Junk Rig for *Ingeborg*, Part 3
Mast, yard, battens and boom - and rigging the whole lot...

by Arne Kverneland

Just as with the previous boat, *Frøken Sørensen*, I decided on a hybrid aluminium-spruce mast for *Ingeborg*. The lower part was a 6m length of 150 x 5mm tube of 6082-T6 alloy. The upper wooden section was 3.7m long, plus 0.60m for burying into the lower mast. This tapered from 140mm to 90mm.

**Preparing the mast top.**
The construction of the top section had been outsourced to my boatbuilder friend, Curtiss Anderson, who is an expert on wooden masts and traditional rigging.
Before joining the two mast sections, I prepared the top with a number of coats of two-pot polyurethane paint (five coats with clear and three with white). After sailing for three years with the mast for *Frøken Sørensen* treated this way, I decided to use that method on *Ingeborg*’s mast too, instead of glassing the top with epoxy first.

20160411 The top section arriving in Lundsvågen.

One great advantage with the hybrid mast is that both halves are easy to transport to the harbour on the roof rack, where they can be assembled for the first and last time into the complete mast.

20160412 Starting the varnishing - 5 coats of clear, topped with 3 coats of white 2-pot polyurethane...
I left the lower, to-be-buried end unpainted but later prepared it with epoxy coating before joining the two halves.

The weather was still quite chilly, so I stored the finished top section in the mast shed for a while to let the paint harden. In the meantime, I set to work with the yard and battens.

**The yard.**

I built the yard from two tubes, which were fixed to each other with one bolt at each end and then a string of slightly thickened epoxy in the two grooves between them. For the main tube, I chose a section which I thought would be almost strong enough alone, and then I added a top tube of the same section as I use for lower battens. This is to stiffen the yard in the vertical plane. To get best possible bond between the aluminium and the epoxy, I sanded with fine-grit sandpaper, right before the epoxy went on.
The epoxy was coated with 2-pot polyurethane. Note the 6mm bolt.

I avoid sewing the two tubes together with a number of bolts. Apart from being quite awkward to do, quite big holes would have to be drilled, just where I don’t want any holes. It could be that a softer glue is better suited for the job than epoxy: Maybe Sikaflex or similar would be better and less vulnerable to UV-radiation. Or maybe some cunning spot-welding would be best. Anyway, the epoxy on the yard of *Frøken Sørensen* has held well, so far.

**Battens and boom**

In between working on the yard (waiting for stuff to harden), I prepared the battens and boom. This time I had chosen to use 50 x 1.5mm tubes for the boom plus the two upper battens, and 35 x 2mm for the lower battens. There are a number of ways to terminate the battens at the sail. I try to make a good connection between the batten end, sheetlet and leech boltrope. I also try my best to secure the batten ends (nearly) flush with the leech to avoid sheet tangle during long slow gybes.

This time I used a slightly upgraded version of the way *Johanna*’s battens were terminated. The method involves three-link stubs of a light stainless chain at the aft end of the boom and sheeted battens. The method is simple and very resistant against chafing. The chain stubs are suspended from a vertical, 6mm bolt, which does second duty as anchor hold when lashing on the sail. The un-sheeted top batten needs no bolt, of course. There and in the forward end of
the battens, I just drilled holes in each side for shackles, and used these for tying the sail etc. on.

20160523 The after end of the battens (boom not shown here).

Assembling the mast
Parallel with these jobs I also assembled the mast, just outside the workshop. When working with slow-hardening epoxy and paint, it is best to have 3-4 tasks running at the same time.

20160625 The joint between the lower and upper mast.
After having checked the mast for a good dry-fit, plenty of thick epoxy was smeared on the 60cm lower end of the top section, and then it was pushed in. After the epoxy had hardened, more or less, I added the fairing of thickened epoxy, shown above, and glassed it. This is the only spot where I used glass on the whole rigging project.
No screws, only Sikaflex was used to secure the mast cap. The clue is to avoid any water ingress in the wood. The top section had developed a very slight bend during storing. I arranged so that this bend would point forward. After stepping the mast, it looks straight to me...

**More odd jobs before stepping the mast.**

There was still a number of small jobs needed before the mast could be stepped;

- padding the yard and boom at the mast.
- dressing the mast with standing and running rigging,
- producing a number of wedges for the partners,
- producing the mast coat,

Constructing the sail surely is the quick and easy job! Rigging the mast and sail for the first time takes a lot more time and ingenuity than one first may think. However, I’ve done it before, so I was prepared. With the facilities and space available at Lundsvågen Boatclub, it is still quite doable.

**Padding the yard.**

20160531 Stitching on some thick PVC canvas onto the yard.

That stitching may look complicated, but is quite quick and easy when one has decided on type of stitching (.. I used ‘Sailmaker’s Herringbone Stitches’....). The material’s thickness gives quite good padding, but it would have been an easy job to fit some sort of additional padding material under the canvas, while I was at it. I just forgot, just as I did with making the batten pockets oversize to allow for padding the battens at the mast....
Dressing the mast

The halyard, topping lifts, mast lift and spare halyard were tied on and secured. Obviously, the yard was not there yet, so to reeve the halyard before erecting the mast, I tied the two needed ‘yard blocks’ to a half-meter long stick, which played the role of the yard until later. This greatly saves work later and also ensures that there is no odd twist in the multi-part halyard. The halyard was this time made with 5-part purchase and good heavy-duty ball-bearing blocks.

The wedges.

20160603 Dressing the mast before stepping it. Here the shackles are being secured.

20170605 mass-production of identical wedges, right after the mast had been stepped for the second time.
Since the correct angle of the mast (plumb) is being ensured by test-stepping the mast and then correcting the position of the mast step, there is no need for wide clearance around the mast at the partners. I only planned for a gap of 20mm. I could therefore produce a number of identical wedges, all with very fine angle of rise. This ensures that the wedges don’t tend to creep back upwards. Note the nose at the top of the wedges. They keep the wedges from ever falling through.

**Making the mast coat.**
This was prepared as early as in February. It is a cone-shaped thing which wraps 1½ times around the mast. That makes it easy to install after the mast has been stepped. It also makes it easy to open the lower lashing of the coat to get access to the wedges. This has proven to be perfectly watertight, although it is not in theory (see p.13). That mast coat resulted in another write-up:

http://goo.gl/G6siDP

**Stepping the mast, rigging and hoisting sail**

**Stepping the mast**

20160519 Before assembling the mast, I found it wise to check that its lower end actually fitted in the mast step. I did. Note the groove meant for draining away any water.

Unfortunately, I don’t possess a device to produce perfectly circular holes of this size, so I have to use my jig-saw and hope for the best. After some sailing, I found it best to bang in a couple of very thin wedges at the mast step. This is also why I prefer to test-step the mast and then correct the position of it: I am simply not an accurate carpenter, and besides; measuring on a boat which is afloat is not that easy.
Mast stepped and maststep permanently secured with screws and epoxy. A little bit roomy fit...

This two-step method with many layers of plywood may be slow, but it is after all quite easy for a non-boat-builder amateur (More details about this in Part 2: [http://bit.ly/2sf2tsW](http://bit.ly/2sf2tsW)).
Rigging procedure.
With the mast secured and the mast coat wrapped, taped and lashed on, it was time for more rigging.

20160605 The topping lifts have been made ready for the boom. Note the ‘dummy yard’ at the mast.

This is standard procedure with me: I start with installing the boom. The mast lift is already in place, so the boom will be held up by this and the topping lifts. A standing tack parrel is tied on to keep the boom from sliding forward, while a temporary one-string sheet keeps it from swinging about. Those topping lifts are just tied to the boom, being more than long enough (for later adjustments). A hose-clip around the boom prevents these from sliding forward. All the mentioned lines are ‘standing’ during sailing, but they were in this case adjusted a bit during trial sailing, mostly to raise the boom with more clearance over the sprayhood (..the tack line, TL, fitted with a stout rubber snubber on it, only came on a few days later, as did the sail catchers...).

Tying the sail to the battens (indoors).
With the garage type workshop available, I copied the assembling procedure I used on my last boat. There is a lot of tying and melt-fusing of string ends afterwards, so being able to do it indoors, speeds things up. Ingeborg had to wait.

( 20160609 ..and yes, this ‘sheet chainplate’ had to be made and fitted to the transom...)

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Rigging the sail.
The sail bundle was only united with the boom and yard after it had been brought on board.
The halyard blocks are only lashed on. Which sort of lashing? Don’t ask, don’t tell...

I later grew sceptical to that string I used, so have by now beefed it up with Dyneema line.

Details from tying on HK parrels and batten parrels.

Again, a hose-clip is used to prevent slipping. Note the use of insulating tape between the stainless hose-clip and aluminium batten.
Note the webbing type mast lift to avoid cutting into the sailcloth. The webbing could have been a bit longer. The standing tack parrel, TP, is also made with webbing where it goes around the mast. Note the pvc-padded boom. The fall of the halyard has been lead aft to the sb. genoa winch, but the YHP, THP and tackline (TL) have not been fitted yet.

**Sail up, ready to go!**

[Image: Last minute before setting off...]

[Image: How the sheet blocks are tied to the transom chainplate]
Finally, on the 17th June 2016, it was time for the first test sail, in light winds. The sheet (Johanna type, see JR for Beginners) was on (more or less), but it always takes some time to tweak the sheetlets into best length. The Johanna style sheet is very good at restricting twist and thus ensure good performance, but it takes up a bit more deck space than there is. However, as long as I can sheet in for close-hauled sailing with only three panels set, I am happy. Still some small jobs to do and some more tweaking to be done, but Ingeborg is from now on a sailing vessel again!

That’s enough for now. As I hoped, Ingeborg turned out to be a fine sailboat under JR. No big changes have been called for, just minor adjustments and additions (Sail catchers, sail cover, wind indicator etc., etc....).

I hope to come back with a concluding Part 4, where I will sum up my sailing experience with her and the small fixes I have done to her.

Stavanger, 20190214

Arne Kverneland

a-kve2@online.no

PS: Thanks to Mark Case for browsing through this for me and gently pointing out the worst few blunders I had made - and thanks for not making a full proof-reading of it. I always used to hate getting back my essays, stuffed with red notes...