



DO IT YOURSELF

THE EAST ARCTIC KAYAK

Text, photos and drawings
by David Zimmerly



Public Archives of Canada

The Inuit of the Canadian Eastern Arctic designed a stable, sturdy kayak, flat-bottomed, with flared sides, generous beam and length and a flat deck. They used it for hunting sea mammals, for transporting seals and walrus on deck, for fishing, and for moving camp. They traveled in rough waters and for long distances. The long, two-bladed paddle could be pivoted from side to side on the raised cockpit coaming to ease the strain. In rough conditions, or for sleeping at sea, two or more kayakers could lash together catamaran-style to avoid capsizing.

This style of kayak was used from the east coast of Hudson Bay, both sides of Hudson Strait, the east coast of Baffin Island, Labrador, and, later, the Thule area of northwestern Greenland.

The kayak's length varied, and records indicate that it increased over time. Examples as short as 13' and as long as 27' are recorded. The East Arctic kayak is a workhorse. Traditionally it was heavily built, weighing up to 140 pounds. Crude examples of the type do look boxy.

The kayak presented in this article is a hybrid of various East Arctic kayakers. This recreational version of the type weighs in at 62 pounds and has a length of 22' and a beam of 28". It is extremely stable, roomy, fast, and easy to paddle. It tracks beautifully, and can carry a high volume of gear. It accommodates a wide range of body types. My 200-pound son and my 145-

pound wife are equally comfortable paddling this kayak.

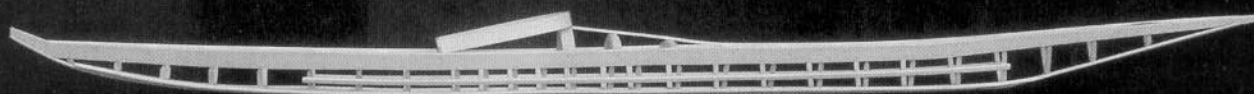
I selected an East Arctic type for this article as the most straightforward construction. I began building the design because I wanted to replace what had long ago been the favorite of my kayak fleet.

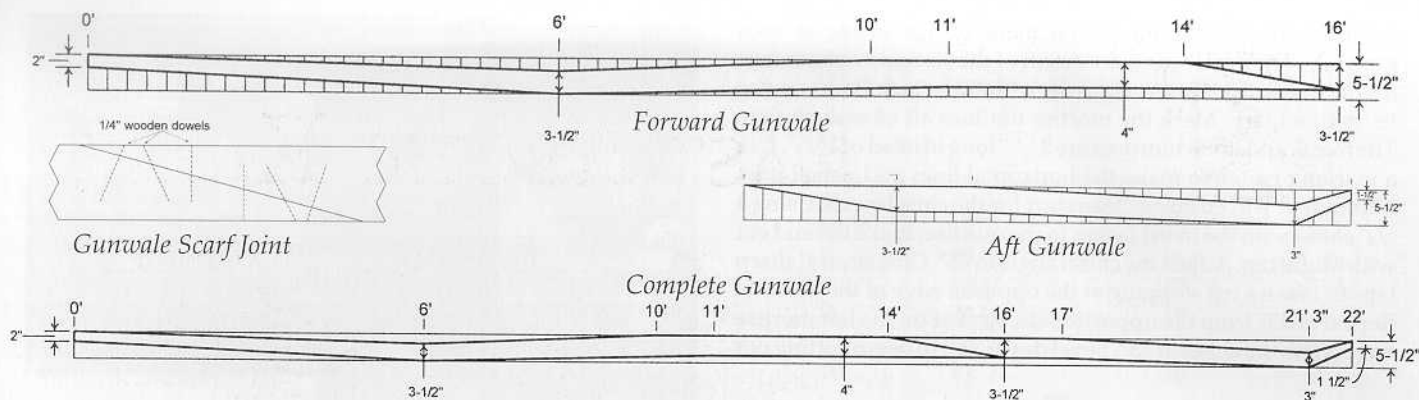
The result has remained my favorite of a fleet of various Arctic kayak types I've built subsequently. I constructed that first East Arctic reproduction in 1973. Suitably, its skeleton remains in Cape Dorset on Baffin Island, where my wife Helga and I sailed on the first leg of the world sailing cruise we began in 1986.

The directions in this article are aimed at the raw amateur kayak builder, but the techniques are those that have been used by the Inuit of the Eastern Arctic for centuries. The experienced builder can learn from them as well.

There is not a nail or screw used in the construction. All pieces are lashed together or pegged. Wood is lengthened by scarfing, bent using steam, and shaved to an eye-pleasing yet strong shape. Some techniques may be unfamiliar—kerfing as a method of bending, for example. All are explained in detail.

Eugene Arima, my predecessor as the Arctic Ethnologist of the Canadian Museum of Civilization, had done extensive studies of this kayak type as part of his fieldwork in Arctic Quebec. In building my reproduction I used a combination of Arima's measurements and my own modifi-





The Gunwales are shaped from a 16-foot and an 8-foot length of 1x6. If you can't find 16-foot boards to work with, you can

make the forward gunwale from two pieces and use another scarf joint.

cations. Construction details came from Arima's work and my own studies of examples in the collection of the Museum of Civilization.

Gunwales

A traditional kayak is built from the gunwales down. They provide the structural strength, and must be sturdy enough to withstand a lot of tension without cracking, even after being drilled full of holes for deck beams and ribs.

You should choose the best wood available at lumberyards in your area. Look for unwarped, knot-free pine.

Inuit used an adze and a curved knife to shape the wood. You can use a circular saw or a drawknife to cut out the shape. Smooth with a plane, and use a rounded spokeshave for the concave shapes.

The East Arctic kayak is too long to even dream of finding decent lumber of adequate length for one-piece gunwales. You'll be scarfing two shorter lengths together to achieve a strong joint.

Draw the forward gunwale shape on a 16' x 1" x 6" board as shown above. Clamp both forward gunwales together and cut them out. Do the same for the stern gunwales. To make the stern handhold, first saw a cut at the deepest point. Use a drawknife to remove the excess wood on both sides of the cut and a rounded spokeshave for the concave portion.

A scarf joint creates a strong connection between wood sections. A width to

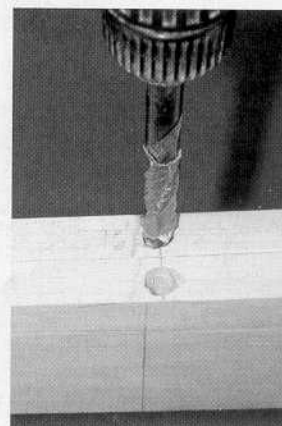
length ratio of 1:8 is best.

Inuit lashed, glued and/or pegged joints together. They used blood for glue, and sometimes, antler or bone for pegs. I use waterproof glue (epoxy or outdoor carpenter's glue), dowels and lots of clamps. Glue and clamp the fore and aft gunwale halves. Drill a 1/4" hole at an angle through the dry scarf joint (see drawing). Drill a second hole at the opposite angle and a third at a straight angle. Drive home 1/4" wooden dowels, first dipped in glue, and cut the pegs off flush with the gunwale. Turn the gunwale over and drill and peg the other side of the joint.

Mark the rib and deck stations. Deck mortises will be chiseled out at these stations; rib mortises will be drilled. Note that the deck mortise placement at station 12 is in front of the marking and behind it at station 13. Clamp both gunwales together. Starting at the bow and using a square, mark and number all deck beam stations on the top of the gunwale. Circle numbers 12 and 13 to remind yourself of different mortise placement. Continue the line down the sides of both gunwales for clarity.

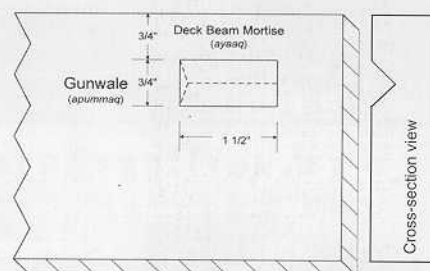
Mark all rib stations across the bottom of the gunwales. Use a marking gauge to mark the centers (3/8") and tap a small nail set at the center intersections. Put tape around a 1/2" drill bit, 1" from the point, and drill all rib mortises 1" deep.

A piece of tape wrapped around a 1/2" drill bit serves as a depth gauge for drilling the 1" holes for the ribs to sit in.

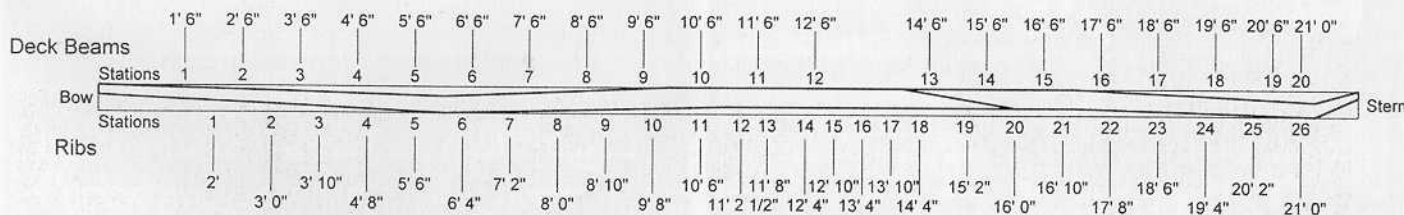


Deck Beam Mortises

Deck beams will slot into V-shaped mortises cut into the inside of the gunwales. The work is simply done with a chisel but the positioning and depth (3/8") are crucial. Separate the gunwales and

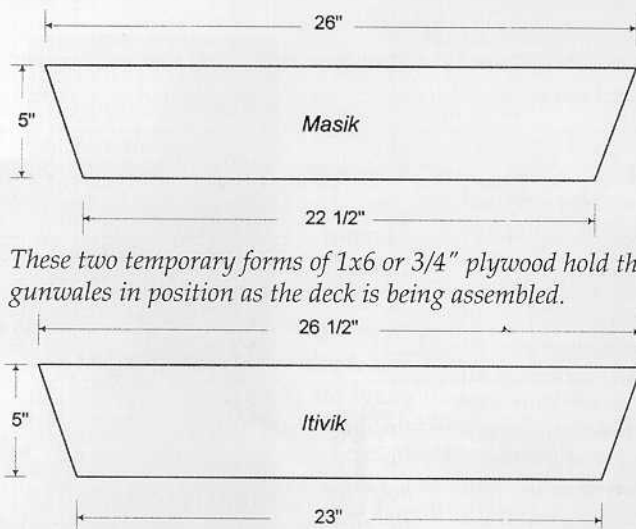


Deck beam mortises are cut to a V-shaped trough with the long sides chiseled at 45°.



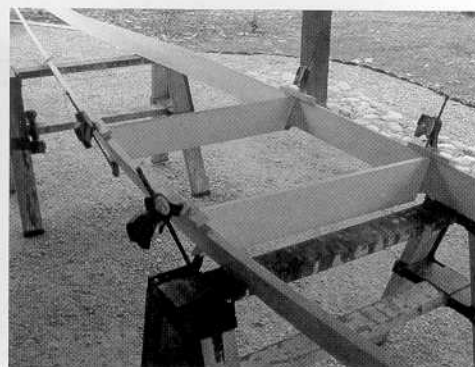
Gunwales: Deck Beam and Rib Stations

continue the deck beam station mark on the inside of each gunwale. The deck beams are set aft of the station marks except for the masik (forward cockpit deck beam), which is forward of its station mark. Mark the mortise outlines aft of each station. The masik and itivik mortises are 2 1/2" long instead of 1 1/2". Use a marking gauge to make the horizontal lines and pencil it in. This indent will ensure a clean start for the chisel work. Using a 3/4" chisel with the bevel facing to the mortise, make the end cut with a light tap. Adjust the chisel angle to 45°. Give several sharp taps to make a cut stopping at the opposite edge of the mortise. Repeat at 45° from the opposite side. Repeat on the left mortise edge. With the chisel at 45°, bevel down, tap to begin cutting out



These two temporary forms of 1x6 or 3/4" plywood hold the gunwales in position as the deck is being assembled.

Small bar clamps and blocks of wood set on top of the gunwales hold the forms in place as the gunwales are sprung.



the mortise. Alternate, left to right, top to bottom, until you meet in the middle. The wood should come out in one piece. Use the chisel to smooth out the V-shaped mortise. Repeat for each mortise, ensuring that masik and itivik mortises are 2 1/2" long and that the masik position is forward of the station line.

The gunwales are shaped and smoothed prior to installation of the deck beams. Temporary spreaders hold the gunwales apart, while temporary lashings draw the ends together.

Use 3/4" plywood or pine to prepare temporary spreaders for masik and itivik locations. These spreaders will set the flare in the gunwales.

Drill two 3/16" holes one above the other through each gunwale approximately 1' from bow and stern. Lash and tie with seine twine to stabilize the shape. Insert spreaders at masik and itivik locations. Use a small clamp on a scrap of wood to keep spreaders from riding up. Tighten up the lashings at bow and stern until gunwales meet.

Different methods can be used for shaping the bow and

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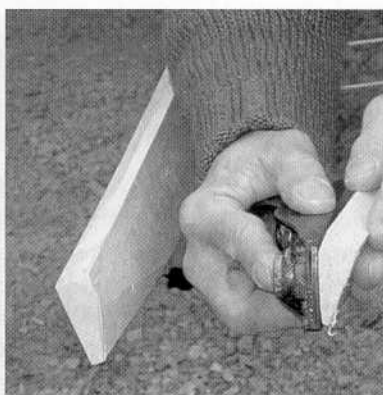
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stern. All arrive at the same overall shape. I like to plane both sides at the joint to have them meet flat. You can also use a saw, repeatedly sawing through the joint until it meets smoothly.

Loosen the temporary bow (stern) lashing. Using a block plane, shave the gunwales vertical so they will meet each other. Tighten the lashing. Finish shaping the gunwales by planing the top edges to about $\frac{2}{3}$ of the way to the outside edge.

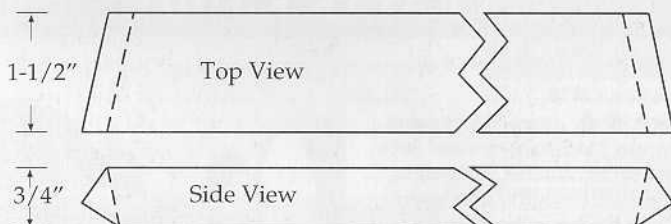


With the sole of the plane vertical and parallel to the centerline of the deck, plane the ends of the gunwale to make a flat joint between them.

Deck Beams

Using the Deck Beam chart above, cut deck beam stock to length for stations 1-9 and 14-20 from $1\frac{1}{2}'' \times \frac{3}{4}''$ pine, marking the station number on each deck beam.

As the gunwale curve changes, so must the angle at the ends of the deck beams. Begin with deck beam #9 and work toward the bow. Holding the deck beam piece on the top of the gunwale over the mortises, use a sliding bevel to measure the angle on the horizontal plane between the gunwale and beam. Mark the angle and trim the deck beam as required on both sides. This angle will change as you move forward. Repeat the process for the stern end, beginning with deck beam #14. The wedge-



The deck beams are first beveled front to back to match the relationship of the gunwales, then trimmed to make pointed tenons to fit the V-shaped mortises.

shaped "tenons" on the ends of the deck beam have a 90° point and are angled downward for a good fit with the mortises. (See the side bar on page 19 for a way to mark the ends.) After cutting the tenons, sand the deck beams smooth and install them temporarily.

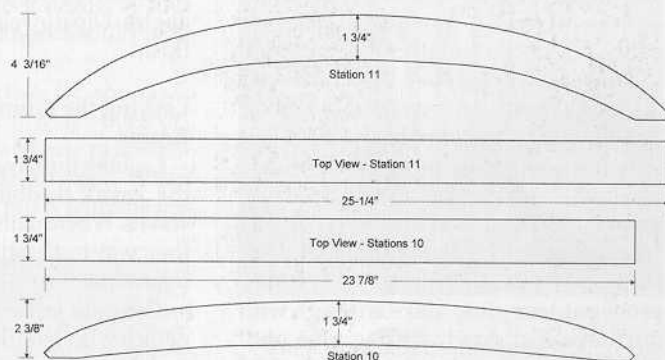
Three deck beams need to be specially shaped. Deck beams #10 and #11 begin the rise in the deck toward the cockpit. Cut them from 2"-thick stock, sand them smooth and fit into place. Make the itivik as shown, sand smooth and fit into place. It will replace the aft temporary spreader.

Masik (forward cockpit deck beam)

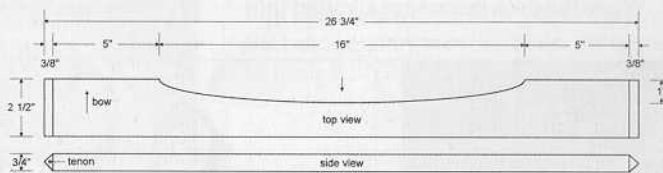
In the original East Arctic kayaks the coamings were not bent. Rather, they were scarfed and joined together from several pieces of wood. You will use the same technique to shape the masik and, later, the ribs and the cockpit coaming. The kerfing

Deck Beams (Overall Length including tenons)

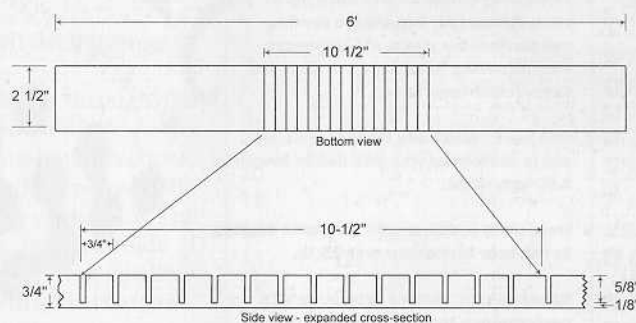
Station	Length	Station	Length
1	3"	11	25 $\frac{1}{4}$ "
2	5"	Masik	26 $\frac{1}{4}$ "
3	7 $\frac{1}{2}$ "	Itivik	26 $\frac{3}{4}$ "
4	10"	14	26"
5	12 $\frac{1}{2}$ "	15	24 $\frac{1}{4}$ "
6	15 $\frac{1}{8}$ "	16	21 $\frac{7}{16}$ "
7	17 $\frac{3}{4}$ "	17	17 $\frac{5}{8}$ "
8	20 $\frac{1}{4}$ "	18	12 $\frac{1}{16}$ "
9	22 $\frac{3}{8}$ "	19	6 $\frac{1}{4}$ "
10	23 $\frac{7}{8}$ "	20	3 $\frac{1}{2}$ "



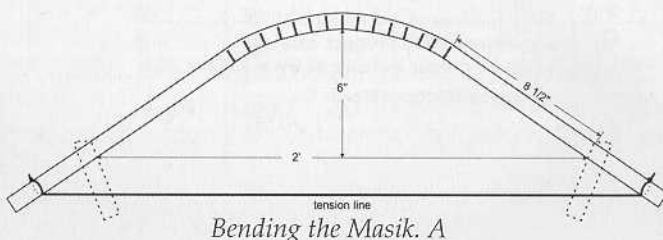
Masirusigiik — Deck Beams 10 & 11



Itivik — Deck Beam at the Aft end of the Cockpit



Masik - Front Cockpit Deck Beam



Bending the Masik. A

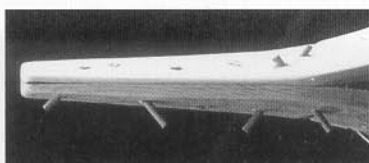
method makes for a smooth, strong coaming and is simpler for the amateur builder. For the masik, cut small kerfs, $\frac{1}{8}$ " wide (standard circular saw blade width) and $\frac{5}{8}$ " deep in the middle section. Then soften the wood and bend to the required shape.

Select a piece of pine about $6' \times 2\frac{1}{2}" \times \frac{3}{4}"$. Mark kerf lines (see drawing, page 9) and saw $\frac{5}{8}"$ deep. Fasten a piece of twine to one end before softening the wood.

An easy way to bend the wood is to boil it over an outdoor fire. End-cap a length of gutter, balance it over the fire (or camp stove), and immerse the wood in water. Boil for about 15 minutes. An indoor method is to attach an electric kettle spout to a piece of end-capped ABS pipe with the wood inside. Steam for $\frac{1}{2}$ hour.

With gloves on, slowly bend the hot wood. Fasten the twine to the other side and tighten until the correct measurement is reached. (See drawing page 9.) Dry thoroughly. To strengthen and solidify, fill in the kerf spaces with waterproof outdoor glue. Make a trough with duct tape and slowly drip in glue until filled. When the glue has cured, sand smooth. Cut the masik to length and install.

When the deck beams are all fitted into



The ends of the gunwales come together along the flat planed surfaces and are pinned with dowels set at different angles.

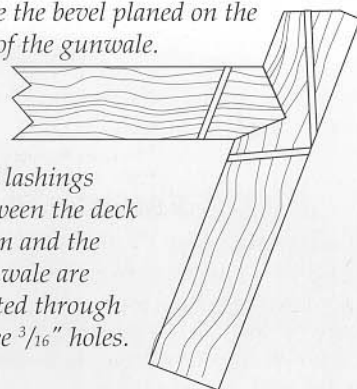
place, check the deck for symmetry. There's no going back after this step. Clamp gunwale ends together and drill three or four $\frac{1}{4}"$ holes through at varied angles. Dip dowels in glue, insert and cut flush.

Lashing the Gunwale and Deck Beams

Lashing the kayak pieces together gives the kayak flexibility to move with the waves. Where nails or screws would work their way out, lashings allow some movement.

The Inuit lashed their kayak pieces together with lengths of sealskin. Bearded sealskin was used for heavy-duty use, ring seal for general use. We will use seine twine. This tarred twine is strong and waterproof—and hard on the fin-

Note the bevel planed on the top of the gunwale.



The lashings between the deck beam and the gunwale are routed through three $\frac{3}{16}"$ holes.

gers. Pull firmly at each joint to ensure a tightly knit structure.

At each station you will drill a triangular path for the twine. (Note special requirements at cockpit deck beams.) Drill a $\frac{3}{16}"$ hole through the deck beam about 1" from the gunwale. Keep the drill bit parallel to the gunwale flare. Drill a hole through the gunwale. Keep the drill bit upright and favor the inside. The hole should come out at $\frac{1}{3}$ to $\frac{1}{2}$ the depth of the gunwale. Where the hole comes out, drill a horizontal hole through the gunwale, being careful not to hit the deck beam. Cut a notch with a chisel or knife in the gunwale top, from the hole inboard. This will provide a trough for the twine



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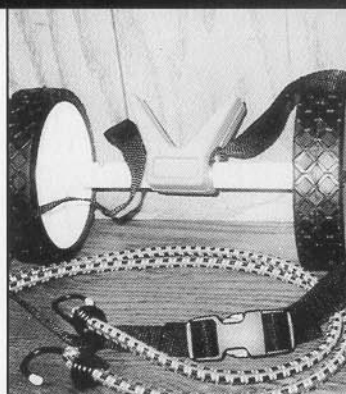
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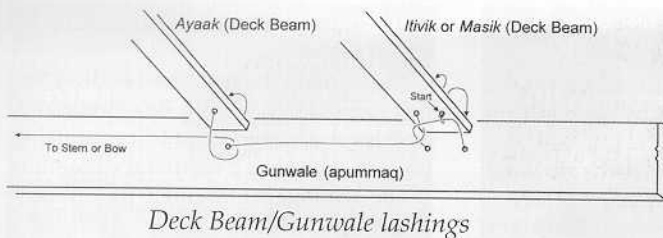
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Right: The completed deck. Note how the end of the deck stringer is tapered and beveled to fit between the gunwales.



and prevent wear in the covering.

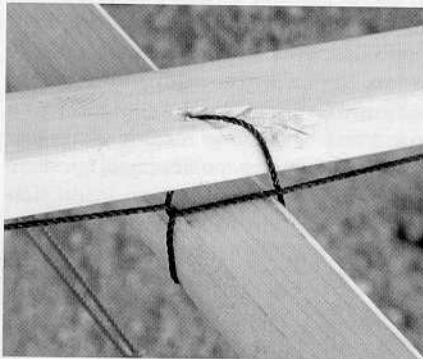
In the cockpit deck beams, drill two $\frac{3}{16}$ " holes, $\frac{1}{2}$ " in from the sides and 1" in from the gunwale. Drill 2 gunwale holes as above.

Ensure that your twine is long enough to make a continuous lashing from cockpit to bow or stern (about $1\frac{2}{3}$ the finished length). Make a loop of twine using a bowline. Run the twine through the masik or itivik from the underside, snugging the loop up to the drilled hole. Working forward from the masik, or aft from the itivik, lash the deck beams to the gunwales in one continuous line (see below). Once you master the first loop, the lashing pattern becomes self-evident. Start with a loop, go up through the masik (or itivik), over the gunwale, through the hole to the inside and through the loop. Take the twine through the second gunwale hole, over the gunwale, down through the masik (or itivik) and under the twine (as illustrated). Snug first toward the loop and then pull in the opposite direction. Continue lashing in the same manner: through to the outside of the gunwale, back to the top of the gunwale, through the deck beam, and under the twine. Make sure the lashing is snug at each station.

Preparing the Deck Stringers

Sand both deck stringers, rounding the upper edges. Thinning the forward deck stringer toward the masik will allow the stringer to follow the curve with ease. Plane from between deck beams #9 and #10 to the masik. Thickness should now be about $\frac{1}{2}$ ".

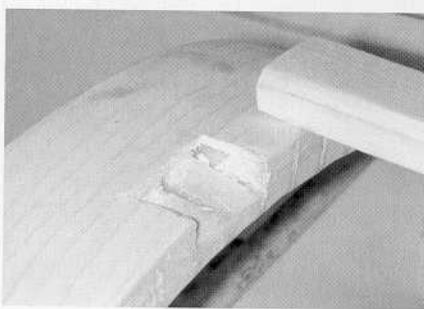
Cut the masik mortise for the deck stringer with a $\frac{3}{4}$ " chisel. Make the mortise deeper at the forward side to accommodate the angle of the stringer. When the stringer is in place, fair it with the top



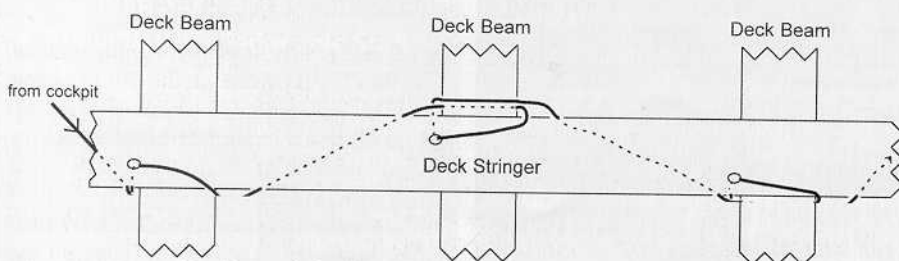
The deck stringers are secured to the deck beams with a continuous lashing. Note the notch that will keep the lashing from protruding into the skin.

of the masik. Lay the aft deck stringer in place.

Drill two vertical holes through the deck stringer and masik or itivik. At the other deck beam/stringer intersections, drill one hole through the stringer only, on the cockpit side of the deck beam. The holes should alternate, from one side of the stringer to the other. Cut shallow grooves in the stringer to lay in the twine.



The forward deck stringer will have its end tapered on the bottom to fit a notch cut into the masik.



Lashing of the Deck Beams and Deck Stringer

Ribs			
Station	Width of Bottom*	Length of Arms*	Total Length
1	2 struts	2 $\frac{7}{8}$ " (2)	3 $\frac{7}{8}$ " **
2	2 struts	5 $\frac{1}{8}$ " (2)	6 $\frac{1}{8}$ " **
3	2 struts	6 $\frac{7}{8}$ " (2)	7 $\frac{7}{8}$ " **
4	2"	8"	20"
5	4 $\frac{1}{4}$ "	7 $\frac{1}{4}$ "	20 $\frac{3}{4}$ "
6	5 $\frac{3}{4}$ "	7"	21 $\frac{3}{4}$ "
7	7 $\frac{1}{2}$ "	6 $\frac{7}{8}$ "	23 $\frac{1}{4}$ "
8	9"	7 $\frac{1}{8}$ "	25 $\frac{1}{4}$ "
9	11 $\frac{1}{4}$ "	7 $\frac{1}{4}$ "	27 $\frac{3}{4}$ "
10	13"	7"	29"
11	14 $\frac{3}{4}$ "	6 $\frac{7}{8}$ "	30 $\frac{1}{2}$ "
12	16"	6 $\frac{1}{2}$ "	31"
13	16 $\frac{1}{2}$ "	6 $\frac{1}{2}$ "	31 $\frac{1}{2}$ "
14	17"	6 $\frac{1}{2}$ "	32"
15	17"	6 $\frac{1}{2}$ "	32"
16	17"	6 $\frac{1}{2}$ "	32"
17	17"	6 $\frac{1}{2}$ "	32"
18	17"	6 $\frac{1}{2}$ "	32"
19	17"	6 $\frac{1}{2}$ "	32"
20	16 $\frac{7}{8}$ "	6"	30 $\frac{7}{8}$ "
21	15 $\frac{3}{4}$ "	5 $\frac{1}{2}$ "	28 $\frac{3}{4}$ "
22	14 $\frac{1}{2}$ "	5 $\frac{1}{8}$ "	26 $\frac{3}{4}$ "
23	12 $\frac{1}{4}$ "	4 $\frac{1}{2}$ "	23 $\frac{1}{4}$ "
24	9 $\frac{1}{4}$ "	3 $\frac{5}{8}$ "	18 $\frac{1}{2}$ "
25	3 $\frac{1}{2}$ "	3"	11 $\frac{1}{2}$ "
26	2 struts	1 $\frac{1}{8}$ "	2 $\frac{1}{8}$ "

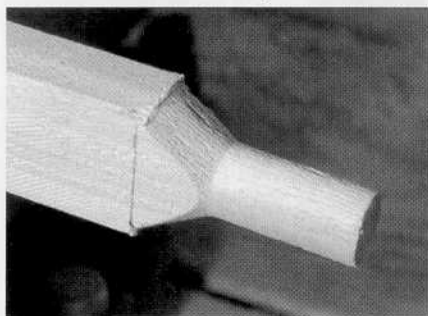
* To middle of kerfs

** Total length for each of two pieces

fair the deck stringer in place. You have now completed your kayak deck.

Ribs

Ribs can be fashioned by several meth-



This round tenon on the end of a rib was made with a tenon cutter turned by an electric drill.

ods. I prefer kerfing, steaming and bending, but three-piece ribs lashed together are an option. Inuit also bent ribs. They thinned the area to be bent with a knife, softened the wood by soaking it, and then clamped it in their teeth while slowly bending it.

With my method, $1/2$ " by 1" ribs will be kerfed and bent for stations 4-25. Stations 1-3 and 26 will have pairs of struts. Struts at stations 1-3 are lashed together. Those at 26 are not lashed.

The Inuit used a curved carving knife to cut the tenons. A simple way is to use a $1/2$ " tenon cutter attached to an

electric drill. The finished tenon is 1" long and $1/2$ " in diameter. Beginning 1" from the end, reduce the rib ends (and one end of the struts) by sanding the narrow sides.

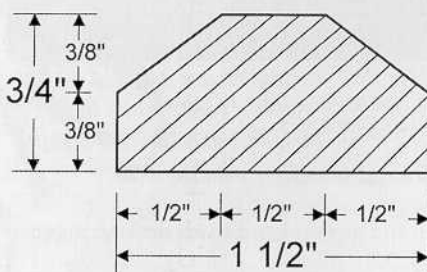
Mark kerf locations on each rib using chart measurements (on page 11). Note that measurements are from middle kerf



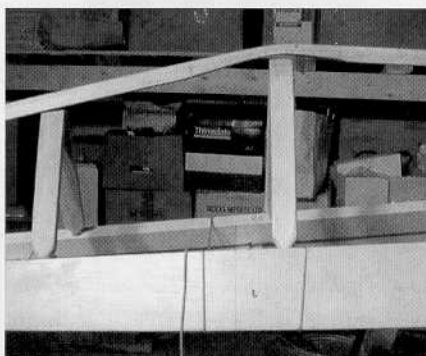
As the ribs are set into the gunwales they must be tuned to keep them flat across the middle and parallel with each other.

to the beginning of tenon. Make 3 saw cuts (kerfs), $5/8$ " apart and $3/8$ " deep.

Attach twine with a bowline to one rib tenon. Soften wood, allowing about 15 minutes if boiling, about $1/2$ hour if steaming. Wrap the twine around the other tenon to maintain tension, and bend rib slowly. While rib is still warm, insert at its gunwale location and make adjustments as needed. If rib starts to crack at the



A cross-section of the keelson showing the bevels planed on the outside corners.



The keelson is thinned where it must bend over rib #4.

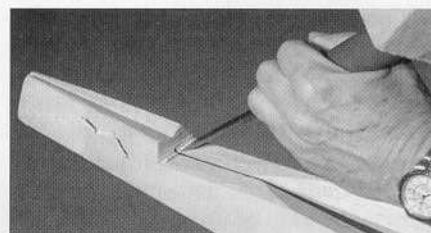
bend, wrap with waxed sail twine (see photo below).

Insert rib at each station, seating tenons firmly. Ribs should be symmetrical and level across the middle. Adjust as needed, by tying a temporary length of twine from the high bend to the opposite gunwale.

Use struts in place of bent ribs at stations #1-3 and #26. Drill two holes about 1" from the top of each strut. Insert struts into gunwales and lash together. Struts at station #26 do not meet at the top. They can float free or be lashed to the keelson.

Keelson

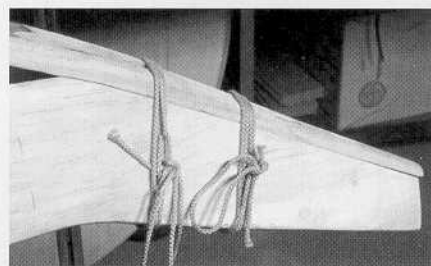
Cut 2 keelson pieces, $16' \times 1 1/2" \times 3/4"$, and $8' \times 1 1/2" \times 3/4"$. Scarf the 2 pieces



The forward end of the gunwales is notched to receive the keelson.

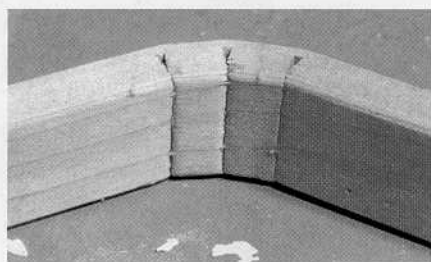
together, making a 12" scarf joint. The keelson length will be adjusted later. Trim the keelson as shown in the cross-section. The keelson needs to be thinned and then steamed for about 4" on either side of rib #4. A simple way to steam the area is to wrap it with a wet rag and place an electric tea kettle under it.

Use a rounded spokeshave to plane the



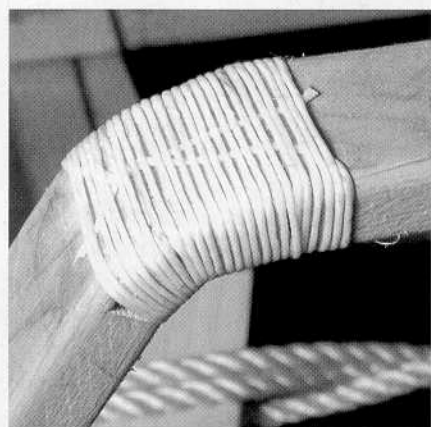
The aft end of the gunwales are planed flat and the keelson tapered before they are pinned together. Temporary lashings hold them together for drilling.

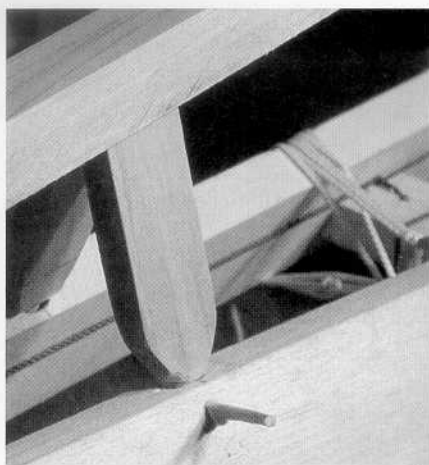
underside of the keelson on either side of rib #4. The keelson at the rib crossing should be about $1/2$ " thick. Steam the thinned area for about 20 minutes. Slowly bend the heated section to shape. You may need to fair some of the rib/keelson intersections or even replace some ribs if they get too high or low and prevent the



Above: Three saw kerfs help make the tight bends in the ribs.

Below: If the outside of the rib starts to split, wrap it with twine.



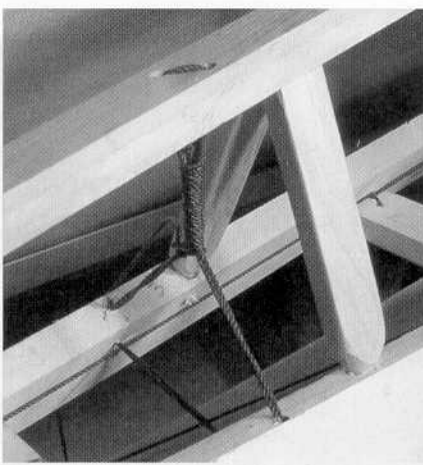


The rib tenons are pinned into their mortises with 1/8" dowels.

keelson from making contact with every rib.

Fasten the keelson securely at bow and stern. Cut a 5/8" deep notch for the keelson about 5" from the bow. Trim the keelson to fit and clamp in place.

At the stern, plane the bottom of the gunwales flat. Fit the keelson to the stern, thinning to about 3/8" thick from the bend to the end and cutting off the excess. Plane to gunwale width and glue keelson



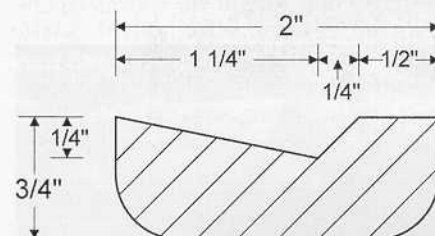
The lashings laced between the keelson and gunwales are drawn tight with turns wrapped down from the keelson.

in place. At the bow, drill two 1/4" holes through the keelson and the front stringer. Glue the keelson in place and then drive 1/4" wooden dowels dipped in glue through the holes.

Pin ribs to the gunwales with wooden dowels. At each station, drill a 1/8" hole through the gunwale and rib tenon. Insert 1/8" wooden dowels dipped in glue. Saw dowels flush both inside and out.

At each of the 3 forward rib struts, drill

3/16" holes in the gunwales as shown. The hole will come out on the inboard side of the gunwale. In the keelson, drill 2 holes, 3/4" apart and placed on the diagonal, centered over the gunwale holes. Make a shallow groove between the keelson holes. Tie a bowline in the end of the twine. Bring the other end up through the keelson holes, back through both gunwale holes and through the loop. Repeat. Wrap the twine around itself from the keelson downward to draw the lashing



Bilge stringer cross-section

tight and tie the end off around one of the two legs.

Beginning at rib #4 with a bowline, work toward the stern and lash keelson to the ribs (see lashing pattern on page 11). As with the deck stringer, cut shal-

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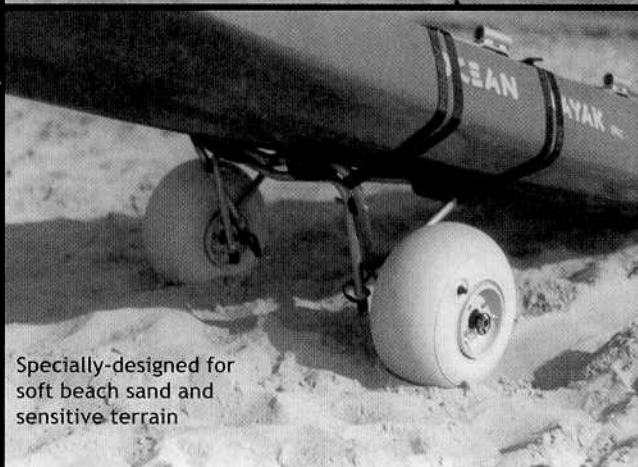
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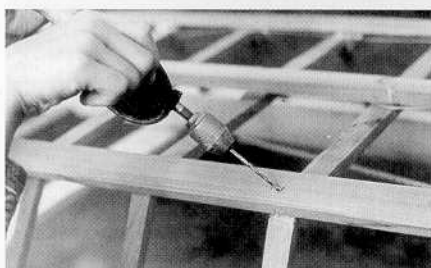


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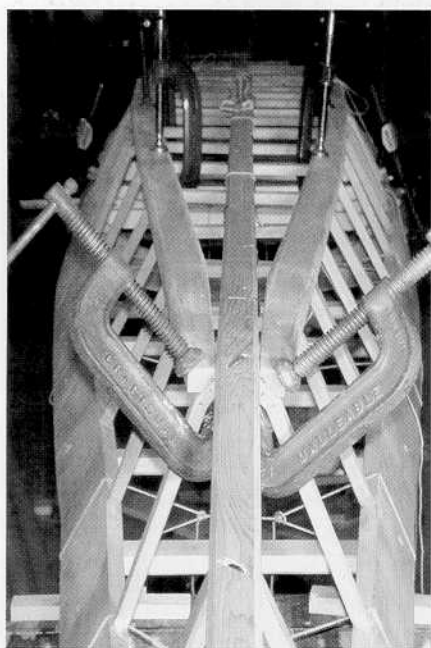
low grooves for the twine to prevent wear on the cover.

Bilge Stringers

The bilge stringers meet the keelson at rib #4. Bending and fairing them requires a gentle touch to avoid cracking the ribs or stringers. If you are lucky enough to have a pond or creek nearby, as I do, immerse the stringers for a few days to soften the wood. Work on stringers as a pair to avoid distorting the kayak shape. Clamp the stringers in the midsection



Holes for the bilge stringers are drilled at an angle, from centered over the rib on the outside to alongside the rib in the inside.



The ends of the bilge stringers are tapered at the forward end and clamped to the ribs.

and use twine to slowly draw the stringers in toward the bow and stern.

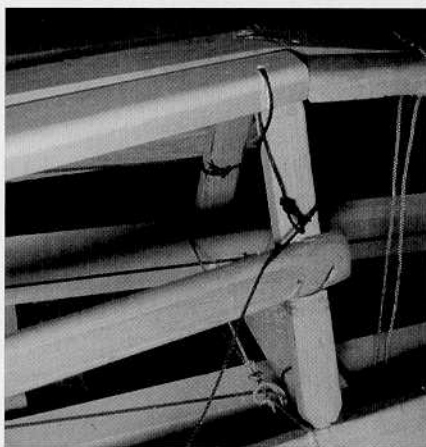
Cut the bilge stringers out of pine or cedar. Shape as illustrated. The groove fits around the bend in the rib.

Clamp both bilge stringers to the midsection and slowly draw them in to rib #4.



At the ends of the bilge stringers, the cutoffs are tapered to fair the stringers into the keelson. Note the rib struts at station 26 at the bottom of the photo.

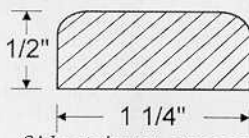
Fair the bilge stringers into the keelson at rib #4 and the stern. Use a hand saw to cut off the excess, using the off-cuts as needed for fairing. Don't force the stringer. If it's in danger of cracking, fair with the off-cuts. It will be planed to



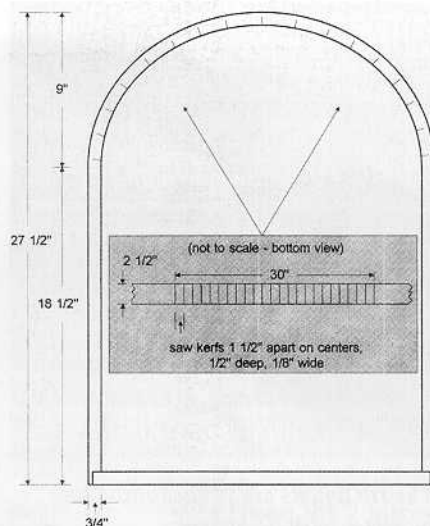
The side stringers are lashed midway between the bilge stringers and gunwales.

shape later. Clamp and tie temporarily but firmly.

You'll use the same type of lashing between the keelson and bilge stringer as you did for the deck stringer and deck beams. Drill $\frac{3}{16}$ " holes about $\frac{3}{8}$ "



Side stringer cross section



After bending, the sides of the coaming should be parallel and $18\frac{1}{2}$ " apart (inside measurement). The back piece is set into rabbets and pinned with $\frac{1}{4}$ " dowels.

to $\frac{1}{2}$ " from the edge of the stringer, alternating sides. Start at rib #4 and make a continuous lashing to the stern, using a length of twine $1\frac{2}{3}$ the length of the bilge stringer.

Remove clamps and temporary lashings at bow and stern. Fair with off-cuts as needed, glue in place and plane or sand smooth. At the bow, the stringers end abruptly. Glue fairing blocks along the keelson to fill in the area toward the keelson.

Side Stringers

Side stringers run between the gunwales and the bilge stringers from just before rib #4 to just beyond rib #21.

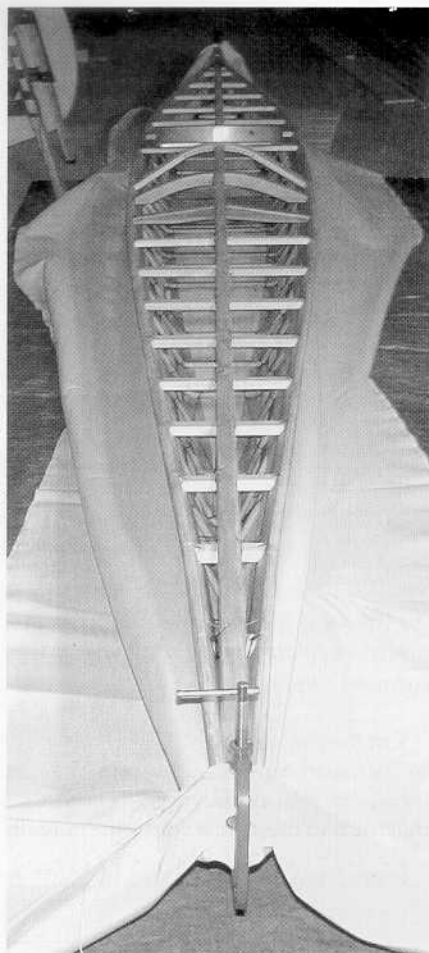
Cut and shape side stringers as illustrated. Beginning just before rib #4, fit to ribs equidistant between gunwale and bilge stringer and attach with clamps. Round both ends to prevent chafe against the covering. Lash as with bilge stringers.

Cockpit Coaming

The cockpit coaming is kerfed and bent in the same manner as the masik. You will install it later, when covering the kayak. The coaming will rest on the cockpit deck beams.

Cut kerfs, steam and bend the cockpit coaming as illustrated. Ensure sides are parallel. Trim to measure $27\frac{1}{2}$ ". Cut notches to fit end piece and glue into place.

The frame is now complete. Before covering, you may want to install a foot brace (see page 18) between the gunwales at a location that your feet will be comfortable resting upon.

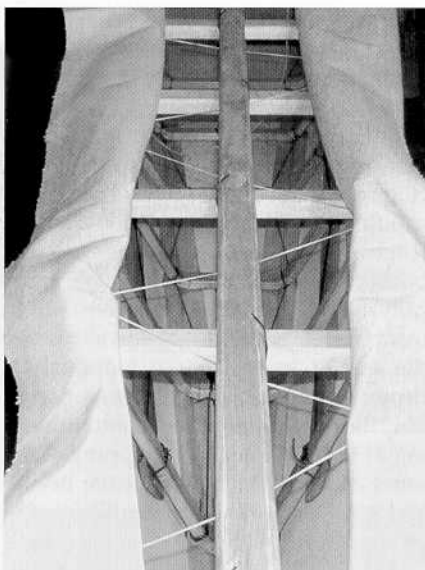


The canvas skin is stretched along the frame and clamped at the ends.

Covering the Kayak

Traditionally, Inuit in the Eastern Arctic used dehaired sealskin to cover their kayaks. A kayak covering required the skins of 4-5 bearded seal, or twice that number of smaller ringed seal. Later, Inuit used canvas.

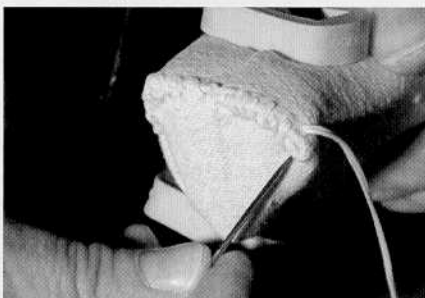
You will need 23' of 60" wide #10 canvas. Fold canvas in half lengthwise and mark the centerline with pencil. Drape canvas over the frame, with centerline at



Zigzag lacing draws the skin tight around the hull.

the keelson, leaving about 4" of canvas overlapping the bow. Fold canvas snugly over the bow stem and clamp fabric there. Stretch the canvas toward the stern and clamp it there too, holding the tension. Turn kayak frame upright.

Drape one side of the canvas over the kayak deck. Lay the canvas across the deck stringer and cut it to leave a 2"



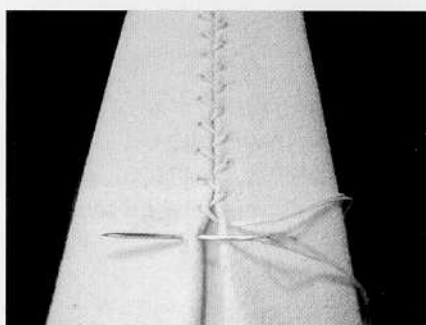
At the ends, the edges of the canvas are turned under and sewn with a simple overhand stitch.



The center seam is sewn from the ends toward the cockpit.

overlap. Repeat on other side. Canvas will now be a rough fit.

Basting the canvas sides together just above the gunwales will hold the canvas in place while sewing the skin together. Make stitches just inboard of the gunwale 1" long and then cross to the opposite gunwale at a 45° angle. Pass the thread over the deck beams and under the deck stringer, weaving from side to side. Pull



The center seam is sewn with an over-and-under stitch, drawing the canvas tight across the deck.

the thread taut to hold canvas in place at the gunwale level, but not so tight as to rip the canvas. Use a triangular sailmaker's needle, heavy waxed sailmaker's hand-sewing thread, doubled, and, if needed, needle-nosed pliers to pull the needle through. You'll need several needles.

Make a pencil line at mid-stringer the length of the kayak. This line marks the fold/sewing line. Pull canvas sides taut to fit around bow stem, folding raw edges under, and sew tightly. Fold the canvas

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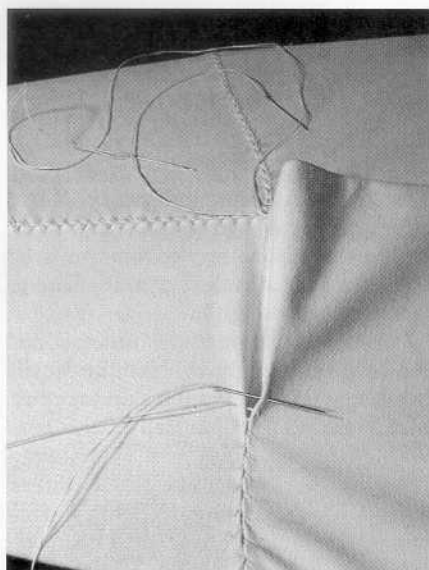
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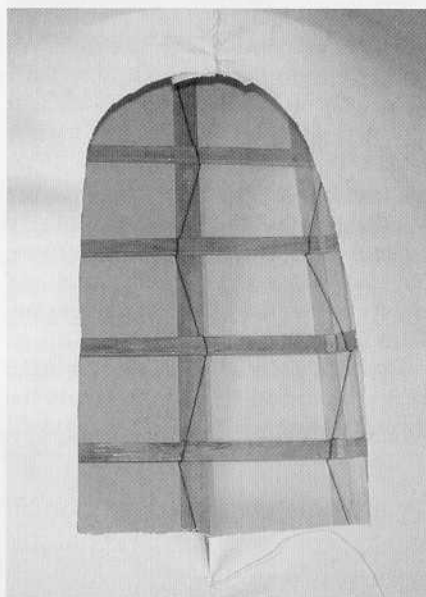
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edges under to meet at mid-stringer. Beginning at the bow, lace the canvas together as illustrated. The needle enters under the canvas about $\frac{1}{8}$ " from the folded edge. Stitches are about $\frac{1}{4}$ " apart. The seam meets at the mid-stringer pencil line with no overlapping. The canvas should have no slack, but don't let the stitch holes strain the canvas. At deck beam #4, on each side, make a hole in the canvas just aft of the deck beam, $\frac{1}{2}$ " in from the top edge of the gunwale. Insert the end of an eye-spliced loop and tie firmly to the deck beam. These loops will hold the forward deck line. Continue sewing as far as the cockpit, stopping at the inner edge of the masik. Leave needle and leftover thread dangling. There may be some ripples at the widest part. They

As you sew the center seam in from the ends the canvas will gather up ahead of the seam. To take the slack out, fold the excess fabric under (don't cut it) and sew a dart up to the center seam. You may need several darts in the stern where the gunwales have the strongest curves.

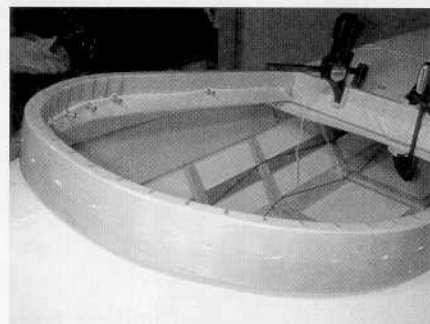


After the decks are sewn, cut an undersized hole within the area covered by the coaming.

will disappear after shrinking the cover. Begin sewing again at the stern, until the canvas begins to bunch up. The strong curves in the shape of the stern will make it necessary to put in some darts to tighten up folds in the canvas. Experiment a bit to get the best fit and angle. Using pushpins to hold the canvas to the deck stringer helps when positioning the darts. Make 2-4 darts in the canvas at the aft cockpit deck and possibly the sides to make a snug fit. Sew the darts without cutting the canvas. Finish sewing the aft seam about 2" inside the itivik. Leave needle and thread dangling.

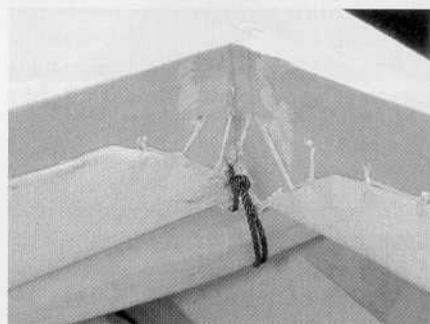
Draw a line 1" from the top, the whole way around the outside perimeter of the coaming. Mark every 2" on that line. Drill two $\frac{3}{16}$ " holes at each spot marked, angling 45° to the left and 45° to the right,

so that the other ends of the holes on the inside will be about 1" apart, 1" from the top. Lay the cockpit coaming in place. Using scissors or a sharp knife, cut a hole in the canvas in a rough approximation of the cockpit shape, leaving a margin of at least 3".



The canvas is pinned to the inside of the coaming with the edge folded under. A clamp holds the aft end of the coaming in place on the itivik.

Cut the canvas on a 45° angle to within $\frac{1}{4}$ " of the aft corners of the coaming. Fold the raw edge in toward the coaming so that the fold meets just below the holes in



After the canvas is sewn to the coaming, lashings in the corners lock the coaming to the itivik.

the coaming. To ease folding around the curve of the coaming's forward end, cut the canvas at right angles at 2" intervals. Stop the cut $\frac{1}{4}$ " before the fold line.

To seat the coaming firmly on the deck framing, clamp the forward part to the masik and make a few stitches in the flat aft section. Start at the centerline of the aft coaming and stitch through each V-shaped hole as illustrated. Fold remaining canvas to the inside at the level of the holes and fasten with clamps and pushpins. Complete sewing the canvas to the coaming.

The coaming will be under strain as you get in and out of your kayak. To prevent the cover from tearing, you need

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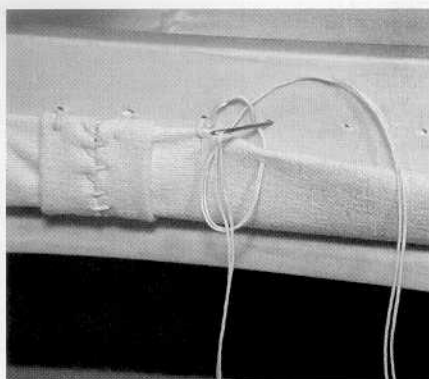
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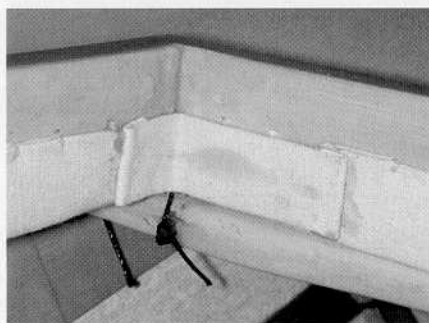
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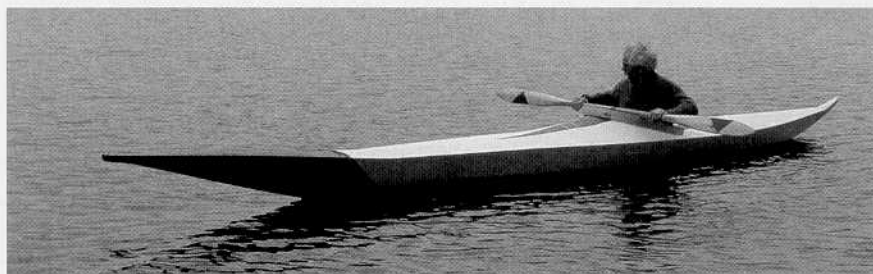
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Left: As the needle passes through the hole in the coaming, it passes over the folded canvas, then through the canvas from the inside. Then the needle is pushed through the canvas from the coaming side so that the thread running from stitch to stitch lies between the canvas and the coaming. The needle then goes into the next hole and the thread is drawn tight. The angled holes hide the thread on the outside so that it is not subject to wear.



A glued-in patch tidies up the corner.



The author takes his new East Arctic kayak out for a test run, using a Mackenzie Delta paddle.

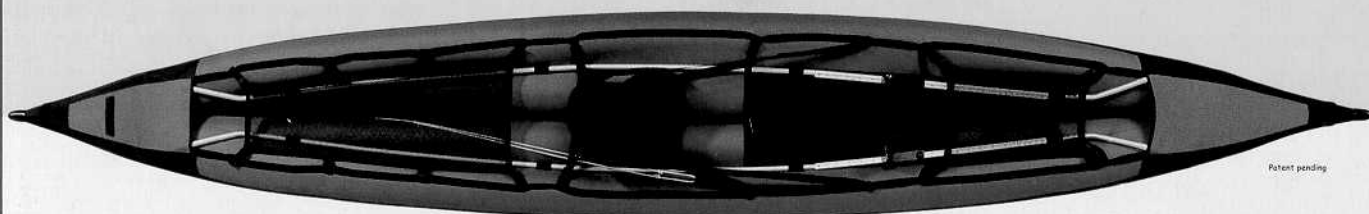
to tie the coaming down. In the aft corners of the cockpit, and in the center front, drill a hole angled to go through both the cockpit coaming and deck beam. Tie together with seine twine. Glue (contact cement) or sew patches around the aft corners and at the center forward seam.

Shrinking and Painting the Canvas

Spray the canvas top and bottom with water, soaking through the fabric. As it dries, the canvas will shrink and become taut. Working outdoors, and using a respirator, apply one coat of clear butyrate



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dope. This will permanently shrink the fabric and seal it. After the dope has dried, apply 2 or 3 coats of an exterior gloss house paint. This is your chance to personalize your finished project.

If you punch a hole in the covering the canvas is easily patched with canvas scraps and contact cement.

Accessories

You will need floor boards, deck fittings, and a long paddle. A slat seat in lieu of floorboards works well, but a padded camp seat with backrest provides some luxury.

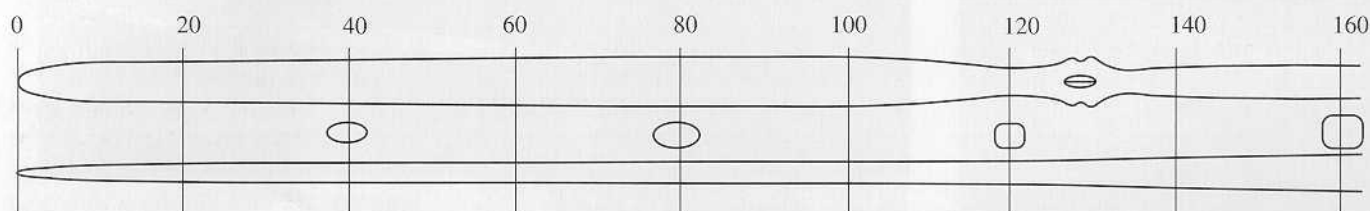
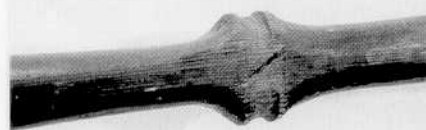


Above: The author's foot rest is supported by plastic shelving brackets lashed to the gunwales. You could use the same arrangement with brackets made of wood.

Right: A drip ring carved into the paddle.

Paddle

The East Arctic paddles were the longest, on average, of any in the Arctic. The long blades often had bone tips for pushing of ice and rock. Drip rings took many forms, including those carved into the shaft. The paddle was used with deep strokes for speed, but for cruising it was kept relatively horizontal and allowed to rest on the forward end of the coaming, sliding back and forth 8 to 10 inches during the stroke. The technique takes practice to master, but it conserves the energy otherwise used for supporting the paddle.



Paddle offsets (All figures in cm from tip to midpoint)

Stations in cm	1	3	5	10	20	30	40	50	60	70	80	90	100	110	120	127.9	128.9	129.8	130	140	150	160	166.5
Half Breadths	1.1	1.5	1.7	2.0	2.3	2.5	2.6	2.7	2.8	2.9	2.9	3.0	3.0	2.5	1.8	2.8	2.6	2.8	2.5	1.9	2.3	2.3	2.3
Thickness	1.1	1.3	1.4	1.5	1.9	2.0	2.2	2.4	2.6	2.6	2.7	2.8	2.9	3.1	3.2	3.3	3.3	3.3	3.4	3.7	4.2	4.2	4.2

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Forward cockpit deck beam: 1 @ 6' x 1" x 3"

Aft cockpit deck beam: 1 @ 28" x 1" x 3"

Temporary spreaders: 1 @ 5' x 1" x 6"

Forward deck stringer: 1 @ 11' x 1" x 2"

Aft deck stringer: 1 @ 8' x 1" x 2"

Bilge stringers: 2 @ 16' x 1" x 3"

Side stringers: 2 @ 11' x 1" x 2"

Keelson: 1 @ 16' x 1" x 2"; 1 @ 8' x 1" x 2"

Ribs: 35 @ 32" x 1" x 1/2" (max. finished size)

Cockpit coaming: 1 @ 5' x 1" x 3"

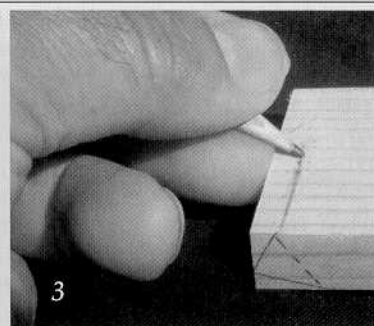
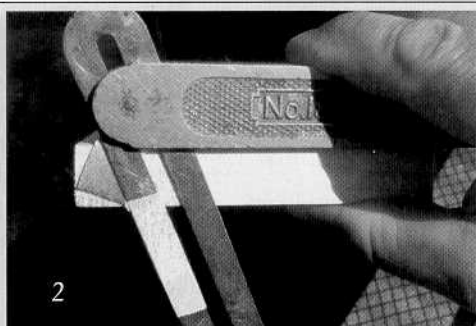
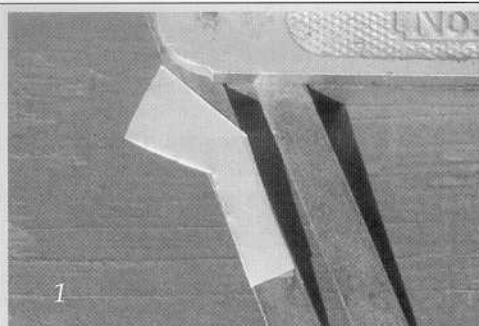
(Bending oak, ash or yellow cedar may be used for the ribs, coaming, and mask and steam-bent without kerfs. Some thinning of the piece in the area of the kerfs will help tighten the radius of the bend. Experiment with some scraps.)

Other materials

Tarred nylon seine twine #30 (Industrial Marine Marketing, 10 High St., Building 12, Wakefield, RI 02879 USA), 23' x 60" #10 canvas, 1/4" hardwood dowels, 1/8" hardwood dowels, waterproof glue, white waxed polyester handsewing thread, clear butyrate dope, thinned 1:1 with butyrate reducer (Poly-Fiber—www.polyfiber.com—or Aircraft Spruce Specialties—www.aircraftspruce.com), exterior gloss house paint.

The tenon cutter used was the 1/2" Veritas mini tenon cutter: www.leevalley.com





Marking and Cutting the Mortises

In the process of editing this article, I used David Zimmerly's instructions to build a 1/4-scale version of the East Arctic kayak. To speed up the process of marking and cutting the tenons, make a pattern of thin metal for the V-shaped tenon. The pattern (photo #1) is a right-angled isosceles triangle with a tab running parallel to the triangle's hypotenuse. The triangle must be slightly taller than the mortises in the gunwale are deep. Tape the pattern to the outside of the sliding arm of the bevel gauge.

Cut the deck beam stock to length fol-

lowing Zimmerly's table. To get the bevel across the wide face of each deck beam, set the deck beam piece on top of the gunwales directly over the mortise. The corner of the deck beam should be at the inside face of the gunwale. Trace along the bottom face of the deck beam and the inside face of the gunwale. Saw the end along that line. With a piece of scrap set across the gunwales and lined up over the cockpit-facing end of each mortise, use the bevel gauge to get the angle between the outside face of the gunwale and the scrap across the top.

With the bevel gauge set for each deck

beam location, hold the bevel gauge on the deck beam stock and set the tip of the triangle at the edge of the deck beam. See photo #2. It is not critical where the point falls along the edge as long as both ends of the deck beam are marked the same.

Draw lines on the top, bottom and end of the deck beam parallel to the edges that you have to cut. You could use a marking gauge to draw these lines, but I just hold a pencil between my thumb and index finger and slide my middle finger along the work piece as shown in photo #3. These lines will serve as guides as you plane, saw or sand the faces of the tenon.

Christopher Cunningham

From 1971-1982, David Zimmerly was the arctic anthropologist with the National Museums of Canada, now called the Canadian Museum of Civilization. He is the author of Hooper Bay Kayak Construction and QAYAQ: Kayaks of Alaska and Siberia. David has a web site of interest to builders of traditional kayaks: www.arctickayaks.com. He and his wife Helga live in Perth, Ontario, Canada.

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