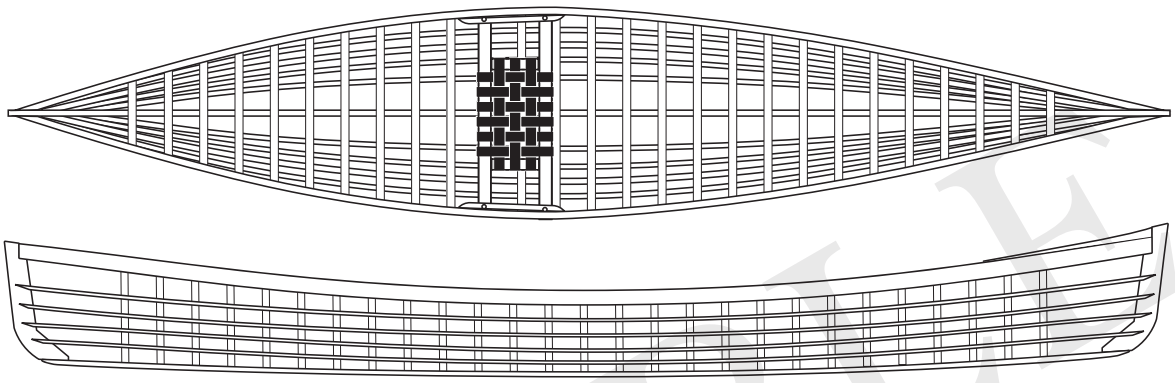
CAPE FALCON KAYAK

Building the 66 Canoe

CUSTOM SKIN ON FRAME CANOE BUILDING SYSTEM

VERSION 2.2 OCTOBER 2023



Originally envisioned as a lightweight double-paddle canoe, the 66 Canoe evolved into a complete building system, capable of making larger canoes as well. The 66 building system gives you the freedom to change many aspects of the hull shaping with easy-to-follow instructions, predictable results, and without the need to build time-consuming canoe molds or a strong back. We offer a range of tested canoe designs as well as advice and support for designing your own canoe.

FEATURES:

- The "balanced tension" design of the 66 canoe doesn't require permanent thwarts, allowing you to dynamically trim the boat while paddling, easily adjust for different gear configuration, steer the boat with weight-shift under sail, or just lay back and stare at the sky.
- The canoes can be rapidly catamaran-ed together for a fun, stable, paddle-able, sail-able platform.
- A safe, simple, downwind/crosswind sail built into the design lets you take advantage of favorable breezes and still have a clean, uncluttered canoe.
- An easy to build outrigger and oar set transforms any canoe into a small rowboat.
- The 66 can be nested together like Russian dolls, allowing you to transport and store two or more canoes in the same space as one.
- A pedal drive version that allows the drive to be completely removed, so the boat still be paddled as a normal canoe

Lightweight, simple, versatile, sizable, this is the 66 canoe.

These plans accompany our online instructional video course. Together, they will give you everything you need to know to complete your canoe. **The build should take between 40 and 70 hours per canoe, depending on your experience level and the canoe size.**

CONTENTS

Support for your build:

Feel free to contact us at any time for help or advice but please review ALL relevant videos and plan pages before reaching out.

I usually respond fastest via text (unless I am away from cell service) and email is also fine:

Phone / Whatsapp: 503-354-4939

Email: brian@capefalconkayaks.com

What's in a Name

One of the big ideas behind developing this canoe was that we wanted it to be less expensive and easier to build than a kayak. When we were done, the pack canoe version was almost exactly 2/3 — 66% — of the time, cost, and weight of a skin-on-frame kayak, so we decided to name it the 66.

The Legal Stuff

Both woodworking and canoeing are inherently dangerous. It is your responsibility to obtain the appropriate training for any tool used in the building process, and the paddling skills necessary to operate your boat safely.

By purchasing this plan set and video course, you agree to indemnify, defend and hold harmless Cape Falcon Kayak, its officers, agents and employees for, from and against any and all claims, liability damages, losses and expenses, including reasonable attorney fees, for any claim, cause of action, demand, personal injury or death or damage to any propery or person arising out of or in any way connected with the products purchased.

GETTING ORIENTED

This plan set is designed to work in conjunction with our Canoe Building video course. All the information you need for the planning stages is presented first, followed by materials and tool selection. Methodically working through the information in the plans AND the videos will give you a solid foundation for your build. The Index at the end of this plan set includes a list of all the videos in the course for quick reference.

You can find many canoe building supplies in our store and guidance in the plans for where to purchase materials that we don't sell.

GETTING SUPPORT

If you need help at any time, feel free to contact Brian via email or phone. Text is a fast way to get questions answered.

Phone / WhatsApp: 503 354 4939
Email: brian@capefalconkayaks.com

The Cape Falcon Kayak Facebook group is a great place to connect with other builders, and is often a good place to go for advice:
facebook.com/groups/capefalconbuilds

The Student Builds blog on our website is a fantastic resource, especially for our builders outside the United States. Builders receive a notification if you comment on their posts, and are often happy to answer questions:
builds.capefalconkayaks.com

Finally, the @capefalconbuilds Instagram page is a great place to go for inspiration, information, and a ton of really cool short videos:
instagram.com/capefalconbuilds

TIPS FOR A SUCCESSFUL CANOE BUILD

1. Spend the money for good bending stock

Most of the canoe builds that I see go poorly happen because someone was trying to bend poor quality wood for the ribs because they didn't want to spend the money on quality bending stock. This results in a LOT of frustration and sometimes tippy canoes because they weren't able to get the bottom flat enough. Watch the videos and read the materials in the course for details on what makes good bending stock.

2. Don't be afraid to ask for help or sizing advice

Your access to this course includes a sizing consultation with me and ongoing support during the build. When reaching out for an initial sizing recommendation, tell me how tall you are, how much you weigh, your level of canoeing experience and how you see yourself using the canoe.

3. Watch and follow the instructions.

The videos are long, I get it. But everything I say relates to a mistake I have seen someone make in the past. The point of this whole course is to help you skip all the common skin-on-frame building mistakes, but I can't help you do that if you don't watch the videos, follow the instructions, or reach out for help when you need it!

4. Believe me when I say things.

For example, I say to clamp the stringers and keel onto their ribs right after bending and lash ASAP to lock in the shape. I've seen multiple people decide they didn't need to do this, wait a week or more, then add the stringers. The result? An uneven shape and a tippy canoe that is too round on the bottom. If I'm emphasizing a step, *there's a reason!*

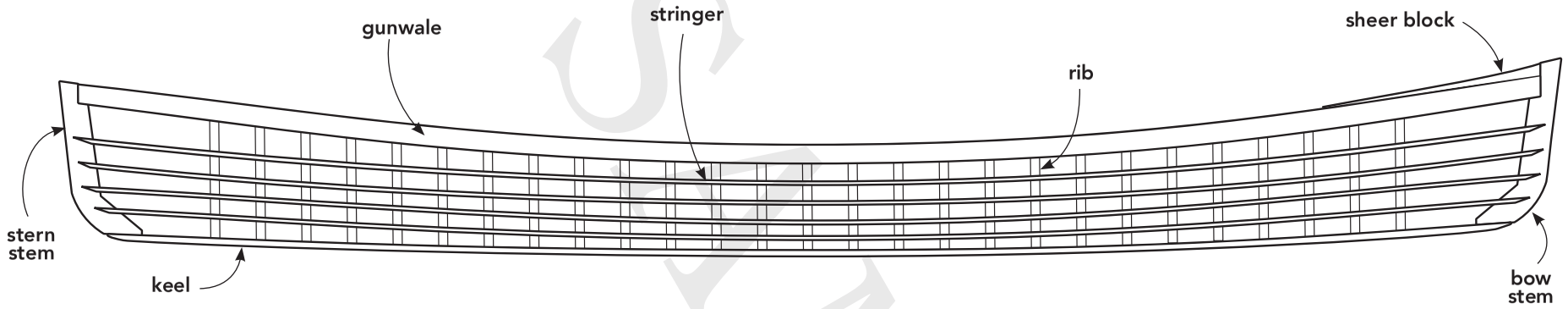
5. Consider starting small

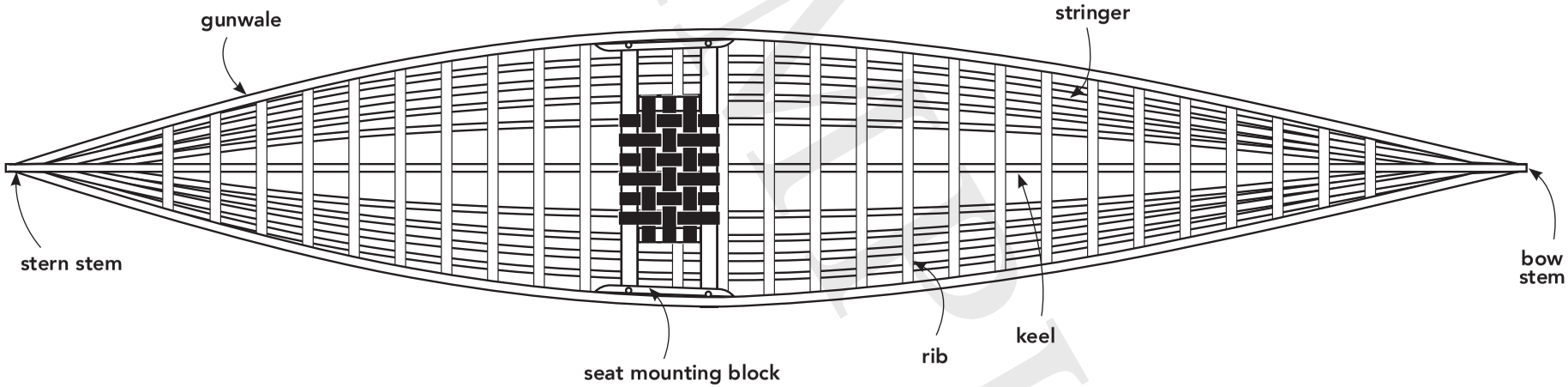
Before you dive into a full size tandem, consider starting with a pack or double-paddle canoe. Smaller canoes are significantly easier to build with our system, and will give you valuable experience that will help a lot with a larger build. You can laminate both sets of gunwales at once to save time.

6. Take the time to set up a decent work space and gather all your materials before you start building.

Not only does this make a nicer building experience, it also minimizes errors and makes the build go a lot faster.

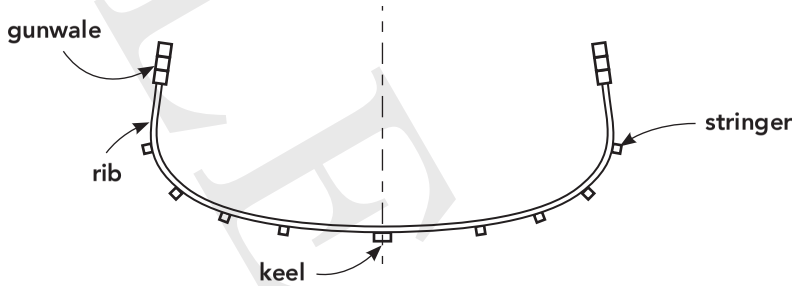
Alright, that's it for now. Good luck. Watch the videos. Read the plans. Text or email if you need help. —*Brian*





NOTE: Different sizes of this canoe have different numbers of ribs and stringers. Frame dimensions have also been altered to better illustrate parts of the canoe.

DO NOT SCALE off this drawing.



Before you purchase your lumber you'll need to decide what sort of canoe you want to build. Different types and sizes of canoes have advantages and disadvantages. The following pages may help you decide on the right canoe for you, but if not, feel free to email or text anytime for a custom recommendation.

DOUBLE-PADDLE CANOES

Double-paddle canoes are paddled sitting on the bottom of the canoe with a kayak paddle.

Shorter Double-Paddle Canoes (typically called Pack Canoes)

10 to 13 feet long, 25 to 30 inches wide, and 9 to 11 inches deep in the center

Advantages: The ultimate in light weight and portability at 14–22lbs, pack canoes allow access to remote launch sites and portages that would be difficult for any other watercraft. They have just enough volume for weekend camping, although ultralight packers often use them for weeklong trips. They are very efficient at typical canoe cruising speeds of 3mph due to their extremely low wetted surface, and sail the best of all our canoes because the sail is better balanced at shorter lengths and the weight of the paddler puts more of the boat underwater, resisting side slipping and allowing you to sail across the wind faster than you can paddle.

Disadvantages common to all double-paddle canoes: Because the paddler sits in the bottom of the boat, all double-paddle canoes need to have fairly low sides to allow for elbow clearance. This means that steep waves can swamp the boat. Having said that, canoes in general perform poorly in rough open water conditions, so if you want to paddle in rough waters, build a kayak instead.

Double-paddle canoes perform best with very long paddles that have short, small, blades to avoid annoying paddle drips inside the canoe. Long paddles can be quite heavy though, which means that for optimal enjoyment you might have to spend a fair bit of money on a carbon fiber paddle. (We suggest 250cm for canoes narrower than 27.5" and 260cm for canoes wider than that.)

Disadvantages specific to shorter double-paddle canoes: Pack canoes are less stable than longer double-paddle canoes of similar width because there is less "wide part" of the boat overall to add stability. They also have less margin between the ideal weight of the paddler and the maximum capacity. When you see maximum capacity listed, think of that as occasional cargo, not a recommended paddler weight.

Longer Double-Paddle Canoes

13 to 15 feet long, 25 to 30 inches wide, and 9 to 11 inches deep in the center

Advantages: Longer double-paddle canoes are still relatively light at 23–30lbs, but can carry significantly more cargo weight and are more stable. A large paddler who might feel tippy in a pack canoe will often feel stable in the same width of canoe if it is a few feet longer. Experienced paddlers can shift from a sitting to a low kneeling position. These canoes also have a higher top speed, which is typically irrelevant for touring, but can be nice if you are paddling hard for fitness. These canoes also sit a little higher in the water, making them a bit more seaworthy in capable hands.

Disadvantages specific to longer double-paddle canoes: All the same common disadvantages for double-paddle canoes apply. Additionally, these canoes are longer and heavier, making them less portable. The sail system still works, but because it sits relatively farther forward and the canoe sits higher in the water, it works best downwind and cannot sail across the wind like our shorter canoes.

FULL SIZE CANOES

Full size canoes are paddled sitting up on a seat or on a kneeling thwart with a canoe paddle.

Full Size Solo Single-Blade Canoes

14 to 16 feet long, 28 to 33 inches wide, and 11 to 13 inches deep in the center

Full Size Tandem Canoes

16 to 18 feet long, 34 to 37 inches wide, and 12 to 15 inches deep in the center

Advantages of all full size canoes: Full size canoes have huge cargo capacity, making it possible to pack more like a rafter and less like an ultralight backpacker. They can handle larger waves, and the paddler sits up on a seat which some people find more comfortable. Good quality canoe paddles are much less expensive than good quality kayak paddles. Solo canoes can also be paddled with a kayak paddle and often soloists will carry one for when conditions make single-blade paddling difficult.

Disadvantages: Because the paddler sits up on a seat, full size canoes need to be wide to be stable. This makes them much larger and heavier. Our full size canoes aren't much heavier or much lighter than any well-built carbon or kevlar canoe. They are FAR MORE impact resistant than lightweight composites, and somewhat less abrasion resistant. Puncture is possible but is extremely rare. With a heavy skin they can achieve durability similar some of the tougher modern composites, although at a similar weight. What we are saying is that there is no free lunch here: skin-on-frame canoes aren't "better", they are just a different way to build a canoe.

Our system works best when used to make shallower canoes with zero to moderate tumblehome. In this case, shallow would mean around 12 inches deep for a solo and 13 inches deep for a tandem. A bit of tumblehome is possible, but if you want more than two inches, this isn't a good system for it.

Important Note: All example sizes are listed BEFORE adding tumblehome, which subtracts up to 2 inches of width at the gunwale and 1 inch of width overall. For example, a canoe listed at 30 inches wide will actually be 29 inches wide overall and 28 inches at the gunwales with 2 inches of tumblehome added.

CANOE LENGTH OPTIONS

For proper shaping, we try to maintain an approximately inch spacing from the last rib to the end of the gunwale. Because of that we are limited to increasing or decreasing the canoe length in 5 inch increments. Depending on your desired canoe length, the center of your canoe will either fall on top of a rib or between a pair of ribs. The following table shows a range of possible lengths, but keep in mind this is not exact and lengths can be changed a little if needed.

Center of canoe centered on a rib

11'-0"	21 ribs	**14'-8"**	29 ribs
11'-10"	23 ribs	**15'-6"**	31 ribs
12'-8"	25 ribs	**16'-4"**	33 ribs
13'-8"	27 ribs		

Center of canoe centered between two ribs

11'-5"	22 ribs	**15'-1"**	30 ribs
12'-3"	24 ribs	**15'-11"**	32 ribs
13'-1"	26 ribs	**16'-9"**	34 ribs
14'-3"	28 ribs		

SIZING FOR NESTING CANOES

To nest or not to nest, that is the question. Being able to put one boat inside of another is pretty neat, and potentially very useful. However, if you decide to go this route, there is usually a bit of compromise involved. To give an example: if I were building ideal double-paddle canoes for Liz and myself at 140 and 160 lbs, I would want both to be inches wide, with mine being and hers being . (Unless we were really focused on cross wind sailing, in which case I'd go a foot shorter on both). Obviously these canoes cannot nest together, so I have to make hers narrower and mine wider, making her boat better for a 130 lb person and mine better for a 200lb person.

Another example of the nesting compromises in solo single-blade canoes: Ideally I'd like my canoe to be and inches wide, and Liz's to be and inches wide. Obviously these won't nest together, so we have to go x on hers, and x on mine.

To take advantage of the nesting feature, double-paddle canoes must have inch difference in width and at least inches difference in length (we recommend inches). Nesting full size single-blade canoes with fixed seat locations must have inches difference in width and inches difference in length for an angled stem or 12 inches difference in length for a curved stem. The sizes below are just some examples to illustrate nesting geometry. Nesting geometry often forces compromises that we wouldn't make in non-nesting canoes! Depending on whether you are camping or not, paddling flat water or moving water, we might recommend different aspect ratios, depth rockers, sheers, etc. Feel free to email for a custom sizing recommendation.

Recommended Length x Beam
Ideal Paddler Weight / Maximum Weight Capacity

	S	M	L	XL
Pack Canoe	110 lbs / 150 lbs	125 lbs / 200 lbs	175 lbs / 250 lbs	225 lbs / 275 lbs
Touring Double-Paddle Canoe	125 lbs / 200 lbs	150 lbs / 250 lbs	200 lbs / 275 lbs	235 lbs / 300 lbs
Single-Blade Solo Canoe		125 lbs / 240 lbs	175 lbs / 350 lbs	225 lbs / 400+ lbs
Single-Blade Tandem Canoe		275 lbs / 400 lbs	350 lbs / 500 lbs	

Again, these are just examples and many other configurations are possible. By laying out the gunwales with the center of the canoe between — rather than centered on — a pair of ribs, intermediate lengths between these sizes are possible.

To understand this tool kit better, please watch the Tools video in the course. Prep work will be easiest with access to the common tools in any woodworking shop, but if necessary some substitutions can be made. See the video course for how we use these tools and feel free to substitute anything you need to as long as you can still perform the tasks safely.

Large tools can often be borrowed, or time rented in a woodworking shop.

RECOMMENDED POWER TOOLS

Tool	Used For	Substitution	Substitution Disadvantages
Tablesaw with thin kerf rip blade	*ripping wood*	Circular saw	*very difficult to rip wood accurately and safely*
Thickness planer	*thinning boards*	Handheld power planer OR tablesaw	*harder to thin stem pieces and bending wood blanks*
Minimum ¾ hp bandsaw with 4T blade	*cutting stems and angles on sheer blocks*	High quality jig saw	*rarely cuts square*
Plunge router with ¼" spiral upcut bit	*cutting rib mortises*	Power drill and mortise chisel	*slow and labor intensive*
Sliding compound miter saw	*miscellaneous crosscutting tasks*	Regular miter saw, circular saw, handsaw	*works fine, just not as easy*
12v drill and driver	*various uses*	Hand drill?	*have fun with that...*
Wallpaper steamer	*steambending wood*	Hot plate and kettle OR pressure cooker	*= less safe, less steam = harder to use*
Hot knife fabric cutter (cheap is fine)	*cutting the nylon canoe skin*	Soldering gun with cut tip OR propane torch and knife	*= doesn't work as well = a bit dangerous*
Trim router (optional)	*beveling/rounding stems & inside top edge of gunwale*	block plane	*cannot cut inside curves*

SAFETY REMINDER: It's your responsibility to get proper training when working with any woodworking tool. Sometimes the most innocuous tools can cause the most serious injuries — be careful with Japanese saws and chisels! Also, it's always a good idea to wear ear, eye, and respiratory protection.

RECOMMENDED HAND TOOLS

Aggresive pull saw *(I recommend the Bear Saw 333C)*

Japanese saw *(I recommend the Gyokucho 770-3500)*

Low angle block plane
(I like the old Record or Stanley 60½ planes, undecided on newer planes. Most block planes do not come with sharp blades, so blade will need to be sharpened)

2-inch opening metal spring clamps
52 for a 13 foot or shorter canoe, 56 for 14 foot, 60 for 15 foot, or 64 for 16 foot. Can be found for $1 apiece at Home Depot.

3 ea medium size engagement clamps
(12- or 18-inch Irwin Mini Quick Grip works well)

1-inch chisel *(chisels will also need to be sharpened)*

Slickplane brand or another 1/8 inch radius plane

hammer

pliers

scissors

T50 staple gun

anvil pruners (*quick way to cut dowels)*

combination square

sliding bevel

torpedo level

tape measure

tailor's tape

pencils

pencil sharpener

couple of Sharpie markers

2 ea cam straps, 9 foot or longer

2 spray bottles filled with water for skinning the canoe

DRILL BITS

1/8 inch bit with countersink

5/32 inch for lashing holes

1/8 inch, 3/16 inch, and 1/4 inch for dowels

Dowels are often under- or oversized so it's a good idea to measure your dowel stock with a caliper. Ideal dowel fit is between 0 and 1/128 inch smaller. 1/64 inch smaller can split the wood. So for example, if my dowel measured exactly ¼ inch I'd buy a size C drill bit which is just slightly smaller, or if my dowel measured 1/128 inch under, I'd use a 15/64 inch.

SAFETY EQUIPMENT:

safety glasses

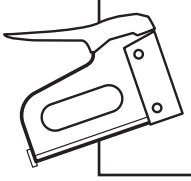
ear protection

respirator

work gloves for steam bending
(I prefer the thinner cotton ones with the rubberized grip)

Dial calipers aren't absolutely necessary but are very helpful for many small measuring tasks, such as matching dowel and drill bit sizes and cutting ribs exactly to thickness (very important!) iGaging sells a decent quality caliper for $36. Always check that your caliper is zeroed before measuring!

Chisels and plane will need to be sharpened. I personally use a Norton 1000/4000 water stone and a cheap honing guide.Watch the sharpening video for details.



Consider a powered staple gun When stapling the skin to the gunwales you'll be using almost as many staples as your canoe is long in inches (roughly 180 staples for a 16 foot canoe). You can certainly do this with a normal staple gun but if you have access to an electric or pneumatic staple gun, the process is a lot easier. The same is true if you plan to make your own canoe seats, because it can be quite challenging to hand staple the webbing into hardwood.

The following materials list is per canoe, however, many of these supplies will cover multiple canoes. We've placed a dot (•) at the front of any item that can be used for multiple boats.

Supplies for seat building, self-rescue, and catamaran attachments are listed in those sections of the plans.

MISC. WOOD

- Birch or other well made dowels:
  1 ea: 1/8 inch, 1/4 inch, 1/2 inch
- 1 ea 4' x 4' sheet of 3/8 inch to 1/2 inch medium-grade plywood to build steam box, forms and jigs
- 1 ea straight 2x6, 2x8 or 2x10 framing lumber as long as the canoe for layout surface, jigs, and forms *(2x10 works best!)*

  1 ea standard framing lumber 2x4x8 to build spreader forms, rib rounding jig, and misc. steambox parts

MISC. HARDWARE AND FASTENERS

100 ea #6 x 3/4" stainless steel flathead Phillips screws for attaching rub rail *(more for longer canoes)*

- A handful of 1 1/4", 1 5/8", and 2" plain wood screws *(misc uses)*
- Box of 3/8" stainless steel T50 staples for your staple gun

LASHING, TYING, AND SEWING

2 ea 4oz (or 1 ea 16oz) roll of flat artificial sinew * °
(1 roll is enough for a small pack canoe. Used in leatherwork, taxidermy & tie dye, check leather or craft shops)

- 1 spool of extra heavy nylon upholstery thread *
- 1 "combo" needle pack with curved and straight needles *

SKIN AND COATING

See p. 17–18 for details on skin, coating, and coloring options

ballistic nylon fabric ° *order 1 foot longer than length of boat*

Spirit Line 2-part polyurethane system ° *(see p.31 for amount)*

Jacquard acid dye *° or earth pigments *°

- Box of push pins

DISPOSABLES

10+ pairs disposable nitrile or vinyl gloves

plastic mixing cups (see coating setup video)

- ordinary plastic cups

2 ea 2-inch chip brushes

4 ea 4-inch high quality foam brushes
(such as Jen Mfg. brand)

1 ea 4-inch roller frames and 4 foam rollers
(2 rollers come in Spirit Line polyurethane kit)

2 ea 4-inch roller trays, *see video*

1 quart Watco Danish Oil, Corey's Pine Tar Boat Sauce °, or your coating of choice

Total Boat Gloss water-based varnish or your varnish of choice. 1 pint for double-paddle or solo canoe, 1 quart for tandem or pedal drive canoe

2 sheets each 120 grit and 220 grit sandpaper

- 18oz Gorilla Glue
- 1 roll each of 3/4-inch and 2-inch masking tape
- A handful of 8 inch long zip ties

OUTFITTING

Narrow-saddle stainless pad eye for bow loop and 2 ea #6 1-1/4" flathead phillips stainless steel screws *

Therm-a-rest Ridgerest Classic pad R
(seat pad/floor mat)

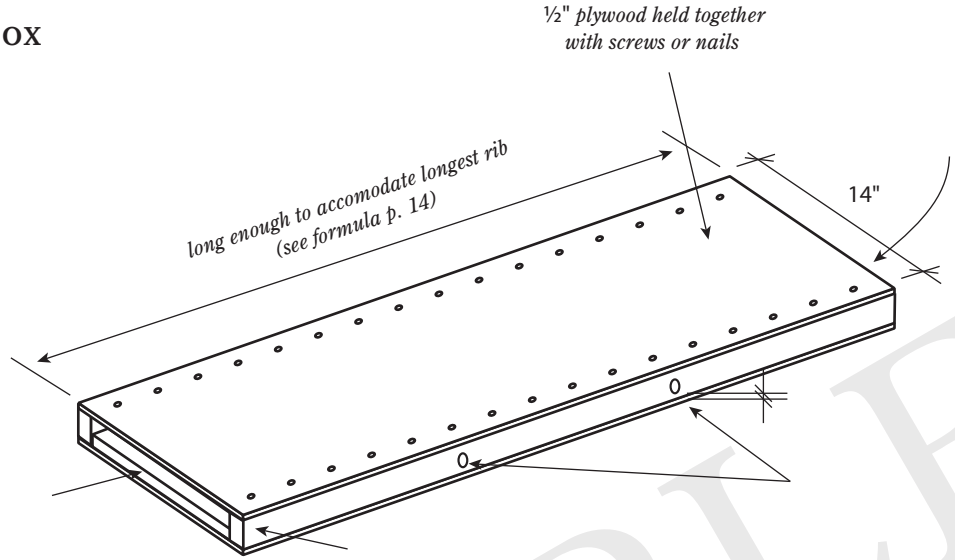
canoe seat of choice for full-size canoes

2 ea 4 inch+ diameter solid "pool noodles" for flotation in pack canoes
(*a good option is the 70" polyethylene cylinders from thefoamfactory.com/closedcellfoam/polyethylene.html)*

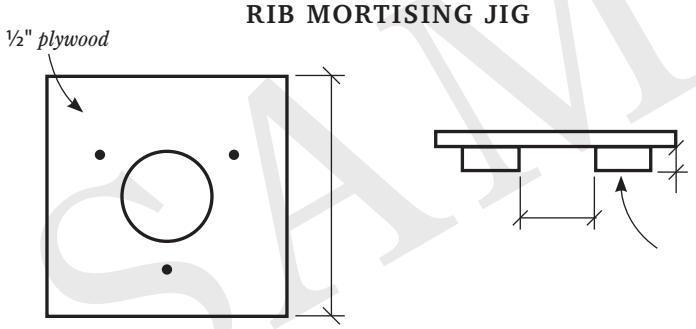
100 feet of parachute cord for tying in flotation

available at:
- * **capefalconkayaks.com**
- ° **skinboats.org**

STEAMBOX

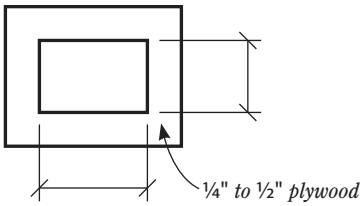


PLUNGE ROUTER RIB MORTISING JIG



CAPTURE FORMS

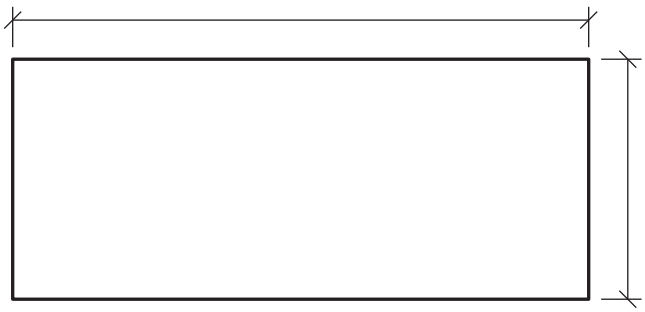
Build 2 per boat



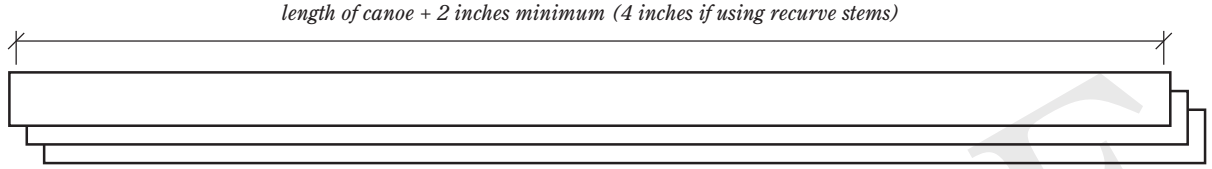
SEAT DRILLING TEMPLATE

Leftover plywood can be used later as a drilling template for the seat mounting holes on full size canoes. The template will ultimately need to be exactly as wide as your canoe seat and as long as the canoe is wide in your seating location.

See video: *Setting up for Installing Canoe Seats: Jig Method*, for more details.



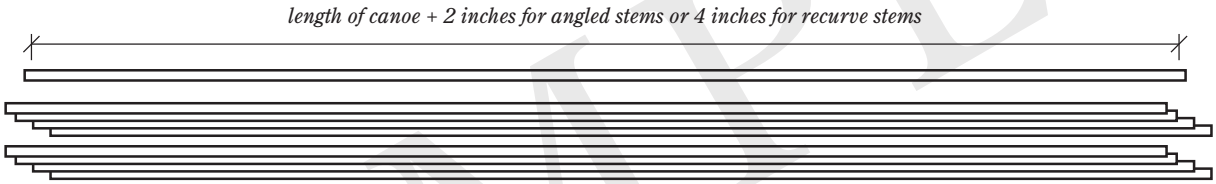
The amount and length of wood you'll need depends on the size of the canoe you're building. Generally the wood for the gunwales and stringers should be at least 2 inches longer than your planned canoe length. Any long, knot-free straight-grained soft wood will work (spruce, soft pine, fir, yellow cedar, red cedar, etc.) but Western red cedar is significantly lighter than the others. For tandem canoes I don't use Western red cedar because such a long canoe needs the extra strength and stiffness of heavier woods. There are many possible combinations of wood that the parts can be sawn out of, below are just some examples.



LAMINATED GUNWALES

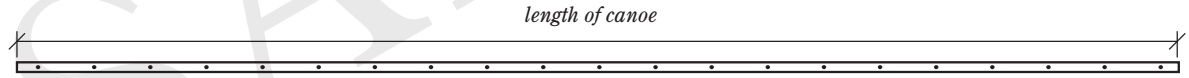
The canoe is built with softwood gunwales cut from 3 ea 1x boards and laminated into a curve.

board width:
wide for 1 canoe
wide for 2 canoes



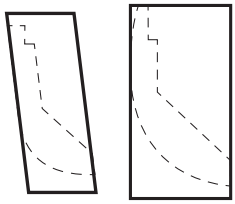
STRINGERS + KEEL

You will need 4 or 5 stringers per side and a keel, see the *Sample Lay Ups* page for exact cross sections.



RUB RAILS

Rub rails are made from x inch split resistant, rot-resistant hardwood. Ash or cherry are both good choices, but ash is stronger. These are piloted with a inch bit and a countersink to accept -inch flathead stainless steel screws , and inch in from the ends. Continuous lengths are desirable, but longer canoes usually use two pieces per side, split in the center of the canoe. We recommend coating them with five coats of varnish.



angled stem recurve stem

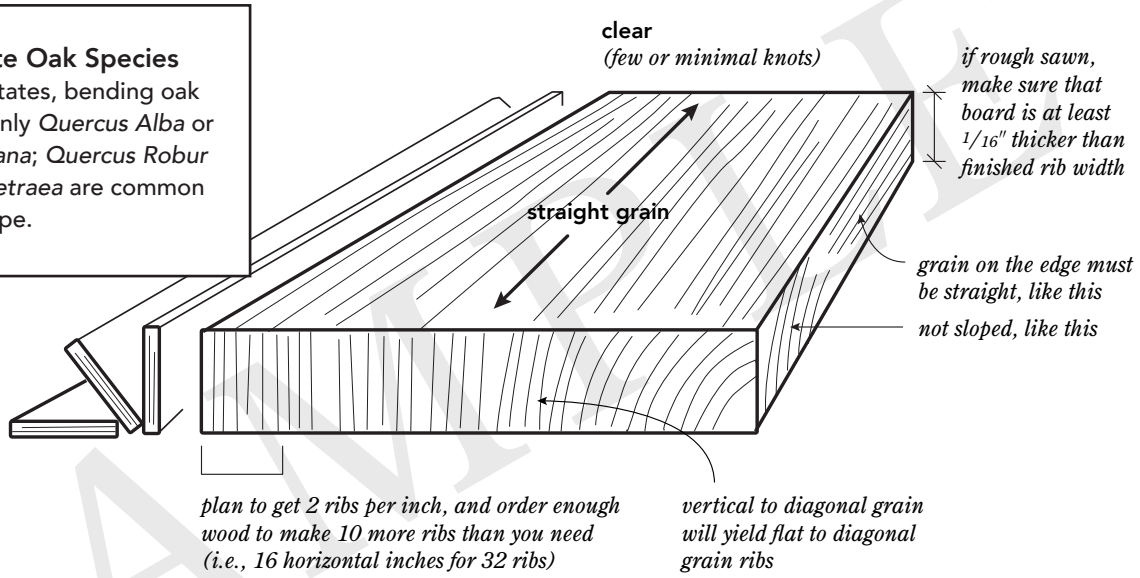
STEMS

For angled stems, you will need a flat sawn for a double-paddle canoe or for a larger canoe. Recurve stems require a flat sawn . Recurve stems limit nesting to inch difference in canoe length; angled stems allow for nesting of inch difference in length in double-paddle canoes, or a inch difference in length in single-blade canoes.

If building a pedal-drive canoe you will need to make some modifications to the stem before building the frame, see *Rudder Blade and Stem Modifications* in our *Building a Simple Canoe Rudder* plan set.

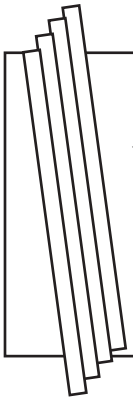
The ribs for the canoe are inch wide and approximately inch thick *(see below)*, made out of bending oak. Bending oak is any white oak species that is clear, straight-grained, and freshly sawn. Other bending woods (ash, locust, etc.) may work, but they must bend very well to create a flat enough bottom shape to avoid a tippy canoe. If you have any concerns about whether or not a wood will bend well enough to build a canoe, purchase a small amount, watch the steaming video, and do some bending tests to see if you can match my bends! We recommend waiting to plane and saw your wood until you are ready to bend to preserve moisture content. If your bending stock has dried a bit and doesn't show visible moisture when sawing the ribs, we recommend soaking the ribs in water (with a few drops of detergent) for 7 days before steam bending.

Suitable White Oak Species
In the United States, bending oak is most commonly *Quercus Alba* or *Quercus Garryana*; *Quercus Robur* and *Quercus Petraea* are common species in Europe.



Approximate number of ribs for different canoe lengths

11'-0"	21 ribs	**12'-8"**	25 ribs	**14'-8"**	29 ribs	**16'-4"**	33 ribs
11'-5"	22 ribs	**13'-1"**	26 ribs	**15'-1"**	30 ribs	**16'-9"**	34 ribs
11'-10"	23 ribs	**13'-8"**	27 ribs	**15'-6"**	31 ribs		
12'-3"	24 ribs	**14'-3"**	28 ribs	**15'-11"**	32 ribs		



RIB THICKNESS

We recommend ribs be made 1" wide with the following thicknesses based on canoe width:

Canoe width	< 27 ½"	27 ½" – 29 ½"	30" –32 ½"	33" – 36"	37" – 48"
Rib thickness					

DETERMINING HOW MUCH BENDING OAK YOU NEED

As a general rule, you want to have a minimum of 1.5 times as many *perfect quality* ribs as you actually need to compensate for breakage and test bends. The following formula will help you determine the quantity of pre-cut ribs or the size of boards you will need to complete your build.

Determining the number of ribs to build or buy

First, consult the table of common canoe lengths on the previous page to determine how many ribs you will need. Multiply that number by 1.5. This is the MINIMUM number of ribs that you should order or build.

_____ x 1.5 = ☐

number of ribs in canoe — number of ribs to buy or build

Next, determine the maximum rib length you will need by multiplying the width of the canoe by the rib length to beam ratio for that particular canoe size (see page 20).

_____ x _____ = _____

width of canoe — canoe r/b (see p. 20) — maximum rib length

Ordering pre-cut ribs

If ordering pre-cut ribs, take your maximum rib length from above and add a minimum of ½ inch. This is the length of rib you will want to order. Consult the table on page 13 to determine the thickness of the ribs you need.

_____ + ½" = ☐ ☐

maximum rib length — rib length to order — rib thickness (see p. 13)

Ordering entire boards

If ordering entire boards, you can generally expect to get two ribs per horizontal inch of bending oak that is at least 70% clear. Take the number of ribs to build, and divide that number in half. This is the minimum total board width in inches of bending oak you should order (Keep in mind this total width will likely be made up of multiple boards).

_____ ÷ 2 = ☐

number of ribs to buy or build — minimum board width

To determine board length, take your maximum rib length and add at least two extra inches to compensate for cracking at the ends of the board. (If there is a strong reason you can't order the extra couple inches you can probably get away from with just one inch longer)

_____ + 2" = ☐

maximum rib length — board length to order

Wood: Effect of Wood Species on Canoe Weight

The gunwales, stringers, keel and stems are generally made from long, clear softwood, although some lightweight hardwoods can work. In the following table we have calculated the total volume of softwood in various canoe sizes so you can compare the effect that choosing different wood species will have on the weight of your finished canoe.

To use this table, start with the cubic feet of softwood closest to the size canoe you are building and multiply that by the weight of the wood you are considering. That will give you the approximate total weight of all your softwood pieces. We have already done the math for some common wood weights. For an approximate finished weight, add your total to the weight in the last column, which represents the average weight of all the non-softwood parts for that size canoe, including the skin, coating, ribs and seats.

Example: 15'-0" x 30" solo canoe with 4 stringers per side:
.6500 cu ft x 32 lbs/cu ft (Douglas fir) = 20.8 lbs + 18.05 lbs = 38.85 lbs finished weight
.6500 cu ft x 23 lbs/cu ft (Western red cedar) = 14.95 lbs + 18.05 lbs = 33 lbs finished weight

approximate total cu ft of softwood (gunwales, stringers, keel, stems) in various canoe sizes		common wood weights in lbs/cu ft					average total weight of all non-softwood canoe parts
		23	25	27	31	32	
11'-8" x 27" pack canoe	.4151 cu ft	9.54 lbs	10.38 lbs	11.20 lbs	12.87 lbs	13.28 lbs	9.46 lbs
13'-8" x 28 ½" double-paddle canoe	.5076 cu ft	11.68 lbs	12.69 lbs	13.70 lbs	15.74 lbs	16.24 lbs	13.32 lbs
15'-0" x 30" solo canoe with 4 stringers per side	.6500 cu ft	14.95 lbs	16.25 lbs	17.55 lbs	20.15 lbs	20.80 lbs	18.05 lbs
15'-0" x 32" solo canoe with 5 stringers per side	.7110 cu ft	16.35 lbs	17.78 lbs	19.20 lbs	22.0 lbs	22.75 lbs	21.65 lbs
16'-4" x 36" tandem canoe	.7800 cu ft	17.94 lbs	19.50 lbs	21.06 lbs	24.18 lbs	24.96 lbs	26.06 lbs

Keep in mind there is a lot of variation within any wood species. Western red cedar is listed at 23 pounds per cubic foot but I've seen it weigh as much as spruce. Eastern white pine is listed at 25 lbs/cu ft, but in my experience it's usually more like 27. Southern yellow pine is listed at 40 lbs/cu ft, but in my experience it's usually lighter than that.

The wood-database.com is a great place to look up weights of different woods, and you can multiply the cubic volume by any wood you choose to find the effect it will have on boat weight.

Weights of various common wood species (lbs/cu ft)

23	Western red cedar (WRC)	31	Yellow cedar
25	Eastern white pine	32	Cypress
25	Norway spruce	32	Douglas fir
27	Butternut	32	Radiata pine
27	Red spruce	34	Scotts pine
27	Sitka spruce	36	Larch
27	Western white pine	40	Longleaf pine *(Southern Yellow)*

When purchasing bending oak without looking at it, you want to ask if the grain is straight and how much of the wood is perfectly clear. You might mention that shorter lengths are fine (for example, two 4 foot boards as opposed to a single 8 foot).

Be sure to check the actual thickness of the boards, because 4/4 can mean roughsawn to exactly an inch or roughsawn a bit thicker. In planed wood it can mean planed to an inch, or planed to ¾ inch. What you need to end up with is 1 inch thick boards after planing, so planed boards need to be 1 inch, and roughsawn boards need to be at least 1 1/8 inch.

It's also worth asking about shipping costs. Certain weights and lengths of wood can incur huge oversize fees. 8 feet long is a common cutoff. It's not reasonable to expect a supplier to rip sapwood or heartwood knots off a board to lower shipping costs, but it is reasonable to ask it be crosscut to length too avoid over-length charges.

Help us out!
If you find a good source for bending oak, please share it with us so we can add it to our list!

BENDING OAK SUPPLIERS

WISCONSIN:

J.W. Swan and Sons Boatworks
jwswanandsons.com
Washburn, WI
(715) 331-9241
will ship internationally

NOTE:
JW Swan sells incredible quality bending oak and also pre-cut ribs, offering significant savings on shipping

ILLINOIS:

Kirkland Sawmill
Kirkland, IL
(815) 522-6150
unsure of shipping

INDIANA:

C.C. Cook & Son Lumber Company
Reelsville, IN
(765) 672-4235
will ship

NEW YORK:

Meltz Lumber
Hudson, NY
(518) 672-7021
unsure of shipping

Rothe Lumber
Saugerties, NY
(845) 246-5202
unsure of shipping

Canoe Skin Choices

Skin-on-frame canoes can be covered with a variety of fabrics, but the fabric we use more than any other is nylon. Nylon is impact and abrasion resistant and pairs well with the 2-part polyurethane we recommend. We prefer fabrics from Skinboats.org because they have proven performance and they can ship you coating and fabric in the same box. Even for overseas customers, it is often less expensive to order nylon and urethane from them than it is to buy local cloth and an expensive, locally available polyurethane. We recommend you price cloth AND coating before making purchasing decisions. Skinboats.org rarely reply to emails, so if you are an international customer please call them directly at 360 299 0804.

For canoes, all nylons should be stretched and sewn on wet, and must remain wet during the entire stitching process.

UNITED STATES SUPPLIERS (WILL SHIP WORLDWIDE)

The Skinboat School (skinboats.org)

840 9oz Xtra Tuff nylon: Our preferred cloth, it has an excellent balance between light weight and durability, with excellent shrinkage.

700 7oz junior ballistic Primo: A good ultralight cloth with some significant disadvantages, this tightly-woven lightweight nylon is surprisingly tough, giving similar durability to the 840 Xtra Tuff while weighing less and absorbing less coating. Unfortunately, it is extremely hard to get this fabric to stay tight and it will always get saggy in high humidity. If you use this cloth you must sew it on cold and soaking wet, stitch very tight, and remember it cannot be dyed with fabric dye.

1050 12oz ballistic nylon: A good choice for very roughly used skinboats, it adds about 30% longer life and durability, but will add 4–8 pounds to the finished weight of the canoe, depending on size. It's up to you to decide if that's worth it or not. Sew on soaking wet.

Other fabrics from Skinboats.org: Skinboats.org offers many options that don't work well. Please email us if considering a different cloth.

Dyson Baidarka and Co

George Dyson also sells fabric but does not advertise. He sells an 8oz nylon that is a bit loosely woven and therefore shows significant thread pull holes, but shrinks well, and a 12oz nylon with moderate shrink that is easy to work with. Consult the internet for a full fabric list and contact info.

If you find other fabrics that work well please let us know!

INTERNATIONAL SOURCES:

UK: Ant Mace, shipshape.works

Poland: Marcin Bober
marcinbober@op.pl

Marcin and Ant both carry two nylon cloths: an 8oz (N260) and a 12oz (N430) that get good reviews from our builders. Marcin can ship to most countries in the EU.

Germany: Extremtextil.de
Extremtextil sells an 8oz nylon that shrinks well and wraps compound curves nicely, but is so loosely woven that it is difficult to work with without pulling large thread holes.

Norway: kajakkspesialisten.no
Anders Thygesen sells a 60/40 nylon polyester blend fabric that gets good reviews from our builders. He sells this as a "kayak skinning kit" in his store. Anders has a wider width of this cloth as well, so please inquire about the width and compare to your canoe circumference.

Canoe Coating and Coloring Choices

Skin-on-frame canoes can be finished with a variety of coatings, but polyurethane pairs best with nylon cloth because both are flexible, allowing the nylon to absorb impacts without damaging the coating.

We recommend the Spirit Line 2-part polyurethane sold by Skinboats.org, which also sells the 840 Xtra Tuff cloth we prefer. This extremely tough coating has the most durability of any semi-translucent finish we currently know of. It has almost no odor and contains no solvents, and is applied wet-on-wet over the course of a single day. It will not stick to itself once it is cured and cannot be recoated, so it's important to order enough for your project.

Skinboats.org sells this coating in three sizes: full order, half order, and touch up kit. See page 31 to determine how much you will need for your size canoe. Generally speaking, the recommended amount will allow four coats plus a keel strip on the 9oz 840 Xtra Tuff fabric. If more coats are desired more coating will be needed; order 30% more if using the 1050 12oz cloth.

Note: the part A is consumed faster and is never a full 16oz. See page 31 and videos for recommended batch size.

OTHER COATING OPTIONS

Coelan Boat Coating Gloss Finish

Coelan is a highly durable, UV resistant single-part finish, but it is also extremely expensive and extremely toxic with strong vapors. It is applied over several days in a well ventilated, conditioned space with a respirator.

For pack and double-paddle canoes: order 2ea 750ml cans + 1ea 350ml can

For solo single-blade canoes: order 3ea 750ml cans

For tandem canoes: order 3ea 750ml cans

Note these are approximate amounts. If you use this product on a canoe please let us know if this was not enough or too much.

The cost of Coelan is roughly three times the cost of the Spirit Line 2-part polyurethane from Skinboats.org, so even for international builders it can be less expensive to ship Spirit Line coating than purchase Coelan locally.

Single-part "Hardware Store" Polyurethanes

A variety of cheap hardware store urethanes can be used to coat a skin on frame boat, but they tend to crack easily and the durability and lifespan is less than half that of Spirit Line's 2-part or Coelan. Application is also usually pretty toxic. You get what you pay for.

Other 2-part Urethanes

Students have experimented with a variety of other 2-part coatings, but so far none have worked well enough to recommend.

As always please let us know if you find another finish that worked well for you!

COLORING YOUR CANOE

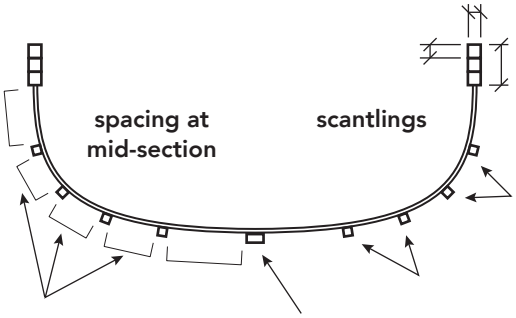
Acid dye is easy (but messy) to apply. The initial colors are fantastic, but they fade with exposure to sunlight. Acid dye cannot be used on the "Primo" cloth sold but skinboats.org or on any polyester. *See dye videos for important notes to prevent coating adhesion issues.*

Earth pigment is our preferred coloring system. It is slightly harder to apply than acid dye, but the colors don't fade and the dark colors are very colorfast. We do not recommend adding more than 4 tsp of pigment per 32 oz of Part B. The color packs we sell contain 6 teaspoons, enough for 1 ½ orders of urethane. Earth pigment can be used on any cloth. *See coating videos for important notes to prevent streaky or splotchy application.*

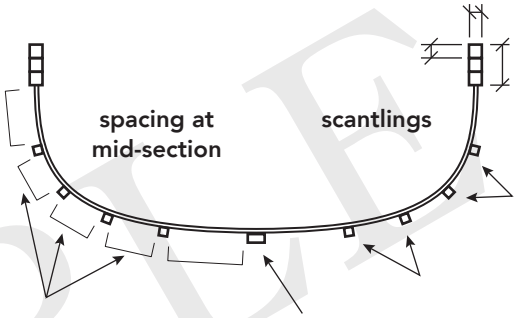
See our color choices video (in the course and on YouTube) for side by side comparisons, test panels of our different dyes and pigments exposed to UV, and a more detailed discussion of the pros and cons of each system.

We recommend the following scantling sizes as a good compromise between strength and weight, yielding an overall durability very similar to a lightweight kevlar canoe. Western red cedar boats will be significantly lighter, but also not quite as strong. We typically use pine, fir, or spruce for our tandem canoes, and Western red cedar for smaller boats.

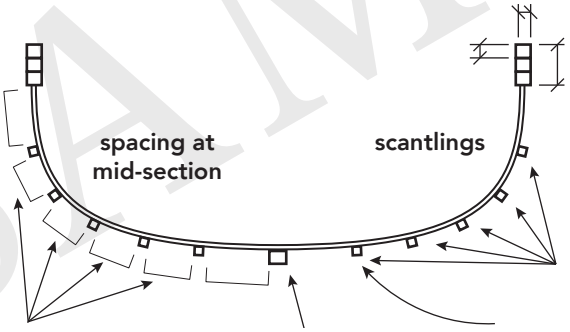
PACK CANOE

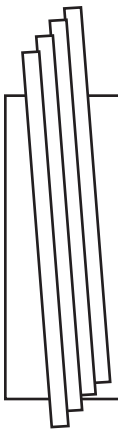


LONGER DOUBLE-PADDLE CANOE



FULL SIZE SINGLE-BLADE CANOE





RIB THICKNESS

We recommend ribs be made 1" wide with the following thicknesses based on canoe width:

Canoe width	> 27 ½"	27 ½" – 29 ½"	30" –32 ½"	33" – 36"	37" – 48"
Rib thickness					

Depth-to-Beam and Rib Length-to-Beam

Throughout this course you'll hear me constantly referring to *depth to beam* (d/b) and *rib length to beam* (r/b). These numbers are important to understand because they form the foundation of our formula-based building system. The relationship between these numbers determines the depth and the shape of your canoe.

DEPTH TO BEAM

Depth to beam (d/b) is the ratio between the width of your canoe and the depth of your canoe. For example, a inch wide canoe with a d/b would be inches deep. Generally, the bigger the depth to beam, the less stable a canoe will be using our building system, so we advise sticking with our recommendations.

For double-paddle canoes, strikes a reasonable balance between elbow clearance and freeboard. For solo single-blade canoes, is a good ratio. For tandems, we drop back down to for maximum stability, and also because tandems really don't need to be much deeper than inches in the middle.

RIB LENGTH TO BEAM

Our canoe building system is based on the idea that in a canoe of certain width and depth, some percentage of the width of that canoe will give the right length for the rib in the center of the canoe. This percentage, expressed in a decimal format, is the rib length to beam ratio (r/b). For example, on a solo canoe with a depth to beam of , a rib longer than the maximum width of the canoe gives a good shape for the rib in the center of the canoe.

Once we know this ratio, we can apply additional compensations for rocker and sheer at each rib location and organize all that information on the *Rib Length Worksheet*. With this information we can then make a measuring stick to determine the length of each rib.

NOTE: If you're interested in a depth to beam ratio that is different than what we show here, please contact us for a custom recommendation. Using an untested depth ratio with our listed rib length-to-beam ratios can result in shaping problems.

OUR RECOMMENDATIONS:

For **double-paddle canoes** with a d/b of use an r/b of for to inch wide canoes. Use for to inch wide canoes. Note: if using this d/b to make a **shallow solo single-blade canoe**, add to the r/b.

For **solo single-blade canoes** with a d/b of use an r/b of . Note: Canoes narrower than inches or wider than may need to adjust this r/b

For **tandem canoes** with a d/b of , use an r/b of for inch wide canoes and for inch wide canoes.

Note: **Our recommendations aren't always perfect**, feel free to text or email pics of your test bends, I'm happy to check the shape. 503 354 4939.

depth-to-beam good for pack canoes, shallow solo canoes, and wider tandems (34–37")

depth-to-beam better for solo single-blade canoes

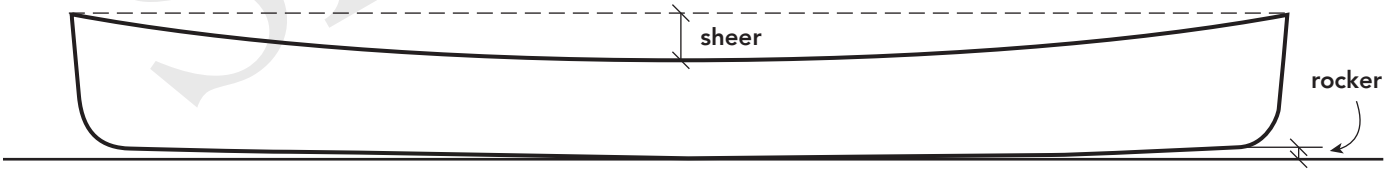
ROCKER

Rocker is the curve of the bottom of the keel. Generally speaking, the more rocker a canoe has, the more maneuverable it is, although overall hull volume and shape have an even stronger influence. We plan extra rocker into our canoes because all skin on frame canoes will lose some rocker during the building process. Generally, we recommend equal rocker bow and stern, which functionally becomes a bit less rocker in the stern and a bit more rocker in the bow when the canoe is sitting with a slight aft-trim on the water. Our recommended rockers typically yield a good balance of turning and tracking, and can be "tuned" by adding some progressive rocker by flexing the keel up on the stems during the building process. If planning to deviate from our suggested rockers, please send an email so we can discuss the pros and cons.

SHEER

The sheer curve is the difference in gunwale height from the center of the boat to the ends. The more sheer a canoe has, the less risk of waves coming over the bow, but the more it will be affected by wind — although overall freeboard and volume are really the important factors. Listed below are what I think are good "compromise" sheer heights that work well with our building system. Just like with rocker, if you are planning to deviate from the suggested sheer measurements, send us a quick email so we can advise. *IMPORTANT NOTE: These suggestions represent the curves while laminating the boards, the actual sheer will be ½–1 inch less due to springback.*

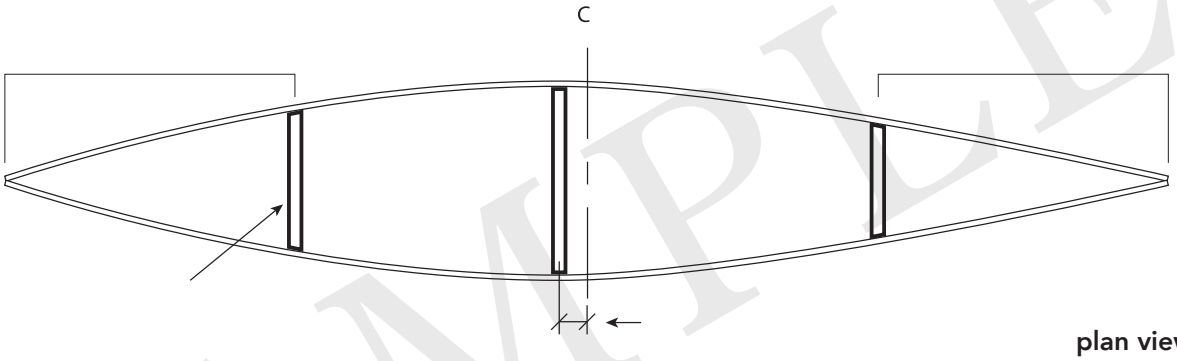
The videos show you how to record rocker and sheer heights for use with the rib length formula. Sheer heights are the distance from the bottom of the gunwale to a baseline, measured at the ends and the rib mortise location. The rocker heights are the distance from the bottom of the keel to a baseline, measured at ends and the rib location.



Initial board length (feet)	12'	13'	14'	15'	16'	17'
Suggested sheer (inches)						
Suggested rocker (inches)						

Canoes are commonly built both symmetrically and asymmetrically and our system can produce either. Symmetrical canoes are the easiest to build, but asymmetry is not hard to accomplish.

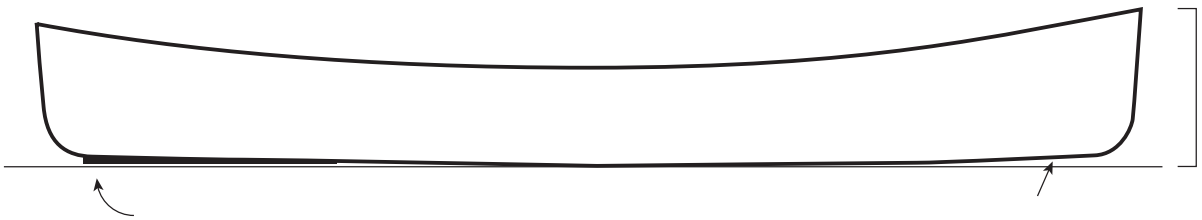
In plan view (from above), the most common asymmetry is for the widest part of the canoe to be shifted slightly aft (toward the back of the canoe). The idea behind this is that the finer section forward parts the water more easily, and the fuller section in the stern drags a bit more which helps with tracking. This shaping is also advantageous in crosswind, tailwind, and when waves are coming from the stern quarter. Presently, I'm making my tandems symmetrical and my solo and pack canoes asymmetrical.



plan view

In profile it is common to see canoes with the sheer a bit higher in the bow than the stern. Some of this is already achieved by the slighly aft trim of the canoe, but if more is desired, it can be added while recording the sheer heights by lifting the bow higher than the stern relative to the baseline. Depending on the depth of the canoe, this extra bow height may or may not be useful for keeping waves out, but it does have the interesting effect of of making the bow section of the canoe slightly finer (using our system), which gives a slight efficiency advantage, and also helps to balance an asymmetrical canoe.

If additional height is desired, it can be achieved by gluing on sheer blocks later in the process (see p. 27 and *Adding Sheer Blocks* video).



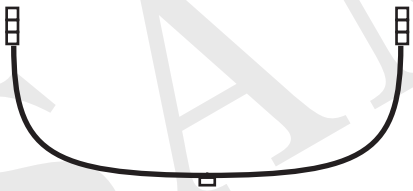
profile view

Tumblehome refers to a canoe shape where the width at the gunwales is narrower than the maximum width. The big advantage to this is that it allows for a more comfortable stroke in a solo single-blade canoe. (The reason this doesn't matter in a tandem is because the part of the canoe that would be narrower in the center is not where you are actually going to be paddling the canoe). We can't achieve the dramatic tumblehome seen in many commercial solos, but we can get up to 2 inches, which can make a noticable difference in comfort depending on the size of the canoe.

To achieve tumblehome we take advantage of the fact that, when built correctly, the canoe will "close up" by a couple inches when the spreaders are removed at the end of the frame building process. To lock in this shaping,

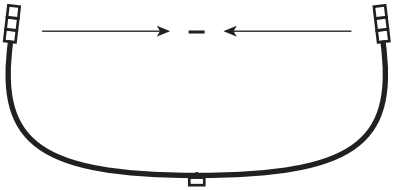
Doing this will cause the gunwales to twist inwards, but then, almost magically, they should twist back to nearly vertical as the tension of the skin increases during the drying process, allowing for normal seat installation.

If planning to add this feature to your solo canoe, three things are important. The first is working with really good bending wood and bending it as far as you see in the videos. This minimizes the outward pressure of the ribs, which will allow your canoe to close up and become narrower later. It may be possible to force tumblehome into a canoe which has not naturally closed up, but we can't promise that won't overstress the frame, resulting in unintended consequences. Second, because the rib ends will be further tortured by tension added by the skin, it's a good idea that they are still a little green when you skin, meaning that you should move through your build somewhat quickly. Putting the skin on within 2 weeks of ribbing should be ok, faster is better. Finally, you will want to use the longer, laminated method of adding seat blocking rather than the shorter, smaller blocks to support the additional structural stress.



No tumblehome

+ : simpler, more primary stability
– : less solo stroke comfort



Tumblehome

+ : more solo stroke comfort, slightly faster
– : less primary stability, more complicated

WHEN NOT TO ADD TUMBLEHOME

Adding tumblehome pulls the gunwales inward, but also pulls the sides of the canoe upward, resulting in a little more speed, but a bit less primary stability. When sized correctly, the speed/stability/ergonomics balance achieved here is similar to what many serious soloists prefer. Having said that, not everyone is a serious soloist, so if you care more about stability while fishing the local pond than improved stroke ergonomics for making long miles, you might not want to do this. Also, if you accidentally made your canoe too round and it's a bit deeper than it's supposed to be, adding tumblehome will only make this worse, which will negatively affect stability. Also, I have no idea what effect tumblehome will have on any part of my pack canoes, so if you add some, let me know how it turns out!

The math involved in this process is simple as long as you stay organized, I recommend printing out the following 6 pages and stapling them together. It's safest to print a packet for each canoe you are building.

Step 1: Start by deciding on the overall dimensions of your canoe and jot them down. These might change a bit during your build, but this gives you a rough idea of what you're aiming for. Some things to consider are that your sheer will usually lose ½ inch from the laminated curve, and your rocker may lose ½ inch during the build. I've already planned these losses into my rocker and sheer recommendations. See *Sample Canoe Sizing* for nesting geometry if building nesting canoes.

Step 2: Mark out gunwale ends, center, and mortises and per the *Gunwale Layout* page.

board length:		canoe length:

Step 3: Block bottom board up to desired rocker curve *for that length of board*, and record end rockers measured wherever the canoes will end along that board. Record the rib location rocker heights on the *Rib Length Worksheet*.

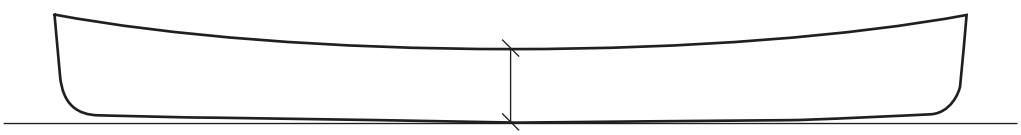
stern rocker height:		bow rocker height:

Step 4: Laminate gunwale boards to the recommended sheer *for that length of board*, split on a table saw, cut to length, mortise, then cut gunwales to length.

Step 5: Lay the gunwale on its side on a flat surface with a straight reference line against the bottom edge (a string line works best) and adjust the curve for a symmetrical or asymmetrical sheer (even height ends or higher at one end). Record end sheer heights on the *Canoe Rocker Worksheet*. Record rib location sheer heights on the *Rib Length Worksheet*.

stern sheer height:		bow sheer height:

Step 6: Choose the appropriate depth-to-beam ratio for the type of canoe you're building and calculate depth. Now, using the depth, rocker, and sheer measurements, we can complete the formulas on the *Rib Length Worksheet*, the *Canoe Rocker Worksheet*, and the *Initial Stem Layout* page.



center depth:

_____ x _____ = _____

LAYING OUT THE GUNWALES

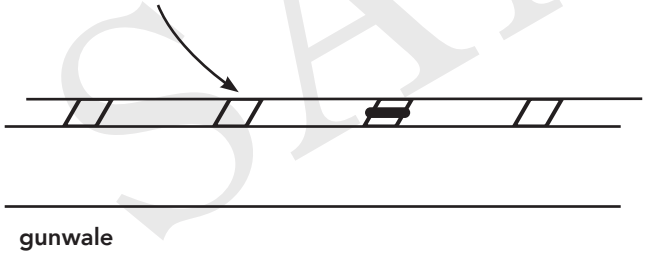
The gunwales are cut from three boards that are laminated into a curve. It's easiest to do the layout for the mortises on the bottom board of the stack before laminating.

For a pack canoe the boards are planed to inch thickness, for a full size canoe inch.

The boards need to be at least 2 inches longer than the desired length of the canoe. The width of the boards depends on how many gunwales are needed. When building one canoe I use inch wide boards. For two canoes, inch wide boards are just barely wide enough. inch boards give you a bit more breathing room if you can source them.

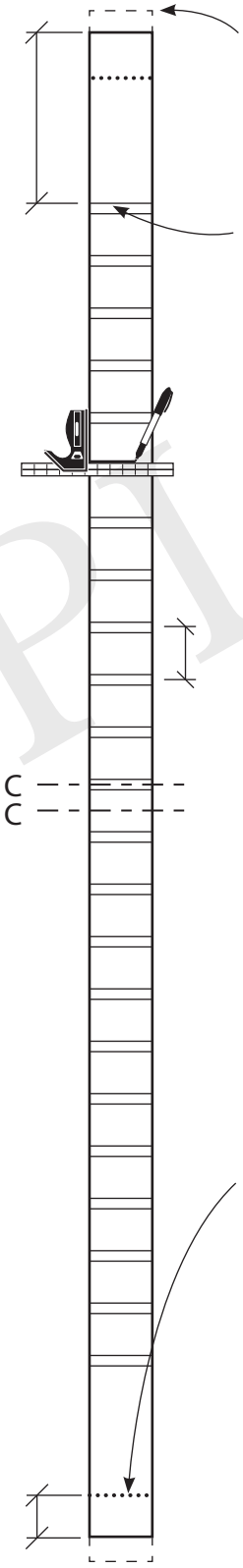
MARKING FOR MORTISES

Ribs are easily marked by holding a combination square (1 inch wide) at the rib location and marking both sides of the square.



MORTISING THE GUNWALES

The fastest way to cut the rib mortises is with a plunge router. Using guide blocks and a drill is another option, but slower. Rib mortises should be centered on the gunwale and cut a little over inch long and inch deep. If using a drill, a series of overlapping holes cuts the mortise easily. If using a router, a carbide spiral upcut bits works best.

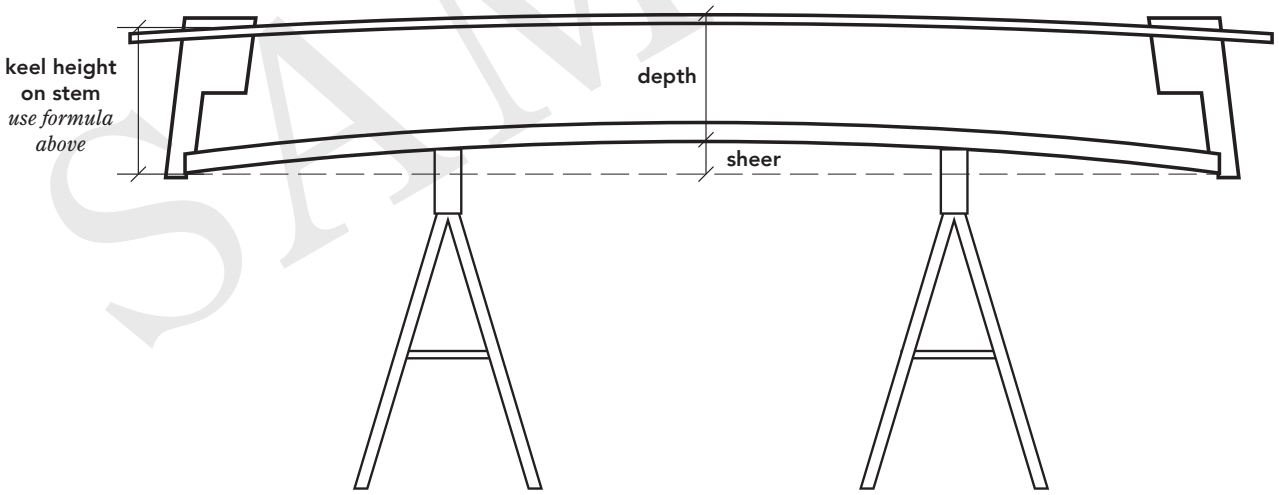


Layout: Canoe Rocker Worksheet

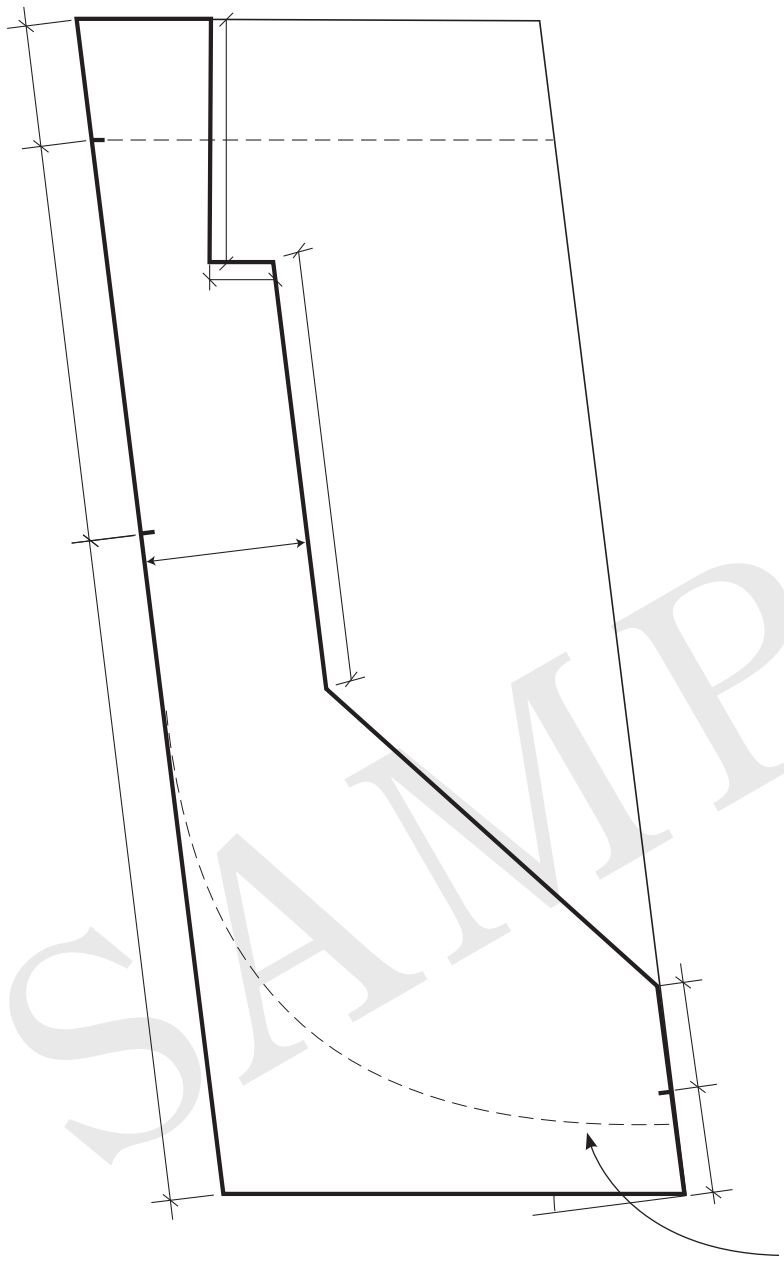
Setting the rocker on the canoe is accomplished by adding the sheer to the center depth and subtracting the rocker. This measurement is taken from the top of the gunwale to the bottom of the keel, then the keel is blocked up to height in the middle, clamped to the marks on the stems, and a line is scribed along the bottom of the keel and the stem is cut to that line, and the keel screwed temporarily in place.

STERN MEASUREMENTS

BOW MEASUREMENTS



Important note: When blocking the keel up to the center depth don't forget to subtract for the height of the keel, which we always set to regardless of the actual height of your keel. (This keeps the relevant reference point, which is the inside of the keel, the same for all builders.) For example, if you canoe is inches deep, you would rest the keel on a block that is . There is a video specifically for this important step.



We usually use inch thick x inch wide flatsawn boards for angled stems on pack canoes for the tightest possible nesting geometry. For full size canoes with angled stems, we increase the board width to inches.

We start by crosscutting the stem blanks to length at a degree angle. Stem length is the center depth plus the sheer height.

Up to inches can be added to the top of the stem if sheer blocks are desired (typically not in pack canoes). This is an aesthetic choice and has no functional advantage. See video: *Adding Sheer Blocks* for details.

Note: this stem width allows for a radius curve at the bottom of the stem. If a more gentle curve (up to radius) is desired, it's advisable to make the stem out of inch wide wood. Keep in mind if you are using wider wood for the stems you must increase the difference in length between nesting canoes to .

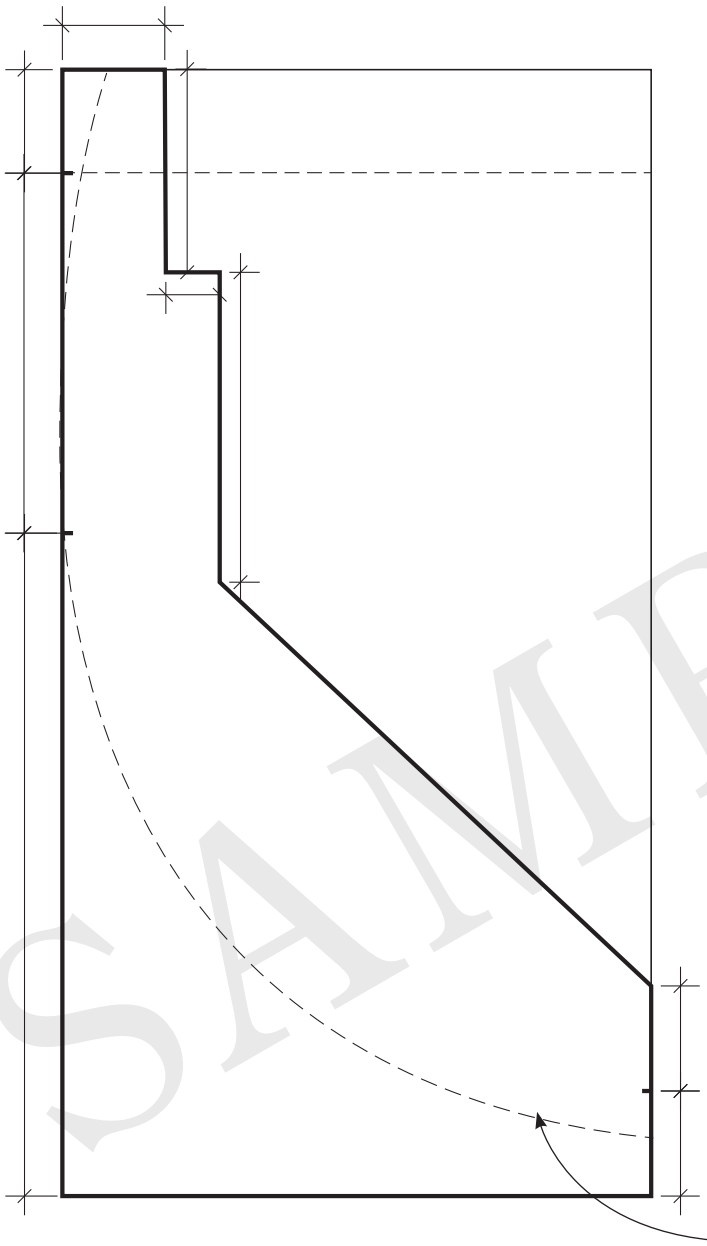
Determine initial stem length using formula at bottom of page and cut stem to length at angle

Final curve will look something like this. Wait until ribs AND stringers are on to cut curve

_____ x _____ = _____

\+ _____ _____ = _____

\+ _____ + _____ = _____



We sometimes use larger, recurved stems on larger single-blade canoes. There is no functional advantage over angled stems, but it does look pretty cool. The stem blanks are cut from nominal flat sawn boards (x). We start by crosscutting the blank square. Stem length is equal to the center depth plus the sheer height.

An additional inches can be added to the top of the stem if sheer blocks are desired for a more upswept end shape. This is an aesthetic choice with no functional advantage. See video: *Adding Sheer Blocks* for details.

Determine initial stem length using formula at bottom of page.

Final curve will look something like this. Wait until ribs AND stringers are on to cut curve, see video: Shaping the Stems on a Full Size Canoe

_____ x _____ = _____

\+ _____ + _____ = _____

\+ _____ + _____ = _____

Layout: Rib Length Worksheet

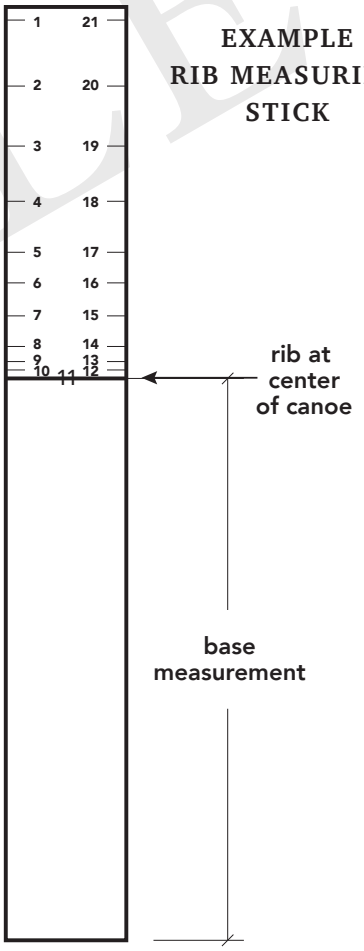
rib #		x		−		= rib adjustment	+	additional adjustments [if needed, see video]	= final rib adjustment
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									
27									
28									
29									
30									
31									
32									
33									

RIB BASE MEASUREMENT

NOTE: this is NOT the depth-to-beam ratio

The rib base measurement formula uses the decimal portion of the rib-length-to-beam (r/b). For example, if your r/b is 1.44, you would multiply the canoe width by .44

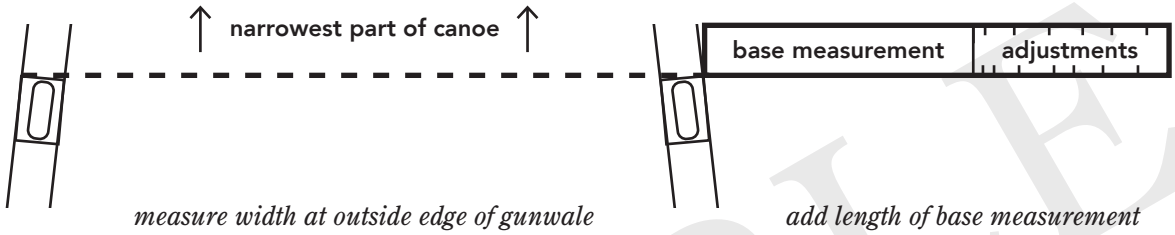
_____ x _____ = _____
base measurement



bow sheer height	
stern sheer height	
bow rocker height	
stern rocker height	

Measuring, Cutting, Rounding, and Thinning the Ribs

To measure for your ribs, lay your adjustment stick across the gunwales at the rib location, and either measure for or directly transfer that measurement onto the rib at that location. Remember: you are always measuring from the side of the rib mortise that is farthest from the center of the canoe. This would be the narrowest measurement of any rib mortise location.

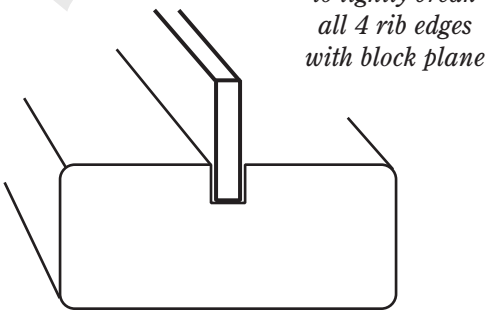


measure width at outside edge of gunwale at narrowest point of rib mortise location

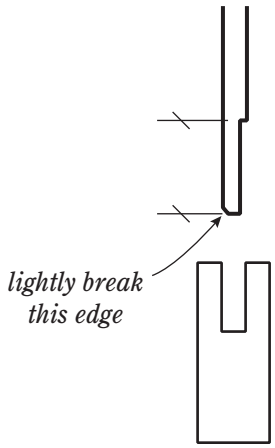
add length of base measurement + adjustment

Once you're done measuring, cut the rib to length, and write the rib number on the end in dark pencil. (Ink will melt off in the steam box). Next, lightly break all 4 edges with a block plane using the rib rounding jig, and break the outside corner of the end of the rib. If necessary, thin the ends so they will fit in the mortises. (Be safe doing this and don't accidentally erase the rib number!)

Note: Regardless of the size of the canoe I typically thin the last rib at either end to inch to make it easier to bend.



use rounding jig to lightly break all 4 rib edges with block plane



thin rib ends if necessary to fit in rib mortises

lightly break this edge

SKINNING THE CANOE

The skin we use more than any other is the 840 denier (9oz) Xtra Tuff nylon sold by Skinboats.org. This fabric is lightweight but durable, conforms well to complex surfaces, shrinks amazingly, and takes dye and holds coating well. For an expedition weight canoe the 1050 cloth (12oz) can be used but it will consume 30% more coating and add 3–8 pounds to the finished weight of the canoe, depending on size. This compromise usually isn't worth it unless you're anticipating dragging the loaded boat over rough surfaces. For an ultralight canoe, the 7oz Primo cloth will shave off 1–2 pounds while still remaining fairly durable, but the Primo cloth doesn't shrink quite as well and is not compatible with fabric dye. However, it can still be colored with earth pigments mixed directly in the coating. **Order your fabric a foot longer than the length of your boat.** See pages 18 for more details on skin, coating, and coloring options.

COATING THE CANOE

We use the 2-part polyurethane available from Skinboats.org because it is by far the toughest skin boat coating available. We recommend ordering 30% more than you need just to be on the safe side. The material is not recoatable, so if you run out you are out of luck! Watch ALL coating videos and follow ALL coating instructions, and text or WhatsApp me immediately if you run into any problems: 503-354-4939.

Recommended mixing amounts in fluid oz for 840 denier Xtra Tuff nylon skin (1050 cloth will use 30% more)
Note: This may need to be adjusted during the coating process if it seems like too little or too much is being applied

	Amount of coating to order	First Coat (Half Hull)	First Coat (Half Hull)	Second Coat	Third Coat	Fourth Coat
Pack Canoe	1 full order					
Very Large Pack Canoe OR Solo Canoe	1 ½ orders					
Very Large Solo OR Tandem Canoe	2 orders 2 ½ orders					

WEAR STRIPS / KEEL PROTECTION

Material	Pros	Cons	Notes
HDPE	easy to work with, cheap, lightweight, medium durability, more colors available	must be at least ¼" x ½" to be stable, adding noticable tracking	
Delrin/ Acetal	lightweight, very tough, can be put on thin with only moderate effect on tracking	more expensive, less UV resistant, uses a lot of screws	
Brass	medium durability, looks sharp, no UV concerns, no effect on tracking	most expensive, heavy, slightly more difficult to pilot and countersink (see video)	

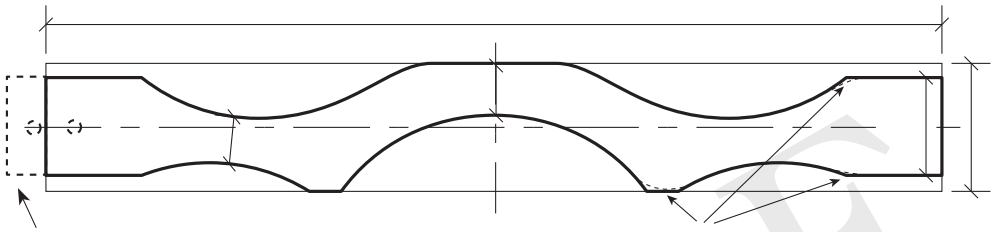
13 Common Coating Mistakes

This is a condensed version of the 13 Common Coating Mistakes document in the video course. For the best success coating your boat, read the full document in the course and do not skip any coating videos.

In our solo canoes, the center seat will hold the shape of the canoe well without additional stiffeners. In our tandems, a center thwart adds stiffness, and its mounting point can also be used as a portage yoke mount (simple yokes can double as the thwart). Tandem canoes with tumblehome must add a center thwart to hold the canoe shape.

SIMPLE YOKE

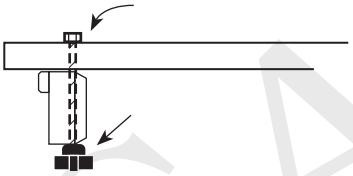
The optimal curve of the yoke opening varies with personal preference. We recommend making a "test yoke" out of scrap wood first to determine what you like.



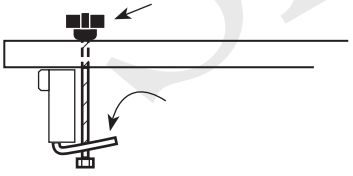
round all sharp edges

Yokes can be installed permanently in tandems, or be made removable in solo canoes or tandem canoes. The best way to find the location for the yoke is to build it a bit wider than your actual canoe and simply put the yoke on your shoulders and the canoe on your head. Move the canoe until it balances. Consider any gear that will always be installed (including possibly a sail) and add it in its location. If in doubt, balance a little tail heavy. Yoke opening should face forward.

Bolt on

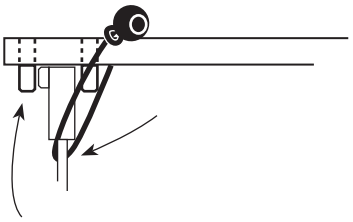


Clamp on



bolt

Pegs and lashings

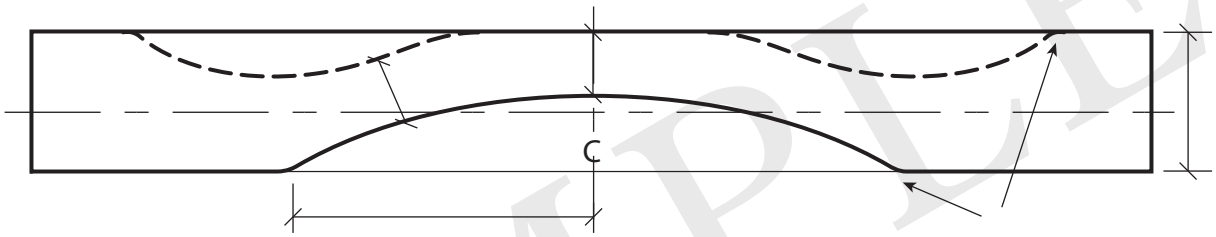


Important Note: When storing nesting canoes, make some sort of brace to hold the gunwales of the outer canoe at the same width as if the seat were installed. This will prevent the canoe from slowly opening up, make it easier to reinstall the seat later, and will help the canoe keep its shape.

MOVABLE / REMOVABLE BACKREST FOR PACK AND DOUBLE-PADDLE CANOES

We use a simple bungee and pad eye loop attachment to hold down a wooden backrest that can be easily removed to nest the canoes together. This can also be switched to a forward loop location to maintain stiffening while allowing the paddler to move freely forward and back, which is useful for weight-shift sailing. If the ends are left long, this piece can even be used as a portage yoke by placing the pegs that sit outside the gunwales in the backrest position to the inside of the gunwales in the center of the canoe, and using a ball bungee or lashing wrapped around the rib in the center of the canoe to hold it in place. Serious portagers will probably want to add clamp on portage pads for long hikes.

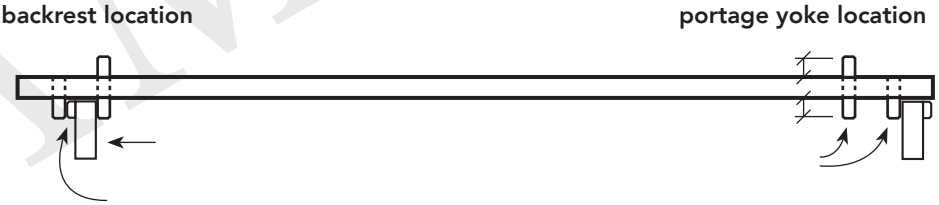
Shown below is a simple version that is easier to build, and a more challenging version shown in the video, which is a bit more solid.



Simple Backrest:

Pros: Easy to build, works OK as a portage yoke, always fits in forward loop

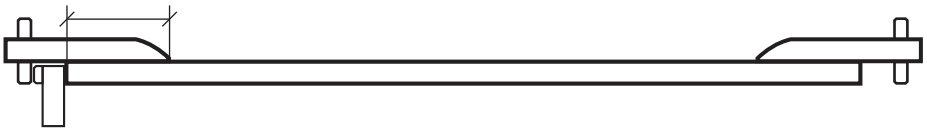
Cons: Not as secure, backrest sits a little high



Less simple Backrest:

Pros: a lot more positive, backrest sits in a better place

Cons: harder to make, sometimes won't fit in forward loop location

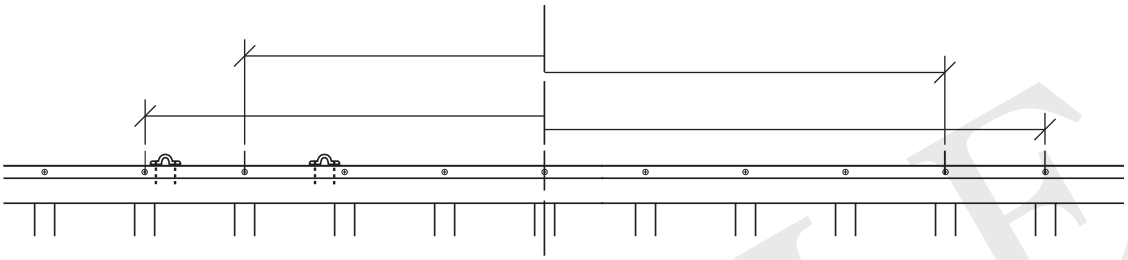


Important Note: When storing nesting canoes, make some sort of brace to hold the gunwales of the outer canoe at the same width as if the seat were installed. This will prevent the canoe from slowly opening up, make it easier to reinstall the seat later, and will help the canoe keep its shape.

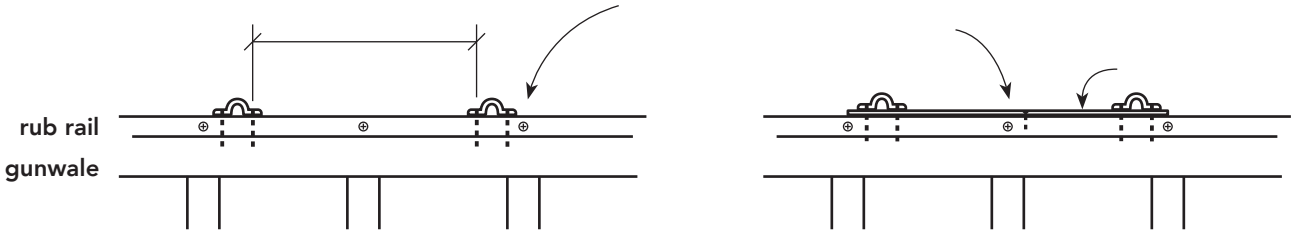
Removable Thwart, Self-Rescue / Catamaran Loop Locations

LOCATING THE PAD EYES

Pad eye location is a combination of many potential factors, and may change depending on the size of your boat and your uses. The following measurements refer to the CENTER of the attachment point, halfway between the pad eyes. Exact location can be shifted slightly to avoid screwing through a rub rail mounting screw. *The following information applies to double-paddle canoes only. Email for location recommendations for full-size canoes.*



Attachment detail



Catamaran / Removable Backrest Bungee Loop Details

Delrin or HDPE plates provide wear surfaces for the catamaran boards to sit on. These plates can sit below or between the pad eyes. Both arrangements have advantages, see the *Alternate Catamaran Attachment* video for a discussion.

MATERIALS PER BUNGEE LOOP:
All materials available at capefalconkayaks.com

2 ea nylon pad eyes

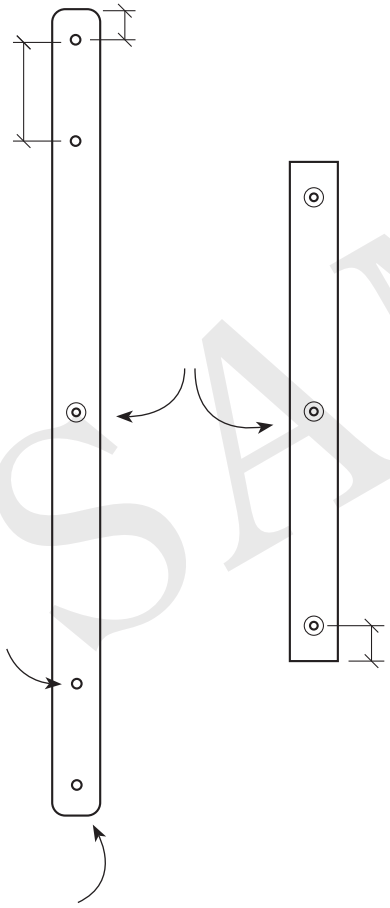
4 ea 1 ¼" #8 flathead phillips stainless steel screws

1 ea ¾" #4 flathead phillips stainless steel screws
(use 2 more for alternate style, see video)

2 feet of $^{5}/_{16}$" marine grade bungee
(we recommend purchasing 4 feet to account for mistakes and replacements)

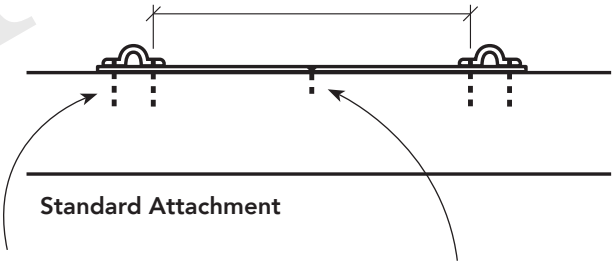
small tube superglue *for sealing bungee knots*

CATAMARAN MOUNTING PLATES

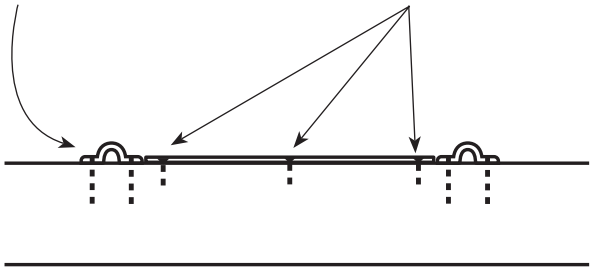


MOUNTING PLATE ATTACHMENT DETAIL

Note: all screws are flathead phillips stainless steel sheet metal screws



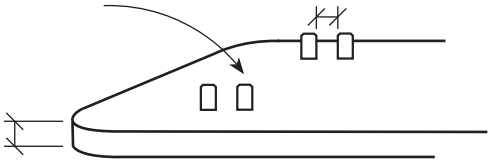
Standard Attachment



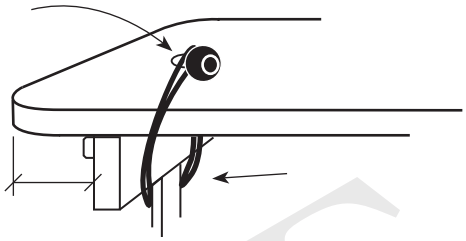
Alternate Attachment

CATAMARAN BOARD ATTACHMENT DETAIL

Method 1: Bungee loop / self-rescue system



Method 2: Simple catamaran system



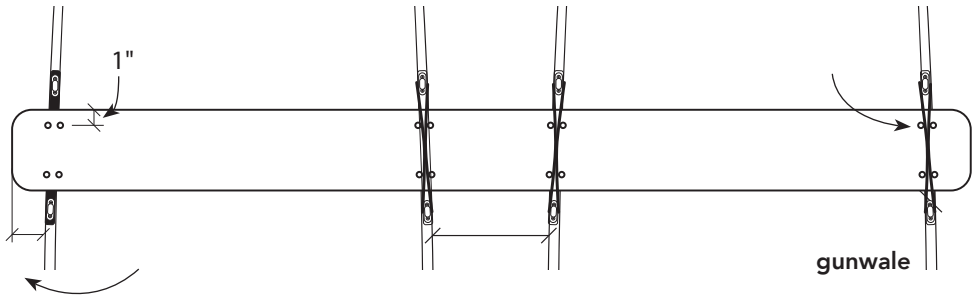
LUMBER SIZING

Catamaran boards are made from nominal softwood lumber with few knots. Closely-spaced pack canoes can often use inch wide x inch thick cedar for the lightest option, and full size canoes used in rough water will need inch x inch spruce, pine, or fir for strength.

SPACING BETWEEN CANOES

Generally speaking, the closer the canoes are together the less stress on the boards and attachments, so you can use shorter, lighter lumber. However, closely-spaced canoes have a tendency to splash water up between them when heading into waves. Wider spacing causes less splashing but requires stronger, heavier wood, and makes the canoes harder to maneuver, especially if heavily loaded. What you choose just depends on your priorities. If building the simpler catamaran system it's easy to shorten the boards if you decide to go closer.

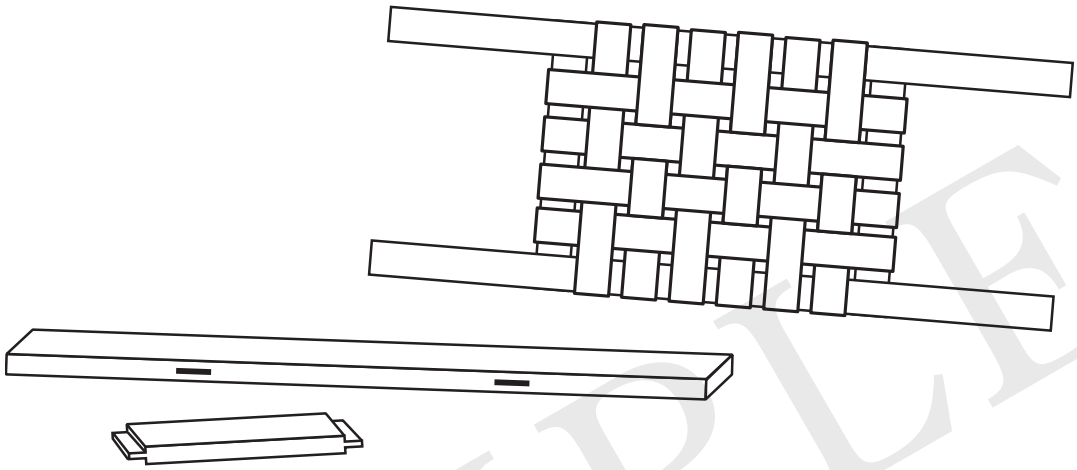
Safety Reminder: It is YOUR RESPONSIBILITY to test your catamaran system to make sure it is safe for the type of voyage you will be making with it. It's a good idea to carry spare bungee and inspect all bungees after every use. NEVER use the catamaran in any conditions that you wouldn't feel comfortable in a solo canoe.



CAPE FALCON KAYAK

Building Canoe Seats

VERSION 1.0 OCTOBER 2023



If you're building a full-size tandem or solo canoe, you'll need a seat to go with it. This plan set contains all of the sizing locating and building information you'll need for a successful install in a skin-on-frame canoe. There are detailed instructions for how to build both flat and curved, laminated seats.

BUYING VS BUILDING

You can buy or build a seat for your canoe. The advantage to buying a seat is that they are relatively inexpensive and a pre-made seat saves you a lot of time and effort. The advantage to building a seat is that it allows you to change the spacing of the seat rails, which gives you a little more freedom for seat placement without interfering with rib locations. For example, on a solo canoe where the center of the canoe is centered on a rib, a standard 10 inch wide seat can only be placed 3 inches or 7 inches aft of center, but an 11 ½ inch wide seat can be placed 5 inches aft of center, which might offer better balance, depending on conditions and gear loading. Personally, I normally buy curved seats from Northstar Canoes for my regular canoes and build 12 inch wide seats for my pedal drive canoes.

CONTENTS

Important note: if you are planning to use these seat building instructions in conjunction with our rudder system with the under-seat tiller bar, make sure you start by looking at the *Seat Modification for Rudder System* plan page (included in the Canoe Rudder Plan and also the last page in this plan), because there is important information covered that affects the construction decisions for your seat.

TOOLS

To build a canoe seat you'll need the following tools. Keep in mind most of these are the same tools you will need to build a canoe:

A 10 inch tablesaw with a sharp ripping blade

Plunge router with ¼ inch spiral upcut bit

12v drill

A twist drill bit index in graduated 64th-inch sizes from 1/16 to ¼ inch and a 17/64 inch twist drill bit

3 foot ruler

Trim router with chamfer bit *(optional)*

2 ea bar or engagement clamps with a 12 inch or greater opening

80 grit, 120 grit, and 220 grit sandpaper

Hot knife to cut seat webbing

Staple gun *manual will work, but a powered staple gun will make the job much easier*

Although not strictly necessary, a small edge/disc sander is very useful for building your seat mounting blocks, spacer blocks, or rounding the ends of the seat back. I use the Wen 6502T, which costs about $100.

For curved laminated seats

Good band saw *for cutting the curve in the laminating jig, must cut square. Note: this is a single cut, so if you don't have one you can likely borrow time on someone else's. Look for a saw with a minimum ¾ horsepower motor and a sharp, aggressive blade.*

At least 5 additional bar or engagement clamps

HARDWARE

For all seats

Titebond 3 glue

Box of 3/8 inch stainless T50 staples

4 ea ¼-20 mounting bolts. *Length varies depending on your desired seat height. We recommend starting with 4 inch long bolts for a standard installation.*

4 ea 1 ½ inch phenolic plastic ¼-20 threaded through-hole star knobs

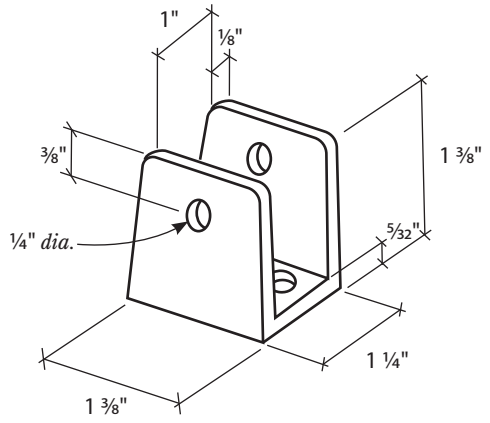
For seat backs

2 ea 1 inch partition brackets *(Jacknob 1910 "U" bracket or similar, see drawing below)*

2 ea ¾ inch #8 pan or flat head screws
OR 2 ea 1 ½ inch 10-24 stainless through bolts and 2 ea 10-24 threaded through-hole star knobs *for quick removal of brackets*

2 ea 1 ¾ inch long ¼" detent pins

partition bracket detail
dimensions do not need to match exactly



SOLO CANOES:

In commercial solo canoes, there is wide variation in longitudinal seat placement. Generally speaking, you want the front edge of your seat to be around inches aft of center in a symmetrical canoe, and a few inches behind that in an asymmetrical (swedeform) canoe. However, because the seat rail cannot sit directly on top of a rib location, sometimes we have to compromise on position. A custom inch wide seat will allow a little more freedom of placement than a standard 10 inch wide seat.

Gear loading and personal preference also play a role. Generally, the farther back you sit the better your boat will handle frustrating crosswinds or wind and waves from the stern quarter, but it may be a bit less efficient and not give quite as precise control on flat water. If you frequently paddle with a backpack or a dog, this might be another reason to sit farther back. If you are unsure of placement, text or email for a custom recommendation.

Placement recommendations for front edge of seat rail in solo canoe, aft of center
Add for hole drilling location

	Standard	Custom
Asymmetrical solo (center lands on a rib)		
Symmetrical solo (center lands on a rib)		
Asymmetrical solo (center between ribs)		
Symmetrical solo (center between ribs)		

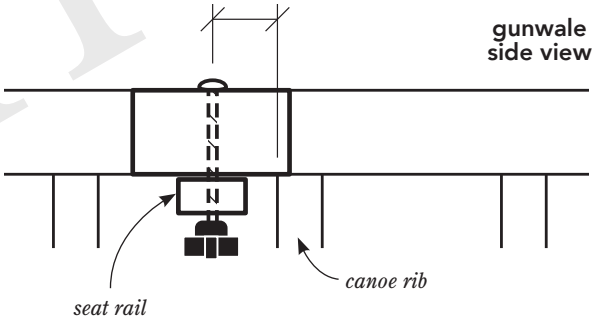
Note: The curved seats sold by Northstar Canoes are 9 ½ inches wide. It's a good idea to have one in hand before gluing seat blocks and drilling holes.

TANDEM CANOES

For tandem canoe seat placement, assuming that the distance between the last rib and the end of the gunwale is inches, we recommend placing the front edge of the bow seat approximately inches back from the bow end of the gunwales. For the stern seat, we recommend placing the back edge of the rear seat inches forward of the stern end of the gunwales. Depending on the canoe, these distances may need to be adjusted slightly to prevent overlap between ribs and seat rails.

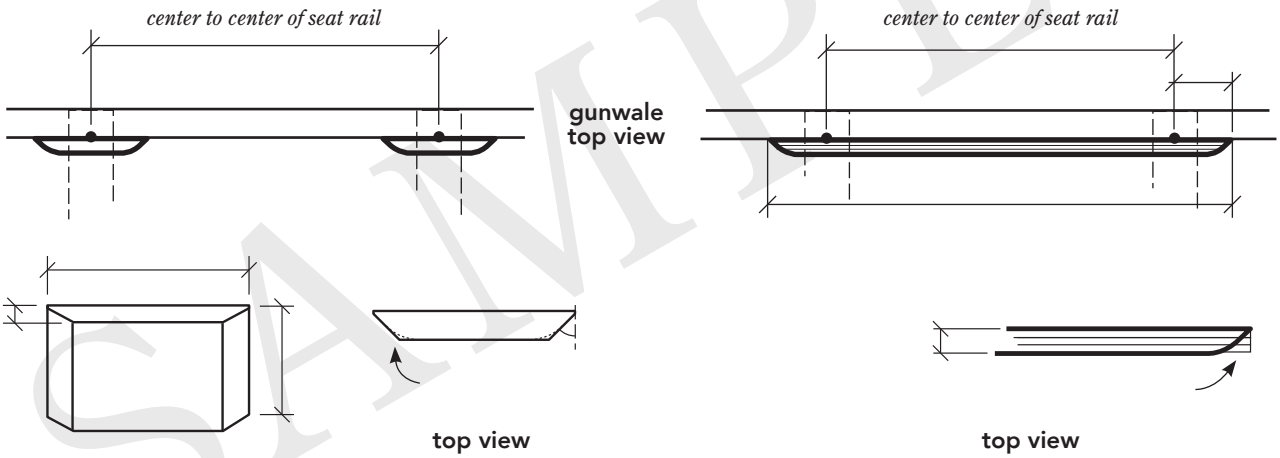
ADDITIONAL CONSIDERATIONS

Regardless of seat blocking method, the seat bolt hole must be a minimum of inch away from the edge of a rib to avoid the star knob hitting thre rib.



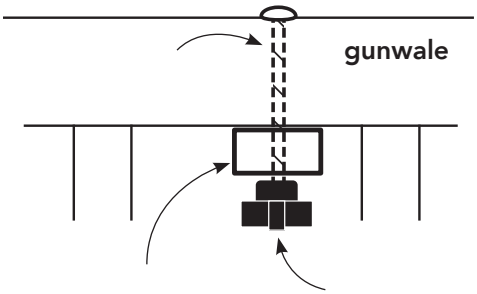
INSTALLING SEAT BLOCKING

For either of the methods below, you'll want to use a medium density hardwood. I really like cherry for this task, and I wouldn't use anything less dense than cherry. Note that if using ash it will slowly turn black, unless you tape it off and varnish it. Other than that, ash is also a good choice.



ATTACHING THE SEAT

We attach the seats to the gunwales with stainless steel truss head bolts (a wide, rounded top with a #1 Phillips head). Hex head bolts are also an option, but you'll need a separate washer up top. inch long full-thread bolts allow the seat to be mounted directly to the bottom of the gunwale, or underneath spacer blocks up to inch tall. Taller spacer blocks require longer bolts. To hold the seats in place, we prefer phenolic plastic 1 ½ inch star knobs, which make it easy to install and remove seats with minimal tools. If you plan to never remove your seat, however, a washer and a nyloc nut work just fine. Whatever mounting hardware you choose, it's always a good idea to have a spare with you when you're out boating.



There are three things to consider when thinking about seat height: What height do you need to be stable? What height is comfortable? And if planning to kneel, what height can you get your feet out from under if you capsize?

Unfortunately, the only accurate way to find the right compromise is to experiment in your own canoe. All I can do is offer some general recommendations, and then you can modify after you see how it feels.

SOLO CANOE SEAT HEIGHT

A good starting point for a solo canoe is to plan for inch of drop on the seat, attached with inch long bolts. This can be accomplished by either adding small spacers or blocks to a flat seat, or by bolting a curved seat directly to the bottom of the gunwales.

TANDEM CANOE SEAT HEIGHT

Tandem canoes are typically deeper and we almost always need some level of seat drop. I recommend drilling with the precision jig method shown in the videos, and starting with the stern seat mounted on short spacer blocks and the bow seat mounted on a short spacer block in the rear and a longer spacer or spacer in the front to angle the seat slightly forward. From there, you can add taller spacers if needed for stability. It is also possible to build curved seats for a tandem, but keep in mind that curved seats installed in narrow locations often need custom spacers to compensate for the portion of the curve that was cut away to fit the seat.

PEDAL DRIVE CANOE SEAT HEIGHT

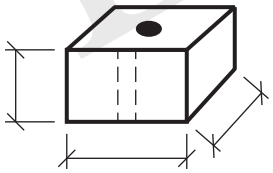
The seat on a pedal drive canoe will always angle backwards toward the back rest. Personally, I put these seats

spacer in the rear that drops the back of the seat inch lower than the front. Maximum stability will come from pairing this with a curved seat.

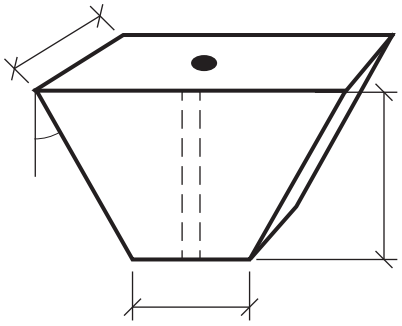
SPACER BLOCKS

If spacer blocks are needed or desired, make them out of a tough, split-resistant hardwood. For safety, cut a longer piece of wood than you need and drill the holes, then cut the spacer blocks to length. Round off sharp edges and dip in oil or varnish.

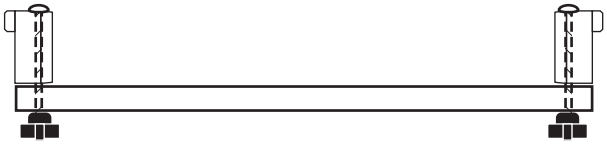
short spacer blocks



tall spacer blocks



Safety Note: Keep in mind if you are planning to kneel under the seat or a thwart, you MUST practice capsizing in very shallow, warm water with a friend spotting you to make sure that you can wet exit safely. Because skin-on frame boats have slightly less room under the seat we STRONGLY recommend wearing low-profile paddle shoes, NOT bulky paddling boots if you are planning to kneel. The NRS Kinetic is my current favorite paddling shoe.



Flat seat bolted to gunwale bottom

Commonly used in wide, shallow canoes

Pros: Simple, inexpensive, strongest. Functions as a stiffening thwart. Best underseat clearance and sitting comfort.
Can use bolts (much less expensive).

Cons: Possibly too high to be stable.

Flat seat bolted with spacer blocks

Commonly used on solo canoes

Pros: Simple, inexpensive, strong. Functions as a stiffening thwart. More stable.
Can use bolts (much less expensive).

Cons: Slightly less strong, possible under-seat clearance issues for larger feet.

Curved seat bolted to gunwale bottom

Used on solo canoes or the front seat of tandems

Pros: More stable, strongest. Functions as a stiffening thwart. Uses less expensive bolts.

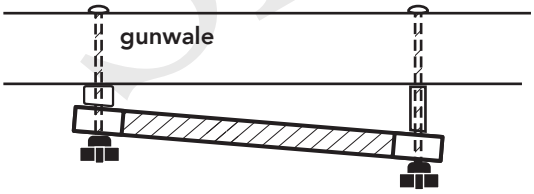
Cons: More expensive or complicated to build, possible underseat foot clearance issues if kneeling.

Curved seat bolted with spacer blocks

Used on pedal drive canoes or the front seat of tandems

Pros: More stable, strongest. Functions as a stiffening thwart. Uses less expensive bolts.

Cons: More expensive or complicated to build, underseat foot clearance issues likely if kneeling unless the canoe is deep.

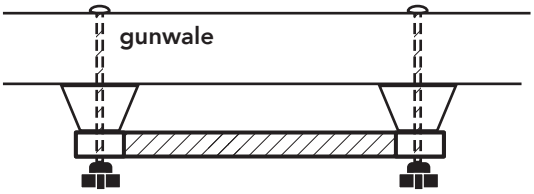


Seat bolted to spacer block in front and in back

Commonly used in bow seat of tandem or on pedal-drive canoes

Pros: More stable, angled for comfort, can still be used as a canoe stiffening thwart.

Cons: More complicated, requires precise hole drilling. Possible foot clearance issues in shallower canoes, especially if combined with a curved seat (most stable).



Seat hanging from even or uneven tall hardwood spacer blocks

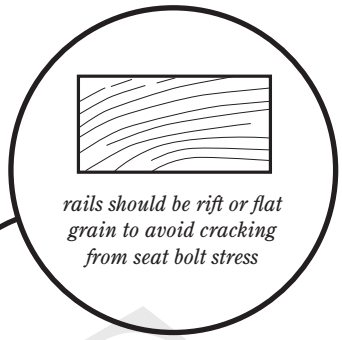
Commonly used in large/deep canoes, or where maximum stability is needed

Pros: Gives the most possible stability.

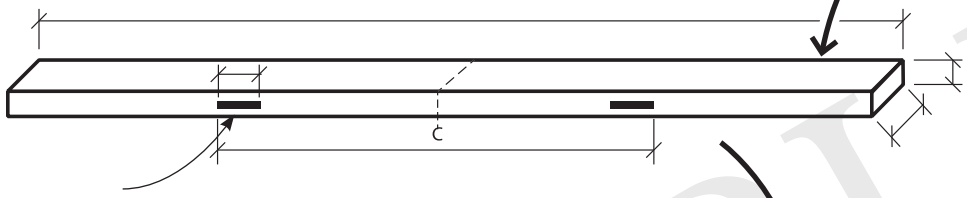
Cons: More complicated, requires precise hole drilling. Possible foot clearance issues in shallower canoes, requires long bolts. Seat can no longer be used as a stiffening thwart; you will need to install a separate thwart to keep the canoe from "opening up".

BASIC FLAT CANOE SEAT:

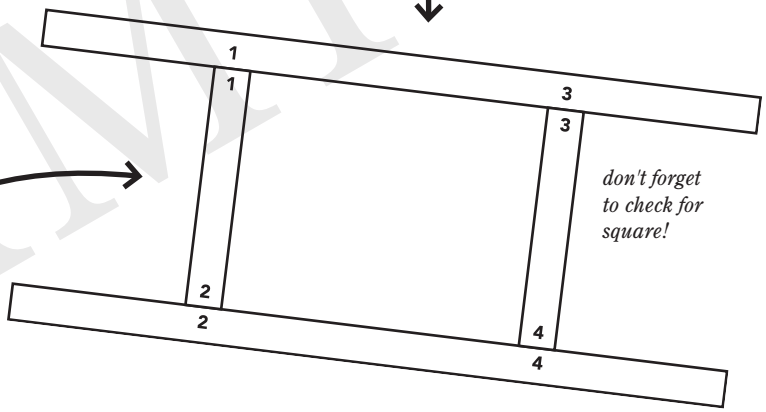
A flat canoe seat is the easiest type to build. It should be made out of ash or any stronger, split-resistant species of wood.



seat rail, build 2

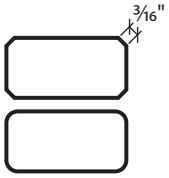


side rail, build 2



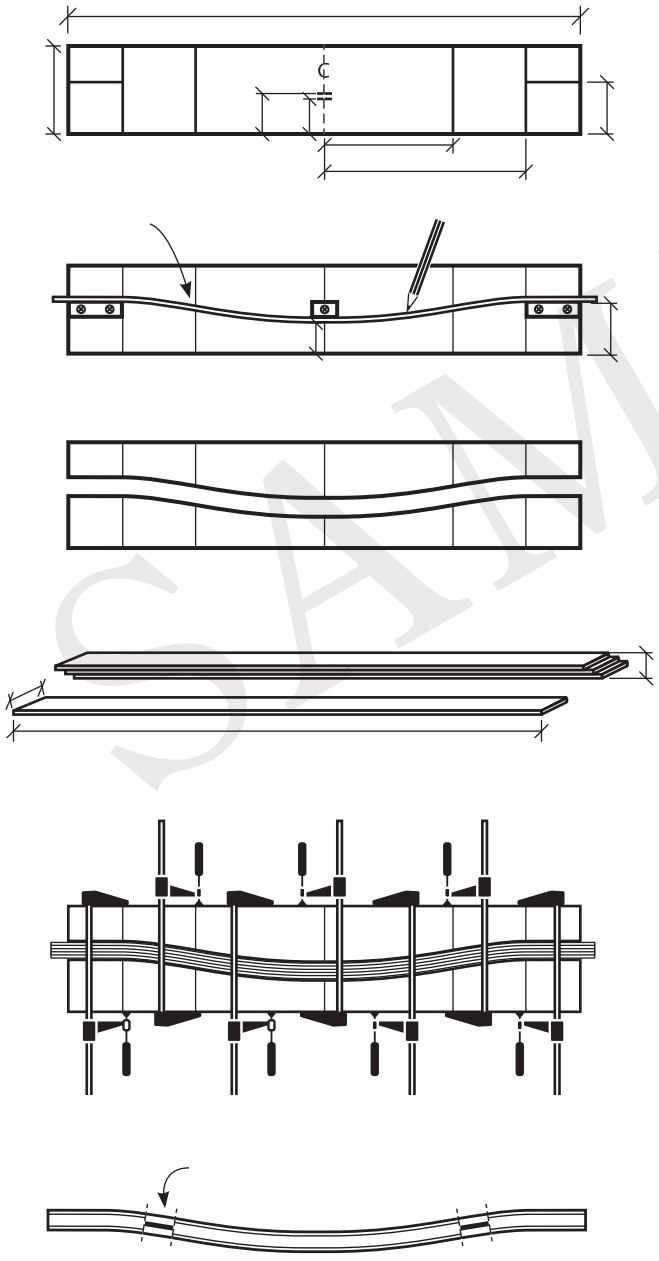
Assembly:

Dry fit all pieces and mark which joints will fit together. Apply a generous coating of glue to the tenons and clamp firmly overnight. Chamfer or round edges no more than 3⁄16".



CURVED LAMINATED CANOE SEATS

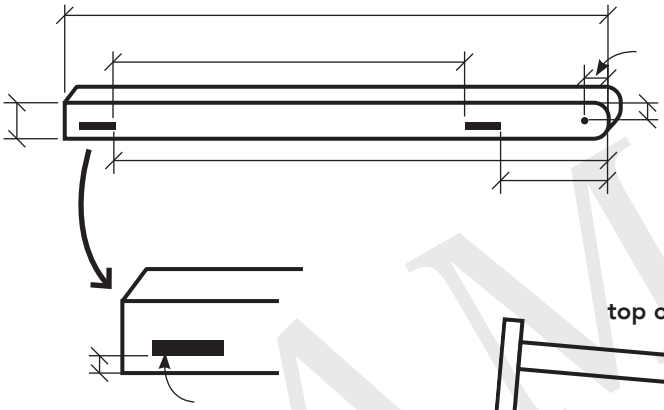
Curved canoe seats are more challenging to build, but they are also stronger, and allow you to lower your center of gravity without using spacer blocks. They can also be used in conjunction with spacer blocks to lower your center of gravity even further, without needing to add a separate thwart in the canoe. Whether or not a curved seat makes sense for you just depends on the seat height that you're targeting. For me personally, a curved seat bolted directly to the bottom of the gunwales usually gives me a good compromise between sitting height, kneeling height, and a safe amount of foot room without the hassle of spacer blocks, but that might not be the same for your situation!



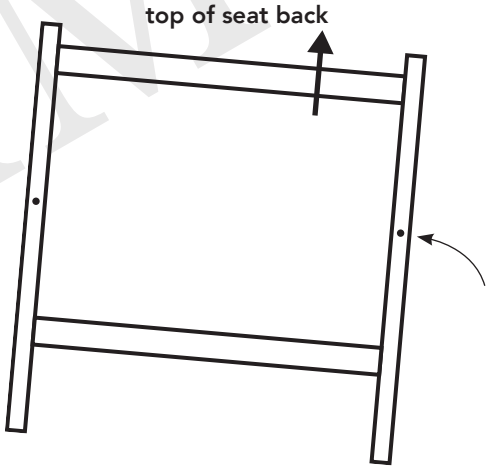
MAKING A TALL SEAT BACK

Because tall seat backs put your body in a position where it's difficult to effectively paddle a canoe, they are typically only useful for pedal drive canoes, which require something to lean and push against. However, a seat back can be a useful add-on for certain situations where you will be sitting and not paddling for a long period of time. Note that the geometry of your first back rest may not be perfect for your situation, but hopefully this basic design will get you close enough to be able to build a perfect one if it doesn't fit quite right. Seat backs should be made out of ash or any stronger species of split-resistant hardwood.

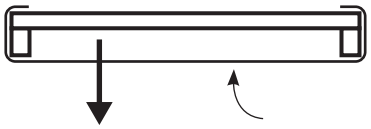
vertical rail, build 2



horizontal rail, build 2

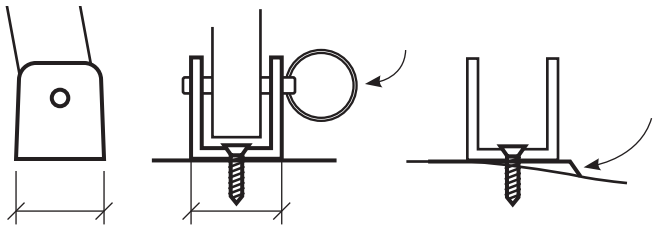


top view of webbed seat



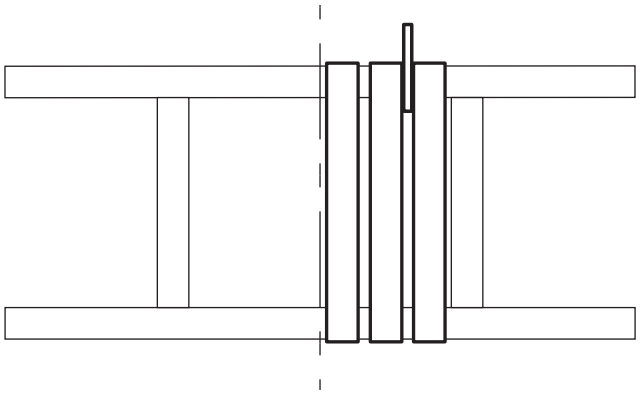
Assembly:

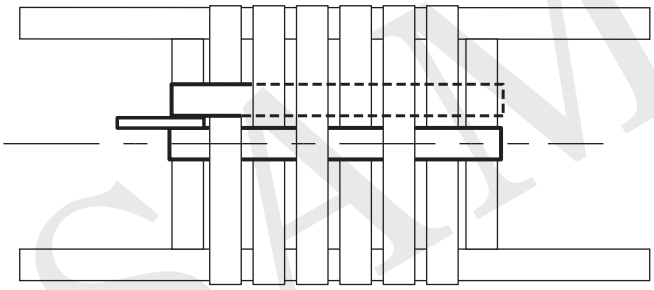
Dry fit all pieces and mark which joints will fit together. Apply a generous coating of glue to the tenons and clamp firmly overnight.

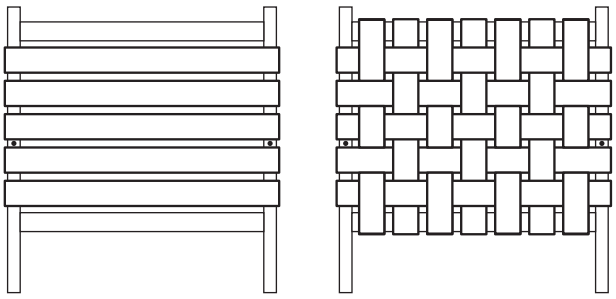


Canoe Seats: Stapling on the Webbing

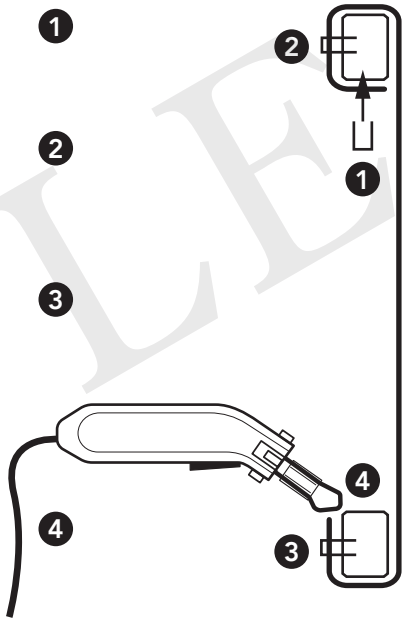
We cover the canoe seat with 1 ½ inch wide heavy-duty polypropylene webbing, although polyester would also work, but not nylon, because it stretches when wet. You will need about 20 feet of webbing per canoe seat. Make sure to watch the video for complete instructions, because there are set up tricks that will make this task a lot easier.

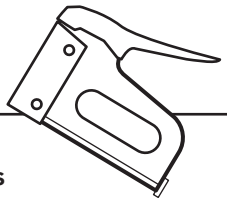






Stapling the webbing





Staples

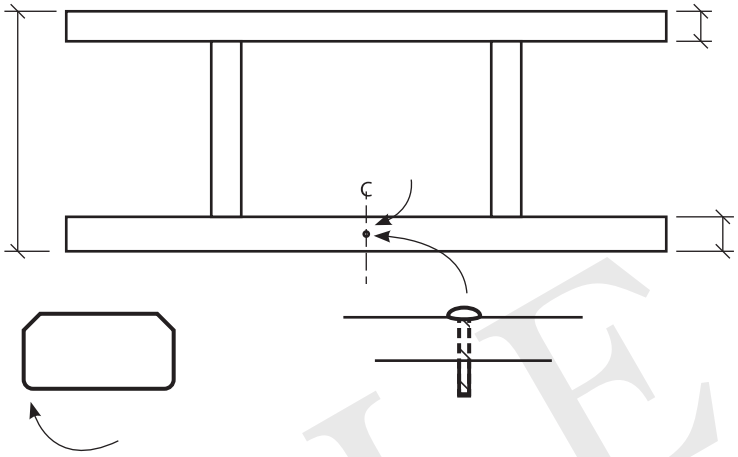
For the staples we will be using ⅜ inch stainless steel T 50 staples. You can staple these into hardwood with a normal staple gun, although a good pneumatic or electric gun is a lot easier.

If you are a finish carpenter and happen to have a ¼ inch crown stapler, that is also an option. Use with ½ inch long stainless steel staples.

SEAT MODIFICATIONS FOR RUDDER SYSTEM

To use this rudder you will need to build a custom 12 inch wide canoe seat with some sizing modifications to the seat rails for strength. Follow the standard seat assembly instructions in videos and plan pages, but with the changes shown here.

modified seat

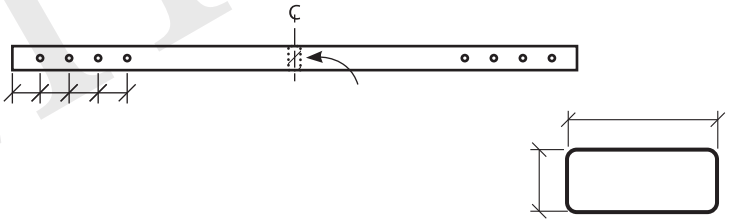


UNDER-SEAT TILLER

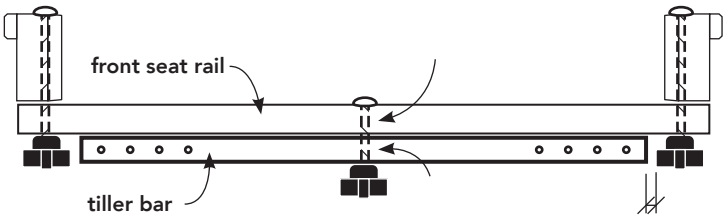
The under-seat tiller is a simple piece of wood with a series of holes drilled in the ends that create a friction brake for the rudder lines, and a hole in the middle used to bolt the tiller to the bottom of the seat with a star knob. Tension on the star knob increases or decreases tension on the tiller. Because the tiller is easy to replace, hardwood is not necessary. If using a curved seat, you will need to use your laminating jig to make your tiller.

under-seat tiller

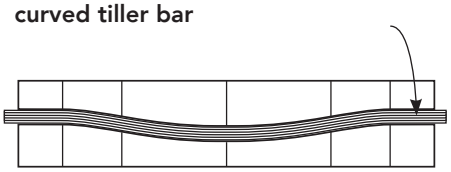
softwood is fine to reduce weight



tiller assembly



laminating a curved tiller bar

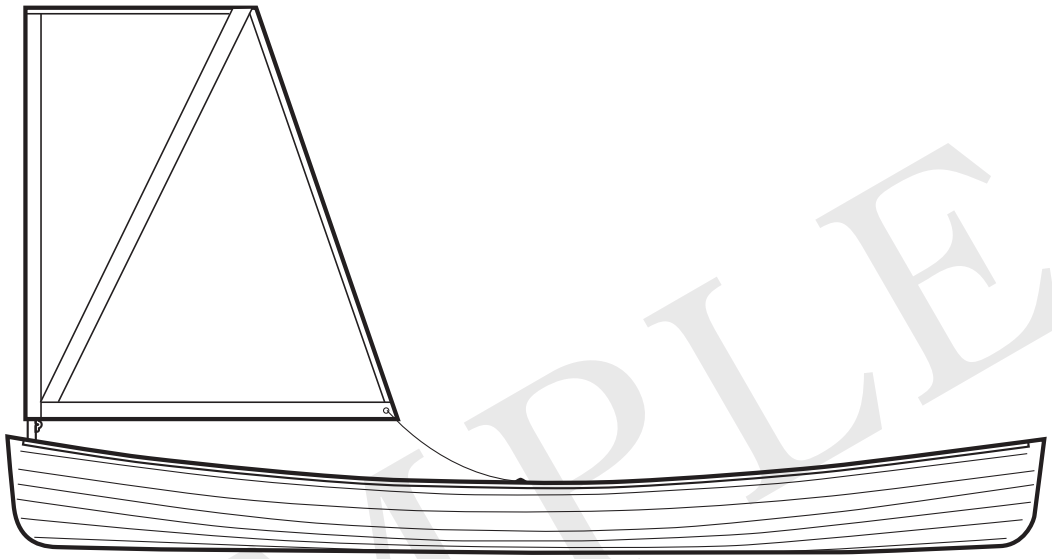


For curved seats, use your seat rail form to laminate a curved tiller bar. Drill all holes as shown above. Personally, I sandwich 3 pieces of softwood between 2 pieces of hardwood, but that's not necessary.

CAPE FALCON KAYAK

Making a Simple Pop-Up Canoe Sail

SAIL AND MAST SYSTEM FOR SMALL BOATS



This simple, modest canoe sail is easy to build and easy to use, and offers a free push when the wind is favorable. With the addition of this sail our full-size single-blade canoes and our longer double-paddle canoes can sail downwind or on broad reaches, and our smallest pack canoes will sail across the wind.

Canoe sailing is a lot of fun but it's important to keep in mind that adding a sail greatly increases the risk of capsize, making flotation, immersion gear, and well-practiced rescues essential. This course includes safety advice, but is not meant to replace qualified canoe instruction and good judgment on the water.

CONTENTS

Why are there so many discrepancies between the videos and the plans?

The original sail making videos are almost four years old now and while we have improved upon the sail design, we have not had time to update the videos yet. So for right now, pay close attention to the materials list and design details shown in the plans, and use the videos as a general process overview. The videos will be replaced in 2024.

SAIL MAKING TOOLS

Scissors

Pencil

Hammer

Rivet gun

6 foot straight edge ruler
(tape measure and stick will work)

Propane torch *(lighter will work)*

Cordless drill and driver

3/32 – 3/16 inch drill bits
(a 7/64 spiral point countersink is nice)

Sewing machine

Extra bobbins

Denim needles

SAIL MAKING SUPPLIES

Organized by source

Cape Falcon Kayak *(capefalconkayaks.com)*

1 ea micro clam cleat with fairlead

2 ea micro clam cleat without fairlead

20 feet of 1/8 inch raided Dacron cord

1 ea narrow saddle pad eye *(uphaul on bow)*

1 ea stamped eye strap *(uphaul on mast)*

12 ea #6 x 1 ¼ inch flathead Phillips stainless steel screws

2 ea #8 x 1 inch flathead Phillips stainless steel screws

1 ea 5 ½ inch piece of .058 wall thickness 5/8 inch diameter aluminum tube

¾ inch plastic end plug for top of mast

Sailrite *(sailrite.com)*

¾" x 6' aluminum rail tubing

2 yds Dacron 4oz 60" wide sailcloth

V69 polyester 4oz thread *(enough for many sails)*

Seamstick ¼" basting tape *(enough for many sails)*

Duckworks *(duckworksbbs.com)*

Ronstan urethane universal tiller extension joint

Other supplies

2 ea 1/8" x ¼" aluminum rivets *(buy a little box)*

Small strips of wood for boom and sprit, see video

The Legal Stuff

Both woodworking and boating are inherently dangerous. It is your responsibility to obtain the appropriate training for any tool used in the building process, and the paddling skills necessary to operate your boat safely.

By purchasing this plan set and video course, you agree to indemnify, defend and hold harmless Cape Falcon Kayak, its officers, agents and employees for, from and against any and all claims, liability damages, losses and expenses, including reasonable attorney fees, for any claim, cause of action, demand, personal injury or death or damage to any propery or person arising out of or in any way connected with the products purchased.

Boating is inherently dangerous because people are not aquatic animals. Adding a sail increases the risk of capsize. By using our sail design you are acknowledging those risks and agreeing that **your safety on the water is YOUR RESPONSIBILITY**. The following are some important safety tips to remember, but are not a substitute for qualified instruction and good judgment.

1) Understand the conditions and potential hazards

- How strong is the wind?
- How strong could it get?
- Is there boat traffic?
- Is there current opposing the wind (creating a dangerous chop)?

2) Make sure your flotation strategy matches the trip

- If I tip over am I certain I can re-enter the canoe in possible conditions?
- If not, can I paddle the canoe to safety anyway?

3) Make sure your immersion strategy matches the trip

- How cold is the water?
- Could I need to paddle a swamped boat or swim extended distances?

4) Keep your boat well organized

- Can I put my hand on anything I need in one second?
- Is my boat free of obstructions or entanglement hazards?
- Do I have a spare paddle and safety equipment?
- Do I have spare clothes, extra food and water?

5) Make sure your rescues are well practiced and appropriate for the circumstances

- Ask yourself: Have I recently practiced rescuing this canoe, with this gear load, in these wave, wind, and water temperature conditions?

Remember, the best way to stay out of trouble is not to get into trouble in the first place.
Sail smart, sail conservatively. Your safety is YOUR RESPONSIBILITY.

Note on signaling/communication devices: While I do carry a cell phone or VHF radio on the water, it is not part of my safety strategy. Although outside help has saved the lives of many boaters, it's ALWAYS a bad idea to incorporate the possibility of rescue into your initial risk assessment.

Table saws are already the most dangerous power tool in a shop and cutting thin wood, long wood, and curved wood all add to the risk of using this tool. Below are some helpful safety tips and suggestions to be considered in addition to qualified instruction and good judgment.

Remember: YOUR SAFETY IS YOUR RESPONSIBILITY.

SETTING UP THE SAW

- Use an appropriately powered saw
- Set up your saw well
- Have a well-supported outfeed that won't jam or steer the wood
- Use sharp blades (I use 24-40 tooth thin kerf ripping blades)
- Raise the blade the appropriate amount
- Use a good push stick
- Use featherboards when needed

SAFETY EQUIPMENT

- Always wear eye protection
- Hearing and respiratory protection are a good idea
- Never wear gloves

CUTTING TECHNIQUE

- Stay out of the line of fire of the blade
- Be confident and maintain control of the wood
- Always push your stock all the way through
- Don't make close cuts
- Cut with the curve running away from the fence
- Never reach around the blade or pull anything through a table saw
- Helpers should never pull or steer the wood
- Don't cut tired

Beware of the "just this once" mentality!

This is a list of all the videos in the course for quick reference. I know there are a LOT of videos, but please watch all videos relevant to your build all the way to the end.

This course is packed with information to help you avoid all the common skin on frame building mistakes so your first build turns out as well as if I'd built it myself!

— Brian

INTRODUCTION

- Course introduction
- Tips for a successful canoe build (text)
- Licensing agreement
- How the course is organized
- Safety disclaimer
- Tips for avoiding a tippy canoe
- Canoe course updates and changes (text)

PROCESS OVERVIEW VIDEOS

- Visual overview of the pack canoe building process
- Visual overview of building a solo single blade canoe
- Time lapse of the entire canoe building process
- The same time lapse slowed down 50% (gives clearer views of each step)

ODDS AND ENDS

- Color options for skin on frame boats: acid dye vs. earth pigments
- Workspace setup and tips for an efficient build
- Canoe seating overview (full size canoes)
- Planning for keel strips and stem bands
- Canoe sail
- Canoe rudder overview
- Overview of polyurethanes, oils, glues, and varnishes

CANOE PLAN SET

VARIOUS CANOE EXAMPLES

- My latest thoughts on canoe design (text)
- Solo canoe with tumblehome: 15'1" x 30" (text)
- Solo canoe with tumblehome: 14' x 30" (text)
- Student built solo canoe: 14' x 30" (text)
- Student built solo canoe: 14'8" x 31 1/2" (text)
- Student built tandem canoe 16'3" x 36" (text)
- Student built tandem 17' x 36" (text)

TOOLS, WOOD, AND OTHER MATERIALS

- Tools for skin on frame building
- Tablesaw safety tips
- Supplies
- Selecting softwoods
- Selecting hardwoods
- Understanding bending wood grain
- Estimating quantity and price of bending wood and communicating with suppliers
- Building the steambox
- Bending oak suppliers (text)
- Canoe skin choices (text)

PREPPING FOR THE BUILD

- Layout process overview
- Cutting the gunwales, stringers, and keel
- Rounding the stringers
- Laying out the gunwales
- Measuring the rocker heights
- Setting up for laminating
- Laminating the gunwales
- Cleaning up the lamination and cutting the gunwales
- Fastening the gunwales together and cutting to length
- Setting up the plunge router
- Cutting the mortises
- Measuring sheer heights
- Calculating center depth
- Cutting stem lengths and angles
- Angled stem layout
- Alternate curved stem layout
- Making the spreader forms and final gunwale prep

BUILDING THE DECK

- Installing spreader and capture forms
- Kerfing the gunwale ends
- Tying the gunwale tips together
- Checking for symmetry
- Doweling the gunwale tips and trimming the ends
- Making the rub rails
- Varnishing the rub rails
- Attaching stems and center block
- Checking the stem angles and setting the rocker
- Temporarily attaching the stems to the keel

BENDING IN THE RIBS

- Making the rib length measuring stick
- Prepping the rib stock and cutting ribs
- Sorting and bending in test ribs
- Measuring, cutting, and rounding the ribs
- Thinning the ends of the ribs
- Setting up for steam bending
- Some tips for steam bending the ribs (text)
- Leveling the canoe, workspace review, and steaming times
- Steam bending the ribs
- Re-steaming, replacing, and fixing cracked ribs
- Pegging the ribs

ATTACHING STEMS AND STRINGERS

- Setting the stringers
- Winding lashing spools and setting up for lashing
- Lashing on the stringers
- Re-checking the rocker
- Fixing shaping issues
- Modifying or replacing ribs (if needed)
- Adding progressive end rocker
- Shaping the stems
- Tapering the keel (if needed) and permanently attaching the stems
- Trimming and fairing in the stringers
- Planning for the mast step location
- Tying the stringers to the stems
- Fixing wobbly stringers

FINISHING AND OILING THE FRAME

- Pegging the keel to the stem
- Reinforcing the keel
- Final keel symmetry check
- Shimming and lashing the keel to the ribs
- Adding sheer blocks
- Cleaning up the frame
- Choosing and marking the canoe seat locations (single blade canoes)
- Canoe seat location recommendations (text)
- Installing seat blocking (single blade canoes)
- Alternate seat blocking method (single blade canoes)
- Special instructions for attaching extra long seat blocking
- Oiling the frame
- Adding tumblehome
- Attaching the mast step

SKINNING THE CANOE

- Skinning supplies
- Skinning process overview, draping the fabric
- Pinning the stem
- Cutting and sewing the stem: center stitch
- Cutting and sewing the stem: side stitch
- Shortening the fabric
- Stretching the fabric and pinning the keel
- Wetting and stapling the fabric
- Clamping and fastening the rub rails
- Cutting and sewing the tops of the stems
- Final rocker check and tuning
- Trimming the excess fabric
- Shrinking out wrinkles
- Setting up for dyeing the canoe
- Coloring the fabric with acid dye
- Coloring the fabric with earth pigment

COATING THE CANOE

- 13 common coating mistakes (text)
- Coating supplies
- Two cup 2 part polyurethane mixing method
- Single cup mixing method
- Batch size and working time
- Coating process overview and workspace setup
- Initial saturation coat
- Second coat
- Smoothing imperfections
- Final coat and finishing touches
- Additional coats

BUILDING FULL-SIZE CANOE SEATS

- Full size canoe seating overview
- Choosing wood and mortising the seat rails
- Cutting the tenons and gluing the seat together
- Sanding and finishing canoe seats
- Making a laminating jig for curved canoe seats
- Laminating the seat rails
- Modifying curved seats for tall backrests
- Building a tall backrest
- Stapling on the seat webbing

INSTALLING FULL-SIZE CANOE SEATS

- Canoe seating overview
- Setting up for installing canoe seats using a drilling jig (more precise)
- Installing canoe seats using a jig
- Setting up for installing canoe seats, drilling freehand (easier and faster)
- Installing canoe seats, drilling freehand
- Adding spacer Blocksb

FINISHING FULL-SIZE CANOES

- Alternate catamaran method
- Making stem bands and rub strips
- Installing stem bands and rub strips

FINISHING PACK CANOES

- Removable backrest attachment introduction
- Making the attachment point
- Tying the shock cord
- Combination portage yoke / backrest
- Pack canoe seating options
- Flotation strategies

SAIL BUILDING

- Sail introduction
- Sail supplies
- Sail tools
- Determining mast length
- Cutting the mast and inserting the tiller extension
- Attaching the canoe mast step
- Marking and riveting the mast attachment
- Sail size and shape discussion
- Planning the sail
- Planning the sail UPDATE
- Cutting and marking the sail
- Setting up the sewing machine and taping the sail
- Sewing the sail
- Making the battens
- Drilling the battens and tying on control lines
- Modifying the clam cleats
- Attaching the clam cleats to the canoe
- Rigging the canoe
- Sailing your canoe
- Canoe and kayak sailing safety

CANOE CATAMARAN SYSTEM

- Kayak / canoe catamaran introduction
- Comparing canoe catamaran styles
- Bungee loop style catamaran overview
- Making the attachment
- Rigging the bungee
- Selecting lumber for the catamaran boards
- Making the catamaran boards
- Finishing the catamaran boards
- Alternate canoe catamaran system

USING YOUR CANOE

- Care and feeding of your skin on frame boat (text)