

**Modeling the Hannah
Chapter 1
The Keel**



A Practicum by Robert E. Hunt

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1. The Keel

We begin our construction of the Hannah with the keel. Welcome! This chapter will deal with the construction of the keel structure. This structure consists of the stem, apron, keel, false keel, sternpost and stern deadwood. Our model will grow outward and upward from this starting point (even though it is going to be built upside down).

1.1 Introduction

Welcome to the Hannah practicum, fifth course in the [College of Model Shipbuilding](#). This practicum will guide you step by step in the scratchbuilt construction of the first armed vessel in George Washington's navy, the Hannah.

You will also need Harold Hahn's plans for the Hannah. These detailed and fully researched plans include a drawing of each frame in the model. To supplement your construction, Mr. Hahn has also written a book titled *The Colonial Schooner, 1763-1775*. These items may be purchased directly from him. His address is:

Harold Hahn
1212 Gordon Rd.
Lyndhurst, OH 44124

You might wonder why this practicum is even needed to construct the Hannah when Hahn's book contains a set of instructions on this same construction. Some of you might be able to build the model using only Hahn's book. But make no mistake, his book will not be plagiarized in this practicum, it will not even be used but for historical reference. I have developed my own methods of frame construction and framing for a Hahn style model that are simple, reliable, and will be explained in precise detail. I can assure you that when this practicum is finished, you will have the skills, knowledge and self-confidence to tackle any of Hahn's models alone, without the aid of a practicum. And you will be ready for the sixth course in the College of Model Shipbuilding, the *Bonhomme Richard*.

Our construction will cover in extreme detail, the step-by-step procedures I have used for years to construct frames using the Hahn method. The model will be built upside down in a jig but modifications will be made to Hahn's method of framing that will prove to be invaluable for future Hahn style models.

You will need many power tools to build this model. A section later in this chapter will outline the tools I own and what tools you will need if you follow the practicum precisely. If you intend to build other models from scratch, or even kits, these tools will become invaluable in your work.

1.1.1 Format of This Practicum

I will be using a special format throughout this practicum. First, each chapter will be broken down into sections and sections will be broken down into subsections. For example, Chapter 1 is on **The Keel**. This chapter is broken down into several sections:

- 1.1 Introduction
- 1.2 Preparing The Keel
- 1.3 Preparing The Stem

Sub sections will be numbered according to their section numbers:

- 1.1.1 Format of This Practicum
- 1.1.2 A Word About Tools
- 1.1.3 Some Supplies you will need

At the end of each sub section, a summary will be provided with checkboxes that you can use to check off the construction as it is completed.

Summary

- Remove all of the parts indicated on sheet 1 of your plans.
- Surface glue each pair of parts and clamp with office clips.
- Lay clamped parts on a level surface to prevent warpage.

This will enable you to first read the section/sub section to understand what you must do, and then keep track of your completion as you progress. It is hoped that this format will help to simplify the complexity and completeness of this practicum.

Should you encounter a problem or have a question, you should post it in the forum for the groups benefit. Please reference the section or sub section by number. This will make it easier for everyone to know exactly what area of the practicum you are having trouble with and answer your question.

1.1.2 A Word About Tools

I guess I should say something about tools. Over the years I have accumulated a number of tools and have become accustomed to their use. That is not to say that the list I'm going to give you is gospel. These are tools I like to use and it took me years to acquire them. I am not saying you need to rush out and buy all of these tools before starting this practicum. If you've been building model ships for a while, you probably have a lot of these tools or equivalents. Some of these tools are a must; some make the job go much easier. So I only list these because many modelers have asked me what tools I use to build my models. Where possible, I list the Micro Mark catalog numbers as I find that source to be

invaluable to the modeler. You can reach Micro Mark at (800) 225-1066 or <http://www.micromark.com>. I am in no way affiliated with Micro Mark nor do I receive any benefits from them by mentioning them in this practicum.

Here are the tools that I've acquired over the years and use frequently:

1. No. 5 Exacto knife handle (Micro Mark #36117).
2. No. 2 or equivalent Exacto knife handle (Micro Mark #14351 or 70233).
3. #10, #11 and #22 Exacto blades (Micro Mark #14360, 36102 and 36113).
4. Micro Saw Blades (Micro Mark #14346)
5. Dremel Rotary Tool (Micro Mark #82592)
6. Helping Hands (Micro Mark #21120)
7. Single edge razor blades
8. Weldbond white glue. (Home Depot or Lowes)
9. Zap A Gap mid cure super glue (Micro Mark #80877 or 80878)
10. Z Ends for Zap A Gap (Micro Mark #80890)
11. Five minute epoxy (Home Depot or Lowes)
12. Delta scroll saw or Jewelers Saw (Micro Mark #22105)
13. Byrnes Miniature Table Saw (Jim Byrnes)
14. Swiss style watchmakers tweezers (Micro Mark #19101)
15. Deluxe pin vise (Micro Mark #82110)
16. Dimensioned mini square (Micro Mark #82147)
17. Ponce wheel (Micro Mark #15200)
18. Steel machinist square (Micro Mark #10117)
19. Angled high precision micro shear (Micro Mark #80334)
20. Tweezer nose pliers (Micro Mark #80338)
21. Mid size file set (Micro Mark #81063)
22. Stainless steel 6" ruler (Micro Mark #10114)
23. True Sander (Micro Mark #14475)
24. Micro drill bit set (Micro Mark #60362)
25. 3" Toolmakers angle plates (Micro Mark #60626)
26. Office clips, small and medium size
27. Pan vise (Micro Mark #21123)
28. Delta bench top mini disk/belt sander (Micro Mark #82218)
29. Preac table saw
30. Preac thickness sander
31. 9" band saw
32. Mini wood lathe with duplicator (Carbatec)
33. Turbo carver with all available bits and compressor
34. Pasche single action air brush with compressor

There are probably other tools I use infrequently and did not mention. Every tool in the list above will probably be used during the course of this practicum. I must emphasize that since this practicum is the Graduate course in my *College of Model Shipbuilding*, I will be pulling out all of the stops, so to speak, and doing some extensive scratchbuilding, including turned cannons. This practicum is

meant to prepare you for the final practicum in the series, the Doctorate course. The Doctorate course will be the famous ship of John Paul Jones, the Bonhomme Richard in 1/4" scale.

1.1.3 Some Supplies You Will Need

There are several items I use regularly in my model building that constantly need replenishing. So that you will be prepared when the time comes, here is a list of certain supplies you will find yourself using routinely:

- Weldbond White Glue
- Zap A Gap Super Glue
- Z Ends (for Zap A Gap)
- Five Minute Epoxy
- Thirty Minute Epoxy
- Tracing Paper
- Thick Card Stock
- #10, 11, 13 and 22 Exacto Blades and Knife
- 100, 150, 220, 330 and 400 Grit Sandpaper
- #0000 Steel Wool
- Polyurethane Satin, Wipe On Poly or Sanding Sealer
- Toothpicks
- Office Clips, medium and small
- Rubbing Alcohol

Other items may be needed as we progress and I will try and give some advance notice of these items when they come up.

1.1.4 Copyright Notice And License Agreement

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When you purchase this practicum, you purchase it for life. It is not like a book that you can read and then later discard by passing it along to someone else, or selling it through eBay or by any other means. The practicum is **Software** and

as such, is **licensed** to you as part of a teaching course. You are **licensed** to use the practicum to help you build the subject model but the **license is not transferable**. **By accepting this practicum, you agree and consent to abide by the license**. If you are unable to accept and consent to abide by the license, you have 24 hours from the day you receive the CD, to put the CD in the mail to me and receive a refund for the practicum. The refund will only be provided with receipt of this first chapter and all costs related to production and mailing of the CD will be deducted from your payment. If the CD is not placed in the mail within 24 hours of your receipt, it is assumed that you have accepted the terms and conditions of this *Licensing Agreement* and no future refund will be available.

Should you conduct yourself in an unacceptable manner in the private or public forums that I provide, you will be banned from these forums and no refund will be available. However, I will continue to support your practicum related questions through private correspondence. But I will not tolerate poor conduct in my forums and have, in the past, banned practicum participants due to improper conduct. I think that the majority of you understand the disruption such conduct causes and can appreciate my policies on this matter.

Ok, that's the legal mumbo jumbo. It is hoped that you all understand that to build a model ship is no easy task. To build the model and go into descriptive detail with photos and video clips to explain the entire process is even more work and challenging. The monthly subscription fee for this practicum is small and barely covers costs when you consider the amount of time and work that goes into writing and building the model. I do hope that you all will respect these copy rights and license agreement and abide by them. If you find it absolutely necessary to not adhere to them, please contact me first and explain your situation. I'm pretty darn easy to get along with if I understand the problem.

Thank you for participating and being a part of the first school on model shipbuilding.

1.1.5 Summary

In summation, I hope that you will find this practicum useful and wish you success in completing the model. I will attempt to steer you clear of problem areas and keep the sequence of construction in a meaningful and useful fashion so that we don't paint ourselves into a corner and accept mistakes that could have been avoided.

Good luck and happy modeling!

Bob Hunt

1.2 Preparing The Keel

We'll begin construction of our model with the keel. If you are milling your own wood for this model, you'll need a piece of stock approximately 12" x 3/16" x 3/16".

We must cut the rabbet joint in the keel. If you are using one of the commercially available laser cut keels, you will need to run the keel through a small table saw like the Preac and cut off all of the pieces that denote the notches that the frames sit on. You want to remove the notches completely and to do this, you need to set the table saw so that when you rip the keel, its height will be reduced to just 3/16". Don't worry; we will be reconstructing the parts removed. Photo P1.2-1 shows my keel with the forward scarf joint.

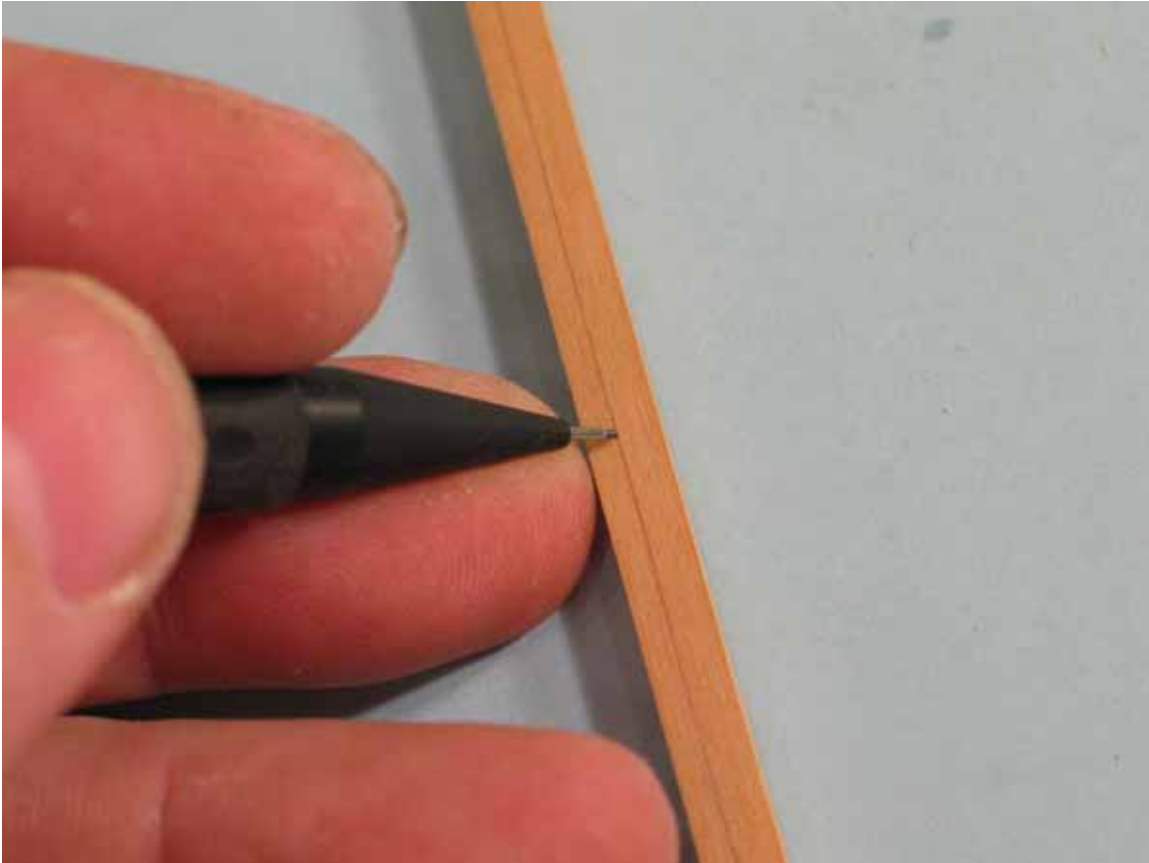


P1.2-1

If you're making your keel from scratch, mill your wood to 3/16" x 3/16" x 12" for now.

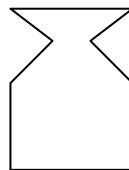
The rabbet joint extends from the tip of the keel where the scarf joint is, aft to the aft side of frame W. Place your keel onto the profile frame drawing on Plate 2 of your plans and align the keel fore and aft. Then mark the aft side of frame W on the side of the keel.

Next, you want to draw a line across the full length of the keel, on both sides, that is 1/16" from the top surface. That's the surface you cut on your Preac when you removed the notches. Photo P1.2-2 shows how I marked the keel by holding my finger against the side of the wood and guided the pencil across the length of the keel. Be sure to mark both sides.



P1.2-2

We will be cutting a "V" groove across the length of the keel up to frame W. Figure F1.2-1 shows what the keel should look like if you were looking at it head on.



F1.2-1

You could try to mill the rabbet joint in the keel with a small table saw tilting the blade at a 45 degree angle. But I found that extremely difficult to set up and you only get one try to get it right if you are using a commercial laser cut keel.

Instead, I found it easiest to just cut the "V" notch in the keel with my #10 Exacto. Photo P1.2-3 shows my keel before cutting the rabbet.



P1.2-3

Photo P1.2-4 shows my keel with part of the rabbet being cut using my Exacto.



P1.2-4

Here you can see how the "V" groove extends from the top surface of the keel to the center of the line we drew earlier. And it extends up from that line to the center point forming a "V" groove. If you work a little from each side, and a little at a time, being careful to take very small amounts of wood off, you can keep the rabbet line smooth and clean. Photo P1.2-5 shows the rabbet after it has been cut, stopping at the aft side of frame W.



P1.2-5

To clean the keel up, you can wrap a piece of 150 grit sand paper around a square piece of wood and sand the groove putting a corner of the wrapped wood into the groove as shown in photo P1.2-6.



P1.2-6

Be sure and cut and clean your rabbet on both sides of the keel.

In the photos above, you have seen the scarf joint at the fore end of the keel. Hahn shows this joint in his plans. You can make a copy of that area or a tracing and use the copy or tracing to transfer the shape of the joint to your keel. Then cut it out with a scroll saw. The stem has a corresponding mated joint also using the same pattern and transferred to the stem piece.

Next, you'll need a piece of 5/32"x 1/16" x 12" boxwood or other hardwood stock. We are going to put back a portion of our notches with this piece of wood. Photo P1.2-7 shows the keel with the rabbet joint and this piece of stock ready to be re-attached.



P1.2-7

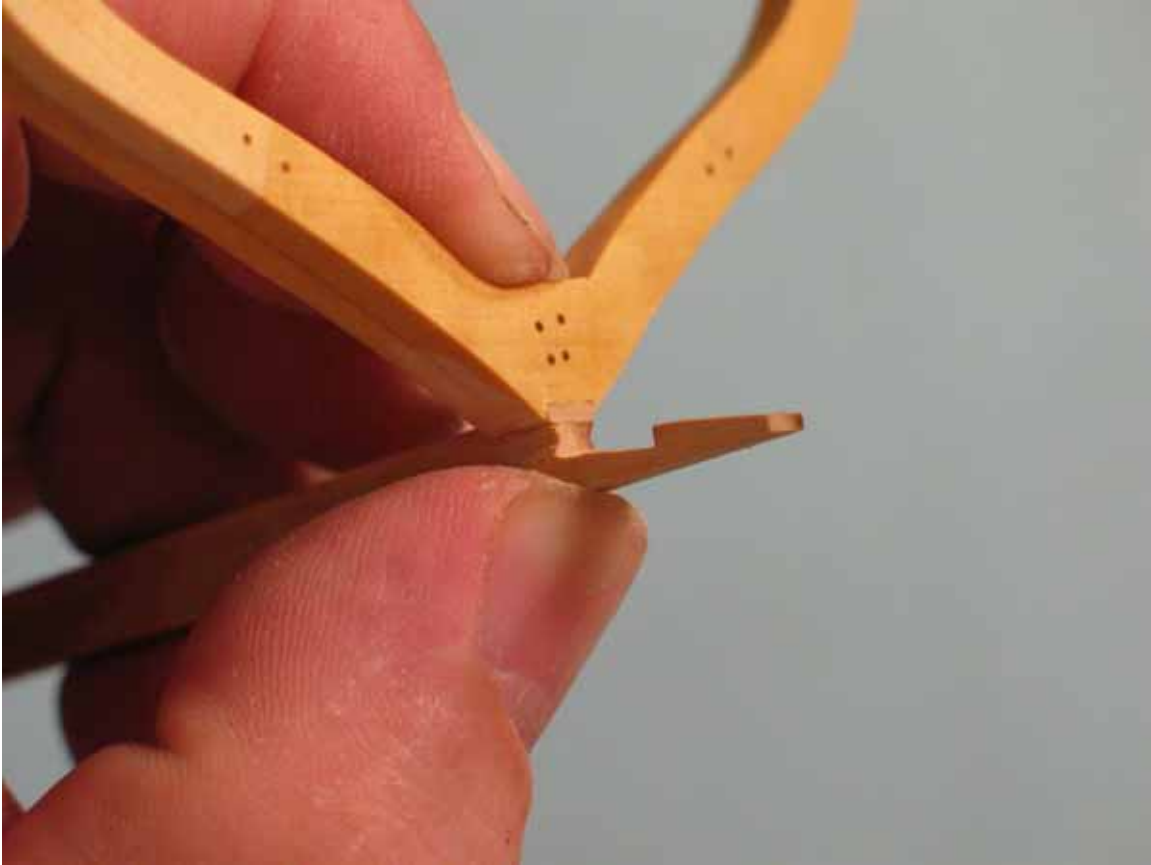
Weldbond works well in gluing this strip of wood to the top of the keel. The piece should end at the aft side of frame W, where you stopped cutting your rabbet joint. Photo P1.2-8 shows the piece attached to the keel.



P1.2-8

This piece runs from the edge of the scarf joint at the forward end of the keel to the aft edge of frame W, the point you marked earlier.

To show you how this piece and the rabbet joint relate to the frames, photo P1.2-9 shows a frame being held on top of the piece we just added. The notch in the frame is 1/16" deep, the thickness of the piece we just added to our keel. You can see in this photo how the frame meets the rabbet joint at what is called the bearding line, the top edge of the rabbet joint. The bottom edge is called the rabbet line.

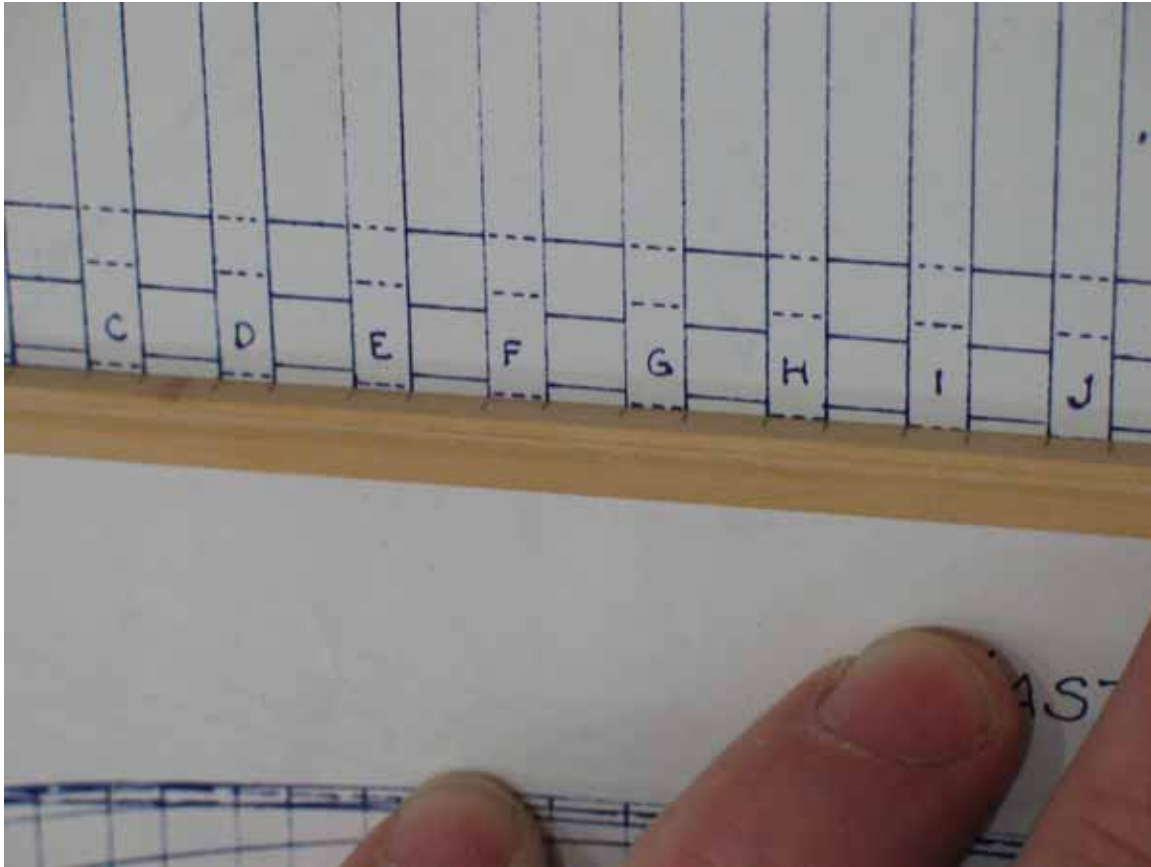


P1.2-9

When the planking is attached to the outside of the frame, the plank closest to the keel, also called the garboard strake or plank, fits into the "V" shaped rabbet joint.

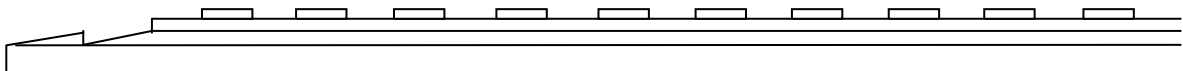
Next, we need to recreate the notches we removed earlier. To do this, you will need another piece of 1/16" x 5/32" x 12" stock, preferably boxwood as well. Before we begin though, we need to mark the location of the notches on to the top board we just added.

Lay your keel onto the profile plan and align it with the mark you marked earlier for the aft side of frame W. Then use a pencil and mark each frame onto the top surface of the keel, both fore and aft lines of each frame. Photo P1.2-10 shows the keel being marked for the frame locations.



P1.2-10

Once the frame locations have been marked, remove the keel from the plans. Now you will need to cut 21 boxing pieces. These are pieces of stock that attach to the keel between the frames thus forming the notches. Figure F1.2-2 shows what the construction of the keel will look like.



F1.2-2

The boxing pieces are about $15/64$ " long and the space between each pair of boxing pieces is the width of our frames, $1/4$ " (approximately).

The lines you drew onto your keel are for guidance. I've found that it's best to use an actual frame to set the spacing of our boxing pieces. However, since we have not yet made any frames, you can substitute an actual frame with two

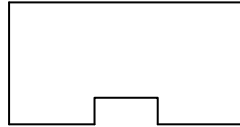
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1. The Keel

1.1 Introduction

pieces of the billeting material that came in your timbering package. These pieces of material are approximately 1/8" thick (my billets measured .105"). You only need a small piece about an inch long with a notch cut in the center edge as shown in Figure F1.2-3



F1.2-3

First cut two pieces of the billeting material 1" long. Glue the two pieces together clamping them well until the glue dries. Weldbond works well for this type of gluing.

Once the glue has dried, find the center of the assembly and mark a centerline. Then measure 3/32" to each side of the centerline and make marks. This will give your notch a width of 3/16", the same as the width our keel. Finally, measure a depth of 1/16" and draw a line from side to side to show the notch you need to cut out. You can use a scroll saw or your Exacto to cut out the notch.

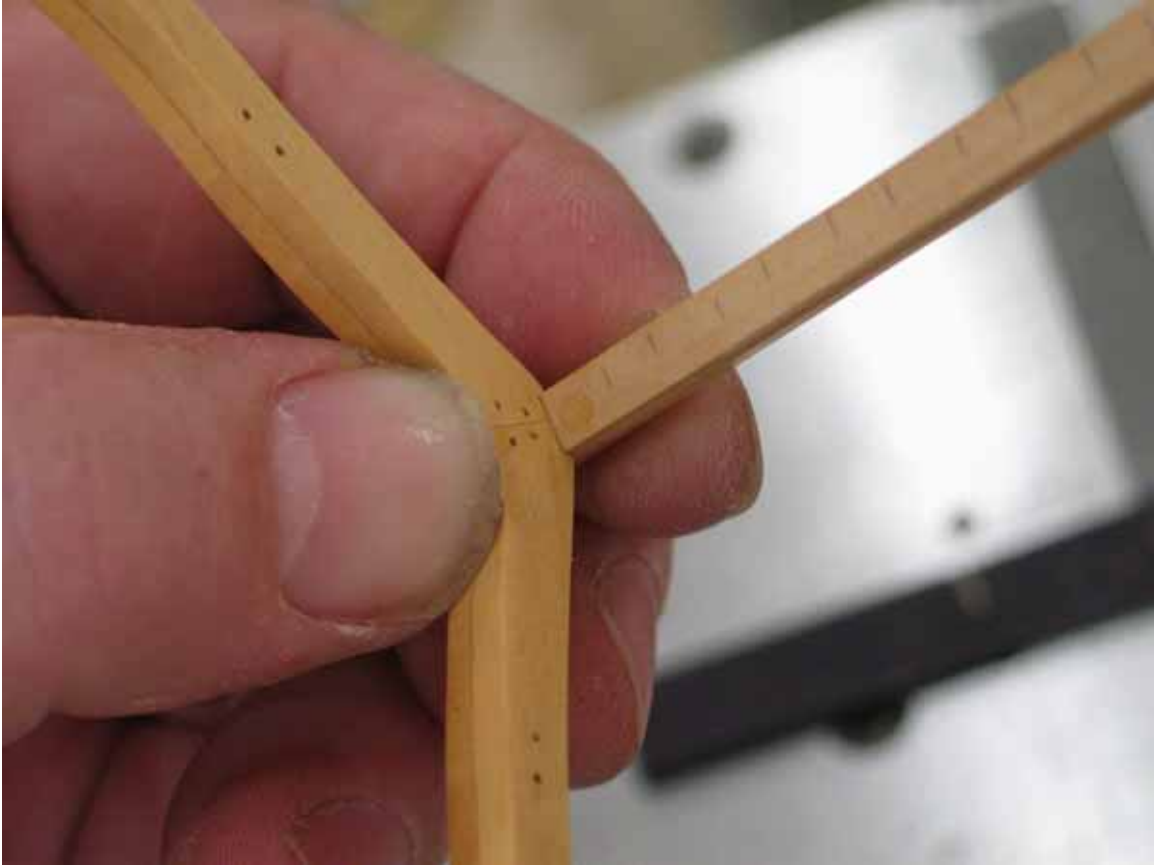
Now test fit this notched piece of stock onto your keel to see if the notch is deep enough and wide enough. You want a snug fit just as I had with my frame in photo P1.2-9 above.

Once you're satisfied with the fit, check the width of this false frame to the profile drawing of Hahn's plans to see if it's within the frame lines shown on his drawings. Remember that his drawings were done by hand, not on a computer so you may see some variations.

You should be ready to attach boxing pieces. You may have to cut these to a set length to start, and then make adjustments to their length with your Exacto. The lines you drew onto the keel are also there to help you determine the notch locations.

Check your notch lines one more time with Hahn's profile frame drawing and determine where the first frame goes on the keel (you can make a small "X" between the frame marks). You don't want to glue your first boxing piece in the spot where the frame goes. The first frame we will work from is frame B. There is no boxing piece in front of frame B.

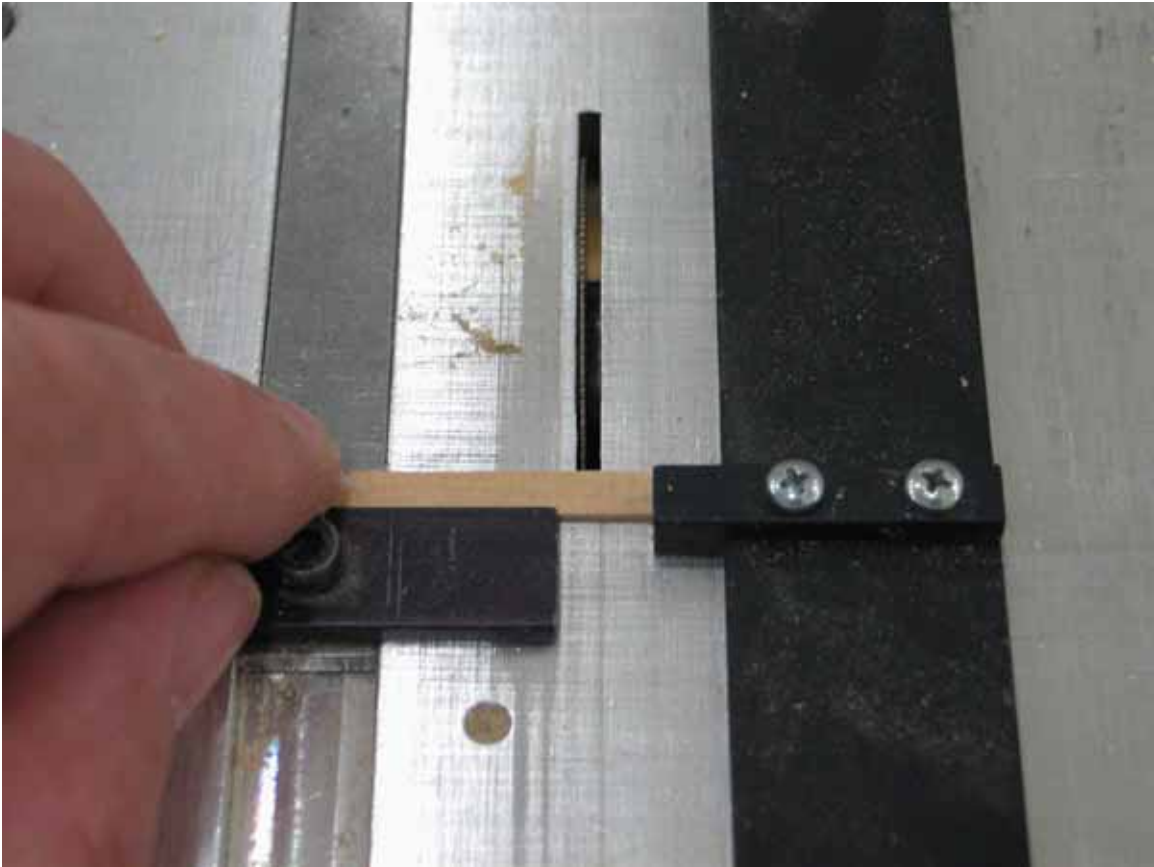
Set your false frame piece onto the keel aligning the aft edge with the line that denotes the aft edge of frame B as shown in photo P1.2-11.



P1.2-11

As you can see, I'm using a real frame but that makes no difference. The important thing is that the piece you are using is made from the same material that your frames are made of (which it is) and that it is the same width as your frames (which it is). Now, what you need to do is to glue a boxing piece up against the frame so that it's tight against the aft side and that it ends on the mark where the fore side of frame C goes, the next frame going aft.

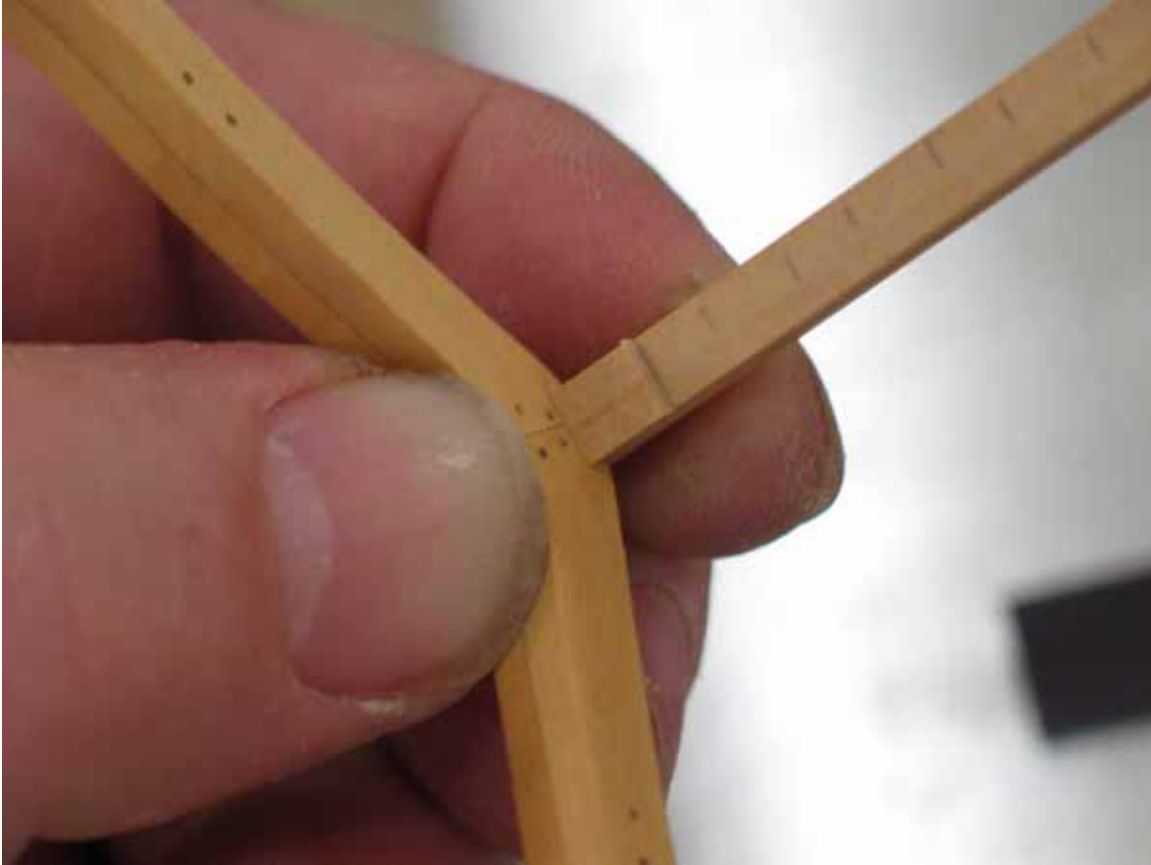
Photo P1.2-12 shows how I use the Preac to cut these boxing pieces. The first one is cut using a ruler to set the length and the table's rip fence with stop piece. I then test fit that piece to see if it ends on the line that denotes the fore surface of the next frame, frame C. If not, I make minor adjustments to the fence and try again. Sooner or later you get just the right length and then you stick with that setting until you see a need to make minor adjustments once again.



P1.2-12

I'm using a .010" blade to cut these pieces.

Photo P1.2-13 shows the first boxing piece glued in place now. The frame has not moved from the position I was holding it in earlier.



P1.2-13

Now remove the false frame and place it in the position of frame C, butting its fore edge up tightly against the boxing piece you just glued in place. The aft edge of the false frame should align with the mark you made earlier showing the aft edge of the frame. If it doesn't, then your marks are off or your boxing piece is too long. Even though it's glued in place, you can use a #10 Exacto and trim off small slivers of wood to shorten it.

Once satisfied, hold the false frame in place and glue the next boxing piece in place aft of the frame, thus locking the frame in place. Repeat this process until you reach frame W. Do not glue a boxing piece aft of frame W. The stern deadwood goes here. Photo P1.2-14 shows the keel at this stage of construction. Now we have our notches back in place and our rabbet joint has been cut into the keel.



P1.2-14

You can see that there is no boxing piece in front of frame B, where the scarf joint is. The apron will sit here and we will need to trim the top board on the keel later when we attach the apron.

If you've made your keel from scratch, you'll need to use your profile plan to determine the length of the keel, the angle at the stern and the location and shape of the scarf joint where the keel joins the stem. You can use tracing paper and card stock to make a template for the scarf joint. You can also lay the keel onto the plans aligning the notches and mark the length and angle of the stern portion.

Summary

- ❑ Remove the notches from your keel using a small table saw and making the keel height $\frac{3}{16}$ ".
- ❑ Measure and mark a line $\frac{1}{16}$ " down from the top surface of the keel and across its full length to the aft edge of frame W.
- ❑ Cut a "V" notch in the keel between the top surface and the line you drew. Clean the V with sandpaper when finished.
- ❑ Attach a piece of $\frac{1}{16}$ " x $\frac{3}{16}$ " stock to the top of the keel from the scarf joint to the aft edge of frame W.

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1. The Keel

1.1 Introduction

- ❑ Use Hahn's profile plan to mark the locations of the frames onto the top board you just attached.
- ❑ Make a false frame from two pieces of 1" long billeting material glued together. Cut a notch 1/16" deep and 3/16" wide into the assembly and test fit to your keel.
- ❑ Place the false frame onto the keel at frame B and cut and glue a boxing piece made from 1/16" x 3/16" boxwood. The boxing piece should but tight against the aft side of the false frame and end on the fore line marked on the keel where frame C goes.
- ❑ Remove the false frame and place it where frame C goes checking its aft edge to see if it's on the line. If not, make adjustments to the length of the boxing piece you just glued on using a #10 Exacto.
- ❑ Repeat the process of gluing boxing pieces on while holding the false frame in place so as to lock it in place until all frames up to frame W have been boxed in. Do not attach an aft boxing piece after frame W.