

Nutshell Builder's Model Kit

THE BACKGROUND

The 7'7" NUTSHELL pram was designed by Joel White in 1983 on commission from *WoodenBoat* magazine to be a high-quality plywood kit (full size) for the amateur to assemble. She rows like a dream and can carry an astonishing load with ease, yet she is only 7'7" overall, has a beam of 4', a draft of 5 1/4", and weighs just over 90 pounds. She tracks exceptionally well, and even in a chop against a breeze she carries her way like a true pulling boat. NUTSHELL will take three adults rowing and still have freeboard remaining so that you don't have to hold your breath to stay afloat. She tows securely and with little disturbance. And she is a really saucy beauty in looks.

NUTSHELL has turned out to be a very successful design, for building, sailing, and rowing. Most of the owner/builders of NUTSHELL have never built a boat before, and have gained greater appreciation of their boats for having built them from the kit, using its carefully prepared instructions and plans. In the process, they learned a good deal about plywood boat construction in general.

THE MODEL

It occurred to us that you wouldn't have to build a big, full-sized boat to learn many of the basic processes of boatbuilding, and to understand what parts go where, if a scale-model kit were designed with this in mind. So we developed the NUTSHELL Builder's Model Kit to reproduce as closely as possible in 1 1/2" scale what is involved in building a "real" boat; she also makes a very attractive and unusual model to display. The NUTSHELL seemed like the ideal boat to start with, since we already offer it as a full-sized rowing and sailing boat, both in kit form or to be built from scratch using our complete construction plans (see the *WoodenBoat* Catalog). Every part that goes into this model is identical (except in size) to the full-sized NUTSHELL. We have not pre-cut the parts, but leave that to you to do, following the plans, patterns, and instructions.

A word about the plans. These aren't simple sketch plans like those that come with many models, but are actual scale plans, reduced to the scale of the model, from the designer's original plans drawn for the full-sized boat. Of course, those plans include additional sheets of drawings and details not needed for this model, and a "table of offsets" from which a boatbuilder would "loft" his boat (draw it out at full size on a loft floor) before starting the actual construction. The plans in this model kit, being reduced to actual scale-model size, will be used as patterns by you to cut out the parts from the wood supplied, just as you would do in building many big plywood boats (the "loftings" the boatbuilder draws become, in effect, his patterns). You will use glue throughout to fasten your boat together, whereas a big boat would be fastened with "mechanical" fasteners (screws, nails, bolts) in many places; we couldn't figure out how to make scale screws that you could see! And anyway, the real NUTSHELL is constructed using the "glued lapstrake plywood" method, in which most of the planking is glued with epoxy, and screws are used only in a few critical areas.

MATERIALS AND TOOLS

You will need to provide a couple of pieces of scrap pine or other softwood to construct the "building jig" and a temporary transom support block, two 1 1/4" wood screws, some small brads (18-gauge), and ordinary white glue, or yellow "carpenter's" glue, and some thread for rigging. Everything else is provided in the kit. When you receive your kit, check each piece of wood against the materials list to make sure everything is there. This will also make you familiar with the various dimensions of wood you will work with. Don't cut any piece until you have checked and double-checked that you are cutting from the right piece of stock. We will begin each step in the instructions by listing what size wood you will be using in that step. When cutting out the parts from the sheetwood, lay out the patterns in such a way as to use the wood in the most economical manner. In a number of instances, you will need to get several parts out of one piece of wood, and will be making small pieces out of scrap. When cutting out parts, it is best to cut slightly outside the line, then carefully trim exactly to the line with a file, fine rasp, or sandpaper.

Cutting patterns will be taken from the plans, but rather than actually cutting the shapes from the plan sheets themselves, we suggest that you use carbon paper to transfer the shapes either directly onto the wood, or onto another piece of paper or thin cardboard that you can carefully cut out as a pattern. It will be easier in the long run to keep your plans intact. Whatever method you use, *be precise*. An error of 1/16" can make a big difference.

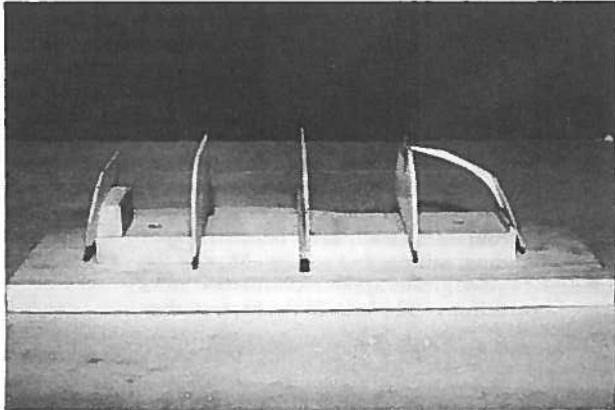
For tools, you will need a ruler that measures in 32nds of an inch, a sharp X-acto knife or other modeling knife, a flexible straightedge, a small square or drawing triangle, a fine jigsaw or coping saw (helpful), a fine file or rasp, a sharp chisel, sandpaper, and several spring-type clothespins to use as clamps.

Now, before you do anything else, **READ THE INSTRUCTIONS THROUGH CAREFULLY, STUDY THE PLANS, AND BECOME THOROUGHLY FAMILIAR WITH WHAT YOU WILL BE DOING.**

BUILDING THE MODEL

Now that you have checked that your kit is complete, have gathered your tools, and have become familiar with the plans and instructions, it's time to begin your NUTSHELL pram model. Don't rush things. If you were building a real boat, someone's life might depend on your care in construction. No one is going to sail this model across the Atlantic, even if the record breakers do voyage in smaller and smaller boats; but you are learning to build a boat, so build it as if someone were.





MATERIALS

*Pine or other scrap wood:

$\frac{3}{4}$ x 15 x 5 $\frac{1}{2}$ " — sub-base

$\frac{3}{4}$ x 2 $\frac{1}{4}$ x 11 $\frac{1}{4}$ " — upper base

$\frac{3}{4}$ x $\frac{7}{8}$ x 2" — transom support block

*Wood screws: 2 @ 1 $\frac{1}{4}$ "

Sheetwood:

$\frac{1}{8}$ x 3 x 12" — molds

$\frac{3}{32}$ x 3 x 6 $\frac{1}{2}$ " — center frame

$\frac{3}{32}$ x 3 x 10" — transoms

$\frac{3}{32}$ " scrap — forekeel

Stripwood: $\frac{1}{4}$ x $\frac{1}{4}$ x 8" — frame cross spall

*Materials not included in kit.

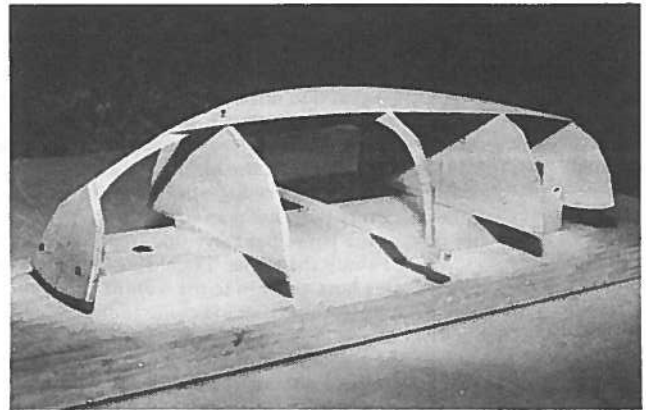
The first step is to construct the building jig. It is made up of a base and two temporary station molds on which your boat will be built upside down. The base is built up in two layers of $\frac{3}{4}$ " pine or other suitable softwood. The sub-base should be approximately 15 x 5 $\frac{1}{2}$ ", with the upper base being approximately 2 $\frac{1}{4}$ " by 11 $\frac{1}{4}$ ", centered on the sub-base and screwed into it. Position the screws so they don't lie where a mold, or the frame, will fall. Check that the surface of the upper base is perfectly flat, with no humps, bumps, ridges, or hollows. The upper base should be marked with a centerline running longitudinally, and three "station lines," perpendicular to the centerline, spaced exactly at intervals taken from your plans.

The temporary station molds 1 and 3 are cut out next, following the shape on the plans. Be sure to transfer to the molds the centerline and "sheer point" marks. Carefully cut the center frame. You can reduce the possibility of breakage by cutting the inside curve first, then gluing on the $\frac{1}{4}$ x $\frac{1}{4}$ " cross spall. This will add support while cutting the outside line. When completed, transfer the "sheer point" marks to the frame and centerline marks to both the frame and cross spall. Because the final shape of your boat depends upon the shape and positioning of the molds and frame, be extra careful in drawing the station lines, in cutting the molds and frame, in gluing the cross spall in the exact position shown on the plans. This is one of the most critical steps in the construction process.

The molds and center frame can now be set up. Refer to the plans to be sure you're positioning them on the correct side of each station line. The cross spall of the center frame is glued directly to the base, while the molds should have cross pieces of $\frac{1}{4}$ x $\frac{1}{4}$ " glued to the base for added support. All three should be held square and plumb to the base's surface while the glue sets.

Now for the transoms. Cut to the *outside* lines shown on the plan, and mark the inner, bevel lines on each piece. The bevels are cut from the outside edge to the marked bevel lines with a sharp chisel, a rasp, file, or sandpaper. It is useful to glue a small, narrow strip of sandpaper to a flat piece of wood to avoid rounding the surface you are sanding. You want a good, flat surface at your bevel to make a "landing" for the bottom and planking. The bevel changes slightly on each surface. The transoms must be marked with sheer points, centerlines, and mounting height lines on the inside surfaces for line-up when setting up on the jig and when planking.

The forekeel, with its shape taken from the construction profile drawing, must be cut to shape and glued to the inside of the forward transom before setup. Position the forekeel on the transom's centerline, flush with the transom's point. When it is positioned on the jig, the mounting height line should be aligned with the top of the upper base of the jig. The end of the forekeel sits in the notch in station 1. Make certain that it lies at the proper angle. A couple of 18-gauge brads driven through the transom into the base will hold it at the correct height, side-to-side positioning, and rake angle. Don't drive these temporary brads home, flush with the face of the transom; you will pull them out later when you remove the boat from the jig. The stern transom must have a block (use a piece of scrap pine) cut to the angle shown on the plan to hold the proper rake and provide backing for two more temporary brads to hold the transom to the jig. Again, align the mounting height line on the transom with the top of the upper base of the jig. Make certain you mount each transom to the correct end of the jig.

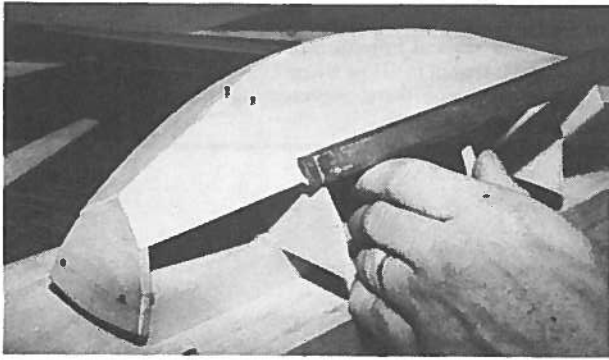


MATERIALS

Sheetwood: $\frac{1}{16}$ x 4 x 10" — bottom

When the setup is complete and has been double-checked for accuracy, planking may begin with the bottom panel. After cutting and trimming to shape, mark it with a centerline (when boatbuilders refer to a centerline, it is always a fore-and-aft centerline), station lines, and the outside stern transom line. It must be sprung into place, which is easiest done by gluing it first to the stern transom, at the outside transom line you drew on the bottom, before springing it across the molds to the bow. After this glue has set firmly ("dry-fit" it first to make sure that it will be aligned correctly when you do spring it down), spread glue on the landing surfaces of the center frame and forekeel, and spring it down in position. **DO NOT** spread glue on the molds. Be particularly careful not to put too much strain on the center frame, or you may break it. Two 18-gauge brads should be driven through the bottom and into the station 1 mold to hold it in place while the glue sets. These nails must come out later, too. Any overhang at the stern will be trimmed off, later.

Beveling the edges of the bottom is the next step. The object here is to work down a bevel that matches the line of the molds, frame, and transom. This may be done with a sharp chisel, file or fine rasp, or sandpaper. An easy way to produce an accurate bevel is to hold a straightedge along the adjacent edge section of each mold and frame in turn, and cut a bevel at those areas on the edge of the bottom panel until the straightedge lies flat and true against each and the bottom edge. Then "fair," or join, these beveled sections to each other (the bevels will be at a different angle at each section, remember) in one long, smooth, changing bevel from end to end. This is the method to use for all plank beveling. This bevel must also carry up either side of the bottom of the forekeel, meeting at its centerline. When this step is finished, you should have a landing surface for the garboard planks that will allow them to sit tightly against all contact surfaces. The final test for this fit comes with a dry-fitting of the garboards after you have cut them.



MATERIALS

Sheetwood:

- $\frac{1}{32}$ x 3 x 12" — planking
- $\frac{1}{32}$ x 3 x 13" — planking
- $\frac{3}{32}$ x 1 x 10" — outer keel

Planking can now continue with the garboard plank, middle plank, then the sheer plank, following these steps:

Cut the shape of each plank, following the plank patterns. It might be wise to allow an extra $\frac{1}{8}$ " length on each end, which can be trimmed away after installation if not needed.

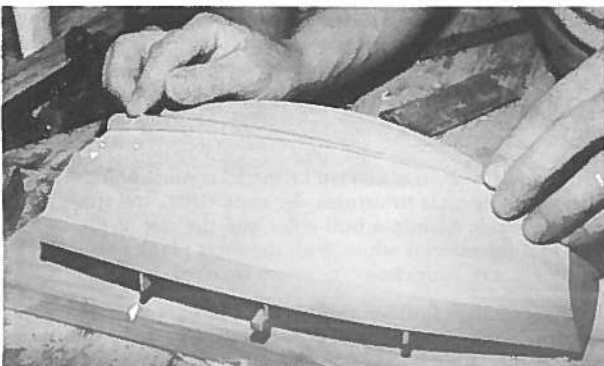
Bevel the top edge of each preceding plank to form a landing (you've done this in the previous step with the bottom to allow the garboard plank to be fitted).

Dry-fit each plank in turn in its proper position before spreading any glue. When fitting, the top edge of the plank (top and bottom defined as if the boat were right-side up) should be lined up along the "knuckle" of the transoms and center frame. The knuckle is the point where the angle of the shape changes. This will, in most cases, leave an overlap on the bottom edge of each plank. This should not be trimmed away, but left, and the V-shaped notch it creates will be filled later (see the "midship construction plan detail"). The garboards may require a bit of trimming where they meet at the centerline forward to obtain the proper fit on the beveled forekeel. The top edge of the sheer planks must be lined up on the sheer points you marked on the frame and transoms.

When you are happy with the fit of the first plank (the garboard planks), spread glue on all contact surfaces and press the plank in place. An extra pair of hands may be required to hold a plank firmly at all points while the glue sets. Small pieces of waxed paper placed over the edges of the two station molds will keep glue off them and prevent your boat from sticking to the building jig. (Remember, the station-molds should not inadvertently become part of your boat! They are not frames.)

After all the planking is complete, the plank ends and bottom end may be trimmed flush with the transoms. The bottom edge of the garboards should also be trimmed flush with the surface of the bottom panel. This would be a good time to sand the outside of the hull and fill the plank lap grooves with a bead of glue.

Next, the outer keel is installed. Its shape comes from the construction profile drawing. Using a flexible straightedge, draw a fore-and-aft centerline on the bottom panel. Position the keel so that the center of the keel follows the line on the bottom panel and glue it in place. Now the forward end of the keel should be faired into the line of the garboards.



MATERIALS

Sheetwood:

- $\frac{3}{32}$ x 3 x 4" — knees
- $\frac{1}{8}$ x 3 x 12" — seats; seat support blocks

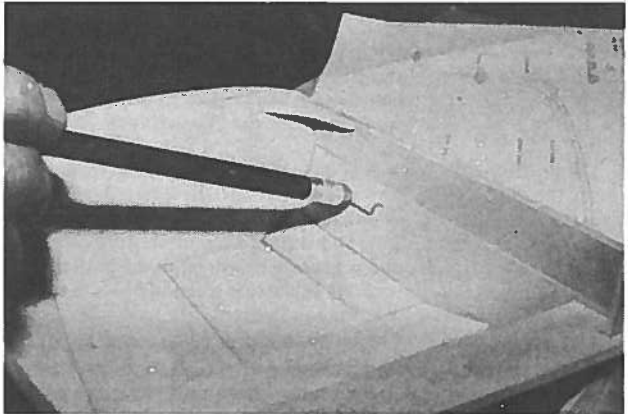
Stripwood:

- $\frac{3}{32}$ x $\frac{5}{32}$ " — guardrails

After removing all temporary brads and cutting off the center frame above the sheer (the cross spall is cut off in the process, too), your model may be removed from the building jig.

The first step in finishing off the pram is installation of the forward and stern quarter knees. Their shape comes from the plan view construction drawing. Adjust the bevel on each knee until it fits tightly against the inner faces of the transoms and sheer planks, tilted up a bit as shown in Photo 5. Guardrails, $\frac{3}{32}$ " thick and $\frac{5}{32}$ " deep, are simply cut to length and glued along the top edge of the sheer plank. Lots of spring-type clothespins help here as clamps. When set, round the forward and aft ends with sandpaper.

The seats may now be cut out and positioned, with shapes, heights, and fore-and-aft locations determined from the construction drawings. When they fit properly, mark their bottom edges on the hull and use these marks to locate the seat-support blocks, which should be cut from $\frac{1}{8}$ " scrap wood. These blocks, after being glued in place, will require some careful beveling of their top surfaces so the seats will lay on them properly. Do not install the seats yet.



MATERIALS

Sheetwood:

- $\frac{1}{32}$ x 3 x 12" — daggerboard case sides and planking
- $\frac{1}{8}$ x 3 x 12" — daggerboard case bedlogs and endposts

One of the more meticulous parts of your project will be assembly and installation of the daggerboard case. Follow these steps:

Cut all pieces to shape (2 sides from $\frac{1}{32}$ " wood; 2 bedlogs and 2 endposts from $\frac{1}{8}$ " wood). Leave the trunk sides about $\frac{1}{8}$ " higher than shown on the plan for later trimming, and the endposts should each be cut $\frac{1}{4}$ " long.

Glue a bedlog along the outside bottom of each case side. Be sure to make a set, not two exactly alike, as they are not quite square and therefore not reversible.

Glue the endposts to the inside of the forward edge and aft edge on one case side, leaving about $\frac{3}{16}$ " sticking down below the bedlogs.

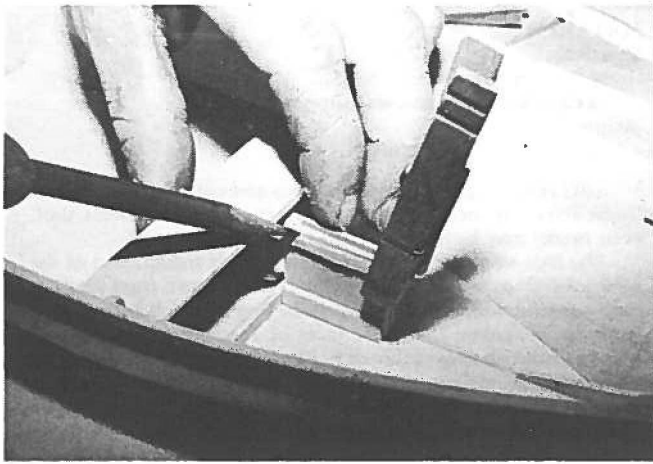
Glue the two case sides together.

Notch the endposts below the bedlogs, where they will pass through the model's bottom, about half their width as shown on the construction profile drawing.

With the aft end of the case held against the forward edge of the center frame of the boat (middle seat removed), mark on the bottom panel where the posts touch. Note that the case must be offset from the centerline so that the daggerboard slot falls just beside the keel and not on top of it.

Cut a slot through the bottom panel to match the slot in the trunk and allow the endposts to drop through without striking the keel.

With the case fitted tightly in its slot, you can mark and cut the top to its proper height, even with the *underside* of the middle seat. The aft end of the case should be up against the forward edge of the seat.



MATERIALS

Sheetwood:

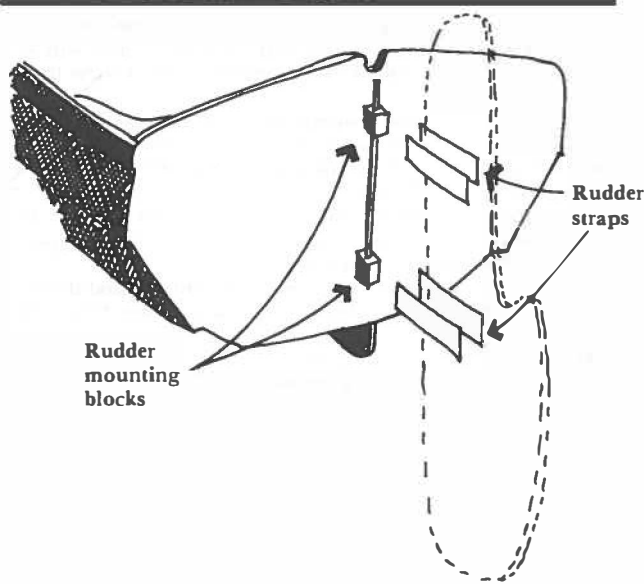
- $\frac{1}{8}$ x 3 x 4" — maststep
- $\frac{1}{16}$ x 4 x $5\frac{1}{2}$ " — daggerboard rudder
- $\frac{3}{32}$ x 1 x 10" — tiller
- $\frac{1}{8}$ " scrap — daggerboard case cap
- $\frac{1}{32}$ " scrap — tiller cheeks

Photo 6 shows the daggerboard case being marked. To find the proper final height of the case, with the middle seat resting on its support blocks and the forward edge of the seat held *behind* the center frame, hold a small straightedge against the bottom of the seat and mark along its top edge across the case side. Cutting to this line will allow the daggerboard trunk cap to sit flush with the top of the seat. Now you may glue the daggerboard case in position.

The cutting, positioning, and fitting of the maststep (from $\frac{1}{8}$ " wood), the mast hole in the step and through the forward seat, the daggerboard (from $\frac{1}{16}$ " wood), and the case cap (from $\frac{1}{8}$ " wood), are all detailed on the plans, and should present no problems. A small, narrow strip of wood is glued lengthwise to the bottom of the case cap so that it fits securely in the case slot and holds the cap in place when the board itself is not inserted.

The seats should now be glued in place.

Follow the plans for the rudder and tiller. Cut the tiller cheeks from $\frac{1}{32}$ " scrap wood. The end of the tiller should be trimmed to the same thickness as the rudder so that when the tiller cheeks are glued on, they will sandwich the rudder in a press fit (don't glue them to the rudder).



The sketch shows how the rudder is mounted to the stern transom of the boat. Small straps made from scrap planking wood are glued to each side of the rudder, where bronze fittings would be on a full-sized boat. Glue small blocks of a proper size (cut from $\frac{1}{16}$ " scrap) to the transom in the correct position so that when the

rudder straps are pressed over them in a fairly tight fit, the rudder will hang in place. If you wish to show more accurate detail, drill a carefully sized vertical hole through both blocks before gluing them on the transom to allow a fine $1\frac{1}{2}$ " finish nail or length of wire to pass through them, representing the rudder-mounting rod.

Spars

MATERIALS

Stripwood:

- $\frac{3}{8}$ x $\frac{3}{8}$ x 13" — mast
- $\frac{3}{16}$ x $\frac{3}{16}$ x 10" — yard
- $\frac{3}{16}$ x $\frac{3}{16}$ x 12" — boom

Cut the spars to length and, taking the shape from the plans, draw the taper on all four sides of the mast. Start with a centerline down the length of each side to ensure that you don't put in a lopsided taper. Note that the mast tapers two ways: a short, quick taper in the base to the heel, and a long taper to the head. Cut to the taper lines, then trim the edges of the four-sided wood with a file, rasp, or sandpaper glued to a flat stick, to form an eight-sided piece. Now sand the sharp edges until the spar is round. Use increasingly fine sheets of sandpaper held in the palm of your hand to form a curve until you arrive at the proper shape and smoothness. Work slowly and don't try to take off too much at once, or you may take *too* much off. The other two spars are thinner, with less marked tapers, and you may be able to work those simply by eye.

Cradle

MATERIALS

Sheetwood: $\frac{1}{8}$ x 3 x 4" — cradle-support pieces

Stripwood: $\frac{3}{16}$ x $\frac{3}{16}$ x 12" — cradle longitudinals

Cut out the cradle's forward and aft support pieces from $\frac{1}{8}$ " material and cut the notch for the boat's keel in each piece as shown on the plan. Cut the two longitudinal pieces to length, then glue them end on to the two supports to make a rigid, boxlike structure. Make sure it is square, without a wobble. The hull of your boat will rest in the cradle high enough to allow the rudder to be mounted. The daggerboard may be inserted through the daggerboard case and partway below the bottom of the hull, but it will not go all the way down (that would require a cradle so high as to look awkward on display).

Sand the daggerboard so that it will be thin enough to fit snugly in the case but not so tight that you have to force it through. Don't forget to allow for the thickness of the paint or varnish you use to finish your boat.

Sail

MATERIALS

Dacron sailcloth

• White thread

Cut the sailcloth to the proper shape using the sail plan as a pattern. For rigging, use white thread for the halyard, sheet, and lacing at the top of the sail around the yard, following the rigging diagram. Note that the sail is "loose-footed," held only at the tack and clew to the boom and not laced around the boom all along its length. If you really want to get fancy, you could put three or four evenly spaced vertical lines of very fine stitching (a *very* narrow zigzag stitch would look even better) with white thread from the top of the sail to the foot to indicate the "panels" of sailcloth used to make a sail. Also stitch all around the very edge of the sail. Some additional stitching at each corner would add to the authenticity as reinforcement stitching.

Finish

MATERIALS

• Paint

• Varnish

How you finish your NUTSHELL model is your choice. A nice, traditional scheme is to varnish the seats, tiller, and spars, and paint the inside bottom a buff color and the rest of the inside white, and the exterior white, with the sheer plank painted in a brighter color of your choice, or even varnished.

Now that you have finished your model, you have learned quite a bit about how a plywood boat goes together. Perhaps your next project will be a big boat!