Kites for Connoisseurs

Sverker

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WINDMAN BIEGOLMAI

Kites for Connoisseurs **is a collection of plans for kites designed by Andreas Ågren. These designs often have a unique technical twist. The plans can be found at** ***http://windman.se/kite-plans*** **and they must not be used for commercial purpose without written consent.**

Introduction to *Sverker* (1996, 2001, 2017)
As '*Sala Drak & Tangosällskap*' (famous group from central Sweden) were going westwards (Washington - Monmouth - Dieppe) in 1996 they decided to make a new Viking invasion, this time from the sky. Andreas had the idea of the 'Bowtie' sail and someone else in the group had the idea of the semi-3D bow. *Karin* and *Per Byström* made the first three ships from flower support bamboo sticks and table cloth from some of the group's many parties, and called them *Svea*, *Göta* and *Vendel*. Andreas built his kite a little bit different and called it *Sverker* and has since then updated it in years 2001, 2005 & 2016. It is the Byström version that is included in Ron Moulton's book *Kites* (1997, pp 220-221). *Sverker* in an old Viking name, and also the name of Andreas' father and his own middle name.

Traditionally viking ships have been depicted with striped sails, or, like on some 900 AD picture stones in Gotland, with checkered sails. The plan for this kite use a striped sail. The colours of the striped sail are as you like, one lighter and one darker looks best. Here it is assumed that red and white is used.

In the design of the viking longship kite there are two tricks hidden:

- The bowtie sail: The material for the sail is cut with a shape like a bowtie, and when put onto the yards (which are straight), catching wind, this will create a hidden dihedral.
- The semi-3D bow which works as a built in windsock.

The kite can be built in two sizes: 2.50 m wide or 1.65 m wide. All measurements are given for the larger kite in cm. with the measurements for the smaller kite within parenthesis.

Materials

Big ship

Frame:

- 10 mm carbon tube -
  - 5 pcs 125 cm
  - 1 pcs 110 cm
- 3 mm carbon rod
  - 2 pcs 110 cm (bow edges)
  - 1 pcs 81 cm (bow sprit top)
- 3 mm fiberglass - 1 pcs 85 cm (bow sprit)
- 5 pcs 10 mm split end caps (sail spar ends and mast top)
- 1 pcs 3 mm nocks (on top of bow sprit)
- 1 pcs 10 mm ferrule (for mast)
- 2 pcs 3 mm ferrule (one for bow centre stick, one for mast bottom connector)
- 2 pcs 10 mm cross connectors (on the mast)
- Plastic tube with inner diameter 5 mm for the bow edge connector
- 4 pcs 3 mm endcaps (to insert in the above plastic tube
- Reinforced braided plastic tube with inner diameter 10 mm for the mast bottom connector

Sail and bow

- 1.4 m red rip stop of 150 cm width
- 1.2 m white rip stop of 150 cm width
- 1.5 m brown rip stop of 150 cm width (or 2 m of 104 cm width)
- Dacron, 20 x 4 cm

Small ship (2/3 of big ship)

Frame:

- 8 mm carbon tube
  - 5 pcs 82.5 cm
  - 1 pcs 72 cm (buy 3 pcs 165 cm and cut)
- 3 mm carbon rod -
  - 2 pcs 73 cm (bow edges)
  - 1 pcs 54 cm (bow sprit top)
- 3 mm fibrerglass - 1 pcs 57 cm (bow sprit)
- 5 pcs 8 mm split end caps (sail spar ends and mast top)
- 1 pcs 8 mm ferrrule (for mast)
- 2 pcs 3 mm ferrule (one for bow centre stick, one for mast bottom connector)
- 2 pcs 8 mm cross connectors (on the mast)
- Plastic tube with inner diameter 5 mm for the bow edge connector
- 4 pcs 3 mm endcaps (to insert in the above plastic tube
- Reinforced plastic tube with inner diameter 10 mm for the mast bottom connector

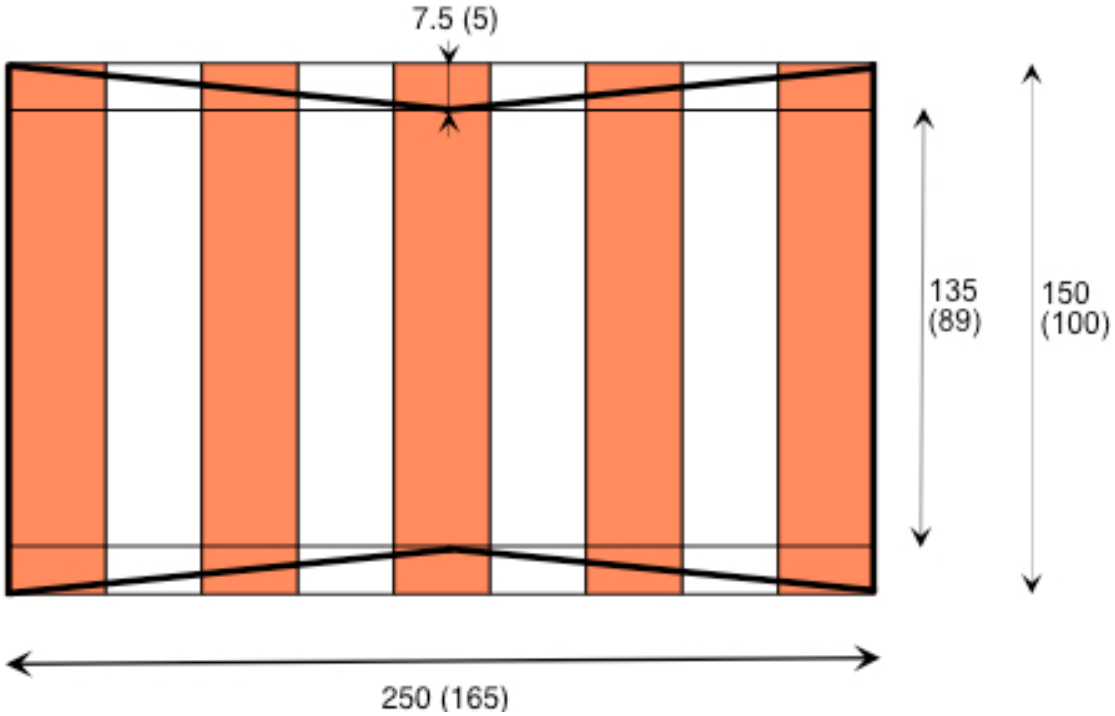
Sail and bow

- 1.0 m red rip stop of 104 cm width
- 0.8 m white rip stop of 104 cm width
- 1.5 m brown rip stop of 104 cm width
- Dacron, 20 x 4 cm

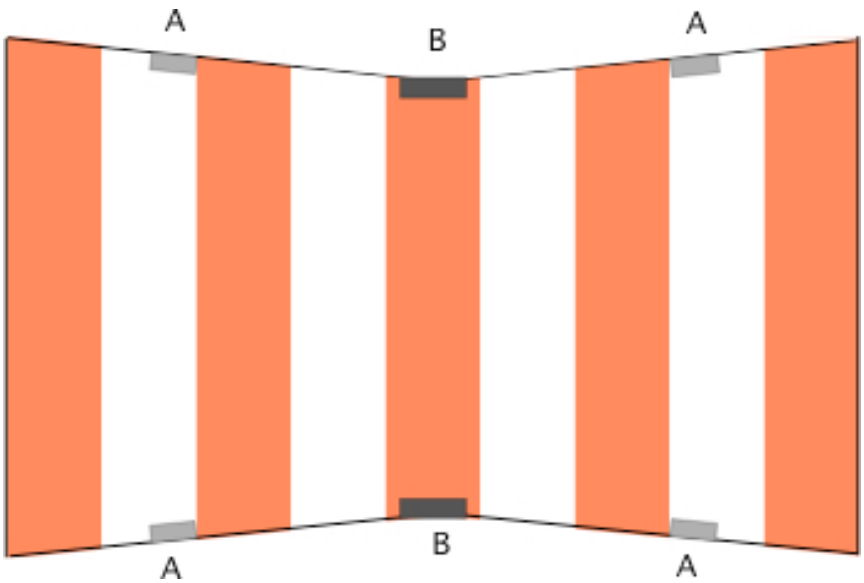
How to make Sverker - The Longship Kite

Sail

1. Cut 9 pieces of 28.5 (19) cm width of rip stop from the 150 cm (104 cm) wide material: 5 pieces of red and 4 pieces of white. This width includes 10 mm sewinf alloance on each side.
2. Sew the 9 pieces together to the striped sail. One way to do this is to first sew four red/white pairs and then join all the pairs plus the remaining red.
3. Hem the sides of the sail (not the top and bottom).
4. Create the bowtie shape: At the centre of the sail, make one mark 7.5 (5.0) cm from the top. From this mark cut to the top corners. Do the same at the bottom of the sail.

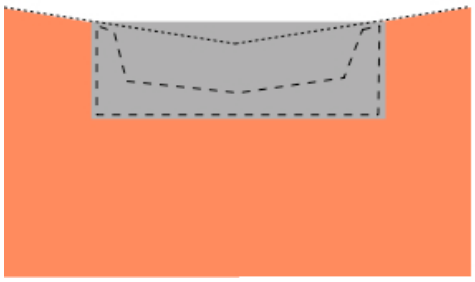


5. Reinforce the bridling points:
   A. For the side bridling points just use a piece of rip stop of the same colour (white). The size should be 12 x 4 cm for both the large kite and the small kite. Sew it on to the sail with long edge aligned with top edge of sail, 70 cm from the centre (just as the new stripe starts).
   B. For the centre bridle point where also the cross coneector is, the reinforcement should be of dacron, size 20 x 4 cm. Sew it on to the sail with the corners of the long edge aligned with top edge of sail.
6. Cut out openings for the centre cross connectors in top and bottom.

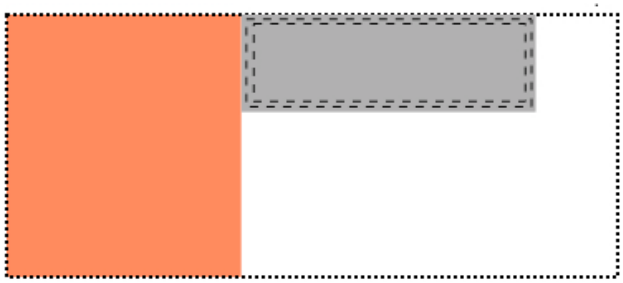


7. Sew the reinforcements; in the centre with a seam that will allow the cut-out in next step, and on the sides with double seams, the inner 5 mm inside the outer.

A The top corners of the reinforcement in the centre are on the edge of the sail. Single seam around the reinforcement and the cut out that will be done on next step.

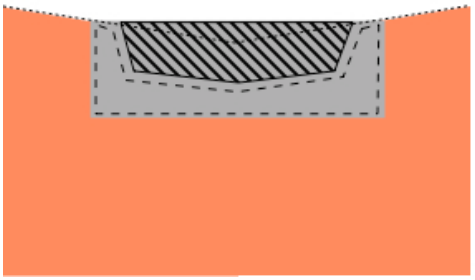


B Reinforcement aligned with edge. Double seams around the reinforcement

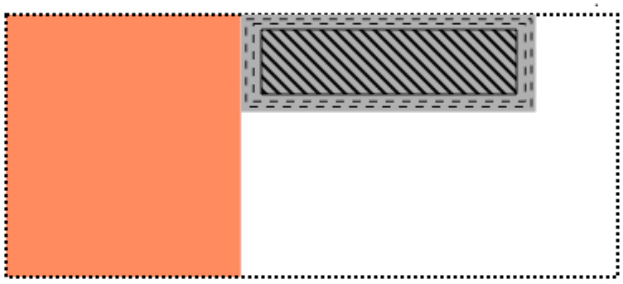


8. Cut out (slanted stripes in below figure) for connectors and bridle in the reinforcements.

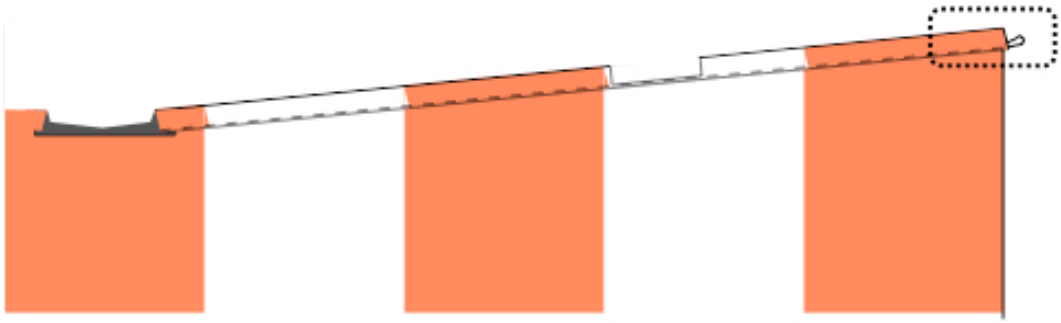
C Cut out for centre cross connector, just inside the seam.

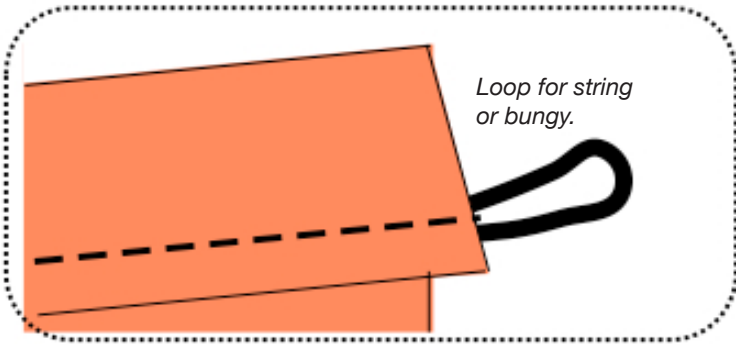


D Cut out for side bridles and bow connectors, just inside the seam.



9. Make pockets for the cross spars on the top and bottom edges by folding the slanting sides 2 cm and sewing. At the edges insert a loop for the bungy or string to the cross spar nocks. See detail.





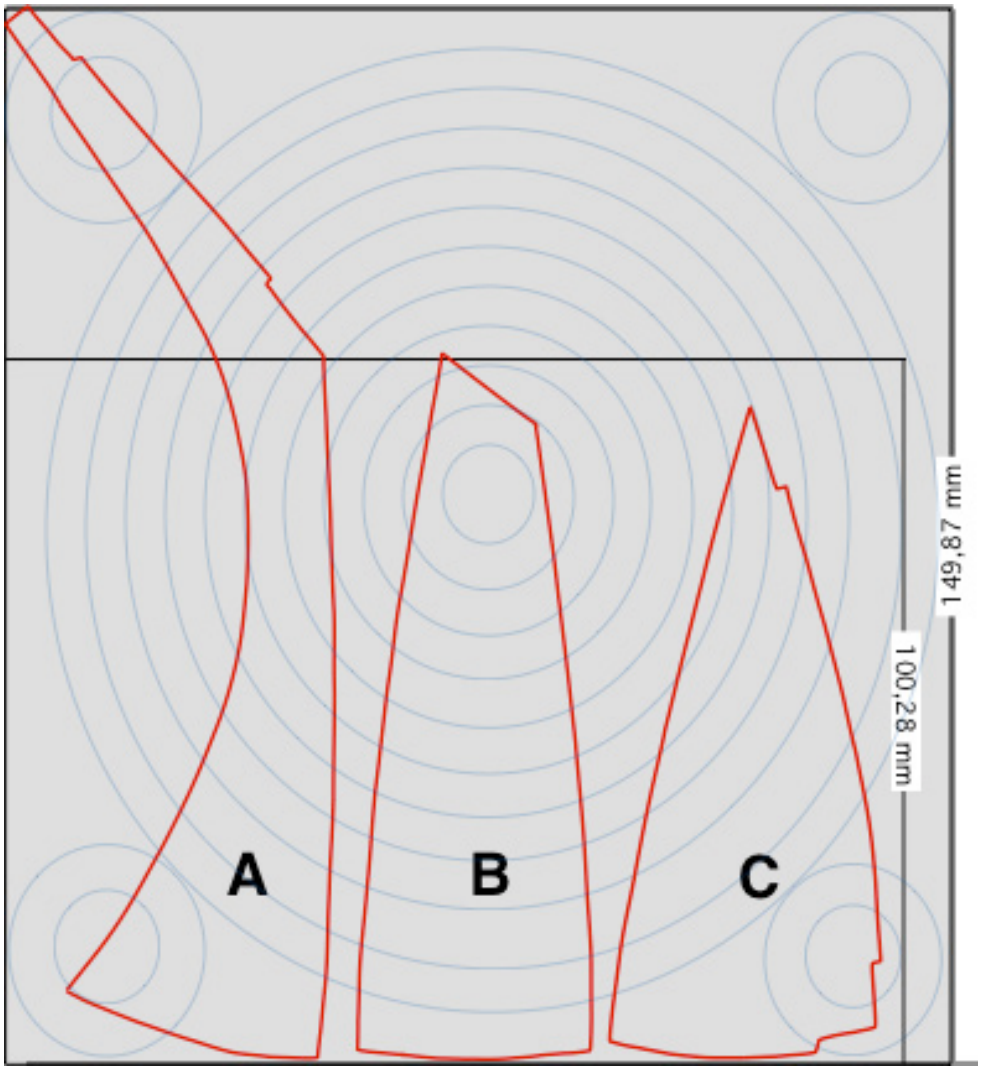
The bow

The bow consists of 3 + 3 parts of ripstop with curved edges to form a bowl. Make first the right side, then the left side and finally join them. The shape of the parts in the bow are not that very sensitive, but since all lines are curved and thus not so easy to copy and enlarge by hand, two separate JPEGs will full scale templates are available for download:

- Bow templates scaled large 150 cm.jpeg
- Bow templates scaled large 100 cm.jpeg

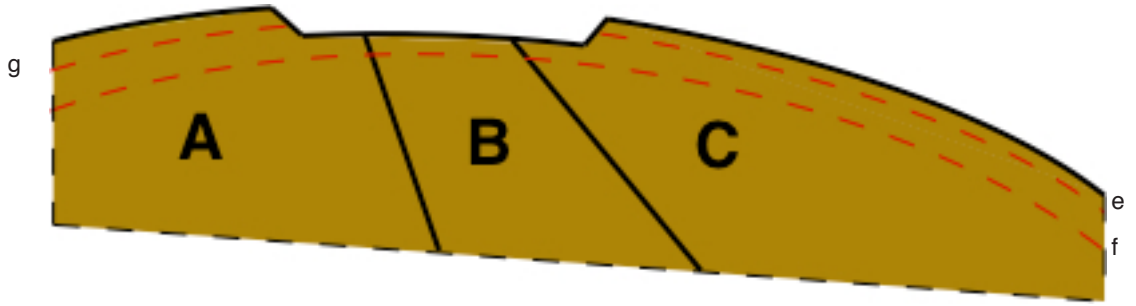
The templates can be printed out using a plotter, or by using software that splits a large picture onto several sheets. In that case, since the pages are not numbered, to facilitate keeping order of the pages, concentric circles are included in the pictures. These circles should make the matching of sheets more easy. How the assemble pages printed out in by normal printer is descibed below.

10. The first step is thus to print out all pages of required templates and cut and paste the full square together.
    a. If starting from top left corner: Leave first sheet intact, but cut the left margin on the second sheet. Apply some stick glue on the right margin of the first sheet and paste the second sheet. Continue like this till the end of the top row (6 or 5 sheets), making sure that all circles match.
    b. For first sheet of second row cut top margin and apply glue on the bottom of the very first sheet and paste. For second and following sheets in the row cut top and left margins, apply glue on the bottom margin of the sheet in the first row and also on the right margin of the sheet in the same row. Paste the new sheet and make sure all circles match.
    c. Repeat for the rest of the rows until all sheets are pasted.
    d. Cut out the template parts A, B and C.
    For a less vulnerable templates, paste the template pieces on card board or similar before cutting out.

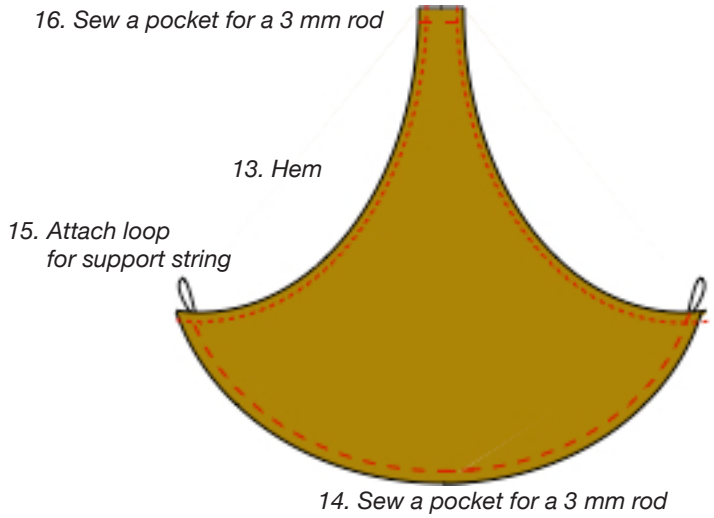


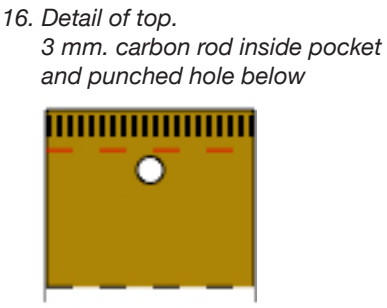
11. Cut out the six pieces (left + right side) of brown ripstop according to the templates. Note that the templates include hems and pockets.
12. Make first the right side, then the left side and finally join them:
    a. Sew together piece A and B of the right side, the seam 10 mm inside the edge. The edges curve the same, so it should be easy to keep the edges aligned.
    b. Sew together piece A/B and C of the right side in the same way.
    c. Do the same for the left side pieces.
    d. The bow will have a 3 mm fibre glass rod in the centre, so a pocket for this must be prepared. This pocket will be sewn only at pieces A and C. Three seams are required, and it really doesn't matter in which order they are sewn, but here is a suggestion: Start from the bottom of pieces C:
    e. Align the two centre sides of C carefully and sew them together with the seam 5 mm from the edge. This is the outer seam of the pocket for part C.
    f. Restart from the bottom of pieces C and sew a seam 5 - 10 mm inside the first seam. Continue with this seam through pieces B (where there is no pocket so here the seam runs 5 mm from the edge). Continue with this seam through pieces A on the same distance from the edge as at pieces C.
    g. Complete the pocket on pieces A by sewing a seam 5 - 10 mm outside the last seam.

Joining the two halves of the bow and creating the pocket for the bow sprit. There is no pocket for part B of the bow, because here there will be a ferrule joining the bottom 3 mm fibre glass rod with the top 3 mm carbon rod.



13. Hem the curved edge of pieces A.
14. Sew the pocket around the bottom of the bow (ABC-CBA).
15. Sew loops of string (shoe string) or ribbon at each end of this pocket (for the supporting strings) in the same way as on point 8 when making the sail).
16. At the top of the bow create a pocket for a short piece of 3 mm rod. Insert a 6 cm piece of 3 mm carbon rod and burn/punch a hole just beneath the rod. See detail.

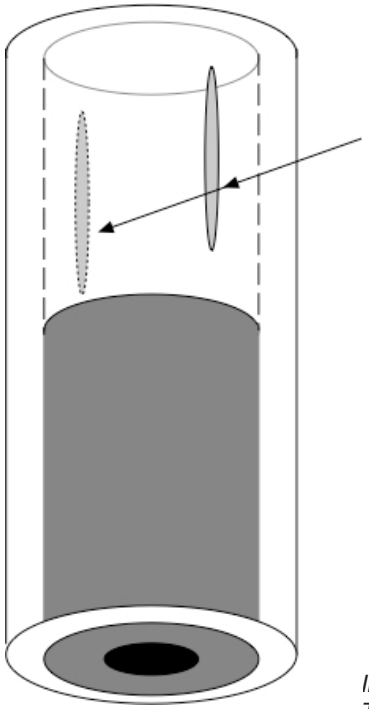




Connectors
Two special connectors are required. One to connect to the mast with the three bow spars, another to connect the bow spar with the lower cross spar. The connectors can be made of plastic tube.

Bottom cross spar connector
The bow connector is made of one piece of good quality plastic tube which has an inner diameter of 5 mm and a length of 25 mm.

17. Cut two slits about 1 cm from the top end of 20 mm piece of tube to allow the connector to be slid onto the sail spar. In the other end insert fully a 3 mm end cap.



Make two slits in the upper part of the tube to allow the cross spar to be inserted.

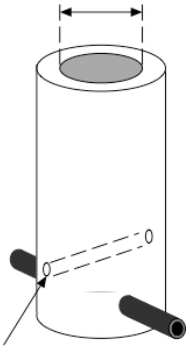
Insert a 3 mm endcap in the tube. This is seen from below.

Mast connector
The mast connector connects four pieces of carbon: The mast with the bow sprit and the two bow edges.

Use an 8 cm piece of reinforced braided plastic tube with an inner diameter of 10 (8) mm.

18. Punch one hole with 4 mm diameter 10 mm from the end and insert a 3 mm ferrule in the first hole. The ferrule should have a 'divider' in the middle.
19. Punch a hole with 3 mm diameter in right angle from the previous hole, about 5 mm above that hole. Insert a 85 (57) cm long 3 mm fibre glass spar (the bow sprit) through the second hole and lock it in position by glueing stoppers on each side.

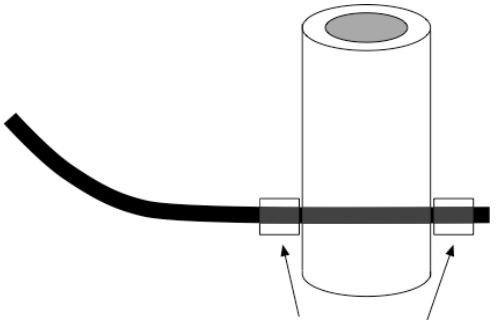
10 (8) mm.



19. A 3mm hole for the bow sprit, in right angle with the ferrule.

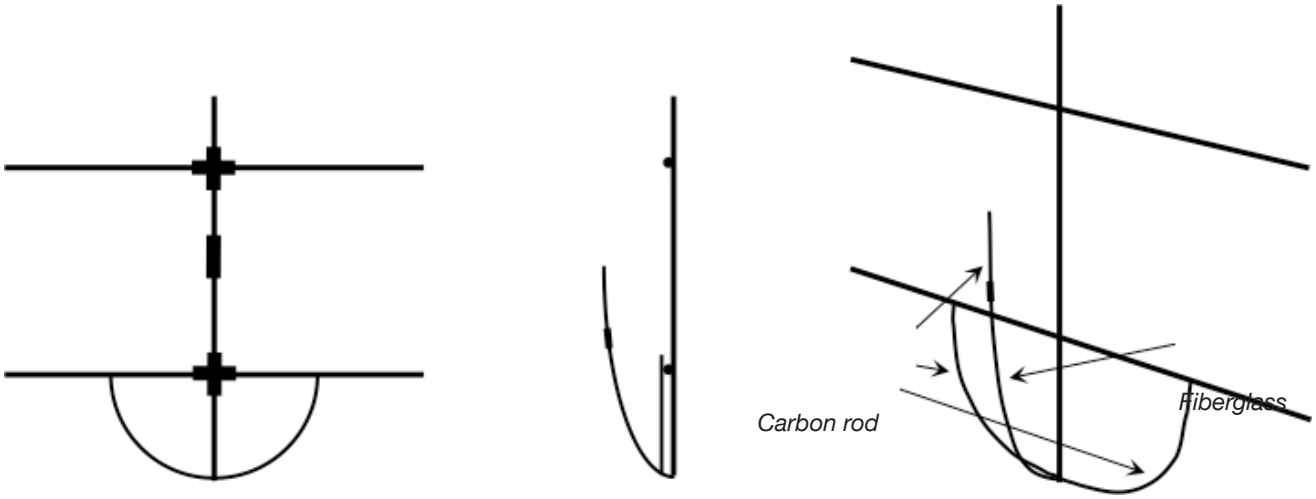
18. A 4 mm hole with a 3 mm ferrule for the bow edge inserted.

Side view without the ferrule



The bow sprit is later inserted through the punched 3 mm hole and locked in position by glueing a small piece of plastic tube on each side

The frame.
The frame consists of one spine and two cross spars, much like a Rokkau. Added on is the bow. The spine and cross spars are of 10 (8) mm carbon tube, while the bow frame is from 3 mm carbon rod, except the bottom part of the bow sprit which is of 3 mm fibre glass. The figure below shows the sticks, the cross connectors and the ferrules. The spine/mast is not quite the same length as the cross spars, so one of the tubes need to be cut. Normally it is best to keep the bottom part in full length and cut the upper part. This top part should be minimum 100 (66) cm, but to have some built in spare it is a good idea to leave it at 110 (73) cm (in case the spine should break).



Front view *Side view* *Perspective view*

The sail frame

20. Put split end nocks on the ends of the cross spars and the top of the mast.
21. Fix a ferrule to the bottom end of the mast top tube.
22. Slide the cross spars into the pockets of the sail. For the bottom spars make sure to slide on the bow connector at the cut-out in the sail.
23. Join each side with the cross connectors.
24. Insert the mast tubes in the cross connectors and join them with the ferrule.
25. Slide the bottom connector so the cross spar is 60 (40) cm from the bottom end. Lock the cross connector in this position (e.g. with a piece of plastic tube tightened with cable tie just above the connector.)
26. Slide the top connector up so the sail gets streched, and lock the cross connector in this position. (The locking plastic tube should be below the connector.)
27. Stretch the sail on the cross spars and tie a loop of bungy through the prepared loop in the sail. Put the bungy loop through the split end nock.

The bow frame

28. The central bow sprit consists of two parts: one figerglass rod and one carbon rod; both 3 mm. Fix a 3 mm split end nock to the 81cm/3 mm carbon rod and a 3 mm ferrule to the other end of the rod.
29. Slide the 85 (57) cm fiberglass rod through the centre pocket of the bow.
30. Slide the 81 (54) cm/3 mm carbon rod piece through the top pocket and join with the fiberglass rod.
31. Insert the bottom fiberglass end through the 3 mm hole in the bottom plastic connector and secure it on both sides according to the figure at step 19.
32. Put a string through the punched hole under the top of the bow and tie the string in a loop through the end nock. This should be tight but still easy removable.
33. Slide the 110 (72) cm/ 3 mm carbon rods through the bottom pockets of the bow.
34. Tie a 140 (90) cm string in the prepared loop at the end of the pocket on each side.
35. Slide the bow connector tube onto the mast and insert the side carbon rods in the ferrule.
36. Put the other end of the side rod into the connector at the cross spar (the 3 mm end cap) and sling the string (from point 33) around the cross spar.

All bow frame parts should stay in the bow when the kite is disassembled. The mast bottom connector should be removed from the mast and stay fixed to the central bow sprit. The top of the bow sprit may be disconnected at the ferrule to make the rolled up length of the bow shorter.

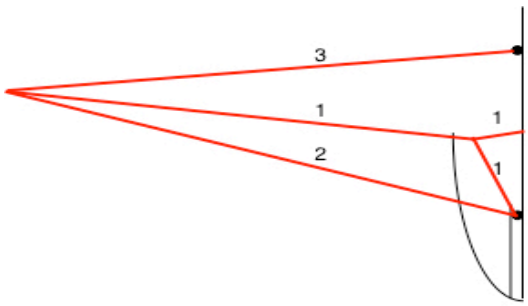
37. Pull the string so the bow gets streched around the edge, tie a loop at the free end of the string and put this loop around the bottom connector.
38. Do the same for the other side, and adjust the loops and string lengths so the both edges of the bow get equally streched: the centre of the bow material should be aligned with the mast.

Bridling

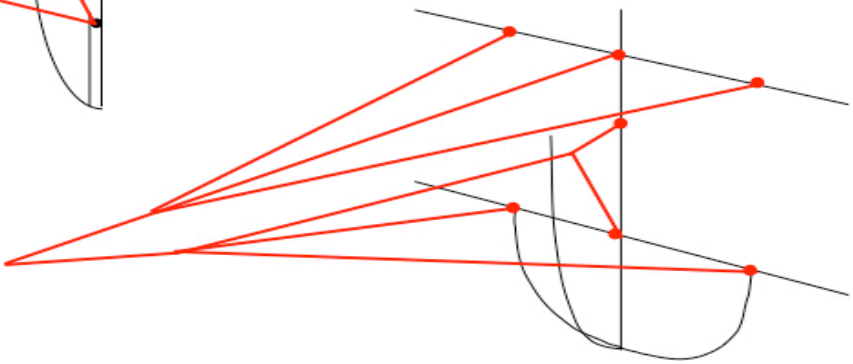
The bridle is a six-point bridle; 3 + 3, where the centre bottom bridle (no 1 in the picture) is not connected diectly to the bottom spar, but to a “local two-point bridle”. In this way the bridle string gives support to the top of the bow. (Here, at the top of the bow, a fierce dragon head should be put.).

The outer bridling points are 72 (48) cm from the centre.

The bridle should be about 6 (4) m long. For a three-point bridle, normally it is easiest to cut a 12 m piece of string, attach each end to the outer bridling points, marking the middle and then attach a 6 m string from the centre bridling point to this middle. The centre bridle string for the lower spar can’t be fixed until the dragon head is in place, see below.



Bridling, side view



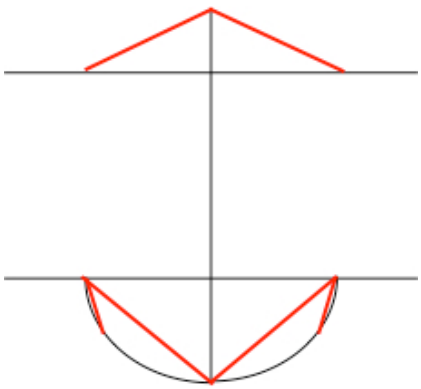
Bridling, perspective view

Support strings

The upper cross spar needs support strings, from the same point as the bridles to the top of the mast.

The figure also shows the stretching strings for the bow.

Frame supporting strings



String tied to the loop in the bow section C is tossed over the bottom sail spar (at the bow connector) and fixed at the mast connector.

The fierce dragon head
A viking ship is not complete without a dragon head on the bow sprit. The vikings used to put the dragon head there before they started an attack on a coastal village, just to scare the villagers.

The head itself can be carved out of plastic foam (styro foam should be avoided because it is too brittle) and then painted.

To make the head removable an 8 mm ferrule is required. This ferrule has to be prepared with two strings: one for the bridle and one securing string to lock the head to the bow.

39. Tie a 80 cm (the lenght needs to be adjusted later) bridle string around the middle of the ferrule. The best knot to use for this is the constrictor knot.
40. Tie a 60 cm string (use a string that securely can be tied a knot on) just next to the bridle string. Also for this string use a constrictor knot.
41. Fix the knots on the ferrule by applying a thin layer of glue.
42. Create a vertical hole (grey in picture) through the dragon head, wide enough for the ferrule.
43. Create a horisontal hole (white in picture) through the throat of the dragon.
44. Now comes the tricky part: to insert the ferrule in the vertical hole and get the bridle string out through the back of the head and through the mouth. One way to do this is to use two pieces of thin wire:
    a. Bend the wire double to a long loop.
    b. Curve the tip of the loop end so it can find it's way from the horizontal hole down the vertical hole.
    c. Insert the loop end of the wire into the horisontal hole from the back of the head and manoevre the wire so it comes out through the bottom of the vertical hole. (Sometimes a crochet hook can give extra help)
    d. Do the same with the other wire but through the horisontal hole in the throat.
    e. With both wire loops coming out of the bottom hole, insert fully one bridle line in each.
    f. Insert carefully the ferrule in the bottom hole with the knot for the shorter string on top. At the same time pull gently the wires on both sides while pushing the ferrule in.
    g. When the ferrule is fully inserted and in position half way through the head, continue to pull the wire loops gently and eventually the bridle strings will come out.
    h. Tie an alu ring (or tie a loop on the string) about 10 cm outside the head.
    i. Tie a hook (lock snap) on the bridle at the backside of the head, some 5 cm from the head.

To attach the dragon head to the bow, just slide down the ferrule over the bow sprit, pull one end of the securing string through the hole in the top of the bow and tie a knot.

Attach bridle string no 1 to the alu ring of the head and the cross-lock snap to the alu ring of the "local two-point bridle".