Building a Solid Hull Model of Sussex

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Introduction

Bob Friedman and Cathy Dupont of SeaWatch Books have edited and published my book, Building a Navy Board Model of the Sussex. This details the construction of a model of Sussex at a scale of 1:48 (¼-inch to 1 foot). Sussex was built in 1693 at Chatham (length: 157 feet 2 inches, beam: 41 feet 4 inches) and, in 1694, led a fleet transporting a large amount of specie with which William III hoped to bribe the Duke of Savoy to join the League of Augsburg in the war against Louis XIV. Unfortunately, Sussex foundered off Gibraltar in a Mediterranean hurricane, usually referred to as a “Levanter.” The wreck of this vessel apparently was found off the coast of Gibraltar by Odyssey Marine Exploration some years ago but has not been thoroughly investigated because of disputes with the Spanish government. (The preliminary archaeological report is available on line: http://shipwreck.net/pdf/OMEPapers1-SussexShipwreckProject.pdf)
This article is intended to assist those modelers who might wish to construct a solid (or hollowed out) model of Sussex, which would take less time to build than a Navy Board model. A Navy Board model (also referred to as an Admiralty model) was constructed like the original vessel, including the keel, all the frames, deck beams, and so on, with the exception that the hull’s planking below the lowest major wale, and approximately half of the deck planking was not installed so that a viewer could visualize the interstices of the vessel and appreciate its intricate construction. Apparently, the shipwrights of the seventeenth century routinely employed models as “marketing tools” when they were attempting to sell a particular ship design to the Navy Board. Bids for construction were made in pounds sterling per ton of ship. It is obvious, therefore, that the shipwright would have gone to great lengths to hire a model maker with appropriate consummate skills to represent his design in the most attractive manner possible, thus increasing his chances of sway-
Hull Construction

The majority of ship modelers who have constructed ship models utilizing various building techniques are aware that solid-hull construction is much simpler and, therefore, much less time-consuming than other methods involving the fabrication of full framing. A comparison of Figure 1 (a solid-hull model of Sussex) and Figure 2 (a Navy Board model of the same ship) readily demonstrates the difference in appearance between the two model types.

The modeler’s first decision is to determine the scale at which the modeler wishes to choose to fabricate the model of Sussex. This article describes a model constructed at the typical “museum” scale of 1/4-inch to 1 foot (1:48) so that the actual overall length is about four feet. If one wishes to make a model at 1:96 scale (1/8-inch to 1 foot), the completed model would be slightly less than two feet in length. It may be easier to fabricate the hull itself at the smaller scale but this advantage evaporates when one realizes that the carvings must be executed to a smaller scale and,
therefore, will be more difficult to accomplish in equivalent detail.

The 1:48 scale model described in this article is not, in reality, a totally solid-hull model in that it was hollowed out and the decks fabricated separately. The “hollowing-out” process was merely to reduce significantly the weight of the model and render working on it less cumbersome. If one should decide to build the model at 1:96 scale (or even smaller), its weight would not be a particular problem. The hollowing-out process, therefore, need not be employed and the hull and each separate deck could be fashioned from one single piece of wood or laminates of the wood of choice.

Unlike the construction of a Navy Board model, when it is necessary first to fabricate the keel, fore and aft deadwoods, stem piece, and sternpost in order to determine frame position and begin framing, when constructing a solid hull model, making up and installing the keel, stem piece, and sternpost may be postponed until after building the hull.

I utilized 8/4 (eight-quarter or 2-inch thick) basswood to construct the model, as this wood is reasonably sturdy, carves easily, is not prone to warp, and finishes well. Obviously the modeler may use any wood of his or her choice. Although pine is light and easy to carve, it would be the least preferable because it does not finish well and is difficult to seal. Hard maple would produce an excellent model; this wood, however, is very heavy and the model would be cumbersome and more laborious to carve. Soft maple or tupelo would also be ideal woods to use. Because the beam of the model at 1:48 scale is slightly over ten inches, I glued four pieces of 8/4 bass wood together, supplemented by a 4/4 piece of basswood glued to each outer
surface (see Figure 3). Instead of laminating these pieces in the usual method (with each individual layer parallel to the water line), I glued them together vertically, at right angles to the water lines, coincident with the buttock lines. This method was employed so that the insides of the two central laminates could readily be cut out with a band saw, thus significantly reduce the amount of inboard area which had to be hollowed-out later. Figure 4 demonstrates laying out the primary 8/4 basswood sections to facilitate tracing their shapes from the plans. Figure 5 shows the central innermost sections of the hull being glued and clamped together, with the completed assembly illustrated in Figure 6. Figure 7 is a view of all the hull sections completed and glued together.

The positions of the stations (every other frame junction), taken from the sheer and body plans, were transferred and marked on the center line of the hull (where the keel would be placed later). Letters denoted station lines forward of the midships of the vessel and numbers aft of it. Thick cardboard templates were then cut out for each station, using the body plan for reference. The rough outboard shape of the hull was completed using a band saw and large carving gouges. The templates were then utilized to derive the correct cross section at each station (Figure 8), and the outer surface of the hull faired to shape. I then used 2-inch diameter Forstner bits and large curved carving gouges for the preliminary stages of hollowing out the interior of the hull (Figure 9), and completed the interior shaping with smaller tools. (Figure 10)

The bulwarks and the deck bulkheads (including the main deck, forecastle deck, quarter deck, poop deck, and poop royale or topgallant deck) were added after

**Figure 8.** The hull block roughed out and carved to fit the templates at the stations.

**Figure 9.** The preliminary stages of hollowing out the interior.

**Figure 10.** Shaping the basic hull block completed.

**Figure 11.** The blocks for the aft section of the upper hull.
the major portion of the hull had been completed. This was in an attempt to lessen the amount of hollowing-out required and had the added advantage of conserving a considerable amount of bass-wood. Figure 9 also illustrates the combination of a cabinet-maker’s vice and a clamping jig utilized to hold the hull in place while shaping it, both inboard and outboard.

A very useful tool for shaping the outboard contours of solid hulls is a large flat tang rasp—or horse tang—which is commonly used in shaping horse’s hooves when fitting or replacing horseshoes. It cuts down basswood very quickly and easily, as the cutting ridges are longitudinal instead of the pointed excrescences of an ordinary wood rasp. The interchangeable “slicing” rasps, manufactured by Lee Valley Tools, are also very effective in this process, causing even less tearing of the grain than with the horse tang. I tend to use these rasps after initially roughing-out with the horse tang. These “slicing” rasps are very sharp and have cutting edges not unlike those of vegetable or cheese shredders.

The bulwarks of the hull were cut out to shape from 3/4-inch thick basswood, referring to the sheer profile plan. The aft upper hull bulwarks are as noted in Figure 11. Figure 12 shows the sections of the quarter, poop, and poop royale deck bulwarks in place. Figure 13 shows the hull with all of the upper hull bulwarks glued in place, including the midships and forecastle segments. With both the upper and the lower hull assembled, the final inboard and outboard fairing process can be completed. I selected a thickness of approximately 3/8-inch for the lower hull, tapering 3/16-inch and 1/8-inch for the upper bulwarks.

After completing the deck bulwarks,
a piece of basswood was fashioned as an overlay to finish the stern of the hull, with the various contours faired in accordance with the ship’s drafts. The curve of the transom board and stern is identical to the camber of the deck. The camber of the decks of Sussex was approximately 6 inches per 10 feet of deck, or approximately 2 feet amidships on the main deck, which has a beam of forty feet. Figure 14 illustrates the faired stern piece, including the tapered areas of the upper and lower counters.

The keel pieces, including the stern post and stem piece, were constructed from 5/16-inch thick South American boxwood to dimensions traced directly from the sheer plan. They were glued and nailed in place with 1-inch brass brads through holes pre-drilled and countersunk in the keel elements prior to their attachment to the hull. The completed segments of the keel attached to the hull are shown in Figures 15 and 16.

Wales

The model’s major wales were made from table-sawn American Beech, 3/16-inch thick and 5/16-inch wide. American Beech is very compressible and bends easily with heat or steam; in this case, the wood was heat-bent over a soldering iron to match the contours of the hull. These wales were pre-drilled and counter-sunk to accept flat-head stainless steel Phillips-head screws, which were ½-inch long and 3/32-inch in diameter. The inner surfaces of the wales were shaped with a slight concavity to match the contour of the hull’s
surface. They were painted black and then glued and screwed in place. It is always advisable to paint such planking and other fittings prior to attaching them to the model as it makes a cleaner job, and also saves time in the long run. Figure 17 shows the aft lower wales positioned, along with the interspersed standard boxwood planking. Figure 18 illustrates the completed lower wales in place. Note that, even though the screw holes need to be filled (with wood filler) and sanded, it is easy to touch up these areas with flat black paint, thus avoiding the necessity of painting the entire wale in situ and preserving a clean junction between the black wale and the planking.

At this point the construction of the solid portion of the hull is completed. I elected to plank the model above the lower wales to give a more realistic appearance to the model, and to imitate the usual Navy Board style. The planking was fashioned from South American boxwood cut on a table saw to 1/16-inch thick and 5/16-inch wide, smoothed on the exterior surface initially with a thickness sander and then with a scraper to obtain a very smooth surface. I elected not to plank the vessel below the lowest wale, as this section would be painted white thereby obscuring any planking. Those modelers wishing to plank the model below the lowest major wale to the keel, including the garboard strake, obvi-
ously may do so at their discretion. It was common in the seventeenth and early eighteenth centuries to bottom paint hulls with “white stuff,” consisting of whale oil, bituminous sulfur, and boiled pitch, to combat sea worms. Subsequently, ship’s bottoms were coated with “black stuff,” made of oil and tar, for the same purpose. Personally, I believe that the white hull below the lowest wale makes for an attractive model.

Figures 19, 20, and 21 demonstrate various stages in the construction of the solid forecastle deck and early construction of the forecastle bulkhead. I decided to employ solid decks with faux treenailed holly wood planking for this model of Sussex, but other modelers may wish to install individual deck beams and treenailed planking. Figure 22 shows some of the outboard boxwood planking in place.

Figure 22. Boxwood planking installation.

Figure 23. Early stages of installing the head assembly.

Figure 24. The completed stern and its carvings.
with nailed pledgets on one of the minor wales to hold the planks in position until the white glue hardened. Afterwards, the nails were removed and the holes filled with inserted boxwood or basswood treenails. Figure 23 shows early construction of the bow; while Figure 24 is a photograph of a segment of the completed stern.

Extensive coverage of the details of the construction of the remainder of Sussex—its decks, fittings, and other items including the many carvings—are presented in my book, *Building a Navy Board Model of the Sussex*. Figures 1, 25, and the front cover illustrate the completed solid hull model.