

East Arctic Kayak:

Building a Reproduction



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Preface

The following detailed, illustrated instructions will allow the amateur boat builder to construct an historic replica of an East Arctic kayak.

Traditionally, Arctic kayaks were built of driftwood or other salvaged wood and covered with animal hide, usually sealskin. This replica uses a choice of lumber yard wood, ripped and worked with modern tools and covered with canvas. Tradition is honored in the form and construction and the time-honored use of lashings to tie the frame together. There is not a single nail or screw used.

The result is a sturdy, yet sleek, comfortable touring kayak which is a joy to paddle.



Figure 1. Great Whale River pre 1921, photo by R.C. Harrison, courtesy Public Archives

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Map 2. Baffin Island, Hudson Strait, east coast Hudson Bay and Labrador.

Introduction

The East Arctic kayak is flat-bottomed with flared sides, generous beam and length and a flat deck. Traditionally, it was heavily built, with plank gunwales, and crude examples look boxy. Its primary use was for sea mammal hunting, particularly seals. It was also used for fishing and for general transport in moving from camp to camp.

Although this kayak had no spray skirt, and had no capability for rolling, it was used in rough waters and for some distances. For example the distance between the east coast of Hudson Bay and the Belcher Islands is over 60 miles. Two or more kayaks could catamaran together to avoid capsizing in rough weather or for sleeping at sea. This type of kayak was used extensively along the east coast of Hudson Bay, from Ivuyivik south to Povungnituk and over to the Belcher Islands, both sides of Hudson Strait, the east coast of Baffin Island, and the coast of Labrador. The long, flat decks were ideal for carrying sea mammal carcasses. Parts could be stuffed inside.

This kayak, in a lighter, recreational version, is a pleasure to use – extremely stable, roomy, fast, and easy to paddle. It tracks beautifully, and can carry a high volume of goods, either stuffed inside, or on deck. If you have seen the classic documentary film, *Nanook of the North*, filmed by Robert

Flaherty in 1919/20, you will remember the amusing scene where Nanook paddles ashore, and out of the kayak pulls his wife children and several dogs. Nanook is paddling this type of East Arctic kayak, but the extraordinary cargo is, of course, faked, one scene being shot at a time and then compiled.

I did paddle my first East Arctic reproduction with several pre-teen children lying on the deck, fore and aft, with no problem and not too many complaints from the passengers. That kayak lasted through 14 years, two canvas covers, and many miles of paddling. When my wife and I sailed our cruising boat, ERASMUS, to Cape Dorset on Baffin Island, on the first leg of a world voyage, I couldn't part with it. Strapped to a side deck, the kayak became a second tender, and proved invaluable. Suitably, it's skeleton remains in Cape Dorset.

That reproduction was made while I was Arctic Ethnologist at the National Museum of Man in Ottawa, now the Canadian Museum of Civilization (CMC). My first attempt, a Caribou Eskimo type, proved disastrous. To try to alter dimensions on that tippy style (initial stability unstable) was not wise. I looked eastward. The Museum storage provided some two dozen examples of the East Arctic kayak.

In addition, my predecessor, Eugene Arima, had done extensive studies of this type as part of his fieldwork in Arctic Quebec, and had built several reproductions. He wrote two unpublished manuscripts, "How to Build Kayaks of the Canadian Arctic", (1975, No. 1005.23, pp. 100, and "How to Build an Eskimo Kayak", (1973, No. 1005.20, pp. 79), available in the archives of the Canadian Ethnology Service, Canadian Museum of Civilization, Ottawa). In building my reproduction, I used a combination of Arima's measurements and my own modifications, with construction details coming from Arima's 1973 manuscript and my own studies of examples in the collection of the CMC. This reproduction is a hybrid, of the various East Arctic examples.

The result was to remain my favorite of a fleet of varied Arctic kayak types built subsequently. I constructed that first East Arctic kayak in 1973. In the fall of 1999, I began another, the one documented in the accompanying photos. An enthusiastic neighbour, Bob Taylor, built one following the text and photos, allowing me to clarify many points. My helpful wife, Helga, has done extensive editing.

Kayak Parts

Gunwales (*apummaq*): 3 – 16' x 1" x 6" (16' x $\frac{3}{4}$ " x $5\frac{1}{2}$ ").

Deck beams (*ayaaq*): 24' – $\frac{3}{4}$ " thick x $1\frac{1}{2}$ " wide (Variable x $\frac{3}{4}$ " x $1\frac{1}{2}$ ").

Masik (forward cockpit deck beam): 6' long x 1" thick x 3" wide (6' long x $\frac{3}{4}$ " thick x $2\frac{1}{2}$ " wide).

Temporary *masik*: (26" top x 22" bottom x 5" high x $\frac{3}{4}$ " thick).

Masirusigiik: 2 deck beams in front of *masik* – 5' x 2" thick x 6" wide (5' long [for both] x $1\frac{3}{4}$ " thick x $5\frac{1}{2}$ " wide).

Itivik (aft cockpit deck beam): 28" long x 1" thick x 3" wide (27" + $\frac{3}{4}$ " x $\frac{3}{4}$ " thick x $2\frac{1}{2}$ " wide)

Temporary *itivik*: (5" wide x $26\frac{1}{2}$ " top x 23" bottom x $\frac{3}{4}$ " thick).

Bilge stringers (*sianiq*): 1" thick x 3" wide ($\frac{3}{4}$ " thick x $1\frac{3}{4}$ " wide).

Side stringers (*qiyuaqyutaq*): 2 – (11' long x $1\frac{1}{4}$ " wide x $\frac{1}{2}$ " thick).

Keelson (*kuyak*): 1" thick x 2" wide (16' x $1\frac{1}{2}$ " x $\frac{3}{4}$ ") + (8' x $1\frac{1}{2}$ " x $\frac{3}{4}$ ").

Forward deck stringer (*tuniqyuk*): 11' x 1" thick x 2" wide ($\frac{3}{4}$ " thick x $1\frac{1}{2}$ " wide) – where the *tuniqyuk* bends, it should be planed to $\frac{1}{2}$ " thick to the *masik*.

Aft deck stringer (*tuniqyuk*): 8' x 1" thick x 2" wide ($\frac{3}{4}$ " thick x $1\frac{1}{2}$ " wide).

Rib (*tikpik*): Various x 1" wide x $\frac{1}{2}$ " thick – Middle Rib: 17" center x $6\frac{1}{2}$ " x $6\frac{1}{2}$ "

Cockpit coaming (*paa*): 5' long x 1" thick x 3" high (5' long x $\frac{3}{4}$ " thick x 3" high).

Cover (*amiq*) or (*tupiksaq* - tent material): 23' long x 60" wide.

Double-bladed paddle (*pautik*): 12' long x 2" thick x 4" wide.

Floor boards (*ingusiaq*): 4 floorboards or wooden slats.

Foot brace: 2" wide by $\frac{3}{4}$ " thick (44" before *itivik* for about 5' 8" person)

Bill of Materials

1. 3 – 16' x 1" x 6" select pine (no knots or small knots that can be avoided)
2. various 16' x 1" x 6" red cedar (no knots)
3. 6' x 2" x 6" pine or cedar
4. black nylon tarred seine twine #30 – Industrial Marine Marketing, 10 High St., Building 12, Wakefield, RI 02879 USA - \$5.95 US
5. 23' x 60" #10 canvas - \$140.00 Can.
6. 4 - 1/4" x 4' hardwood dowels - \$ 3.16 Can.
7. 2 – 1/8" x 4' hardwood dowels - \$ 1.20 Can.
8. clear buyrate dope – Poly-Fiber, BOX 3129, Riverside, CA 92519, <http://www.polyfiber.com>. Provides a tautening dope that slowly draw-tightens natural fabrics. For use only on Grade A cotton or Irish Linen. Thin 1 to 1 with butyrate reducer.

Tools

1. circular saw – finish krome edge
2. planes – jack, smoothing and block
3. nailset (fine)
4. chisels (3/4")
5. sandpaper, various grits
6. drill bits of 1/8", 1/4" 1/2"
7. 3/8" battery operated drill
8. drawknife
9. rounded spokeshave
10. 25' measuring tape
11. combination square
12. hammer, plastic and regular
13. carpenter's wooden mallet
14. marking gauge
15. belt sander
16. sliding bevel
17. taut line hitch, bowline, half hitches
18. small "U" tool gouge (3/32")
19. sailmakers needles
20. beeswax
21. chalk line
22. LePage Outdoor Wood Glue (or some waterproof type)
23. steam pipe: 6' - 3" ABS pipe; 1 – 3" x 3" x 1 1/2" tee; 2 – 3" couplings; 2 – 3" cleanout plugs (\$24.83 Can.)
24. steamer: 1 – electric kettle and aluminum spout (Lee Valley - \$42.95 Can.)
25. steam chest: 6' - 3" ABS pipe; 1 – 3" x 3" x 1 1/2" tee; 2 – 3" couplings; 2 – cleanout plugs (hardware store - \$24.83 Can.).

Gunwales

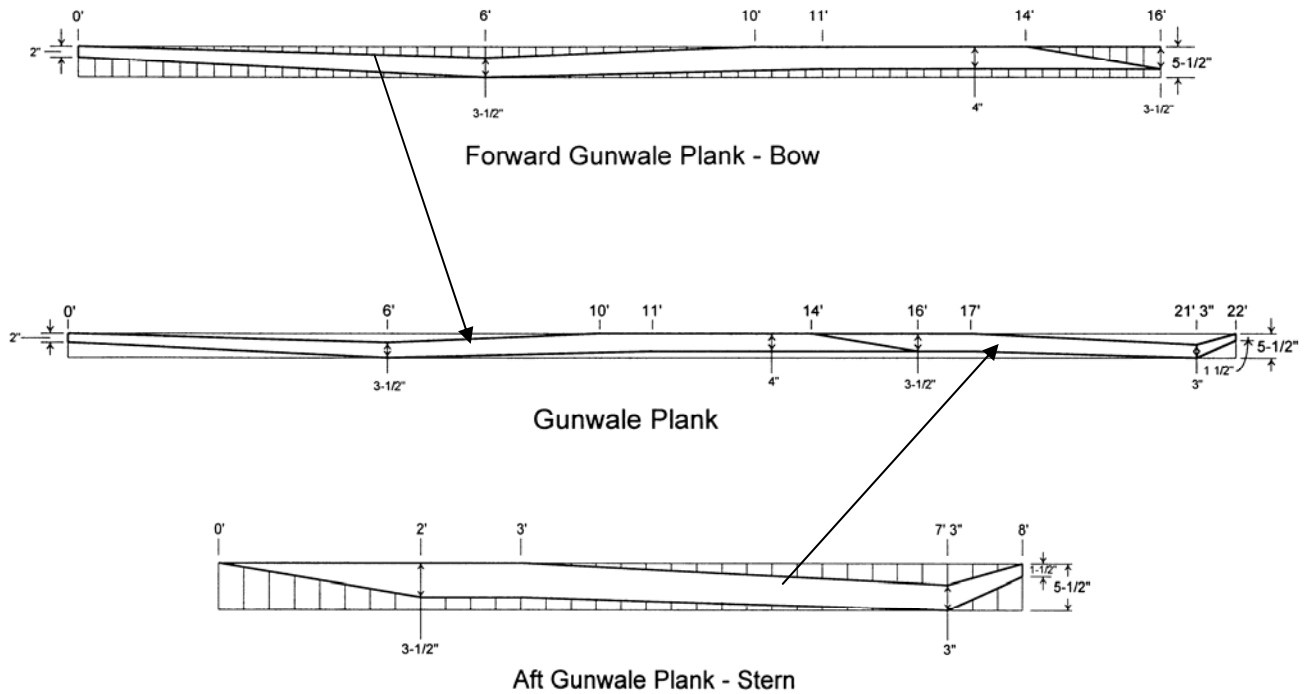


Figure 3. Measuring gunwale plank.

1. Draw the forward gunwale shape (16' x $\frac{3}{4}$ " x 5 $\frac{1}{2}$ ") on the 16' x 1" x 6" board.



Figure 4. Gunwale with drawknife cutting away scarf joint.

1. Take another 16' x 1" x 6" board and clamp it to the first.
2. Cut out the both gunwales as a unit, using the circular saw, the drawknife the planes and the spokeshave (see below).
3. Do the same for the stern gunwales (8' x 1" x 6" board).



Figure 2. Sawing the stern handhold.

1. Make stern handhold by first sawing a vertical cut at the deepest point.



Figure 5. Using drawknife to shape stern handhold.

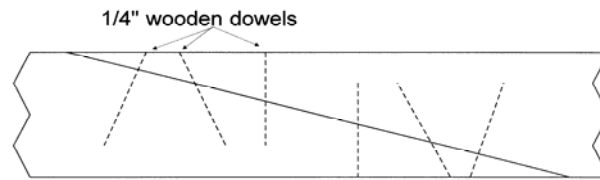
1. Next use the drawknife to remove the excess wood on both sides of the cut.



Figure 6. Using spokeshave to shape stern handhold.

1. Use rounded spokeshave for the concave portion.

Scarf Joint



Scarf Joint in Gunwale



Figure 7. Setting up the gunwale scarf joint.

1. Prepare scarf joint by joining the two gunwale halves with outdoor glue.
2. Use cabinetmaker's clamps to draw the wood together.
3. Two sets of quick clamps help keep the gunwale horizontal.
4. Let dry thoroughly.



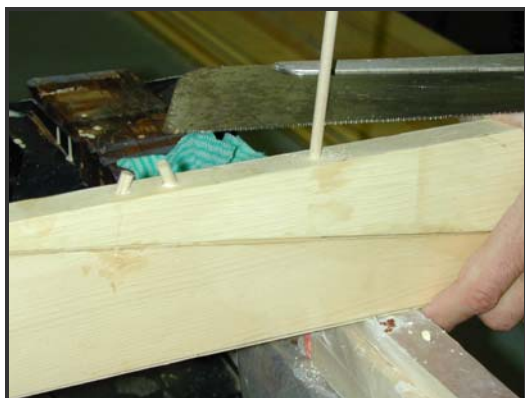
Figure 8. Drilling for wooden pegs in gunwale scarf joint.

1. Drill a 1/4" hole at an angle through the dry scarf joint.
2. Drill another hole at the opposite angle.
3. Drill a third hole at a straight angle.



Figure 9. Driving in a wooden peg in gunwale scarf joint.

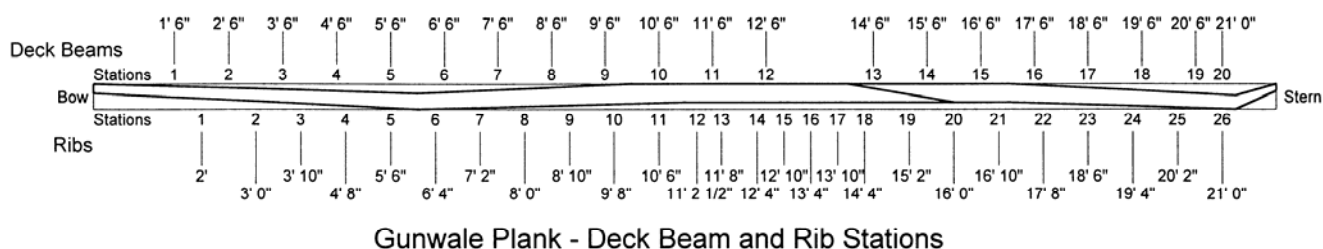
1. Drive home 1/4" wooden dowels, dipped in outdoor glue.



1. Cut the wooden pegs off flush with the gunwale.
2. Now turn the gunwale over and drill and peg the other side.
3. Do the same with the other gunwale.

Figure 10. Sawing off pegs in wooden peg in gunwale scarf joint.

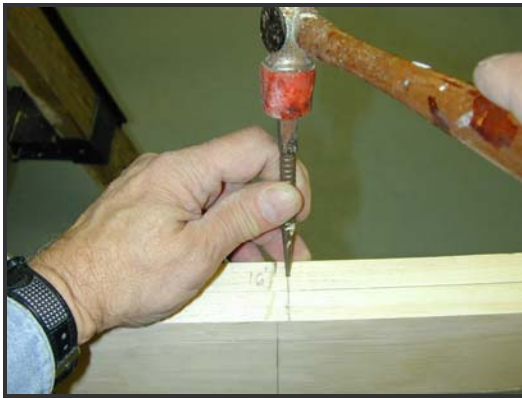
Stations



1. Starting at the bow, mark all the deck beam locations on the top of the gunwale, continuing the line down the sides of both gunwales for clarity.
2. Use a square for marking from the top of the gunwale.

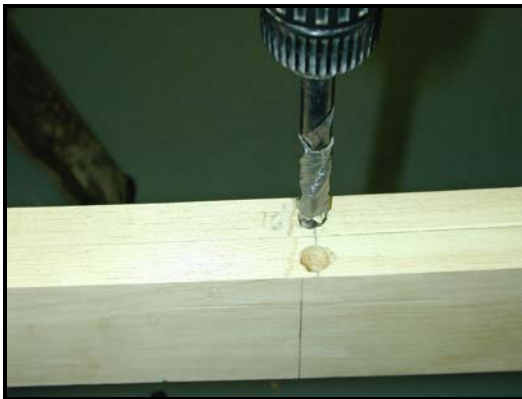
Figure 11. Marking the deck beams on the gunwales.

Rib Mortices



1. Mark all the rib locations across the bottom of the gunwales with a pencil line.
2. Use a marking gauge to mark the centers ($3/8''$).
3. Tap a small nail set at the center intersections.

Figure 12. Nail set used in marking rib locations .



1. Tape around a $1/2''$ drill bit 1" from the bottom.
2. Drill all rib mortises 1" deep.

Figure 13. $1/2$ inch holes drilled in bottom of gunwale for ribs.

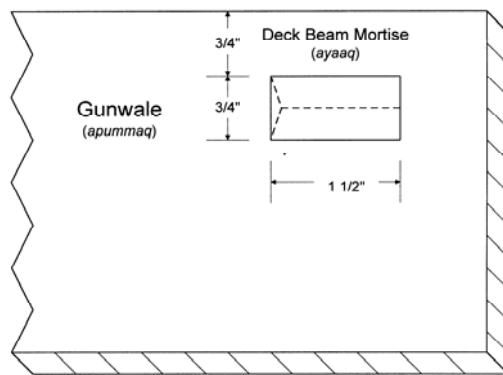
Deck Beam Mortises

Deck Beams			
Station	Distance From Bow	Gunwale * Width	Deck Beam Max. Length**
1	1' 6"	4 1/4"	3"
2	2' 6"	6 3/8"	5"
3	3' 6"	8 3/4"	7 1/2"
4	4' 6"	11 3/8"	10"
5	5' 6"	13 7/8"	12 1/2"
6	6' 6"	16 1/2"	15 1/8"
7	7' 6"	19 1/4"	17 3/4"
8	8' 6"	21 5/8"	20 1/4"
9	9' 6"	23 3/4"	22 3/8"
10	10' 6"	25 5/8"	23 7/8"
11	11' 6"	26 3/4"	25 1/4"
12 - <i>Masik</i>	12' 6"	27 1/2"	26 1/4"
13 - <i>Itivik</i>	14' 6"	28"	26 3/4"
14	15' 6"	27 3/4"	26"
15	16' 6"	26 3/8"	24 1/4"
16	17' 6"	23 1/2"	21 7/16"
17	18' 6"	19 1/4"	17 5/8"
18	19' 6"	13 7/8"	12 1/16"
19	20' 6"	8"	6 1/4"
20	21' 0"	5"	3 1/2"

* The gunwale width is at the "Distance From Bow" measurement.

** The deck beam maximum length includes the sections in the mortises.

Table 1. Station, Distance for Bow, Gunwale Width, and Deck Beams.



Deck Beam Mortise in Gunwale

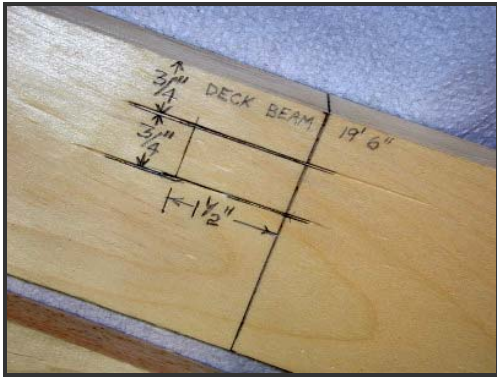


Figure 14. Preparing deck beam mortise in gunwale.

1. Separate the gunwales.
2. Continue the deck beam location line on the inside of each gunwale.
3. Measure and mark each deck beam position. * All are aft of the position line except for the *masik* (forward cockpit deck beam) which is forward of the position line.
4. Note also that the *masik* and *itivik* mortises are 2 1/2" long instead of the usual 1 1/2".
5. Use a marking gauge for the horizontal lines, and then pencil it in. The indent will ensure a clean start for the chisel work.



Figure 15. Preparing deck beam mortise in gunwale with chisel at right.

1. Use a 3/4" chisel with the bevel facing inward.
2. Mark the end cut at right angles with a light tap.
3. Keep the chisel vertical but adjust the angle to 45°. Give several sharp taps to make a cut stopping at the opposite edge of the mortise.
4. Repeat from top to bottom and again on left mortice edge.

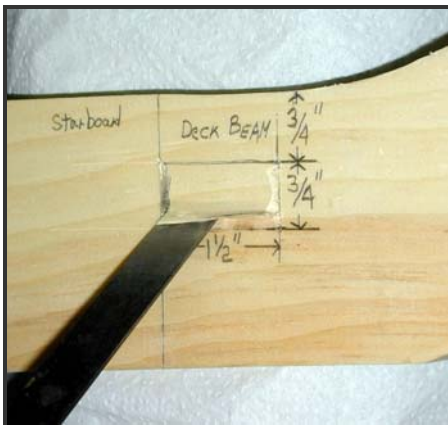


Figure 16. Preparing deck beam mortise in gunwale with chisel at bottom left.

1. With the chisel at a 45°, bevel down, tap to begin cutting out the mortice.
2. Alternate left to right and top to bottom until you meet in the middle.
3. The wood should come out in one piece.



Figure 17. Deck beam finished mortise in gunwale.

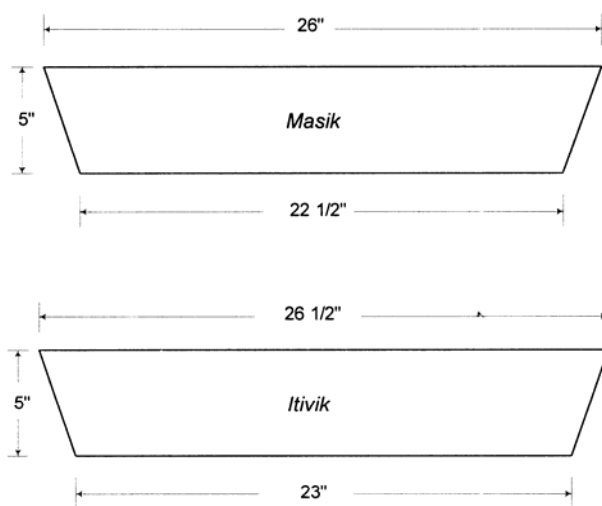
1. Use the chisel to smooth out the V-shaped mortise.



Figure 18. Deck beam finished mortise for *masik*.

1. The *masik* and *itivik* mortises are 2 1/2" in length. The *masik* location is forward of the location line.

Temporary *Masik* and *Itivik* (cockpit deck beams)



1. Prepare the temporary *masik* and *itivik* out of 3/4" stock. It doesn't matter whether you use plywood or 1" x 6" pine. This is to set the flare in the gunwales.

Temporary *Masik* & *Itivik* (cockpit deck beams)



Figure 19. Closeup of bow with holes through gunwales for lashing.

1. Drill 2 - 3/16" holes one above the other through each gunwale approx. 1' from bow and stern.
2. Lash and tie with seine twine to stabilize the shape. This lashing is temporary and will help hold the gunwale ends together. It will be adjusted in the next step.



Figure 20. Gunwales spread apart with temporary *masik* and *itivik* - from bow.

1. Insert temporary *masik* and *itivik* spreaders.
2. Tighten up the lashings at bow and stern until gunwales meet.



Figure 21. Gunwales spread apart with temporary *masik* and *itivik*.

1. Use small clamp on a small scrap of wood to keep spreaders from riding up.

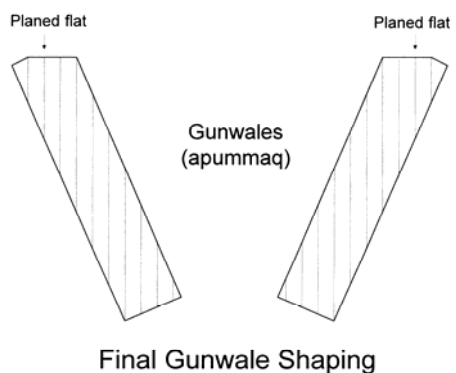
Planning of Bow and Stern Gunwales



1. Using a block plane, cut the gunwales vertical so they will meet each other.
2. Do the same with the stern gunwales.

Figure 22. Gunwales spread apart for planning bow.

Final Gunwale Shaping



1. Plane the tops of the gunwales flat to about 2/3 of the way to the outside of the gunwales.

Completed Gunwales, Bow and Stern

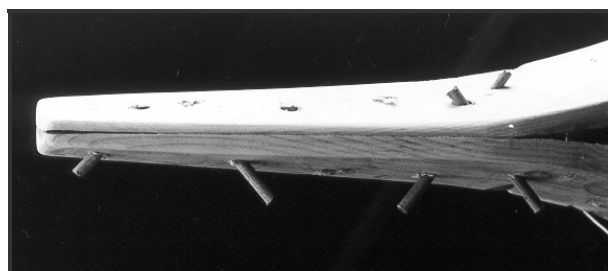
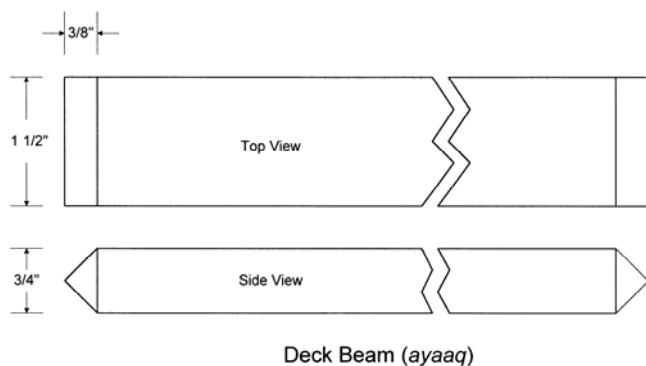


Figure 23. Bow side view with sewing and dowels. Figure 24. Stern bottom view with dowels.

Deck Beams

Ayaaq (deck beams)



1. Cut the 18 variable length deck beams (not including the *masik* and *itivik*) following "Deck Beam Maximum Length" (1 1/2" x 3/4"), Table 1, p. 13.
2. Mark the station #'s on the deck beams.

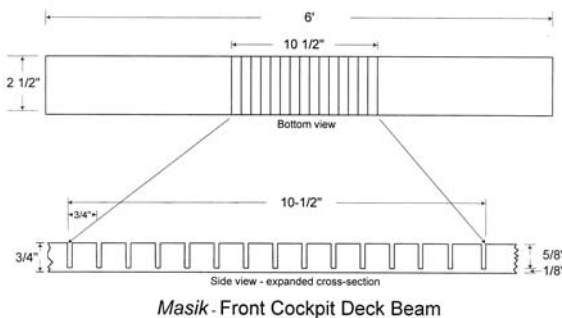


Figure 25. Deck beam on belt sander preparing tenons.

1. Prepare the deck beams as follows, beginning with station 11 and working toward the bow.
2. Hold the deck beam with the ends in the mortises.
3. Use a sliding bevel to measure the angle between gunwale and deck beam. (it will be close to 90°).
4. Mark the angle and trim the deck beam at the required angle on both sides.
5. As you move forward, the angle will increase stabilizing as you near the bow.

1. Prepare tenons as follows:
2. Mark each side with a pencil line, 3/8" from edges top and bottom.
3. Sand the edges at a sharp angle to the 3/8" mark (see side view drawing).

***Masik* (forward cockpit deck beam)**

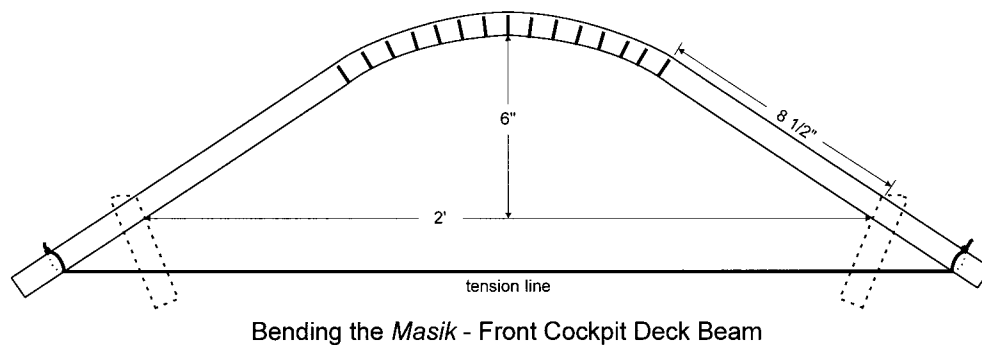


1. The masik is made from pine about 6' long (it will be trimmed to shape).
2. The middle part has small kerfs or cuts about 5/8" deep for bending.



Figure 26. Boiling the wood in a converted eaves trough with ends capped.

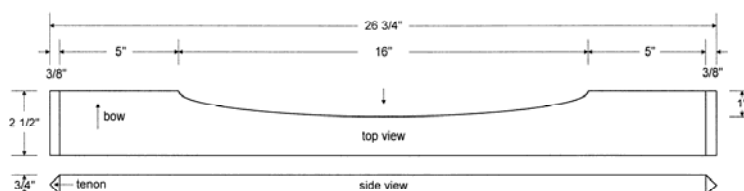
1. Boil in a length of end-capped eaves trough for about 30 minutes.
2. Use a camp stove or an outdoor fireplace to heat the water.



1. Then, with gloves on, slowly bend the wood as shown in the figure at the left.
2. Slowly tighten the twine until it is bent as in the drawing.
3. The same is done for the cockpit coaming (more later).

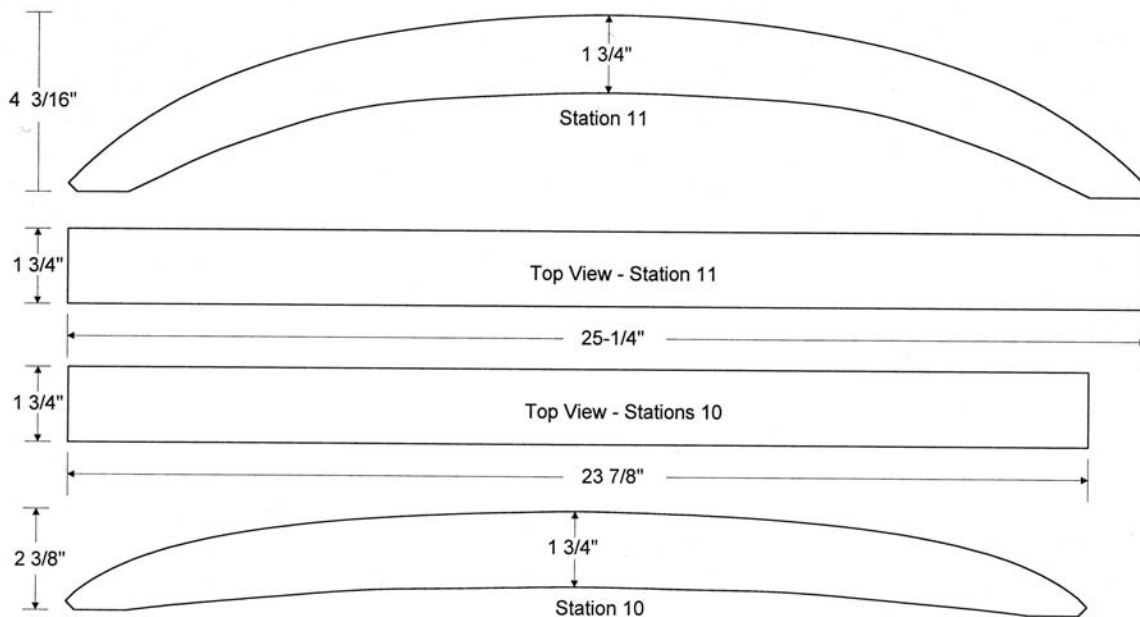
Figure 27. A boiling container is made from a length of eaves trough with the ends capped.

Itivik (aft cockpit deck beam)



1. Make the *itivik* as shown and fit it in place.

***Masirusigiik* (two deck beams forward of the *masik*)**



***Masirusigiik* - Deck Beams Stations 10 & 11**



1. Make from 2" stock.
2. A 2" x 6" will do for the largest of the two.

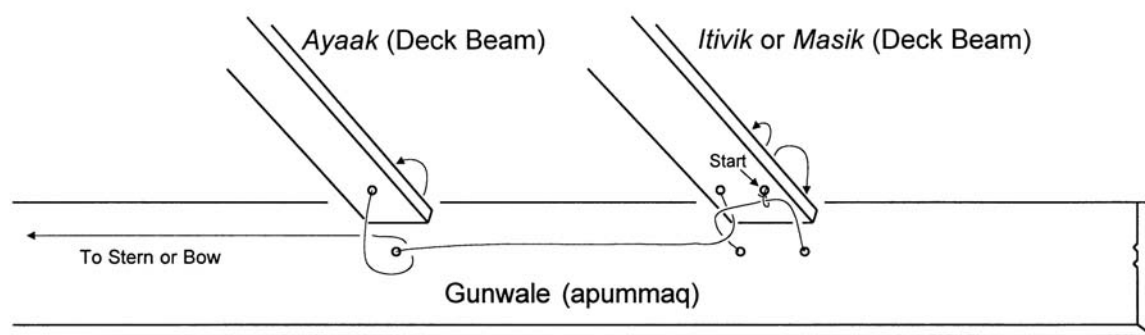
Figure 28. *Masirusigiik* (two small deck beams)



1. These are the gunwales, deck beams, temporary *masik* and *itivik*, held in place for adjusting only.

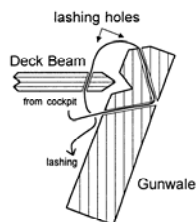
Figure 29. Kayak gunwale, deck beams, temporary *masik* and *itivik* from front view.

Lashing for Gunwale and Deck Beams



Deck Beam and Gunwale Lashing

1. Make a loop of twine using a bowline.
2. Run the twine through the itivik or masik from the underside, snugging the loop up to the drilled hole.
3. Lash the twine between the *itivik/masik* and deck beams as shown.



Cross-section of Gunwale and Deck Beam with Lashing

**Figure 30. Drilling vertical hole in gunwale for deck beam lashing.**

1. Drill a 3/16" hole through the gunwale, keeping the drill bit upright with the hole about 1/3 from the inside of the gunwale.
2. Cut a notch in the gunwale top, from the hole inboard. The hole should come out at 1/3 to 1/2 the depth of the gunwale.

**Figure 31. Drilling horizontal hole in gunwale for deck beam lashing.**

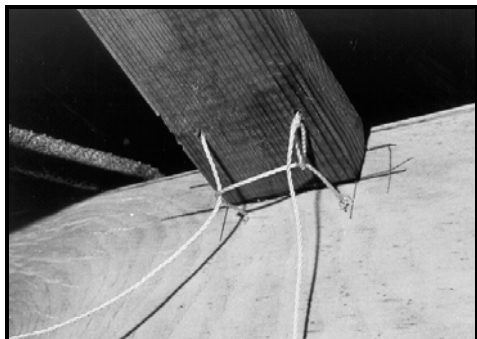
1. Where the 3/16" hole comes out above, drill a horizontal hole through the gunwale, being careful not to hit the deck beam.



1. Drill a 3/16" hole through the deck beam about 1" from gunwale.
2. Keep the drill bit parallel to the gunwale.

Figure 32. Drilling hole in deck beam for deck beam lashing.

Lashing of the *Masik* and the *Itivik*



1. Tie a loop in the twine at one end of the aft cockpit deck beam (*itivik*).
2. Lash the twine toward the stern in one continuous line as shown in the drawing above.
3. Repeat on the opposite side and from the forward cockpit deck beam (*masik*) to the bow on both sides.

Figure 33. Tie at aft cockpit deck beam.

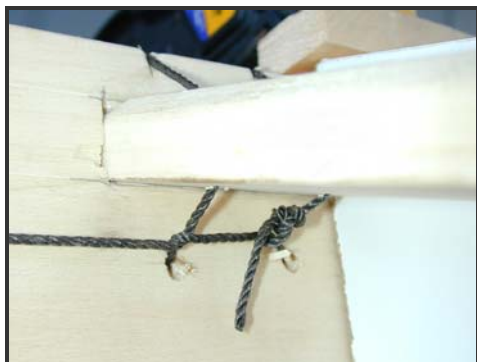
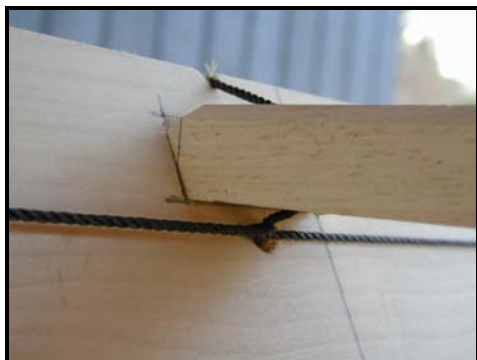


Figure 34. Lashing of cockpit deck beam to gunwale.

1. Once you master the first loop. The lashing pattern becomes self-evident.
2. Start with a loop and go up through the deck beam to the top of the gunwale, through the hole, and through the loop inside the gunwale.
3. Take the twine through the second gunwale hole to the outside, and through the adjoining hole to the top of the gunwale.
4. Bring the twine back through the deck beam, under the line as illustrated.
5. Snug toward the loop and then pull in the opposite direction.



1. Continue lashing in the same manner.
2. Make sure lashing is snug at each station.

Figure 35. Lashing of deck beam and gunwale.

Forward Deck Stringer



1. Plane the deck stringer to $\frac{1}{2}$ " thick from the *masik* forward to half way between the slightly raised deck beam (#10) and the flat deck beam (#9).
2. Thinning this portion of the stringer will allow it to follow the curve with ease.
3. Cut the *masik* mortise for the deck stringer with a $\frac{3}{4}$ " chisel.
4. Make the mortise deeper at the forward side to accommodate the angle of the deck stringer.

Figure 36. Mortise in *masik* and deck stringer.



1. When the deck stringer is in place, fair it with the top of the *masik*.

Figure 37. *Masik* and deck stringer.



1. Drill 2 vertical holes through the deck stringer and the *masik*.
2. At the other deck beams, drill only one hole through alternate sides of the stringer, being careful not to hit the deck beam.
3. The hole must be on the cockpit side of the deck beam (see illustration below).
4. Cut shallow grooves in the top of the deck stringers to lay in the twine and prevent wear on the cover.

Figure 38. *Masik* and two forward deck beams.



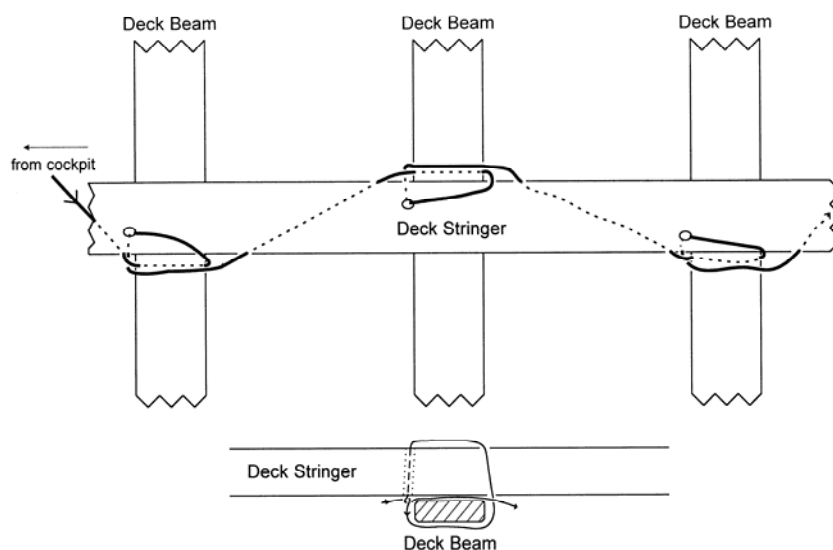
1. Cut a length of twine equal to $1 \frac{2}{3}$ the length to the bow.
2. Begin the lashing with a bowline as you did for the deck beam/gunwale lashing.
3. Lash toward the bow.
4. Fasten the twine to itself with 2 half-hitches.

Figure 39. Masik and forward deck stringer lashing.



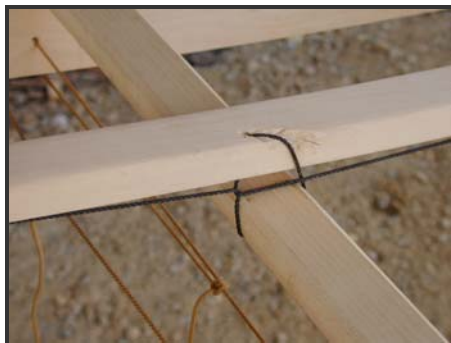
1. At the bow end, fair the deck stringer in place.

Figure 40. Bow gunwales and deck stringer.



Continuous Lashing of Deck Beam (ayaaq) and Deck Stringer (tuniqyuk)

Aft Deck Stringer



1. The lashing is continuous from the masik to the bow and from the itivik to the stern.
2. The black tarred fishing line is put in a groove on the deck stringer so that it does not stand proud.

Figure 41. Lashing of deck stringer and deck beam.

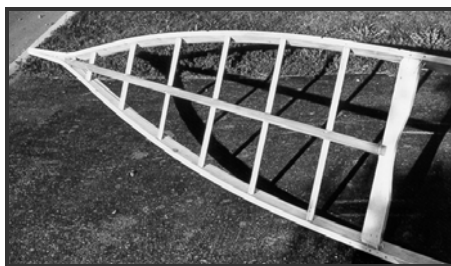


Figure 42. Aft gunwales, deck beams and forward stringer.

Completed Gunwales, Deck Beams and Deck Stringer



1. The completed kayak deck is now finished.

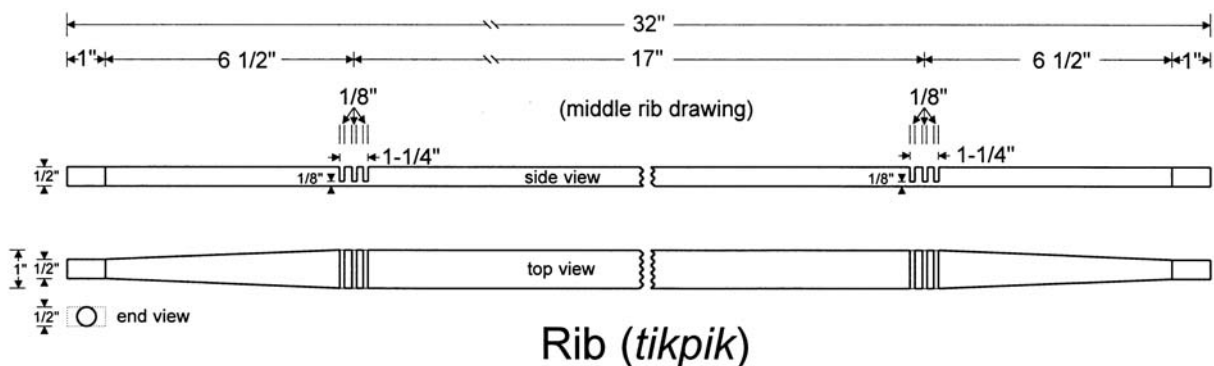
Figure 43. Completed gunwales, deck beams and deck stringers

Ribs

Station	Rib Distance From Stem	Width of * Bottom	Length of Arms	Total Length
1	2' 0"	2 struts	2 7/8" (2)	3 7/8" **
2	3' 0"	2 struts	5 1/8" (2)	6 1/8" **
3	3' 10"	2 struts	6 7/8" (2)	7 7/8" **
4	4' 8"	2"	8"	20"
5	5' 6"	4 1/4"	7 1/4"	20 3/4"
6	6' 4"	5 3/4"	7"	21 3/4"
7	7' 2"	7 1/2"	6 7/8"	23 1/4"
8	8' 0"	9"	7 1/8"	25 1/4"
9	8' 10"	11 1/4"	7 1/4"	27 3/4"
10	9' 8"	13"	7"	29"
11	10' 6"	14 3/4"	6 7/8"	30 1/2"
12	11' 2 1/2"	16"	6 1/2"	31"
13	11' 8"	16 1/2"	6 1/2"	31 1/2"
14	12' 4"	17"	6 1/2"	32"
15	12' 10"	17"	6 1/2"	32"
16	13' 4"	17"	6 1/2"	32"
17	13' 10"	17"	6 1/2"	32"
18	14' 4"	17"	6 1/2"	32"
19	15' 2"	17"	6 1/2"	32"
20	16' 0"	16 7/8"	6	30 7/8"
21	16' 10"	15 3/4"	5 1/2"	28 3/4"
22	17' 8"	14 1/2"	5 1/8"	26 3/4"
23	18' 6"	12 1/4"	4 1/2"	23 1/4"
24	19' 4"	9 1/4"	3 5/8"	18 1/2"
25	20' 2"	3 1/2"	3"	11 1/2"
26	21' 0"	2 struts	1 1/8"	2 1/8"

* Middle of kerf

** Total length (x2)



Rib (tikpik)



Figure 44. Sanded tenon.

1. Prepare the rib for the tenon cutter by sanding the narrow sides, beginning 1" from the end.



Figure 45. Using a tenon cutter.

1. Attach a 1/2" tenon cutter to an electric drill.
2. Cut tenons at both ends of each rib, preparing the rib.



Figure 46. A finished tenon.

1. The finished tenon is 1" long.



Figure 47. Rib ready to be bent.

1. Mark kerf locations on each rib using measurements in the table above.
2. Note that measurements are from middle kerf to 1" from the end.
3. Make three 1/8" thick saw kerfs, at 5/8" from each other and 3/8" deep.

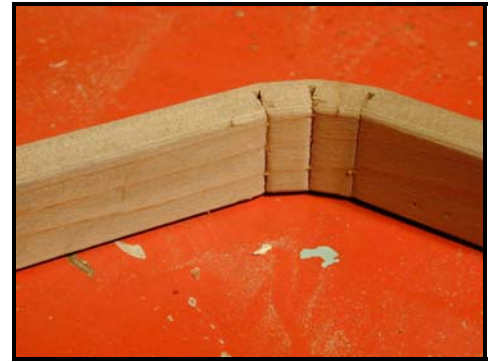


Figure 48. Bent ribs showing three one-eighth inch cuts (kerf).



Figure 49. Ribs boiling in water to heat them for bending.

1. Attach twine with a bowline to the ribs tenon to be immersed. Loop other end of twine around the inside kerf (saw cut) at far end.
2. To bend ribs, immerse in boiling water for about 15 minutes.
3. Slowly pull on the twine to bend the immersed rib.
4. Fasten with a slipknot and place opposite rib end in boiling water.
5. After 15 minutes, begin bending rib by slowly pressing down.
6. When bend is complete, move string up from kerf to tenon and fasten to maintain tension.
7. While rib is still warm, insert at its gunwale location, making adjustments as needed.
8. If a rib starts to crack at the bend, whip with waxed sail twine.
9. A deep roasting pan on top of the stove is adequate for heating one kerfed area at a time.
10. Several ribs can be heated at once.



Figure 50. ABS pipe and kettle.

1. An alternate source of heat is an electric kettle with spout extension leading into a length of ABS pipe with screw ends.
2. This method keeps you out of the kitchen, but is less efficient.
3. Allow ½ hour of steaming.



Figure 51 Kerf whipping completed.

1. If the bend starts to crack or fibers lift, put on a whipping of heavy waxed sail string.
2. The figure on the left show a completed whipping, while on the right it shows how to do it.



Figure 51. A simple rope whipping.



Figure 52. Bent ribs.

1. Insert ribs at each station, seating tenons firmly in both mortises.



Figure 53. Rib in place with adjusting twine.

1. From rib # 19 to rib # 4, the tops of the ribs should be level.
2. If needed, tie a temporary adjusting length of twine to bring the rib level.



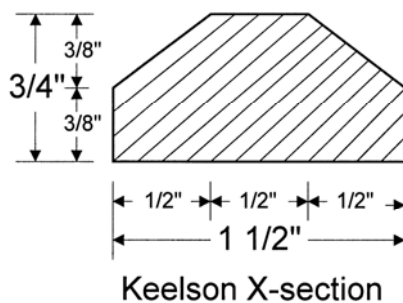
Figure 54. Rib pinned to gunwale.

1. Drill 1/8" through gunwale and rib tenon, and insert 1/8" wooden dowel dipped in glue.
2. Saw off dowels flush both inside and outside.



1. Drill two holes about 1" from top of each strut.
2. Lash struts together.

Keelson



1. The keelson needs to be scarfed to achieve the necessary length (about 23').
2. Cut 1 keelson piece 16' x 1 1/2" x 3/4".
3. Cut a second section 8' x 1 1/2" x 3/4".
4. Scarf the two pieces together making a 12" scarf joint.



Figure 55. Keelson planed thin at bend in stem.

1. Plane the keelson using a rounded spoke shave for about 4" on either side of rib # 4.
2. The keelson at the rib crossing should be 1/2" thick.
3. Place a tea kettle under the narrow section and wrap the section with a wet rag.
4. Steam about 20 minutes.
5. Slowly bend the heated section to shape.



Figure 56. Keelson at stern.

1. Continue keelson to stern, cutting off excess to fit gunwale.
2. Plane to about 3/8" thick and appropriate width.
3. Plane gunwale flat.



Figure 57. Faired in keelson.

1. Glue keelson in place for stern.



1. Cut a notch for the keelson at the bow.

Figure 58. 29-3 Bow showing keelson inlet into the gunwales.

Keelson Lashing

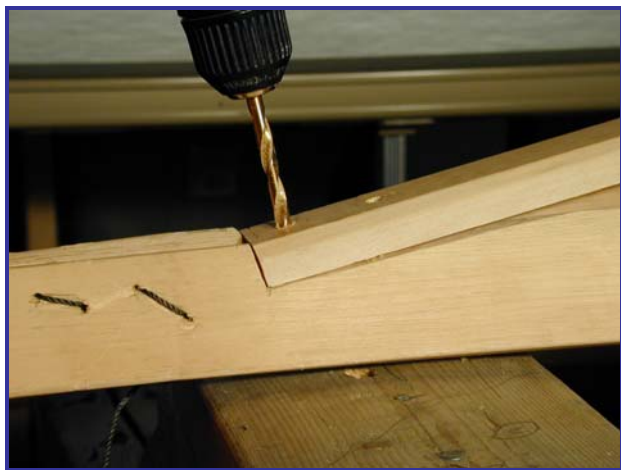
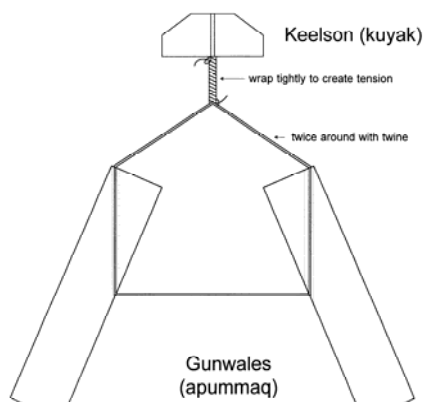


Figure 59. 1/4" hole drilled through the keelson at the bow.

1. Drill two 1/4" holes through the keelson and the front stringer.
2. Drive a 1/4" wooden dowel through the drilled holes using outdoor glue in the holes and under the keelson.



Gunwale/Keelson Lashing in front of Rib Strut

1. Lash the keelson at 3" in front of each of the 3 forward rib struts.
2. Tie each lashing twice around and frap (wrap to tighten), starting with the keelson end.



Figure 60. 3/16" hole drilled through the gunwale.

1. Drill holes 3" forward of each of the 3 forward rib struts.
2. Hole is drilled and comes out the inboard side of the gunwale.
3. Drill 2 diagonal holes 3/4" apart in the keelson, one forward and one aft, of the two gunwale holes.
4. Make a groove between the keelson holes.



Figure 61. Loosely-tied gunwale/keelson lashing.

1. Tie the twine with a bowline and run through the gunwale holes and the two keelson holes twice around.

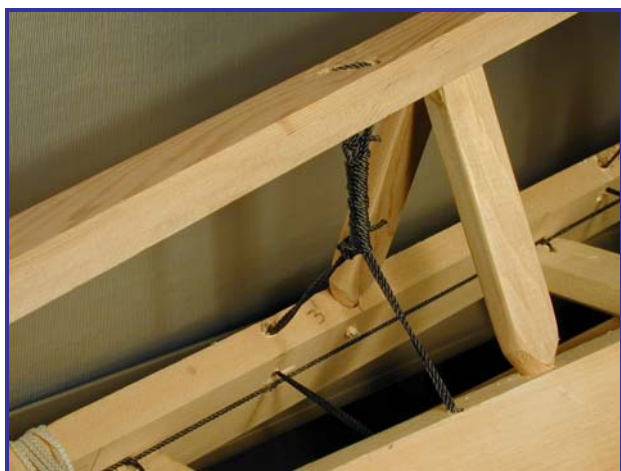


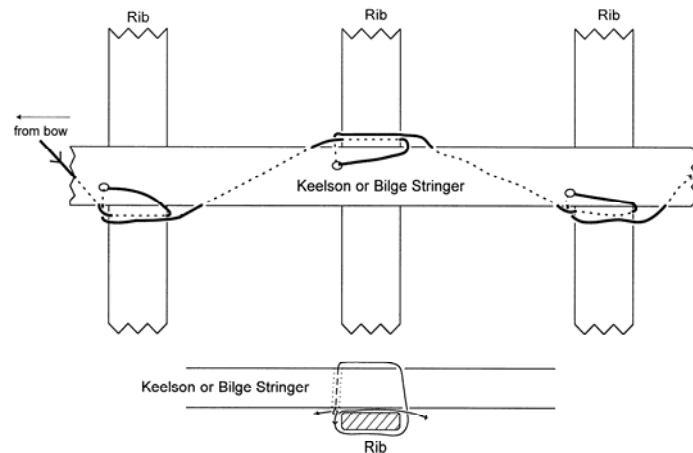
Figure 62. Tightly tensioned twine.

1. Wrap the tie around from the keelson downward to create tension.



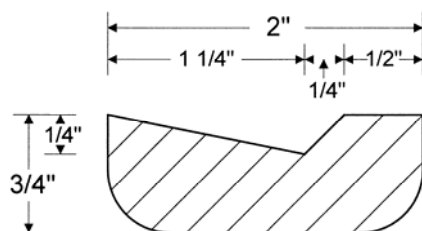
Figure 63. Keelson lashed in place.

1. Lash keelson tightly to ribs with illustration below.
2. Start at rib # 4 with bowline as before.
3. As with the deck stringer, cut shallow grooves for the twine to prevent wear on the cover.



Continuous Lashing of Keelson (*kuyak*) or Bilge Stringer (*sianiq*) and Ribs (*tikpit*)

Bilge Stringers



Bilge Stringer (*sianiq*)

1. Make the bilge stringers out of pine or cedar (see illustration).
2. Fair the bilge stringers into the keelson at rib # 4, using a hand saw.
3. Use the offcuts to fair in the keelson.



Figure 64. Bilge stringer tied on at bow.

1. Tie bilge stringer starting at rib # 4 and continuing toward the stern.
2. The continuous lashing for the bilge stringer and the ribs are as below.



Figure 65. Aft bilge stringer being cut to fit.

1. Fair in the bilge stringer using a hand saw (left illustration).
2. Don't force the bilge stringer. If it's in danger of cracking, fair with offcuts and plane to shape (right illustration).



Figure 66. Glued in fairing pieces on stern of bilge stringer.

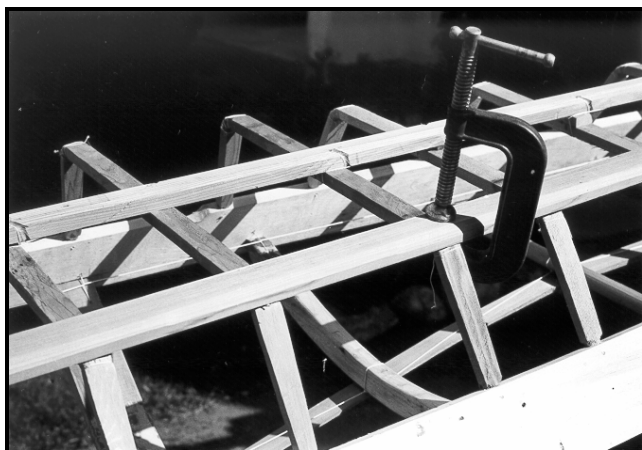


Figure 67. Bilge stringer with clamp.

1. Clamp the bilge stringer to the rib.

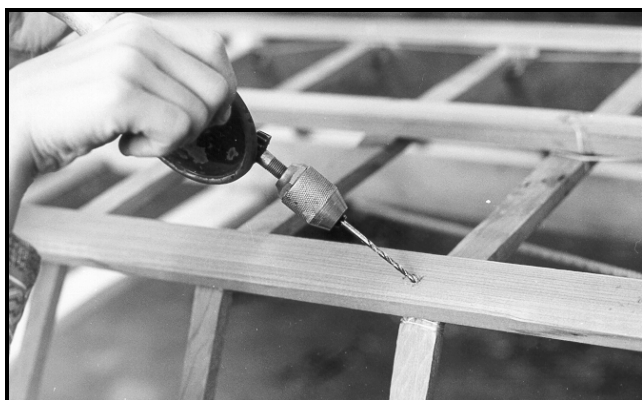


Figure 68. Drilling hole for tie on bilge stringer.

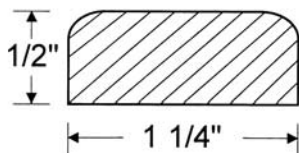
1. Drill holes for the lashing alternating sides.



1. Glue small wooden blocks alongside the keelson in way of the *niutaq*.

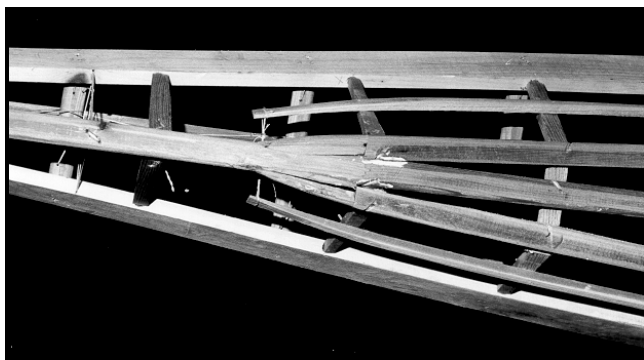
Figure 69. Fairing blocks for bow area bilge stringers.

Side Stringers



Side Stringer X-section (qiyuaqyutaq)

1. Two side stringers are made about 11' long, 1 1/4" wide and 1/2" thick. They are in between the keelson and the bilge stringers. They run from about 5' to 16 1/2'.



1. Side stringers from the bow between ribs # 3 and # 4.

Figure 70. Keelson, side stringers and bilge stringers.

Cockpit Coaming

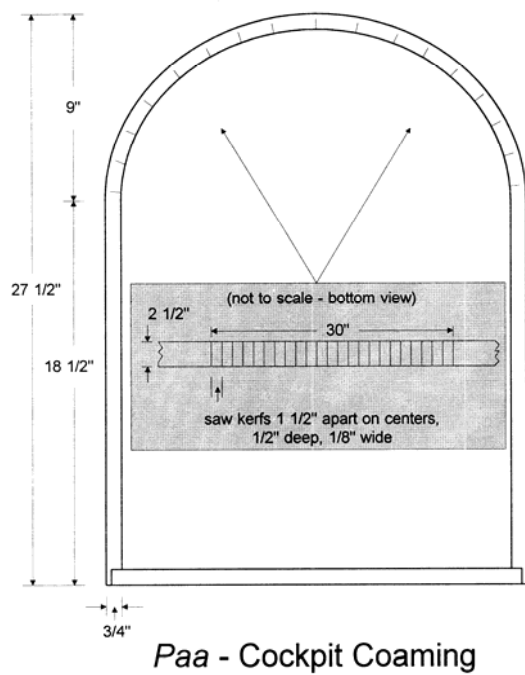


Figure 71. Eaves trough capped on ends for steaming cockpit.

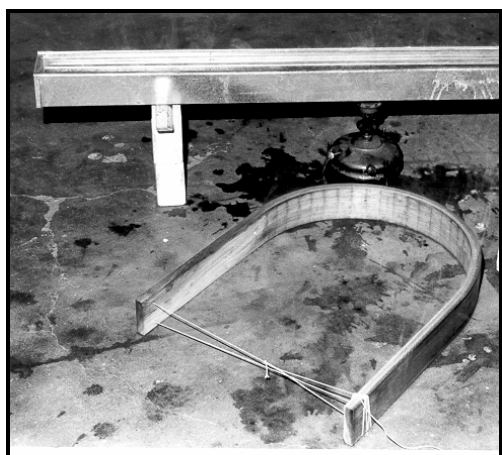


Figure 72. Cockpit coaming being bent.

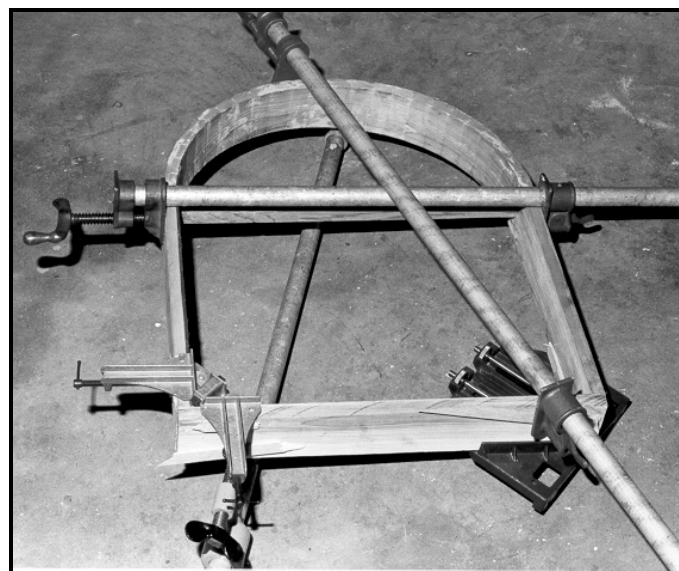


Figure 73. Cockpit coaming with bottom section.

Foot Brace



Figure 74. Foot brace installed.

1. Before covering kayak, install foot braces 40"-50" forward of aft cockpit deck beam. (Sit in kayak to determine comfortable distance).
2. Fasten plastic wall shelf brackets to gunwale with seine twine.
3. Cut $\frac{3}{4}$ " x 2" pine or cedar brace. Shape ends to fit brackets and install.



1. Lash shelf brackets with two holes through gunwale and a groove connecting the two outside. The groove must be wide enough for two lashings.

Completed Frame



Figure 75. Elevation view of finished frame.



Figure 76. Top view of finished frame minus coaming.



Figure 77. Bottom view of finished frame minus coaming.

Covering

1. Fold canvas in half and mark centerline with pencil at 12" intervals.
2. Drape canvas over the frame, with centerline over keelson, leaving about 4" of canvas overlapping the bow.
3. Fold canvas snugly over the bow stem and clamp fabric at the bow.
4. Stretch the canvas toward the stern and clamp.



1. Turn kayak frame upright.

Figure 78. Clamping the canvas bow and stern.



Figure 79. Cutting the canvas to fit.

1. Drape one side of the canvas over the kayak deck.
2. Trim the canvas next to the deck stringer, leaving a 2" overlap.
3. Repeat with other side.
4. Canvas will now be a rough fit.



Figure 80. Basting with waxed sailmaker's thread.

1. Baste canvas (sew temporarily), just above the gunwale as shown below.
2. This step will hold the canvas in place while sewing the covering together.



Figure 81. Basting stitch.

1. Stitches are about 1" in length and at a 45° angle from each other.
2. Stitches pass over deck beams and under the deck stringer.
3. Pull taut to hold canvas in place at the gunwale level.

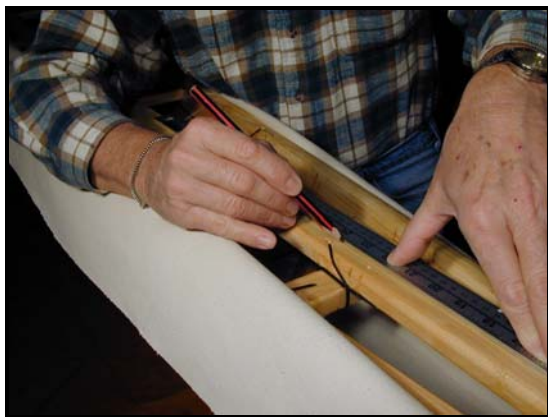


Figure 82. Drawing center line with pencil.

1. Make a pencil line mid-stringer the length of the kayak.
2. This line marks the fold/sewing line.



Figure 83. Sewing the bow.

1. Pull canvas sides taut to fit around stem, folding raw edges under.
2. Use a triangular sailmaker's needle, heavy waxed sailmaker's hand-sewing thread, doubled, and, if needed, a needle-nosed pliers to pull the needle through.



Figure 84. Sewing the canvas starting at bow.

1. Lace the canvas together as shown. The needle enters under the canvas edge 1/8" – 1/16" in from the folded edge. Stitches are about 1/4" apart.
2. Seam should meet at mid-stringer.
3. The canvas should have no slack, but the stitch holes should not strain the canvas.
4. Continue sewing as far as the cockpit.
5. The two edges should meet without overlapping.

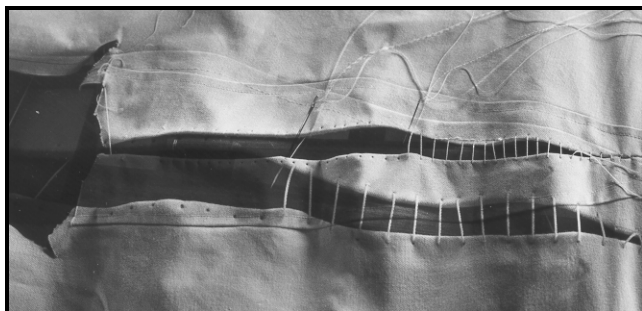


Figure 85. 33-8 Additional canvas inset at widest part.

1. If the canvas is less than 5' wide it will not meet in front of and behind the cockpit.
2. Insert a triangle of canvas as shown.

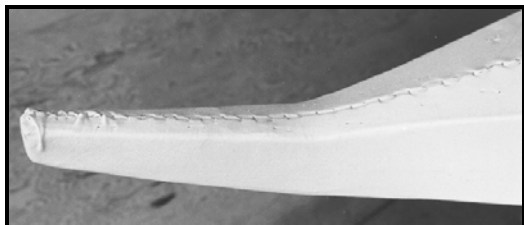


Figure 86. 34-4 Sewing at stern.

1. Begin again at the stern and sew as far as the cockpit.



Figure 87. Sewing a side dart without cutting the canvas.

1. Make 2 to 4 darts in the aft cockpit deck and possibly the sides to make a snug fit.
2. Sew the darts without cutting the canvas.
3. You will need to experiment a bit to get the best fit and angle for the darts.
4. Pushpins holding canvas to the center stringer help position it.

Lacing on the Cockpit Coaming

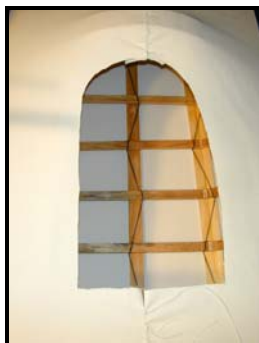


Figure 88. The opening for the cockpit coaming.

1. Cut the canvas as shown in a first approximation.
2. Stitches should stop at inner edge of *masik* and about 2" inside the *itivik*. Adjust if necessary (reverse sew through same holes).



Figure 89. Measuring the coaming for holes 1" below the rim.

1. Lay the cockpit coaming in place.
2. Draw a line 1" from the top, the whole way around the outside perimeter.
3. Mark every two inches on that line.
4. Drill a 3/16" hole at each spot marked, angling 45° to the left and 45° to the right, creating a V. The inside holes are about 1" apart, 1" from the top.



Figure 90. Fitting canvas to coaming.

1. Cut the canvas on a 45° angle to 1/4" from the cockpit stern corners.
2. Before folding, trim the canvas to 3" from the bottom of the coaming.
3. To ease fold around the curved part, cut the canvas at right angles at 2" intervals. Stop the cut 1/4" above the fold/inside hole line.

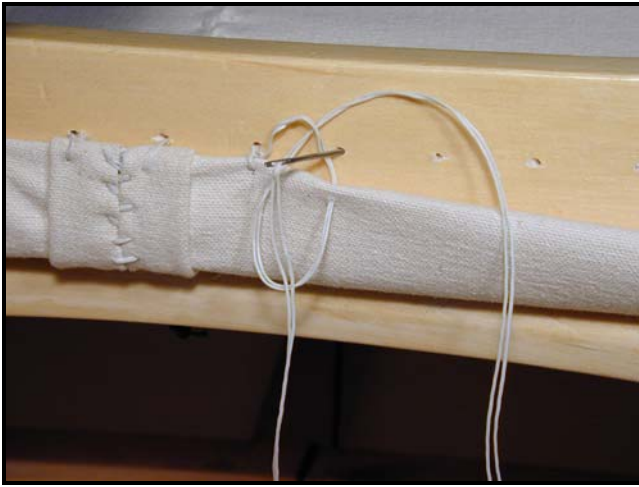


Figure 91. Start of canvas coaming at centerline of aft cockpit.

1. To seat the coaming firmly, clamp the forward part to the *masik* and take a few stitches on the flat aft section.
2. Start at the flat part of coaming (aft) at the centerline.
3. Stitch through each V shaped hole as illustrated.



Figure 92. Push pins through canvas in the cockpit coaming.

1. Fold canvas to the inside at the level of the holes and fasten with clamps and pushpins.
2. Complete sewing canvas around the cockpit coaming.
3. Glue (contact cement) or sew patches around the aft corners and at the center forward seam.



Figure 93. Black seine twine cockpit tied to deck beam.

1. Drill an angular hole through the cockpit coaming and through the deck beam.
2. Tie the two together with some seine twine.
3. Do the same for the other corner and for the front of the cockpit coaming through the *masik*.



Figure 94. Glued on (contact cement) patch.

1. Glue or sew a canvas patch on the corners and the front of the cockpit.



Figure 95. Spraying the raw canvas with water to shrink it.

1. Spray the canvas top and bottom with water. The canvas will shrink and become taut.

Painting

CAUTION: All painting must be done outdoors. A proper respirator is mandatory.

Put on one coat of clear butyrate dope (see Poly-Fiber, p. 7). Provides a tautening dope that slowly draw-tightens natural fabrics. For use only on Grade A cotton or Irish Linen. Thin 1 to 1 with butyrate reducer. This will shrink the fabric and seal it between the individual threads.

Put two or three coats of an exterior gloss finish, (we used the Canadian Moore's House Paint, Linseed/Alkyd Resin). Use any paint scheme you choose.



1. Paint one coat of white with another of your choice.

Floor Boards



1. Make 4 floorboards of cedar, fitting between the ribs in the cockpit area.

OR



Figure 96. Top view of slats

1. Make 9 – ½” thick x 1- ½” wide x 28” long slats.
2. Drill a center hole 3/16” 2” from both ends.
3. Use one length of seine twine for each end to lace the slats together as shown in the illustration at left.



Figure 97. End view of slats.



1. Paint with red rust paint.
2. The seat is made from a Hooper Bay, Alaska kayak, but it serves as well for the east arctic kayak.
3. The designs represent the foot of a sea gull or ravens. Both birds are good at fishing and at ease in the water.

Figure 98. Bob Taylor painting designs on the slat seat.

The Completed Covering



Figure 99. Kayak with canvas and one coat of dope – elevation.



Figure 100. Kayak with canvas and one coat of dope – plan view.



Figure 101. View from the stern.

The Completed East Arctic Kayak



Figure 102. Finished kayak - elevation. Kayak is 22' long, 28 1/2" wide and weighs 61 lbs.



Figure 103. Finished kayak - plan view.



Figure 104. Finished kayak in water – Bob Taylor.



Figure 105. Finished kayak in water - David Zimmerly.

Deck Fittings

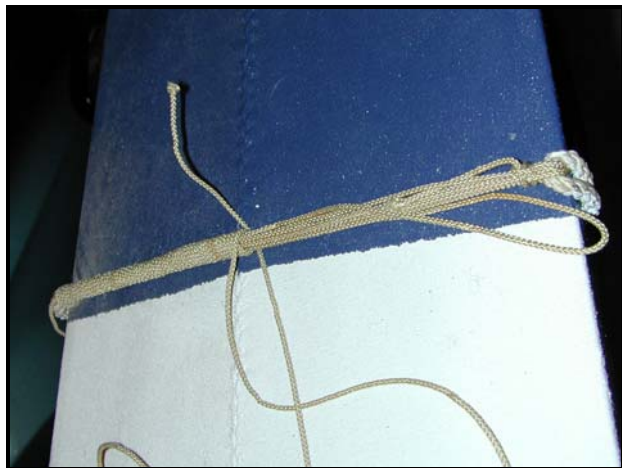


Figure 106. Forward deck line.

1. Lash about 4 or 5 lengths of twine through the loops and secure the ends.
2. Put a simple whipping over the lengths of twine.

Paddle

1. The paddle is a Mackenzie Eskimo style. Cut out the paddle from a 9' – 2" x 6". Use the table of offsets to draw the paddle on the wood. Duplicate measurements on right half.

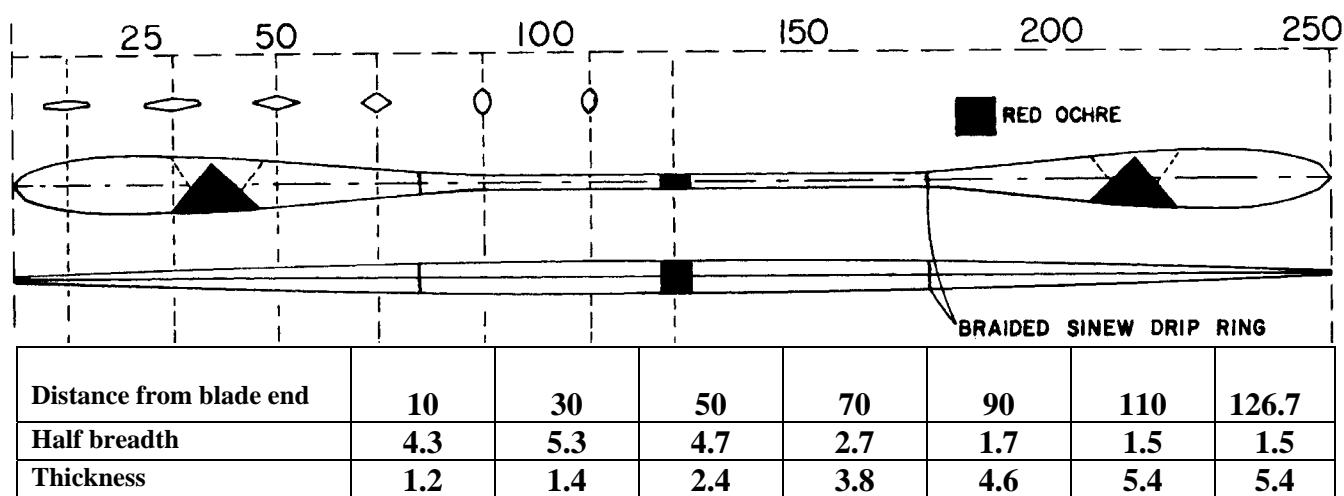


Table of Offsets - Mackenzie Delta paddle - measurements in cm.



Figure 107. Top view of rough-cut paddle.

1. Rough cut the drawn shape with an electric hand circular saw.



Figure 108. Extra pieces glued to the loom.

1. Glue up some cedar or pine, top and bottom, for the loom thickness.



Figure 109. First shaping planed/smoothed on the plan view.

1. Plane rough-cut paddle to a smooth shape.
2. Using a hand-held electric plane will save a lot of effort.



Figure 110. The paddle is nearing completion.

1. Square loom to an oval shape.



Figure 111. Fiberglass put on ends.



Figure 112. Attach drip rings to paddle. A piece of twine tied with a square knot works well.

The Completed Mackenzie Eskimo Paddle



Figure 113. Plan and elevation of Mackenzie paddle.



Figure 114. Transporting to water.

Addendum

Knots



Figure 115. Bowline.

1. Start with one method of tying that is simple to photograph and which is an easy and reliable way of forming the loop in the standing part.

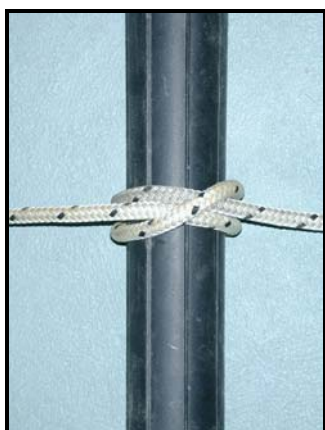


Figure 116. Clove Hitch.

1. The clove hitch is a quick and easy knot to tie especially when you can pop it over the end of what you're tying on to. It's easy to untie even after a load has been applied.

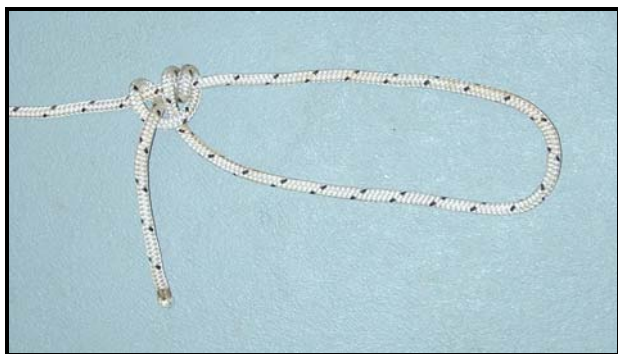


Figure 117. Tautline Hitch.

1. The Tautline Hitch is an adjustable knot that is commonly used for tensioning guy lines, such as on a tent. The knot can be slid up and down the standing part. When released, the tension on the standing part tightens the coils in the knot, increasing the friction and keeping the knot in place under tension. The rope must be able to slide around the object it is secured to for it to be adjustable.

Expenses for 2 East Arctic Kayaks

1. Beaver Lumber 16' - 1 x 6	34.78
2. Nixon Building Supplies 10' - 5/4 x 6	15.53
3. Beaver Lumber 48' - 1 x 10	69.00
4. Beaver Lumber 64' - 1 x 10 select	239.20
5. Adams & Kennedy North Gower - cedar wood 4 - 16' x 1" x 6"; 2 - 19' x 1" x 6"	258.06
6. Home Hardware - paint brush	4.99
7. Ottawa Awning & Canvas 44' - #10 x 72"	<u>305.15</u>
March 1, 2000	Sub-total 926.51

1. Decorating by Design - house paint Exterior Alkyd/Resin - 1 gallon + 2 liters white & blue	85.07
2. The Aero Mart - 2 gal. clear butyrate dope + 1 gal. Reducer	237.64
3. Home Hardware - brushes, etc.	40.26
4. Decorating by Design - house paint Exterior Alkyd/Resin - 1 liter.	19.54
5. Canadian Tire - fibre glass kit	13.79
6. Home Hardware - spar varnish - 1 liter.	11.50
7. Decorating by Design - house paint Exterior Alkyd/Resin - 2 gal.	92.00
8. Nixon Building Supplies - 18' - 2 x 6 pine & 12' - 5/4 x 6 cedar - for paddles	<u>50.82</u>
April 20, 2000	Sub-total 550.62

21 April 2000 **Total 1477.13 CDN**

Cost for 1 kayak \$492.00 US

Cost for 1 kayak \$738.57 CDN