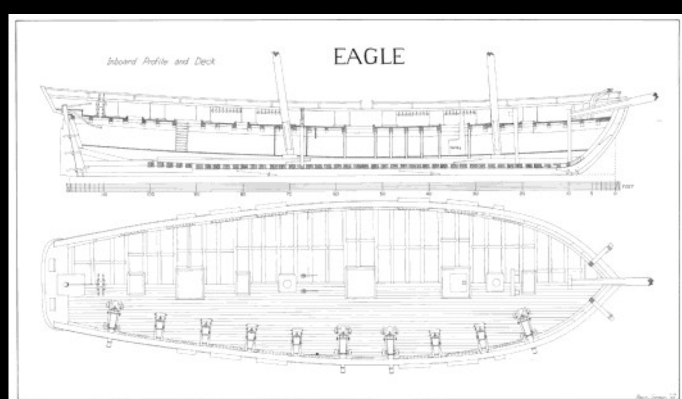
The US Brig Eagle (1814)

A Plank-on-Frame Modeling Project

By Gene Bodnar



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The US Brig Eagle

A 1/4”=1’ Scale Modeling Practicum
Based on the Plans and Masters Thesis
by Prof Kevin Chrisman of Texas A & M University

By Gene Bodnar

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Introduction

The project is divided into two distinct segments:

1. The first segment is a tutorial on "How to Convert a Set of Plans to Plank-on-Frame Construction."

2. The second segment is devoted to the detailed steps involved in building an Admiralty -Style Model of the Brig *Eagle* of 1814.

Many of you have built kits and/or plank-on-bulkhead (POB) models of ships, but I suspect that few of you have attempted a plank-on-frame model from scratch, and still fewer of you have drawn your own set of plans to be used for a plank-ion-frame (POF) model. These two segments will explain the mechanics of how you can take a set of line drawings of any ship, draw your own set of frames and building jigs yourself, and then proceed to use your own plans for building a plank-on-frame model or even an admiralty-style model. Of course, this is a time-consuming task but it is not a difficult one, and I can promise that, if you follow these two segments from beginning to end, you will experience the most rewarding feeling that is possible in this hobby.

Before we begin the tutorial, it is essential that you acquire the following tools and materials:

1. A copy of Kevin Crisman's dissertation on the Brig Eagle, which we will be using to develop POF plans from his drawings found in the book. His dissertation is available from two sources:

a. A free download from the Texas A & M University website. It contains 410-pages of vital information, including his line drawings for the "Eagle" and a great deal of important narrative about the vessel. We will use this dissertation constantly in our discussions and in all of our drawings. It is available at the following site, where you will first see an introduction to the vessel, and then a free download area at the bottom of that page: http://nautarch.tamu.edu/anth/abstracts/crisman.htm

b. Kevin Crisman's published book, called *The Eagle: An American Brig on Lake Champlain during the War of 1812* is still available from many used book sites, including abebooks, eBay, and Amazon. I should mention that his book contains some data that does not appear, or has been edited, in his dissertation. A review of his book appears in the "Appendix" section at the back of this book, where you will find details you may need for ordering it. It is not essential that you obtain a copy of the book, but it is recommended, especially if you like to work with a hard copy of the data and if you would like to read the fascinating history of the ship without doing so on line.

2. A good scanner. This will be used for scanning plans from Dr. Crisman's book.

3. A copy of a program called "Brava Reader," which is also available as a free download from many different sites on the web. Just google those two words and you will find it. This program will be used for enlarging plans that you scan. The program allows even unusual enlargements, such 3.62 times, with great accuracy. I've used the program for at least a year now, and I have found that it is free of any distortion in enlarging plans to any scale you like.

4. A pair of proportional dividers. This tool is essential from drawing frames and other details

in plans, and it is also extremely useful in determining planking widths on ship construction.

5. 1/4"-square graph paper. This graph paper will be used exclusively for all drawings of the "Eagle." I recommend that you obtain about 100 sheets of standard-size graph paper.

6. A steel-edged ruler. This will be used on almost every drawing. I have also found it useful in cutting thin planks as well as many other uses.

7. A draftsman's T-square and a 90-degree draftsman's triangle. These items are necessary for dividing Crisman's plans into individual frames. You will be using them for almost every one of his drawings.

8. Pencils, of course.

9. An X-Acto knife or single-edged razor blades. This will be used for making mirror-images of frames. In effect, you will be drawing one half of a frame, then scoring the centerline of the frame, and duplicating the other half of the frame without re-drawing it.

10. Carbon paper. This item is not essential but you many find it useful.

11. Lots of patience and perseverance. I cannot stress these items enough. Learning to draw your own plans will take time -- lots of it. It typically takes 30-40 hours to draw a complete set of POF plans, At times, you will find yourself making mistakes and doing things over again. This is normal. My best advice in this area is to take your time, go slow, and stop when you're tired. I never work on plans more than a couple of hours a day myself, mainly because I start seeing lines that don't belong there.

PART ONE:

HOW TO CONVERT A SET OF PLANS TO PLANK-ON-FRAME CONSTRUCTION

CHAPTER 1

Understanding Plans in General

This chapter will introduce you to the meaning of the various lines found on a typical set of plans. Many of you may be familiar with these lines already but it won't hurt to review. For illustration purposes, I will be using the plans for the *Eagle* found on pages 251 and 252 of Dr. Crisman's dissertation. You may want to scan these pages and enlarge them to 1:48 scale in your Brava Reader program, because you will be using these same plans throughout the entire build of the *Eagle* itself. An annotated picture of the stern half of these plans is given at the end of this chapter.

It is essential that a good set of plans contain the three basic views, including the **Body Plan,** the **Sheer Plans,** and the **Half-Breadth Plan.** All three of these plans are required in order to build a three-dimensional model with any kind of precision, because each view shows the ship in different perspectives.

The Body Plan: The Body Plan is sometimes called the Section Plan. It is divided in half, with one half showing a stern view of the vessel and the other half showing a bow view. In Dr. Crisman's body plan, the bow view is on the left-hand side of the plan, with the stern view being on the right-hand side. The lines on this plan are comprised of four types that you will use to draw your own frames: waterlines, section lines, buttock lines, the deck line, and diagonal lines, each of which will be explained momentarily.

The Sheer Plan: The Sheer Plan is sometimes called the Elevation Plan. It represents a view of the ship from its side. Note that it, like the Body Plan, contains waterlines, section lines, the deck line, and buttock lines. It also contains many other important pieces of information, including the locations of gun ports, rails, and masts.

The Half-Breadth Plan: Sometimes, the Half-Breadth plan is simply called the Plan View. It is a view of the ship looking from the top downward. Only one-half of the plan is necessary because the other half will be a mirror image of the former. Like the Body Plan and the Sheer Plan, the Half-Breadth Plan also contains waterlines, section lines, buttock lines, and diagonal lines.

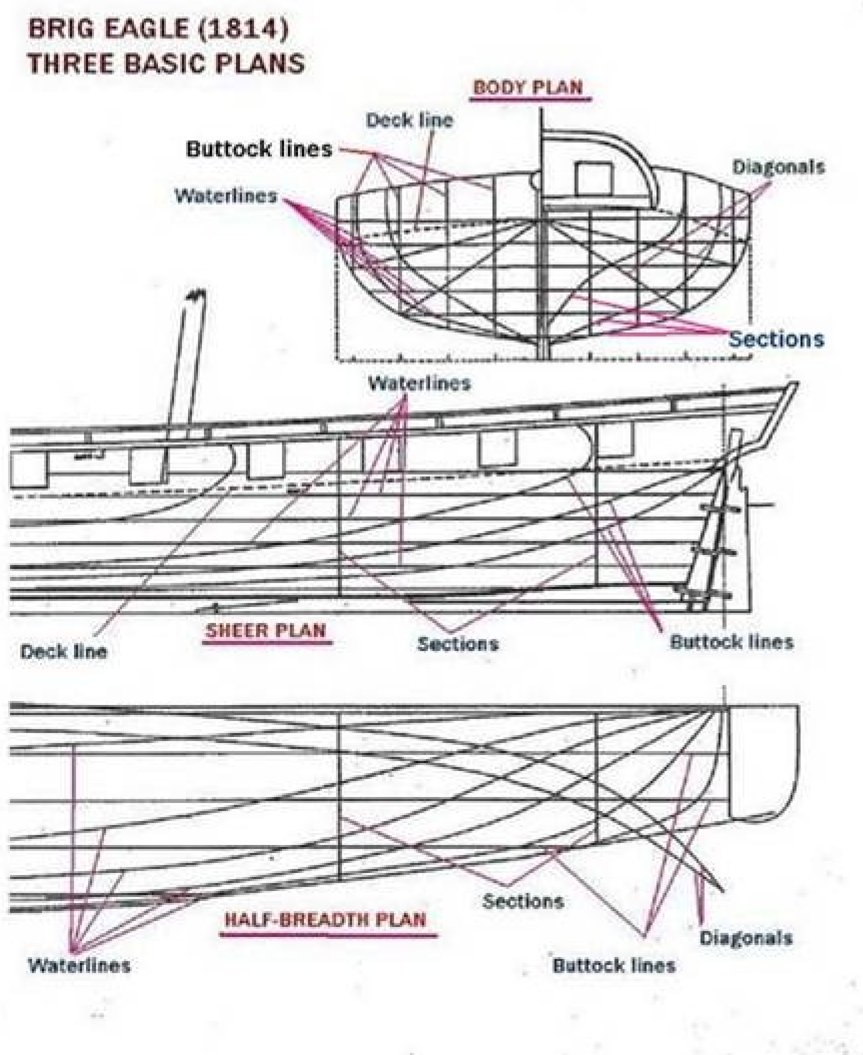
Now that we know what each plan represents, let us discuss the individual kinds of lines found on each plan. Let's start with waterlines. **Waterlines** are horizontal lines that pass through the hull at each area shown on the plans. Usually, these lines are designated with numbers from the keel upward starting with 1, and every plan will show the same waterline number. As you can see, the waterline near the midsection of the hull will be wider and slightly longer than the waterline below it.

Section lines are lines that pass perpendicularly in a vertical plane through the hull. These lines define the basic shape of the hull much more graphically than other lines. They are especially important for building the frames for a POF model. Any given section line on the existing plan may be an exact placement for a frame, but you will be require to develop many more section lines yourself when drawing the frames for a POF. Usually, section lines on plans start with a centerline somewhere near the midpoint of the ship (in other words, at its maximum beam). Moving away from the centerline toward the bow, the section lines are labeled A, B, C, and so forth. From the centerline toward the stern, they are identified numerically. Of course, the Body Plan, the Sheer Plan, and the Half-Breadth Plan will all have the same identifying letters and numbers.

Next are the **buttock lines**. These are the lines that pass through the hull in a position that is parallel to the centerline. The Sheer Plan shows their true shape. On the Body Plan, however, the buttock lines appear as vertical straight lines, and on the Half-Breadth Plan they appear as horizontal straight lines. Although the buttock lines are rarely used in constructing the model itself, they will be quite useful in verifying the section line shapes.

The **diagonal lines** pass through the hull at an angle to the vertical plans of the centerline. They are usually not used in the actual construction process, but they do serve the purpose of checking the accuracy of the other lines.

Each of the above four major types of lines will be used in creating your own POF plans. Of course, there are a few other lines on a set of plans that are important to the scratch builder. They will be discussed when the need arises.



CHAPTER 2

LOFTING PLANS

A. Gathering Information

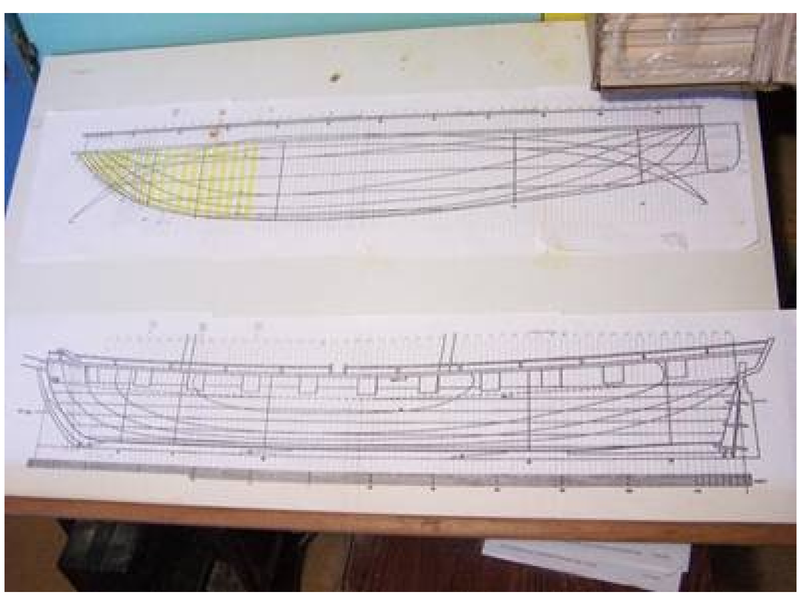
All of the POF plans that you yourself draw for the *Eagle* from this point forward will be the same plans you will use to build a POF model of the vessel itself. Therefore, if you have not yet scanned Dr. Crisman's lines drawings, including the Body Plan, the Sheer Plan, and the Half-Breadth Plan, it is imperative that you do so now. After scanning pp. 251 and 252 of Dr. Crisman's book, load them one at a time into your Brava Reader program, and enlarge them to 1:48 scale (1/4" = 1'). You must figure out the *exact* proportion by which to make the enlargement, which may take some trial and error in test-printing the scale. A fixed enlargement number cannot be assigned, because this would vary from scanner to scanner and from computer to computer. Do not be satisfied until it measures precisely 1/4" to the foot. Of course, this can be easily verified by testing the lines against a 1/4"-square piece of graph paper. Test a longer proportion than a mere 1/4". For example, test that a 10-foot full-scale length of the ship measures 2.5" on your graph paper.

The Body Plan, when enlarged to 1:48 scale, will fit on a single sheet of standard paper (8.5" x 11"). However, when the Sheer Plan is enlarged to 1:48 scale in your Brava Reader program, you will need to enlarge four different sections of the plan and then tape them together, making sure that the lines match precisely for each section of the plan. The same holds true for the Half-Breadth Plan.

While it is true that paper shrinks and expands even without taping individual sheets together, I don't believe you will experience much of a problem in this area, mainly because these plans will only be used for the duration of time that it takes to create the POF plans you will be drawing -- perhaps a month.

Mylar could be used as a substitute for paper, if you so desire, but I don't think that's necessary. Remember that these are temporary plans that you will probably never use again once this tutorial is finished.

I suggest 1:48 scale because this is the common standard for admiralty-style models. If you wish to build on different scale, make sure you print all plans consistently for your scale.



On the previous page is how your plans should look after you've done all the enlarging and taping of the sheets.

It is also important that you read pages 197-218 of Dr. Crisman's dissertation, which covers most of the items you will be lofting in your own plans, including the keel assembly (keel, stem, sternpost, and deadwood), the frames (square frames and cant frames), and the keelson. You should also take a look at Figure 56 on page 282 of the dissertation, which you will need to lay out your drawings, because it shows a good section view of the ship. Take notes on each of these topics as you read, especially noting full-size measurements, which you should convert to 1:48 scale. Any time you see a measurement that has been averaged, I highly recommend that you use that average throughout the drawings for that particular item. Check your scale conversions carefully, ensuring their accuracy, because any mistakes you make here will be carried over into your drawings and ultimately to the model itself.

Here is an example: On page 197, Dr. Crisman tells you that the keel "averaged 18 inches moulded and 12 inches sided." Converted to 1:48 scale, this becomes 3/8" moulded and 1/4" sided. Jot this down in your notes for the keel, because it will be used for drawing your keel on graph paper.

Once you have accumulated measurements for the various items you will be drawing for your POF plans, you will be ready to start lofting your plans.

IMPORTANT NOTE: The dissertation states that the moulded dimension of the keel is 16". However, his book has been edited to show the CORRECT MOULDED DIMENSION OF 18". Please correct this figure in your notes.

Your notes should contain the following information, as a minimum:

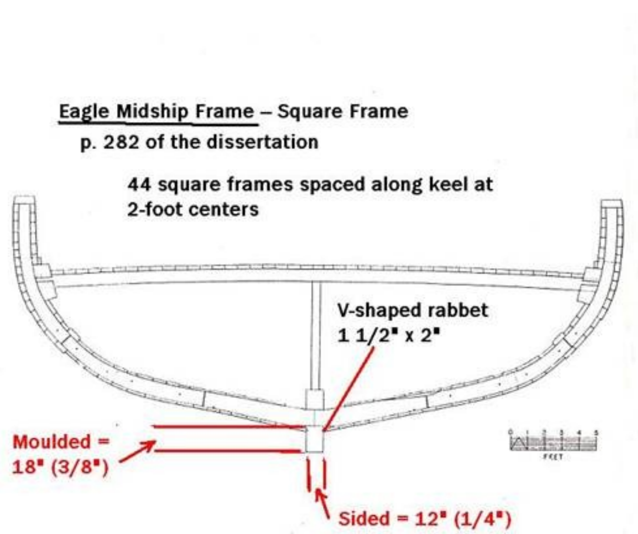
KEEL: Moulded dimension = 18"; sided dimension = 12". It consists of three timbers flat-scarfed end to end. It contained a V-shaped rabbet 1 ½" thick by 2" wide.

STEM: It was flat-scarfed to the keel, in the dimensions stated on page 218 of the dissertation.

FRAMES: There are three types of frames: 4-6 cant frames at the stem; 44 square frames; and 9 half-frames at the stern. The square frames are spaced along the keel at 2-foot centers, with each frame having overlapping pieces. See p. 228 of the dissertation (Fig. 36) for a view of the overlapping pieces.

KEELSON: It is flat-scarfed end-to-end from the apron to the uppermost stern deadwood timber. The mast steps were located in the keelson.

Some of this information can be noted directly on the midship frame enlargement, as shown in the illustration to the right.



B. A Few Definitions

Since many of will are unfamiliar with some of the terms in your notes, I will provide a few definitions.

Lofting plans: Originally, this term was used to describe the act of laying out a full-size drawing of a part of a ship, such as a frame. The term has been carried into model shipbuilding for any act of drawing any part of the plans, whether it is the hull lines, a frame, or whatever. Thus, you will be lofting the midship frame momentarily.

Moulded dimension: The height or width as seen in the Body Plan.

Sided dimension: The measurement across the outer frame faces or tops of longitudinal timbers. It is the opposite measurement from the moulded.

Flat-scarfed: Like the joints shown in the keel in the Half-Breadth Plan. This particular joint is sometimes called a hooked flat-scarf joint.

Rabbet: A groove cut into the keel, stem, and sternpost that receive the hull planking.

Stem: The forward vertical extension of the keel, which is a part of the keel assembly.

Square Frame: A frame that is perpendicular to the keel and extends all the way across the hull from port to starboard.

Half-Frame: A frame that does not extend all the way across the hull; rather, it is a frame constructed in two separate parts that are attached to the deadwood.

Cant Frame: A frame that is not perpendicular to the keel. They are usually found attached at varying angles to the deadwood at the bow and at the stern.

Deadwood: Solid timbers attached atop the keel to which half-frames and cant frames are attached. The deadwood is a part of the keel assembly.

Keelson: A long timber mounted atop the entire length of the square frames. It locks those frames in place and provides additional strength to the keel assembly.

Mast Steps: Fittings mounted on the keelson into which the lower end (heel) of a mast is set.

C. Creating a Grid

In order to begin lofting your square frames, you must first create a grid on which to make your drawings. The grid will be used to create ALL of the frames; however, we will start by lofting only the square frames. Every sheet of grid paper (1/4" graph paper) will use the exact same grid lines throughout the project, so you can draw a single grid and make copies of it as you use them, or you can keep drawing individual grids. If you do copy them, I advise that you re-draw the thin blue lines on the graph paper with a dark pencil, because copiers don't handle the light blue color very well.

To draw the grid:

1. Draw a vertical centerline right down the center of a sheet of ¼" square graph paper, but do it so that the paper is turned long-wise facing you. (See the photo below.) This line represents the vertical centerline of the vessel, therefore also the centerline of the keel.

2. Draw a baseline near the bottom of the sheet of graph paper. This baseline represents the bottom edge of the keel.

3. Next you will draw the waterlines on your grid. If you have enlarged your plans properly, measure the distance between each of the waterlines found the Body Plan and the Sheer Plan; they should be exactly ½" apart. On the Body Plan and the Sheer Plan, mark the waterlines 1, 2, 3, and so forth, starting from the baseline (bottom of the keel) upward. Now, do

the same on your grid.

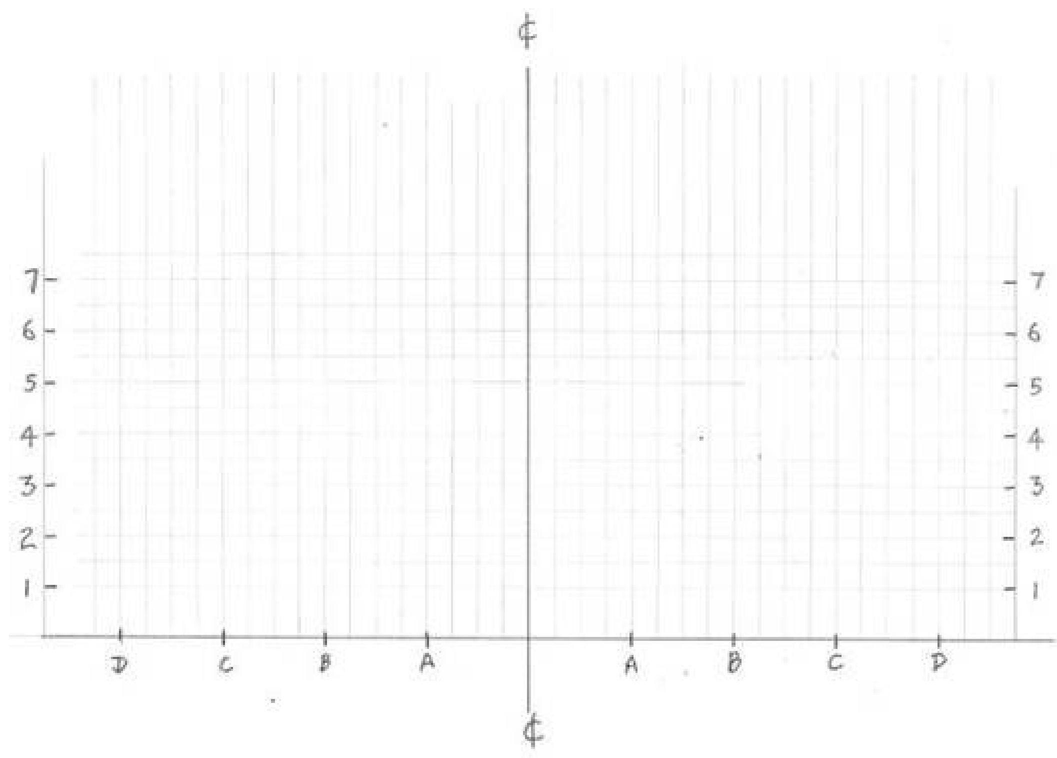
4. Now you will draw the buttock lines on your grid. Measure the distance between each of the buttock lines on your Body Plan and your Half-Breadth Plan; they should measure exactly 1" between each of them. Now label these A, B, C, and D starting from the centerline going outward. This should be done on both sides of the centerline, using the same letter designations, because both sides of each frame are mirror images of each other.

You will use about 65 copies of this grid in the process of lofting all of the frames.

I should mention that the waterlines and buttock lines that you've just drawn on your grid fit very neatly right on the lines of the ¼' graph paper; however, this is not usually the case for the plans of other vessels. Of course, the principles for lofting frames for OTHER vessels will be exactly the same, but your grid may have to be specially drawn and will not conform so neatly to the lines already drawn on graph paper.

D. Locating the Placement of Frames

First, it is necessary to determine the measurements of the frames on 1:48 scale. The dissertation tells you that the moulded dimension between the keel and the keelson of a typical square frame averaged 11". This should be rounded out to 12", which is ¼" on 1:48 scale. The 1" dif-



ference is too miniscule to cause concern; in fact, 1" on our scale is equal to slightly more then 1/64". Furthermore, wood is generally available in ¼" thickness. When you actually build the model, this difference is entirely negligible to the viewer.

Now, the sided dimension averaged 8" to 10". For this measurement, too, I suggest you use 3/16" on scale, which will make for easy construction of the frames. Since the frames are built in two layers, the total thickness of each frame will be 3/8”.

Another indication that 3/8" x ¼" will work perfectly in the final model is the fact that the frames, as stated in Crisman’s dissertation, is that the frames were spaced apart on 2-foot centers. This means that that must be 1/8” spaces between each frame. Thus, all across the keel, there will be a 3/8” frame followed by a 1/8” spaced followed by a 3/8” frame and so forth.

The next task is to determine the location of the midship frame, which is the reference point for all other frames. First of all, the midship frame is always the one located at the widest part of the vessel, looking across its beam. Take a look at the Sheer Plan, and you can see that the widest part of the vessel lies somewhere near the 50' mark on the scale above the drawing. On many plans, the midship frame is situated right on a section line, but unfortunately, this is not true for the Eagle plans, so you must decide where to place it yourself. Thus, you will be making this decision based on what you find on the Half-Breadth Plan.

Now, look at the Half-Breadth Plan at the same 50' mark. Now, we will apply some trial-and-error logic. As a trial, let's assume that our 3/8" midship frame is placed adjacent to this gun port opening. Take your ruler and measure off 3/8" intervals along with 1/8” spaces to see what happens to those lines. You will find that there will be a consistent slight overlap at the edges of each gun port opening. Therefore, placing the midship frame adjacent to this gun port will make almost every gun port have frames adjacent to both sides of each port, with a slight overlap, which will make things much easier to build on a consistent basis.

On ship plans OTHER than the Eagle, it won't be as easy to find the location of the midship frame. In these cases, the object of your test-trials is to find a location for the midship frame so that it interferes with the least number of gun ports. Frequently, you will find that you must change the thickness of the frames and spaces. Sometimes, you will find no measurements that work, and you will find yourself spending time reconstructing each and every gun port. However, this poses no problem with the Eagle plans, where everything fits nicely.

Thus, the midship frame is located right at the 50' mark, just adjacent to that gun port.

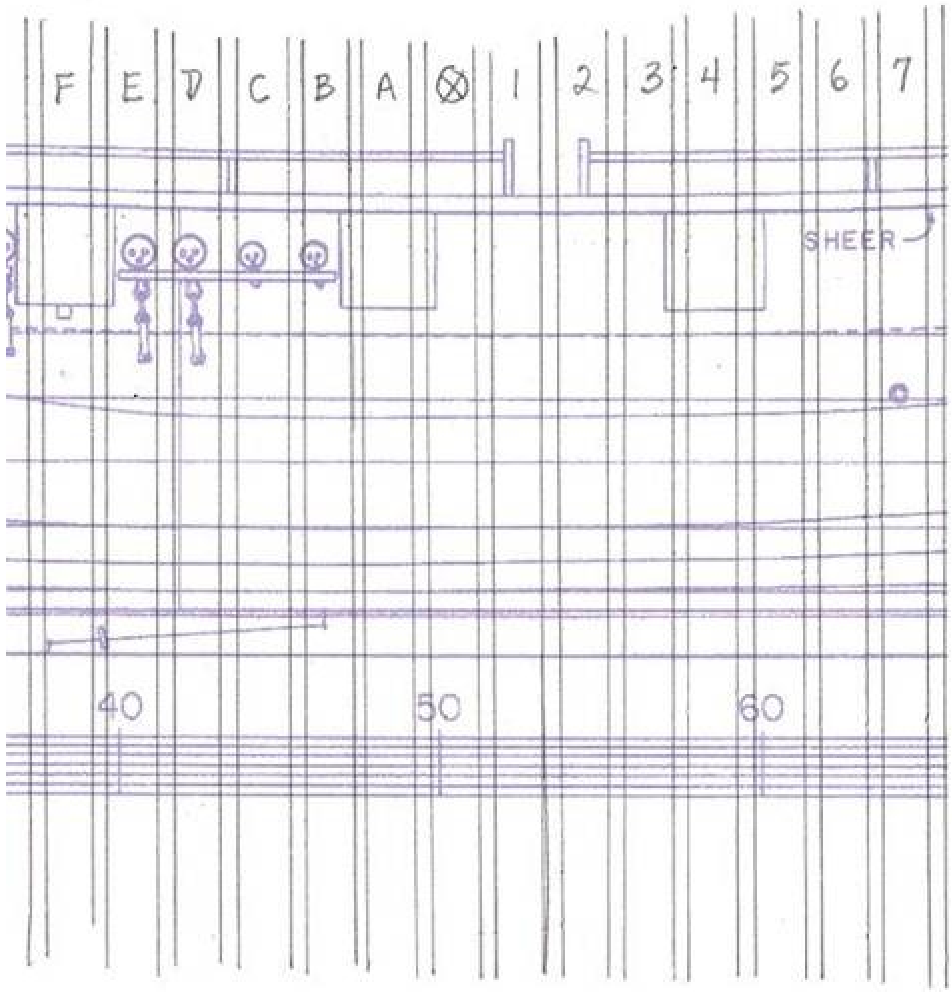
Now that you have found the exact placement for the midship frame, your next task is to draw the locations of all frames on the Sheer Plan and the Half-Breadth Plan, starting with the midship frame and following the Room-and-Space Rule. All these frame lines must be perfectly perpendicular to the base of the keel, and all frame lines will be parallel to each other. Although time-consuming, the frame lines can easily be drawn using a T-square and a draftsman's triangle. Both the Sheer Plan and the Half-Breadth will have frame lines drawn on them.

After drawing the frame lines, each frame must be assigned some identification mark. The midship frame is commonly designated with a symbol that is a circle with an "x" in it. Label it with this symbol. Progressing outward from the midship frame toward the stern of the vessel, you must label each frame with numbers 1, 2, 3, and so forth. Progressing from the midship frame toward the bow of the vessel, you must label each frame with letters A, B, C, and so forth. Labeling the frames in this manner is commonly used for all POF plans. IMPORTANT NOTE: STOP WITH FRAME "32" GOING TOWARD THE STERN, AND STOP WITH FRAME "T" GOING TOWARD THE BOW. DO NOT DRAW FRAMES BEYOND THESE POINTS. Frame beyond these points are different, and they will be discussed later.

The following picture shows a part of the frame lines drawing on the Half-Breadth Plan as well as the labeling procedure. This should also be drawn on the Sheer Plan (not shown).

E. Lofting Square Frames

The square frames extend from Frame T at the bow to Frame 24 near the stern. There are several different types of square frames: (1) Those that extend across the beam from port to starboard, and that contain no bevels, (2) Those that extend across the beam from port to starboard, and that contain bevels of varying degrees, and (3) Those that intersect with gun ports, and that may or may not contain bevels of varying degrees.



We will start by lofting the midship frame, which is an example of #1 above. To loft each of the square frames you will need:

1. The enlarged-to-scale Sheer Plan.
2. The enlarged-to-scale Half-Breadth Plan.
3. Sharp-pointed pencils, preferably soft leaded, about 2B grade is fine.
4. A pair of proportional dividers.
5. A sheet of 1/4"-square graph paper for each frame.

You should expect to consume at least 20-30 minutes lofting a single frame. Since accuracy is extremely important in this stage, I suggest that it be attempted only when you are fully rested and have lots of time on your hands.

A few observations are in order. First, look at the midship frame on the Half-Breadth Plan. Note that the waterlines that cross this frame are almost perfectly parallel to the centerline of the keel. This means that the construction of that frame will contain no bevel. Now look at the frames close to the bow and those close to the stern. Note that the waterlines cross these frames at greater and greater angles to the centerline the closer you approach the bow or stern. These angles are the bevel angles that must be incorporated into your drawings.

Another observation that you might want to draw on your first grid is the shape of the keel, which we already found measures ¼" x 3/8". The dissertation tells us that the keel contains a 1/32"-deep V-shaped rabbet that is also 1/32" wide, and the rabbet is located 1/32" below the top of the keel. We also know that the distance between the two edges of each square frame at the keel is ¼". This information is drawn on the grid shown below, mainly to show how a square frame fits on the keel. It is not necessary to draw this keel information on your frame grids.

Now let's start lofting the midship frame. If you haven't done so already, mark the Buttock lines A, B, C, and D on your Sheer Plan, with Buttock A starting closest to the keel centerline and going outward. Also mark the Waterlines on the Half-Breadth Plan 1, 2, 3, 4, 5, 6, and 7, starting with Waterline 1 closest to the keel centerline.

Using the Sheer Plan, place one end of your proportional dividers firmly on the baseline of the keel (its bottommost edge) right at one side of the midship frame, and stretch out the other end of the dividers until it reaches Buttock A. Now, keeping the dividers open to this dimension, transfer this exact measurement to your grid by placing one of the divider points onto the base line of the keel at Buttock A, and placing the other end right on the same Buttock A. Press slightly on the point above the base line. Take your pencil and mark a sharp point here. Now return to the same Plan and place one end of your dividers on the same keel baseline right at the same side of the midship frame, and stretch them open until they reach Buttock line B. Now transfer this measurement to your grid by placing one point of the dividers on the keel base line at Buttock B, and by placing the other end of the dividers right on the Buttock B line. Make another sharp dot with your pencil. Now repeat this same procedure until you have completed all four Buttock lines.

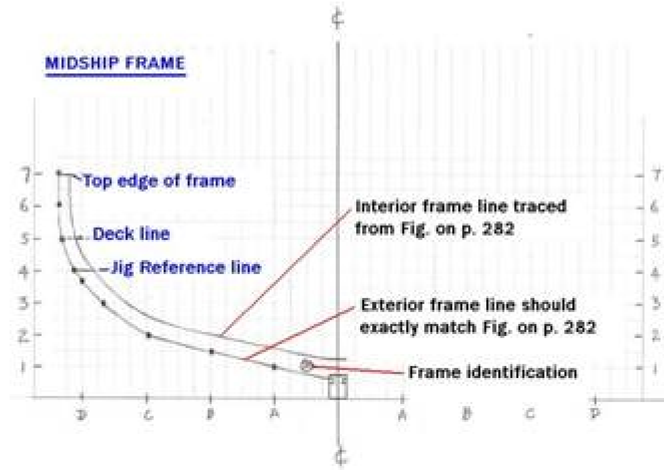
Now using the Half-Breadth Plan, place one end of your proportional dividers on the centerline of the keel at the same side of the midship frame. Then stretch them open until they reach Waterline #1. Transfer this measurement to your grid by placing one point of the dividers at the intersection of the centerline and Waterline #1. Then place the other end of the dividers firmly on the same Waterline #1. Press the point of the dividers down, and then mark this point with a pencil. Now return to the Half-Breadth Plan, place your dividers on the centerline right at the same side of the midship frame. Then stretch out the dividers to Waterline #2. Transfer this measurement to your grid by placing one point of the dividers at the intersection of the centerline on the grid with Waterline #2 and the other point of the dividers right on Waterline #2. Press down, and then mark a point with your pencil. Repeat this procedure until you have exhausted all the waterlines.

Now connect all the dots with a smooth line. Drawing this line will take a little practice, and you might be finding yourself erasing it and starting anew every now and then. Follow the dots precisely, while still keeping a smooth line, making a nice smooth curve where necessary.

So far, your grid should look like the one shown below in the first diagram. The dots are much enlarged to clarity - they should be mere pinpoints on your grid.

At this point, we need to add three more key lines to our grid: the bottom edge of the rail, the deck line, and Framing Jig reference line.

EDGE OF THE RAIL - This is found on the Sheer Plan. It represents the uppermost edge of the frame. This line will vary almost unnoticeably with every frame you loft, but it is important that it be marked precisely on every frame because there is a slight concave dip in the top rail of the ship, as is true of most sailing ships. Thus, this point must be marked individually on every grid. Extend your proportional dividers by placing one end of the dividers on the base line of the keel



right at the midship frame and extend the other point up to the bottom edge of the rail (which is also the uppermost edge of the frame). Transfer this measurement to your grid by placing one end of the dividers on the base line of the keel near the outer edge of the frame and the other end of the dividers at that height, and then mark a point with your pencil. Draw a short horizontal line across this point.

DECK LINE - The deck line should be marked as well. It will be a reference point for installing the waterways and decks on the model itself. Using the Sheer Plan, extend your proportional dividers from the base line of the keel right at the midship frame up to the deck line. Transfer this information to your grid in the same manner as you did for the top edge of the frame.

FRAMING JIG REFERENCE LINE - The Framing Jig will be explained more fully in a later part of this tutorial. At this point, it is sufficient to know that, during the construction of the ship, all frames will be placed in a Framing Jig as they are being built. The jig holds all frames in place, ensuring that they are perpendicular to the keel and are perfectly square with it. The Framing Jig Reference Line remains in its same position for all of the frames. When a constructed frame is inserted into the Framing Jig, the Framing Jig Reference Line on each grid will be precisely located with the top edge of the jig itself. You will be in a better position to understand this as we progress further into the tutorial. The Framing Jig Reference Line should always be parallel to the base line of the keel, no matter what ship you are building. For the Eagle I have selected Waterline #4 as the Framing Jig Reference Line. By the time this tutorial is finished, you will understand why.

Using the Sheer Plan, extend your proportional dividers from the base line of the keel up to Waterline #4, which measures exactly 2 inches. Transfer this measurement to your grid, marking a point 2" above the base line of the keel. Draw a small horizontal line across the frame at this point. The location of this Framing Jig Reference Line will be in EXACTLY the same position on every frame grid.

So far, our grid only shows the exterior portion of the midship frame. Now the inner frame lines must be determined and lofted. First of all, it should be pointed out that the bulwarks of any vessel are of a consistent thickness throughout the length of a ship. If you are researching a vessel other than the Eagle, this can usually be determined by observing their thickness on the plans. Of course, the thickness will be at its thinnest point at the rail, and the thickness will increase gradually as you move toward the keel. The top edge of a square frame at its center point meets the bottom edge of the keelson. In between these two points, you will be required to loft a smooth, tapering line that will represent the shape of the frame. Once you have established a satisfactory shape, those general measurements will be used to all frames.

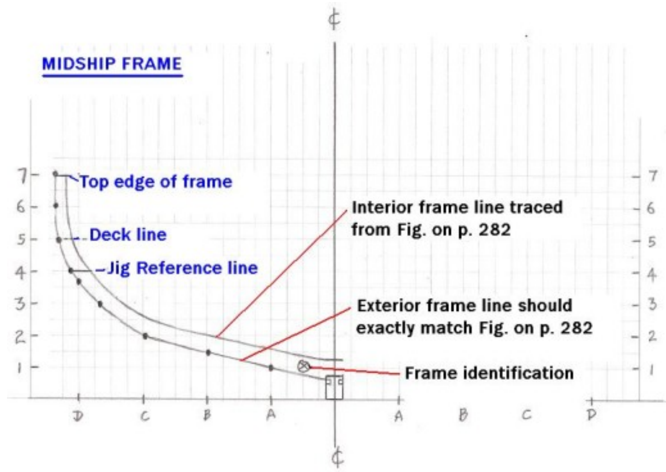
The dissertation has made this easy for us. We don't have to determine our own measurements, for the dissertation provides a perfect picture of the Eagle's midship frame. See Fig. 56 on page 282. Enlarge this drawing to 1:48 scale, and you have your required measurements. Simply lay your grid on top of this drawing and trace the inner portion of the frame onto your grid. Incidentally, if you have drawn your outside frame line properly, it should be exactly the same as what appears in this drawing. These measurements (the distance between the interior and exterior lines are various points) will used throughout lofting the plans for most the remaining frames.

Next, we must identify this frame clearly in placing its name directly on the frame itself. For the midship frame it is customary to use the symbol of a circle with an "X' in it. For other frames you should use its number or letter designation. If you don't label it, you will lose track of it, which is the last thing you want to do, because you have a total of more than 60 frames by the time you're finished. Each one will be very slightly different from each of its adjacent frames.

So far, the lofted midship frame should look like this diagram:

You have completed only one-half of the grid drawing. The best way to complete the other half is to use the following procedure, which ensures that all of your frames will be perfectly symmetrical.

1. Using a steel ruler and a sharp-pointed X-Acto knife or a single-edged razor blade, gently score a line directly down the centerline of the grid. This scoring line must be precise, because the goal is to make both halves of the grid perfectly symmetrical. Do not cut all the way through the paper; instead, score just enough to be able to fold the grid sheet in half.



2. Crease the grid drawing right at the fold you just scored with the black side of the grid INWARD.

3. Now turn it so you can see the grid you drew.

4. Place a sheet or carbon paper (or graphite paper) under the entire folded sheet but FACE UP.

5. Using a sharp-pointed pencil, trace over all the lines you lofted.

6. Open the grid and you can see that all the lines you traced have completed the other half of the grid.

7. You are now finished with the Midship Frame.

Of course, our more computer-oriented members can find a better way to complete the other side of the grid. The grid could be scanned and opened in a program that creates a mirror image, and then printed out a one completely whole and symmetrical frame. The goal is to create a completed, symmetrical frame, and whatever way you choose to do this is perfectly acceptable as long it achieves your goal.

F. Lofting Frames Containing Bevels

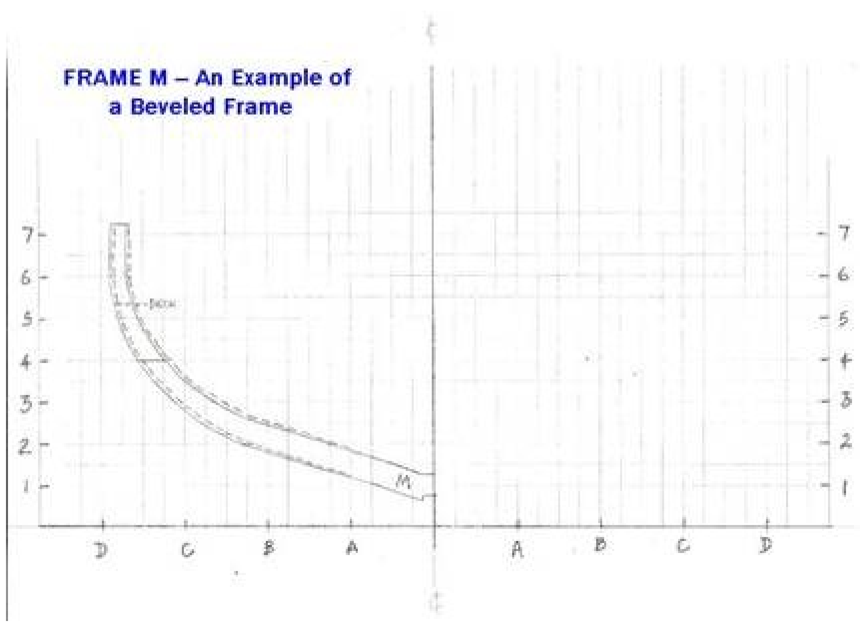
As I pointed out earlier, the Midship Frame is the reference point for all other frames. Moving away from the Midship Frame toward the stern, frames are designated by a sequence of numbers. Moving away from the Midship Frame toward the bow, frames are designated by a sequence of letters. The further apart you move in either direction away from the Midship Frame, the bevels on those frames will increase more and more. As an example, let's look at Frame M on the Sheer Plan. Note that the Buttock Lines for this frame veer off on a slant, far from being parallel to the base line of the keel. The same observation can be made on the Half-Breadth Plan for the Waterlines of Frame M - they form significant angles to the keel's centerline.

The angles shown for the Buttock Lines and Waterlines on these two plans represent the angle of the bevel to be drawn on your grid for Frame M, which will be cut on the frame when you construct it for the model. The bevel is the angle at which planking will rest perfectly at that point. It is important that the bevels be accurate, because any significant variance from the plans will result in constructing a frame on which the planking material will not rest properly.

IMPORTANT: As you loft the plans for each and every frame, keep this rule strictly in mind. Of course, every frame will have two sides. All frames going away from the Midship Frame toward the stern (all numbered frames) MUST be drawn as follows: The front on the frame will be lofted from the left-hand side of the frame, and the rear of the frame will be lofted from the right-hand side of the frame. The opposite holds true for all frames going away from the Midship Frame toward the bow (all lettered frames). In this case, the front side of the frame will be lofted from the right-hand side of the frame, and the rear of the frame will be lofted from the left-hand side of the frame.

This rule will be clear when you understand this: The bevel on the numbered frames (those going sternward) will taper at a northeastward direction (toward the upper stern), while the bevel on the lettered frames (those going toward the bow) will taper at a northwestward direction (toward the upper bow). Thus, when you construct the actual frames from you grids, the beveled side of the frame will be placed in position so that the bevel is in its proper location on the ship.

Now let me explain how to loft Frame M, which will face toward the bow. I am using this frame because it contains a very noticeable bevel and is fairly easy to display in an illustration. Other frames will contain miniscule bevel, and still others contain greater bevels.



Start lofting Frame M by drawing the frame, remembering to use only the left-hand side of the frame from the Sheer Plan and Half-Breadth Plan. To summarize:

1. Find and mark the Buttock points on your grid, using the Sheer Plan.
2. Find and mark the Waterline points on your grid, using the Half-Breadth Plan.
3. Connect the points, drawing them smoothly with a pencil.
4. Loft the interior line of the frame, using the same measurements in your Midship Frame.
5. Add the location of the rail.
6. Add the location of Deck Line.
7. Add the Framing Jig Reference Line.

Now, stop at this point. Next, you will loft the beveled side for Frame M, which will correspond to the right-hand side of the frame on the Plans. Repeat Steps 1 through 7 above, with one difference: Use a dashed line for drawing this beveled side of the frame. This will distinguish it from the face side of the drawing, which is extremely important during its construction.

You will discover that the bevels differ widely from frame to frame, and you will also find that a single bevel can vary widely on each individual frame. Generally, it will start very small at the keel, get wider near the larger curve of the frame, and perhaps get thinner at the upper part of the frame. It is important to note that it is very important to loft this line as carefully as possible.

Now loft the inner part of the beveled side of the frame. This can be done by sight; just make sure that the same distance of the bevel appears on the outer side of the frame as well as the inner side of the frame.

Now mark the identification letter directly on the frame. Then complete the grid by making a mirror image of the grid, as described above. Your finished Frame M will appear similar to the first drawing below.

G. Lofting Frames That Intersect with Gun Ports

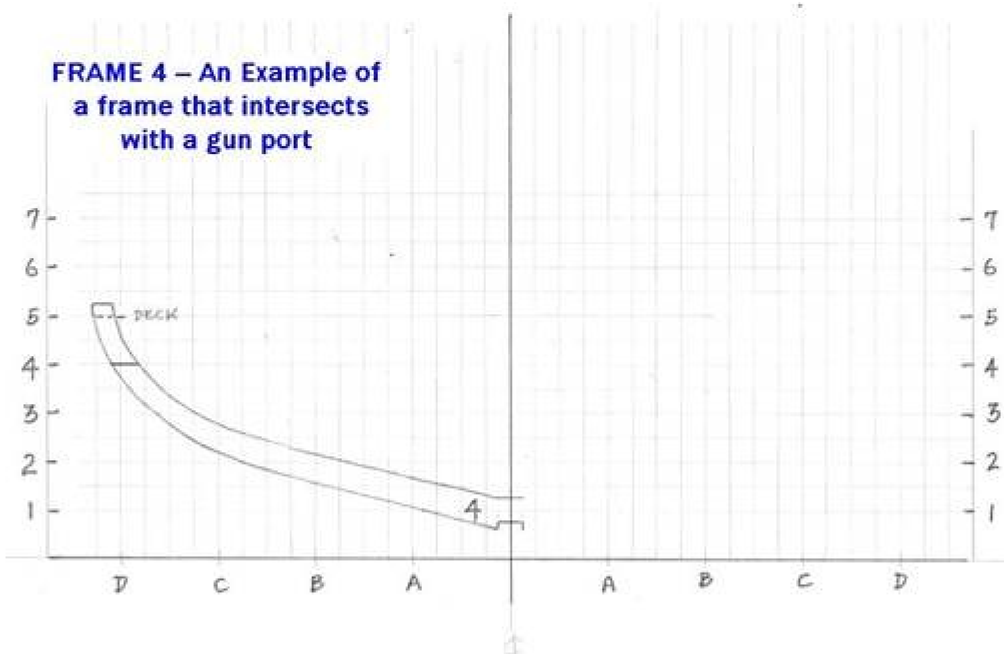
You will notice that every fifth frame intersects with a gun port. To draw these frames, follow the lofting instructions already described, including bevels, if there are any. Note on the Sheer Plan that the lower side of every gun port is exactly 1/8" above the Deck Line. This 1/8" will also be true when lofting grids that contain gun ports. Hence, there will be no rail points to mark, and the frames simply cease at 1/8" above the Deck Line. Frame 4 is shown below to illustrate this type of frame.

There are 45 square frames to be lofted. If you follow the instructions already provided, all these frames may now be lofted. As I mentioned earlier, the lofting of each frame will take about 20 minutes. Multiplying 20 minutes by 45 frames means you will be busy lofting these frames for somewhere around 15 hours.

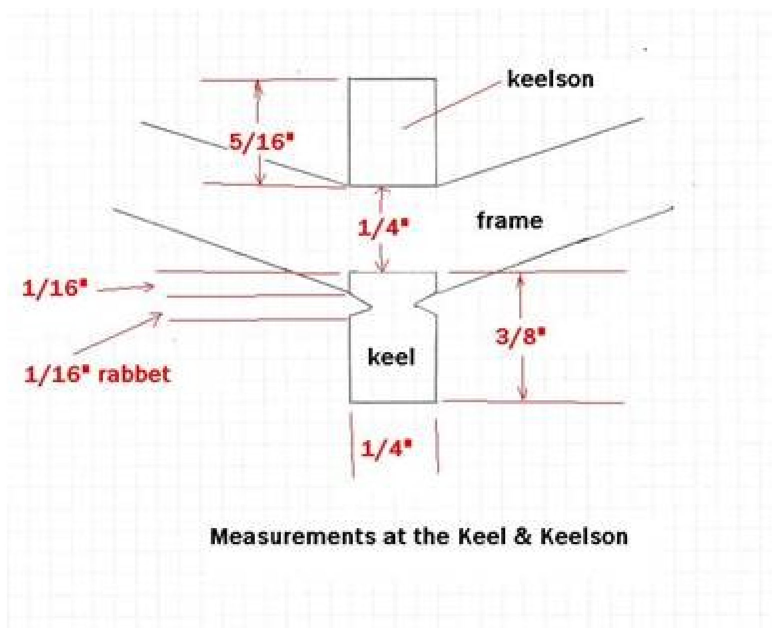
Please do not attempt to loft any frames, except those between Frame T and Frame 24. Frames other than these will require more information that I have not yet provided.

The diagram below will show the exact dimensions that should be applied consistently for all square frames.

The taper for each square frame is more difficult to apply; however, we know the precise taper of the midship frame, as shown in Crisman's diagram for that frame. You'll note that it starts its widest point at the keel, narrows slightly as you approach the rounded portion, then tapers to



3/16" at its top where its meets the rail. This is the typical appearance of almost any ship's frames. This same taper should be applied to all square frames, ending with 3/16" at its top



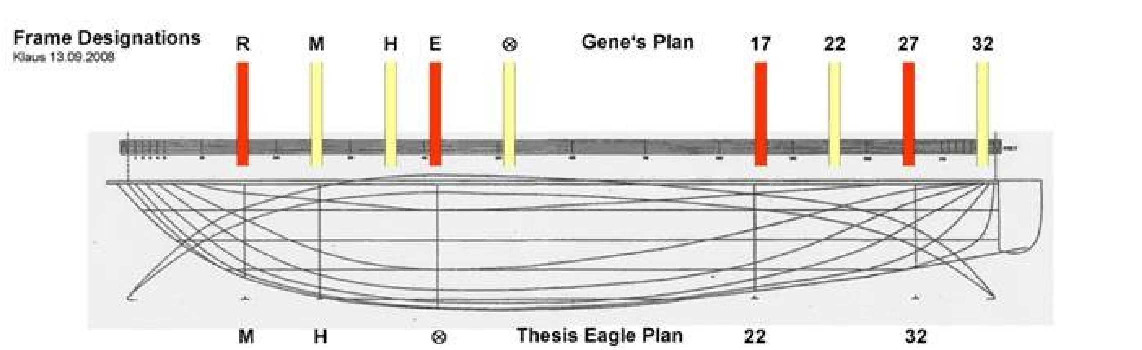
edge. Remember also to loft your bevel lines as closely as possible to this same taper as well. Your eye is the best judge. When you actually construct and install the frames on the keel, you will find it much more difficult to cut out and fair up inside bevels than the outside ones, so you should loft these lines with as much care as the outside bevels. When we built the vessel itself, I will provide more suggestions.

H. Frame Designations

I would like to point out an important difference in the designation of frames in the thesis' plan (from Kevin Crisman's thesis) and in what I will call "the tutorial plan". This is due to the fact, that the position of the main frame in the tutorial plan is different from that in the thesis plan.

The situation is shown in the figure below. The lower part of the figure shows the thesis' half-breadth plan and the five section lines M, H, Main, 22 and 32, which denote the positions of the corresponding frames. The upper part of the figure shows the location of frames with equivalent designations according to the tutorial plan. The figure clearly shows that the thesis' frame positions correspond to the frames R, M, E, 17 and 27 in the tutorial plan.

This is important, when you compare the results of your frame lofting with the body plan (Fig. 49) or with the hull sections (Fig. 47) as given by the master thesis. I would strongly recommend such a comparison in order to confirm your results and to make sure, that you apply the method correctly. Therefore I suggest that you start your lofting work with frames E, M, R and 17 (of the tutorial plan) and compare these to the main frame and to the frames H, M and 22 of the thesis.



When the corresponding lines match, you can believe in your ability and proceed.

I. Determining the Location of Half Frames

Half frames are numbered Frame 25 through Frame 32. They are called half frames because they are built in two halves, with one half lying on one side of the deadwood and the other side lying on the opposite side.

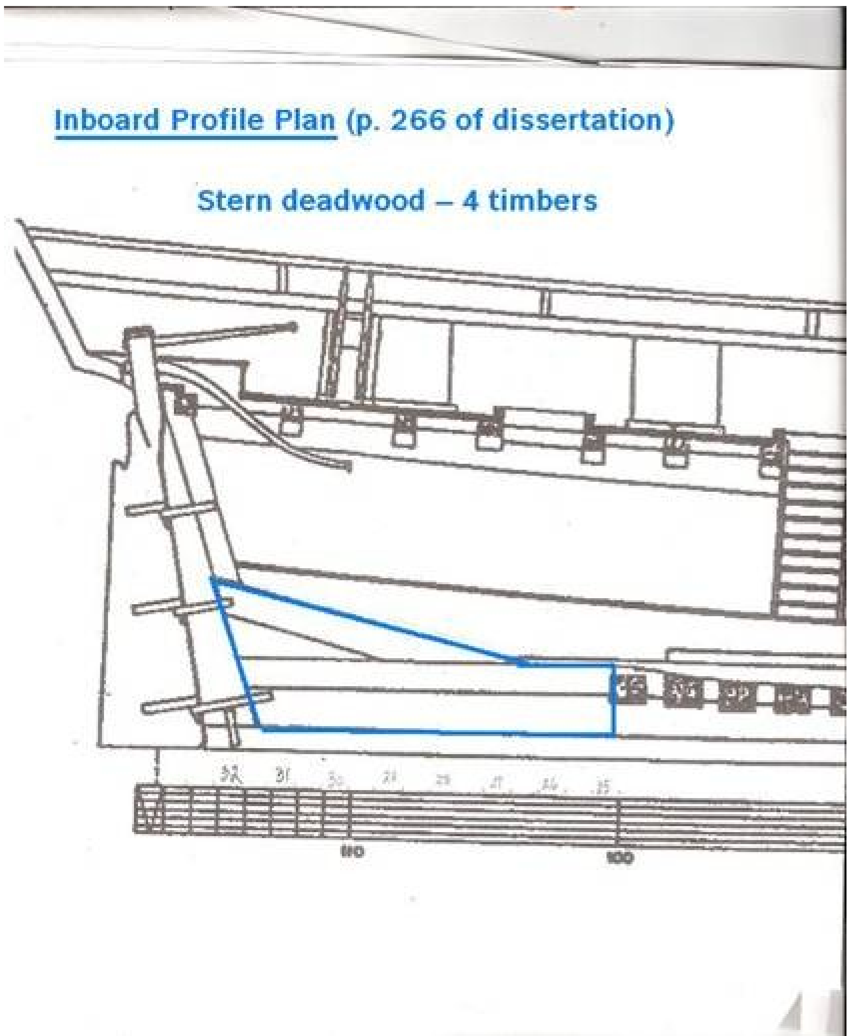
Usually, all half frames are canted, meaning they are installed at a slight sternward angle to the deadwood. However, this is not the case with the Eagle. As Crisman pointed out, there were a maximum of 6 canted frames, all located at the bow. Thus, our stern half frames will be constructed exactly like the square frames, without cants (angles).

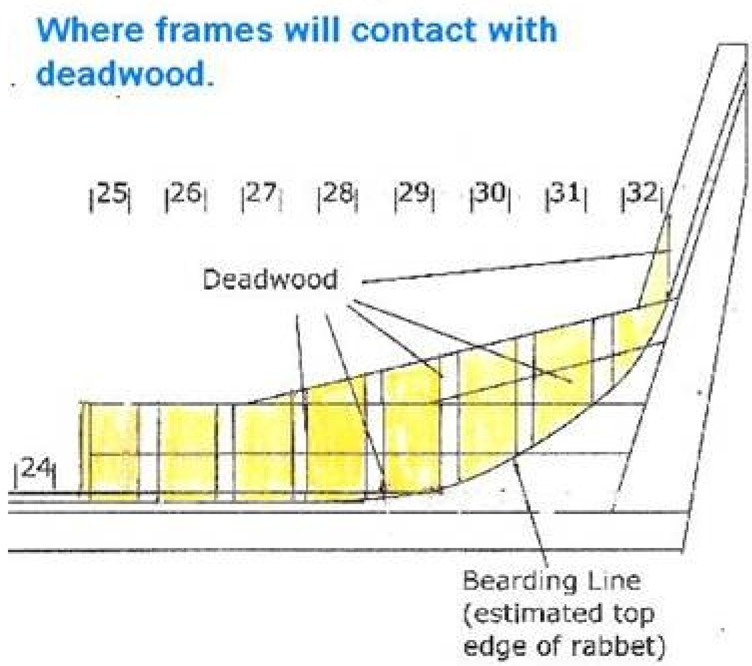
As a side note, let me say that if you will be building a model of the Eagle, you will need to enlarge all of the appropriate plans in the dissertation to the proper scale. As a minimum for building the Eagle, you will need to enlarge the Deck Plan on page 266 as well as the Inboard Profile Plan. If you expect to mast and rig the ship, you will also need to enlarge other appropriate plans, including the Tops, Caps, and Crosstrees on page 270 and the Masts and Spars on page 271. Furthermore, all the plans you yourself are currently lofting will actually be used in constructing a POF model of the Eagle itself, so don't destroy them.

Now, to determine where to locate the half frames, we need to copy the Inboard Profile Plan found on page 266. You will note that this Plan has the bow facing east. I recommend that you reverse the image before enlarging it to your scale, so that it faces west like your other plans. There are many ways to do this. The only I used is to scan the plan from the dissertation, then open it in "Paint," where the image can be flipped horizontally. Once you have done this, then open the flipped image in your Brava Reader and enlarge them as you did the other plans, making sure you watch your scales.

Right on the Inboard Profile Plan, mark out the location of the deadwood, which I have shown highlighted in blue in the picture below. Then, superimpose this highlighted deadwood directly onto the Sheer Plan. This is necessary because you need to know the precise location of the deadwood in order to draw your Half Frames. This is shown below as well.

You have already drawn the location of the frames lines on your Sheer Plan. In a picture below, I have isolated where the half frames will come in contact with the deadwood. Note that the frames stop at the "bearding line." This line is shown here to explain its purpose. It is an extension of the inner rabbet line at the stern. Here, the deadwood tapers toward the aft end of the keel rabbet and the stempost rabbet of the ship. It is the place where the exterior planking rests smoothly. You will be deriving its precise location when you loft the lower ends of the half frames, which will be described shortly.





J. Lofting Half Frames

When lofting half frames, it is definitely helpful to add extra Buttock lines to the Sheer Plan and extra Waterlines to the Half Breadth Plan. I suggest that you add at least one more of each halfway between each of the existing Waterlines and Buttock lines. You should be sufficiently familiar with purpose of these lines to draw them yourself. This is not absolutely necessary but it will provide greater accuracy in lofting the frames.

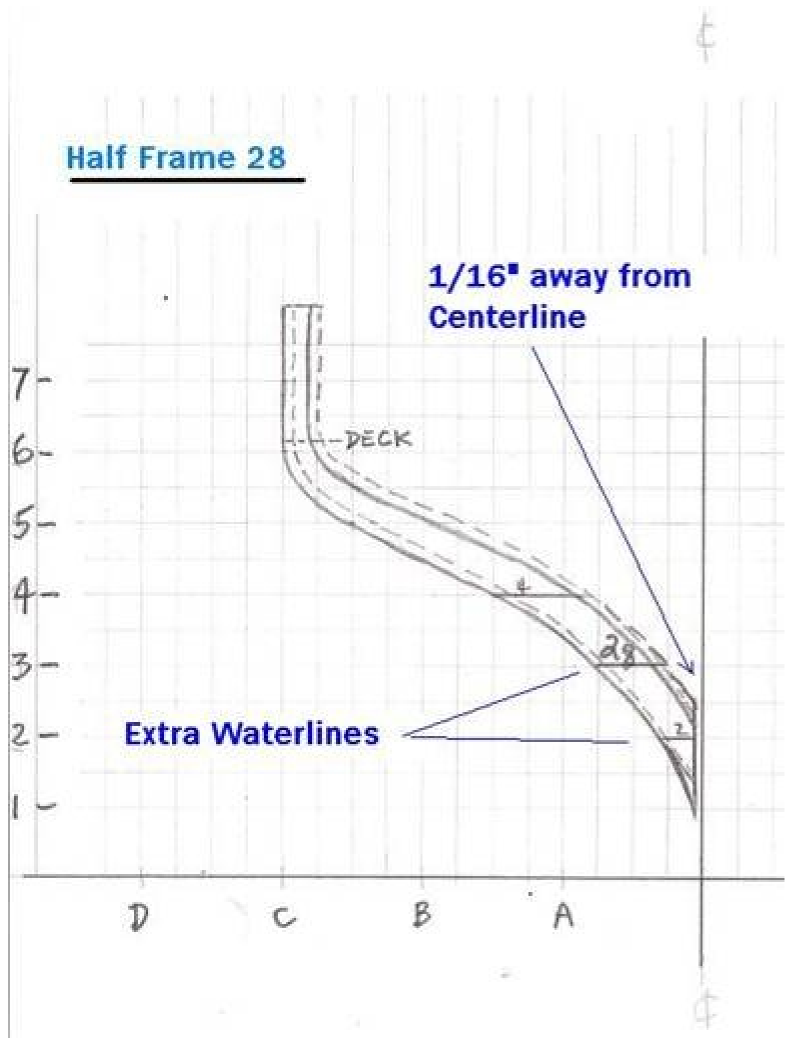
Now that you have these additional lines on your Sheer Plan, you are ready to loft the Half Frames. They are lofted in the exact same manner as the Square Frames, with one big difference. Only half the frame is lofted. Furthermore, when you attach the frame to the deadwood area in building the ship, you will cut a 1/16"-deep groove into the deadwood so it has a firm resting place. Since this groove is cut on both sides of the deadwood, this means that both sides of each of the Half Frames should be extended by 1/16" in order to fit into the cut groove. Therefore, each and every Half Frame will be lofted so that it rests in its groove.

As you plot the bottommost edge of the frame, there will be a point where it is not flush with the top edge of the rabbet line, In fact, the farther you go toward the stern, the farther away from the top edge it gets. Plot it as you find it, because this will represent the precise location of the bearding line. Going sternward from Frame 29, you will find that the rabbet line veers further and further away from the keel.

You may also note the angle at which the bottom edge of each Half Frame varies. You can note this on your frame drawings as well, if you like.

Finally, I suggest that you draw the location of the lower Waterline right on your Half Frame drawings. When you build your Keel Assembly (far in the future), these same Waterlines will be marked on the deadwood. Drawing the location of the Waterlines on each Half Frames will definitely assist you in placing the most precisely on the Keel Assembly when you build it.

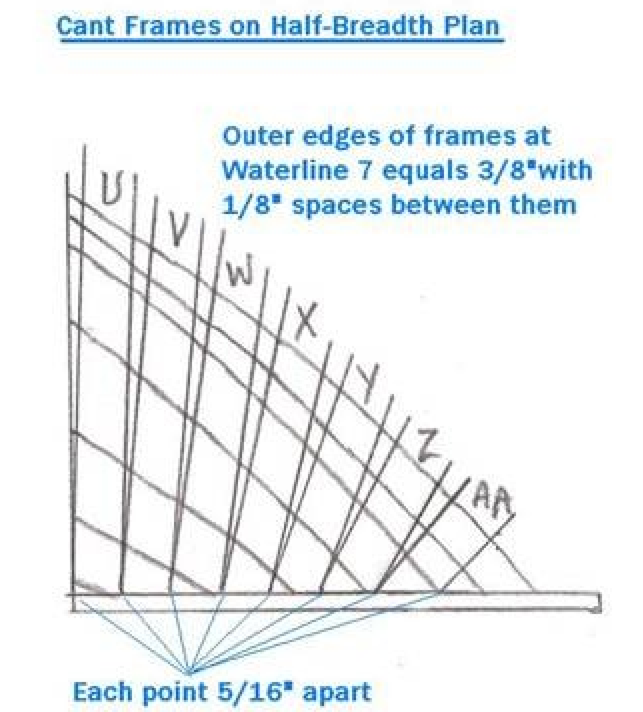
Frame 28 is shown as an illustration.



K. Drawing the Placement of Cant Frames at the Bow

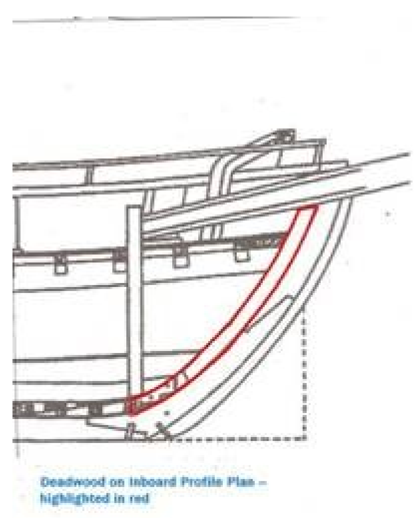
There are seven cant frames at the bow. The width of these frames at the OUTER EDGES of each frame will be 3/8" with 1/8" spaces between them, exactly like the square frames. Therefore, at the OUTER edge of hull, mark off these 1/8" spaces and 3/8" frames. This is true only at the outer edges, which are all canted (at an angle). The wood used to make the frames will only be 5/16" in thickness, and they will be spaced directly abutting each other at the keel. Thus, starting at Frame T (the last square frame) and going toward the bow, mark 5/16" intervals at the edge of the keel.

Now draw in the lines for the cant frames, and label them from U to AA going toward the bow. This is shown in the following illustration.



L. Locating the Bow Deadwood

All bow cant frames will be positioned directly on the bow deadwood. The bow deadwood is highlighted in red below. It is a fairly narrow timber attached directly to the keel. It will necessary to mark your 5/16" intervals along this deadwood as well, keeping all spacing parallel to the keel.

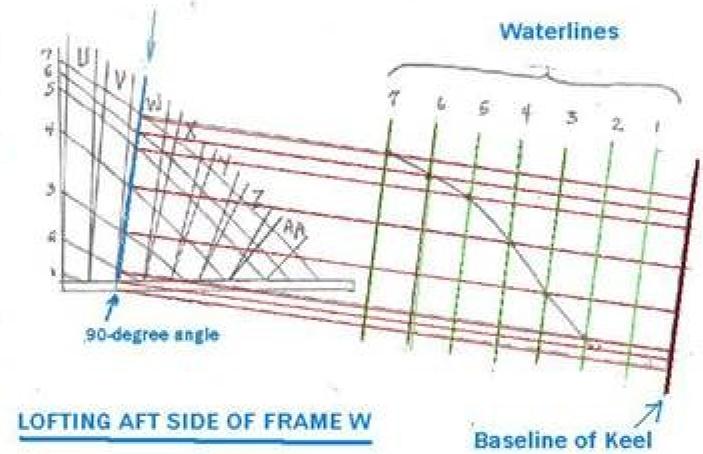


M. Lofting the Bow Cant Frames

Because all bow cant frames lay at irregular angles to the keel, lofting these frames requires special consideration. You have already marked the locations of the can frames on the Half-Breadth Plan, so now you must determine the curves of the outside edges of these frames (the area where exterior planking will rest).

Using the illustration below as a guide, which only shows the aft side of Frame W, perform the following steps, one at a time:

1. At the exact point where each Waterline intersects the cant frame, draw an extension of that Waterline at a precise 90-degree angle to the edge of the frame. Extend the line several inches. Repeat this for each of the Waterlines. All these lines must be parallel to each other. This step is shown in red.



2. Now, starting with the baseline of the keel (shown in brown), draw the Waterlines exactly as you see them in the Half-Breadth Plan, which we already know are spaced at 1/2" intervals, making sure that they are perpendicular to the red lines.

3. Now you can see the exact points where identical Waterlines lines intersect. For example, note that Waterline 3 from the Sheer drawing intersects with Waterline 3 of the Half-Breadth drawing. Place a dot at this point. Repeat this for all the existing Waterlines. Then connect the dots with a smooth hand-drawn line.

4. Now repeat this procedure for the fore side of Frame W right on the same drawing in order to find the required bevel line for Frame W, which should be shown as a dotted line. Then, still maintaining a consistent thickness for the frame, draw in the inside of the frame, along with its bevel.

5. Of course, you will need a mirror image of this frame for the other half that will be attached to the opposite side of the deadwood.

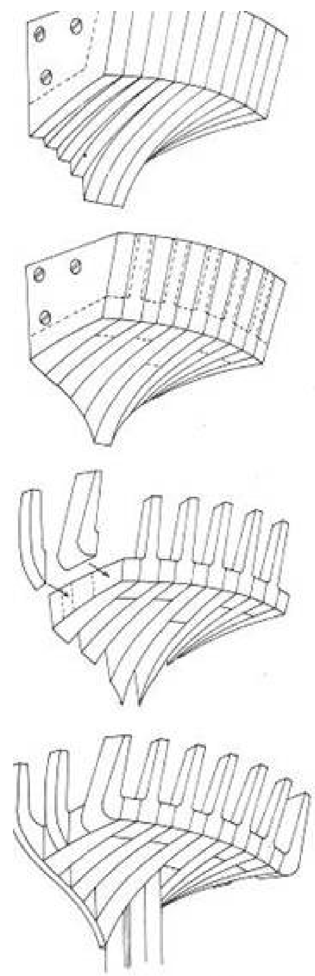
6. Follow exactly the same steps for another frame, using a new sheet of paper for each frame.

N. Counter Timbers

Next, we will begin lofting the Counter Timbers located at the transom of the Eagle. The Counter Timbers will probably be the most difficult timbers to loft properly, and it will not be easy to explain. I'm sure it will help to understand how the Counter Timbers are actually constructed on the model before attempting to loft those timbers.

The illustration below, which pictorially shows how the Counter Timbers are usually constructed for a POF model, originates from Wolfram zu Mondfeld's book, "Historic Ship Models."

First, a series of pieces of wood that contain the finished shapes of the Counter Timbers, along with spacers, are screwed or glued together. Then, the unwanted portions of the spacers are removed from the transom area. The area for the rudder post is also removed. The underside of the assembly is sanded or filed to a

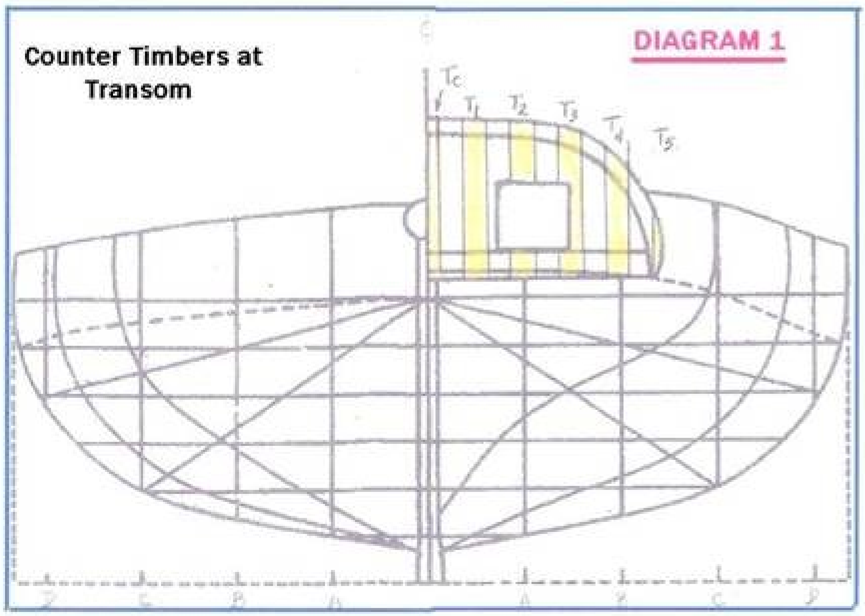


Construction of Counter Timbers

shape that conforms to the shape of the vessel itself. Then, the outer edges of the frames are attached. Finally, the spacers are removed from the underside of the assembly. Everything that remains is then attached permanently to the aftmost square frame.

O. Lofting Counter Timbers

Diagram 1 below shows the location of Counter Timbers on the Body Plan in yellow. Note that the Counter Timbers and Spacers run the full width of the transom, so you will be making mirror-image



pieces for the other side of the transom as well. Visualize them by noting how they will be built, which I illustrated earlier. I have shown one way to design them, using 1/4" thick pieces of wood and 1/4" spacers between them. You may use whatever thicknesses you are comfortable with, because they will be fully planked over on the inner side as well as the outer side when you build the model.

I have designated the central Fashion Piece as TC (Transom Center), and it will lie on the midpoint of the transom. Proceeding outward from the midpoint, I have labeled each Counter Timber T1, T2, and so forth. In between each of the Fashion Pieces are Spacers. A mirror image of these same pieces will also be created for the port side, too.

Diagram 2 shows the location of the center Counter Timber (TC) on the Sheer Plan. It is important to note that each and every Counter Timber will rest upon and be attached to Frame 32, which is the last Half Frame.

Diagram 3 shows where each of the Counter Timbers will be attached to Frame 32. Remember that the aftmost side of Frame 32 is shown as a dashed line, which represents the beveled side of the frame, which is also the side upon which all Counter Timbers will be attached. The exact same spacing that you used on the Body Plan for the Counter Timbers is now applied to the aft side of Frame 32. This

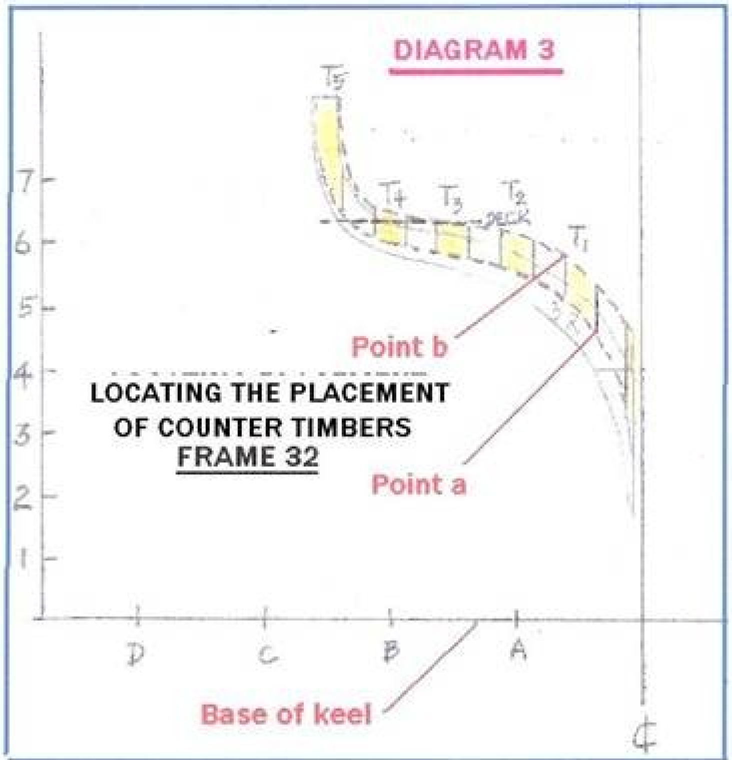
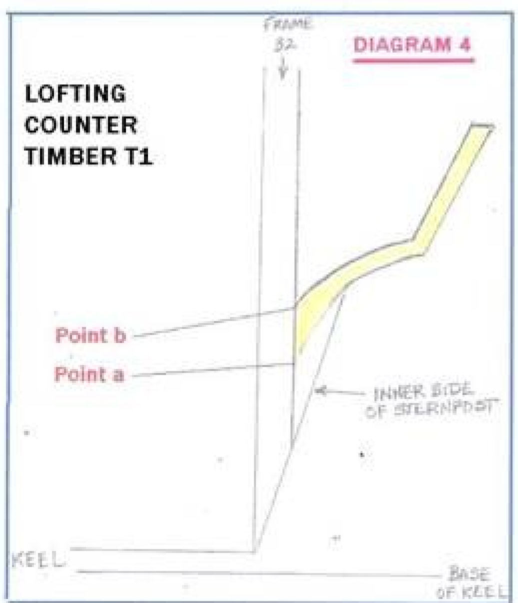


Diagram 4 shows how to loft the drawing for T1, and only T1.



A similar drawing must be prepared for each and every Counter Timber and each and every Spacer between the Counter Timbers. Including the mirror image pieces for the port side, you will have a total of 21 drawings. To loft T1, first lay out the following information on a separate sheet of paper:

1. From the Sheer Plan, trace out the Keel Base Line and the inner side of the Sternpost.

2. Draw the location of the aft side of Frame 32.

3. Trace the location of the Transom Center Counter Timber, but only up to the location of the Sternpost.

Now, you might want to duplicate this information on 21 pieces of paper, because this much of it will be identical for all Counter Timbers and Spacers. The aft edge of the transom is flat and perpendicular to the keel, so this portion of all drawings will be the same.

Now we must find the location of the points at which T1 attaches to Frame 32. Look at Diagram 3. Note that the lowest point of T1 at the aft edge of Frame 32 is shown as Point "a." The highest point of T1 is at the aft edge of Frame 32 is shown as Point "b." Now, the object of the next operation is to transfer this data to your drawing of Diagram 4. Do this by taking your proportional dividers and placing one end on the baseline of the keel on Diagram 3 and stretching them open to the lowest point on T1, at the same time keeping both ends parallel to the centerline of this diagram. Now transfer this measurement to Diagram 4 by placing one end of the proportional dividers at the baseline of the keel, and the other end of the proportional dividers on the aft edge of Frame 32, keeping the dividers even with the frame, and then mark the point. Repeat this process for Point "b." Now connect Points "a" and "b" with a smooth line to the edges of the existing lines for this Counter Timber. The result is the lofted drawing of Counter Timber T1, which is shown in yellow in Diagram 4.

This drawing can be duplicated for the other side of the transom as well, and it will be a mirror image.

Now repeat this process for each Counter Timbers and for each Spacer. However, be sure to keep the Deck Line in mind, because remember that Counter Timbers are attached directly to Frame 32 at points BELOW the Deck Line, not above it. The Counter Timbers that are not attached to Frame 32 will still be necessary to build, but that process can be completed at the time we go to building the vessel.

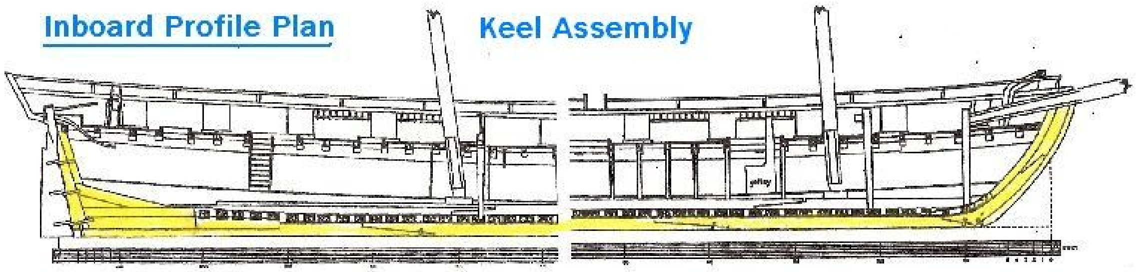
P. Lofting the Keel Assembly

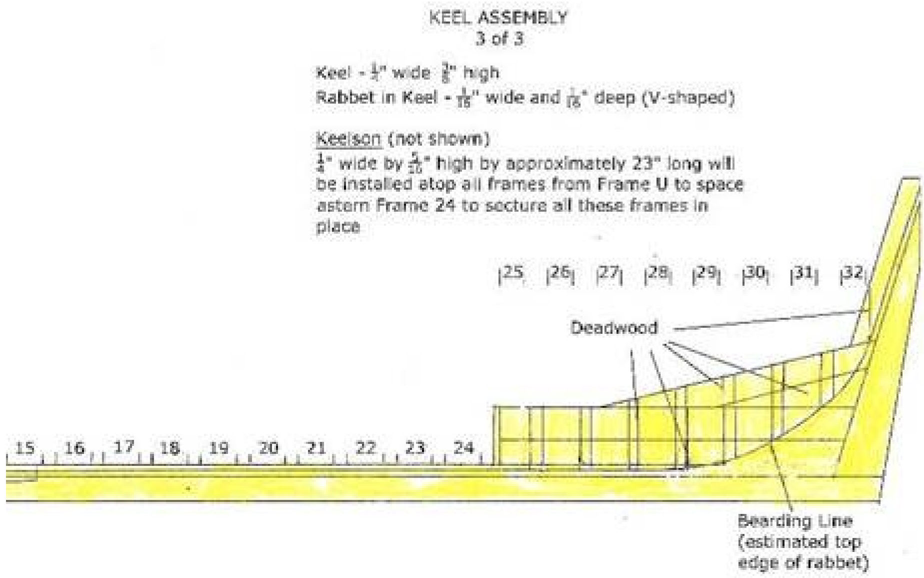
The purpose of lofting the keel assembly is to develop a pattern for laying your keel for your model. It includes the keel itself, the sternpost, and the cutwater at the bow, as well as the deadwood areas. You should already have all of these lines marked on your plans, so it is simply a matter of transferring all this information onto a keel assembly pattern.

Use the Inboard Profile Plan for your main pattern, which shows all these details for the full length of the vessel. This is shown in the illustration below. As you loft your own drawing, make sure you mark all pertinent information that you will need to build the keel assembly, including the location of every frame, the rabbet line, the location of all scarph joints, the placement every piece of deadwood, the bearding line, the areas on the deadwood that will require indentations for holding half frames and cant frames -- in short, everything you know.

The stern portion of the keel assembly is shown below to get you started. Make sure every marking is as precise as possible, because this indeed will be the backbone of the model you will begin building shortly.

Note that the keelson, which is also a part of the keel assembly, is not shown on the illustration. The keelson rests on top of all square frames and holds them securely in place.





Q. Lofting the Framing Jig

First, let me explain the purpose of the Framing Jig and how it will be used. When we start to build our model of the Eagle, we will use a Framing Jig and a Keel Assembly Jig to provide a supporting framework for the entire ship throughout its construction. Its purpose is to ensure that the keel is always aligned properly, and it also hold every frame in a perfectly upright position while the building progresses. It also allows the builder to check the accuracy of each stage of the framing process. Furthermore, a POF model cannot be built without a Framing Jig. I've added a couple of photos below to show its use.

The Framing Jig is essentially a piece of 1/4" plywood cut out with the location of all the frames, which is set at a certain height to hold the frames perfectly in position. For the Eagle, this height will be Waterline #4 on the Half Breadth Plan, which is precisely 2" above the base line of the keel.

Lofting the Framing Jig is a relatively simple process. However, it is very important that it be lofted as accurately as possible, because the perfect alignment of all frames depends on its accuracy. If something is even slightly out of alignment on your Framing Jig, this misalignment will be carried to the model itself.

To loft the Framing Jig, you will need a piece of paper 11" wide by about 34" long. Such a sheet can be made by taping 4 sheets of 1/4"-square graph paper together. Draw a centerline down the center of the paper longwise (down the 34" length.

Starting at the left-hand side of this long sheet, leave an inch or so blank space. Then mark off alternate 3/8" and 1/8" spaces, which are exactly the same measurements of our frame and space measurements on our Keel Assembly that we've already lofted. Do this all the way across the length of this long sheet.

Now place the Keel Assembly plan on this long sheet. Place it so that you can leave an inch or two spacing at the bow area. Now locate where the midship frame should be on this long sheet. Mark this point and set the Keel Assembly aside.

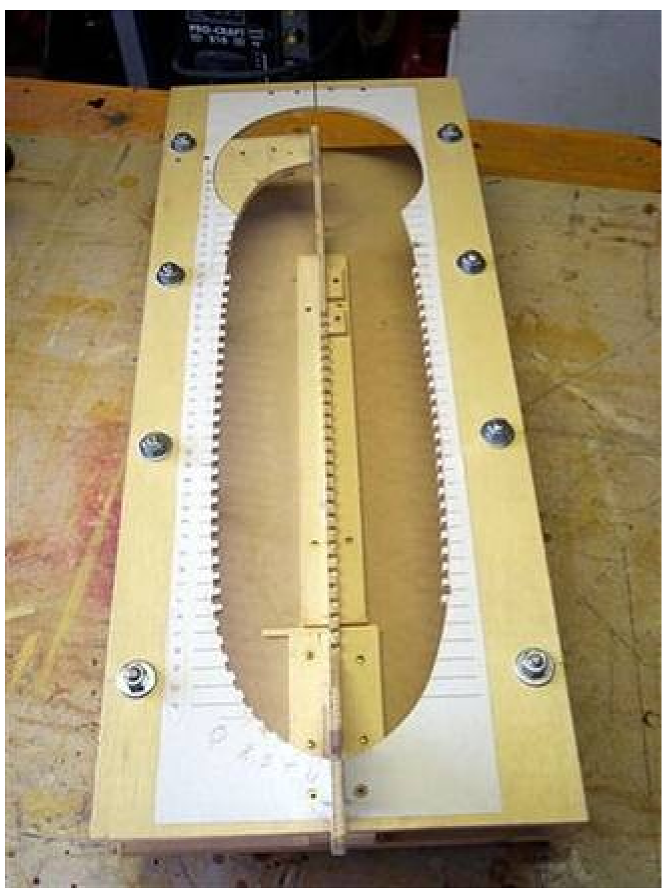
Next, USING ONLY WATERLINE 4 ON THE HALF BREADTH PLAN. plot points for both sides of each frame   Do this with your proportional dividers by setting one point on the centerline and extending the other point to Waterline #4. Transfer this to your long sheet. Repeat this for the other edge of the frame. Remember that all bevels must be taken into consideration, just as you did in lofting the frames. Repeat this process for port and starboard sides for every frame.

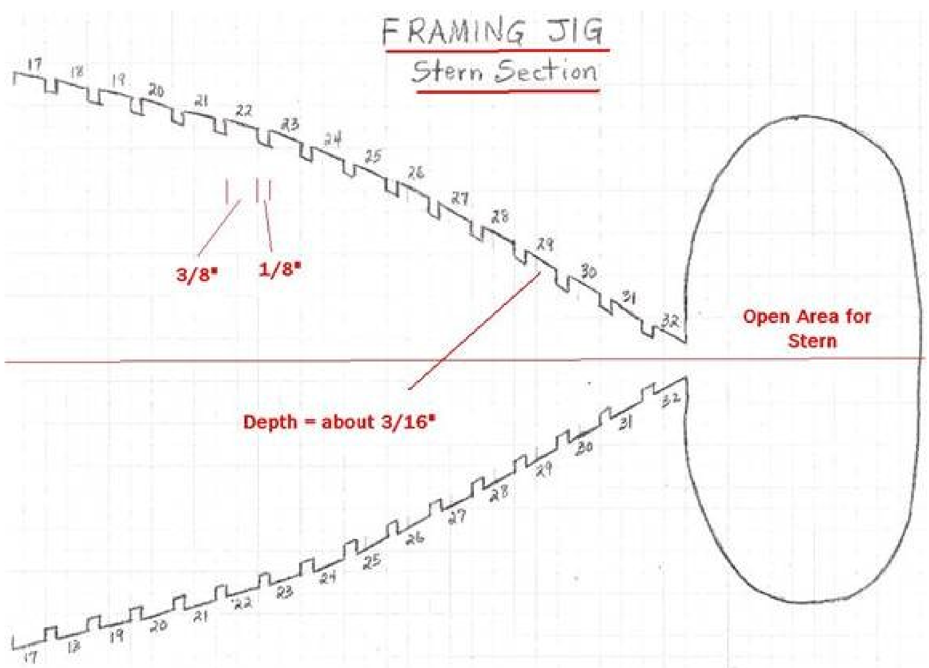
The depth of these notches should be at least 3/16". A greater depth is okay but not necessary.

You will note that Waterline #4 does not exist for Frame AA or for the knighthead. Just ignore these -- you're only interested in Waterline #4. Note on your plan also the exact place where the keel stops at Waterline #4 and mark this on your plan.

When you reach Frame 32 at the stern, you will find that both sides of this frame are very close together. That's okay. Just after Frame 32, draw a wide-open oval shape. This area will leave room for us to construct the stern area of our model while the model is still sitting in our jig.

I have illustrated the stern area of the Frame Jig below. To let you know what happens next, you will be pasting this lofted framing jig on a sheet of plywood and then using a jigsaw to cut out every notch and curved exactly as you've drawn them




FRAMING JIG
Stern Section
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
3/8"
1/8"
Open Area for Stern
Depth = about 3/16"

PART TWO

BUILDING AN ADMIRALTY-STYLE MODEL OF THE BRIG *EAGLE* (1814)

CHAPTER ONE

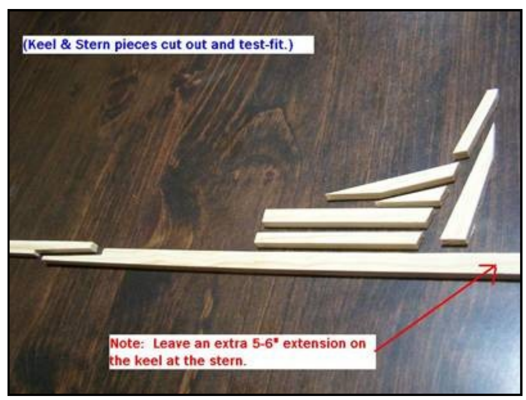
BUILDING THE KEEL ASSEMBLY

To build the Keel Assembly you will need the Keel Assembly Plan and a quantity of 1/4" wood of your choice. Use whatever wood you like for your own project.

Please note that all narrative and all photos should only be used as a guide to your own building. There are many different ways of accomplishing the same results. The methods I describe should be interpreted as one way of doing things, so do not be constrained by the method I describe -- if you have a better way or a different method that you yourself prefer, by all means do it your way.

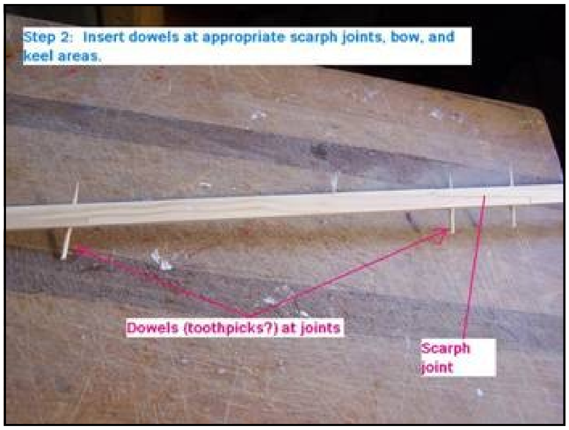
Step 1: Cutting Out and Test-fitting All the Pieces of the Keel Assembly. Use the Keel Assembly Plan as a guide for cutting out all the pieces. Start with the keel itself, which consists of 3 pieces that contain scarph joints. Note that you should add about 5 or 6 inches to the stern piece of the keel so that the Keel Assembly can be held in the building board that will be built next. Also cut out the 3 parts of the bow end of the Keel Assembly, including the two bow pieces and the bow deadwood. Then cut out the 6 pieces of the stern, including the sternpost and 5 pieces of deadwood.

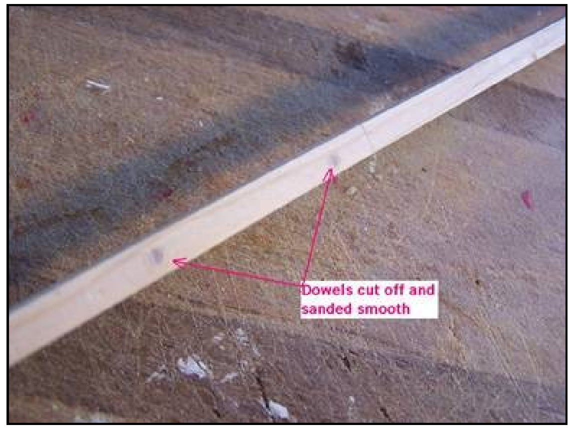
You can use whatever saw you prefer, whether it be a table saw, jib saw, or band saw. Sand each piece smooth. After you have cut them out, place them in position directly on top of the Keel Assembly Plan for a good test-fitting. Make sure they all fit snugly together and lay perfectly on the plan itself.



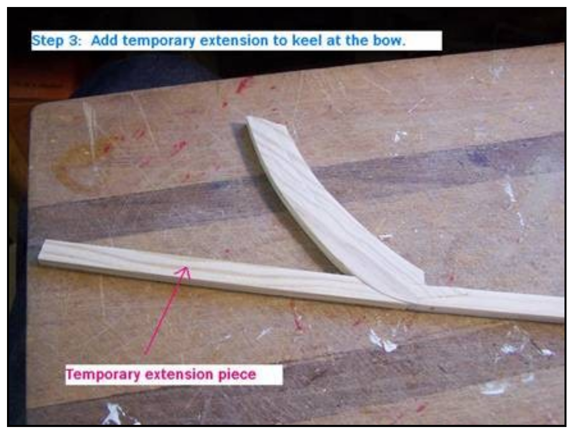
Step 2: Glue All Pieces of the Keel Assembly Together and Dowel at Appropriate Locations. I used Elmer's Carpenter's Glue to glue all pieces together, but many other kinds of glue are also suitable. I suggest that you glue all the pieces together right on top of the Keel Assembly Plans. Make sure that you place the entire assembly on top of a perfectly smooth and flat surface -- this is very important because you don want any curvature whatsoever in the Keel Assembly. Place weights on top all along the whole assembly to keep it perfectly flat. You may also want to use small clamps at the scarph joints as well. Let the glue dry well before any further handling.

To ensure that joints do not loosen over time, dowels should be inserted at appropriate joints, especially where shown in Crisman's plans at the bow, sternpost, and scarph joints. Crisman only shows one dowel for each scarph joint, but I inserted one dowel at both ends of each scraph joint for additional support. If you think round toothpicks make for too large of a dowel, use a dowel size of your choice. After you've drilled the holes, dip each dowel in glue, and insert, wiping off excess glue. After the glue has dried, cut off the excess portions with a razor saw and sand smooth.

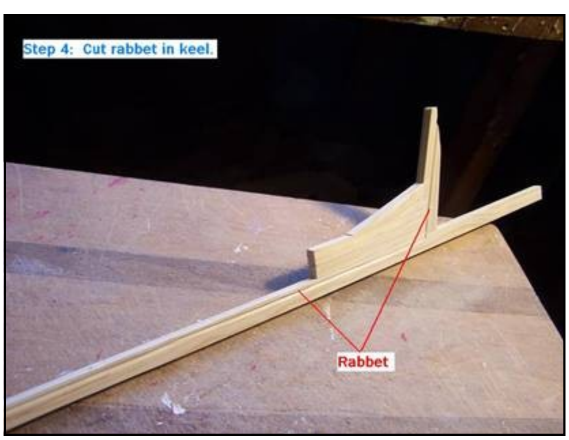


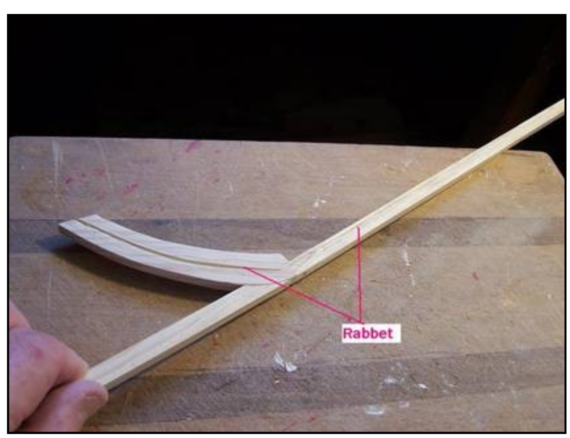


Step 3: Add an Extension Piece to the Bow of the Keel. This piece is strictly temporary. Its purpose is to allow the entire Keel Assembly to fit into a jig that we will be building next. Like the extra length you added at the stern, this piece should be about 5 or 6 inches long. Make sure it is glued on a flat surface, making it as flat and straight as the rest of the Keel Assembly.



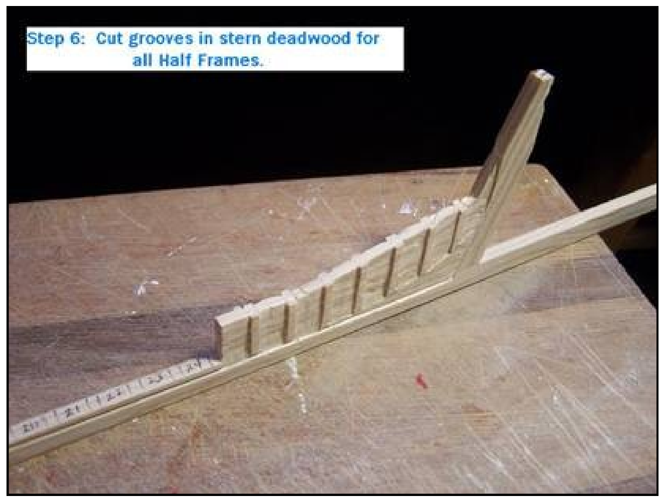
Step 4: Cut Rabbet in Keel Assembly. Remember that the rabbet is a V-shaped groove 1/16" wide and 1/16" deep. The Keel Assembly Plans shows its precise location. I used a steel ruler and an X-Acto knife for most of the length of the rabbet. Cut it carefully. Use a V-shaped miniature file to clean it out. Note that at the stern the bearding line is also part of the rabbet, so cut this out smoothly as well. This can be done by shaving a very slight amount of wood off, starting at the bearding line, then tapering it to a maximum depth of 1/16" at the bottom edge of the rabbet itself. Sand smooth until you are satisfied.





Step 5: Mark the Placement of All Frames on the Keel Assembly. Using the Keel Assembly Plan, align your Keel Assembly with this plan. Very carefully and precisely mark the location of every frame. Make your markings as inconspicuous as possible; mark them where they won't be seen after the frames as in place.

Step 6: Cut Grooves in Deadwood for the Half Frames. The grooves should be 1/16" deep and 3/8" wide. I used an X-Acto knife and a steel ruler, cutting lines for each of the frames. Then I used a wide carving X-Acto blade to trim out the grooves, taking a little wood at a time. I also used miniature files to smooth out each of the grooves.



Your Keel Assembly is now finished and is ready to be placed on the Building Board, which will be described next.

CHAPTER TWO

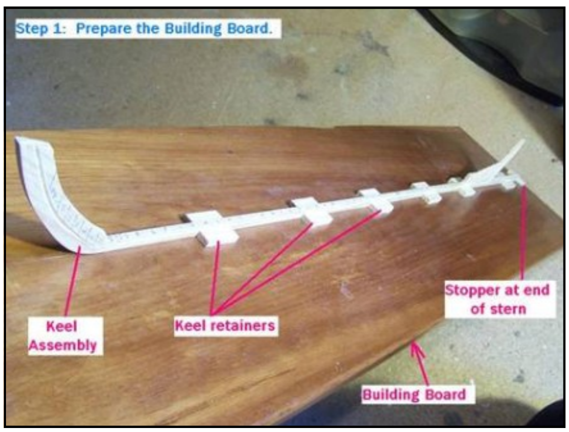
BUILDING THE FRAMING JIG

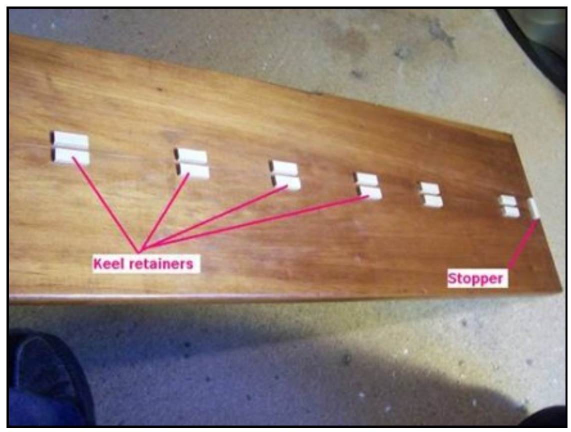
Step 1: Prepare a Building Board. The Building Board is the base of the Framing Jig. The board should be 3/4" thick, about 40" long, and 11" wide. It should be completely warp-free, perfectly straight. Do not tolerate even the slightly warp. The main purpose of the board is to prevent the Keel Assembly from warping throughout the building of the vessel.

Draw a centerline all the way lengthwise down the center of the board.

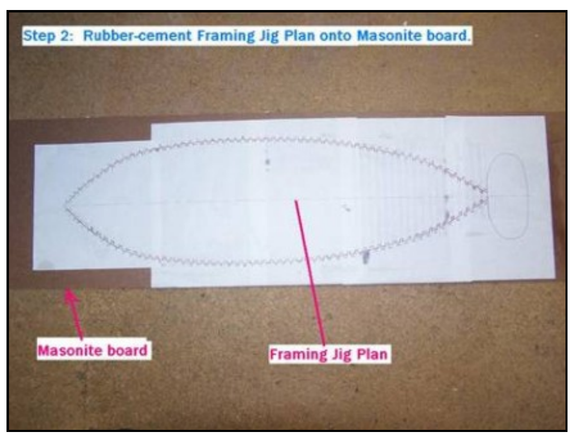
Place the Keel Assembly on the Building Board so that it rests precisely on the center of this centerline and rests with the keel extension about 2" from one end lengthwise.

Cut out about a dozen Keel Retainers. These are small pieces of wood that measure about 1" long by 1/2" wide by 1/4" thick. Their purpose is to hold the Keel Assembly in place lengthwise down the center of the Building Board. Glue them in pairs on each side of the keel, as shown in the illustrations. Note that there is also a Stopper Retainer at the stern keel extension as well. The keel retainers should be fit snugly against each side of the keel all the way down its length. Make sure you don't glue the keel itself to the keel retainers. When finished, the Keel Assembly can be lifted out easily and replaced easily, and fit snugly down its full length.



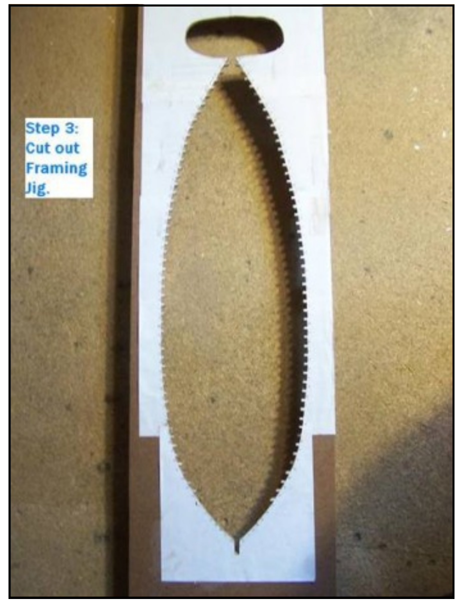


Step 2: Setting Up the Framing Jig. I used a piece of Masonite the same size as the Building Board. One-quarter-inch plywood is also suitable. Again, this piece should be warp-free. Take your Framing Jig Plan and rubber-cement it in the center of the piece of Masonite. You can also use any white glue, if you like. After you cut out the Framing Jig, what's left of the Plan will remain on the Masonite for the duration of the build.

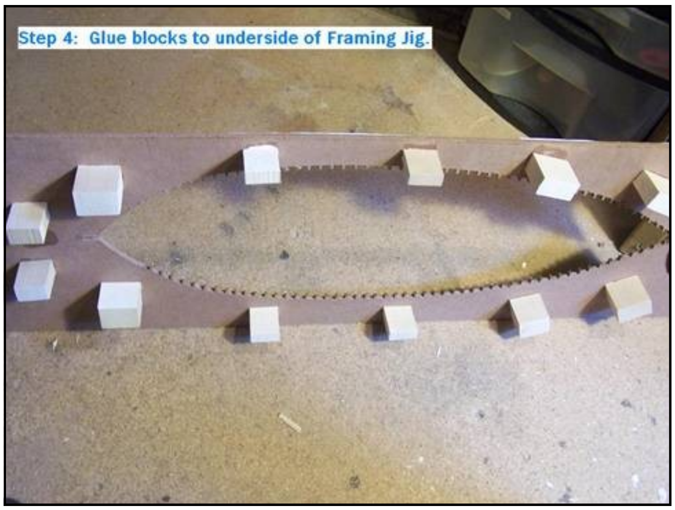


Step 3: Cut Out the Framing Jig: Drill a large hole in one end of the waste material of the Framing Jig. The entire Framing Jig should now be cut out on a jig saw. It's easier to first cut out the general shape of the inside of all the notches, then return to cut out each notch one at a time. If you use Masonite, this is not an easy task. What I did is jig saw the two sides of each notch, then score the remaining side with an X-Acto knife, then break out the notch with a pair of

pliers, and finally use a file to file out the square shape. Whatever method you use, make sure you are as precise as possible.

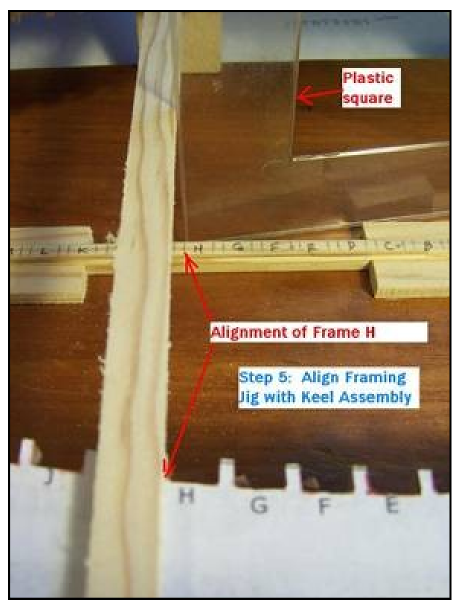


Step 4: Gluing Blocks to the Underside of the Framing Jig. The purpose of this step is to raise the Framing Jig so that its TOP EDGE is EXACTLY TWO INCHES ABOVE THE BUILDING BOARD. This two-inch level is Waterline #4, which is our reference point for building the Framing Jig. Since my piece of Masonite is 1/4" thick, I cut out about a dozen blocks of wood to a height of 1 3/4" each. Then, I glued a block about a half-inch or so OUTSIDE THE EDGE OF THE FRAMES. Make sure none of them will interfere with the Keel Assembly, especially at the stern.



Another way to accomplish this is to use wing nuts and lag bolts on your plywood. This was illustrated on the last page of "Lofting Your Own Plans." The goal here is to raise the Framing Jig so that its top edge is exactly 2" above the Building Board.

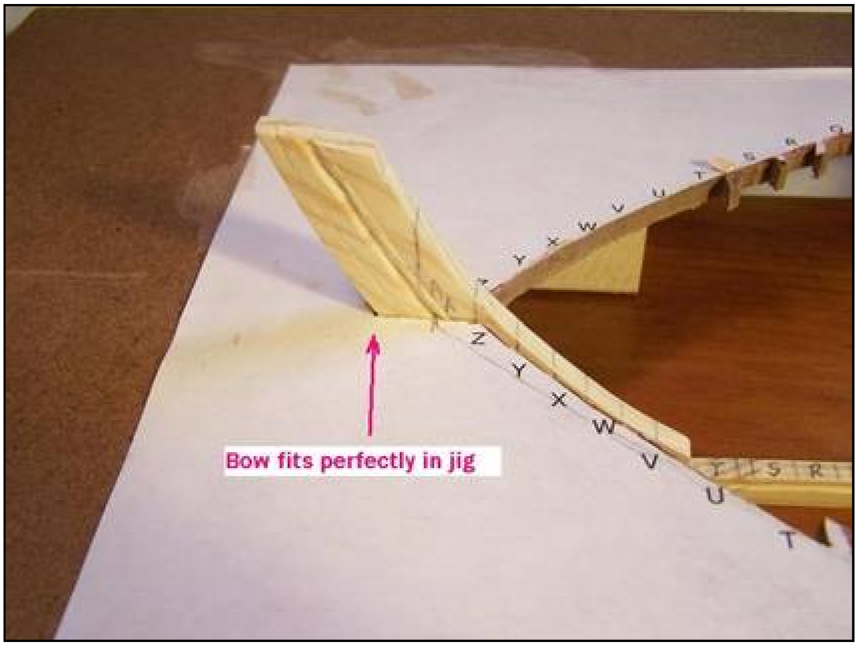
Step 5: Align the Framing Jig Up with the Keel Assembly. Be fanatical on this step. Make sure EVERYTHING is in perfectly alignment before you make anything permanent. There are several ways to check your alignment procedure:



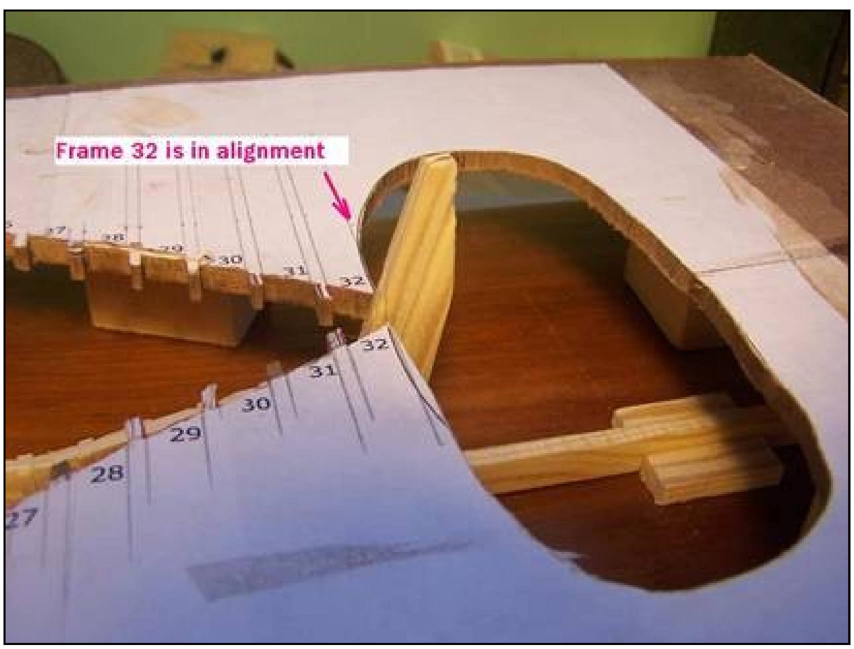
1. Take a length of wood and place it on top of the Framing Jig at one side of the Midship Frame, matching up port and starboard. Then take a 90-degree square and place it on the Building Board inside the Framing Jig. Match up the Midship Frame at both of these points PRECISELY. Do this for several frames. Once you're satisfied, remove the Framing Jig, place Elmer's Glue on the underside of each block, and glue the whole Framing Jig to the Building Board (DO NOT USE A FAST-DRYING GLUE), again rechecking your alignment. Before the glue dries, make the following checks also.

2. Make sure the Keel Assembly itself is perpendicular to the Building Board. Use a 90-degree square to check the alignment.

3. Make sure the bow of the Keel Assembly fits snugly into the Framing Jig.



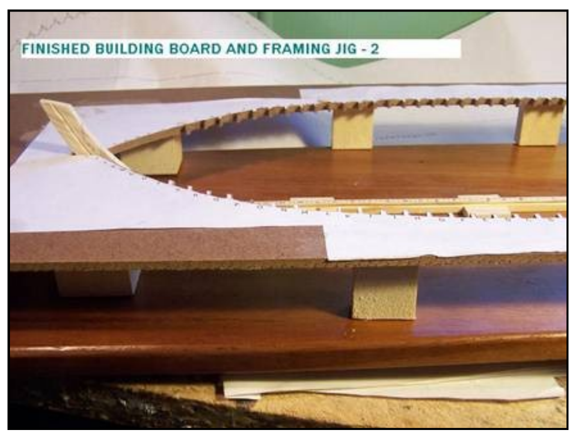
1. Make sure Frame 32 is in perfect alignment.



Like I said, be fanatical in this alignment procedure. If anything is out of whack now, it will be out of whack when you build the frames.

Step 6: Secure the Framing Jig to the Building Board Permanently. Once you are satisfied that everything is in perfect alignment, place the whole glued-down assembly on flat surface, and then place heavy weights at several locations to secure it in place permanently. It's best to check it again even after the weights are in place and before the glue has set. You want PERFECTION here.

The finished Framing Jig is now ready to accept frames as we build them next.

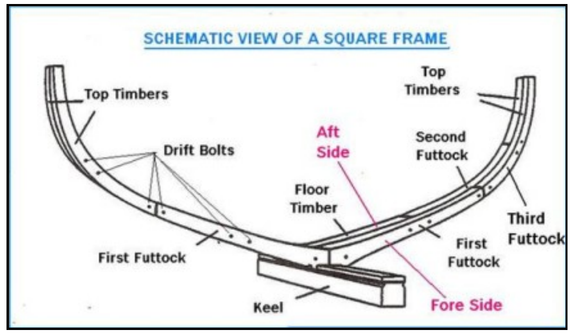


CHAPTER THREE

BUILDING THE FRAMES

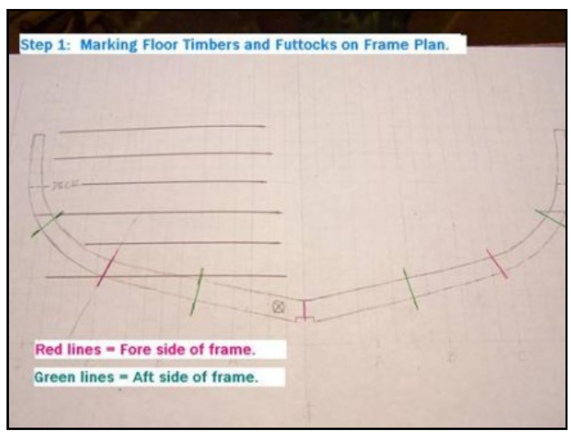
A. Building the Square Frames

The *Eagle* requires 45 square frames, extending from Frame T near the bow to Frame 24 near the stern. Each square frame will be constructed as shown in Crisman's "Schematic of a Square Frame" shown in the first illustration below. Note that each square frame has a fore side and an aft side, with each side being 3/16" in thickness. The fore side of a square frame consists of 2 first futtocks and 2 third futtocks. The aft side of a square frame consists of one floor timber, 2 second futtocks, and 2 top timbers. (The 2 third futtocks on the fore side are sometimes called top timbers.) Study this illustration until you understand it thoroughly, because all 45 square frames will be constructed in this same manner.



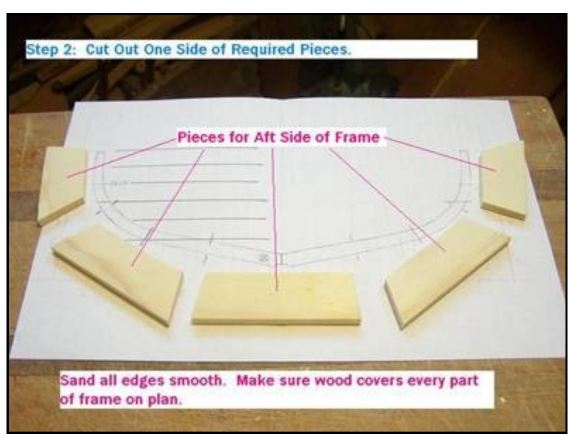
Every joint is held in place by a square drift bolt in the original ship. A drift bolt is a piece of square iron without a head or a point, driven in as a spike. Before driving the bolt into a hole a hole is bored somewhat smaller than the drift bolt. The drift bolt acts as a nail or spike by preventing lateral movement of the parts connected.

For all drift bolts I recommend that you use bamboo dowels. They can be made by pulling a larger length of bamboo through successively smaller and smaller holes in a draw plate until you reach a diameter equal to about a #57 drill bit size. I recommend that your bamboo dowels be left round, since it will be next to impossible to simulate a "square" drift bolt.



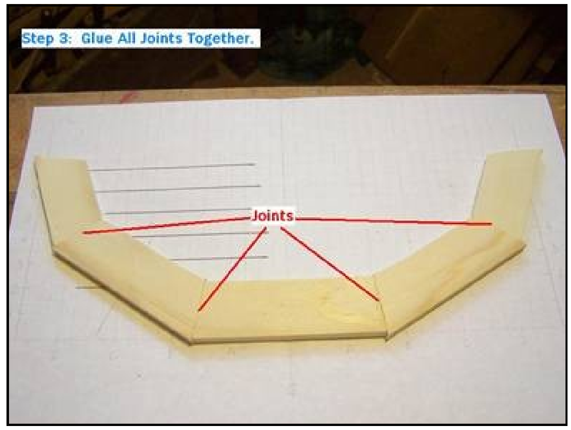
Once you are certain you understand the "Schematic of a Square Frame," you are ready to begin construction.

Step 1: MARK FLOOR TIMBERS AND FUTTOCKS ON FRAME PLAN. The Midship Frame is shown in all the illustrations below. The location of each joint should be approximately equally spaced. Mark them right on your Frame Plan, and extend the lines beyond the frame itself so you can see the location of the lines even after the wood is placed on the plan.

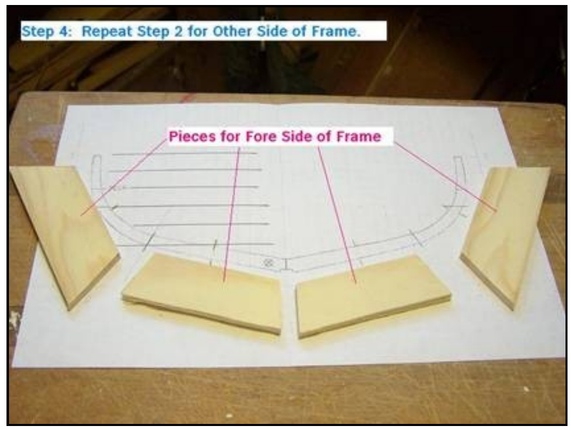


STEP 2: CUT OUT THE PIECES REQUIRED FOR ONE SIDE OF THE

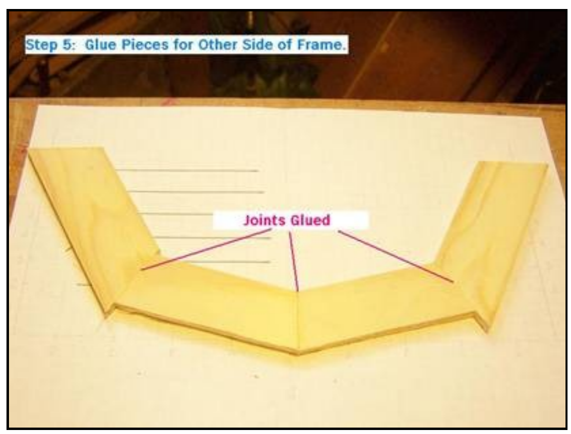
FRAME. For each piece of wood that you cut out, make sure that the grain of the wood follows the curvature of the frame. Also make sure that each piece of wood covers the frame completely between the two joints. Make sure each piece, when placed on the plan, fits precisely at the joints you have marked. Sand these joint areas smooth, making sure they are perfectly square.



STEP 3: GLUE ALL JOINTS TOGETHER. Using Elmer's Carpenter's Glue, glue all joints together. Make sure the joints mesh together well. When all joints are glued together right on top of the frame plan, make sure none of the frame can be seen -- the wood should cover every part of the frame. It's a good idea to weight it down so it can't move while drying.



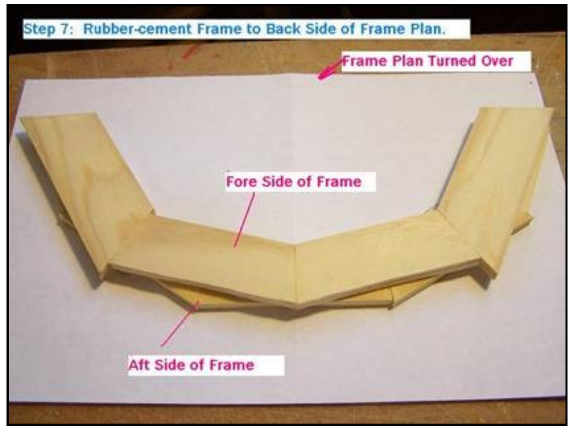
STEP 4: REPEAT STEP 2 FOR THE OTHER SIDE OF THE FRAME. Using the same frame plan, cut out the pieces of wood, again following the curvature of the frame for the placement of the grain of the wood. Repeat everything in Step 2.



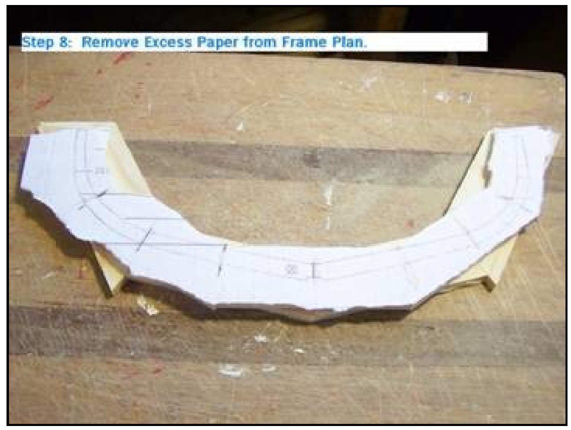
STEP 5: GLUE ALL PIECES FOR OTHER SIDE OF FRAME. Repeat Step 3 for the other side of the frame.

STEP 6: GLUE THE TWO SIDES OF THE FRAME TOGETHER. Use an ample supply of Elmer's and glue both frames together. Place the assembly right on top of your frame plan. Make sure the wood covers every area of the frame plan. Place a couple of heavy weights on top the frames and set them aside to dry.

STEP 7: RUBBER-CEMENT THE GLUED FRAME TO THE BACK SIDE OF THE FRAME PLAN. Flip the frame plan over to its back side. It helps to place the plan on top of a strong light source so you can see the frame plan clearly. Now cover one side of the glued frame with an ample quantity of rubber cement and place the glued frame on top of the back side of the frame plan. Make sure that the glued frame covers ALL of the frame area on the plan. If you have any gaps here, you will have gaps in your frame when you cut it out on your saw, so be extra careful.



It is important to note that when you glue frame plans onto your glued-up frame, you should follow this general rule: For ALL frames make sure that you rubber-cement the frame plan onto the side FACING THE MID-SHIP FRAME. Thus, for all frames aft of the Midship Frame, the frame plans will be rubber -cemented in one side of the frames, and for all frames forward of the Midship Frame, the frame plans will be rubber-cemented to the opposite side of the frames. This takes into account that the bevels will always be made in their proper place on the frame plans.



STEP 8: REMOVE EXCESS PAPER FROM THE FRAME PLAN. Take off unwanted paper with a pair of scissors, an X-Acto knife, or whatever. Or rip it off carefully.

STEP 9: CUT OUT THE FRAME. I use a band saw, but a jig saw will work as well. Don't cut it out right on the line -- stay just at the edge of the outside of the line. This is also true of frames that have bevels -- stay just at the edge of the outside of the bevel lines, too. Cut very carefully. If you accidentally cut into too much of the frame, start over and make a new frame. Nicks and over cuts will show up on the finished frame.

If this is a frame that contains bevels, now sand off the beveled areas. For this I recommend a small sanding drum attached to a Dremel. Use a sanding stick for finer finishes. When you are sanding bevels, always keep in mind the direction of the bevel when placed on the ship.

Finally, remove the rubber-cemented paper from the frame. A light hand-sanding on a large piece of sandpaper works well for this operation. The paper will come off easily.

STEP 10: DRILL HOLES FOR DRIFT BOLTS. You might want to mark these first with an awl. There is one drift bolt on each side of every joint -- on BOTH side of the frame. There will be a total of 14 drift bolts. Drill holes with a #57 drill bit.

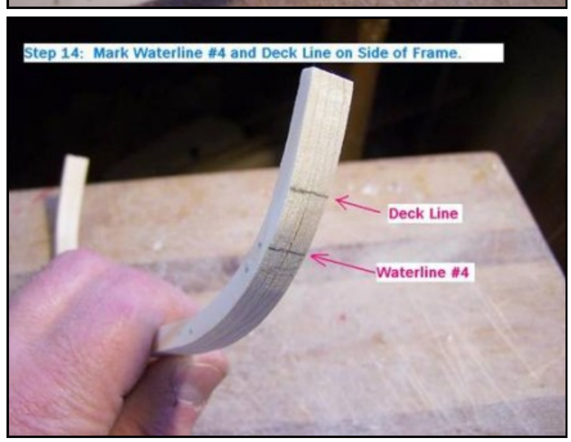
STEP 11: GLUE BAMBOO DOWELS IN DRIFT BOLT HOLES. Using a length of bamboo that you have pulled through a draw-plate down to a size of a #57 drill bit, coat it amply with Elmer's Glue. Then push it through each hole, having it extend outside the edge of the hole slightly. Let them dry.

STEP 12: SNIP OFF EXCESS DOWELS. A pair of ordinary toenail clippers works perfectly for this operation. Just snip them off closely.

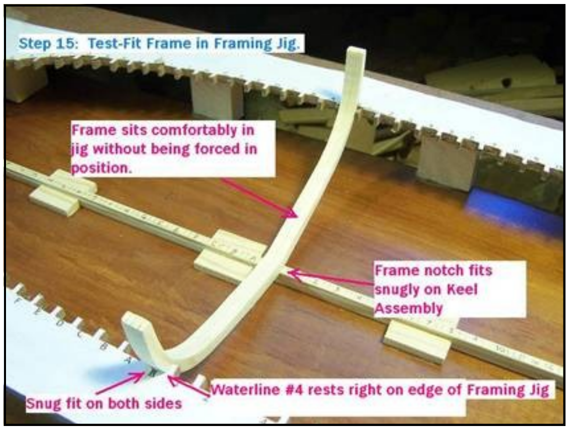
STEP 13: SAND SMOOTH WITH A SANDING STICK. Using a sanding stick, finish up the entire frame. Smooth off the drift bolts level with the frame; remove any slight burrs; make the whole thing nice and smooth.

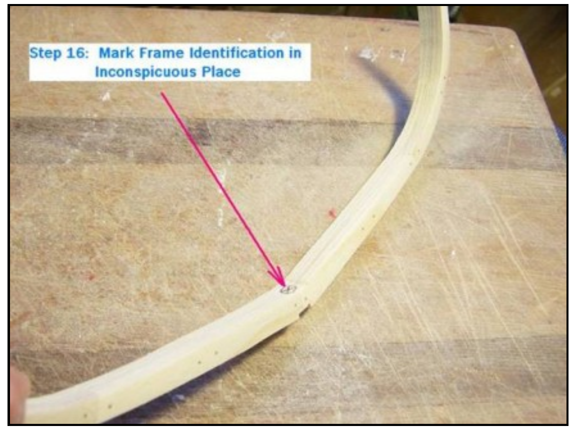
STEP 14: MARK WATERLINE #4 AND DECK LINE. Use a pencil for these marks. They will be used as reference points throughout the build.

STEP 15: TEST-FIT THE FRAME IN YOUR FRAMING JIG. Set is in place in the Framing Jig. Don't force it any way. Check out its alignment -- Waterline #4 should match at the top edge of the Framing Jig; the keel notch should fit snugly. EVERYTHING should fit perfectly.

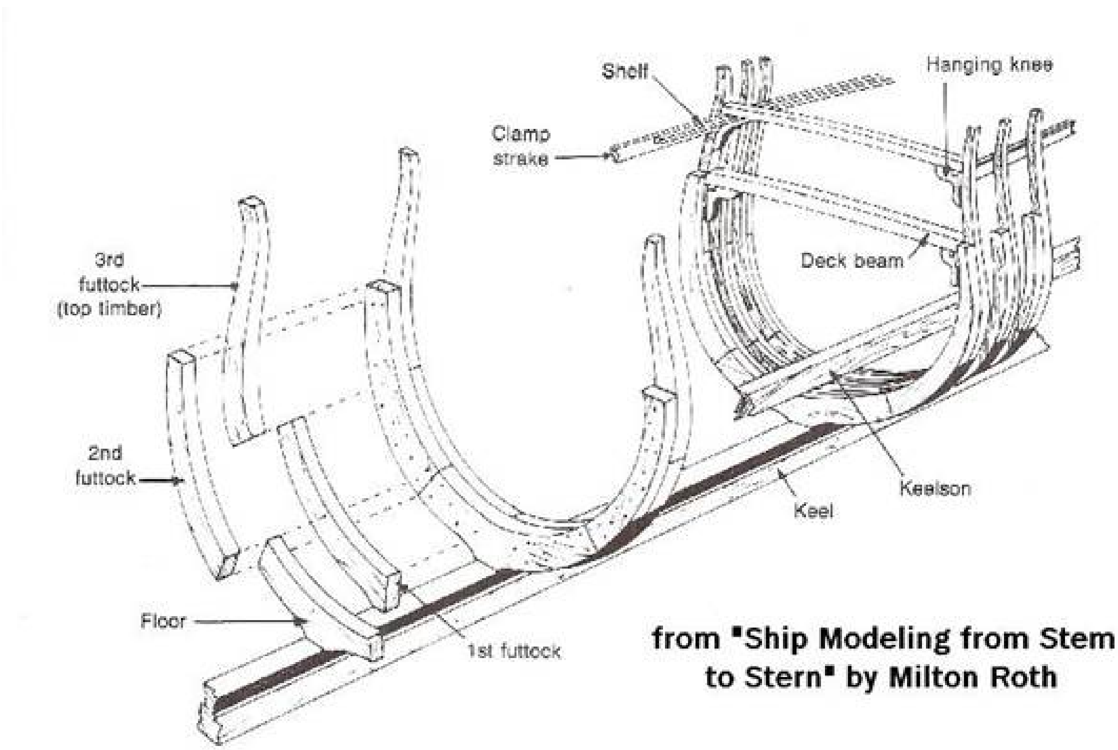


STEP 16: MARK FRAME IDENTIFICATION. Mark it in an inconspicuous place, such as the very center where it will eventually be covered by the keelson. Make sure the frame is sitting in its proper direction, especially if it has a bevel.





As a POF modeler, you should be aware of alternative methods of framing, depending on the type of vessel being modeled. Here, note that a single frame consists of two individual thin frames glued together, much like what we are doing with the Eagle. However, the top timber (third futtock) appears on only one half of the frame, with the other half ending with second futtocks, and the second futtocks cease right at the level of the deck line.



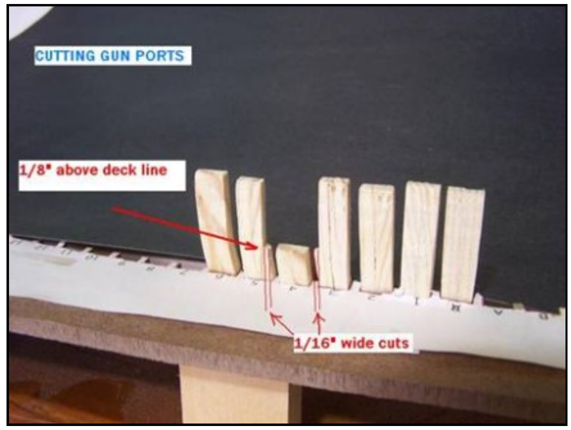
CUTTING GUN PORTS:

Before explaining how to cut gun ports into the appropriate frames, there are a few general rules for gun port construction that apply to ALL warships:

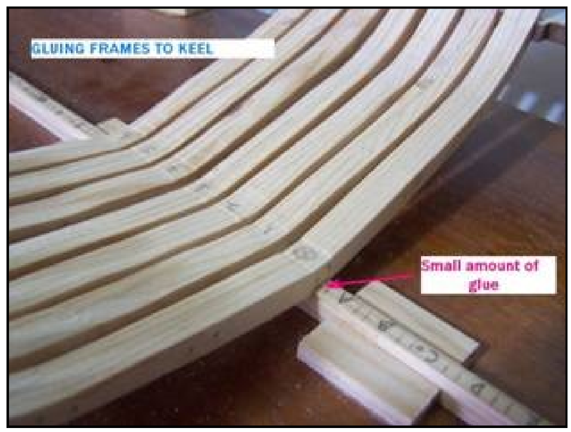
1. The horizontal (top and bottom) edges of a gun port are always parallel to the deck of the vessel.

2. The vertical sides of a gun port are always perpendicular to the keel.

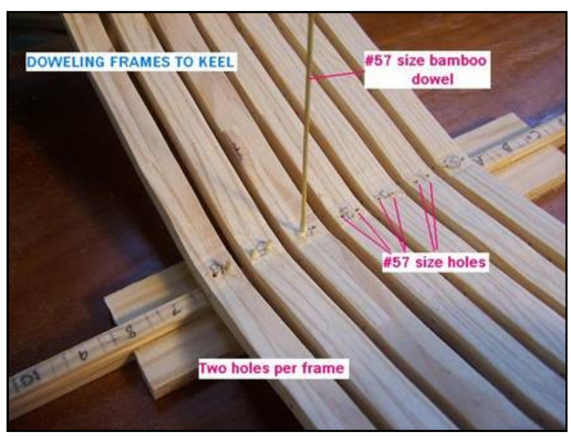
3. The vertical sides of a gun port will contain bevels equal to its location of the gun port. The bevels will be perpendicular to the curvature of the hull at that gun port's location.



Keeping these rules in mind, you are now ready to cut the gun ports. I will use Frames 3, 4, and 5 as an example. Frame 4 is the central frame of this gun port, and it is already cut to its proper location. However, a 1/16" notch must be cut into the aft side of Frame 3, and into the fore side of Frame 5. These cuts are made precisely 1/8" above the Deck Line. I recommend that you use a razor saw for the horizontal cuts, but make sure you don't go deeper than 1/16". The vertical cut extends all the way to the top of the frame and can be made with a razor blade, if your wood is soft enough, or a razor saw, or what-ever tool you feel comfortable with. This cut can be smoothed out with a fine file. Remember that both port and starboard sides have gun ports. As you approach each of the remaining gun ports, keep the general rules for gun port construction in mind.



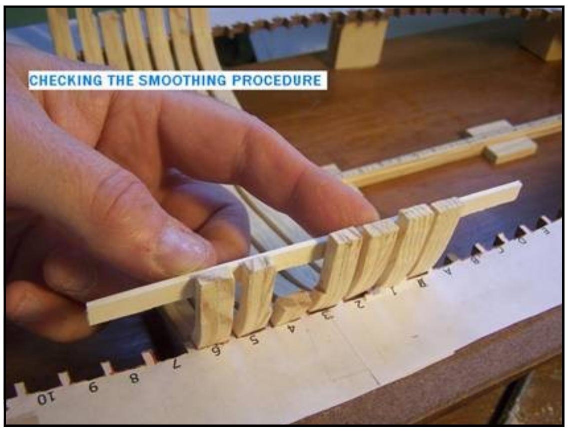
GLUING FRAMES TO THE KEEL: After you have constructed several frames, it's time to glue them onto the keel. Use a spare amount of Elmer's Carpenter's Glue; if you use too much, it will ooze out and leave an unsightly blob that you don't want to see. Leave each frame in place in the jig to dry thoroughly, and make sure it fits properly at all points.



DOWELING THE FRAMES TO THE KEEL: It is recommended that you use two #57-size dowels for each frames. You might want to use a piece of stopper tape on you drill bit, because you don't want to penetrate all the way through the keel with the holes, only MOST of the way. Dip the dowel in Elmer's, and twirl it as you insert it to get the hole saturated with glue. These dowels will provide a solid strength to the frames. After the glued has dried, snip off the dowel with a pair of toenail clippers and sand smooth.

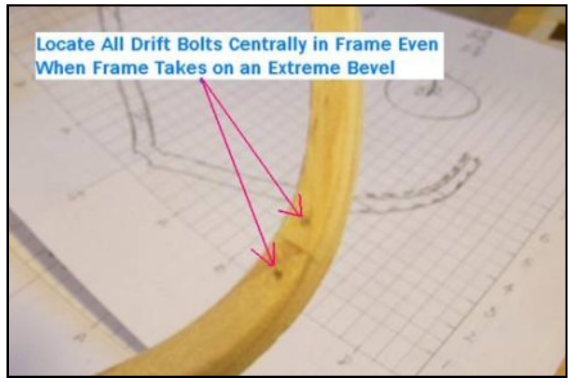
SMOOTHING OUT THE INTERIOR OF THE FRAMES: Once you have installed a quantity of frames, it's time to check the evenness of the batch. Using a length of thin wood, place it right on the interior of the frames. (Don't worry about the exterior at this time.) There will probably be some SLIGHT amounts of wood to sand off here and there. Do so now. A drum sander attached to a Dremel works fine, and so does a sanding stick. If you encounter a frame that is WAY out of whack, take it out and make a new one -- we're only dealing here with SLIGHT imperfections.

CHECKING THE SMOOTHING PROCEDURE: Move your length of thin wood all around the frames. Test it everywhere. Does it still need a bit of sanding to make it perfectly smooth? Do it now. In the midship area, this is a relatively easy task; however, as you approach the bow or stern frames, each frame will take on a much more radical interior curvature. This testing with a piece of thin wood will continue even at these areas, so that the thin strip always rests comfortably and completely on each frame. All of this will become very important when we build the interior structures of the ship, where it will be critical that these structures fit properly.



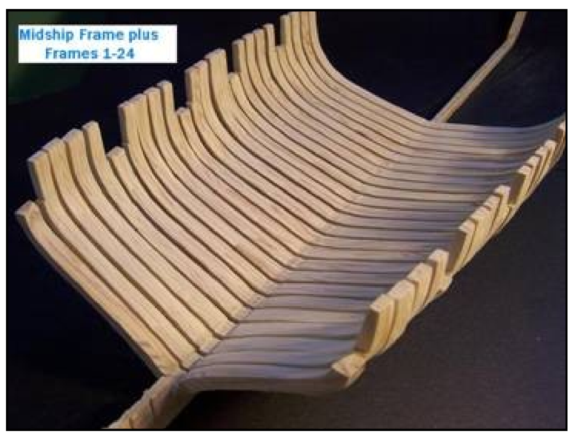
REMOVING THE KEEL ASSEMBLY & FRAMES FROM THE FRAMING JIG: After you have completed a number of frames and properly installed them, your curiosity will develop to the point where you cannot resist taking the keel assembly with its installed frames out of the jig for some inspection, and also to admire your handiwork. This is perfectly okay, but do it gently -- you don't want to break or dislodge anything. In fact, it you are unable to remove it, you've done something wrong; either the frames fit too tightly in your jig or you got glue where you don't want it. Figure out what you've done wrong and fix it. Of course, replace the assembly in your jig carefully.

Locate All Drift Bolts Centrally on Each Frame: As you approach the bow and stern areas, you will note that the frames require a greater and greater bevel. The drift bolts should be installed so that they are always located centrally on both sides of the frame. As the frames change their angle, the drift bolts should be installed on a similar angle.



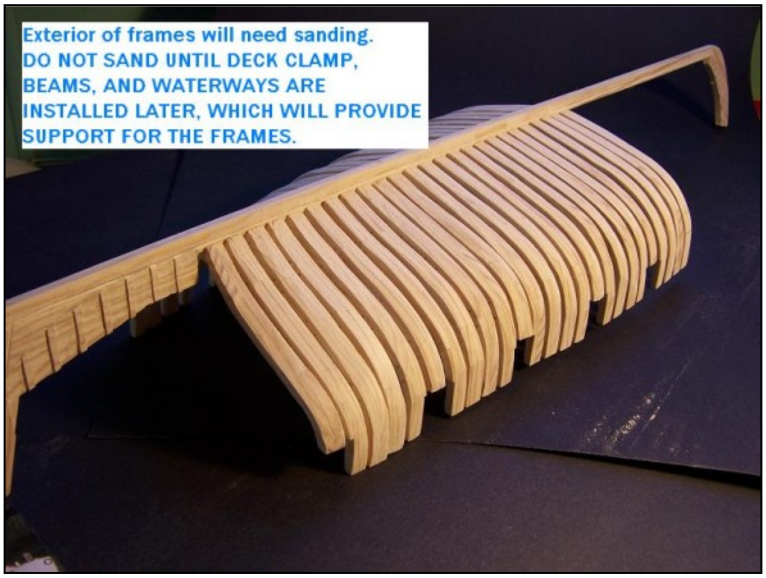
Further Details on Sanding the Interior of All Frames: The object of your sanding is to make all frames consistently smooth throughout the interior of the vessel. You will find yourself making YOUR OWN tools for much of this operation. You will need specialized sanding disks, which can be made from circles of hard plastic super-glued to one of those extra Dremel wheels you never use. Super-glue a piece of sand paper right to the plastic. This sanding disk works well for the flatter areas of the frames.

Another device that comes in handy is a sanding disk made from a flexible computer mouse pad cut into about a 3" circle. Again, glue the mouse pad to an extra Dremel wheel you never use, and attach a piece of sand paper. The flexibility of the mouse pad allows you to go up around those interior curves on the frames. (By the way, I saw this device on another website a few years ago, and I think it's ingenious.)



Although you can build the square frames starting at the midship frame going sternward or from the Midship frame going toward the bow, I chose the former. The illustration shows the first 25 frames installed. As you can see, a bit on sanding is still required on the interior of several of the frames. Next, I will build Frames A-T, which will complete the square frames.

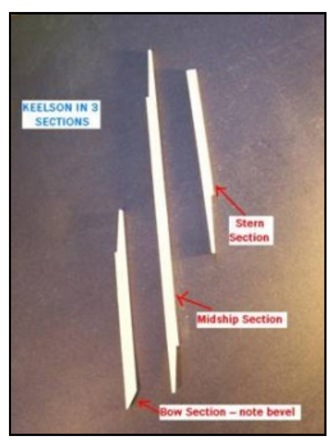
DO NOT ATTEMPT any sanding for the exterior of any of the frames -- they do not have sufficient strength to withstand much pressure of any kind at this point. The exterior of all frames will be sanded after we have installed the deck clamps, deck beams, and waterways. By that time, the frames will be fairly secure and will be able to tolerate sanding.



Finishing the Square Frames

After you have finished the entire group of square frames (from Frame T through Frame 32), you are ready to install the keelson. Make sure all frames are smooth on the interior, sanding down where necessary. Check that everything fits properly. Also be sure that all the top edges of the floor timbers are in perfect alignment.

Making the Keelson: The keelson is an internal keel mounted over the floor timbers and immediately above the main keel, providing additional structural strengthening. Some people consider it to be the real backbone of the ship. This is true of the real ship and your model, too.

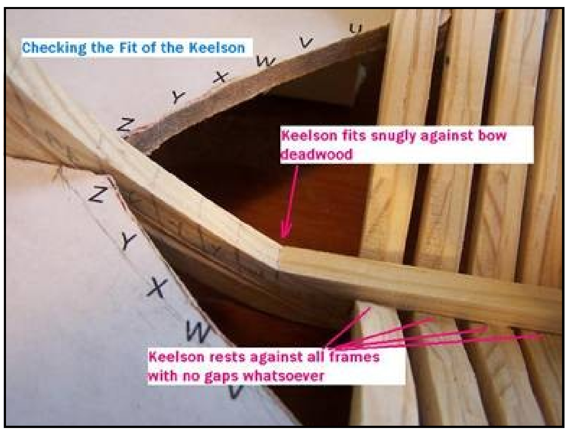


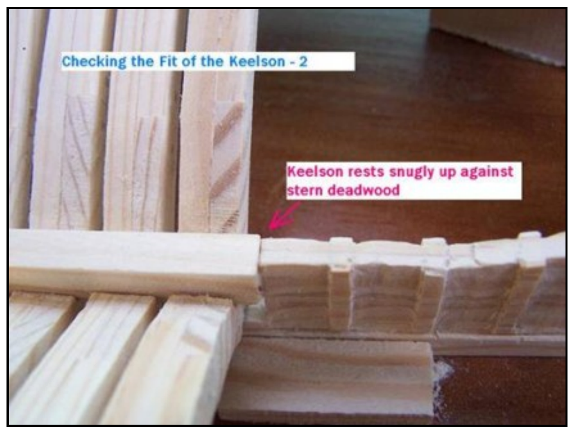
Dr. Crisman describes the keelson as having four timbers flat-scarfed together. However, in the simplified plans that you have already lofted, only three flat-scarfed timbers are required. The keelson measures 1/4" by 5/16" and is scarf-jointed at the first two areas shown in Crisman's Inboard Profile Plan. Make these three timbers. Glue them together and place heavy weights on the structure, making sure that it is perfectly straight throughout its entire length. After the glue dries, I recommend a couple of #57 bamboo dowels be installed for each of the joints.

Installing the Keelson: Once the keelson has dried and you are satisfied that it is perfectly straight, install it in place to test-fit first. It must fit perfectly between the deadwoods of the bow and stern. If it's too short, make another one. If it's too long, shorten it to its perfect length.

Apply a small amount of Carpenter's Glue to the top of all floor timbers. Then place the keelson in position. Weight it down heavily.

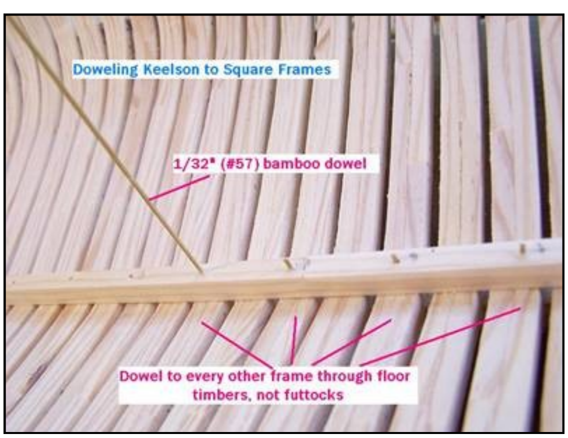
Checking the Fit of the Keelson: BEFORE the glue dries, make sure the keelson fits perfectly, particularly at the bow and stern deadwood. Does it rest nicely on all frames?





Doweling the Keelson to the Square Frames: A drift bolt (bamboo dowel) is installed on every second frame through its FLOOR TIMBER, not its FIRST FUTTOCKS. The floor timber provides greater support than the first futtock, which contains a joint right at this point. Use an awl to mark your holes, drill them so that they penetrate into the floor timbers, and use #57 bamboo dowels amply covered with glue. Let the glue dry.

Removing Excess Doweling: Snip off excess doweling with a pair of toenail clippers, and then sand the keelson smooth.



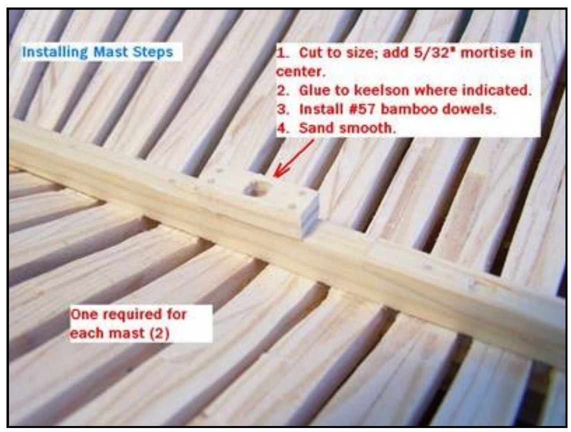
Installing Mast Steps: The mast steps are wood fittings which take the heel of the mast. They are mounted on the keelson and contain a mortise for the tenon of the heel of the mast. On a real ship they are usually made of the hardest and toughest kind of wood, mainly because of the crushing strain of the mast itself.

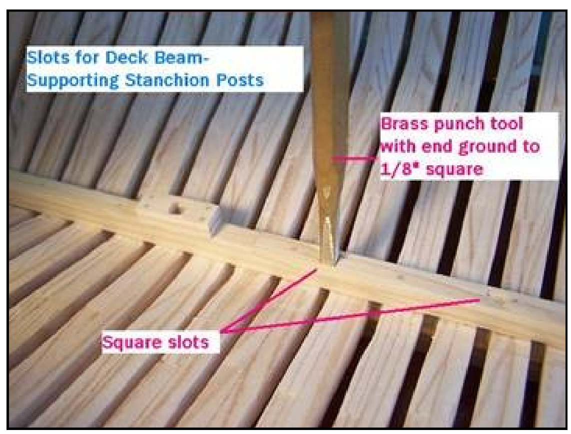
The Eagle has two mast steps, with each measuring 3/16" thick, 1/14" wide, and 13/16" long. Each mast step contains a centrally located 5/32" square hole that will eventually hold the tenon of its mast. The square hole can be made by drilling a 5/32" hole and filing it square with a miniature file. Make two mast steps, as described.

Glue the mast step PERFECTLY in position. If they are not positioned exactly where they belong, you will have a problem getting the proper rake of the masts later. Glue the CENTER of the mast steps in these positions:

1. Foremast -- The center of the square hole should be aligned with the aft side of Frame M. Glue it in place here.

2. Mainmast -- The center of the square hole should be aligned 1/16" aft of the fore edge of Frame 10. Glue it in place here.





Dr. Crisman then tells us that each mast step contains 4 drift bolts in a rectangular pattern. Drill

4 holes in this pattern and insert #57 bamboo dowels coated with glue. After the glue has dried, fair up the mast steps.

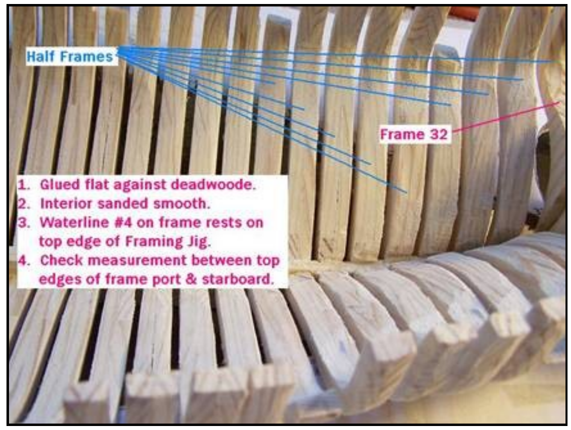
Slots for Deck Beam-Supporting Stanchion Posts: The only remaining items for the keelson are the slots for the stanchion posts. The slots are merely indentation in the keelson into which the supporting posts (stanchions) are inserted. To make these indentations I ground a brass punch to a 1/8" square (which is the size of the posts as shown on the Inboard Profile Plan. Note that there should be a deck beam stanchion indentation for EVERY main deck beam all along the keelson. Therefore, based on the quotation below (from "The Built-Up Ship Model" by Charles G. Davis), I will be installing 30 stanchions, one for each main deck beam that runs from port to starboard. You may wait until we build the deck beams themselves to indicate their indentations in the keelson.

"Under each main beam, in the middle of their length, there should be a stanchion to give it support, and this will be found a great source of strength to the hull as a whole.... You cannot imagine how, in a gale of wind, the ship will roll, and when she happens to roll at the time when an unusually heavy sea crests up and tons of water, impelled by a gale of wind blowing at 60 miles an hour, come crashing against the flat of her deck laid over, just at that time, at an angle that catches the weight squarely on the deck. It is then the sailor's life depends on the strength of the hold stanchions as they prevent the decks from crushing in and sinking the ship."

B. Building the Half Frames and Counter Timbers

HALF FRAMES: Half frames extend from Frame 25 to Frame 32. If you have successfully built the square frames, the half frames will pose little difficulty because they are built similarly to the square frames, except that they are built in two halves and will fit into the grooves cut in the deadwood. I recommend that you install all the half frames, except Frame 32, upon which we will build the counter timbers before installing the whole assembly on the deadwood.

As you build the Half Frames, there are a few precautions to take:

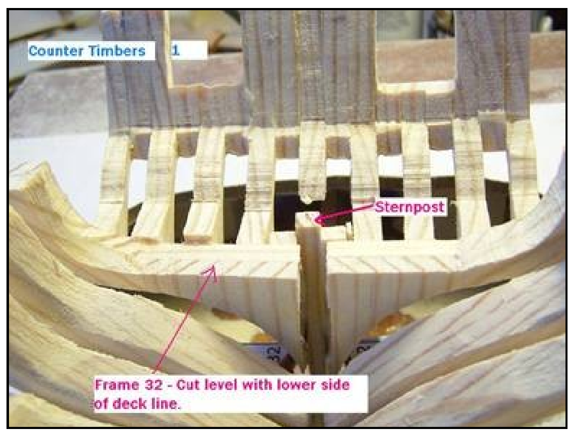


1. Make sure the frame fit snugly in the deadwood groove and flat against the deadwood (no angles, however slight).

2. Sand them on their interior nice and smooth to match up with the curvature of the square frames.

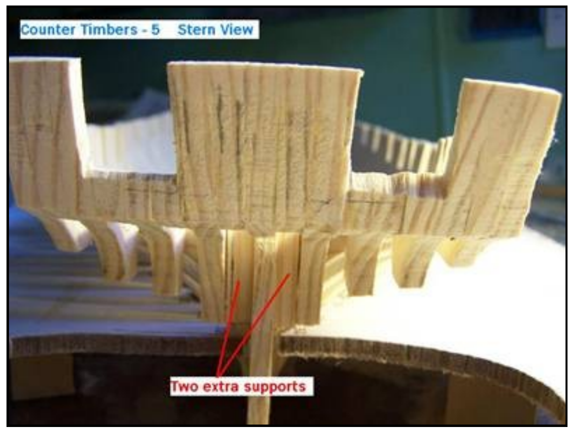
3. Make sure that Waterline #4 on each frame rests precisely at the top edge of your Framing Jig.

4. Finally, and most important, make sure you measure the distance between to top of each edge of both installed frames. This measurement should be exactly the same as the measurement across the same frame at the rail, which should be the same as that shown on the Inboard Deck Plan. When this measurement has been verified, you can be sure your Half Frames have been properly installed. If it doesn't check out, you've done something incorrectly and need to fix it.



COUNTER TIMBERS: First of all, Frame 32 should be built to include the lower edge of the deck line of the vessel, as shown in the pictures below. The lower edges of the counter timbers will be glued evenly with this deck line. This also means that you should build the counter timbers onto Frame 32 before installing the assembly on the ship.

On a band saw or jig saw, cut out the 17 counter timber pieces. I used 1/4" thick wood for all counter timbers. Note that the "spacer" portions of the counter timbers must be lopped off at appropriate intervals. (See the diagram of the construction method that was shown when you lofted the counter timbers.) I did not lop off the upper sections here, because the interior and exterior will eventually be fully planked so they won't be exposed.



Glue each counter timber and spacer together, starting from the center and working outward on both sides. Make sure the transom (where the gun ports are) is perfectly flat. There is no curvature on the transom. Make sure all counter timber pieces are aligned perfectly. Test-fit the glued-up assembly to make sure the assembly rests perfectly on Frame 32. Sand slightly where necessary to ensure that the counter timbers fit flat against Frame 32.

Now align it perfectly with the deck line on Frame 32, and glue the assembly in place. Let it dry.

There is very little support for fitting Frame 32 into its groove in the deadwood. To overcome this deficiency I added two rectangular support pieces on either side of the sternpost, as can be seen in the photos. These supports will provide a little more support for the assembly, because they cover a small portion of the sternpost, giving it much better support.

Now glue Frame 32, with its counter timber assembly, in place. Be particularly careful to ensure that the whole assembly is in perfect alignment. It's also a good idea to make sure the top of the transom is precisely 2 29/32" above the top edge of the Framing Jig. Look at it from the top. Look at it from the stern. Is everything pleasing to the eye? Measure and measure again to make sure everything is just right.

After the glue dries, you may sand off the lower edges of the counter timbers even with Frame 32, keeping the curvature consistent. It is not necessary to spend a lot of time here -- all of this is still in the rough. We will spend more time refining this area after we have installed some interior supporting structures, such as the deck clamp and waterways. Right now, all of the framing structure is rather precarious and won't tolerate too much handling, but don't worry about it at this point. We still have a long way to go.

C. Building the Cant Frames

Cant frames at the bow are made exactly the same as the half frames at the stern, except they are canted at varying angles to the keel. The angle for each pair of cant frames will vary somewhat, becoming more pronounced the closer you go to the cutwater.

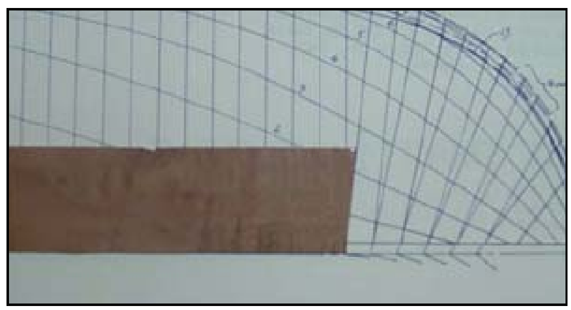
I made the cant frames in two layers of wood, just like all the other frames, along with a couple of joints that are doweled. I then sanding the frames down to 5/16" thickness instead of 3/8" because these frames, when beveled, have a much greater area exposed than the other frames.

The angle for each pair of cant frames should be found using the following information:

Step One: Set the sander table roughly to the angle for the first cant frame based on the drawing for the cant frames.

Step two: Using a wooden batten approx 1 foot long and one inch wide (thickness not being too critical) sand the angle for the first frame across the 1 inch face of the batten, as shown below.

Step three: Trial fit the batten to the plans and adjust the sander table by trial an error until the batten matches the plans exactly, as shown below. At this point it is crucial that the table is not moved until both halves of the cant frame are beveled.



Step Four: Once the table is set to the angle needed for the frame it is a simple matter of sanding down to the center of the outside line being sure to keep the line parallel to the sanding disk.

Once the first pair frames are in place it is a simple mater of readjusting the sanding table to the angle of the next pair.

Once you've beveled the required angle on a pair of cant frames, then sand the required bevel inside and out. Also note that each cant frame will rest directly on the deadwood with a rather steep upward slope that follows the bevels of the frame itself. Install them with a bit of CA glue so that they set and dry quickly.

After you've installed all the cant frames, sand the interior areas of the frames so that they all form a smooth curve that matches with the adjacent square frames. A sanding disk made from a computer mouse pad attached to a Dremel bit works well.

Again, don't worry about the exterior of the frames at this point. Sand them before installing them. If they line up nicely with the square frames and form a nice curvature, that's sufficient for now. At this point, all exterior surfaces should be "in the rough" and will be sanded smooth AFTER we provide more strength for the frames by building the deck clamp and other interior structures that will give it much more stability.

The two knightheads are made similarly to the cant frames and attached to the deadwood as well. Mine are a bit too tall, but that will be fixed later.

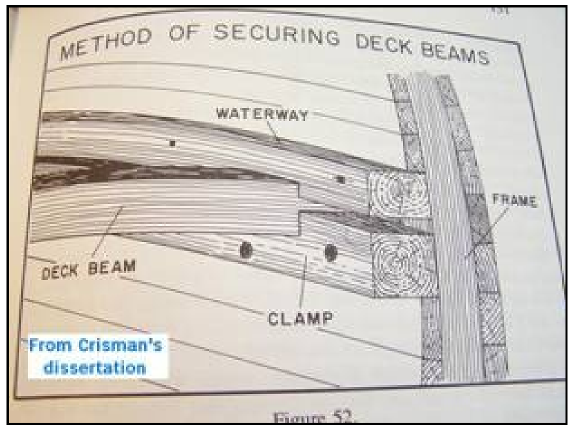
CHAPTER 4

INTERNAL HULL STRUCTURES

Introduction

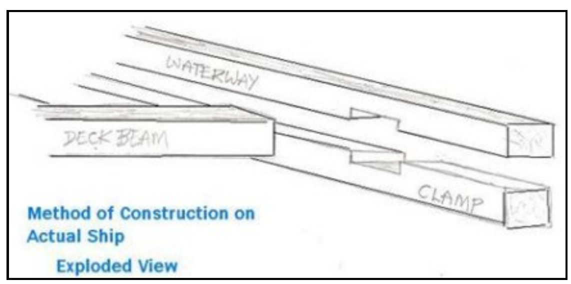
This topic will describe how to build deck clamps, waterways, deck beams, carlings, shot lockers, the camboose (galley), and ladders. This topic will also include ceiling planking, various bitts, and the berth deck. Also included in this section are the stanchions, hatches, and companionways. If I am able to find information on the captain's cabin, other cabins, the officer's mess, sail lockers, magazine, and storerooms, these will also be included here. it will not include other Deck Fittings, which will be reserved for discussion in another thread called by that name.

Deck Clamps

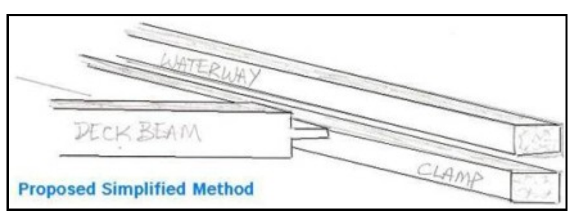


The first internal hull structures that we will make are the deck clamps. On a typical ship the deck clamp is a thick horizontal plank that supports the ends of the deck beams. It also serves the very important purpose of securing all the frames, making them immovable. It runs close under each deck along the ship's side from stem to stern.

Crisman's dissertation supplies us with a drawing that includes the deck clamp, deck beam, and waterway. In his narrative, Crisman describes these items as shown in the "exploded view" shown below. The deck clamp has a notch on its upper side into which the lower part of the deck beam rests. The waterway has a similar notch on its lower side into which the top part of the deck beam rests. The deck beam itself is nearly square at its ends.



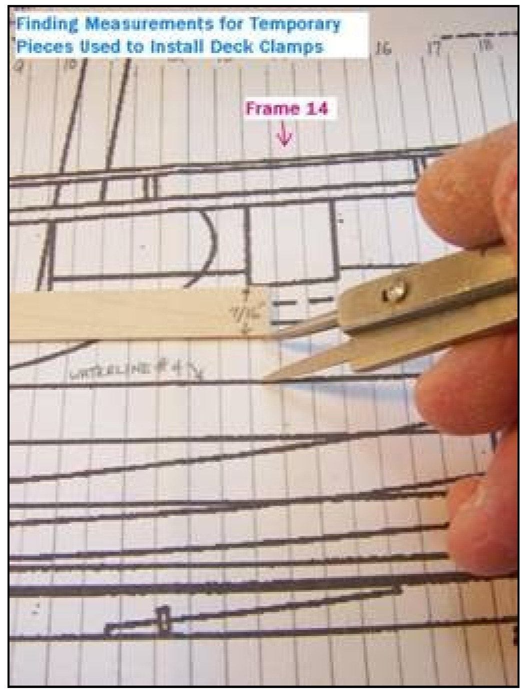
For those of you who have the expertise and tenacity for building these structures as shown in this diagram should go ahead and do so. However, in my opinion, this is not a task for a beginner or even a modeler who has built many ships. It requires that each notch on each deck clamp and waterway (there are 136 notches required in total) be cut precisely before installing them, and furthermore, it also requires that each pair of notches on both port and starboard sides match up perfectly so that every deck beam is exactly perpendicular to the keel -- an almost impossible task for the average ship modeler.



My own solution to this problem is to construct these items as shown in the Proposed Simplified Method shown in the diagram below. The final result will look PRECISELY THE SAME as Crisman's illustrations for the finished structures when all the structures are completely built and installed. This simplified method is MUCH easier to build and looks no different.

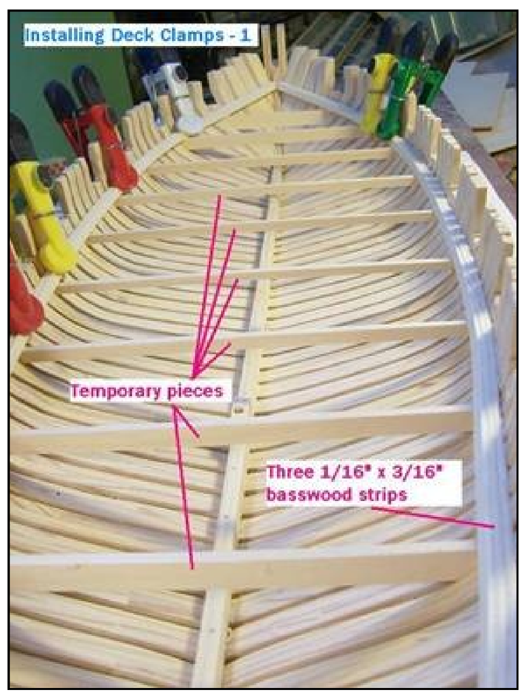
That said, here are the measurements for each item, which are based on Crisman's averages. Again, I have simplified in this area as well. The deck clamp, the waterway, and the deck beam will measure 3/16" square. There will be a 1/16" gap between the deck clamp and the waterway. The deck beam will have a 1/16" tenon protruding exactly at the center of each end of the beam that will be cut to fit precisely between the deck clamp and the waterway.

Our first task is to find the exact place all along the frames where the lower edge of the deck clamp should rest. We know that the top edge of the main deck is exactly 1/8" below the lower edge of the gun ports. We also know that the top edge of the waterway must be 1/8" above the top edge of the main deck. When it is installed, we also know that the top edge of a deck beam will rest 1/8" below the top edge of the waterway, which allows for the main deck planking. Therefore, if you draw this out on paper, you will find that the bottom edge of the deck clamp must rest exactly 7/16" below the bottom edge of the gun ports. Now cut a piece of thin wood or cardboard to this 7/16" measurement.



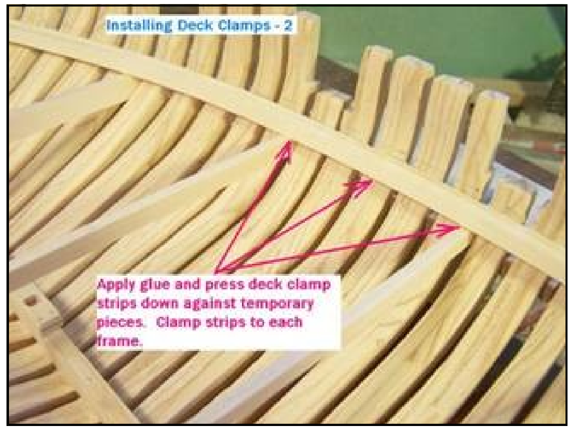
The following steps will show the exact place for the lower edge of the deck clamp to be secured all along the full length of the frames.

Using your Sheer Plan (you're not done with it yet!), place your 7/16" piece of wood or cardboard even with the lower edge of a given gun port opening. Keep it firmly there. Using your proportional dividers, place one point at the lower edge of your wood strip, and place the other point of the dividers on Waterline #4, as shown above. Since we know that the top edge of our Framing Jig represents Waterline #4, the distance you just measured is the height that the lower edge of the deck clamp must rest above the Framing Jig. Now cut out a piece of 1/8" wood to this measurement and place it at the same gun port all the across the ship, from port to starboard, and let it protrude a bit at both sides. Make sure that it's up against the jig.



Do this same thing for each and every gun port opening, cutting out pieces of 1/8" wood and inserting them between frames at each gun port. Each piece will vary slightly. When you've finished all the pieces for every gun port, you will have a resting point for the bottom edge of the deck clamp from bow to stern. Furthermore, both port and starboard sides will be perfectly symmetrical.

Now you are ready to cut out your deck clamps. Here again, I varied from the actual plan. I did not use a solid piece of wood for my deck clamp. Instead, I used 3 lengths of 1/16" thick basswood, glued on one at a time for form the 3/16" thickness. It's a whole lot easier than trying to bend a thick piece to shape and sanding



the extreme curvature at the bow and stern. The final result will still look exactly the same. As I glued each of the 3 strips in place, I made sure that they were pressed down onto the strips of wood that define its final shape. Use clamps to hold it in place until it dries.

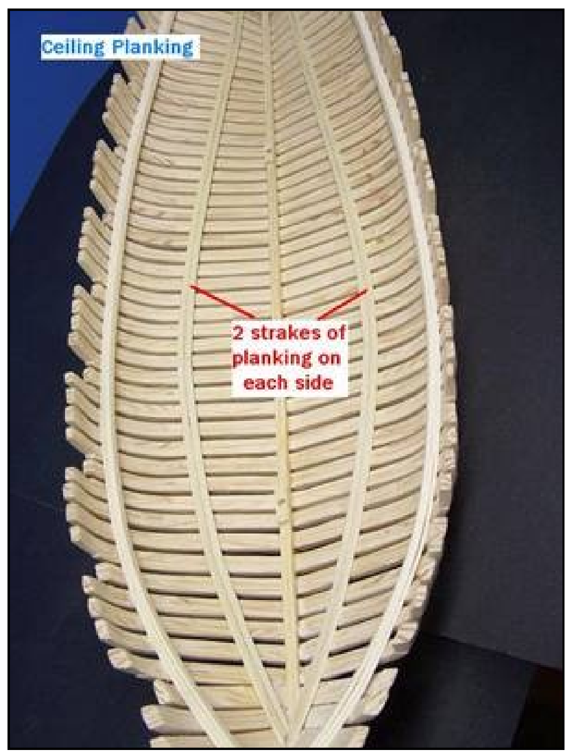
After the pieces of the deck clamp have dried, sand the top edges smooth. Then install #57 bamboo dowels with an amply supply of wood glue in random areas around the entire deck clamp. It's okay to drive the dowels all the way through the frames. Snip off the excess portion of the dowels after the glue has dried, and then sand all smooth. Remove the temporary strips of wood, and that completes the deck clamps.

The Berth Deck

Dr. Crisman's dissertation tells us that the berth deck was the base for bulkheads and equipment lockers. There was 5'6" between the berth deck and the main deck. It followed the sweep of the sheer, had no deck clamp, and contained uncambered beams attached directly to the ceiling planking.

The sweep of the berth deck is shown on the Inboard Profile Plan. To find the precise location of the berth deck on the internal frames, one way to do this is to measure and cut several temporary pieces of wood much like we did for the location of the main deck clamp. Using the Inboard Profile Plan and a set of proportional dividers, measure the height of any given space between two frames, from the base of the keel to the berth deck. Cut a strip of scrap wood to this height, making it long enough to completely cross the frames from port to starboard. Then cut a notch for the keel assembly. Finally, fit this piece over the keel assembly at the exact space that you measured. Do this for 7 or 8 more frames all the way across the ship, and leave the strips in position. They should all look similar to the one shown in the photo below, but they will vary slightly in height and width.

The next step is cut enough planking material for two full strakes of ceiling planking. In a real ship, the ceiling planking actually covers most of the interior of the hull, going from the keel all the way up to the deck clamp, but we will only suggest the ceiling planking here, because we don't want to cover up our framing. In admiralty models, it is common to omit much of the ceiling planking so we don't hide all the painstaking work that has gone into constructing such a model.



For the two strakes of ceiling planking I used 3/16" wide basswood 1/16" thick. I cut them in about 5" lengths and glued them to the frames, pushing them down level with the temporary pieces used to define the sweep berth deck. When installed properly, you will see a nice sweep to the sheer of the deck that will roughly follow the main deck sweep from bow to stern as well. I used CA glue so they would dry quickly in place. Incidentally, you many not want to limit your own model to two strakes; you can add a couple more if you like. No two admiralty models will be the same.

Next, install the berth deck beams. I used 1/8" square basswood. Crisman does not tell us how many to use or where they were located. In any case, do not place them in the way of other internal hull structures, such as main deck beam stanchions, bits, etc. This requires that you examine the Inboard Profile Plan carefully and understand exactly where each internal structure will be eventually located. I used only 13 berth deck beams located as follows: At the midpoint of the midship frame, at the midpoints of frames 5, 14, 17, 20, 23, 26, N, and S. I also placed one on the bow edges of frames C and J. Finally, I placed one on the stern edges of frames 11 and F. They are all beveled on both ends to fit on both sides of the top edge of the first strake of ceiling planking. Look down your ship longitudinally to make sure they are level to the eye as well. When you're satisfied, glue them in place.

To complete the berth deck cut out planking material that will be glued atop the deck beams. I used 1/16" thick basswood cut to 5/32" wide. Where to place your own deck planking is purely a matter of personal taste. Of course, I do not recommend that you cover the entire berth deck, because you will also be covering most of your framing workmanship. Also, do not cover the area immediately above the keel, mainly because your main deck beam stanchions will fit in these areas. Make sure you also leave room for bitts that are attached to the frames.

As a minimum, I do recommend that you plank those areas that will require a landing area for internal structures, such as the shot lockers at the base of the mainmast, the area where the camboose (ship's galley) will rest, the areas upon which ladders will rest (below hatches and companionways). If you wish to provide additional planking, by all means do so -- just watch your placements.

It is quite likely that the Eagle did not have much, if anything, in the way of cabins or other compartments on the berth deck other than those items discussed above. Therefore, such cabins and compartments will be omitted on this model. In closing this segment, I will quote a part of a paragraph from the book "The Built-Up Ship Model" by Charles G. Davis, which further supports this decision:

"The after section, the steerage, ward room, and cabin, had permanent floors with scuttles giving access to the spirit room and magazine, and the bulkheads separating these rooms, were permanent. Part of this layout may be shown to advantage if one cares to go into that detail; but we will be satisfied in our case with the fitting in of the beams and maybe a part of the flooring that will not hide to much of the ship's construction."

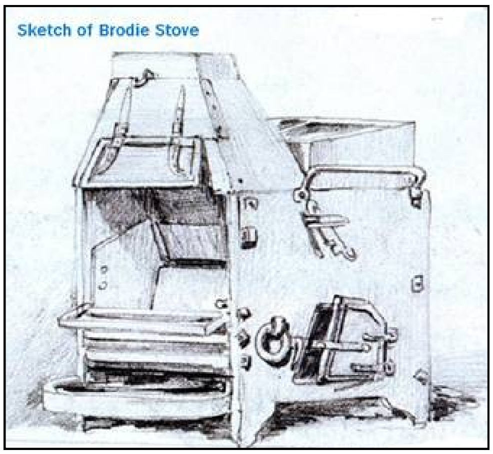
Bitts

The Eagle has two sets of bitts, one at the bowsprit and one at the foremast. Taking the measurements from the Inboard Profile Plan, I made them from basswood. The bowsprit bitts contain

no taper. The bottom edges of these bitts are beveled to fit the frames upon which they rest, then glued in place. The foremast bitts do have a taper; the bottom edges are also beveled to fit the frames; and I also added a small dowel at the bottom of each bitt that fits into a small hole in the frame to provide greater support.

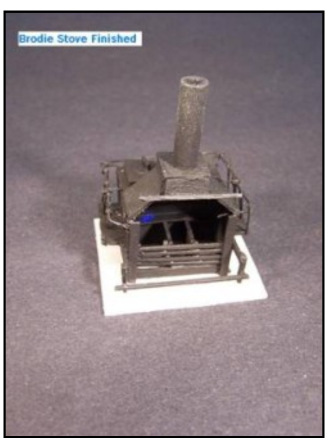
Brodie Stove

Dr. Crisman tells us that the camboose, or ship's galley, aboard the Eagle was the same one that was taken from a captured British sloop of war named "Alert." There is much information about this vessel's history, but I cannot find a definite picture of the stove used on the vessel. However, the Royal Navy had an exclusive contract with Alexander Brodie, who provided "Brodie stoves" for all naval vessels for about 30 years, from 1780 to 1810. Chances are, the Brodie stove was used aboard the sloop "Alert." Since there are several drawings and pictures of the Brodie stove available, I decided to use them for building a model of the stove for the Eagle. Here are two of the available pictures.



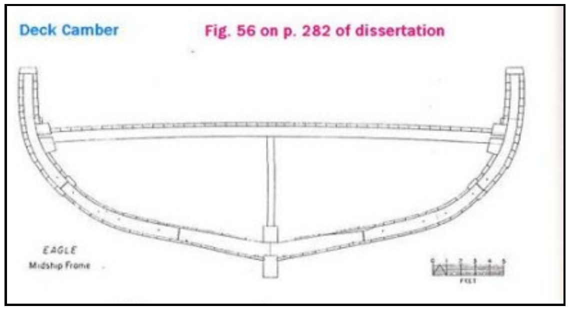
I did not make a set of plans for the stove; however, there are sufficient details in the pictures so you can make one from scratch yourself without using plans. I used many odd bits and pieces of material for constructing mine, including basswood, bamboo, thin cardboard, and wire. Just use your imagination and you can probably build a better one than mine.

I mounted mine on a gray platform and positioned it as shown in the Inboard Profile Plan.



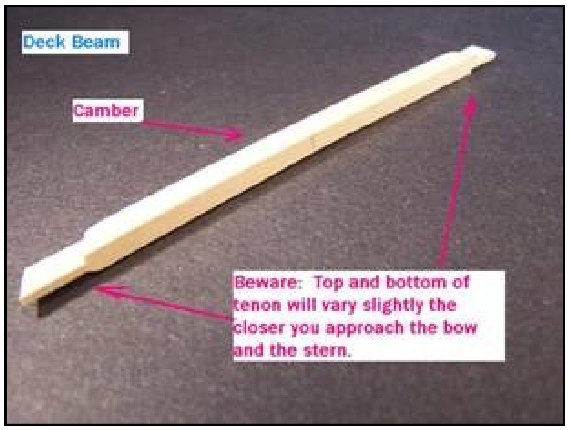
Main Deck Beams

I only installed two deck beams at this stage, both of which provide further support for the bitts installed above. To make deck beams you must first determine the correct camber of the deck. Dr. Crisman states that the Eagle's camber was 5" in 32'. On p. 188 (Fig. 64), he also provides a drawing of the deck camber. If you enlarge this drawing by a factor of 2, it will be perfect for a 1:48 scale model.

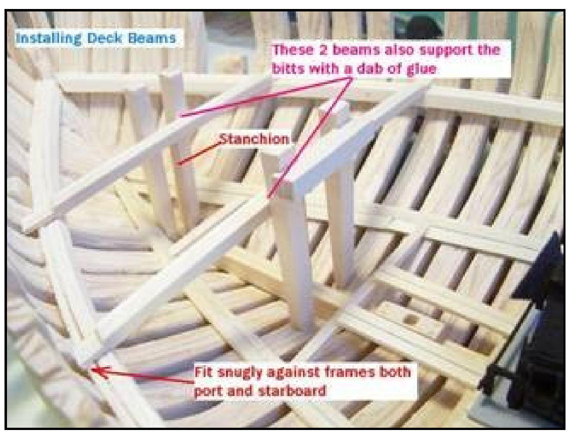


Make a pattern of this deck camber out of a thin piece of wood. It will be used for all of your deck beams, about 30 of them. All deck beams will be 3/16" square going from port to starboard. The easiest way for make your beams is to lay them out on a 3/16" piece of basswood by measuring spaces equal to 7/32" in thickness all the way down the sheet. The extra 1/32" allows for the thickness of the saw used to cut it, plus it allows for some sanding. Also mark the midpoint of all deck beams by drawing a line down the center of the sheet.

Once you've laid them out on your basswood sheet, cut out the top each of one deck beam. Then sand it smooth with a disk sander. Then cut out the lower edge right on the line of the next beam. Sand the lower side of the beam with a sanding stick. Then sand the top edge of the next on your disk sander before cutting out the next beam. Repeat this procedure for all deck beams.



I recommend that you don't install the deck beams until you are certain that there is nothing more to install in the lower part of the vessel. Deck beams will be in the way of everything on the berth deck. Install each deck beam only as you need them.



Remember that the ends of each deck beam will consist of a 1/16" tenon that will rest directly on top of the deck clamp. The edge below the tenon will vary slightly from the top edge of the tenon, especially as you approach the bow and as you approach the stern -- where the curve of the deck clamp becomes more pronounced. Spend lots of time cutting out this tenon to fit precisely. The outer edge of the tenon will abut directly against the frames.

Underneath the exact center of each deck beam, drill a 1/8" hole about halfway through the timber -- be careful NOT to go all the way through. This hole is for a 1/8" square stanchion. I used those 1/8" square toothpicks you can find in party stores. To find the length of the stanchion place the deck beam in its proper position. Take a length of your 1/8" square material and place it on top of the keelson, extending it up to the deck beam. Mark the length, which will be about halfway up the side of the deck beam. Punch a slight indentation in the keelson for the exact location, as described earlier. Glue the stanchion into the hole in underside of the deck beam. Test-fit all to make sure everything is aligned perfectly. Then secure everything in place at all contact points with carpenter's glue.

Note that the two deck beams I have installed so far abut right up against the bowsprit bitts and the foremast bitts. Place a spot of glue at these points as well.

Common Pumps

The Eagle carried two "common pumps" located just before the foremast. In smaller ships like the Eagle, the pumps drew up water from the lower part of the hull for discharge into the sea. It generally consisted of long wooden tube, frequently made of elm, that operated from the main deck by the pump brake and two pistons to which valves or clappers were attached. The illustration of a typical common pump is shown below; it is taken from a Texas A & M thesis written in 1984 by Thomas Oertling and is called *The History and Development of Ships' Bilge Pumps, 1500-1840.* The method for seating the pumps adjacent to the keelson is also illustrated below and is taken from the same source.

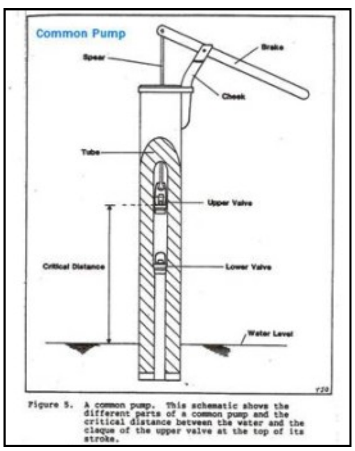


Figure 5. A common pump. This schematic shows the different parts of a common pump and the critical distance between the water and the claque of the upper valve at the top of its stroke.

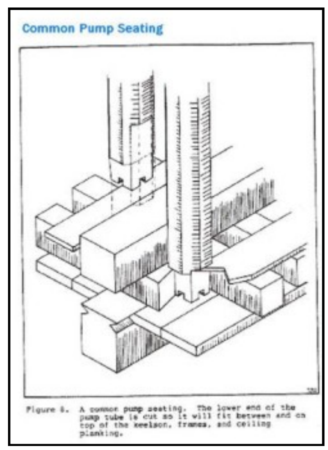


Figure 6. A common pump seating. The lower end of the pump tube is cut so it will fit between and on top of the keelson, frames, and ceiling planking.

The pumps can be made by starting with a 3/16" dowel long enough as shown on the Inboard Profile Plan. File the dowel into an octagonal shape, which was typical of elm pumps. Pay special attention to the bottom edge of the pump, which must be seated properly, with a flat side fitting against the keelson, and with a tenon that fits between Frames 8 and 9. Drill a hole at the top end of the pump and darken the inside with a soft lead pencil to simulate the lead lining that was frequently used on these pumps. A 1/16"-wide piece of electrical tape is glued around the pump just below the top edge -- it simulates an iron band. The brackets that hold the handle is made from 1/8" basswood. A slot for the handle is cut into the top end of the bracket. The handle is made of 1/16" basswood. A small hole is drilled into the top end of the handle and a piece of thin-

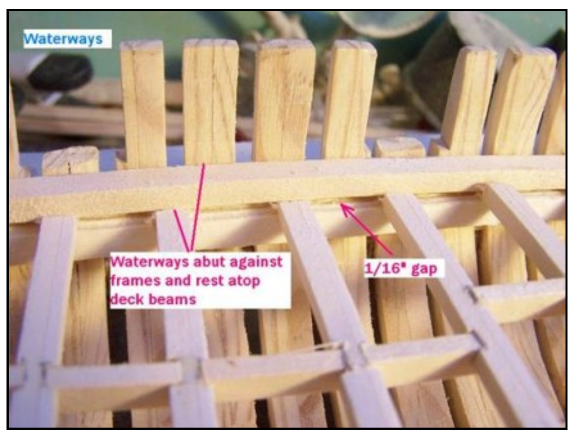
gauge wire was shaped like an eye bolt and inserted in the hole. After assembling the parts, the entire pump was stained with Golden Oak stain.

Shot Locker

The shot locker was used to store ammunition, including shot and cannon balls that were not already carried on the main deck. The Eagle's shot locker was probably a simple affair -- a fair-sized box with hinged doors. The one shown in the photo below is made from 1/32" basswood that was stained Golden Oak.

Main Deck Beams

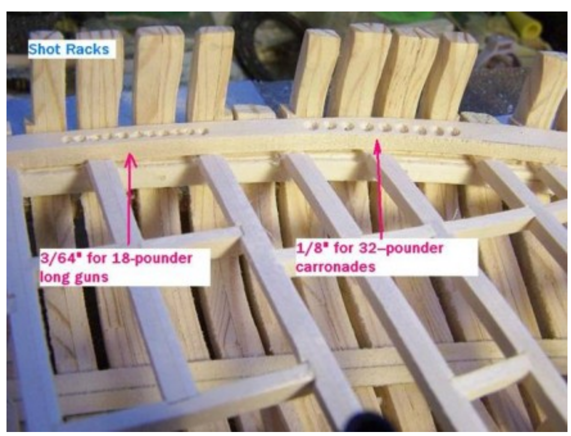
The procedure for making deck beams has already been described. I should note here that, as you add more deck beams, take a long, thin piece of wood and lay it on the finished deck beams from bow to stern. The strip of wood should rest on ALL deck beams when you apply slight pressure to the strip, and there should be no gaps, however slight. If you find that a deck beam does not meet this requirement, remove it and make another one. There will be some deck planking on the model, so make sure the deck beams are capable of accepting deck planking that looks like it should, with no dips or bulges.



Waterways

The waterways are made from 3/16" square lengths of basswood, with one side shaped to fit against the frames for the full length of the vessel. Crisman suggests that each waterway was probably constructed in four or five lengths of material.

The bottom edge of the waterway fits snugly on the tenon of each of the deck beams, and the waterway will rise precisely 1/8" higher than the edge of the deck beams.



Shot Racks

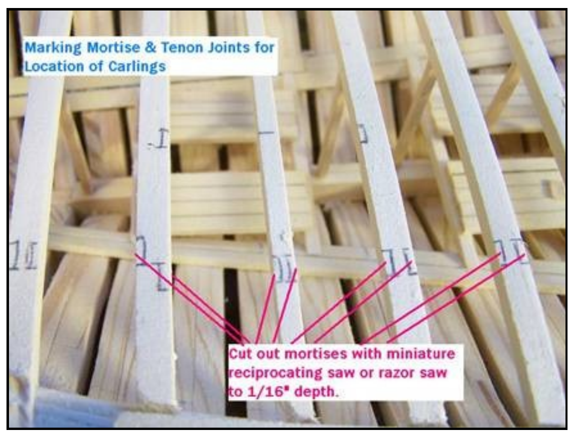
The *Eagle* carried twelve 32-pounder carronades, which fired shot 7" in diameter. There are 9 indentations for the carronade shot between the appropriate gun ports. The ship also carried

eight 18-pounder long guns, which fired shot 5" in diameter, and there are 11 indentations for the long gun shot between the appropriate gun ports. The placement of each type of shot can be found on Crisman's Deck Plan.

The indentations for each type of shot consisted of a row of round depressions, chiseled to a depth of 2". On the model I used a template to mark the location of each type of shot indentation.

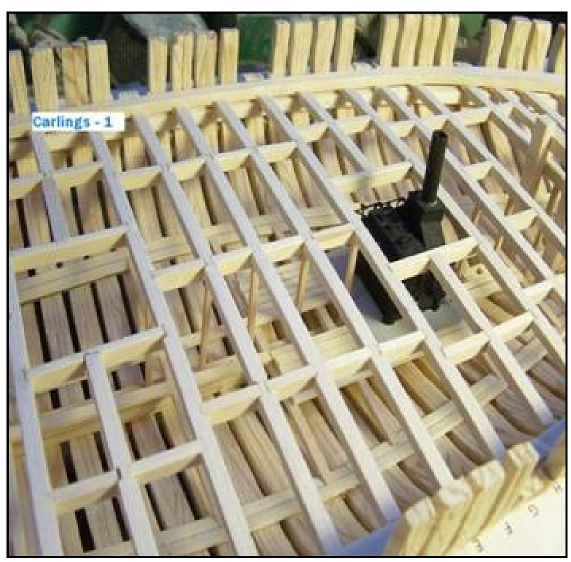
Be careful not to mark too close to the frames, allowing for 1/32" bulwark planking that will be installed later. Use a 1/8" drill bit for the 7" indentations, and a 3/64" drill bit for the 5" indentations. Only use slight pressure on the drill; the goal is to simulate a chiseled indentation for each piece of shot, so drill carefully. Clean up any unwanted edges with a sanding stick.

I decided to install the appropriate size shot in every indentation. For the 32-pounder shot I used large-size round-head pins. First, I painted the round pin heads with black enamel paint. Then, I snipped off the heads and glued them in place with CA glue. For the 18-pounder shot I used small-size round-head pins in the same manner.



Carlings

Carlings are short pieces of timber ranging fore and aft between the deck beams. They provide strength for the deck beams and support for the deck planking. Crisman's Deck Plan shows the carlings on his Deck Plan for the port side. The starboard side carlings are a mirror image of the port side. All carlings are mortised into the deck beams, as shown on the plans.



Before cutting out and installing the carlings mark the location of every mortise required for every carling. Using the Deck Plan as your guide, mark each precisely. The carlings will all be 1/8" thick by 3/16" deep. Every mortise will measure 1/16" deep by 1/8" wide.

You should be aware that knees are used to further support the carlings and deck beams on most ships; however, knees were omitted on the *Eagle* in the interest of rapid construction.

After you have finished marking the location of all mortises, cut out each fore-and-aft portion of a mortise with a miniature reciprocating

saw or a fine, thin razor saw. Do not cut out mortises that intersect with hatches or other open areas at this time; they will be cut out after all other carlings have been installed. Gently pop out each mortise with a small chisel and then sand the opening square with a miniature file.

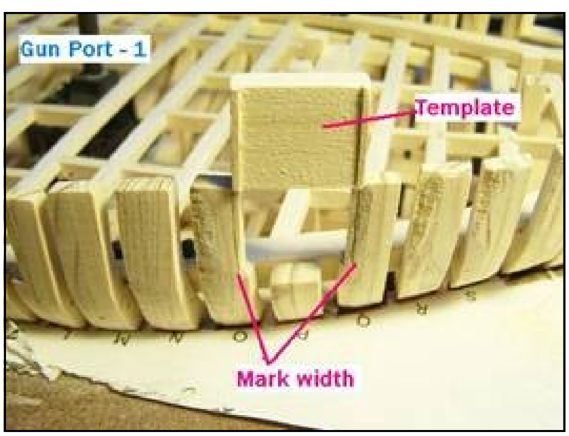
Cut a long length of carling material, which will measure 1/8” by 3/16”. Start with the outermost carlings on the port and starboard sides, and work toward the center of the ship. Installing the outermost carlings first will provide more strength for the cuts toward the center. Now cut out one carling at a time by placing one end of your carling material into a mortise and marking the precise location of the other end of the carling. Score with a razor blade and cut off with a razor saw. Place a supply of white glue on both ends of the carling as well as in both mortises. Then push the carling in place. When cut to proper length and inserted correctly, there will be no gaps of any kind. Continue this procedure until all carlings have been finished.

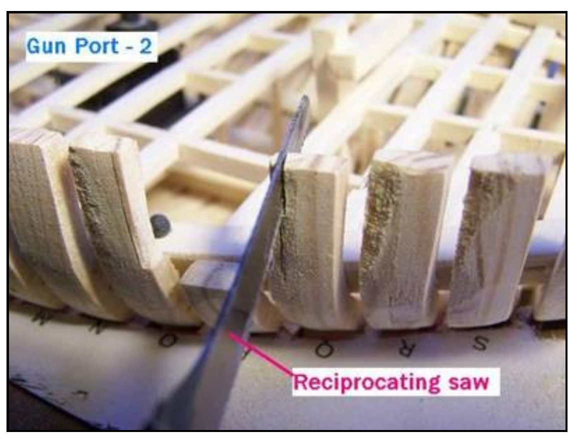
It is recommended that you sand all carlings smooth after they’re all installed. Check for smoothness by placing a long strip of thin basswood on the beams and carlings, looking for unwanted dips or bulges.

Gun Ports

Since the interior and exterior gun port areas will be covered with planking material, it is only necessary to create a framing for each of the gun port openings. All openings are of the same size. The lower timber of the opening is placed 1/8" higher than the interior waterway. The two side timbers extend from the lower timber up to the rail. A top-timber is not necessary because the cap rail will form the upper part of the opening.

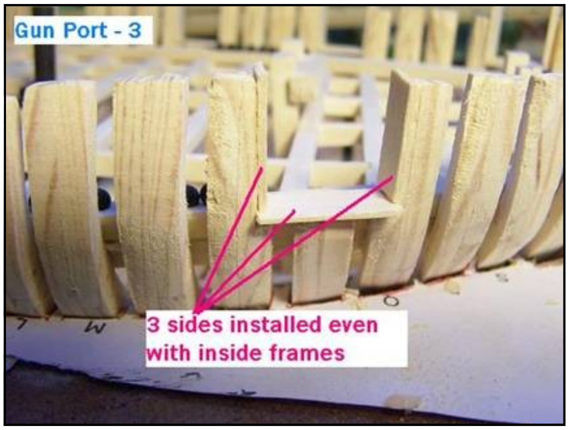
Make a template of the gun port opening that includes the width of the side timbers. Mark this width at the opening of each of the gun ports. Using a reciprocating saw, cut each opening to the width you marked. These cuts should be perpendicular to the keel at every location.

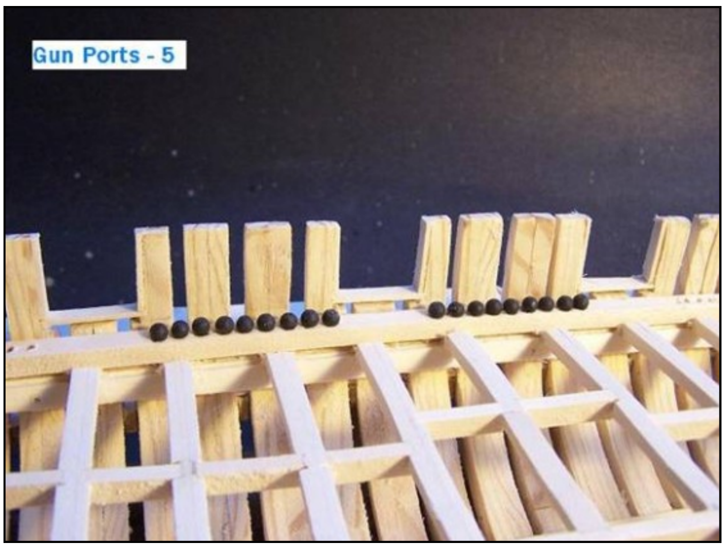




For all gun port framing timbers I used 1/32" strips of basswood. This is not to true scale, but, as I mentioned, all will be planked on both interior and exterior areas. The strips were glued in place with carpenter's glue, starting with the lower timber, then the two side timbers. Remember that the lower timber must be placed 1/8" higher than the interior waterway.

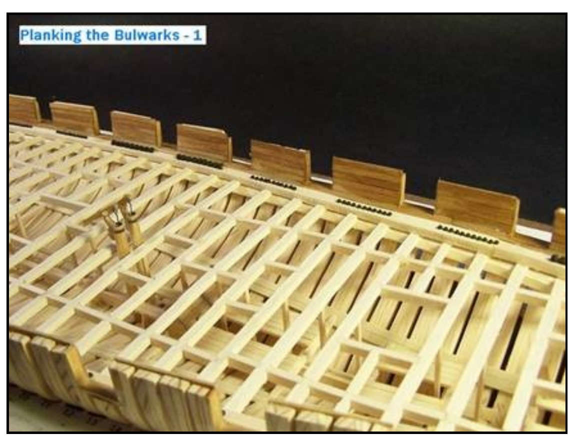
Finally, sand all timbers smooth and even with the frames on both the interior and exterior sides.





Planking the Bulwarks

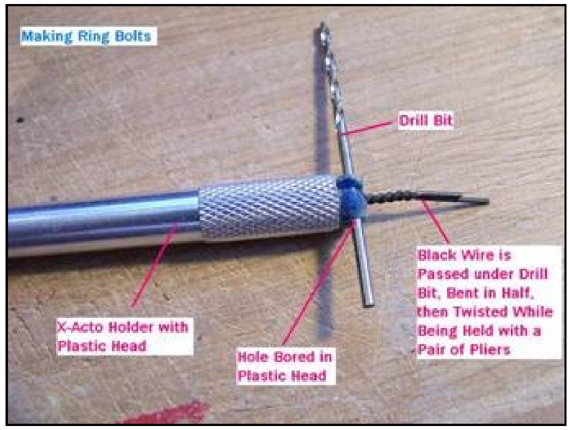
The bulwarks are planked with 1/32" x 5/32" basswood cut to 4" lengths and stained with Golden Oak stain. Each strake of planking was glued onto every frame with carpenter's glue and clamped in place until dry. After the glue dried, the planking is trimmed even with the gun port openings. The gun port openings can also be stained at this time.



Eyebolts for the Rigging of the Guns

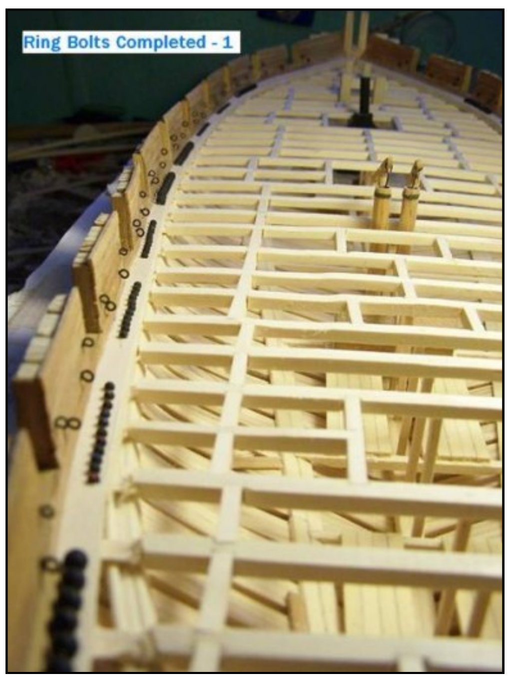
It's a good idea to install all eyebolts before any of the deck fittings are installed. If you install them after the fittings are in place, you will find that the fittings get in the way of the installation process.

Before making the eyebolts, first make a template for marking the location of the eyebolts on the bulwarks. By marking with a template you will ensure that all eyebolts are consistently and accurately located. Use the template by placing it midway between two gun ports at the proper height and then puncture the holes slightly with an awl. Then drill the holes.



There are two different sizes of eyebolts -- one size is made from 22-gauge black wire that is wound around a #51 drill bit, and the other size is made from 28-gauge black wire that is wound around a #54 drill bit.

To make the eyebolts I used an old X-Acto handle that has a plastic head. I drilled a hole through both parts of the plastic head. Then place the proper size drill bit through both holes. Take a length of black wire and slip it under the drill bit between the two holes. Bend the wire in half.



Grab both ends of the wire with a pair of pliers. Hold the X-Acto handle tautly and twist it round and round until the wire forms an eyebolt. Snip off excess wire, leaving around 1/8" length to fit into the hole. You will need 48 pieces of each size of wire to make a total of 96 eyebolts.

Install the eyebolts into the bulwark holes by holding the eye of the eyebolt with a small pair of pliers, then put a touch of CA glue on the twisted part of the wire, and push it into the hole. Each eyebolt will be in a vertical position when installed properly.

CHAPTER 5

EXTERNAL HULL

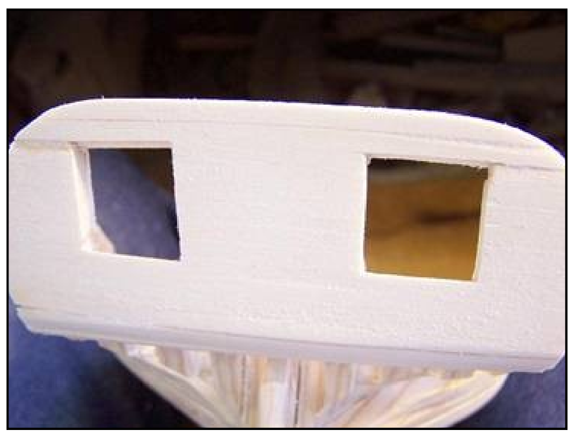
Before starting on the deck fittings we will finish the external hull, including the rudder, the transom area, all external planking, the channels, and chainplates.

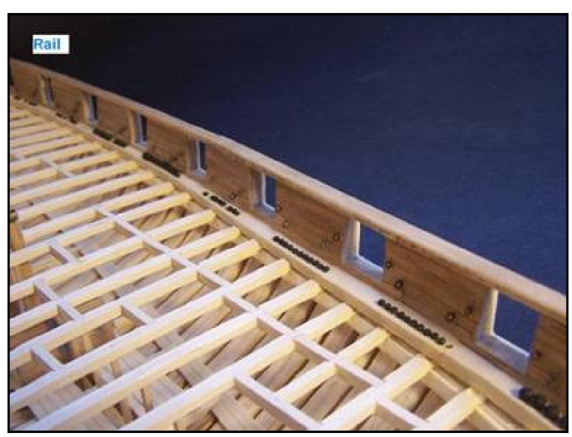
The Rudder

The pattern for the rudder is shown on the Inboard Profile Plan. Cut out the rudder at the same thickness that you used for your keel assembly. Round all edges except the side that faces the sternpost, which should remain flat. The head of the rudder will project into the deck. Use a small bamboo dowels for the three pintles. Use thin card painted black for the braces, and glue them in place at the angle shown on the plans. Now glue the rudder assembly in place on the sternpost.

The Exterior Transom Area

Install a piece of wood above the two gun port openings and shape it as shown on the plans. Plank the exterior transom with 1/16" material about 5/32" wide. It's best to plank over the entire transom area, including the gun port openings, using carpenter's glue. Note that a port and starboard sides of the transom are slightly curved. Cut out the gun port openings after the planking has dried.





Planking the Exterior Hull

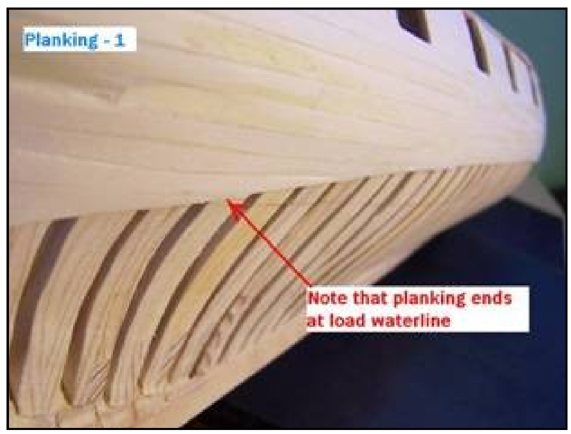
1. Installing the Rail -- The rail is made of 1/8" thick basswood cut to the shape shown on the plans. I used Golden Oak stain to give the rail its warm brown appearance. Apply an ample amount of carpenter's glue to the top edges of the frames, and then pin the rail in place until the glue dries.

2, Marking the Load Water Line -- Place the model in a perfectly upright position, ensuring that it is perfectly level. Place a small block of wood exactly 11/16" high under the keel at the bow area (the load water line is NOT perpendicular to the base of the keel, so this 11/16" piece of wood placed under the keel will allow it to be marked perfectly where it belongs). Now place a pencil in your waterline marking gauge so that its point is exactly 2 1/4" above its base. Very carefully mark the waterline all around the model.

3. Planking the Hull -- For all planking above the load water line I used 1/16" basswood. First, I laid out two battens (1/16" x 1/16" wood) the full length of the hull in order to get the general sweep of the planking. This sweep should look pleasing to the eye and may need some adjustment until you get it just right. The battens on both port and starboard should be identical. Draw a pencil line across the top of the full length of each batten and then remove the battens.

In the full-size ship the exterior planking averaged 8-10" in width, with the planking at the rail tending to be the thinnest in width.

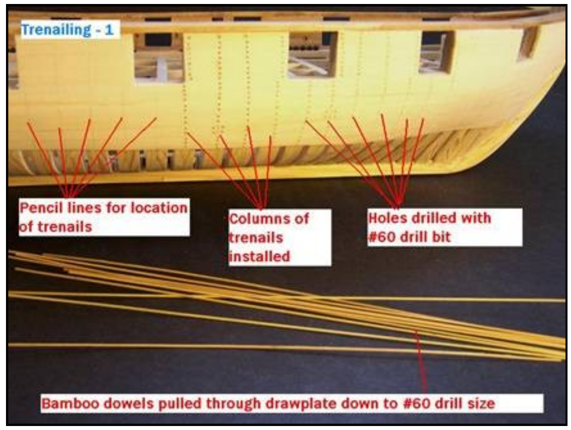
There are many rules to be aware of in planking any ship, especially in regards to the distance allowed between butt joints, the number of strakes allowed between two butt joints, etc. These rules can be found in nearly every book on modeling that discusses planking. Keep these rules in mind as you plank your model.



I highly recommend that you employ a good set of proportional dividers during the entire planking process. I will attempt to explain their use very briefly here. You will note that when you laid out your battens that the midship area of the space between two battens is significantly greater than it are at the bow or stern areas. This means that a single strake of planking will be its widest at the midship area, and then taper to a less width at the bow and at the stern. Making all measurements as described in the next paragraph will account for the varying width of any given strake of planking.

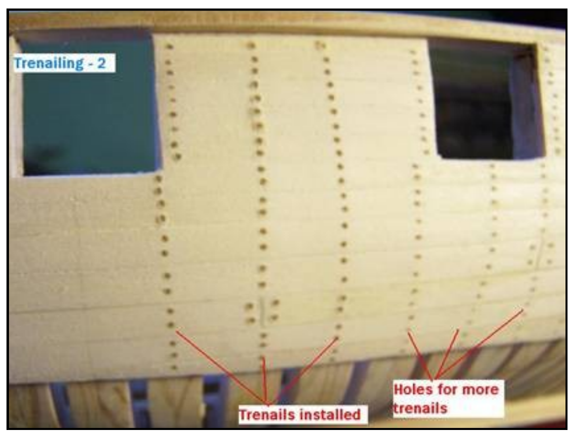
Measure the distance between the rail and the first batten line. Let us say hypothetically that it measures one inch at its widest point (amidships). Since we already know that the upper strakes (those at the rail) are of less width than those further down the hull, we can assume that these strakes are about 8" in width on the full-size ship. Thus, on 1:48 scale, we can fit about 5 strakes of planking between the rail and the first batten. Set your proportional dividers to a ratio of 1:5. Starting at the bow at about the third frame, place one point of your dividers at the point where the rail and the frame intersect, then open them up and place the other point on the first batten line. The other end of the dividers (the smaller end) shows you the exact width of that strake at that position. Take a straight piece of basswood long enough for a planking piece and plot your point on the wood with the dividers. Now move two or three frames over, and then repeat this process, marking this point on your planking material at that distance away from your first point. Repeat these steps for the length of the plank. Any single plank will always end half way between a given frame.

Now cut out the plank. It is best to use a steel French curve for this, because most planks will contain a very slight curvature. Glue and clamp the plank in place. Repeat this entire procedure for all the planks in the first strake below the rail. After you have exhausted all the planks for the first strake, change your proportional dividers to a ratio of 1:4 and repeat the whole process for the second strake of planking. For the next strake set your dividers to a ratio of 1:3 and repeat. Thus, as you can see, there is no measuring involved and the process is a relatively simple one.



All of the above steps can be performed for the upper several strakes of planking, but you will reach a time when spiling becomes necessary because the basswood can no longer be placed flat against the frames. Here again, spiling is addressed in many elementary books on planking.

Note that all planking extends to and ceases at the load water line. Cut off unwanted edges with a razor blade right at the load water line.



4. Trenailing -- Trenails are small pegs of wood inserted in holes in the planking that secure the planking to the frames. Probably the best material for trenails is bamboo. Pull bamboo strips through a drawplate until it is the size of a #60 drill bit. There are two trenails located at every frame on every plank. The butt ends of each plank will also have two trenails. Pierce these points with an awl and drill holes with a #60 drill bit. Add a touch of carpenter's glue to the tip of a bamboo dowel, insert it in a hole, and snip it off with a pair of toenail clippers. This is a slow, tedious, and time-consuming process, but the end result is well worth the effort.

Making your own trenails:

Step 1 -- I have experimented with many different materials for making trenails over the years, and I have found bamboo to be the best. Most of the time, I use the kind found in those small size sun shades that you can pick up a many stores, as shown in the photo below. Another good source is the type you find in a bamboo fishing pole, but here you're limited to the length by the distance between two of the knuckles of the pole. If you use the fishing pole, cut off lengths between two of the knuckles and then split that piece into smaller usable-size pieces.

Step 2 -- Take a piece of bamboo that your have split and sand it to a point on a sanding stick.

Step 3 -- Place your drawplate securely in a vise. By the way, I use a standard drill bit measuring gauge, not a drawplate. This works almost as well as a drawplate that is specifically made for making trenails. The drawplate, however, has the advantage of being countersunk at each hole, which makes pulling the bamboo a little easier.

Step 4 -- Insert the pointed end of the bamboo piece into a hole in the drawplate. The chosen hole will be the one into which the bamboo will fit snugly. Grab about 1/4" of the pointed end with a pair of pliers, hold firmly, and pull the bamboo smoothly all the way through that hole. Try not to stop pulling for its entire length so the bamboo doesn't get hung up. After you've used the pliers on the tip of the bamboo, you will frequently find that it is too flattened to use on the next hole.

Break that flattened area off, and re-sharpen another point. Then go to the next smaller hole and continue until you reach the size hole you are looking for. For a 0.06" dowel you would stop after you've pulled it through a #52 hole.

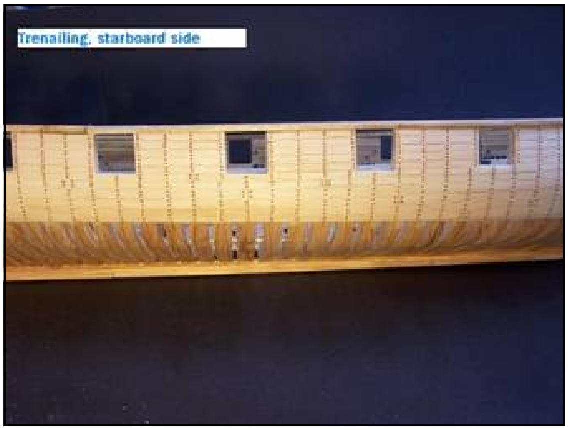
Repeat steps 2 through 4 for another piece of bamboo. You may be required to pull a piece a second time through the same hole because it won't fit into a smaller hole yet.

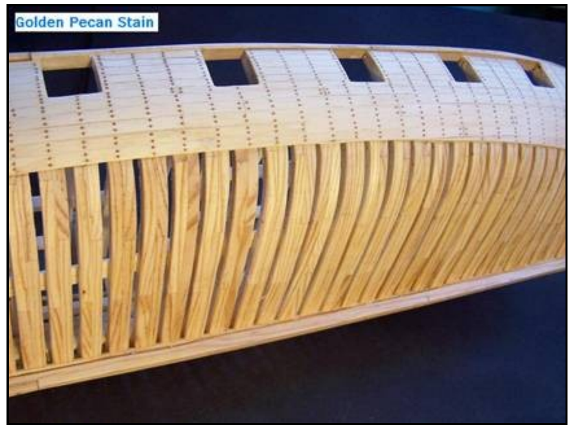
I recommend that you make about a dozen foot-long dowels at a sitting. This will take about an hour of your time. Use the foot-long piece to start inserting your trenails. Put a touch of glue on the tip, insert it about 1/8" deep, and then snip it off with a pair of toenail clippers. Thus, a single foot-long length of bamboo will make about 96 trenails.

Yes, trenailing is a tedious and time-consuming project. For example, the Eagle will require several thousand trenails, and I expect to spend somewhere around 35-40 hours installing all of them. However, when that task is finished, the results are stunning.

In the next three photos, the starboard side of the Eagle has been fully trenailed. After finishing this side, I gave the entire starboard side, including the frames, a coat of Pre-Stain Wood Conditioner and then a coat of Minwax Golden Pecan Stain to make the trenails stand out.

Tip: If you are building with a highly porous wood, such as basswood or pine, and if you plan on using stain as a finish, I recommend that you give it a coat of Pre-Stain Wood Conditioner before applying the stain. Porous woods do not usually accept stain very well, becoming blotchy with an uneven color. The Pre-Stain Wood Conditioner eliminates this problem; however, the stain must be applied within two hours after the conditioner is applied, or else it will not work.

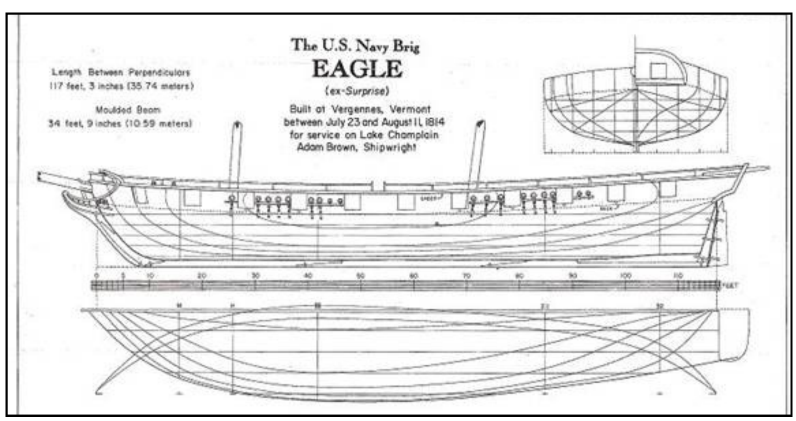




The trenailing is completed in the next two photos.

Channels

The plans for the channels are included in the scan below, which is an updated version of the *Eagle* plans sent to us by Dr. Crisman some time ago.



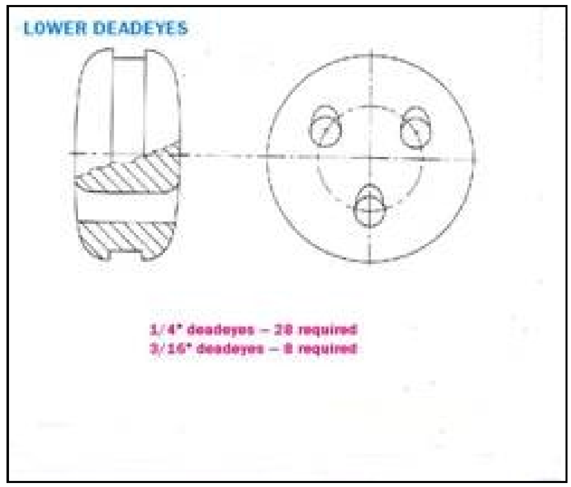
In building the channels, I used 3/32" basswood built up from gluing together 1/16" and 1/32: pieces of basswood. All channels are 1/4" wide, and their lengths vary as shown on the plans.

Since there will be a great deal of pressure on the channels when we start rigging the shrouds, I installed two 1/4" bamboo pins inserted into holes drilled on the inner edge of each channel, and corresponding holes into the hull planking, trying to ensure that the holes were set into the frames. This provides much greater strength to the channels.

After the channels have been installed, give them a couple of coats of golden pecan stain.

Lower Deadeyes and Chain Plates

Making Deadeyes -- Of course, you can purchase ready-made deadeyes, but I like to make literally everything from scratch, including blocks and deadeyes. A diagram for a correctly made deadeye appears to the right.



Chuck a prepared length of basswood in your miniature lathe, and turn it down to 1/14" diameter. Mark the width of each deadeye, which will be about 5/32". Using a miniature, knife-like file, cut grooves lightly on the marked places. Between each groove, use a slightly wider miniature file to cut the groove in the center of the deadeyes.

Remove the length of wood from the lathe. Then part off the first side of the deadeye with a razor saw. Using a sanding stick, sand the edge until it is smooth and slightly convex. Now part the first deadeye off with your razor saw, and then sand it between your fingers until it, too, is slightly convex. Repeat until you have completed 28 deadeyes of 1/4" diameter.

Using a small awl, mark the three holes for the laniard into each of the deadeyes. Holding each deadeye on a block of wood with a pair of large-size tweezers, carefully drill the holds perpendicularly to the deadeye with a small drill bitt.

Repeat this process for 8 more deadeyes of 3/16" diameter.

I stained all deadeyes with Natural Stain.

Making Chain Plates -- A diagram of the parts of a chain plate appears on the next page. This diagram is not followed exactly in the actual construction of each piece. For example, I have consolidated the toe link and middle link into a single piece, which is also called a preventer.

Starting with the preventer (the lowest part), I took an ordinary paperclip, opened it up, and punched each end of the length of the preventer with a hammer and metal punch. You can make about 5-6 preventers from a single paperclip.

Gently hammer the whole paperclip flatter, but not as flat as the two ends you punched.

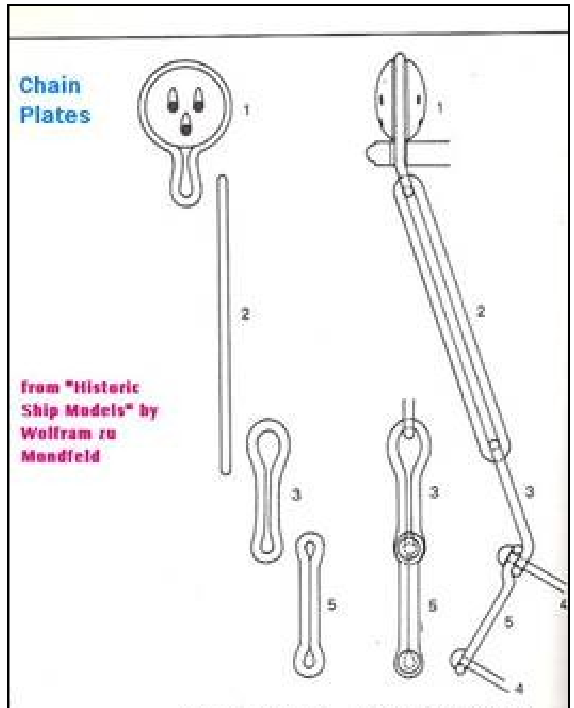
Make holes in the two flattened ends with an awl, and then drill small holes with a small drill bitt chucked in a Dremel.

Snip off each of the preventers with wire cutters.

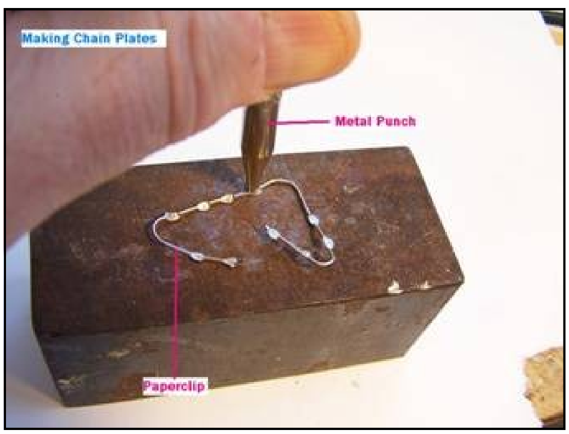
Using a grinding wheel, grind each end of the preventer, making it as round and flat as possible.

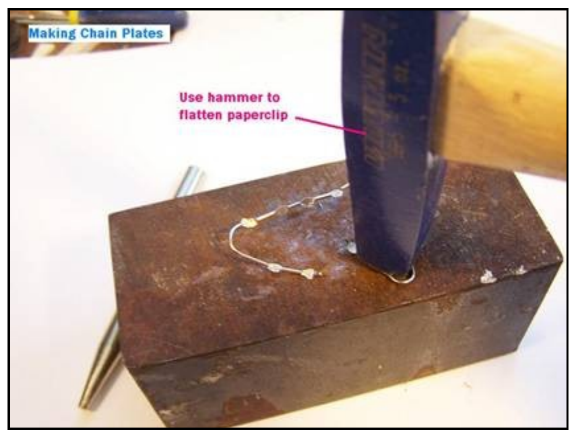
A finished preventer is shown in a photo below.

The middle link of the chain plate is simply a piece of 22-gauge wire bent to shape. The middle link is bent to shape to fit in the top

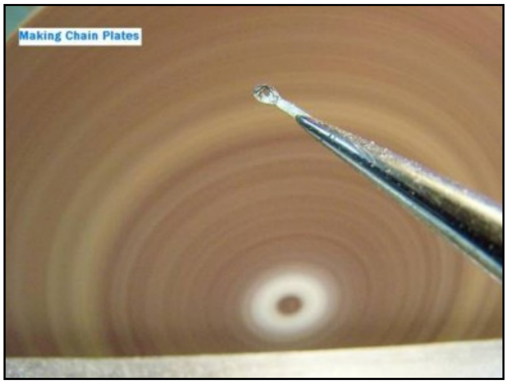


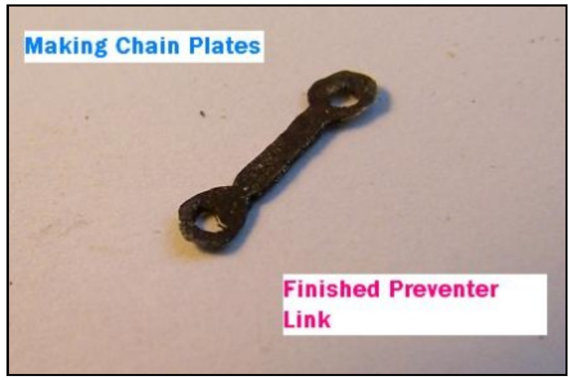
Chain plates: 1. Lower deadeye and upper link; 2. Middle link; 3. Toe link; 4. Bolts; 5. Preventer link





hole of the preventer link.

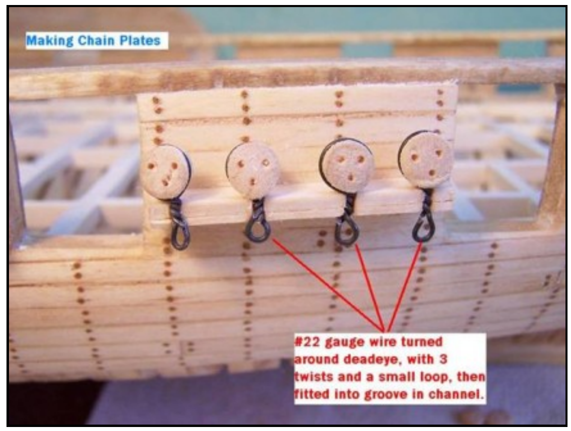




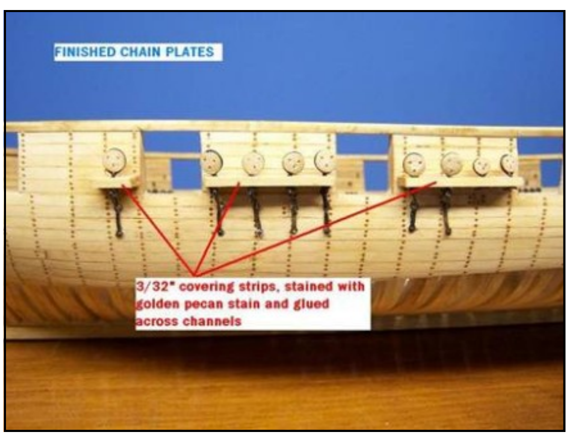
The upper link is also a piece of 22-gauge wire bent around the deadeye, followed by three twists, and then followed by a small loop below the twists. The area of the three twists will rest snugly in the groove of the channel.

Finally, a small pin, blacked with Blacken-It, is pinned into the lower hole of the preventer link.

Keep in mind that the angle of the chain plate will follow the positioning of the shroud attached to the deadeye.



After installing the lower deadeyes and chain plate assemblies, cut out a 3/32" length of 1/32"-thick basswood to cover the length of the channel, which also covers the three twists made in the upper link of the chain plate. These strips should be given a coat of Golden Pecan stain to match the hull planking.



Finishing the Stern

The top of the stern is exactly 1/4" higher than the main rail. Build it up to this height will a piece of 1/8" wood, if necessary.

Plank the stern area just like you did for the rest of the hull.

Install trenails in all frame areas of the planking, as you did for the hull. Sand smooth.

Give all of stern area a coat of Golden Pecan Stain.

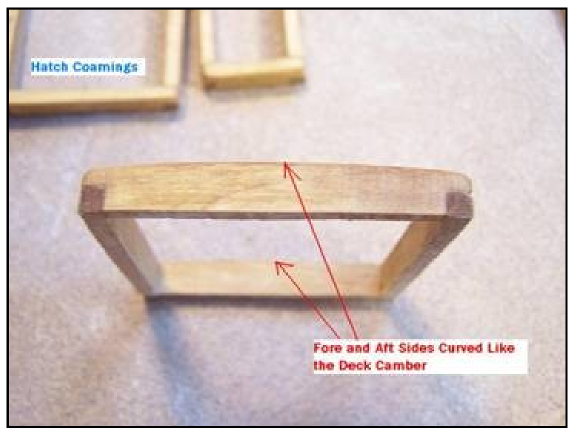
CHAPTER 6

DECK FITTINGS

Hatch Coamings

The *Eagle* has five hatches. The hatch coamings are relatively easy to build and consist of four pieces of 1/8" basswood with notches at each end that fit together. The length of each side is determined by measuring the rectangular area for each hatch, which will fit directly over the deck beams and corresponding carlings.

Cut out the required pieces about 3/16" in height, as shown in the photo below, and then glue them together. Note that the fore and aft edges of each hatch should be sanded to a curve that is similar to the camber of the deck. Give them all a coat of Golden Oak Stain. Do not glue them in place on the deck yet. Set aside.

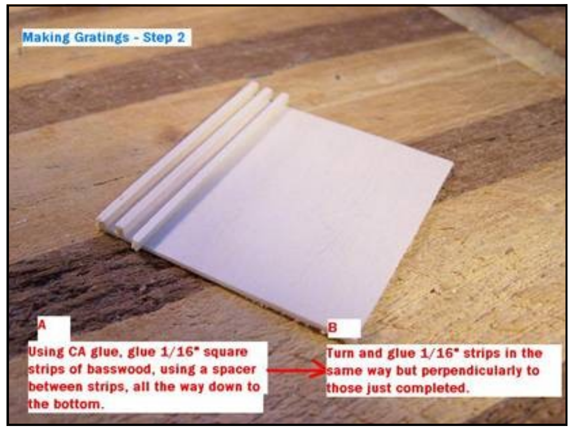


Gratings for Hatch Coamings

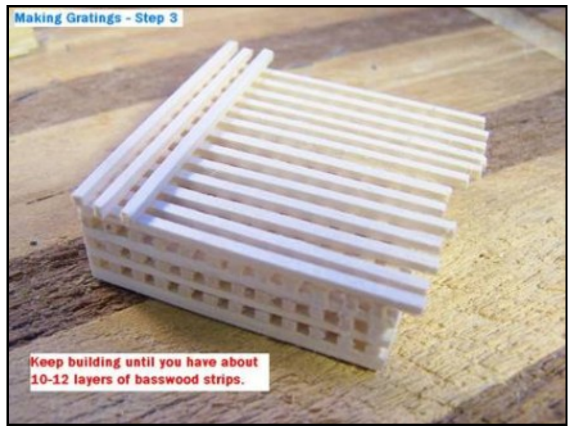
The hatches of most sailing warships were covered with gratings instead of hatch covers. I have chosen to make gratings for all hatch coamings.

I will describe a method of making gratings that is very effective and very simple. It is particularly useful for builders who do not own a Preac saw or other saw capable of making specialized cuts. In fact, the method requires no electrical tools at all, except for slicing out individual layers of gratings.

Step 1: Cut out a 2" square piece of 1/32" basswood. This will be your base for the gratings.



Step 2: Cut out many pieces of 1/16" square pieces of basswood a little longer than 2". Cut out one piece of 1/16" square pieces of basswood about 4" long, which will act as your spacer. Starting at the top of the base piece of basswood, glue a 1/16" square piece of basswood with CA glue even with that edge. Place your spacer directly under this strip, and glue another piece of 1/16" square strip. Take the spacer out and place it directly beneath the last square piece you just glued. Glue another 1/16" piece just under your spacer. Continue this process until you reach the bottom of the base piece. Now turn your assembly 90 degrees and begin gluing your 1/16" square strips perpendicularly to those you just finished, using your spacer as you go.



Step 3: Keep building layer upon layer of these 1/16" square pieces, alternating each layer of strips in perpendicular fashion. About 10-12 layers of strips should be sufficient.

Step 4: Examine the block of strips you have created. One two of its six sides look like proper gratings.

Step 5: Using a band saw, select a side that looks like a proper grating and slice it off on your band saw. Continue slicing off gratings until you've exhausted all the pieces.

Step 6: Sand both sides of the gratings with a pad sander. You may need to sand the inside of the square holes, too, especially if you used basswood, which is an extremely soft and fuzzy wood -- use a miniature pointed square file for this.

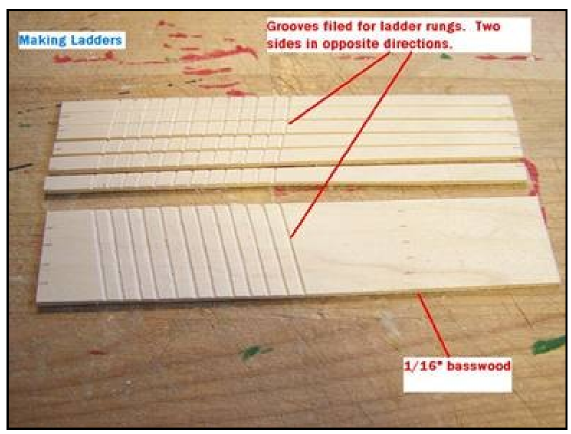
Step 7: Now place a hatch coaming upside down on a piece of grating material. (Incidentally, if the grating material is not large enough for a given hatch coaming, simply cut off the required piece from another grating and glue it on in proper position.) Precisely mark the area with a sharp pencil, making sure that the grating is centered properly. Test fit it in position (should be very snug). Now, glue it in position even with the top of the coaming. Note that each grating should be glued in position to match the curvature of the deck camber. Therefore, apply CA glue to one-half of the coaming the insert the grating and hold it in position until the glue dries. Then glue the other half, holding until the glue dries. This should result in the proper curvature.

I did not apply any finish to the grating. I have found that, if you use any kind of finish on basswood, stain or paint, the grating will warp considerably because of the small-size pieces being subjected to excessive moisture. If you use wood other than basswood, you may not experience this problem, however.

DO NOT permanently install the hatch coamings/gratings in position yet.

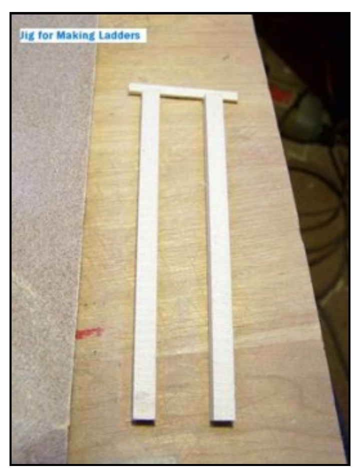
This method of making gratings originally appeared on a Spanish website (Modedismo Navalis), and I have used it here with some modifications.

Ladders



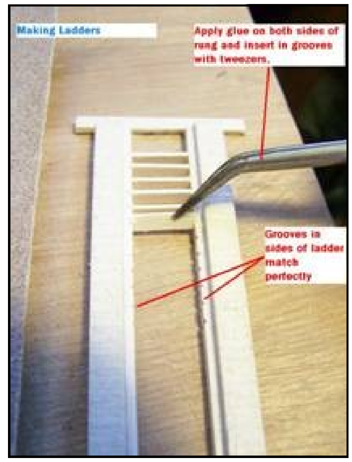
According to Dr. Crisman, there were at least five ladders on the Eagle, perhaps as many as seven.

The sides of the ladders are made from 1/16" thick basswood, 3/16" wide, and a little longer than what you expect to need for the length. (I made mine much longer, which makes it easier to handle for painting.) Measure and mark 5/32" spacing for the distance between the rungs. File grooves diagonally across the sides of the ladder at an angle that will be parallel to the deck when the ladder is finished. I made 12 grooves for 12 steps; you have to cut off 2-3 steps, depending on where a ladder is placed. Note that the grooves in each of the two sides will be in opposite directions, and they should align perfectly when the steps are inserted.



Make a simple jig of three pieces of wood, as shown below. The inside distance between the two long pieces should be equal to the width of the completed ladder.

Place two of the sides of a ladder against the inside of the jig, making sure that the two sides are situated so the steps will fit correctly. Cut out the steps, which are made from 1/32" thick basswood by 1/8" wide. The length of each piece is measured by finding the precise distance between two grooves directly

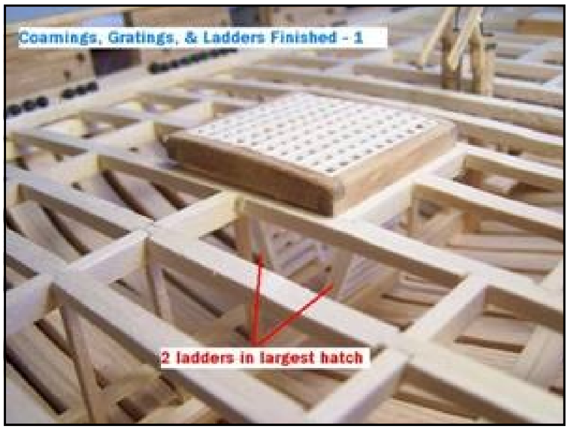


across from each other. Apply just a touch of glue to both ends of the step and, using tweezers, insert it in place. Continue this until all 12 steps are in place.

Remove the assembly from your jig as soon as you finished one ladder; it may need a little push from a thick piece of wood, pushing it toward the bottom of the jig.

After you've made five or more of the ladders, paint them with flat acrylic paint. Let dry.

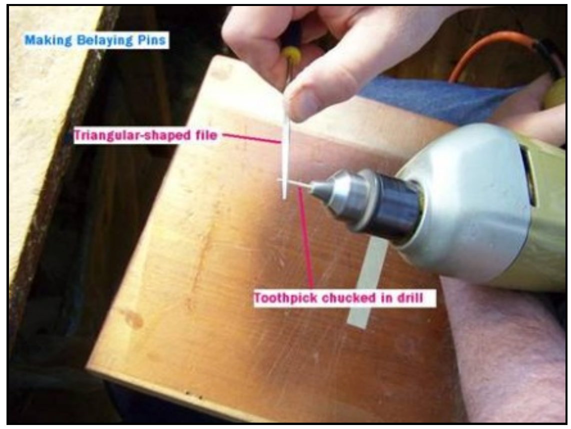
Apply a tad of glue to the contact points of the ladders inserted in its proper location. After you've secured all ladders in place, then install the hatch coamings and gratings permanently by applying a bit of glue.



Covering for Stove

This item is simply a piece of 1/16" basswood cut to fit on the deck beams and carlings over the stove area. A small rectangular hole is cut into this piece at the location of the base of the flue of the stove. The entire piece was given a coat of Golden Oak Stain and then glued in place.

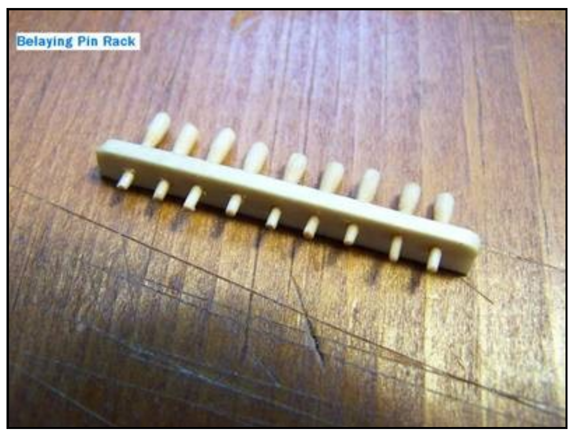
Belaying Pin Racks



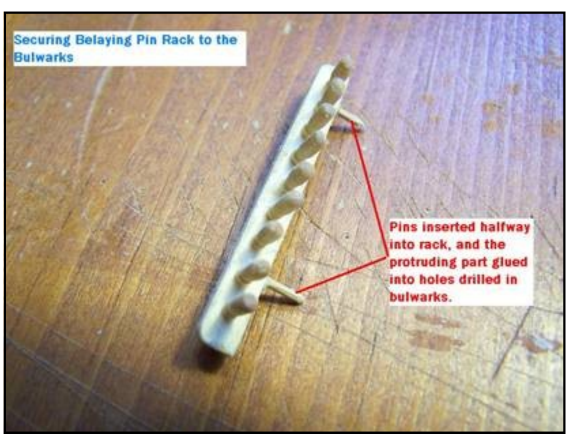
The bulwarks of the *Eagle* contain eight belaying pin racks, with nine belaying pins in each rack. Thus, you will need to make 72 belaying pins.

One of the simplest ways to make belaying pins is to chuck a toothpick into an electric drill, turn on the drill, and file the toothpick to the shape of a belaying pin with a triangular-shaped miniature file. See the photo below. The only difficulty you will experience is getting them all to look the same. This is not as difficult as it seems, because you will grow quite adept at it after making only a few of them. Each one can be completed in less than a minute.

The belaying pin racks are made of 1/16" thick basswood 3/16" wide and long enough to fit between the gun ports, as shown on the Inboard Profile Plan. There are nine equally spaced holes drilled into each belaying pin rack. The outer corners of each rack are slightly rounded. (There were never any sharp corners on any warship.) Insert belaying pins into each hole. Glue is unnecessary. Simply dip the whole unit into Natural Stain, wipe it dry, and let dry completely.



Since the rigging attached to belaying pins exerts a certain amount of pressure on the racks, it is recommended that you install wooden pins (at least two) into the inner edge of each rack to help secure it strongly to the bulwarks. This is shown in a photo above. Drill corresponding holes in the bulwarks. Then apply CA glue to the whole assembly, including the wooden pins, and attached it to the bulwarks, holding firmly until dry.

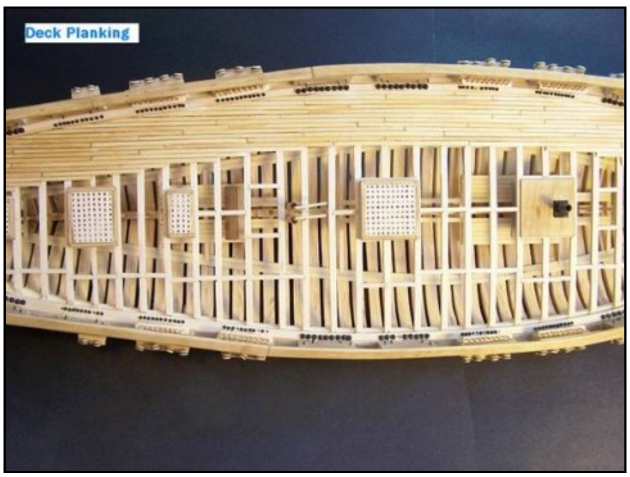


Deck Planking

In keeping with the concept of an admiralty-style build, only a part of the deck planking needs to be completed. What part you complete depends on your purpose for the model. I have chosen to display a full array of guns on the port side of the ship, leaving the starboard side with no guns, so I planked only that portion of the deck where those guns will be situated. Of course, some admiralty models only display one or two guns, or perhaps no guns at all -- the choice is yours.

For the deck planking I used 1/16" thick basswood 5/32" wide. The lengths can vary but should not be more than 20 feet long on scale. To simulate the caulking in between individual deck planks I rubbed one edge of each plank with a very soft lead pencil (6B works great). When installing them with carpenter's glue, I made sure that the "caulked" side of a plank always faced in the same direction. It helps to weight each plank down as it dries.

When the planking is finished, it can be sanded smooth and given a coat of Golden Pecan Stain.

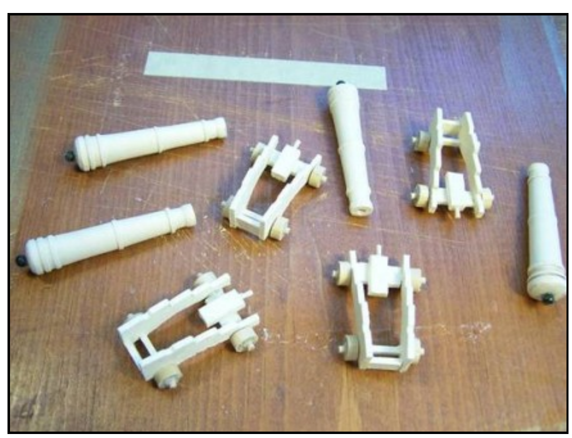


Armament

The *Eagle* carried 20 guns, including eight 18-pounder long guns and twelve 32-pound carronades. Their arrangement is shown on the Inboard Profile and Deck Plan. I will be building half of the required number of guns.

a. Long Guns

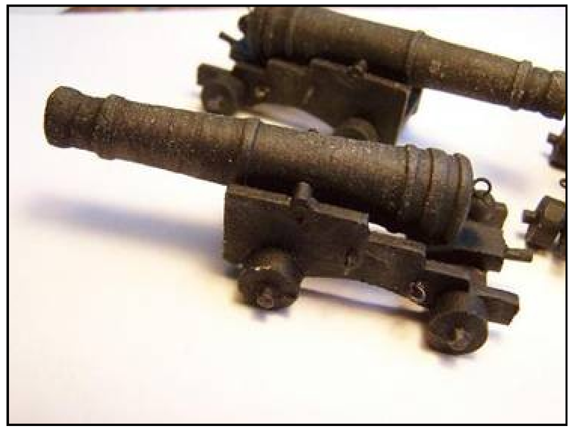
The gun carriages made of 1/16" basswood. Make patterns of all the required parts so that all are consistently formed. Each carriage, as shown so far in the photo below, consists of 2 carriage sides, 1 transom, 2 different axles, and quoin made of 1/8" basswood, and a piece of toothpick to suggest the handle of the quoin. Four 5/16" wheels are cut from birth dowels. The part of the axle protruding from each wheel is a 1/16" birch dowel cut to 1/16" long.



The cannon barrel is a 1/2" diameter piece of basswood turned on a miniature lathe. The cascabel of the barrel is a round pin head.

Each long gun requires at least 5 eyebolts: one on each side the carriage for the breeching; one on each side of the carriages for the gun tackle; and 1 above the cascabel for the breeching. Each eyebolt is made from 26-gauge black wire.

Drill a hole for the trunnion in the gun barrel, and insert a 1/16" trunnion so that it extends to both edges of the carriage.



Paint the carriages and the gun barrels separately with flat black acrylic paint. After the paint dries, mount the barrel in the carriage. Do not place them on the deck yet -- some of the gun tackle will be installed off the ship.

Carronades

I made 6 carronades to complete one half of the required number. The carronades were designed to fire 32-pound shot. However, they could also fire a potpourri mixture of missiles at point-blank range.

As shown in the photo below, the carronade platforms consist of 3 pieces of basswood cut to the shapes shown, which can be measured from the Deck Plan. The two lower pieces are 1/8" thick and the upper piece is 1/16" thick. The two wheels are made from a 1/16" dowel, with both sides formed from 1/32" basswood strips. Note that the wheels are installed so that the carronades can swivel sideways, not forward and backward. Each platform contains six 28-gauge eyebolts and two 24-gauge eyebolts (for the breeching). The finished platforms are dipped in Golden Oak Stain and left to dry.

The barrels are turned on a miniature lathe from 3/8" square basswood. The breeching ring is formed from 28-gauge black wire.

The carronades barrels are mounted atop a quoin and a piece that represents a bolt, with both pieces made of basswood painted black.

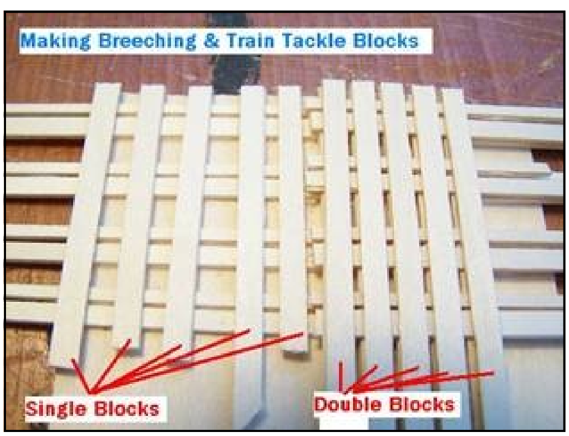
Making Blocks for the Breechings and Train Tackles

Each long gun and each carronades requires two 3/16" single blocks and two 3/16" double blocks. All blocks will have hooks attached (not shown in photos yet).

There are many ways to make your own blocks. I am showing only one method that I

used here -- a method that is described in details in many elementary ship modeling books. Using 1/32" basswood cut strips and glue them to a base piece of 1/32" basswood. The space between two of the strips will represent the hole through which the tackle rope passes. For double blocks the strips of basswood are repeated a second time.

After the glue has dried, cut out individual blocks, and then sand them to the shape of a block in whatever fashion you can -- a sanding stick or miniature file works well. Dip the finished products into Golden Pecan Stain and wipe dry.



Gun Rigging

The breech and tackle rigging I used two different sizes of DMC cotton thread, running them through a piece of beeswax a few times. Most elementary texts on ship modeling include a diagram of the precise rigging required. Hooks are installed in the single and double blocks. The breeching is installed on the cannon before it is secured permanently to the deck, and then both ends are tied to the eyebolts in the bulwarks. The tackle blocks are fully rigged off the cannon, then hooked to the appropriate end bolts. The rope coils are made by placing a very small amount of carpenter's glue on the deck, and then winding the rope carefully into a coil atop the glued area.

Ship's Wheel

Of course, you may purchase a ship's wheel from a commercial source, but you must subject such a purchase to a very critical appraisal. I do not recommend plastic or metal, mainly because it is impossible to make these material look like timber

Making a ship's wheel yourself is a very tricky task. For the Eagle it is a double wheel. Each wheel consists of a nave, a wheel rim, 8 spokes, and 8 handles. Each of the wheels is mounted on each end of a barrel. The barrel assembly is fitted on a pedestal at both ends, which is installed on a platform.

I made mine as follows: The wheel rim is cut off from a 1" birth dowel. I drilled a large hole in the center of this piece, and then used a small sanding drum to enlarge the size of the hole to about 7/8" -- if you try to drill the hole this size, the wood will split in all likelihood. Now divide the rim into 8 equal sections. Drill a small hole at the outer edge of the rim for each section you marked.

Make the spokes from toothpicks by inserting a toothpick into a drill bit and then use a file to shape each spoke carefully. The outer edge of the spoke should fit easily from the inside of the rim into one of the 8 holes. Make it slightly longer than necessary so that it is able to slide back and forth in the hole (very slightly). The inner edge of each spoke, after being shaped properly, should be made into a point to fit into a corresponding hole drilled in the barrel.

Make the barrel from a 1/4" dowel. Mark and drill 8 tiny holes at each end of the barrel. Place a supply of slow-drying glue at each hole in one end of the barrel all at once. Insert the barrel in the center of one of the rim/spokes assembly. Using tweezers, push the inner end of each spoke into its corresponding hole, while at the same time ensuring that it's long enough NOT to come out of the hole at the rim. Then let this assembly dry completely. Repeat this for the outer rim/spoke assembly at the outer end of the barrel.

Make 8 handles for each wheel by shaping toothpicks chucked in a drill bit and filing to size. The lower end of each handle will be made so that it fits into the tiny hole drilled at the outer end of the rim. Use CA glue to glue each handle in place.

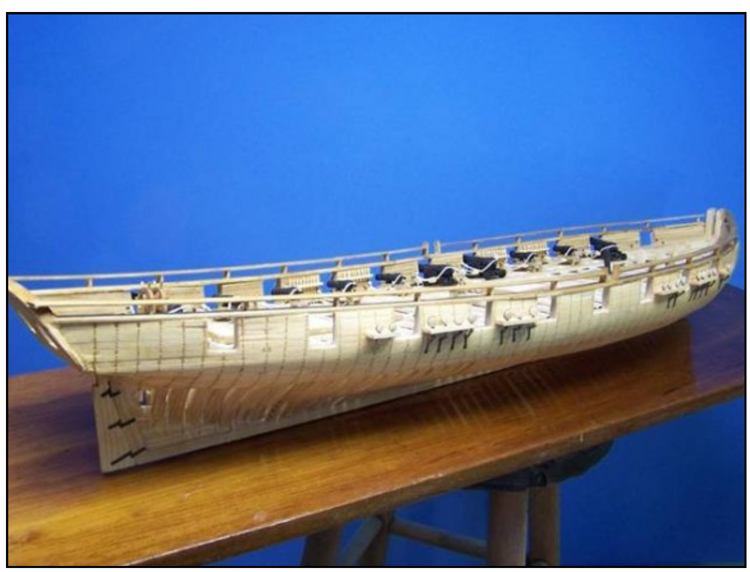
Make and install the two pedestals with CA glue. Finally, make and install the platform.

The entire assembly may be dipped in Golden Oak Stain and wiped dry. Glue the finished unit in place, as shown on Crisman's Deck Plan.

The tiller housing and tiller are all made from 1/16" basswood and given a coat of Golden Oak Stain. Glue in place.

Top Rail

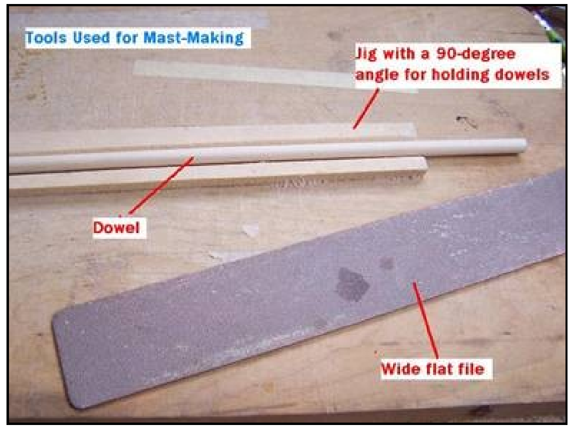
The top rail is precisely 1/4" above the main rail. As shown on the Inboard Profile Plan, there are eleven posts on both the port and starboard sides holding the rail up. The posts are made from small pieces of basswood 1/4" high x 3/16" wide. I reinforced each post with a small bamboo dowel glued into the post and the rail. The rail itself is made many pieces of 1/16" bass-wood by 5/16" wide, with each piece shaped to fit. Each piece of the top rail is glued in place with CA glue. Finally,



the rail and posts were all given a coat of Golden Oak Stain.

CHAPTER 7

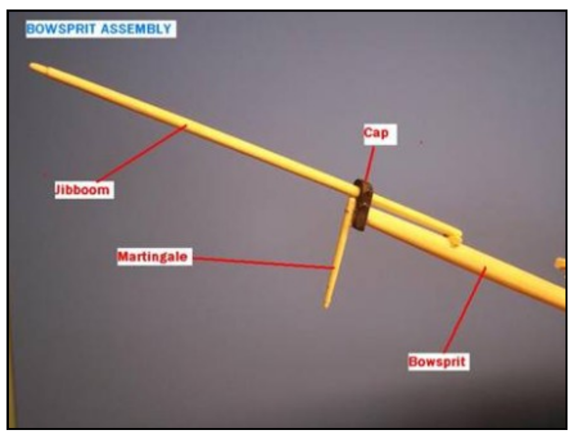
MASTS, YARDS, AND BOOMS

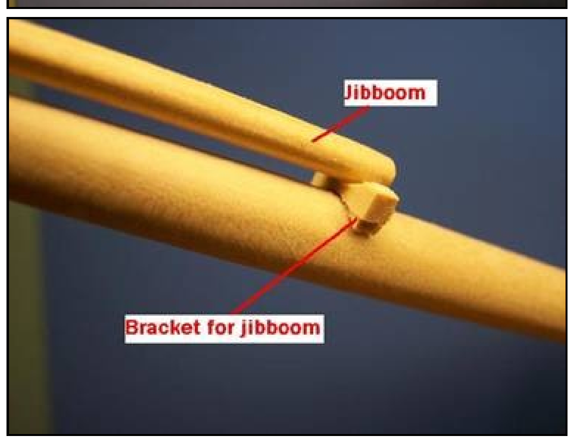


You don't need a lot of special tools to shape masts and yards. You don't even need a lathe. To make all masts, spars, and booms, all you really need is a disk sander, a jig for holding a dowel, and a wide, flat file. The disk sander can be used for tapering a dowel; simply hold the dowel in one hand and run the dowel with a twisting motion across the face of the disk, and at the same time pulling it toward you. This takes some practice, but with time you will able to produce perfectly tapered dowels. It can be finished off with a sheet of sandpaper folded around the dowel and pushed back and forth in your hand.

The jig for holding the dowel to form octagonal areas on a mast or spar is simply two lengths of basswood cut off at a 45-degree angle and glued adjacent to each other so that the dowel can be held firmly in place. The wide, flat file is used to file flat areas on the dowel, including octagonal areas. For an octagonal area simply file one side flat, turn 180 degrees and file a second area flat, and keep turning until you have completed eight flat areas. This will also take some practice, but is easily accomplished with a little practice.

The plans for the masts, yards, and booms are found on page 271 of Crisman's dissertation. These much be enlarged to 1:48 scale in your Brava Reader program.





Bowsprit Assembly

This assembly is comprised of the bowsprit, the jibboom, and bowsprit cap, and the martingale. One end of the bowsprit is octagonal in shape, as shown in Crisman's dissertation. File this end of the dowel as described above. Taper and file the jibboom likewise.

Install a bracket on the bowsprit where the jibboom will rest.

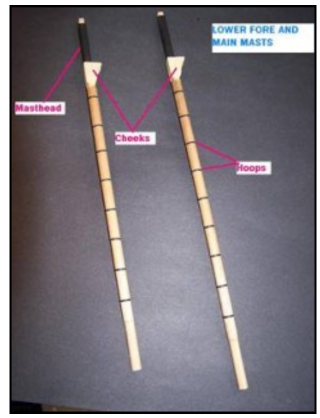
Make the bowsprit cap. Note that the jibboom fit into the upper hole in the cap, while the bowsprit will be squared to fit into the lower end. There are two eyebolts on each side of the cap for rigging lines. The mast cap is painted flat black.

The martingale also has a slight taper at its lower half. Note that there are two small holes at the lower end for rigging lines. Drill these carefully. The martingale can be glued and doweled with bamboo at the cap. Note that the martingale and bowsprit cap are perpendicular to the waterline.

The assembly is given at coat of Natural Stain.

Glue the whole assembly together. Install it in place in the hole in the bow between the two knightheads. The octagonal end of the bowsprit also has a small tenon that fits into a hole in a piece made for it, as shown in the photo below.

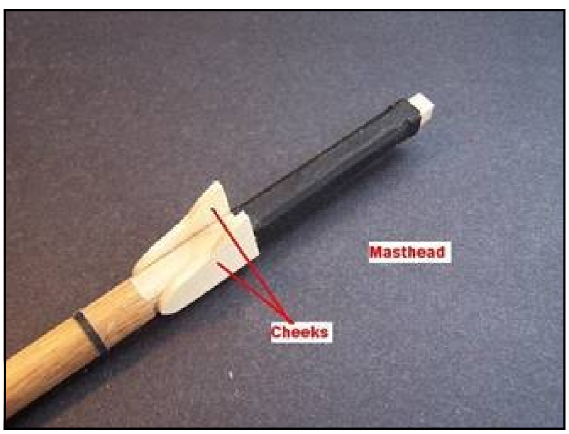
Lower Fore and Main Masts



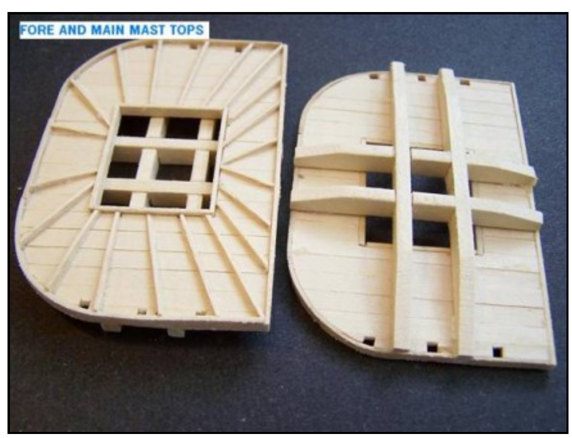
Both of these masts are identical, with the exception that the main mast is slightly longer than the foremast. The lower end of both masts is octagonal. There is a slight taper toward the mast-head. The masthead is square, with each square edge shaved slightly. Finally, there is a tenon at its top. Create all these shapes with your disk sander and wide, flat file.

There are 9 mast hoops on the mainmast and 8 on the foremast. I made these out of masking tape cut into 1/8" wide strips and painted black. Use a touch of Carpenter's glue when you install them around each mast.

The cheeks are made of 1/16" basswood shaped as shown in the plans. They are glued to a flat area on the masts at the lower end of the masthead. The top of the cheeks should be parallel to the deckline.



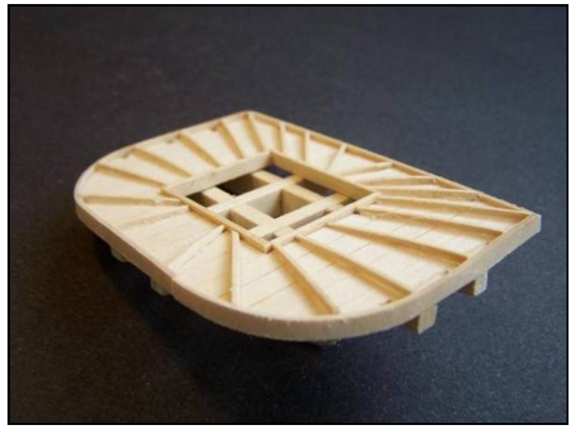
The masthead is painted flat black, and the rest is given a coat of Natural Stain.



Lower Fore and Main Mast Tops and Trestletrees.

The floors of the tops are cut from 1/16" bass-wood. All other parts of the tops are 1/32”

basswood. The ring that supports the ribs at the top is also 1/32" basswood that has been cut out ACROSS the grain of the wood so that it can be bent easily. Note that the ribs are



tapered toward the center of the top and they are distributed radially are fairly even spacing. Remember to cut three holes on each side of the top for the futtock shroud rigging.

The trestletrees are made of 1/8" basswood cut to the lengths shown on the plans. They are fitted together with notches cut in each pair. They should be tapered on each underside as shown in the photo (this is not shown on the plans). When the trestletrees are finished, the tops should be glued on top of them, as shown in the photo. Make sure they are properly centered.

Topmasts and Topgallant Masts

These two masts are prepared similarly to the foremasts and mainmast. Note that they are separated by crosstrees at their respective mastheads. The crosstrees are made from 1/16" basswood and finally painted black. Follow the plans for their assembly.

Installing the masts

Test fit all the parts of the mast. Once you are certain they are properly shaped and fit nicely together, glue all parts together, ensuring that they remain perfectly in alignment. Let the glue dry thoroughly.

Using a 1/8" piece of basswood, cut it to a shape that fits on the deck beams and carlings at the location of both the foremast and mainmast. Drill a hole in each piece, making sure that the hole corresponds with the rake of each mast. File the holes to fit the octagonal shapes of each lower mast. Test-fit the piece with each mast in place, and make sure to have the rake of each mast in perfect position.

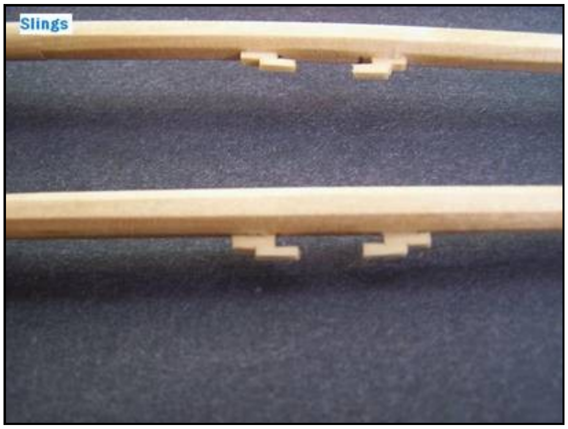
Once you are satisfied that the mast will fit properly, shape the heel of the mast with a tenon that fits into the mast step. Remember that there is a small square hole in each mast step. Test-fit the mast once again. Apply CA glue amply at this tenon, and also at the deck line of the lower mast. Glue the mast in position. Check that the mast is perfectly upright and properly rakes, and hold in position until dry (30 seconds or so).

Yards and Booms

The *Eagle* contains nine spars: Main and fore yards; main and fore topsail yards; main and fore topgallant yards, the spritsail yard, the spanker boom, and the spanker gaff.

Make each spar as previously described. Note that the central areas of the main and fore yards and topsail yards are octagonal in shape.

Make the yard slings as shown in the plans and glue them in place. Mine are cut from basswood, with the main and fore yard slings being 1/8" thick, and the rest being made from 1/16" basswood.



Note that all yards contain yard arm cleats, which are used to hold rigging in place. Use 1/16" basswood for the larger yards and 1/32" basswood for the smaller yards, gluing them in place with CA glue.

The spanker boom and gaff both have jaws built into the inner end of them. The jaws are held in place with three iron bands. Add an extra piece of 1/8" thick basswood for each side of the jaw, and shape both pieces to look like jaws. The iron bands are masking tape painted black. Note also that there is a tiny hole in the end of each jaw, which will eventually hold the parral with its trucks.

After you have completed all the spars, set them aside. We won't be working with them again until we install the running rigging.

CHAPTER 8

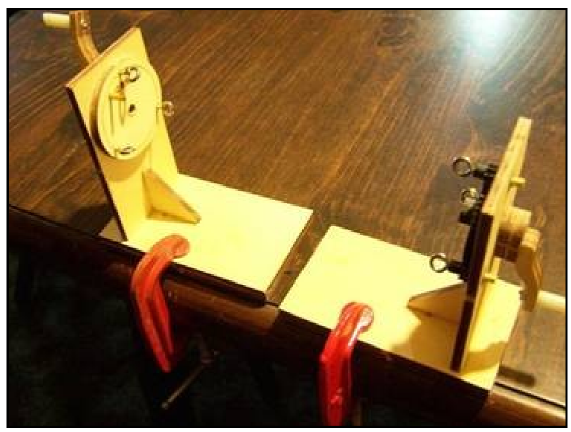
STANDING RIGGING

Introduction

Let us begin by discussing the type of thread to be used in rigging the *Eagle*. Many of you will most likely purchased ready-made rope from a source you are already familiar with. Other will have their favorite type of thread on hand -- stuff they've used for years. Some of your will use a rope-making machine. In fact, some of you will build your own rope-making machine from one of the many plans that are available on the Internet.

Many people say that linen thread is the best to use if you're using a rope-making machine. Opinions vary widely as to the type of thread that is "best," with each person having a favorite, or at least a type that they're familiar with.

For many, many years I have used DMC Cebelia 100% cotton thread for all rigging, with no exceptions. Doesn't cotton have a lot of fuzz? No, not if you beeswax it. Doesn't cotton look less like real rope that other material, such as linen? No, not if you make your own rope on a rope-making machine. Doesn't this type of thread have only a limited number of colors? Yes, but you can dye it in many different ways.



Rigging any ship is a time-consuming and tedious project, but it is also very relaxing and fun if you take it one step at a time. To those who have never rigged a ship this part of the project looks daunting and downright scary, especially with its apparent web of confused rope going every which way. However, I must say that, once you understand a few basic principles, all rigging is perfectly understandable, and you will find no confusion whatsoever. It's organized and consistent, too.

This tutorial will provide you with every detail you need to rig the *Eagle* properly, including the size of the various ropes, how they should be connected, and the blocks sizes that should be used, and why each rope is there in the first place. Many of the details that will be provided here are not provided in other sets of plans; in fact, most of the time, you must do your own research. However, this tutorial will assume that you have never rigged a ship in your life.

For making my own rope I use a simple device that I purchased a couple of years ago from Model-Expo in Florida. It's an extremely simplified device (see photo below) compared to some that are homemade; however, it suits the purpose and does a very good job, especially with the Cebelia cotton thread that I use for my rigging. You can indeed use the Cebelia thread right off the ball if it is the right size. However, in many cases, you will be required to make your own rope because the rope is not manufactured in the larger sizes needed for some models. Therefore, if you don't buy your own rope, I recommend that you get a rope-making machine, or make one from the many plans that can be found. In fact, perhaps one of our members could post a set of plans and explain its use.

All standing rigging is made to be attached to the masts of a vessel, never the spars. Thus, all standing rigging is fixed in place only on the masts, and its only purpose is to support those masts in a particular direction. All standing rigging is immovable. It has nothing to do with controlling the yards, booms, gaff, or what have you.

From this point on you will be using Crisman's Rigging Profile Plan found on p. 272 of his dissertation. You will not need to enlarge this plan; in fact, even if you did, it leaves much to be desired concerning the details. It is a "general" diagram in the sense that it is assumed that you known many details that are not shown on the plan.

Our first task in installing the standing rigging is to install the shrouds. A shroud is a the rope that supports the mast laterally, running from the masthead to the side of the ship, usually ending with a deadeye secured with a laniard into the corresponding deadeye in the channel. The *Eagle* has 5 shrouds on each side of the lower foremast, five more on each side of the lower mainmast; four on each side of the topmast; another four on each side of the mainmast; two on each side of the fore topgallant mast; and another two on each side of the main topgallant mast.

The lower foremast shrouds on our scale (1:48) should be 0.055" thick, and the lower mainmast shrouds should be 0.065" thick. Three pieces of #20 Cebelia cotton thread about 45" long should be twisted on your rope-making machine for the 0.055" size, and you will need 5 of these ropes. Three pieces of #10 Cebelia cotton thread about 45" long should be twisted on your rope-making machine for the 0.065" size, and you will also need 5 of these ropes as well. The finished larger-size rope appears in a photo below.

To rig all the shrouds you will also need to make forty-four 1/4" deadeyes and sixteen 3/16" deadeyes.

Lower Foremast and Mainmast Shrouds

As I mentioned, the rope size of the lower foremast shrouds is 0056" and the rope size of the lower mainmast shrouds is 0.065". I am using #20 DMC cotton thread turned on a ropewalk for the foremast shrouds and #10 DMC cotton thread turned on a ropewalk for the mainmast shrouds.

If you are making your own rope on a ropewalk, you can measure the size of the rope you are making by using the following information: Take a length of 1/4" dowel and mark off a 1/4" interval at one end, leaving about a half-inch space at the very end of the dowel. Starting at your left -hand mark (if you're right-handed), wind your piece of thread around the dowel snugly until you reach the other quarter-inch mark. Don't pull too tautly. When you've covered your 1/4" markings, count the number of turns you've made for the rope and multiply by 4 to get the number of turns per inch. Now divide that number into the basic unit of one inch to get the size of your thread. For example, if you've counted 32 turns on your 1/4" markings, then 32 x 4 = 128. Then 1 divided by 128 = 0.0078".

A very useful book for determining rope sizes for the rigging of American vessels is *The Art of Rigging* by George Biddlecombe. The back of the book contains tables that provide information on rope sizes and types and sizes of blocks as well. It is indispensable for finding this information if you don't have such information available from any other source. One thing you need to determine in order to use Biddlecombe's tables is the tonnage of the vessel. To determine the tonnage I used the following formula:

$$\frac{\text{Length of Deck} \times \text{Maximum Beam} \times \text{Depth of Hold}}{94}$$

Thus, based on these figures for the *Eagle*, it tonnage is about 320 tons. I realize that this figures conflicts with Crisman's figure of 500-550 tons, but I have used this formula for every vessel I've ever rigged. In fact, if 500-550 tons were indeed used for determining rigging sizes, the rigging on our ship would appear much too heavy for its size.

The shrouds are always set up in pairs (with a single pair called a span). The first shroud goes to the starboard forward side of the ship, the second to port forward, the third to starboard again, and so forth. The fifth shroud, called a swifter, stands alone. Each span is seized at the masthead. The swifters are seized similarly.

A deadeye is turned into the lower end of every shroud with a throat seizing and lashed with two round seizings a little further up. The deadeyes are then set up with laniards (#30 DMC cotton thread not turned on a ropewalk) to their counterparts in the channels. The proper way to install the laniards can be found in most texts on rigging. The end of the laniard is then lashed to the left-hand side of the deadeye as seen from outboard.

Fore and Main Topmast Shrouds

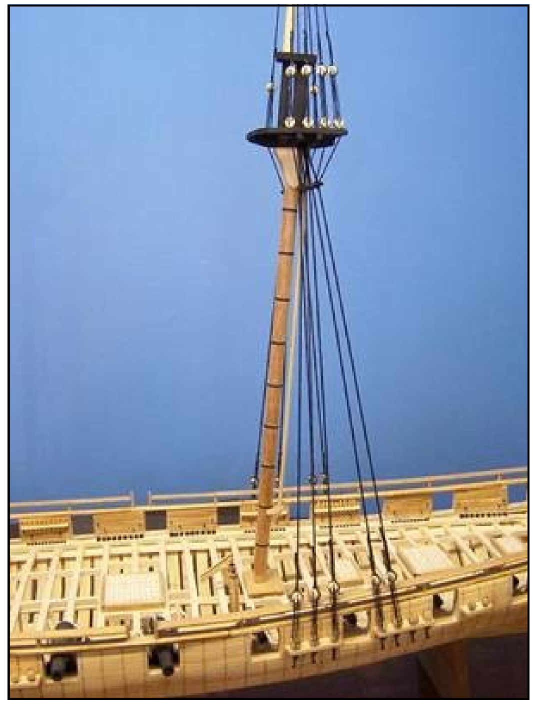
A futtock stave is lashed in place on the lower fore and mainmast shrouds one-and-a-quarter inches below the top on both port and starboard sides. There are 4 futtock shrouds (#20 DMC thread twisted on a ropewalk) on both sides of the top on both the foremast and mainmast. I consolidated a lower deadeye and futtock shroud, turning it once around the futtock stave and seizing it to its nearest shroud.
For all topmast shrouds I used #20 DMC thread twisted on a ropewalk. They are installed in the same way as the lower shrouds.

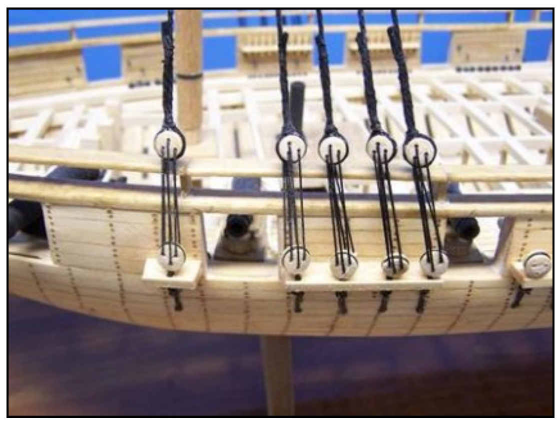
Topgallant Shrouds

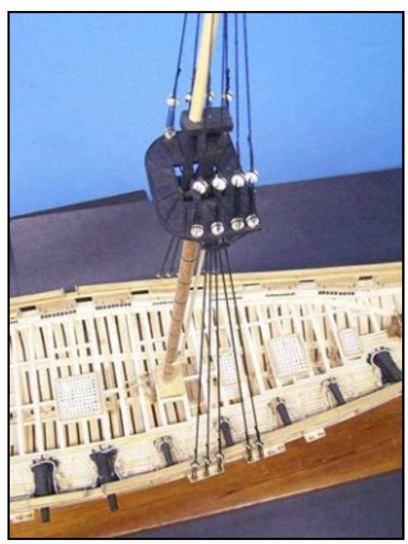
These are still incomplete in the photos below. They should be set up similarly to the topmast shrouds. There are two on each side of each mast. The deadeyes should be 3/16" and the rope size should be #20 DMS thread.

Backstays

Backstays are ropes which support the mast against the forward thrust of the sails. For the Eagle the topmast backstays stretch from the masthead, eye-spliced in a span, down to the two deadeyes aft of the swifter shroud. The topgallant backstays are two separate ropes on each





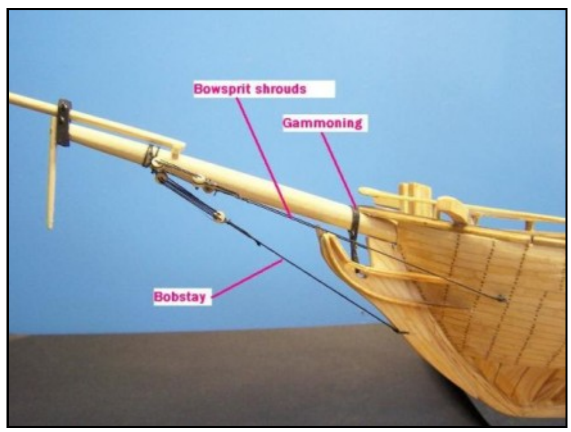


side of the foremast and mainmast, and they, too, are lashed separately around each mast location. The topmast backstays are 0.036" rope, while the topgallant backstays are 0.017" rope (#10 and #30 DMC cotton thread, respectively).

All backstays end with deadeyes in the channels, and they are finished off just like the shroud deadeyes, with one exception -- the topgallant deadeye laniards are about an inch longer, resulting in the deadeyes being a bit higher than the others in the same channel.

Bowsprit Shrouds and Bobstay

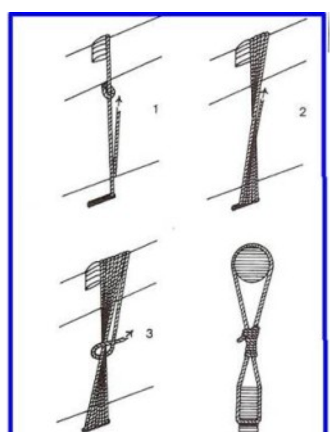
Although Crisman's rigging diagram does not show it, there should be one shroud on each side of the bowsprit, which should be 0.036" size rope (#10 DMC cotton thread). As shown in the photograph, each shroud is attached to an eyebolt in the ship's hull, and then with two deadeyes in a laniard at the bowsprit. The upper deadeye is attached to a collar around the bowsprit.



The purpose of the bobstay is to hold the bowsprit down against the strain of the foremast stays. Use 0.036" rope (#10 DMC thread). One end is lashed to a small hole drilled in the cutwater, where it is eye-spliced. The other end is set up with a collar and two deadeyes and a laniard.

Gammoning

The gammoning is a tautened rope staying the bowsprit to the knee of the head. It serves to hold the bowsprit down against the upward pull of the forestay. Use 0.048" rope. The proper way to install the gammoning is to: loop the rope over the bowsprit, pass it down to the knee of the head, through the gammoning hole, up again to the bowsprit and over it, back to the gammoning hole again, etc., the whole repeated about eight times. Each turn over the bowsprit is always in front of the previous turn, and at the gammoning hole, each turn was behind the previous turn. The last turn is passed over the bowsprit to the middle of the gammoning, taken around the gammoning eight



Sequence of the bowsprit gammoning

times, and made fast. The finished gammoning can be seen in the preceding photograph.

Stays

A stay provides support for a mast along its fore-and-aft axis.

MAINMAST STAYS

1. Lower Mainmast Stay (frequently called the Mainstay): This rope is the strongest rope on a ship, with the exception of the anchor cables. Use 0.07" rope. Start by forming an eye and a mouse around the masthead. Extend it to its lower end, where a 5/32" heart block will be installed. Another identical heart block is lashed to it with 0.02" rope about 3/4" long. The lower heart is secured in a large eye-bolt, which is glued to a hole in the deck slightly in front of the starboard side of the foremast.

2. Lower Mainmast Preventer Stay: Use a slightly smaller size rope, perhaps 0.06". It is installed exactly the same way as above, with the exception that its eye-bolt on the deck is secured to the port side of the foremast.

3. Main Topmast Stay: The stay is 0.036" rope. Lash a 1/4" single block about one-third of the way up the foremast masthead. Install an eye=bolt about 1/4" behind the base of the foremast. Install a cleat on the foremast about 1" above its deck-level. Now, it's best to rig this stay backwards. First, rig a tackle with a single block at the bottom and a double block at top. Then secure the stay rope to the double block. Secure the tackle arrangement properly and belay the end of the tackle to the cleat on the mast. Now take the stay and pass it through the single block at the foremast masthead and pull it up to the topgallant masthead, where it is secured with an eye-splice with a mouse. Tauten it up, but not so tight as to pull the pasts out of whack.

4. Main Topgallant Stay: The stay is 0.02" rope. First, lash a 3/32" single block about one-third of the way up the fore topmast masthead. Also install a small eye-bolt and a cleat in the foremast top. Rig a tackle with a single block at its bottom and a double block at its top. Secure the lower block to the eye-bolt, then glued the eye=bolt into a hole drilled in the top, and belay the loose end of the tackle to the cleat. Secure the stay to the top of this double block, and then pass the stay through the single block on the masthead, and finally secure the stay to the topmast masthead. This stay has no mouse; just eye-splice around the masthead.

FOREMAST STAYS

1. Forestay: Use 0.06" rope. The forestay is rigged in the same was as the mainstay, but it is made fast to the bowsprit about halfway between the jibboom and the bow of the ship, and it is lashed with two 5/32" heart blocks.

2. Fore Preventer Stay: Use 0.05" rope. This stay is rigged exactly the same as the forestay, and it ends at the bowsprit about 1" in front of the forestay.

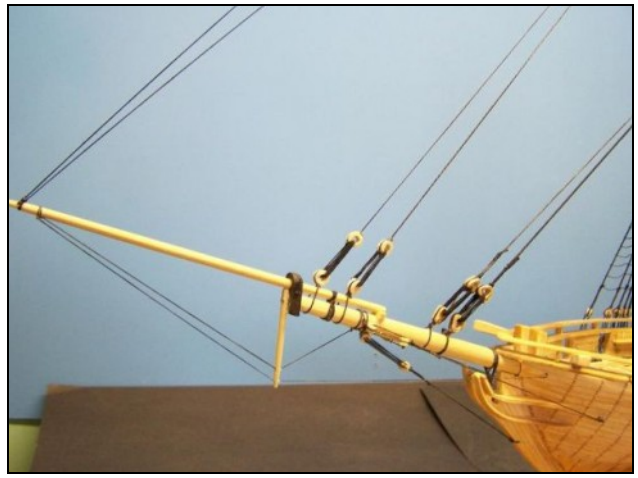
3. Fore Topmast Stay and Fore Topmast Preventer Stay: Use 0.036" rope for the fore topmast stay and 0.03" rope for the preventer. These stays are rigged exactly like the forestay, with the exception that they end at the bowsprit with two large thimbles instead of heart blocks. The laniard between the thimbles should be 0.015" rope. They are secured to the bowsprit just aft of the bowsprit cap.

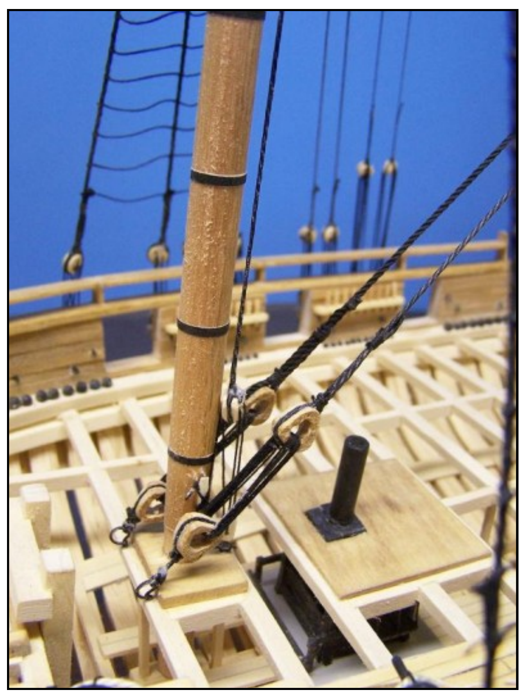
4. Fore Topgallant Stays: Use 0.02" rope. These are simply eye-spliced in place, as can be seen in the photos.

BOWSPRIT STAYS:

Martingale Stays: Use 0.03" rope. The outer stay is eye-spliced at the end of the jibboom, then passes through the lower hole in the martingale, and finally ends at an eye-bolt secured in the hull. The other rope passes through the upper hole in the martingale, but I'm not really sure where it ends for this brig. I eye-sliced it around the bowsprit.

The photos on the next few pages provide illustrations for the rigging of the stays.





CHAPTER 9

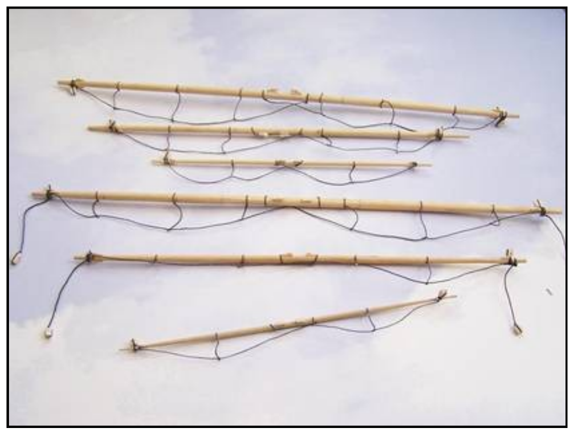
RUNNING RIGGING

FOOTROPES AND STIRRUPS

The footropes stretch under the yards and jibboom. The men used them to stand on while loosing or furling the sails. The stirrups are short ropes attached to the yard, supporting the footropes. Each stirrup leads through an eye in its lower end.

For the foremast and mainmast: Use 0.02" rope for the footropes of the main yard and fore yard, and 0.015" rope for the stirrups. Use 0.015" rope for the footropes of the topmast yards, and 0.01" rope for the stirrups. Use 0.01" rope for the footropes and stirrups for the topgallant yards. The footropes are the first ropes attached for the yards at the cleats near the ends of the yardarms. Note that footropes always cross over each other at their midpoints.

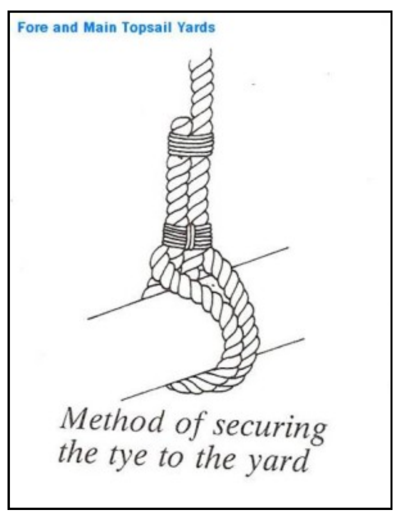
LIFT BLOCKS AND BRACE BLOCKS



I recommend that you install as much of the rigging gear as possible before securing the yards to the masts. It is much easier to add all required blocks to the yards in this manner. Since I expect to add only halyards, lifts, and braces on my model, I installed only the blocks required for such rigging. If you intend to fully rig the Eagle, several more blocks should be installed in their proper locations.

SLINGS AND TYES -- FORE AND MAIN MAST YARDS

The main yard and the fore yard contain slings that are rigging as shown in the diagram below. Use 0.04" tan rope. Note that these yards should be set about 1.5" below their respective tops.



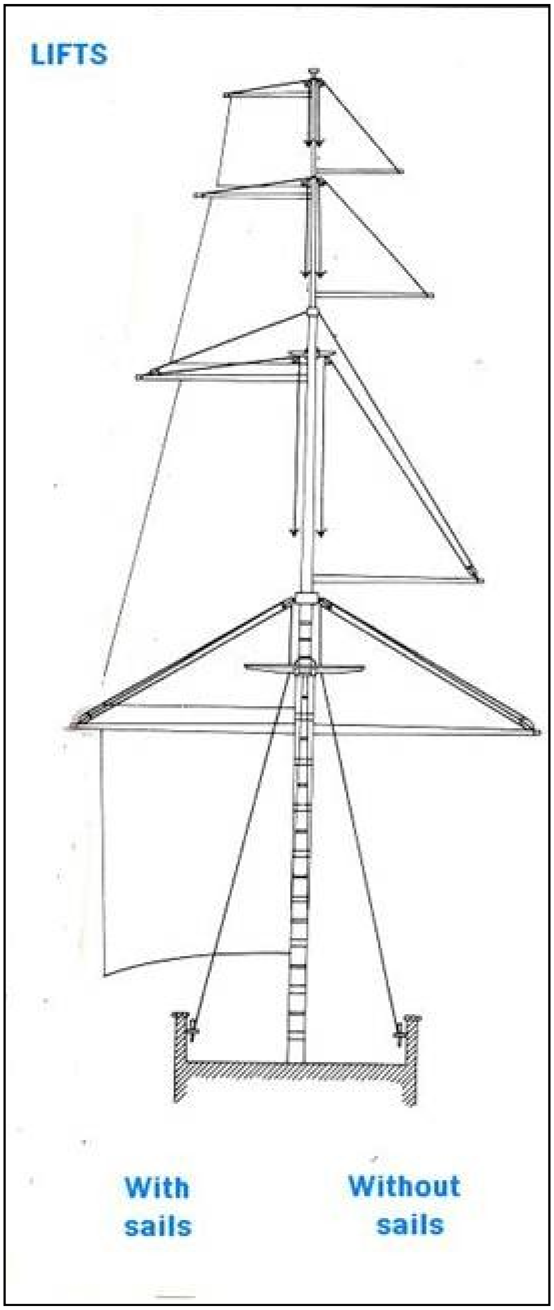
The remaining yards on the fore and main masts are rigged with simple tyes as shown in the diagram below. Use 0.02" tan rope for the both topsail yards. Pass the rope through a hole in the mast (to represent a sheave) just below the topmast futtock shrouds. Belay both in the lower tops.

The topgallant tyes are drawn through a hole in the mast just below the topgallant stays. They, too, are belayed in the lower tops.

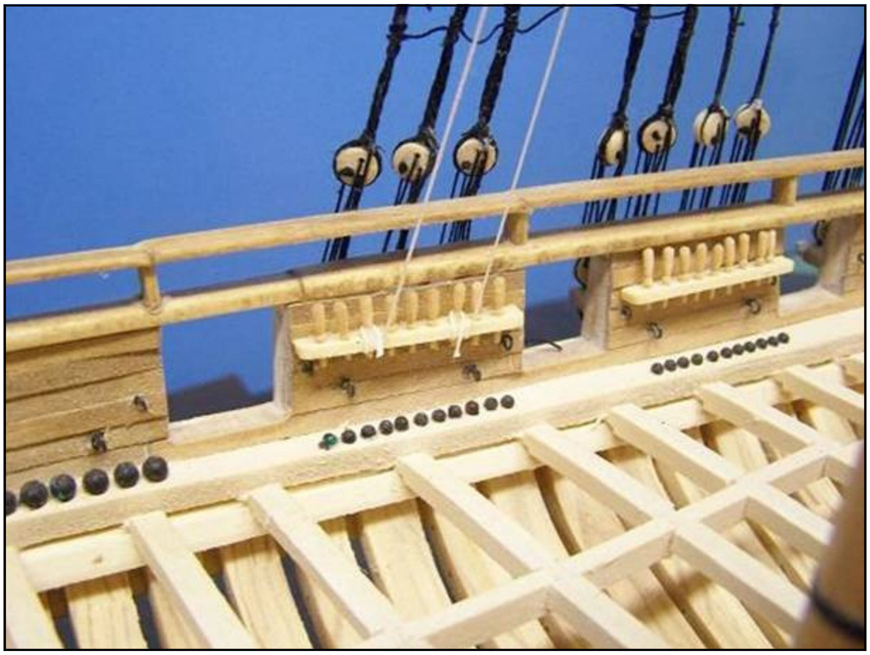
LIFTS

The lifts run from the masthead to the yardarms. They are used to square or alter the vertical angle of the yards. Three sizes of tan rope are required for the lifts -- the lower lifts are 0.02" rope; the topsail lifts are 0.017" rope; and the topgallant lifts are 0.013" rope.

The diagram below shows the method of rigging. The lower and topsail lifts are belayed to the pinrails, and the topgallant lifts are belayed to the lower tops.

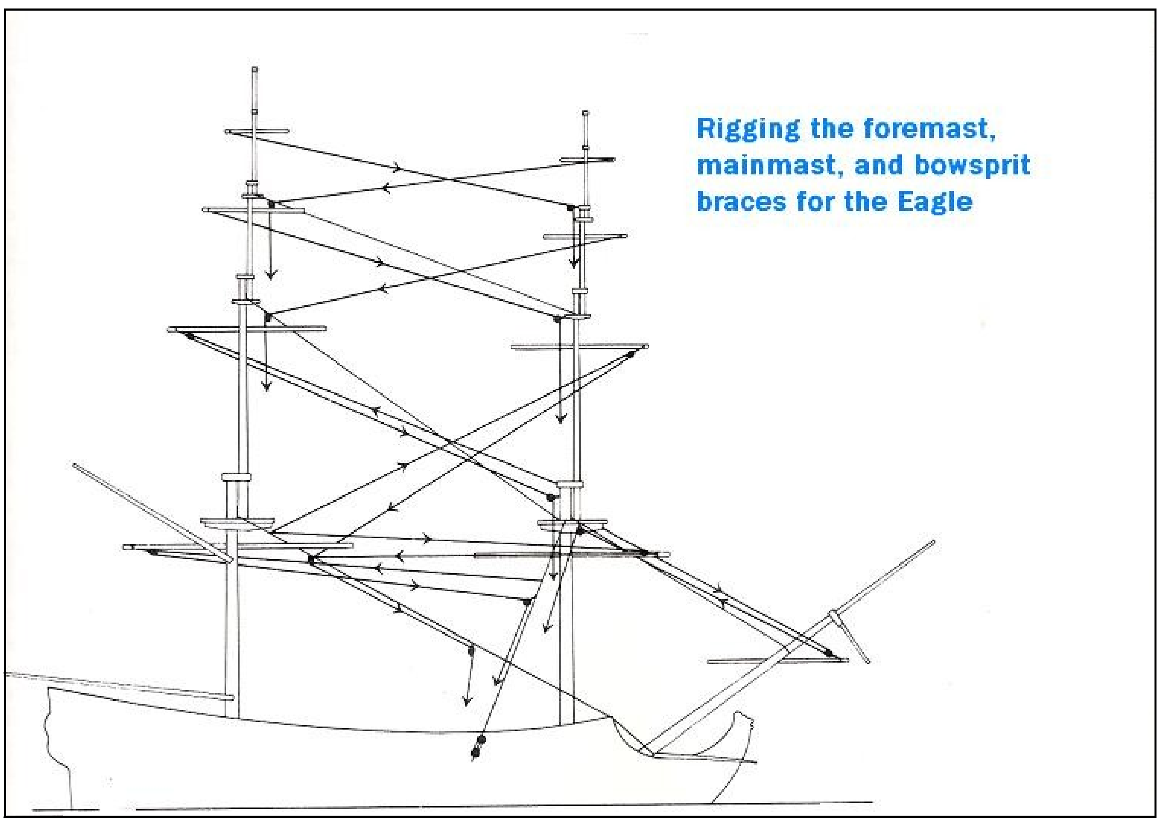


The next few pages show the details of slings, tyes, and lifts.



BRACES for the Fore and Main Masts

Following the rigging diagram shown below, use 0.02" rope for the main yard and more yard braces; 0.017" rope for the main and fore topsail yards; and 0.013" rope for the main and fore topgallant yards. I belayed all of them, probably not correctly, to the pinrails.



BOWSPRIT

For the bowsprit running rigging I had included only lifts and braces of the sprit yard. For both I used 0.017" rope.

SPANKER BOOM and GAFF

As already mentioned, it is best to install as much rigging gear as possible while the boom is still not installed on the ship. Lash blocks were required.

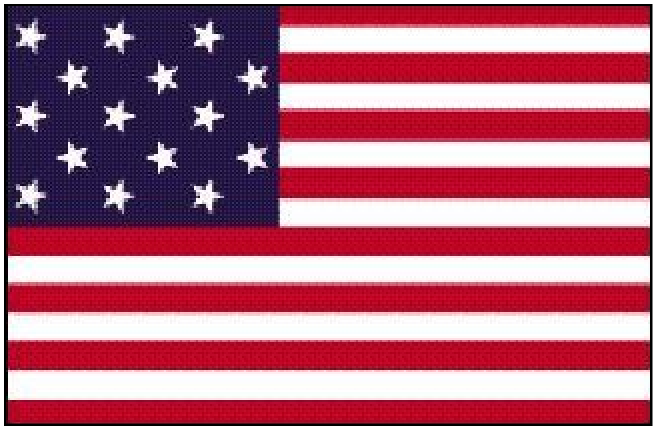
For the parral for both items I merely installed black thread to tie them to their appropriate mast.

For the spanker boom I recommend that you first install the topping lift (0.02" rope)), which runs from the aft end of the boom through a block in the main cap, and the belays to the deck. Next, install the horse near the center of the boom (0017" rope), which has a double and single block tackle that belays to the bulwarks or to the outer edges of the deck. Make sure the boom is centered on the ship.

For the spanker gaff install the peak halyard first, making sure the gaff is at the correct angle and centered properly. Rig the vangs next. They consist of a long double and single block tackle, with the lower single block attached to the side of the deck and the loose end belayed to a cleat in the bulwark. Vangs appear on both sides of the gaff.

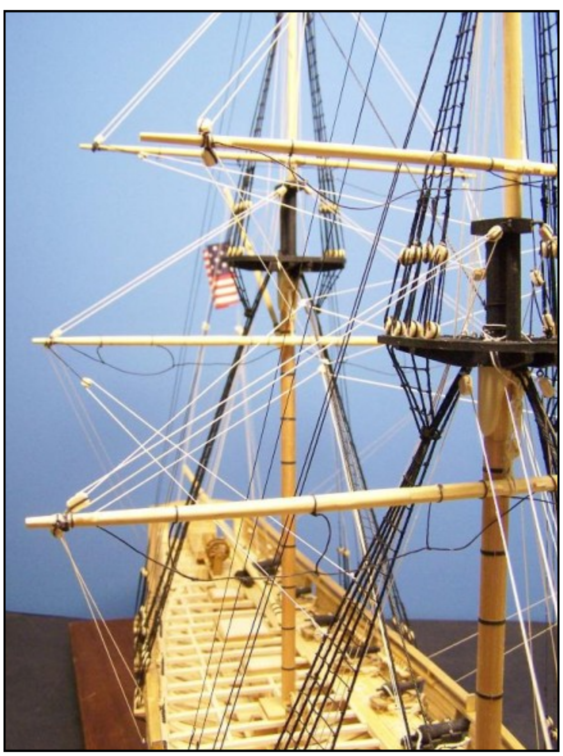
SIGNAL HALYARD

The signal halyard is very thin thread. Install a 15-star American flag on this halyard. Then secure it to the aft end of the gaff and belay it to the deck. The flag, which is known as "The Star-Spangled Banner" flag, can be picked up on the Internet, sized as necessary, and reversed horizontally on your computer. Or you can use the picture below. It should be near 3" in length on its shorter side.



SHEETS ON THE MAIN YARD AND FORE YARD

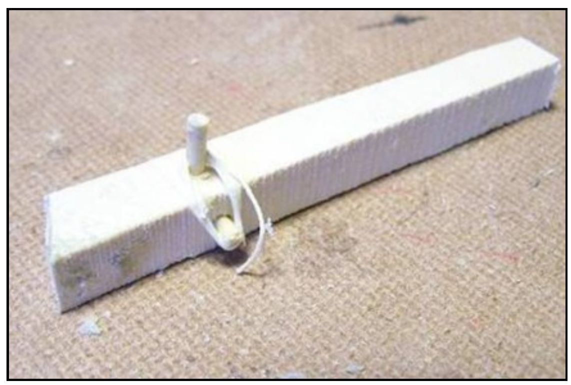
Since sheets for the lower yards are so prominent in most models, I decided to install them on the Eagle. Use 0.03" rope. It rums from an eye-bolt in the outer hull, up to a block on the yard-arm, and back to a hole in the hull near a belaying pin, where it is belayed.

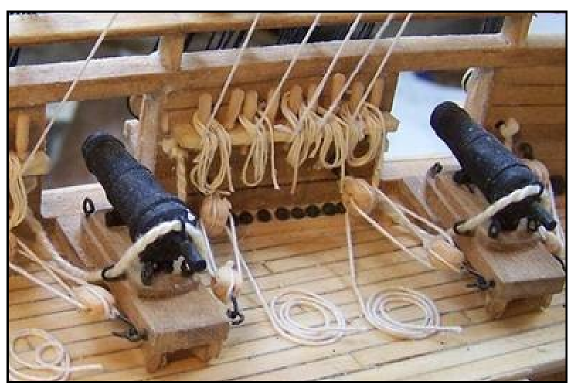


ROPE COILS FOR BELAYING PINS

A nicely shaped rope coil of rope should be installed on each rope that has been belayed to a belaying pin. Making the coil of rope is relatively easy. For each coil you should use the same size rope as was used for the rope that is belayed there.

To make a little jig for making rope coils, drill two small holes on a 1/4" piece of wood, as shown in the photo below. Glue a 1/8" piece of dowel in the hole on the side, and insert (do not glue) a similar dowel in the top hole. Place an ample supply of white glue between your thumb and forefinger, and then run a piece of rope through it several times to saturate the rope with glue





Wind the rope clockwise around the two dowels in your jig about four or five turns. Snip off excess rope, leaving a short piece to hang down. Remove the top dowel from the coil of rope. Grab the coil with a pair of tweezers, and then remove it from the dowel on the side. Carefully install the coil onto the appropriate belaying pin, slipping all the coils over the top of the belaying pin. Pull down gently by inserting the tweezers in the middle of the coil. Straighten out the loose end of the coil to make it look as natural as possible.

Try to do this rapidly because the glue tends to start drying quickly. If you can't get it to look right within a minute or two, start over and make another one.

CHAPTER 10

FINISHING THE EAGLE

ANCHORS

A couple of simple anchors of the period are required for the Eagle. Their shanks should measure about 2.5 inches on 1:48 scale, based on the size of the vessel. Of course, you will need to install a couple of hawse holes as well. This can be seen in a photo below.

HUMAN FIGURES

A few seamen added here and there always add interest and give the observer a sense of scale. The figures should be about 1.5" inches tall.

NAME PLATE

Brass name plates look great. If you wish to create your own, by all means do so.

This concludes the Eagle project. The following series of photos show the completed model.