How to Build the Sassafras Canoes
Thanks for your order. This manual will help you assemble the Sassafras canoe from a CLC kit or from plans. Building your Sassafras canoe will be much easier if you read through the manual a few times before starting construction. If you encounter any technical problems while building your boat please feel free to call us: 9am to 5pm (Eastern time) Monday through Friday. You can email any time.

**The Sassafras 12 & 16**

The lapstrake canoe is an ancient craft. In its recreational form it had already reached a very high pitch of refinement by the 1880’s, in the hands of artisans like J. Henry Rushton. Something about the combination of lightweight utility and easy, graceful lines makes the lapstrake canoe a very desirable creature, indeed.

Chesapeake Light Craft first introduced the lapstrake Sassafras canoes in the late 1990’s. Named after a placid and scenic river on the upper Chesapeake, these handsome canoes are at home in rivers, lakes, and bays, able enough to surmount wind, chop and powerboat wakes, and to carry a good load.

Lapstrake canoes built the way Rushton did it require extremely sophisticated skills and equipment. Using CLC’s exclusive LapStitch™ process, assembly is accessible to beginners. There’s no mold, no lofting, no spiling, no tricky joinery.

By 2011, hundreds of Sassafras canoes had been built, and the 13-year-old designs were ready for freshening. An entirely new Sassafras 16 was designed for the 2011 WoodenBoat Show, where a dozen were built during a “family boatbuilding” event. A further 18 of these tandem canoes were built at the show in 2012, with additional refinements, and still more were built at classes and shows in 2012 and 2013. This is probably an unprecedented field test for a new boat kit design, and with much feedback in hand, by 2014 we were ready to make the Sassafras 16 Mark II available to the public. Improvements over the 1998 original include more stability and payload without the loss of speed and handling, and much-simplified construction. Plans, which for the early models had been all but schematic, were upgraded to full-sized patterns for every part, and the manual was given an expansive rewrite.

The Sassafras 12 design was completely overhauled in 2012. Like the Sassafras 16, the Sassafras 12 Mark II is essentially a new design on the same theme. It remains an ultralight solo “pack canoe,” light enough to carry in one hand. The revised canoe is prettier, stronger, and easier to build.

Particular thanks to the August 2012 WoodenBoat School class, from which many of the photos in this manual are drawn. John C. Harris wrote and illustrated the manual, with much help from Jay Hockenberry, Nancy Noyes, Matt Cordrey, and Blaine Skilling.

Please remember that when you buy a kit or a set of plans you are purchasing the rights to build only one boat. You must buy additional kits or plans and/or get written permission to build additional boats. Chesapeake Light Craft and the boat’s designer retain all rights, including copyright, to these designs.
Sassafras 12 - Kit Contents

- Rails
- Panels 1 to 6
- Temporary Molds
- Seats (Top and Bottom)
- Deck Trims
- Decks
- Bulkheads
- Thwart
- Nylon Backband
- Instructions
- Hull 'Glass
- Hull Hardware (see checklist)
- Adjustable Footbraces
Sassafras 16 - Kit Contents

- Panels
  - Panel 1
  - Panel 2
  - Panel 3
  - Panel 4

- Rails
  - Panel 1
  - Panel 2
  - Panel 3
  - Panel 4

- Planks

- Seats/Spacers

- Rail Doublers

- Bulkheads

- Temp Frames

- Decks

- Deck Trim

- Thwart

- External Bow Molds

- Instructions

- Hull 'Glass

- Hull Hardware
  (See Checklist)
Stitch-and-Glue Essentials
Tools and Supplies

It takes relatively few tools to build a stitch-and-glue boat. Here’s a list. Many of these items are available from Chesapeake Light Craft. Check out our boatbuilder’s store at clcboats.com.

- Tape Measure and a yardstick/straightedge
- Pencils
- Small Handsaw – Best are the Japanese-style saws that cut on the pull stroke. A small back saw or dovetail saw will also work.
- Block Plane – Make sure it is sharp.
- Drill and bits – Along with a set of high-speed bits, you will need a countersink with a 3/8” plug borer.

Buy an extra 1/16” drill bit, the size needed for drilling wire stitch holes. You’ll break them.

- Screwdrivers
- Pliers – The best are the “lineman’s”, specifically for working with wire.
- Wire cutters – These are for cutting stitches; the diagonal cutter type is by far the best.
- A selection of wood rasps
- Sharp knife – A regular utility knife with a box of new blades.
- Sawhorses – The straight-top style is best for gluing up your hull.
- Sanding mask or respirator
- Safety glasses – Wear them.
- Clamps – You’ll need at least 30 clamps. 60 is better. We used inexpensive 2-inch (50mm) spring clamps
- Electric sander – The 5-inch random orbital type is the most versatile and that’s what you see in the photos in this manual.
- More clamps

Tools for builders working from plans; optional for kit builders:

- Tablesaw
- Bandsaw
- Router – with rabbeting and round-over bits.
- Even more clamps
Essential Consumable Supplies:

- Sandpaper – 80-grit, 120-grit, 220-grit
- #6 x 3” drywall screws
- 2” masking tape
- Disposable foam brushes – with wooden, not plastic, handles. About 36.
- Disposable bristle brushes – So-called “chip brushes,” about 36 for this project.
- Disposable foam rollers – Buy only the short nap yellow type that is also used for applying lacquer. Never use the black foam rollers. About two dozen.
- Epoxy metering pumps – These pumps are included in our kits.
- Stirring sticks – Popsicle sticks or any similar pieces of wood.
- Disposable gloves – It’s economical to buy boxes of 100.
- Respirator or disposable masks.
- Polyethylene (plastic) sheeting
- One-gallon Freezer bags (for epoxy fillet dispensers)
- Scrap Wood – A variety of dimensional lumber scrap for clamping puzzle joints
- Denatured Alcohol (not isopropyl)
- Clean rags
Stitch & Glue Essentials

Marine Epoxy Basics
Throughout this manual, we refer to waiting until “cures” before you move to the next step. In reality it takes weeks for epoxy to cure (“activate” is the precise term, but you know what we mean). 24 hours is long enough at room temperature. Whenever an assembly has some critical curing time, we’ll be specific.

Epoxy is a two-part adhesive, consisting of a resin and a hardener. You can pick the hardener’s speed — fast, medium, or slow; but you can’t change the ratio at which you mix the two. A chemical reaction causes the epoxy to activate and “cure.” As the mixture begins to cure the chemical reaction generates heat. This can be a problem if you mix too much at a time and take too long to use the epoxy. Plan ahead and even rehearse assembly procedures so you are able to get the epoxy out of the cup in a reasonable time. The reaction always runs faster at higher ambient temperatures and slower in lower ambient temperatures. When in doubt, mix small batches.

The epoxy CLC provides is mixed at a ratio of two parts resin to one part hardener. Unlike polyester resin, you cannot speed up or slow down the epoxy cure by altering this ratio. If you change the ratio, the epoxy may never cure.

We use epoxy in several different ways to build our stitch-and-glue boat. We’re going to use it as:
• A liquid coating, to seal the wood or saturate fiberglass cloth.
• An adhesive to bond wood parts, usually thickened with Cell-o-fill.
• A structural filler, mixed with wood flour to make a thick paste.

Mixing Epoxy
Our epoxy comes in two jugs, one with resin and one with hardener. When we speak of “unthickened epoxy” it means mixed right from the pumps. One push on the resin pump and then one on the hardener pump automatically dispenses the proper amount of resin and the proper amount of hardener. Carefully follow the instructions included in the resin and hardener pump package. Be sure to put the hardener pump in the hardener and the resin pump in the resin!

When you’re making a big batch of epoxy, pump out the resin and hardener by alternating strokes on first one pump and then the other; the two parts will have a head start towards being mixed, and it’s harder to lose count. Mix very carefully with a clean, skinny mixing stick. Most problems arise from not having mixed the epoxy long enough. Thirty seconds mixing for every pump of resin is ideal, up to a maximum of 4 minutes for larger batches.

Clamping Glued Joints
For clamped wood-to-wood joints like scarfs, we need the strongest possible mix. We mix a strong cellulose filler called Cell-O-Fill into the epoxy to thicken it. This mixture produces an extremely hard adhesive. It’s no fun to sand so clean up carefully. We refer to the ideal thickness of such a mix as a “mustard” consistency. It doesn’t drip off a stick, but it spreads easily and smoothly.
Filling and Fairing
For filling gaps, or for epoxy “fillets” (pronounced “fill-it” in this application), we use wood flour, which is nothing more complicated than highly-refined sawdust. You will mix it with the resin and hardener to create a peanut butter-like paste, and you’ll be using gobs of it in the Sassafras canoe. Wood flour and epoxy creates a strong filler which adheres to the wood on either side of a joint, fills gaps well, and can be spread smoothly with simple filleting tools.

Microballoons are also just what they sound like: microscopic phenolic resin spheres. Since they are thin-walled spheres, microballoons are mostly air. The epoxy mix is light, like foam, and easy to sand. Think of it as industrial-strength Bondo, perfect for filling in pits or low spots. A microballoon mix is not for gluing joints. Professionals will sometimes mix it with wood flour for a customized, light-weight filleting blend. Microballoons aren’t included in the Sassafras kits but are handy for finishing and fairing prior to paint.

Whenever you make up thickened epoxy, pump out the resin and hardener by alternating resin and hardener, mix the two completely, and then begin adding the thickener a little at a time until you have the consistency you want.

Applying Epoxy and Glass Cloth
You will be applying fiberglass cloth to much of the interior and the exterior of your Sassafras canoe. With the low-viscosity epoxy we supply in our kits, you can roll out fiberglass fabric onto clean dry surfaces, make sure everything’s smooth, then apply epoxy. Coating the glass, or ‘wetting out,’ is done with unthickened epoxy. Mix in batches of about 10-12 ounces and use a spreader or a squeegee to spread the poured liquid evenly over the fiberglass. The first coat must be only thick enough to saturate the cloth. As the cloth is saturated it will become transparent and any dry spots will be loudly obvious. When properly done, the cloth will be transparent but the weave will still be very evident. If you apply too much epoxy on the first coat the cloth will float to the surface and you will have a weaker structure.

Subsequent coats fill the weave prior to painting or varnishing. The best tool to use is a disposable yellow foam roller specifically designed for epoxy application. After rolling on the epoxy, “tip” it out with a disposable brush to pop the tiny air bubbles left by the rollers.

Epoxy cures to a bumpy surface. When you are sanding an epoxy surface in preparation for varnish, you want to remove all of the shiny spots. Sand the really jagged areas with 80 grit paper. 120 grit is good for leveling everything in preparation for paint primer. Areas to be varnished should be rubbed down with 220 grit sandpaper first to remove the swirls left by coarser sandpaper.
Finishing
It may seem peculiar to start our manual with a discussion of the boat’s finish, but how you plan to finish the boat can make a difference in how you build the boat. In general, the neater you are as you build, the easier the boat will be to finish. You can spend as much time, or more, on the finish as you did in actually assembling the boat.

You must apply some type of finish to your boat. The epoxy coating might remind you of varnish, but you can’t stop there. Epoxy, like most plastics, deteriorates in sunlight, turning yellow and dull and after a while beginning to crack. It needs to be protected from UV light with either paint or varnish.

Types of Finish:

Varnish
A “Bright Finish” in the world of boatbuilding means a clear coating over the wood. (Not to be confused with “staining,” a term from furniture building that implies changing the color of the wood with a special dye.) It’s the traditional way to finish small pleasure boats like canoes and rowing skiffs. In modern times it has become a favorite finish for wood-epoxy small craft. A bright finish means you need to take great care with your plywood—no scratches or sanding marks!—and your fillets need to be really neat. Virtually everyone will want to varnish the interior of their Sassafras canoe.

You’ll need 3-5 coats of a good marine-grade varnish. Don’t be tempted to use less expensive household interior or polyurethane varnishes. Use either a top quality natural bristle or a disposable foam brush and sand lightly between coats.

Paint
We recommend marine-grade polyurethane paint on top of a strong enamel primer. One-part paints have come a long way and it’s what we used on our own Sassafras canoe. Boats that will spend only a few days at a time in the water can use this sort of paint on the underwater surfaces. However, after long immersion such paints will begin to bubble and peel. If you are going to keep your Sassafras canoe in the water for more than a few days at a time, apply an herbicidal “bottom paint” directly to the sanded epoxy surface below the waterline.

Painting versus Varnishing
Most first-time boat builders want to show off the wood. However, there’s an argument to be made for painting. Paint is easier to apply; easier to touch-up; not as many coats are required; and you can use fillers or primer under the paint to achieve a smoother finish. Even big scratches or chips in the wood can be repaired with epoxy fillers and hidden under paint. Whatever you do, make sure every wooden surface on the boat has multiple coats of epoxy before you apply your finish.
Building Your Sassafras Canoe from Plans

*Kit builders should skip to page 29.*

By its very nature, stitch-and-glue boatbuilding depends upon pre-fabricated components that are assembled into a boat and then fixed in place with epoxy. Plans builders will need to create a “kit” of parts before joining up with the kit builders farther along in the manual.

Choosing Materials

All of the Sassafras canoes built from CLC kits are made out of okume plywood. Okoume is a plantation-grown African mahogany that’s available in a very high quality marine grade specification. It’s easy to work and finishes beautifully. Okoume is also the lightest weight plywood you can find, and is responsible for the Sassafras 12 and 16’s light weight compared to plastic, aluminum, or old-fashioned wood-canvas canoes. It’s still widely available (including from Chesapeake Light Craft) and it’s what we recommend you use to build your Sassafras canoe.

Other materials will work, but the boat will be heavier. We suggest sapele, another marine grade plywood with an exceptionally beautiful grain pattern. Sapele is even stronger than okoume, but a bit heavier and twice as expensive. Meranti will work if you can find it in a marine grade spec (British Standard 6566 or 1088). All plywood used in the Sassafras canoe should be marine grade.

While we haven’t tried it, it’s possible to build a Sassafras 16 canoe out of marine-grade fir plywood. This material has been around since the 1940’s and is still available in high-quality sheets. It’s strong but extremely heavy, at least 50% heavier than okoume. A marine fir hull would have to be painted, as the grain is unattractive.

Do not contemplate building a Sassafras canoe out of lauan or construction-grade plywood or anything not sold as marine-grade. Wood-epoxy composite hulls like the Sassafras canoe’s are not suitable for cheap, low-quality materials with voids and weak cores, like lauan or AC-grade plywood.

Likewise, we strenuously recommend sticking with the designed plywood thicknesses for the hull panels: 4mm (or 0.157”) for the Sassafras 12, and 6mm (0.236) for the Sassafras 16. These thicknesses not only yield a desirable combination of strength and weight, they are also going to BEND properly. Thicker plywood is unlikely to take the sharp twist in the lower hull panels in either boat, while thinner plywood might result in outright flimsiness. The urge to substitute some other thickness might come about for many reasons, including availability and economy, but understand that the trade-offs may prove unacceptable.

Material for the Sassafras canoe’s rails can be just about any straight-grained, knot-free material with good gluing characteristics. The kits are supplied with mahogany or Spanish cedar rails; spruce, fir, pine, cypress, or cedar would all work too, though they wouldn’t be as pretty. Red or white oak is too stiff for the rails and doesn’t take epoxy well; Western red cedar is too light and brittle for rails.
In the US, finding clear, long lengths of lumber is getting hard. There isn’t the slightest problem with putting a couple of scarf joints in the rails to join shorter lengths of clear timber into longer lengths. This is, in fact, preferable to long lengths of lumber of questionable quality.

Scarf joints in the rails should have an 8:1 ratio, as shown in the “rail scarf” drawing later in this section. They are easy to cut with a japanese pull-saw, with a bandsaw, or on a tablesaw jig. You can clean them up with a block plane before clamping them together with epoxy. Scarf joints should be glued using Cell-o-fill mixed into the epoxy for maximum shear strength.

Composite wooden boats like the Sassafras canoes only work with marine-grade epoxy. Don’t consider using polyester resins or other adhesives to substitute for the epoxy, as they simply aren’t strong enough for this style of construction. Epoxy should be a low-viscosity blend that doesn’t create an amine blush as it cures. We endorse the MAS, WEST System (with 207 hardener), and System 3 Silvertip brands, all of which have these qualities and are available from CLC.
Sassafras 12 Canoe Materials List (for Plans builders)

**Plywood:**
3 sheets 3/16” (4mm) marine plywood: okoume, sapele, khaya, meranti, etc.
1/4 sheet 1/4”-3/8” (6-9mm) MDF or similar for temporary molds

**Lumber:**
52 lineal feet (16m) of 3/4” x 3/4” (18mm x 18mm) mahogany, etc. for outwales and inwales.
2 lineal feet (.6m) of ¼” x 6” (19mm x 152.4mm) mahogany, etc. for deck trim

**Fiberglass:**
4 yards 4-ounce 50” Fiberglass Cloth (4 meters at 135grams/sq.meter)

**Epoxy:**
1 CLC #1 MAS Economy kit or:
1 gallon (4 liters) of resin
1/2 gallon (2 liters) of slow hardener
1/2 gallon (2 liters) of wood flour thickener
1 qt. (1 liter) of silica or cellulose thickener
Calibrated dispensing pumps

**Hardware:**
100 feet .041” diameter (18 gauge or 1mm) copper wire
(4) #8 x 1-1/4” (32mm) bronze woodscrews (for thwart)
(2) Drain plugs with screws
(1) 31” Ash canoe thwart
(1) 24” x 24” x 3/4” (600mm x 600mm x 18mm) Minicel foam for seat
(1) Kayak backband with hardware
Sassafras 16 Canoe Materials List (for Plans builders)

**Plywood:**
4 sheets 1/4” (6mm) marine plywood: okoume, sapele, khaya, meranti, etc.
1/2 sheet 1/8”-3/16” (3-4mm) marine plywood: okoume, sapele for decks
1/2 sheet 1/4”or 3/8” (6-9mm) MDF or similar for temporary molds

**Lumber:**
70 lineal feet (21m) of 1” x ¾” (25mm x 18mm) mahogany, etc. for outwales and inwales, and seat cleats.
2 lineal feet (.6m) of ¾” x 6” (19mm x 152.4mm) mahogany, etc. for deck trim

**Fiberglass:**
10 yards 6-ounce 38” Fiberglass Cloth (10 meters at 203grams/sq.meter)

**Epoxy:**
1 CLC #2 MAS Economy kit or:
1-1/2 gallons (6 liters) of resin
3/4 gallon (3 liters) of slow hardener
1 gallon (4 liters) of wood flour thickener
1 qt. (1 liter) of silica or cellulose thickener
Calibrated dispensing pumps

**Hardware:**
150 feet .041” diameter (18 gauge or 1mm) copper wire
(4) #8 x 1-1/4” (32mm) bronze woodscrews (for thwart)
(2) Drain plugs with screws
(1) 39” Ash canoe thwart
(2) Caned canoe seats
(2) Seat spacer hardware kits
Sassafras 12 builders will split two sheets of 4mm marine plywood down the middle, and use scarf joints to create two 16-foot (4.9m) blanks. This will take care of panels 1, 4, and 5.

The third sheet of 4mm ply is cut into four 12” (305mm) strips, then scarfed to length for panels 2 and 3.
Decks are cut from attractively-grained plywood, 3 or 4mm thick.

The temporary molds should be cut from sturdy construction-grade plywood.
Creating “Blanks”

Start by creating rough “blanks,” rectangles of plywood long enough for the hull planks. The diagrams on pages 17 & 18 show a suggested layout scheme for your blanks.

“Scarf joints”—simple tapers cut in the plywood blanks—are the logical way to create blanks of sufficient length.

Scarfs may look intimidating, but they are not at all difficult once you set plane to wood and just do it. Scarfs should have an 8:1 ratio, or about 1-1/4” long in 4mm plywood and 2” long in 6mm plywood. We have the best results cutting scarfs with a very sharp block plane. We’ve also experimented with beltsanders and grinders for cutting scarfs; they never achieve the same precision as a good sharp plane, and aren’t any faster. If your plane is dull, however, you might as well chew the scarfs into the panels with your teeth. (Look for plane-sharpening tips on our website.)

* A scarf joint, shown here in cross-section, provides a strong and reliable way to join sheets of plywood together. *

The length of the scarf joint is generally eight times the thickness. Thus, in the Sassafras 16’s 6mm hull planking, the scarf will be 24mm or 2 inches long. The 4mm Sassafras 12 plywood requires 32mm or 1-1/4-inch scarfs. Stack your matching sheets in a stair-step fashion as shown below, and plane as many scarfs at once as possible. You’ll need to scarf the full width of four sheets of plywood for the Sassafras 16; scarf all four at once by stacking the sheets.

Mark the scarf length on the end of each blank with a straight-edge or tri-square.
Here are four blanks stacked up and aligned, ready for scarf joints. The bottom-most blank is lined up with the end of the workbench for support.

Set to it with your sharp block plane.

You can use the side of your block plane as a handy straight-edge to check the uniformity of the “ramp” you’re planing.
Finished scarfs will have neat, parallel plywood glue lines. The glue lines are a big help in cutting uniform scarf joints.

Scarfs will be glued with epoxy. To save setup time, you can glue a couple of blanks at one time, one stacked above the next as shown here.

Just be sure to slip a sheet of thin polyethylene plastic, the kind used as a drop cloth, between each layer. This writer has forgotten this vital step more than once, gluing blanks together irretrievably.

Thicken epoxy with Cell-o-fill to a thin jam consistency and brush both sides of the mating scarf joints. If you look close, note that the plywood adjacent to the scarf joint has been masked off with tape to catch the squeezed-out epoxy. This greatly speeds clean-up.
If you’re lucky enough to have a big worktable or wooden floor, you can screw a wooden plate down to clamp the scarfs while they cure. Don’t forget a strip of plastic to protect the clamping plate.

A block of 3/4” (18mm) timber for clamping scarf joints.

If you must work on a concrete floor, you can use a heavy weight like a bucket of sand to clamp down the scarfs.
**Cutting Out the Parts** *(plans builders only)*

The Sassafras 12 and 16 hull panels are shown at full size in the plans. Do NOT cut out the strips of paper; the narrow strips of paper won’t hold their shape well enough to be traced accurately. You have a couple of options for transferring the shapes to plywood. The first would be to glue the wide paper patterns to heavy cardboard or masonite, and then cut them out so that you can trace around them.

The second approach, and the one we prefer at CLC, is to place the patterns on the marine plywood and punch through the paper with an awl or icepick. This is fast and accurate (because you aren’t gaining width on the shapes by tracing). Connect the punch-marks with a pencil, and you will achieve very accurate transfers.

You only need to trace out half of the side panels. You’ll stack the blanks and cut port and starboard panels at the same time, to save time and ensure symmetry.
You’re ready to cut out the hull panels. Your options are a saber saw or a small circular saw. Our preference at CLC is the circular saw, because it wanders less than the saber saw, and cuts “plumb.”

The way to cut curves with a circular saw is to set the blade depth just a little deeper than the thickness of the stacked plywood. The plywood sheets rest on sawhorses or scraps of wood.

Unless you have hands like a surgeon, you’ll want to cut just outside the pencil lines with the saw, and trim to the pencil line with a sharp block plane. Clamp matching pairs of panels together while planing so that they are identical.

The full-sized patterns also indicate where wire holes should be drilled. Drilling those 1/16th-inch (2mm) holes now will greatly speed along assembly of the boat.
**Cutting the Rabbets (plans builders only)**

The LapStitch™ joint is central to the Sassafras canoe’s ease of assembly. This involves machining a rabbet on the lower edges of adjoining hull panels, creating a tight and self-aligning joint. Plans builders will use a router to cut the rabbets, shown in cross-section, right.

With a pencil, carefully mark the edges of the panels where the rabbet is to be cut. The plans are explicit on the location of the rabbets.

You must create port and starboard pairs of panels and it’s quite easy to end up with two starboards and no ports, or the rabbet cut on the top instead of the bottom of the panel. An emphatic pencil mark that says, “Rabbet HERE” will spare you that heartache.

On the Sassafras 12, panels 2, 3, 4, and 5 receive rabbets on their lower edges.

On the Sassafras 16, panels 2, 3, and 4 receive rabbets on their lower edges.

Neither boat has a rabbet on the #1 panels.
You have a couple of options for rabbet-cutting. The first is a rabbeting bit, like the one shown here. The cutting length needs to be 1/2” (12mm) for the Sassafras 16 and 3/8” (9mm) for the Sassafras 12.

Just adjust the bit to cut half the thickness of the plywood (3mm deep in the 16, 2mm deep in the 12), and run the router along the lower edges of the panels.

The roller bearing will be riding against a pretty skinny target; you’ll need to support the panels carefully along the edge of a work bench, adjusting the panel often so that it’s supported and your cut depth is consistent.

If you can’t find a rabbeting bit, an alternative is to use a 1/2” (12mm) end-mill bit (below), and to clamp a bit of scrap wood to your router base as a fence, below right. Run the fence along the edge of the panel with the end-mill bit set to the correct depth.
**Bulkheads and Temporary Frames** *(plans builders only)*

The best way to transfer the shapes of the bulkheads and temporary molds from the plans to the wood is to poke through the shapes with a sharp awl. This will leave indentations in the wood or pattern material that are easy to connect freehand with a pencil line.

A saber saw is ideal for cutting out all of the bulkheads. *(Peace Canoe shown)*

Sassafras 16 builders will need a pair of these external formers. They should be made of sturdy plywood at least 3/8” (9mm) thick. These are disposable and, like the temporary frames, don’t need to be marine-grade.

The temporary frames in both the Sassafras 12 and 16 kits have some fancy CNC-cut lightening holes, which help us keep the shipping weight down, but are not in any way necessary for plans builders.
**Solid Wood Parts**

Both Sassafras canoes feature inwales and outwales. Inwales, outwales, rubrails, gunnels, rails—pick your preferred nautical term. These should be a clear-grained and attractive wood; the rails are both structural and decorative.

You will need to rip 3/4” x 3/4” (18mm x 18mm) stock for the rails. Mahogany looks pretty, if you can find it. We use either Fijian mahogany or Spanish cedar in the kits.

You’ll need 70 lineal feet (21m) for the Sassafras 16 and 52 lineal feet (15.9m) for the Sassafras 12. If you can find material long enough for the boat without needing scarf joints, great! Most folks will need to use a couple of scarf joints *(below)* to join up shorter, high-quality material into lengths suitable for each boat.

Epoxied together, many shorter lengths with scarf joints making up rails is preferred to a single long length of crummy wood.

As we get deeper into the instruction manual, details for solid timber parts are discussed.

Having created a “kit” of parts, we’ll now join up with kit builders.
Kit Builders: Join Us Here!

Trimming Machine Tabs

All of the parts in your kit have small tabs left behind by the CNC machine, similar to those you encountered when assembling a plastic model airplane kit.

The tabs help steady the parts on the cutting table and thus can’t be avoided.

Using a small plane, sanding block, or a rasp, gently remove these tabs. Don’t carve into the panel or create a divot!
Gluing Scarf Joints on the Rails

Glue the scarfs together on the rails. There are two long sections and a short section, with scarf joints where they’re glued together.

Protect the floor with a bit of plastic. Mix Cell-o-fill with resin and hardener to a jam consistency and brush it on the mating surfaces.

We use 2-inch spring clamps to hold the scarf joints while they cure. Be careful to align the scarf joints exactly when you clamp them.

Lubricated with epoxy, the scarf joints will want to slide apart as soon as you apply clamping pressure. Some quick adjustments, and the addition of a second clamp, and things will settle into place.

Allow the epoxy to cure for 24 hours at room temperature before moving the rails to a safe spot in your shop.
Assembling Puzzle Joints

The Sassafras 16 has four strakes, or panels, on each side; the Sassafras 12 has five. Each of these consists of two long sections. Identify the parts of each panel and lay them out on your workbench or floor. You can work on the floor—but your back and knees will thank you if you put a couple of 4x8 sheets of plywood atop sawhorses to form a big, temporary workbench for puzzle-joint gluing.

Because it’s vitally important that the panels for the left and right sides come out symmetrically, you will glue the matching left and right panels in a stack, one atop the other, at the same time.

For each set of panels, mix Cell-o-fill with resin and hardener to a jam consistency. Use a small brush to spread the epoxy on mating puzzle joints.
The puzzle joints should be a neat slip-fit right out of the box, but some gentle persuasion is sometimes required. Note the sheet of plastic protecting tools and boatbuilders from the epoxy.

The left and right panels must be separated at each puzzle joint with a sheet of plastic or waxed paper. Gluing the lefts and rights together at this stage would not be funny. (We've done it.)
On certain panels you may find that the thin rabbetted edge does not lay flat and line up at the puzzle joint. These sections will need to be clamped while the epoxy cures.

We use small binder clips (from your office supply store) to keep the rabbets flat.

Note that we've added another small scrap of plastic to prevent gluing the binder clip to the panel.
Carefully screw a clamping pad down on the puzzle joint with drywall screws. Make sure you’ve got a piece of plastic protecting the clamping pad from the epoxy, or you’ll have to chisel it off tomorrow.

If you cannot clamp the joint with screws, set a bucket with 10-15lbs of sand on the clamping pad.

Allow the epoxy to cure for 24 hours at room temperature.
Sanding Puzzle Joints

There will be plenty of “squeeze-out” of the epoxy at the puzzle joints, and now is the time to clean those up, when you can spread out the panels on the work bench.

We use 120-grit sandpaper on a 5-inch random orbital sander to clean up the puzzle joints.

Your aim is to knock down any elevated areas of epoxy, so that you can run your fingers over the puzzle joints without feeling any humps or bumps.

The real danger here is over-sanding, cutting into the plywood veneers and exposing end-grain.

Don’t try to erase all traces of the epoxy squeeze-out; the dark stains are okay as long as the panel is smooth to the touch. We’ll be turning the entire boat that darker color. If you try to grind it away completely, you’ll damage the part.
Be sure to sand any excess epoxy out of the rabbets at the puzzle joints. A big blob of epoxy left in the rabbet will impede hull assembly.

Where the panels meet at the bow and stern, there is a notch, known in boat-building as a "gain."

Use a rasp or a sanding block to create a taper in the rabbet at the end of all of the rabbeted panels. The taper should be about 4” (100mm).

This taper or “gain” in the rabbet allows the strakes to come together smoothly at the bow and stern.

The #1 panels do not receive this treatment.
Gluing on Rails - Sassafras 12 Only!

The Sassafras 12 is built of very thin plywood. The plywood panels are essentially...floppy. To give the lightweight hull some support during construction, we will actually glue on the outwales, the outer layer of the rails, BEFORE we assemble the hull.

The rails are glued to the upper, outside edges of the #5 panels. The outside face of the panel is the face opposite the machine-cut rabbet.

Mix Cell-o-fill with resin and hardener to a mustard consistency, and spread a thick film of epoxy on the rails.

Round up some helpers, align the rail with the top edge of panel 5, and start adding spring clamps.

The rails will need to take a pretty good bend. Clamp the rail first at one end, then at the middle, and then start adding clamps on 6 to 8” (150-200mm) centers.

Unless you’ve done this a few times, this is not a great step to try solo. Helpers are nearly essential.
It takes lots of clamps.

Note that in kits, the supplied rails are much longer than necessary, and will hang off the ends.

Place your #5 panels someplace flat and warm and allow the epoxy to cure for 24 hours at room temperature.

When the epoxy has cured, remove the clamps, and use a sharp saw to trim the excess length of the rails flush with the end of the panel, as seen here.
Hull Assembly

We’ll be wiring the hulls together with 18-gauge copper wire. Kits are supplied with 12-inch (300mm) circumference spools of wire. Use a pair of sturdy tin snips to cut these spools into thirds, to create convenient quantities of 4-inch (100mm) wire.

We’ll begin, logically enough with the two #1 panels.

Place the #1 panels flat against each other, and thread wires into the matching holes along the keel edge, which is the straighter of the two curves.

Twist the wires tight with your fingers. We just want “finger-tight” stitches at this stage; no pliers are needed. Here’s a close-up of a stitch:

Once you’ve stitched the bottom panels together along the keel, open the two panels like a book.

Find the temporary frames. The temporary frames are dropped into place.

Frames are located on the #1 panels in kits by a row of double-wire holes. Plans builders will have marked the bulkhead locations using their full-sized patterns.
The frames are stitched onto the #1 panels. The wires are passed through three holes—two in the hull panel, and one in the bulkhead, as seen in the diagram here.

Getting the wire stitches threaded through the frame and the hull panels is a little fussy, and benefits from an extra pair of hands. This is a Sassafras 12.

Here are the temporary frames in a Sassafras 16.
The stitches that hold the frames in place benefit from a pair of pliers, to pull them tight.

Frames in place? Find the #2 panels and start stitching them to the #1 panels, and to the frames as well.

Remember, the side of the panel with the rabbet is the INSIDE face.

Particularly in the Sassafras 16, make no attempt to get the hull panels wired tightly together at the bow and stern at this early stage. A lot of three-dimensional shaping will emerge in due course; don’t try to force it now. Just stitch the panels together loosely.

The Sassafras 12’s thinner planking will fight you less at the bow and stern...
...and you can use wire stitches to connect port and starboard sides of the hull at both ends.

Here’s a Sassafras 16 with one #2 panel stitched in place. Temporary frames are stitched to the #1 panels.

The temporary frame in a Sassafras 12.
Once you have the #2 panels in place, you’ll have enough hull assembled to support the permanent bulkheads near the bow and stern.

These are wired in place just like the temporary frames. Note that they have a pronounced angle, leaning towards the ends of the boat.

Stitch holes in the panels will establish the bulkheads’ location and angle.

Permanent bulkhead in a Sassafras 16. Note that left and right halves of the boat have not been joined at the bow and stern. This will make bulkhead installation a great deal easier.

Another view of a bulkhead in the Sassafras 12.
Keep adding panels. In a few short hours, you’ll have an assembled canoe!

When the last panels are ready for installation, Sassafras 12 and 16 builders will briefly follow divergent paths.

*Sassafras 12 builders should skip ahead to page 48.*

Sassafras 16 builders should stitch on the last panel, #4.
Note how the bow and stern have been left open until the #4 panel is in place.

With #4 installed, we can start to bring the bow and stern together.

A helper is strongly recommended: one person to press port and starboard halves together, while another passes stitches through and tightens them with pliers.

Don’t be surprised if you break a few wires at this stage! There’s a lot of twist at the bow and some patience is required.
External Molds - Sassafras 16 Builders Only

There never was a pretty boat that didn’t have a few sharp twists in it. The alternative is...a box, and we’re looking for an elegant shape.

To help draw the bow and stern of the Sassafras 16 into an elegant shape, a temporary external mold is installed. This is made out of sturdy, cheap plywood.

Screws driven through the two “legs” of the mold will hold it in position. Use a 3/16” (4mm) drill bit to pre-drill for these screws as shown here.

The temporary molds slide onto the hull just forward of the second vertical row of stitches.

It will take some gentle persuasion. With one person squeezing the hull in, a second can usually push the mold home, seated firmly against the keel.

We’ve also brought out a rubber mallet to tap it into place, but be careful. If the marine plywood you’re using is especially stiff, give this area a soaking with hot water. Just be sure to let the water dry before shifting to epoxy work!

With the bow mold secured in place, you can finish aligning and stitching the bow and stern.

(We refer to “bow” and “stern,” but in fact both canoes are perfectly symmetrical. You won’t choose the bow and stern until you install seats. But “bow and stern” sounds better than “bow and bow” or whatever.)
Cross-section with the external bow mold in place. 2-inch (50mm) drywall screws are driven right into the hull to keep it in place. The small holes left by the screws are easily filled later.

A Sassafras 16 bow, neatly aligned and complete.
Mounting Panel 5 - Sassafras 12 Builders Only

To help support the Sassafras 12’s thin top strakes during assembly, we glued the external rail on in advance.

To make it easy to mount the #5 panels on the Sassafras 12, stitch the bow and stern ends together, then spread the two panels with a bit of scrap stick. The spreader stick should be about 27” (690mm) long, and placed roughly in the middle, as seen here.

Two loose wire stitches at the bow and stern will be plenty.

Lower the #5 panels onto your hull assembly and line it up at both ends. The bulkheads will take over from the spreader stick, which can be discarded.
Stitch the #5 panels to the hull and bulkheads.

The assembled Sassafras 12 hull, almost ready for glue.
Tightening Wires and Checking For Hull Twist

Flip the hull over on sawhorses and use pliers to tighten all of the wire stitches.

At this stage it’s important to make sure that each panel is firmly seated in its corresponding LapStitch™ joint (see diagram at the bottom of the page.)

You don’t want to see daylight where the planks meet, ideally. But don’t drive yourself crazy. This is a forgiving process, and if you can get it close, epoxy will fill all gaps.

Areas that will be hard to pull completely tight are the keel line, along its length, and the sides of the hull at the extreme bow and stern. Don’t fret if it’s not perfect. These areas will be filled in with epoxy during later steps.

The “bad” example on the right is what we want to avoid: the panels not cleanly seated in the LapStitch™ joint.
This is also the best opportunity to address any twist or alignment issues in your canoe’s hull.

A typical misalignment is shown here. Viewed from the end, the bow and stern panels form a zig-zagging line.

This is easy to fix simply by pressing the offending panels back into line.

Less common, but possible, is a bow or stern that isn’t standing “plumb” to the floor, but leaning to one side.

This is addressed by having a helper hold the hull at one end while you twist in the opposite direction.

This is what you’re looking for: bows and sterns that are plumb to the saw-horses, and the all of the panels straight at the bow and stern when viewed from the end.

This is a step that really pushes the buttons of some obsessives, who bring out laser levels, advanced instrumentation, and great anxiety. But trust your eyeballs: if the hull looks right, it IS right. No need for a lot of hand-wringing here.
Epoxy Fillets on the Bulkheads, Bow, and Stern

We’ve reached the “glue” stage of “stitch-and-glue” construction. We’ll start by applying structural “fillets” to the permanent bulkheads and the inside of the bow and stern. “Fillet” in this setting is pronounced “FILL-it,” not “fil-LAY” as in “fish fillet.”

Mix resin and hardener, then add in wood flour a little at a time until you achieve a consistency of smooth peanut butter.

You’ve got the consistency right when the epoxy mix is stiff enough to “stand” on your mixing stick without slumping back into the cup. Too thin, and your epoxy fillets won’t hold their shape. Too thick, and you won’t be able to spread them smoothly.

Mix about eight ounces (250ml) of epoxy to start with; as your confidence builds, you can mix larger batches.

Spread a 1-gallon (4 liter) freezer bag in a clean cup, then ladle the thickened epoxy into the bag with your mixing stick. *(Top photo)*

Twist the bag to force the epoxy into one corner, just like a chef’s pastry bag. Then snip about 3/8” (9mm) off one corner with a pair of scissors.

You’ll need a filleting tool for this step. Use thin plywood with a neat radius sanded into one end. Tools with a 3/4” (18mm) and 3/8” (9mm) radius are ideal for this step. *(CLC sells these tools cheaply.)*
Squeeze a thick bead of epoxy from your “pastry bag” into the corner where the permanent bulkheads meet the hull.

With your filleting tool, press down hard and shape the epoxy fillet into a smooth radius.

How large should you make these epoxy fillets? They should be large enough to cover the copper wire stitches that secure the bulkheads.

Use a clean, flexible plastic spreader like this one to scrape up all of the excess epoxy.
A neat, structural epoxy fillet on a Sassafras 16 bulkhead.

Epoxy fillets are easy to do, but require patience to do well. This cross-section of a typical epoxy fillet at a bulkhead shows good and bad examples. The middle example needs a lot of clean-up with the spreader. The right-hand example is too shallow, and does not fill the corner neatly.

You’ll create another epoxy fillet on the forward side of the bulkhead, and also on the keel line...
...and right up the inside of the bow and stern as seen here.

About 22 inches (750mm) of the keel line should receive an epoxy fillet on the inside of the hull between the permanent bulkhead and the center of the boat.

Use your filleting tool to make the fillet taper to nothing around the 22-inch mark, before you reach the temporary bulkhead.
Here’s a view of the epoxy fillet work in the bow area of a Sassafras 12, treated just like the Sassafras 16.

Let your interior fillets cure for 24 hours at room temperature before moving on to the next step.
Gluing the Exterior Seams

Next we’ll glue the seams between the hull planks.

This calls for a different epoxy brew. Mix resin and hardener, then add Cell-o-fill (the white stuff) until you achieve a sauce consistency. “Hollandaise sauce” has been suggested as ideal.

This batch actually needs to be on the runny side, so that we get decent penetration into the seams.

Dump your sauce-consistency blend of epoxy into a 1-gallon (4-liter) plastic bag.

This will take several batches, at least. Unless you’re a pro, don’t be tempted to make more than 6 or 8 ounces (250ml) at one time.

Snip a 1/8”-1/4” (3-6mm) hole in the corner of the bag.

The smaller the aperture the neater the job, but you don’t want to split the bag by having to squeeze it too hard. This makes a frightful mess.
For this round of seam gluing, we’ll just be injecting a bead of epoxy between each wire stitch.

In essence, we’re “tack-welding” the boat together so that the wires may be removed. We won’t try to fill the seams completely until a later step.

Throughout most of the boat’s length, the LapStitch™ joints are wide open and easy to inject with epoxy. The seams are tight at the bow and stern, however.

Simply apply a thin bead of epoxy atop each seam. Your runny blend of epoxy will have surprising powers of penetration into these plank seams. Going on six or seven thousand of these LapStitch™ boats, we’ve never heard of a single one coming unzipped at the seams, at the bow or anywhere else.

Injecting epoxy into the seams on a Sassafras 12.

It’s hard to keep the epoxy from dripping right through the keel joint onto the floor, along the centerline of the boat, because that’s a butt joint instead of an overlapping seam.

For this reason, we have often made up a special batch of epoxy, closer to a jam consistency, to tack-weld the keel line. The thicker epoxy won’t flow through and make a mess of the interior.
Clip the Wires and Prep for Interior Fiberglass

Let your epoxy seam work cure for 24 hours at room temperature, then start clipping wires.

You’ll be able to clip and pull out all of the stitches along the longitudinal hull seams.

The wires at the bow and stern and the ones that hold the permanent bulkheads will be entombed. Just clip those wires flush on the exterior of the hull. The soft copper wire will sand flush later.

If any of the plank seam stitches refuse to pull out cleanly, snip them on the inside of the hull, like this...

...then pull the stitch out from the outside of the hull.
You will remove the temporary frames at this time and discard them.

Before we move on to interior fiberglass work, any epoxy that oozed through will need to be sanded smooth. If the epoxy fillets around the bulkheads are rough, they should be sanded smooth now, using 120-grit sandpaper wrapped around a foam pad or dowel stick.

Fiberglass won’t tolerate any lumps of cured epoxy, so take your time to eliminate anything that’s sticking up in the interior between the permanent bulkheads.

The compartments in the bow and stern will not be fiberglassed, and thus do not require sanding work.

When you’ve got everything clean, use a vacuum to remove every last bit of dust and grit from the interior. Even a tiny crumb of cured epoxy can create a nasty permanent air bubble in the fiberglass.
The #1 and #2 panels are fiberglassed on the interior. You’ll do a neater job of it if you use masking tape to protect the lower edge of the #3 panel, as seen here.

Here, the lower edge of the #3 panel has been masked on both sides of the hull.

Fiberglass fabric is capable of wondrous things, but it will not turn a sharp corner. Thus we will need to eliminate the sharp corners between the #1 and #2 panels by creating a small epoxy fillet along that seam on the interior.
Set aside enough time to do both your epoxy fillets, and the fiberglass sheathing a few pages ahead, all in one big step.

Mix up the now-familiar “peanut butter” blend of epoxy, using wood flour as a thickener, and transfer it to your “pastry bag.”

Dispense a neat bead of epoxy into the seam between panels #1 and #2.

Use a filleting tool with a broad radius, or the corner of a plastic spreader (as seen here) to smooth the epoxy along that seam.

Neatness counts. Most builders will varnish the interior of their canoe, and this seam will be very noticeable.

Note that this builder has only now added the short length of epoxy fillet on the keel, discussed back on page 55.

The length of keel between the erstwhile temporary bulkheads is a gentle angle and does not require an epoxy fillet; the keel fillet should end about where you see it here.

How big should the fillet between panels 1 and 2 be? About 1/2” (12mm) wide is plenty, as seen in this cross section of the joint.
Clean up the excess with great care. Don’t leave behind any lumps of epoxy or rough edges that would prevent the fiberglass from laying flat, or worse, would look ugly beneath varnish.

Here are some cross sections of the fillet between panels #1 and #2. The top drawing is what we’re after. The middle drawing is the work of someone who got the fillet right, but failed to clean up afterwards. The bottom looks good, but there isn’t enough epoxy in the joint to eliminate the sharp corner between the panels.
Fiberglassing the Interior

If you’re satisfied with the look of your epoxy fillets and you have cleaned up every last smear of excess goo, we’ll move at once to fibreglassing.

There will be much better adhesion between the fiberglass and the epoxy fillets if they haven’t cured completely. You probably have up to around two hours between the last step and this one, enough time to eat lunch or run an errand.

As with nearly every step in building a boat, you’ll benefit from a helper or two when you’re ready to spread out the fiberglass.

Smooth the fiberglass fabric with your hands, pressing it gently into the seams. Don’t mess up your neat fillets!

Note the presence of a spreader stick in the lower left of the photo, just a loose bit of wood scrap. This is holding the boat’s max beam at around 39” (990mm) on the Sassafras 16 and 28” (711mm) on the Sassafras 12.

With clean, sharp scissors, cut the fiberglass just above the seam between panels 2 and 3. You’ll want about a 1/2” (12mm) overlap onto your masking tape.
Here’s how you’ll divide up the sheets of fiberglass specified in the materials list, and provided in the kit.

The Sassafras 12’s interior and exterior sheathing fits neatly on a single 12-foot by 50-inch (3.66m x 1.27m) sheet.

The Sassafras 16’s interior and exterior sheathing fits on two 16-foot by 38-inch (4.87m x 1m) lengths of fabric.
Here’s the fiberglass smoothed and trimmed in a Sassafras 16.

At either end the fabric has been trimmed to rest on the cured epoxy fillets holding the permanent bulkheads.

Note the complete absence of wrinkles. Before you mix epoxy, spend all the time you need to eliminate wrinkles and bubbles. The fiberglass should hug the bottom four hull panels like a skin.

If you can get started with the fabric smoothed everywhere, you’re likely to end up with a smooth job of fiberglassing once epoxy has been applied.

Here’s the fiberglass being spread and trimmed in a Sassafras 12. Everything is the same, except that the Sassafras 12 uses 4-ounce (135g/sq.m) fabric instead of 6-ounce (203g/sq.m) fabric.
A neat job of smoothing the fiberglass in this Sassafras 12.

This is your first step where you’ll just be mixing resin and hardener, without any fillers.

Lots of things can go wrong here, however. Like forgetting to add hardener, getting the ratio of resin to hardener wrong, or simply forgetting to mix thoroughly.

You’ll need to make several batches, but start with no more than about 8 ounces (236ml) if you’re new to fiberglassing.

Dump the entire mixed batch into the boat and start spreading, using clean plastic squeegees like these.

Why dump the whole batch in at once? Since epoxy is an exothermic reaction, it heats up quickly when concentrated in the mixing cup. If it gets too hot, you’ll have a runaway chemical reaction and you might lose the whole batch.

Spread out the mixed epoxy, and the reaction slows down, giving you more working time.
You are looking for a very specific texture with this, your first coat of epoxy on the fiberglass.

You want the fabric to turn perfectly clear, but the fabric weave should remain prominent.

Not enough epoxy, and the fabric will appear gray or white. Too much epoxy, and you get a puddle. The fiberglass floats on the puddle, giving you an ugly (and heavy) fiberglass job.

Patiently spread the epoxy, watching for dry areas, pooling, bubbles caused by bits of crud “tenting” up the fabric, or air pockets caused by “bridging” across seams.

Press down hard on the plastic spreader as you move the epoxy around. It’s not a paint brush, it’s a squeegee, and you want to simultaneously saturate the fibers in the fabric while squeezing out the excess.

If you end up with too much epoxy sloshing around, squeegee it back into your mixing cup, or blot it up with paper towels.

Let the fiberglass cure for 24 hours at room temperature.

Once cured, trim the fiberglass by running a sharp razor in the seam between panels 2 and 3, as shown here. Peel away the excess fiberglass and masking tape, leaving a nice, clean edge. Be careful! The cut fiberglass edge will be as sharp as the razor you cut it with.
Fitting and Installing the Sassafras 12’s Inwales

The exact timing of this step is flexible, but now seems as good a moment as any to install the inner layer of the Sassafras 12’s rails.

Sand the scarf joints smooth, being careful not to over-sand and “wasp-waist” the rails.

Find a helper and bend the rails into the boat.

Use a rasp to clean up the notches in the permanent bulkheads so that the rails drop smoothly into place.

Where the inwales meet at the bow and stern, you’ll need to cut a “bevel” so that the rails meet cleanly at the ends.

We use a sharp Japanese pull-saw to cut these bevels \textit{in situ}. 
The inwales beveled and dry-fit in the Sassafras 12.

Label the rails carefully with a pencil so that you can remove them to apply epoxy.

Mix resin, hardener, and Cell-o-fill to a jam consistency and spread a heavy film on the mating surfaces of the rails.

A nice trick is to clamp the rails side-by-side like this, giving your glue brush a wider target while spreading the epoxy. More goes on the rails and less onto the floor.

Unclamp the rails, and with a helper, lift them into place one at a time.

It’s probably impossible to use too many clamps. We use 2-inch (50mm) spring clamps, spaced about 6” (150mm) apart.

Note the spreader stick in the middle of the boat, holding the beam around 28” (711mm). The Sassafras 12 will try to make itself narrower when you add the rails.
Installing the Sassafras 16’s Outwales

The outer rails, or outwales, are an easy step on the Sassafras 16.

Mix resin, hardener, and Cell-o-fill to a smooth jam consistency, and slather it generously onto the rails.

With a helper, lift each outwale in turn onto the Sassafras 16’s upper panel. Add lots and lots of clamps, being careful to align the rail with the top edge of the upper hull panel.

The rails shipped in kits are longer than necessary. You’ll need to trim the length on at least one side to allow both rails to be glued on at once.
The easiest way to get these on is to start at one end, while a helper supports the opposite end well away from the hull, as seen here.

The helper slowly bends the rail in towards the boat as clamps are added, starting at one end and moving to the other.

A Sassafras 16 with outwales glued in place.

Note that C-clamps were substituted at the very end. The stronger C-clamps will ensure that the rail doesn’t wander as it’s glued in place.

Let the rails cure, then roughly trim any extra length at the bow and stern. We’ll make them pretty, later.
Prepping the Exterior for Fiberglass

Until now, the exterior has been a mess. We’ll fix that with a few hours of determined and careful sanding.

Start at the bow and stern, which are pretty rough. We use a 5-inch random orbital sander and 80-grit to smooth the profile of the bow and stern.

We’ll be fiberglassing this area, and the rough, sharp bow and stern need to be turned into a smooth, gentle radius. The cross-sections here demonstrate what we’re after.

You’ll want to round over the bow so that the fiberglass will wrap neatly.

The blunter and rounder you make the bow, the easier the fiberglass work will be.

Blunt noses also hold up better out in the real world, as they’re harder to ding when you hit something.

An 80-grit beltsander belt, cut and glued to a scrap of plywood, makes an excellent tool for smoothing the keel seam. This tool is called a “longboard” in boat-building shops.
You want to eliminate all of the rough spots on the bottom panels. Shift to 120-grit sandpaper once you’ve ground off the worst of the slag.

The longboard is also a great, easy-to-control tool for smoothing the bow and stern.

Team sanding on a Sassafras 12.
Shaping the bow of a Sassafras 12.

Like all lapstrake boats, the idea with the Sassafras canoes is that the overlapping planks resolve into a smooth surface a few inches short of the bow and stern.

Not only does this look good, but it’s essential to the application of a patch of fiberglass on the exterior of the bow and stern.

If your alignment was perfect when you stitched everything up and glued the seams, smoothing the sides at the bow and stern will go quickly.

If your alignment of the panels at the bow and stern was a little rough, this is the effect. In the process of sanding everything smooth, you’ll cut through the plywood veneers and expose a lot of end-grain.

There are no structural implications, but it won’t look great under varnish. We think these boats looks better with painted hulls, anyway.
Time for a round of “patch and fill.” We’ll be finishing up the hull seams, filling them right up with thickened epoxy.

Add wood flour to your epoxy until you’ve got a peanut butter consistency. Use a pastry bag to dispense a bead of epoxy into each hull seam.

Use a filleting tool to clean up each seam, so that each seam in cross-section looks like the diagram in the upper right.
You’ll also be taking care of any other gaps that need to be filled with epoxy putty at this time. Where the planks meet at the bow and stern, for example, you’re likely to have some gaps to fill.

What constitutes a gap big enough to fill? A simple guide: If you can fit your fingernail into the gap, it needs to be filled with putty.

Do NOT fill each wire stitch hole with epoxy putty. (The wire holes are not large enough to fit your fingernail; they fail the test.) The wire stitch holes will be filled completely without any additional effort when you coat the hull with unthickened epoxy in later steps.

On most boats, the centerline of the keel will have gaps along its length requiring filling with epoxy putty. The cross-section drawing, below right, shows what you’re after along the keel.
Fiberglassing the Exterior

We will be fiberglassing the #1 panels only, plus a strip up the bow and stern.

Just as with the interior, begin by making sure the surfaces to be fiberglassed are perfectly sterile, with no dust or excess epoxy to get in the way of the fiberglass.

The fiberglass stops right at the intersection with the #2 panel. Masking tape protects the edge of the #2 panel; note that the tape ends short of the bow and stern.

Have an assistant help you spread the fabric over the hull, then trim the excess along your masking tape.

Take all the time you need to smooth the fabric until it’s wrinkle-free.
Mix resin and hardener thoroughly—no fillers—and start in the middle of the hull, using a plastic spreader to turn the fabric clear and squeegee out the excess epoxy.

Work your way from the (easy) middle section towards the (more difficult) bow and stern.

Switch to a disposable brush to saturate the fabric where the ends of the boat are nearly vertical.
Note how the fiberglass has been worked right into the seam between panels 1 and 2.

A strip of fiberglass is needed to protect the bow and stern.

Cut strips of fiberglass from your scrap, no more than 4” (100mm) wide, and long enough to cover the vertical bow and stern.

Use a disposable brush to wet the bow and stern with epoxy, then press the strips of fiberglass into place with gloved fingers as seen here.
The fiberglass is surprisingly stretchy, and will accommodate the curved profile of the bow and stern.

Use a disposable brush to turn the fiberglass clear and to work out any bubbles or wrinkles.

Note how the masking tape ends short of the bow and stern.

If you gave the bow and stern a good round-over back on page 73, the fiberglass will conform neatly. If you have any sharp corners, you’re at risk for bubbles in the fiberglass.

Here, a gloved thumb is pressing the fabric down where it wouldn’t cooperate immediately.
Once the fiberglass has cured, use a razor knife to trim the overhang along the seam, and pull the tape.
Installing the Sassafras 16’s Inwales

This is a good time to install the Sassafras 16’s inwales.

Start by rasping the notches in the bulkheads so that the rail will fit neatly.

Use a short length of scrap rail stock to test the fit of the bulkhead notches...

...and trim as needed until you’ve got a slip-fit with the inwales.
For a neat fit of the inwales at bow and stern, see the Sassafras 12 instructions back on page 69, and cut bevels where the inwales meet.

You can also just let the rails end short of the bow, as seen here. Literally 50 of the Sassafras 16 Mark II’s were built this way with no apparent ill effects. The decks cover the ends of the inwales forever and will still have plenty of gluing surface.

Round up your helper, spread epoxy thickened with Cell-o-fill, and clamp the rails in place.

Again, you can’t have too many clamps.

Let the rails cure for at least 24 hours.
Prepping for Decks and Sealing the Interior

We’ll need to clean up the rails before we install the decks and start our final seal-coats of epoxy.

There’s nothing like a good sharp plane for flushing the surface of the rails.

At the bow and stern, you’ll want to make sure that the rails are flat across, so that the decks will rest on the rails.

Here, the bulkhead is being flushed with the rails.
Of course, you can use a sander on the rails, too.

Ultimately, we want to see every surface in the boat covered with a minimum of two and a maximum of three coats of unthickened epoxy.

Use a disposable chip brush to work epoxy into all of the nooks and crannies.

These coats of epoxy will fill up the stitch holes, and seal the okoume plywood forever from water damage.
A roller and tray speed the spreading of epoxy over large areas. “Tip out” the bubbles with a disposable chip brush.

The bow and stern compartments, which will never again see the light of day, should receive special attention in your epoxy coating.

One failure mode we’ve observed in these LapStitch™ hulls is the upper, interior edges of the strakes not being sealed in epoxy.

Make sure the epoxy fills this little corner in the interior seams.

The diagram below illustrates what you’re looking for.

The bow and stern of the Sassafras 16, in particular, seem to need plenty of epoxy in the inner seams for strength and waterproofing.
Here, a Sassafras 12 receives the first of its sealing coats.
Installing the Decks

The decks are a straightforward installation. They are simply glued down to the inwales, and a bit of decorative trim called a “coaming” is glued to the inboard edge.

Every Sassafras built will have a slightly different shape, just because of variations in the humidity and density of wood. The deck should just cover the plywood endgrain of the side planking, and its perimeter should be parallel to the rails.

The pattern in the plans and the kit parts will be very close. Trim the plywood decks if necessary for a neater fit.

The coamings are cut from mahogany or some other similarly attractive wood, preferably to match the grain of the rails.

In kits this part is provided with extra length, allowing a precise fit to your boat.

You can see the extra length here.
Trim the coamings to match your fitted decks.

A neat “bullnose” finishes off the outboard ends of the coamings. We used a roundover bit in a router to ease the hard edges of the coamings.

Note in this photo how the deck covers the hull planking, and follows the curve of the rails exactly.

Before the decks are installed, the undersides need to be sealed with a coat of epoxy, preferably two coats.

Just for looks we use a dark, reddish-brown plywood called sapele for the decks. This contrasts nicely with the okoume in the hull.
Mix wood flour with epoxy to a mustard consistency and apply a thick layer to the mating surfaces on the inwales.

Clamp the decks down!

We glued on the coamings in the same step to save time.

This is optional; you may certainly wait until the decks have cured before gluing on the coamings.

In any case, spend lots of time cleaning up squeezed-out epoxy. Once cured, you’ll probably never succeed in sanding off the rock-hard excess.
A Sassafras 12 deck in place.

The compartments at the bow and stern are to be watertight, to serve as reserve buoyancy in the event of a swamping.

You’ll find a small gap at the top of the bulkheads beneath the deck. Mix up some of your peanut-butter-blend epoxy and create an epoxy fillet between the underside of the deck and the bulkhead.
Installing the Sassafras 16’s Seat Reinforcement

Before we get to our final finishing stages, the last bit of carpentry in the Sassafras 16 is the addition of two pairs of “seat supports.” These are 12” (305mm) sections of the same 3/4” x 3/4” (18x18mm) stock from which the rails are cut.

These short lengths of timber will create a “hard point” on the rails from which the two seats are slung.

We created a simple “ogee” shape on the ends of the seat supports for an attractive appearance.

The dimensions below are to the center of the seat support. This is the moment when you choose the bow and stern of your Sassafras 16!

Thickened epoxy and a single C-clamp in the middle of each seat support will hold them in place. Note the clamping pads protecting the wood from the C-clamp.
Sanding, Then the Final Coats of Epoxy

Boatbuilding is 95% sanding, as the old joke goes. It’s almost true.

This will be our final round of sanding and sealing, then it’s time for paint and varnish.

One favorite boatbuilder trick for cleaning up rough epoxy is a heat gun and a sharp scraper. This will remove big runs and sags with remarkable speed.

But ultimately, it’s the 5-inch random orbital that you will get to know the best. Use 120-grit sandpaper to clean up the interior and exterior of the hull.

A beltsander or a larger angle grinder is a quick way to smooth the seat supports and the tops of the rails. But be careful not to take too much!
With the decks in place, you can finish the shaping of the rails. Use a sander to give the corners a soft radius. At the bow and stern, tapering the rails and shaping the ends to a rounded “bullnose” as seen here will enhance the appearance of your canoe.

With the last of the woodworking done, every surface in the boat must be coated in epoxy. Your second and third coats on the exterior will “fill the weave” of the fiberglass sheathing and fill all of the wire holes.

Coating a Sassafras 12.
Paint and varnish won’t stick well to the cured epoxy surface. Once you’ve finished with your epoxy coating, you’ll have to sand every inch of the boat, flattening the epoxy and leaving all surfaces with a consistent gray-white matte finish.

Wrap sandpaper around a dowel stick to clean up the lap joints.

Sanding the intricate interior of a boat like the Sassafras just takes time. But spending the time to get everything smooth is the difference between an amateur and a professional finish.
Paint and Varnish

We’ve seen every possible combination of paint and varnish on the Sassafras canoes, from all-varnished to all-painted, and everything between.

We favor painting the exterior hull in a light color like white, beige, or gray. The reason is that the paint allows the graceful sweeps of the lapstrake planking to cast interesting shadows. It doesn’t hurt that a painted hull requires much less fussy finishing work!

We varnish the interior, rails, and deck.

The next few photos show the painting and varnishing sequence for a Northeaster Dory, a boat of similar construction to the Sassafras.

Begin by masking off the rails.

We advocate the use of a primer beneath the finish paint. Interlux makes an excellent primer for its Brightsides line of paints. You can choose white or gray primer; since this hull is to be black, we used gray primer.

The primer is rolled on in a thick, even coat, using a thin-nap foam roller and no brush.
When the primer has dried, the hull is sanded with 120-grit, then 220-grit sandpaper.

Expect the sanded primer surface to be blotchy. What’s happening is that the primer is filling low spots in the surface, while your sander cuts off the high spots. This translates into a smoother, prettier paint job on the hull.

Our preferred painting scheme involves a thin-nap foam roller to spread the finish paint, followed immediately by a foam brush to “tip out” the bubbles left by the roller.

Ideally two people apply a finish, the first rolling ahead of the brush-tipper. Especially in warmer shops, you must work fast to maintain a “wet edge” and avoid brush strokes.

Marine-grade polyurethane paints are much, much thinner than house paints you may be familiar with. It’s intended to be applied in several very thin coats.

As a simple test, your paint roller should almost feel “dry” as you apply the paint. If you can get the paint on in thin coats, you won’t suffer from the runs and sags that signal the work of an impatient painter.
Here, the foam brush chases right behind the roller, tipping out the bubbles with light strokes before the paint sets.

We use 400-grit wetsanding paper between coats to build up a rich gloss.

Expect to apply a minimum of 3 coats and a maximum of five coats for good coverage with a marine polyurethane.

Any surface to be varnished should be finished with 220-grit sandpaper before you start. 120-grit sandpaper leaves tiny cuts and swirls in the surface that diminish the gloss.

Like marine paints, marine varnishes are very thin, and also benefit from very thin coats.
A team approach works best, with one person rolling on the varnish in a thin film and the second tipping out the bubbles with a foam brush.

3-5 coats of varnish will be sufficient to build up a nice gloss and protect the epoxy from UV light.

Find more details and finishing strategies at clcboats.com/tips
The Sassafras 16’s Seats and Thwart

Check the width of the boat at the puzzle joints. Measured to the outside of the rail, the canoe should be 40-1/2” (1029mm) wide.

If the hull has spread out, use a tie-down strap to pull the beam in a bit.

A final check on the beam.
The caned seats, supplied in kits or available separately for scratch-builders, are longer than needed.

Rest the seats on top of the rails.

With a ruler, mark the seats for cutting.
Here are the pencil marks on the stern seat.

Use a Japanese pull saw to trim the seats to length.

This seat is ready for installation.

Once suspended from the seat supports, the seat should be just a bit narrower than the hull. The seats must NOT rest against the hull planking.
Drill 1/4” (6mm) holes through the seat supports for the seat hangers.

On the forward seat, you’ll actually need to angle the drill bit inwards a bit, as the seats are just barely wide enough.

The seat hanging hardware looks like this. A bolt passes through the rail, through the spacer block, through the seat, and is bolted on the underside.
A diagram of the seat installation hardware.

A close-up of the seat hangers.

A trial fit of the seats.
Here’s the forward seat in the Sassafras 16. Note that the seat hangs clear of the hull planking.

The seats should be finished with varnish. We don’t recommend epoxy-coating the ash-and-cane seats. They’ll hold up well with just varnish on them.
The center thwart for the Sassafras 16 is shipped just a little longer than needed.

Mark and trim the thwart, which is fitted at the exact center of the boat, above the puzzle joints.

Drill two neat countersunk holes for the #8 x 1-1/4” (32mm) bronze screws that will hold it in place at either end.

Test fit of the center thwart.

If you’re going to varnish the center thwart, now’s the time, prior to installation.
It’s an awkward reach under the thwart to pre-drill for the screws. We’ve done it by hand, but if you have one of these handy angle-drills, that will make fast work of it.

The screws, two per side, are driven into the underside of the rail.

The finished interior of the Sassafras 16, glowing with multiple coats of varnish.
The Sassafras 12’s Seat and Thwart

Like all “pack canoes,” the Sassafras 12’s solo paddler sits right down on the bottom, with a kayak-style seat and backband.

The Sassafras 12’s thwart will need to be trimmed to fit at the location shown here. The thwart is screwed to the underside of the inwales just as in the Sassafras 16, on page 108.

The back band is secured to the thwart with two loops of 1/4” (6mm) bungie.

Pulling it forward off the thwart are two adjustable 1” (25mm) lengths of webbing.
The webbing is fastened at the forward end with a #10 x 3/4” (18mm) wood screw, driven through the webbing and into the underside of the rail.

Fastening the webbing to the inwale.

The straps allow height and tension adjustments.
A view of the bungie cords on the back of the Rapid Pulse Backband.

The seat bottom comprises two layers of 3/4” (18mm) minicel foam.

Use ordinary contact cement (available, well, everywhere) to glue the top and bottom together.

The longitudinal location of the seat is shown in the diagram on page 109.

Glue the seat to the bottom of the hull with the same contact cement. The contact cement is strong enough for ordinary use, but weak enough to allow you to get the seat back out again when you’re ready to refinish!
Optional inspection plates, in either 4” or 6” diameters (100 or 150mm), will give you waterproof access to the air chambers at the bow and stern.

This allows you to store your wallet and keys, and perhaps more importantly permits you to ventilate these chambers while the boat is in storage.

You can cut the hole with a saber saw or a Roto-zip tool.

If you know from the beginning that you want inspection plates, you can cut the holes way back on page 29, before you even start assembly. That’s easier than doing it now!

Apply a bead of a good marine-grade silicone caulk around the inspection plate flange, and screw them to the bulkheads with #8 x 1/2” (12mm) stainless screws.
Another option for the watertight compartments is a simple drain plug.

If your epoxy fillet work was careful, the compartments should be airtight. Why, then, might you need a drain plug?

There’s enough enclosed air volume for water to condense out of the air when you encounter big temperature changes, and this moisture, over many years, can find its way into the wood through tiny gaps in the epoxy sealing coats. This will discolor the wood.

Unscrewing the drain plugs to allow a little bit of ventilation while the canoe is stored for the winter will help prevent moisture ingress.

These drainplugs simply require a 1” (25mm) hole in the bulkheads and two #8 x 1/2” (12mm) stainless screws. Be sure to use lots of marine silicone caulk beneath the flange of the drain plug when you install it.
Final Thoughts

HAVE FUN!

If you’re new to small boats, avoid cold or rough conditions. Wear your life jacket at all times.

Never leave shore without a bucket to bail with and all Coast Guard-required equipment.

Send your photos to info@clcboats.com. We love to see your completed boats!
Sassafras Canoe Gear

This is a small selection of our tools, supplies and accessories. Call 410.267.0137 or visit clcboats.com for our complete catalog of tools, supplies, and accessories.

A. NRS Deluxe Touring Safety Kit
B. Tempest Paddle by Grey Owl
C. Vista PFDs from NRS
D. Square Blade Canoe Paddle by American Traders
E. Beavertail Canoe Paddle
F. Trailex Lightweight Trailers

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Boatbuilding Tools

G. Low Angle Block Plane (1-3/8” x 6”)
H. Stanley Spokeshave
I. Waterstone
J. Japanese Saw
K. Bonsai Saw
L. Super-hard Milled Scraper (set of 4)
M. Sliding T-Bevel (1/2” x 6-1/4” x 7”)
N. Plastic Epoxy Spreader
O. Epoxy Syringe
P. Shinto Saw Rasp
Q. MAS Rapid Cure Mini Kit
R. MAS Handy Repair Kit

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Finishing

S. Interlux Brightsides Paint
   (Yellow, Fire Red, Sea Green, Dark Blue, Hatteras Off-White, White, Sapphire Blue, Black. Other colors available.)
T. Interlux Schooner Varnish
U. Interlux Goldspar Satin Varnish
V. Chip Brush
W. Foam Brush
X. Roller Frame
Y. Foam Roller Covers
Z. Fine Line Tape
More at clcboats.com

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