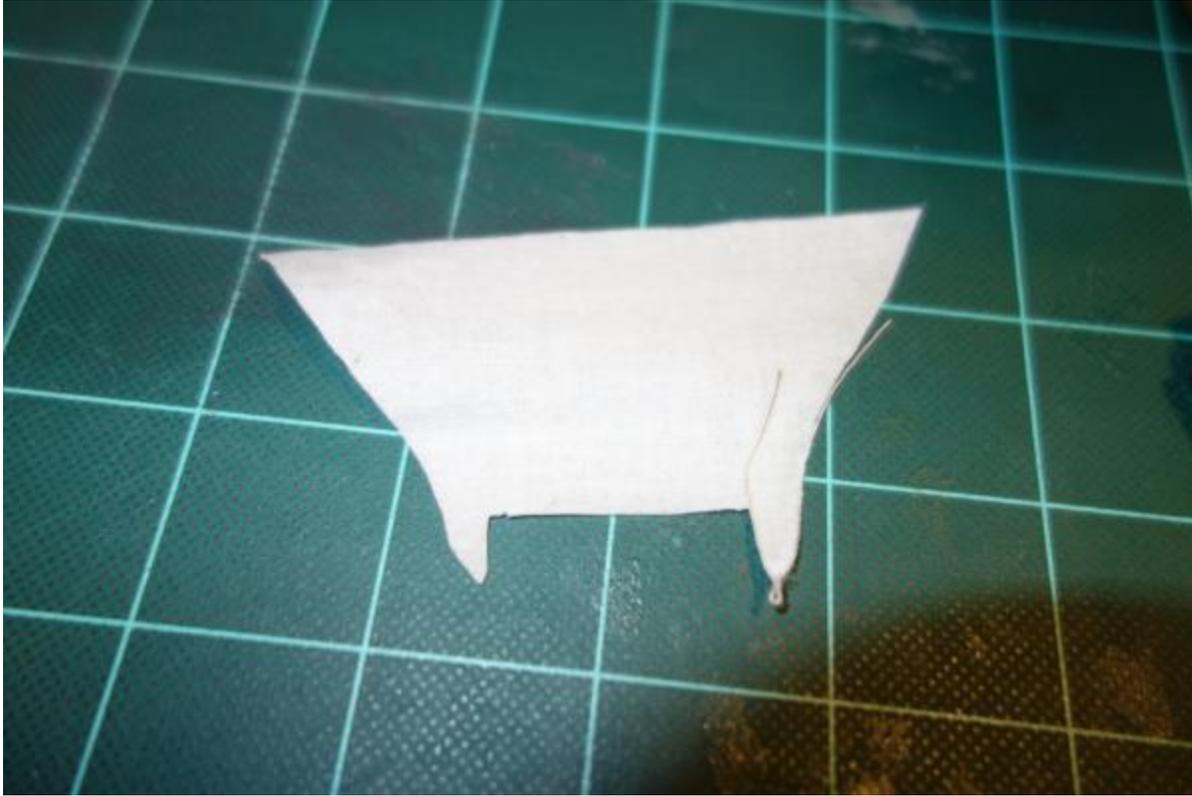


Next up was to cut out the sail using the pattern. Hems are usually added to the edge of the sail to avoid issues with the cloth fraying, as well as to give a stronger area on which to sew the various lines (so the thread doesn't pull through and rip the thin cloth, especially where the sewed holes are close to the edge). I found a way to avoid all that - anti-fray adhesive 😊 It worked very well in not only preventing fraying as the cloth was cut, but it also stiffened up the fabric a tad bit to make cutting the cloth in straight lines very simple and strong enough to sew close to the edge without needing a hem. I also used Aleene's fabric glue in various steps to glue the cloth - it is thicker and much tackier than diluted PVA, which made for much quicker gluing times without needing pins or clamps to keep the glued portions together - a few seconds of holding them together did the trick. Both adhesives glued clear, without any sheen, and without stiffening the cloth much at all. It's probably worth trying them out on whatever cloth you use as a test to make sure you get similar results.

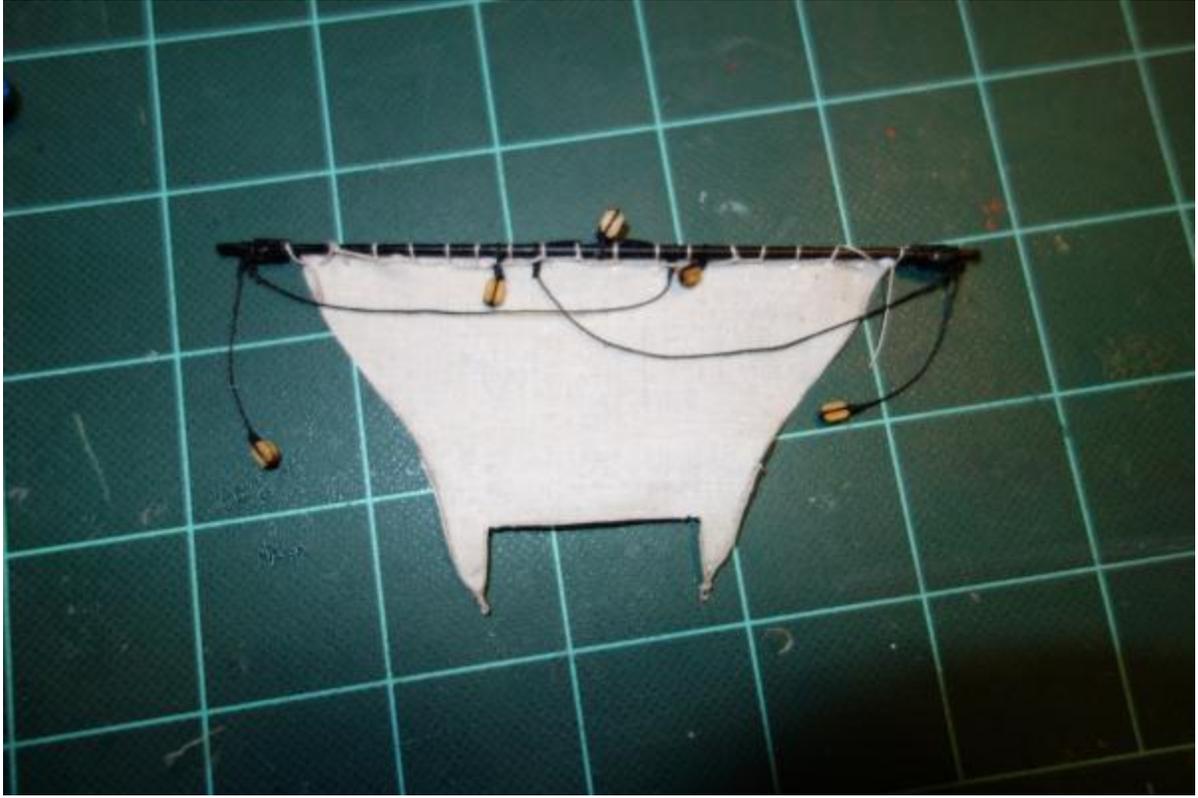


First, the clews are created and attached. I made them using 0.25mm natural thread from kit. I ended up making them a tad longer and ran them into the sail and up along the outside edge a bit farther than necessary to ensure that the clews were visible when the dog-ears were folded down. They were attached with fabric glue.

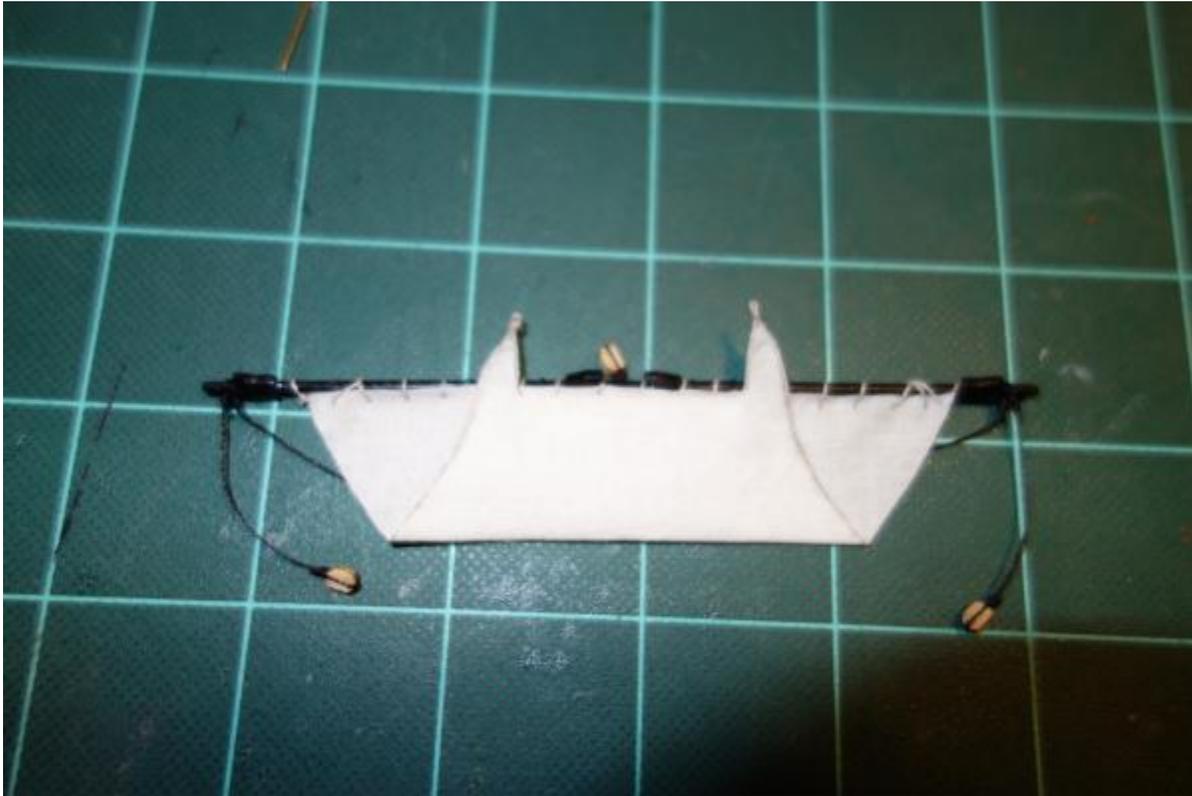




Next step was to bend the sail to the yard. I didn't take pictures while this was in process, so hopefully the following description makes sense. I used 0.25mm thread here as well. First step was to mark on the front of the sail the points where the thread would be run through the sail - I marked points 5mm apart. Second, I used a running knot to attach the line on one end of the yard. Third step was to run the line from the front into the rear of the sail, then as you loop it over the yard, run it underneath the prior line and repeat til the end. It got a bit tricky with the yard horses and blocks, but after a while you get the hang of it. Once the sail was fully attached, go back and tighten the lines by pulling the vertical line towards the other end of the yard, and down along the top of the rear of the sail.



Next step was the first fold. From the front of the sail, the bottom half was folded up so that the bottom line between the two dog ears was at the top of the sail.

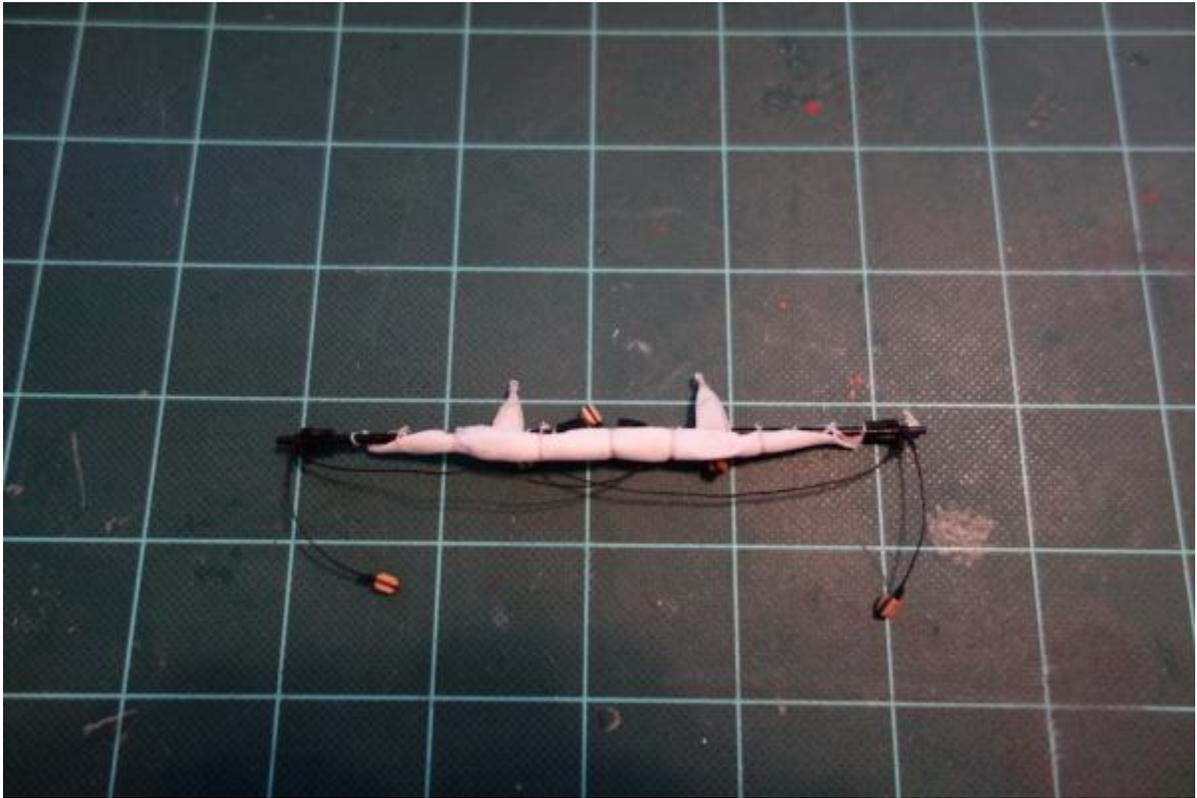
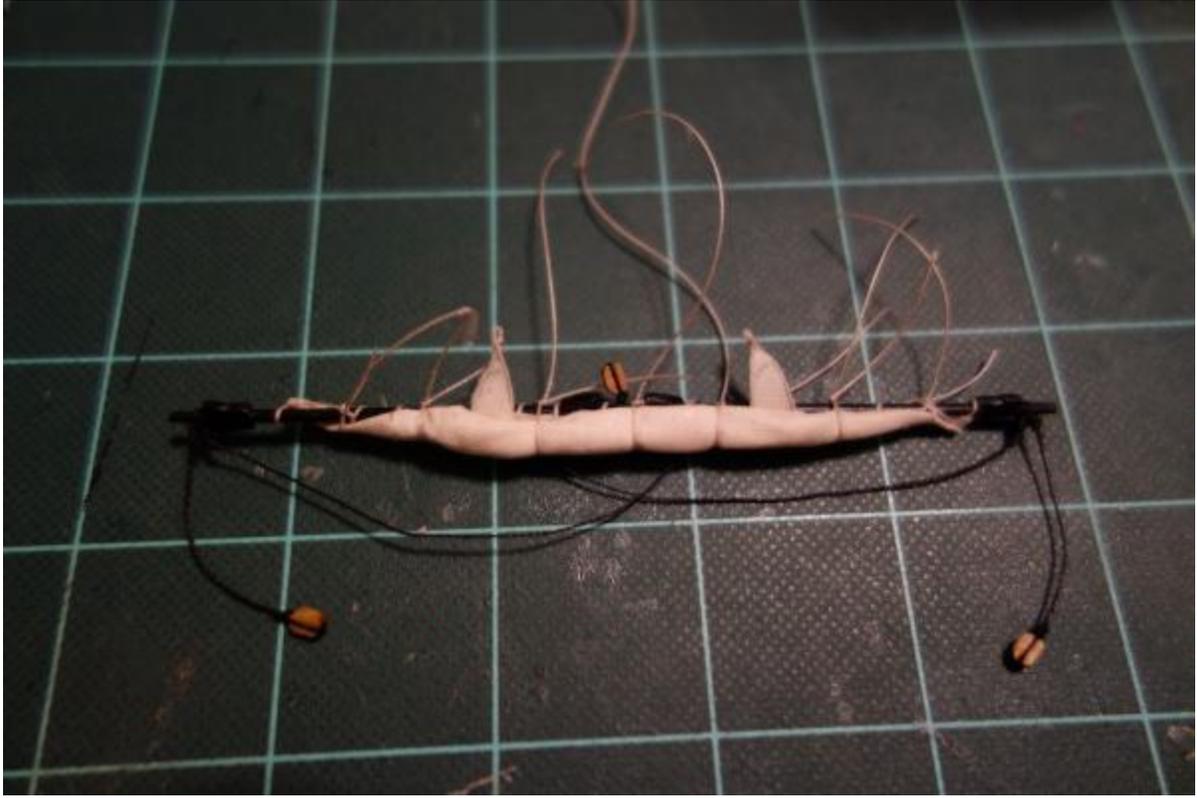


Next step was to fold the bottom corners up and in, to help add more volume to the middle of the yard, and reduce the volume at the ends.

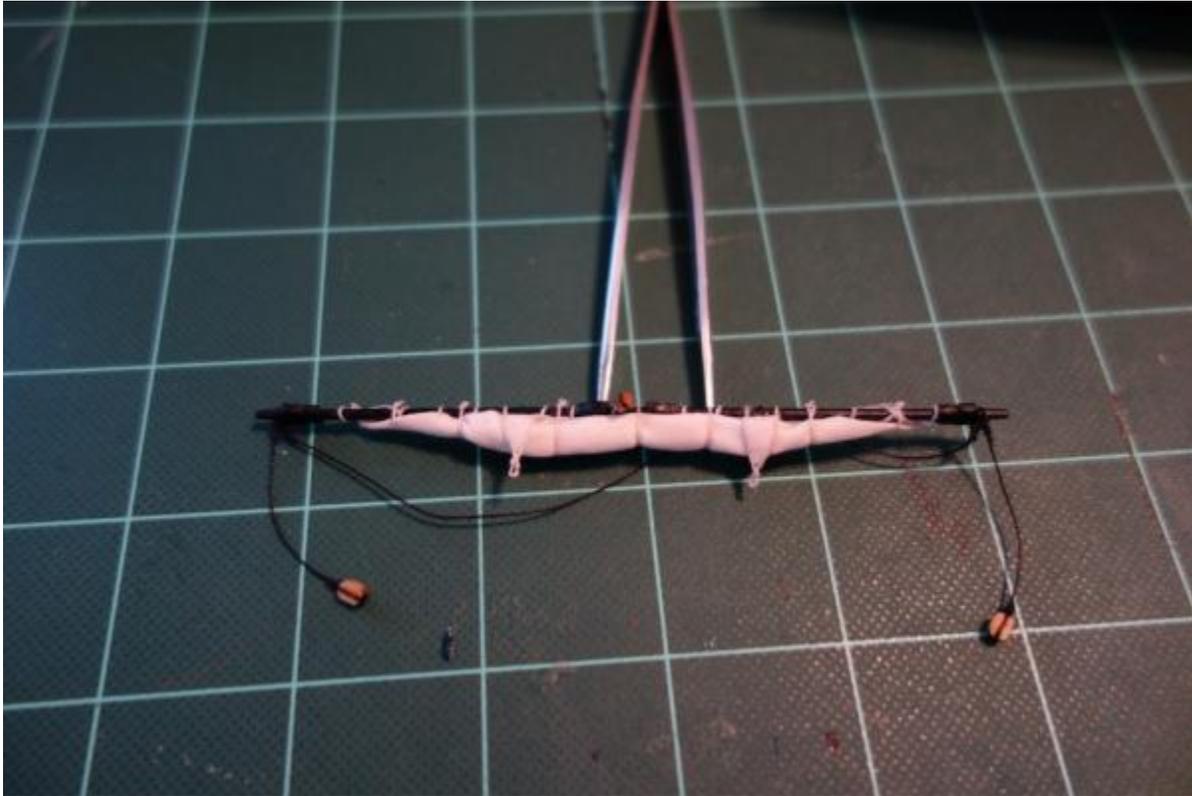


Next step was to furl the sail and attach the gaskets. From my research, when furling the sails, the sails were "gathered up" such that the sail was folded into an accordion type of pattern with the final fold up and against the top of the yard. That was a bit hard to do at this scale, so I ended up just folding and rolling the sail up from the front until it was tight against the yard. Took a few tries, which helped I think to get the cloth more relaxed to get a tighter furl.

Then the gaskets were installed. I started with one in the middle, and then added three to each side roughly evenly spaced out. These were fairly easy to do using a running knot, and then using tweezers to help tighten the furl as the gasket was tightened (sometimes with the help of some fabric glue to help keep the material furled). After a few final adjustments, the knots were sealed with diluted PVA, and then the extra lines cut off.



Finally, using fabric glue, the dog ears for the clews were bent downward and glued into position.



There you have it - the no sew method of furling sails. 😊 I spent an inordinate amount of time researching and thinking about how to do these, so hopefully these look relatively authentic. I know that opinions differ on whether sails should be attached or not, but I think furled sails add a nice touch and are a good compromise given the scale issues with adding full sails - plus, these are sailing ships after all 😊

I think there were lines running from the clews downward which helped to keep them in their downward orientation (and probably keep the furl tight). I haven't figured out where those lines go, so if anyone has the answer, I would love to hear it 😊

The topsails and courses will be a bit trickier, given that they have blocks for the bunt lines, and yard horses. I'm thinking that I will pre-rig the bunt lines by gluing a portion of the line into the sail to be furled, which will eventually be run through the blocks. The instructions have the line started at the block by knotting one end of the line before it is run through the blocks - I think, however, that the line is technically started at the buntlines in the sail which are run through the blocks on the yard. Haven't fully figured that out yet, so again, would love to hear from anyone with answers on how that works. 😊

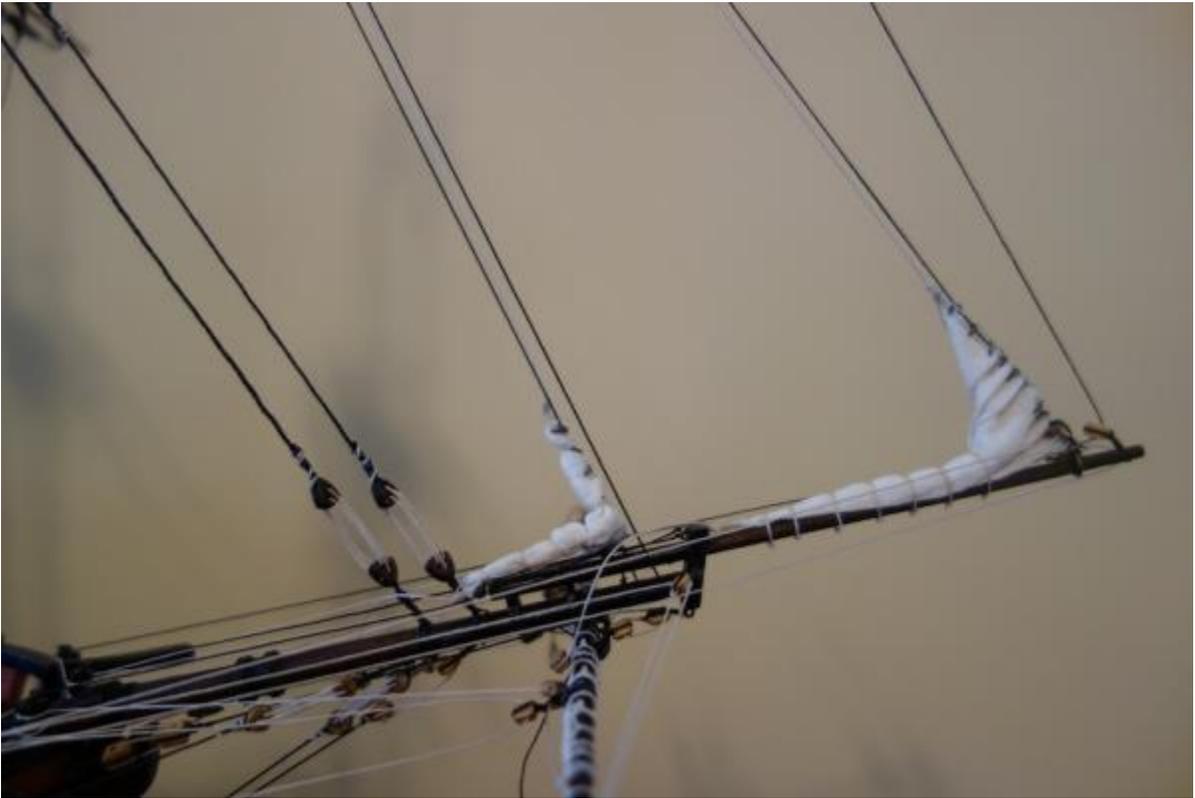
I also have to do a little more research on the spanker and jibs - the spanker should be relatively straightforward, but how to reduce the sail to remove bulk while maintaining the brail lines will be tricky. The jibs are complicated, in that there are hanks, jib stays and travelers that need to be attached. All part of the fun I suppose 😊

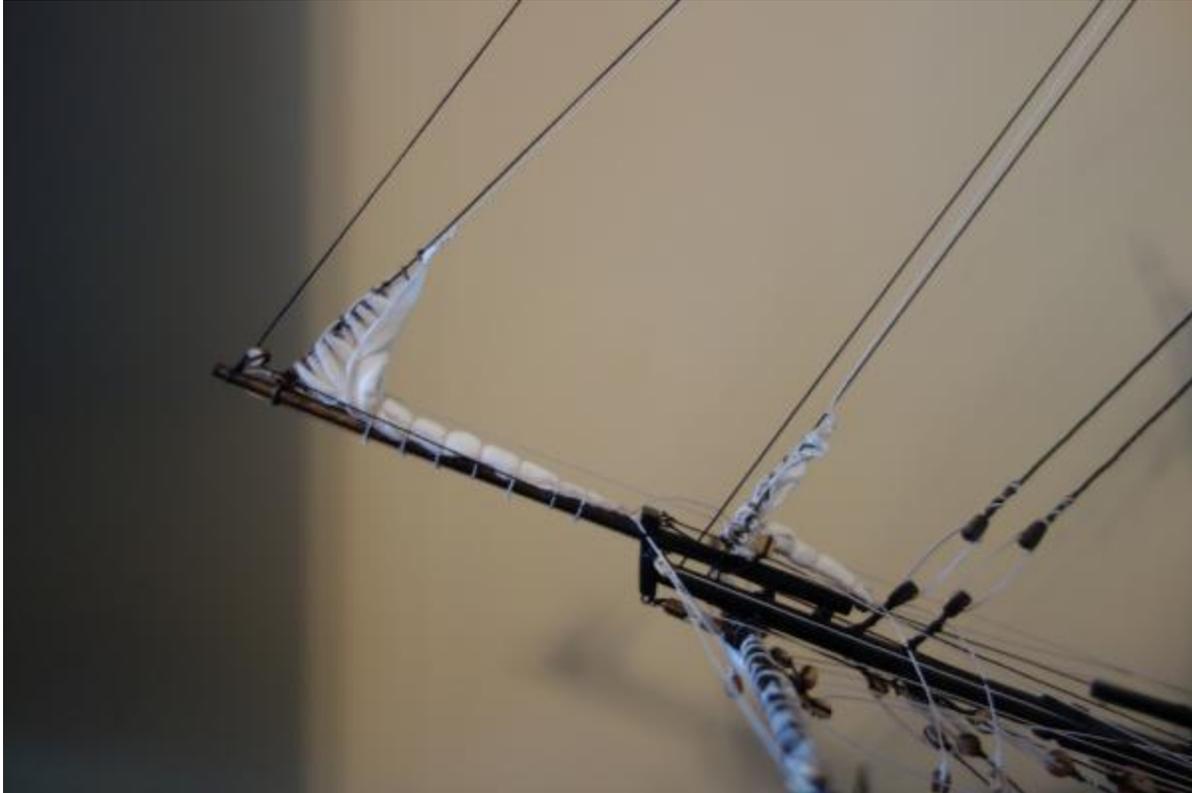
Here are the posts from my Badger log on how I added a furled fore topmast staysail and a furled jib.

Before I get too far, let me mention the resources that were of immense help in figuring out what to do:

1. [Lennarth Petersson - Rigging Period Ship Models](#) - pictures say a thousand words, and this book really simplifies the mysteries of rigging. Helpful to see the pictures of how the rigging for these sails works, but I would say that it shows rigging for larger ships so, for example, the haliards would be more simple than the block and tackle arrangements shown in this book. Still, very highly recommended.
2. [The Fully Framed Model \(TFFM\) Vol. 4](#) - This Swan series book is an incredible resource for anyone that wants great detail into rigging period ships. Antscherl compiles a lot of research into this book, with excellent pictures, to help one go step by step.
3. [Lees - The Mastng and Rigging of English Ships of War](#) - Good detailed historical account and narrative description of these sails and their rigging.
4. [Harland - Seamanship in the Age of Sail](#) - Excellent descriptions of the actual mechanics of bending, raising, furling, etc. sails. Very helpful discussion of what went into furling sails, particularly how the sails were gathered and then a "skin" was draped over the entire bundle. The remaining 2/3rds of the book goes into fantastic details on how the sails operated in various conditions, etc.

Here are the pictures of where I am now, and I'll set up the next couple of posts to talk about the construction of both sails. Needless to say, for what ultimately looks like rolled up wet tissues, these things took a while to figure out how to construct and to install. But, I very much like the end result, which to me anyway looks better than a ship bare of sails. The staysail needs a bit more positioning, which I will do once the sheet whips are installed.





Fore topmast staysail.

This sail took a ton of planning as there are a number of ways that these could be installed on a ship - bent to a fore topmast preventer stay, bent to a fore topmast staysail stay, and I think they could also be set flying (no stay at all). Then there was the question of how to run the haliards - single, double, etc.

Based on Lees and TFFM, I decided to add a fore topmast preventer stay and bend the sail to it. Not sure if this was 100% historically accurate, but this route helped simplify things a bit as the preventer stay would use the existing bee sheaves in the bowsprit, and the running end would end in an eye and mouse around the mast, rather than have a running end that ended in haliards somewhere down the mast. It also added a sense of symmetry with all the rigging, which is more artistic than anything.

Another reason to go with the preventer stay over a staysail stay was that there was not much room to furl the sail as it was given the proximity of the fore stay and fore preventer stay, but using the bees gave a couple of millimeters of extra space. As you can see in the picture below, the staysail is probably only 25% of what the full sized staysail would look like. This was to ensure a tightly furled sail and keep the sail in front of the fore stay and fore preventer stay.



Two other things I had to add to the model for the staysail. First, I needed to add a cheek block on the port side of the fore topmast head (I also added one for the jib sail on the starboard side). Second, from Lees, Petersson, and TFFM, the staysail was not laid on top of the bowsprit, but instead was laid on top of a netting between the bowsprit horses. So, I added the horses and a simplified netting run between two staves that the horses went through. I unfortunately don't have a picture of this, but the staysail covers all of it so I didn't go all out with a very detailed netting.

After all that, the rigging of the staysail is fairly simple. The staysail is triangular in shape with a peak cringle at the top, the tack at the fore bottom corner, and the clew cringle for the sheet pendant at the aft bottom corner. After threading the fore topmast preventer stay through the hanks on the sail (constructed of beading wire from a local craft store and painted brown):

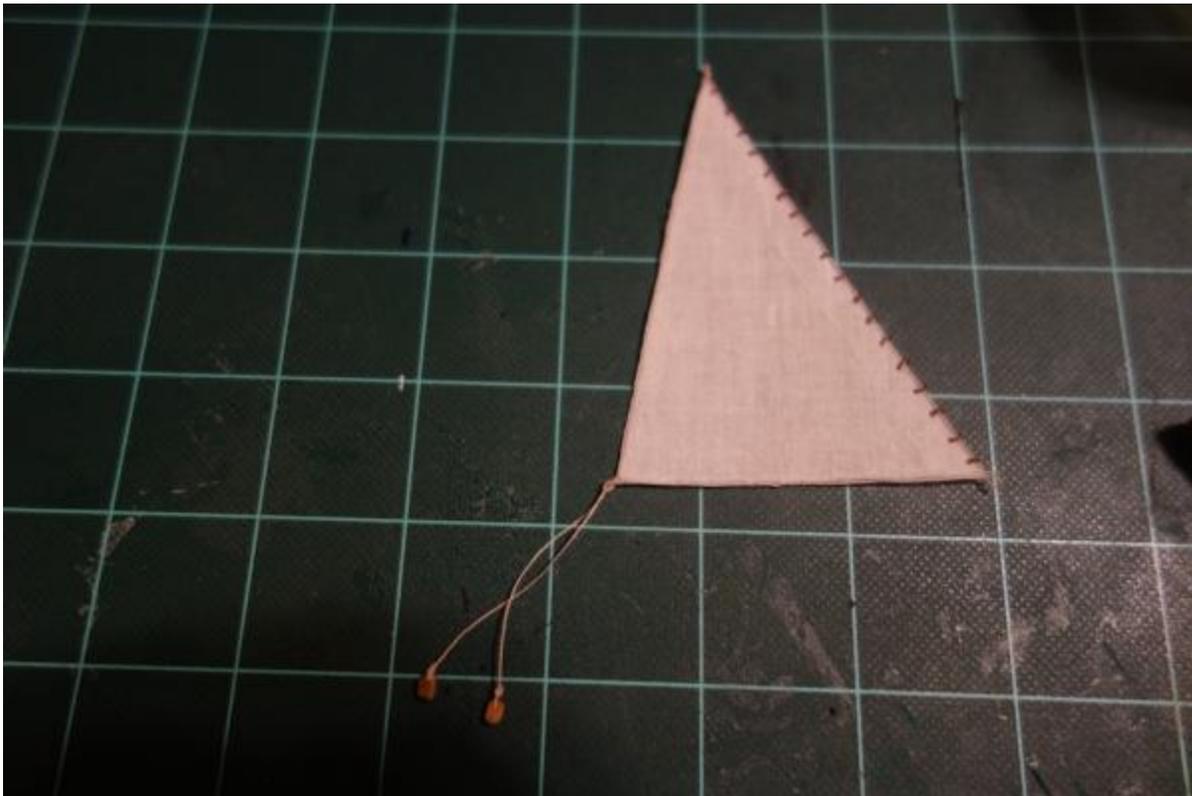
1. Peak cringle: The haliard (to pull the sail up the stay) is run from the peak cringle up through the lower sheave of the port cheek block, and belays either to the foot of the fore mast or to a timberhead opposite the after fore shrouds, port side. Also attached to the peak cringle is the downhaul (to pull the sail down the stay). The downhaul is threaded through a few of the hanks, through a block attached to the foot of the stay, and belayed at a port timberhead.
2. Tack: The tack is tied to the cringle. This is the one fixed corner of the sail.
3. Clew cringle: The sheets are attached to the clew cringle, which in turn split into pairs of whips. The sheets go to each side, ending in a block. The standing end of the whips are attached to an eyebolt, run through the block on the sheets, and the running end is belayed to a timberhead (I haven't done this step yet).

Jib sail.

The jib sail was simpler in some ways (not requiring the netting/horses or figuring out what kind of stay to use), but requires a special piece of hardware called a "traveler" which is detailed below.

Similarly to the staysail, I had to cut down on the size of the jib sail to ensure a tight furl. Looking at pictures of ships with furled sails, as well as the pictures in the Harland book, it's amazing how tightly these sails were furled. The jib had more running room, so I went with a larger sail than the staysail - I also wanted to run it up the jib stay a bit higher than the staysail, so I needed more cloth to work with.

Construction was very similar to the square sails on the yards - using fabric glue I added bolt ropes and cringles. As mentioned above, for the hanks I used very thin beading wire which is much more flexible than using brass wire. The wire was looped around a brass rod in a spiral shape, painted, then cut as needed and shaped into a loop. Real hanks had a more complicated shape which I couldn't duplicate at this scale, so I just went with simple loops. I also painted them brown because it seems like these tended to be wood. The pictures below show the sail (with the sheets installed), as well as bent to the jib stay. The pre-furled shape of the sails is probably a bit different in the angle at the tack is the angle formed by the jibboom and the jib stay. I figured that this would make furling the sails down to the jibboom a lot easier.





Setting up the jib was a lot easier than the staysail, except to the extent that I needed to built a traveler. The traveler has three main pieces: the main loop that goes around the jibboom, the shackle that runs forward to the end the jibboom on which the outhaul is attached, and then a hook to which the jib's tack cringle is attached. These were created using brass wire and a hook from the kit. A block is also attached to the traveler for the downhaul. The traveler itself (minus the shackle) was covered in leather for protection. I didn't bother to simulate it as such but just left it as blackened brass.



Here is how the rigging proceeds:

1. Jib stay: The jib stay is attached to the traveler ring, through the hanks on the sail, up through the top sheeve on the cheek block on the starboard side, and down to the aft end of the starboard fore channel. Given the size of this ship, it seemed correct to tie it off directly, rather than use a block and tackle arrangement as in larger ships.

2. Outhaul: This line is tied to the shackle of the traveler, runs forward along the jibboom through a sheeve, to a timberhead on the starboard side. This functions similarly to the tack for the staysail in that it establishes a fixed position for the sail along the jibboom.

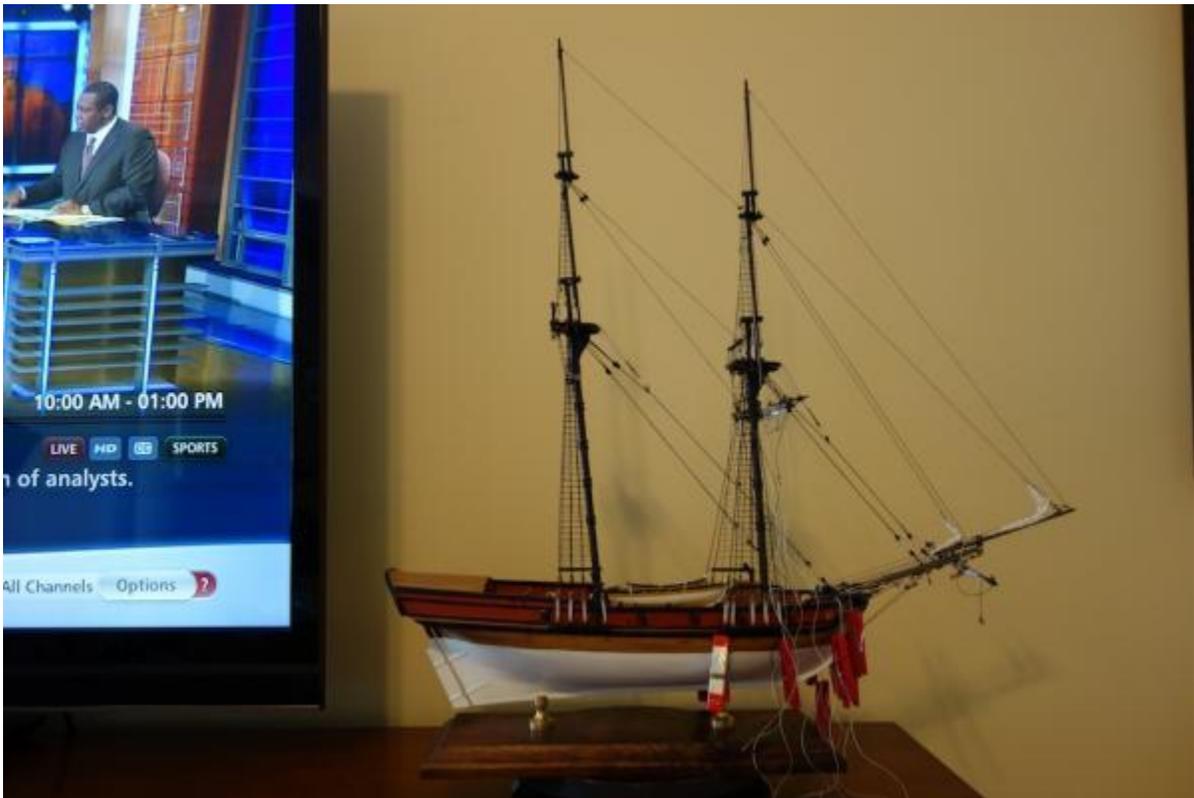
3. Downhaul: Similarly to the staysail, it attaches to the peak cringle, runs through a few hanks, down through the block attached to the traveler, and belays to a starboard timberhead.

4. Haliard: Similarly to the staysail, the haliard is run from the peak cringle but up through the lower sheeve of the starboard cheek block, and belays to a timberhead opposite by the aft end of fore shrouds, starboard side. As with the staysail, I ran these without a block and tackle for two reasons. Historically, it seemed smaller ships did not use a block and tackle. From a practical standpoint, and probably more importantly, adding a block and tackle would have been very hard to achieve given the scale and general size and busy-ness of the ship. So, I felt comfortable not using block and tackles.

5. Tack: The tack is attached to the hook on the traveler.

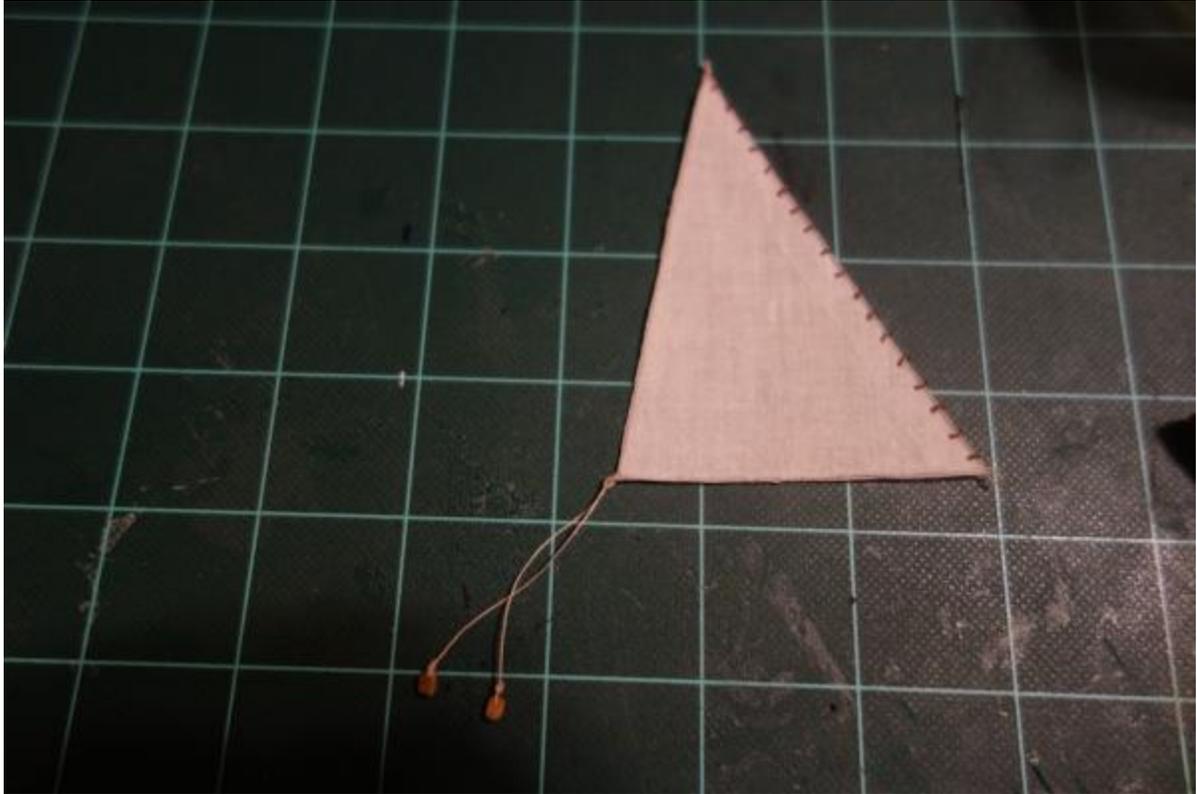
6. Sheets: The sheets are run just like for the staysail.

Here's the end result (sorry, had the TV on in the second):



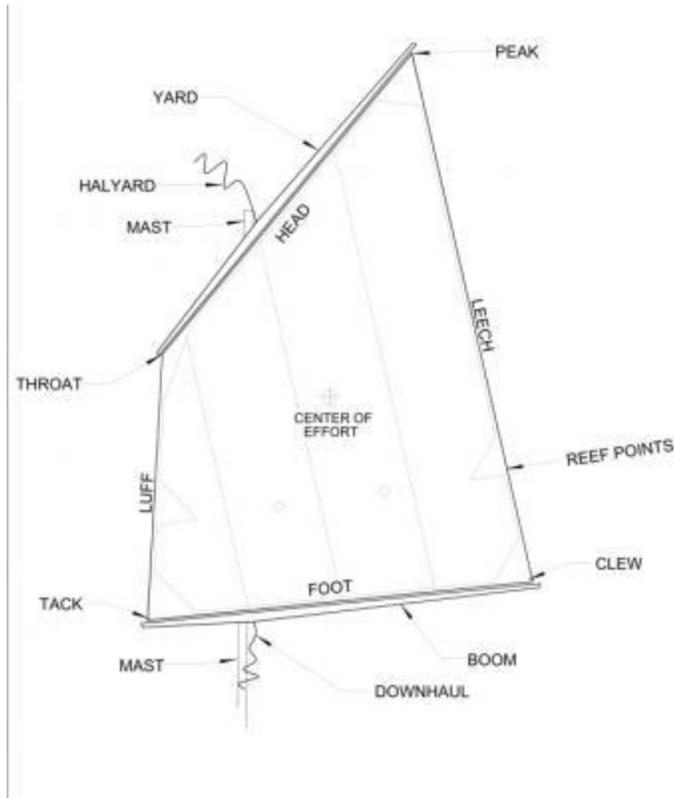
Hope all this is helpful (and accurate and correct!). I found that there was a lot of information online for furling and adding square sails, but not much really on the fore and aft sails. I spent many hours trying to figure all this out from the resources mentioned above, and at least to my eye, I think they really improve the ship. So, if I can give back to others for all the help I've received on here in the past five years, I'll feel very happy.

Attached Thumbnails

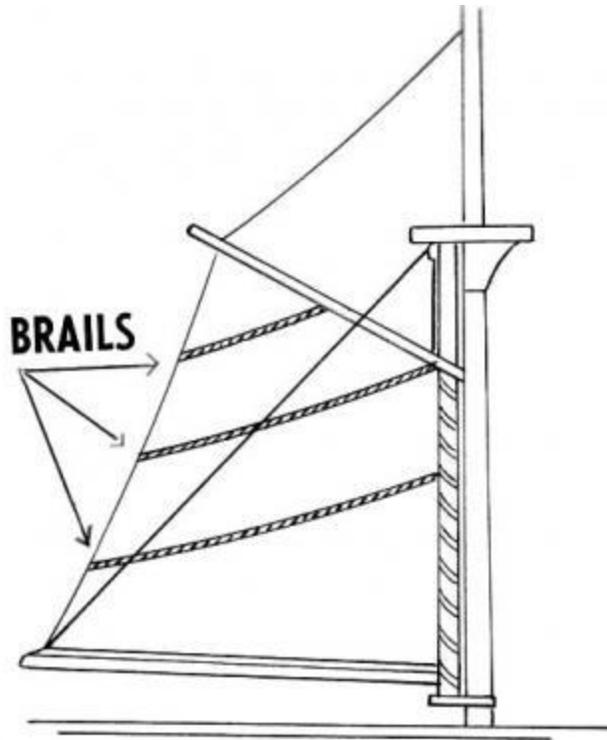


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- **Furled Driver Sail**
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- Here is what I did for the driver sail. I've seen these types of sails under a variety of names, including mizzen sails, gaff sails, driver sails and spanker sails. I think mizzen and gaff sails refer to the overall category of these types of sails. From what I can tell, "driver" and "spanker" are particular types of sails where the driver is associated with a boom, whereas a spanker is set free without a boom. The Badger has a boom, so this sail is a driver. Before I get too far, it might be worth attaching a diagram of a gaff sail's parts:

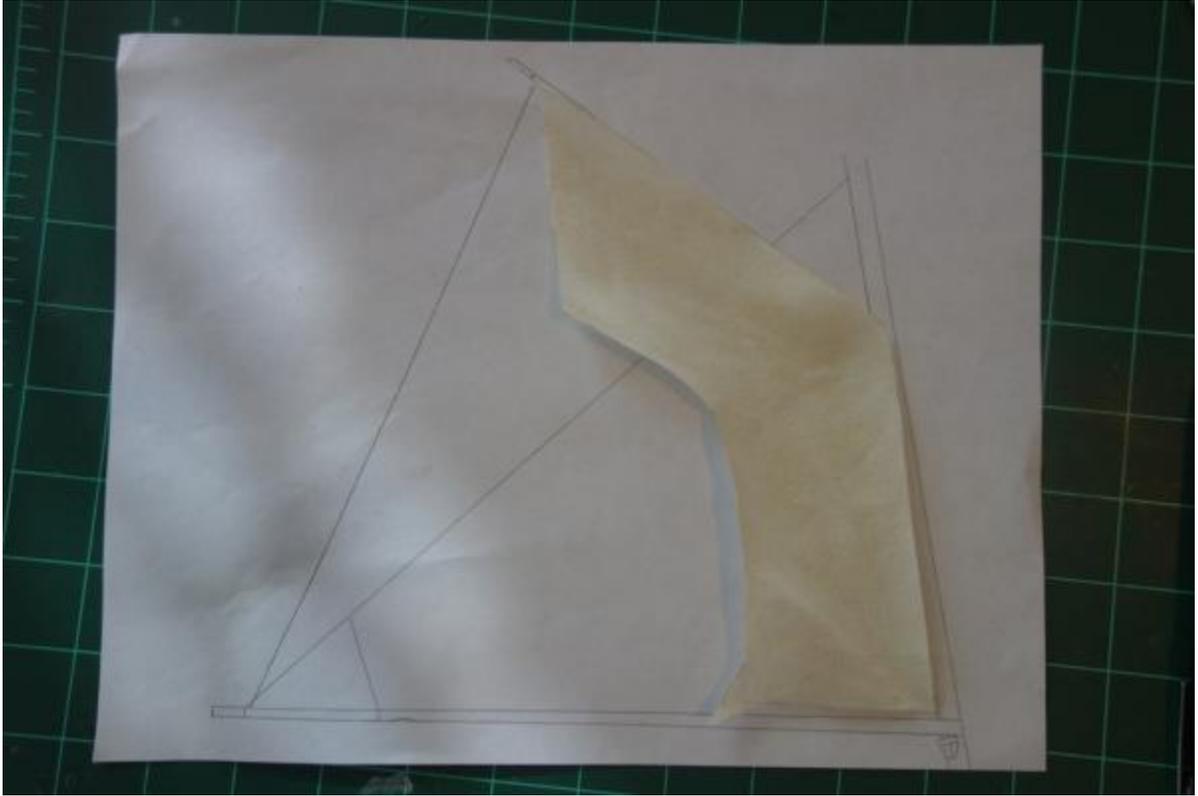
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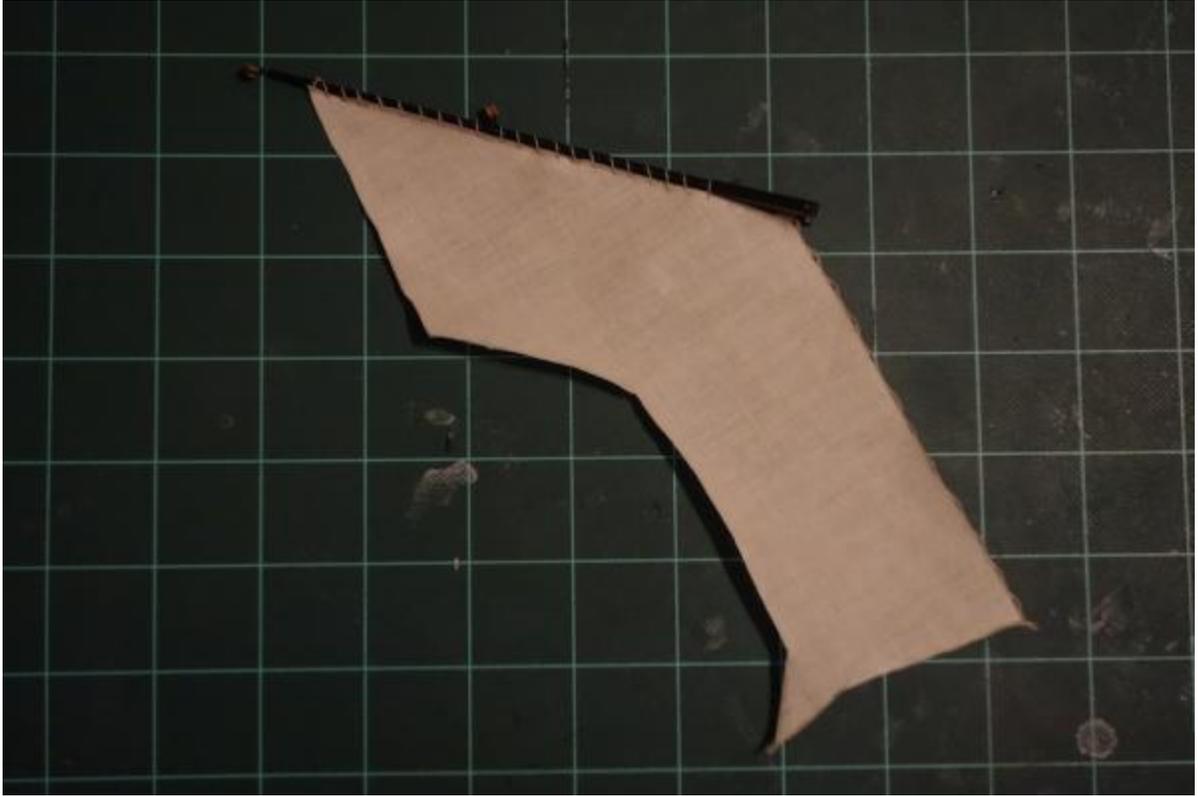
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- In some ways the driver was easier than the other sails, but in others, it was more complicated. Unlike the other sails where the sail is bent to the yard on only one edge of the sail (the head for the square sails, and the luff for the fore sails), the driver is attached on both the head and the luff. So rather than furling the sails in one general direction, furling the driver takes on multiple directions. On real sails, this was accomplished using brail lines that start along the leech side, and run up to the head and luff ends. A bit hard to explain, but this picture might help.
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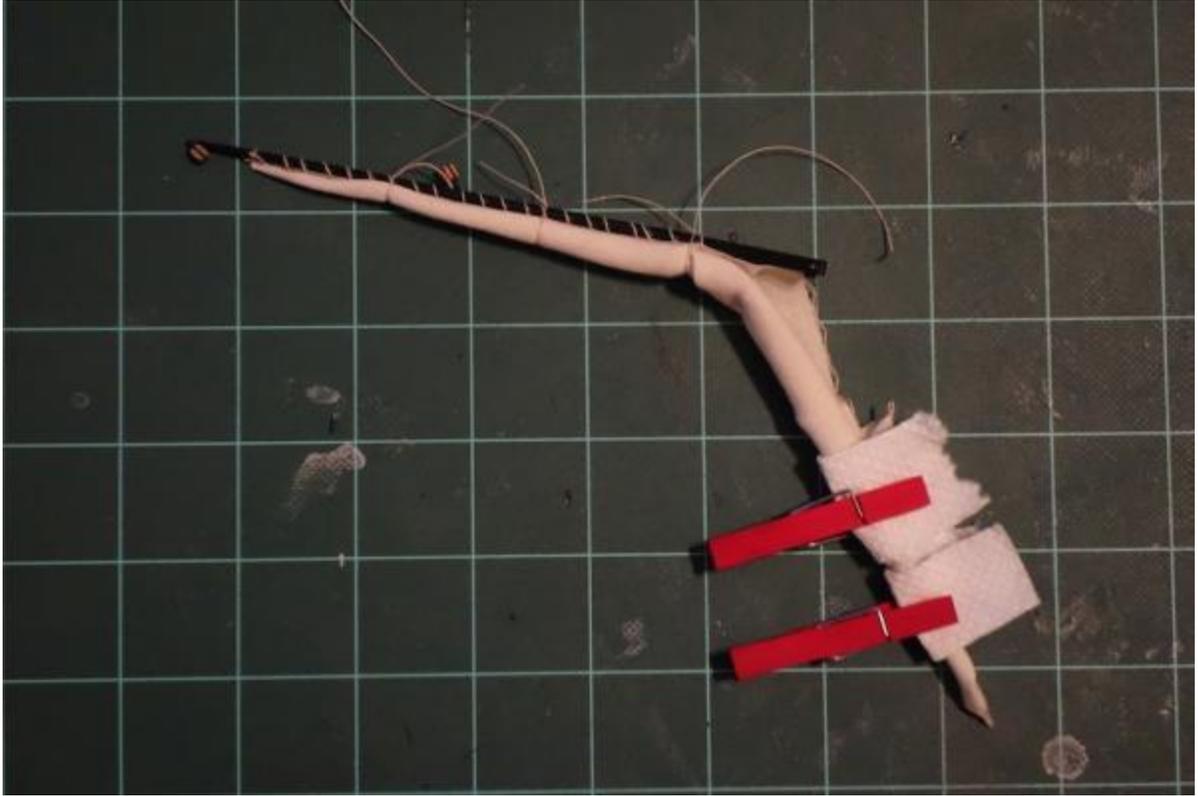
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- From my research, it seemed like gaff sails had around 5 brail lines, with 2-3 on the head and another 2-3 on the luff. The diagrams I've seen, however, on how/where the clew was furled differed from resource to resource. Some diagrams show a brail at the clew. Others show the bottom most clew on the leech as being about 2/3 of the way down the leech (and not at the clew). Then there is the matter of where the clew ends up. Some diagrams had the clew ending up at the throat, others, midway along the luff.
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- **My approach**
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- Like the other sails, I started by drawing a general outline of the driver sail, tracing the plans for the gaff, main mast and boom, and then just drawing a line for the leech end of the sail. The next step was to draw the pattern for the reduced sail. Here, there were three considerations: (1) how to reduce it enough that I could get a tightly furled sail; (2) how to design the pattern so that the furled sail bulk would be thinner at the peak and tack, and thicker in the area in between; and (3) mechanically, how would I proceed with the furl given that the furl takes multiple directions along the brail lines.
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- Here is what I came up with:
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- The total bulk of the sail is reduced to about 40% of the full sail size. The depth along the head and along the luff is about the depth of what I used for the furled fore and main course sails.
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- The shape is a bit odd in that at the head area, the leech end is angled inward, while at the foot, it runs parallel to the boom (on actual mizzen sails, I believe the foot of the sail was curved). This was because of the way I planned to furl the sail. First, I furled the sail up to the gaff, similarly to how I furled the square sails. So, the leech end, like the sides of the square sails, was angled inwards to reduce bulk at the peak. Second, I furled the sail at the throat area and the luff side. The foot is parallel to the boom and not angled as the head was because I realized that as I furled the gaff area, the outer edge of the foot would be pulled upwards, essentially angling the leech end near the foot upwards. So, there was no need to cut the pattern to an angle like I did with the head (otherwise, I would have almost no sail to work with at the tack). Hope that all makes sense.
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- The other thing to note is that I added a mock clew at the edge of the sail. Given the shape of the overall driver sail, I thought the clew on the actual sail would end up midway along the luff, rather than at the throat. I also wanted to add an outhauler line that was attached to the clew. I modeled this off the MS Brig Niagara instructions, where the clew is brailed up the middle of the luff.
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- With the pattern cut, I prepped the sail to attach it to the gaff. I added lacing holes along the head (5mm apart) to run the lacing to the gaff. I also added cringles along luff area (10mm apart) so that I could subsequently attach it to the mast. I also added clew and tack cringles at those areas.
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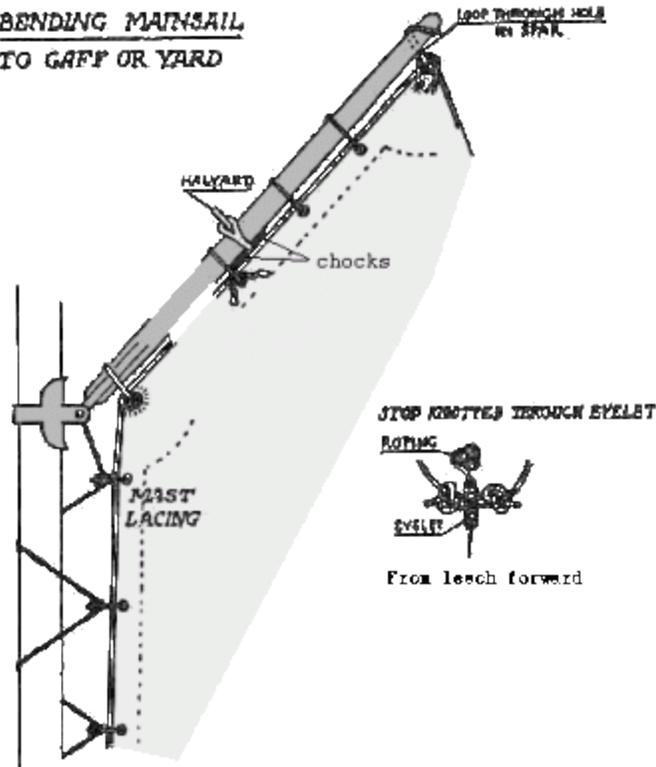


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- From my research, it seemed that these sails were bent to the gaff with simple lacing that ended at the throat of the gaff. I went with 5mm apart for the holes, which was what I used on the square sails. The sails are bent to the mast using a different lacing pattern (shown in the next post) using cringles, which I represented by running a line of thread along the edge using fabric glue, and pulling it up every 10mm to create the cringle. Given that the sail will be furled, these will not be visible later on. They did serve as a good guide for the mast lacing however, which I couldn't accomplish using holes drilled into the sail itself.
- Next step was to furl the sail as much as possible off the build before attaching the gaff to the main mast:
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- I was able to completely furl the head area along the gaff up to the throat of the gaff. You'll see I used three gasket type lines to hold the furl here, to somewhat represent the brail lines. Not sure if this would be accurate as I think the brail lines actually ran through brail blocks at the gaff, and then were belayed down to the deck. But, this would have been overly complicated at this scale, not to mention that multiple pins and cleats would have to be added. So, I went with these three gasket type lines. Ultimately, I went with two along the gaff, and moved the remaining line to the throat area of the sail (and not at the throat of the gaff itself).
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- I was also able to get the luff edge furlled pretty well at this stage as well. My plan of not angling the foot worked out pretty well, as you can see that the bulk is greatly reduced at the tack, with most of the bulk at the throat. In case you're wondering, I'm using napkins under the red clothespins because I've found that the color on these colored clothespins can rub off on the sail cloth 🙄
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- From there, it was a matter of installing the gaff and lacing it to the mast. As noted above, the lacing for the mast is a bit different than the lacing to the gaff - I think zu Mondfeld has 10 different approaches in his book. From my research, part of the reason for the different lacing was so that the sail could slide more easily up and down the mast. I used the mast lacing pattern as in this diagram:
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**BENDING MAINSAIL
TO GAFF OR YARD**



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- Next I furled the rest of the sail, and added two more brail lines against the mast. I also added a block and tackle arrangement at the deck as you can see in the third picture below. I'm also planning on adding the outhauler line, which would run from the tack clew, through a sheeve at the end of the boom, and belayed at a deck cleat at the base of the main mast. The kit plans have two pairs of deck cleats to be installed at the base of the main mast, with only one pair used, so all I needed to do was add an extra pair of eyebolts to the deck.
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- They still need some work to try and get in some folds, etc., but overall it came out somewhat ok I think. I'd also note that in addition to real drivers having brail lines and blocks, there are a number of other inhauler/outhauler lines at the peak, as well as lines at the end of the boom. For my build, I thought they would add too much complication given the kit's pin and cleat configuration, and I had already installed them per the kit plans before deciding on the furled sails.
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- So that's how I added a furled driver. There are probably better ways of doing this, but hopefully this helps give people a jump start on how to approach them - I had searched all over the internet for methods on how to install a furled driver, but couldn't find any so hopefully this helps a bit.
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