Making the sail
.. lofting, cutting and sewing...

With a sail plan in hand you should be ready for the actual production process. As an example we’ll use the sail plan (sheet 1 to 6) that once was the basis for Johanna’s sail. As you can see, the plans are not much more than sketches, but they are still good enough to work from. This sail was actually made by a local sail maker (except for the corners, batten hoops and loops), so a short instruction followed the plans. (.. they screwed up completely, so had to do it all over again. Hopefully this instruction will be more complete and let you avoid the pitfalls they fell in...)

How to use this chapter:
This chapter has definitely been written for the doers, not for the arm-chair readers. Instead of squeezing in small diagrams among the text here, I have put them in the end of it. I suggest you print out at least the diagrams so that you can have them side by side the text. Since they are full size, you will have space for adding your own notes on them too. I also attach Johanna’s sail plan at the very end of this chapter.
Try to read the chapter 2-3 times and take notes. Then make the sail in your head before setting to work

5.1 Things you will need:
This you will need, at least:

- Sufficient canvas in weight and quality according to the sail plan. The sort of canvas is not critical. What you should look for is a canvas that resists rot and sunrot and which is quite wind tight (. i.e. when you try to blow through it, it should make quite strong resistance). The blue canvas I have used is a kind of rip-stop woven nylon, coated on one side with silicone, I think it is. It has very low diagonal stiffness which helps taking up the compound curves of the baggy panels. On the other hand; it is not the best against sun, but that’s all right in Stavanger at 59deg latitude. The stress in the fabric in a junk sail is much lower than in a “normal” sail, so the canvas weight can be half that of a gaff sail of the same size. Still it could be an idea to use stronger canvas in the top 3 panels than in the lower section. In Johanna’s sail the canvas weight is 220g/sqm all round (about 6oz).
• **Light 25mm nylon ribbon.** You will need ca 2m of this ribbon for fitting as telltales; one at the leech of each panel.

• **A well-lit room** with space for a lofting floor, at least big enough to room 1-2 panels at a time and also a good size sewing table. A rough wooden floor would be perfect; that would let you pin the canvas and templates etc to the floor. That would also allow you to make marks on it with felt tip pen. If you have to work on a “sensitive” floor, a dance hall or something, you can get away with making tape marks and using weights to hold down the measuring tape, splines or lines. A temporary lofting floor of thin plywood has once let me loft a little sail in my living room.

• **A sewing machine** and a roll of suitable thread. If you intend to use your domestic sewing machine, I suggest you buy the biggest needles that it can take, (say 110, 120) and bring the sewing machine with you to a sail- or canvas maker. There you can try what they have and test with the thickest possible thread the machine can take. My machine is an old *Pfaff 360* and the thickest thread I can use is no. 30 (rising number — falling thickness, similar to T-70 in American numbers where T90 is just a bit too thick for my machine).

• **Measuring stuff;** metre-sticks, tapes (min 10m), awls, tacks, bendy splines of batten length plus a little, etc.

• **Marking stuff;** felt tip markers; tailor’s chalk, chalked line if possible; 25mm nails and a hammer; some template stuff, the length of one batten, possibly made of painter’s paper or thin plywood; etc.

• **A good office stapler.** With the shown methods of joining sail panels and batten panels, an ordinary office stapler will do well in basting the panels together before dragging them to the sewing machine. I find it easier to use than the basting tape. Your choice.

• A good pair of scissors or even a hotknife if the canvas is not coated.

### 5.2 Some techniques you must master:

Before starting up with the lowest panel, let’s go through some techniques involved in the project. I guess it would be smart to actually make and rope a little “test sail” with two batten panels, a batten pocket in the middle, hemming, roping and corners, hoops and loops. This way you would not have to look at the start up areas in your real sail showing bad quality craftsmanship. I recommend you spend a couple of hours on that test sail.

**Joining canvas panels**

You are lucky if the available canvas for your sail comes in widths that spans one whole batten panel, including the barrel rounding (i.e curve along the battens). It is more likely that you will have to join two lengths of canvas first. Now, machine-sewing sail cloth can be a real pain; the canvas slips, it is heavy and it is bulky. It helps to have a nice long sewing table with the sewing machine in the right end (sail makers often sit in a hole in the floor with the sewing machine on the left edge...) A quite simple way of joining two panels is shown in Fig. 5.1. The trick here is that the first seam can be made by just putting that edge into the sewing machine — no rolling up. It also lets you staple the panels together prior to dragging them to the sewing machine. After that first seam it is easier to work without things falling apart, and complete step 2 and 3. The result looks like a double seam on one side and a triple seam on the other.
**Hemming the sail**

Note: Hemming of the sail is done batten panel by batten panel prior to joining them to the sail along each batten. The hemming method depends on the method you will use for later roping of the sail; see below about *roping the sail*.

- *The rope type boltrope* method (fig 5.2) requires that you make a conventional hem along the edges of the sail with the exception that an inner boltrope of 5mm is sewn into the hem. This inner bolt rope will act as an extra stronghold when the outer boltrope is hand-stitched on to the completed sail.
- *The webbing type boltrope* method (fig 5.3) only requires a simple hem about as wide as the webbing you are going to use as a bolt rope.

**Fitting telltales**

At the leech of each batten panel, mid between the battens; fit 25cm long telltales (Fig 5.4). These are of great help in sheeting the sail for best speed. They are not optional! Fuse the ends well or they will soon frail.

**Joining batten panels along the battens**

As will be seen, we shape and hem each batten panel, starting at the bottom panel. As we finish them we join them along the battens. Figure 5.5 shows three different ways of joining the batten panels. Also see fig 5.8.

- I used the Amateur method A on my first boat, *Malena* in 1994. It isn’t neat, but the sail is still in use and we haven’t had to repair a stitch (2010). The load in the seams is much lower than it would have been in a gaff sail of the same size, so don’t worry, it works.
- Amateur method B is the one I recommend. It looks better and might be stronger and also let you make the batten pockets at the mast in a stronger chafe-resistant canvas (e.g. thick PVC.). In addition the step one seam that joins the batten panels is totally covered from sun when the batten pocket is fitted over it. On both method A and B you avoid having to coil up a lot of canvas to pass inside the sewing machine.
- Method C is how a sail maker would want to do it. It is all right as long as he makes the batten pocket as shown here; not a big flat pocket to squeeze the tube into. The former mentioned method shown for joining canvas panels might make the job easier, but it is still awkward for an amateur (fig 5.1).

Both Method A and B (and possibly also C) let you join the batten panels with staples to simplify the seaming. Needless to say, remember to remove the staples afterwards.

**Roping the sail**

When all the batten panels have been made and joined and batten pockets are in place, it is time for roping the sail. The whole idea is to let the edge of the sail be strong and not elastic, so it will take the loads. The hardest load is along the leech. Note that I have not specified a single strengthening patch in any corner or elsewhere. The bolt rope is to take the loads. The sail cloth is just there to catch the wind and transfer the forces to the battens. From a stress point of view, there are 7 small sails involved, not one big one as in a gaff sail.

- *The rope type boltrope* (fig 5.2) is fitted by hand stitching it to the inner boltrope with groups of 3 stitches, secured with half hitches and fused. The spacing between the groups of stitches should be about 15cm, but with closer spacing at the battens and corners. This method of roping includes splicing in a number of hoops for the batten ends to rest in, see later in Para. 5.6 about *roping the sail and fitting corners, hoops and loops*. I start my roping on the middle of the foot of the sail and make one long
bolt rope around the sail. On a 32sqm sail I took the time; 8 hours. I think it is a good method.

- **The webbing type bolt rope** (fig 5.3) is fitted around the edge of the sail with 3 passes (triple stitching) with the sewing machine. Here we don’t need to think of the hoops for the battens etc. yet. We will fit them later. Again, see below under *roping the sail and fitting corners, hoops and loops*. This method is pretty fast and seems to stand up well. One little worry is that it seems that the bolt rope at the leech of Johanna’s sail stretches a bit. I might cure that by hand-stitching on an extra outer boltrope to share the load with that webbing. Starting from scratch I would consider roping the leech with double webbing; in effect sandwiching the edge of the sail between the two webbings. (*Indeed, Johanna got an extra boltrope stitched onto its leech in 2008 – this chapter was started a long time ago...*)

### 5.3 Preparations to your sail loft:

**Sewing table**

Unless you are a soft-limbed person who comfortably can sit on the floor for hours in front of your sewing machine, I suggest you install a long and possibly wide table for the sewing machine. You will spend a week or two there, so a good chair is recommended too.

**Marking luff- and baseline on the floor**

For making the 5 lower panels, the floor will need two basic helping lines; the base line and the luff line at right angles. Mark them up with felt pen or removable tape (Fig 5.6)

**Making a rounding template**

Before we clutter the sail loft with canvas, a hammer and saw job is needed:

To save time and ensure we make a number of (.. here: 8...) identical roundings along the battens and boom, a template from thin plywood (.. recommended...) or thick paper is made. On Johanna’s Sailplan sh.3, the specified rounding on panel 4-7 is shown, here 26cm. Shape this rounding on that plywood to a nice and fair curve with the help of a wooden or plastic spline which you position with nails or some weights. The aft section (1/3) of that curve should be straight (fig 5.7).

**Oops!**

After having made Broremann’s sail in 2009, I think I have changed my mind: I now think that making full size patterns from painter’s paper for all the panels makes a lot of sense. It helps you to make best use of the sail cloth, and speeds up the lofting process of the lower panels (see photos on page 1 and 5). Weave orientation is not critical since the load in the cloth is so low.
5.4 Making the lower section (here: panel 4 – 7)

NB! From now on you must remember which side of the mast the sail will ride on. The normal side for a sloop sail is the PORT SIDE of the mast. Don’t forget! I loft the sail panels with the mast side up. On this side the batten pockets, hems, boltrope and batten hoops also sit. Also if the two sides of the fabric are not identical, then make sure that the same side is the starboard side on all panels. This is easy to forget when you are in the middle of the job, hungry and tired.

Also, you now have to decide on which type of boltrope to use as the hemming differs with roping method.

The lower panels are made as identical parallelogram panels with the same camber. Here it definitely saves time to make a common paper pattern for panel 4 – 7.

Cutting and preparing the lowest panel (panel 7)

- Mark up the geometry of the lowest panel pattern. (Sailplan sheet 2 or 5). Use the base-line and luff-line and use that RISE to get the correct angle of the boom, etc. (fig 5.6).
- Use a bendy spline and copy the curves along the battens (barrel rounding) from sheet 3 onto the paper pattern. The pattern is cut to net size, not counting the hems etc.
- When making ready for cutting in canvas, remember to mark up for hems etc at luff/leech/foot and for joining with other panels at the batten.
.. panel 6 about to be marked up on the canvas, using the template common to panel 4-7...

- **Note, special for batten panel 7**, the lowest: I have found it wise to cut off the clew corner of the lowest panel about 25cm on *Johanna’s* sail. I did it when I saw the sheets catching the protruding boom end when hoisting sail. Also, with one or more reefs in the sail, the sheets often caught the boom in a jibe. You could do the modification now and save trouble. General guideline: Cut off 4-5% of the boom length at the clew.
- When you have marked up sufficient extra space for the hems etc, you will have the lines to cut from. You might also want to mark up guide lines on how to wrap the edges to get an even hem of the desired width.
- Cut out the batten panel. Note: Even before you lift a batten panel from the floor, mark the tack corner of the starboard side (or whatever side which is the mast side) with “T7”, T6” etc. This is the best guarantee from screwing up when joining the panels.
- Hem the panel along luff, foot (panel 7 only) and leech.
- Fit the telltale (fig 5.4) now onto the middle of the leech, while manhandling the panel is easy.

.. the tack corner marked with T4 on panel 4...  ...

...fitting a telltale prior to assembling two panels...
Making the next parallelogram batten panel (here: panel no 6).

- Before repeating the procedure of making the lowest panel, you may find that you have so much leftover canvas after cutting out the first, that you will make use of it. Then you just join it to a new length of sail cloth as described in 5.2. In other words, you just add “new” canvas to the “old” as you need it for the rest of this sail (Fig 5.1).
- This batten panel is made just like the first one except for not cutting away that clew corner. Now both upper and lower rounded side must be prepared for joining neighbouring batten panels and fitting of batten pockets.
- After this panel has been hemmed at luff and leech (and telltale fitted), join it with the lowest panel along the batten in your preferred way (para. 5.2) and fit batten pockets as per Johanna’s sail plan sheet 6 (and fig 5.5 and fig 5.8) before starting the next panel.

Finishing the lower section (here: panel 4 – 7)
Note: If you are a tidy, well organized person, you may well cut the 4 lower panels in one go. That doesn’t suit me; I make one panel at a time, fit it to the already finished sail, and fit batten pockets as I go. As the sail grows, it rapidly gets heavier to work with (dragging it between the floor and the sewing machine). The paper panel pattern (common for panel 4-7) saves marking up time, though. When the 4 lower panels have been assembled, batten pockets and all, wrap this section together and put it aside.

5.5 Making the top section (here: panel 1 – 3)
By building up two halves of the sail and finally joining these, you save a lot of manhandling of canvas. If your sail is really big, say 100sqm/1100sqft, it may be an idea to finish the sail as two separate sections and tie them together at the “joining batten” as the sail is rigged on the ship.
Making the top panel
With the sailplan sheet 4 in hand it is easy to loft panel 1 (or as here; a paper pattern for it).

- The marking up of the panel starts by making use of the helping point at the luff. This lets you mark up a triangle on the prepared canvas (or paper). Then it is easy to cut off the “luff tip” to correct yard and batten length (*Johanna*; B=5.80m, *Broremann*; B=2.45m). Don’t forget space for hem at the luff.
- The marking of the rounding along the long sides is found on Sailplan sh.3.
- In the 2 upper panels we also want a 3cm hollow at the leech, so this is marked up too.
- Mark for hems and batten edge, cut out, hem along luff, head and leech, don’t forget the telltale. You are a pro by now so I skip the details.

Making panel no. 2 and fixing it to no.1
- The procedure is the same as for the top panel, except for making both long sides ready for battens this time.
- Staple panel 1 and 2 together and seam them together.

Making panel no 3 (the “transitional” panel) and finishing the top section
- Mark up panel 3 pattern according to Sailplan sh. 5. I use the marked up baseline and luff-line plus the Chord and Rise to establish the luff and foot of this panel (Fig. 5.6). From there it is easy to make a fix for the two other sides. The panels could have been marked up using the diagonals too, but the rise method ensures that the rise angle gets correct. The most important thing is that the sides have correct length along the battens, or they will not fit when joining.
- Mark up and cut out the panel, make the hems and fit the telltale.
- Staple it together with panel 2 and seam it up.
- With all batten pockets and telltales in place the top section is finished.

NOTE.
On *Johanna*’s sailplan sh.3 the rounding in two mating panel sides are not the same. In later designs I generally make the sides match better than here, at least in panel 3. This is to keep the sides of same length. In other words, I make the panel with asymmetric barrelling so that the sum of the two roundings ensures correct camber. In the two top panels the added length due to rounding is negligible.

5.6 Finishing the sail.
Finishing the sail involves joining the two sections, roping the whole sail and fitting corner hoops, batten hoops and a number of smaller loops. This sail is made without a single metal grommet. We use webbing (or rope) hoops instead. My experience is that this works fine. In a way we should think of the sail cloth as fragile paper. If we want to fasten to something strong, we should aim for the strengthened hems cum boltropes and for the battens. As said, the sail cloth is there just to catch the wind. The bagginess of this sail reduces the tension in the canvas to an even lower level than in the flat junk sail.

Joining the upper and lower sail section:
This is of course just like any joining of single panels; mate the two batten-3 edges with staples (. ok, ok – or with basting tape...) and drag the whole lot to the sewing machine. By now you will be glad you worked with 2 sections.
Webbing-type roping:

![Photo above, left: The webbing boltrope was sewed on without using staples or anything...](image)
![Photo above, right: The second seam is coming on. And yes, that red telltale...](image)

Bolt rope:
As described in Para. 5.2, the roping of the sail simply means machine-sewing a strong webbing all around the edge as shown on the photos above ( .. on the mast side, remember?). With all your gained experience from assembling the sail, this will be piece of cake. Make a double or triple stitch job of it. Try if you can to keep the webbing tauter than the sail when feeding it under the sewing machine’s foot. The point is that we want the stretch along the edge to be taken by the webbing, not the sail. If you are unsure if the webbing you have is stiff ( un-elastic) enough, then double it along the leech all the way from the clew to the peak of the sail.
Sail corners:
Look at photo above. It should explain the whole procedure of fitting the corner hoop from webbing. Use the same webbing as for the bolt rope.
The trick is to adjust the length of the corner hoop so that the pulling forces go perfectly in line with the sail’s edges. Special for the throat corner: Here the angle of the corner is so wide that the 180° twisting can be skipped.

Batten hoops:
External ropes (sheetlets and several parrels) will be tied to the battens and will do their best to rip the battens off the sail. The dominating vector on these forces is down along the sails edges. The best way to transfer them to the luff and leech is to fix hoops for the battens to rest in (photo above). Use same webbing as for the bolt rope. A one-metre piece of dummy batten will make correct fitting of the batten hoops easier: Insert the dummy batten in the batten pocket and wrap the batten hoop around it to determine its length and position.
Loops:
A number of small loops of, say, 20mm webbing is needed along the head and foot of the sail. The sail is to be laced to the boom and yard via these loops. Fit them in a distance of around 30cm. In addition we need to fit the same loops at the end of each battens, just below the batten hoops. The battens’ horizontal position is fixed with a little lacing to these loops. Note: The forces in these small loops, wherever they are positioned, are light compared to those in the corner- and batten hoops.

Malena in 2010. Her 16 years old nylon sail is pretty clapped out with big holes and lots of mould and sunrot in it. Still, the rope-type boltrope and Amateur Method A batten pockets are still doing their job. Thanks to the low load in the sail cloth the camber has not changed much since new and Malena is still moving along nicely...

Photo: Andrew Bailey, 2010

Rope-type roping:
This was the way I fitted a boltrope to Malena’s sail back in 1994. It looks difficult, but if you have the right gear (sailmaker’s glove, sail needles and waxed twine), you will soon learn to master the technique. I think the rope version is at least as good as the webbing version, for two reasons:

- It seems easier to find a suitable 8-10mm pre-stretched 3-strand line than to find a pre-stretched webbing.
- When actually sitting there hand-roping the sail, it is easier to make a slightly taut roping, ensuring that the forces will act on the boltrope and not on the canvas.

An important difference to the webbing version is that you cannot finish the roping first and then fit the corner- and batten hoops afterwards: You have to deal with all these jobs in sequence as your roping job passes a corner or a batten position.
Bolt rope:
The bolt rope is fitted on top of the sail’s edge, i.e. on the batten side.
As said in para. 5.2 it consists of fixing the outer bolt rope to the inner one by groups of stitches (“stops”) every 15cm or so, using double waxed lacing thread and starting with a stop knot in the end (Fig 5.2). I make at least one stitch right through both ropes, then 2-3 more passing around them. I secure each group with 2-3 half hitches and burn the ends of the twine afterwards. I have no expert text-book method on this, I just found a way too do it and stuck to the method. After 16 years of use on Malena’s sail, not one stitch has needed repair yet.

Sail corners:
There are no separate hoops for the sail corners, unlike in the webbing method. Just let the boltrope follow the corner and make the last stitch group about 5cm from it on each side (Fig 5.2b). When you later tie these corners to the yard and boom and go sailing, the forces will be transferred directly to the bolt ropes; no need for strengthening patches at all.

Batten hoops:
Each time you approach a batten position, you have to stop and fit the batten hoop. The hoops are made of the same rope type as the bolt rope and are spliced into the bolt rope before continuing the roping job. I suggest that the closest stitch groups are placed 2-3cm on each side of the batten. Just as with the webbing method the dummy batten is useful in getting the right position of the batten hoops.

Loops:
The sail will be laced to the yard and boom directly via the bolt rope at about 30cm intervals. There is no need for webbing loops here. On Malena’s 32sqm sail I didn’t use webbing loops at the batten positions either; just laced the batten to the boltrope. It works, but on bigger sails I still would fit those small webbing loops to spread the load a bit more.

Before declaring the roping job for finished, go over all these stitch groups and burn the ends. Then, finally...

Congratulations, you have made a sail!
Fig 5.1

**JOINING CANVAS PANELS**

**Step 1:** Make a 25-30 mm wide fold along the edge of one panel and insert the edge of the next panel. Make the first center seam.

**Step 2:** Flip panel B over and make the 2nd. seam along the edge of the fold, (panel B rolled up to pass "inside" the sewing machine).

**Step 3:** Turn the whole lot upside down to let you see where to put the 3rd. seam.

Result: A strong joint without raw edges. Looks double-stitched on one side and triple on the other.
Fig. 5.2

**Fig 5.2a)**

DOUBLE OR TRIPLE SEAM THE HEMS WITH AN INNER BOLTPROPE IN PLACE. USE A CHEAP KIP LINE OR SOMETHING.

**Fig 5.2b)**

HAND STITCH OUTER BOLTPROPE TO INNER BOLTPROPE WITH 3-4 STITCHES AT 10-15 CM INTERVALS.

FINISHED

CLEW OF SAIL

TIE THE OUTER BOLTPROPE TO ROOM AT 30-50 CM INTERVALS
Fig 5.3

**Webbing Type Boltrope**

- **Clew Before Fitting a Hoop at the Corner**

- **Cut Through Webbing Type Boltrope**
Fig 5.4  

Fig. 5.4  FITTING TELL TALES AT THE LEACH OF EACH BATTEN PANEL

BURN RAW EDGE
TECTALE FROM 20MM LIGHT RIBBON

(I STRESS THE FITTING OF TELL TALES BECAUSE THEY ARE SUCH A GOOD HELP IN TRIMMING YOUR SAIL)
Fig 5.5

**CAMBERED JUNKSAIL, JOINING BATTEN PANELS AND MAKING B. POCKETS**

- **AMATEUR METHOD A:**
  - FAST AND GOOD ENOUGH.
  - NOT PRETTY; LEAVES A RAW EDGE.

- **AMATEUR METHOD B:**
  - SLOWER BUT BETTER LOOKING.
  - FIRST JOIN THE PANELS AS IN A
  - THEN ADD THE B. POCKET FROM SEPARATE STRIPS OF CANVAS.

- **THE SAILMAKER'S WAY.**

**30.9.2006**

Anne Kromeland
Fig. 5.6

The BASELINE and LUFFLINE METHOD makes it easy to mark up the 4 corners of the panel with good accuracy:

1. Knowing the CHORD and RISE, POINT A (HOLE: CLEW) can be found after the CHORD D-E has been measured up. Either use a LARGE CHALKWOOD? RIGHT ANGLE or 2 TAPES to find POINT A.

2. With that right angle it is natural to progress to POINT B in one go.
Fig 5.7  

**Making a Plywood Rounding Template**

- **Max Camber Point**
- **Bend Spline**
- **Plywood Template**
- **B = 5.82 (here)**

Art 30-40%, should be straight.
Fig 5.8

**JOINING TWO CAMBERED PANELS**

**Fig 1**

Panel N

**ROUNDING AT EDGE**

Panel N+1

**ROUNDING AT EDGE**

**Fig 2**

**EASY PANEL JOINING BY CHEATING...**

**STAPLE HERE FOR SIMPLE SEALING**

Panel N wrapped down on top of Panel N+1

---

As long as the two panels have the same or almost the same rounding at the edges that are to be joined, the amateur method of joining panels is dead easy, even with Terylene canvas.

Note: The sketches above show how to do it with the battens on the port side of the sail - i.e. with the sail riding on the starboard side of the mast. Think twice, sew once!

2.1.2007

Anne K.
Appendix 2 to Chapter 5:
Johanna’s sail plan

Sheet 1
Sheet 2

SEIL PLAN: 48 m² DJONKERSTIG FOR ALO 28.

\[ R_1 \cdot E_2 \cdot B = 5.80 \text{ m} \]
\[ l_1 = 1.20 \text{ m} \]
\[ l_2 = 1.90 \text{ m} \]
\[ l_3 = l_4 = 2.40 \text{ m} \]
\[ l_5 = 0.10 \text{ m} \]
\[ l_6 = 0.55 \text{ m} \]
\[ \text{RISE} = 1.01 \text{ m} \]
\[ \text{AR, E} = 5.71 \text{ m} \]
\[ \text{PAW 1} = 7.00 \text{ m}^2 \]
\[ \text{PAW 2} = 7.06 \text{ m}^2 \]
\[ \text{PAW 3} = 6.92 \text{ m}^2 \]
\[ \text{PAW 4} = 27.41 \text{ m}^2 \]
\[ \text{TOTAL} = 48.94 \text{ m}^2 \]
\[ \text{OMKRETS} = 28.65 \text{ m} \]
\[ \text{AR} = 1.27 \]

\[ \text{GROUNLINE} = 5.71 \text{ mm} \]

\[ \text{ARK 2, SKALA 1:50} \]
9.5.2001
Anne Krommelund