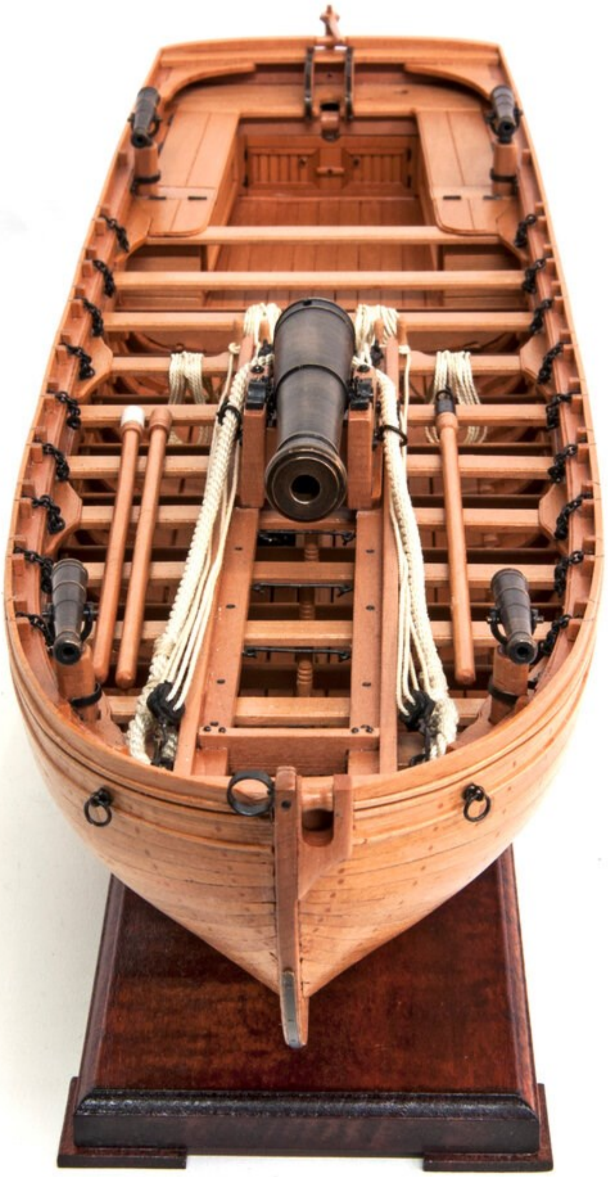
The MSB Journal

by ship modelers for ship modelers



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Armed Long Boat
by Ruediger Eschker

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Editorial

Yet another month has come and gone. Not sure about where you live but usually for us here in Exeter, Ontario, Canada, February is one of the coldest months of the year. That's not the case this year. We've seen temperatures in the double digits (C^0) several times through out the month. I'm beginning to like global warming a little bit! :-)

In this issue we start off with the continuing story of the HMCSS Victoria and Pat Majewelski discusses diagonal planking.

Robert Hunt finishes up his two part article on hull planking. For anyone interested Robert has a great mini practicum available on his website on hull planking crammed full of information. In fact I just popped over to his site to have a quick look and I see that he has a four-pack of mini-practicums on sale for a great price. If you're interested you can check them out at https://www.lauckstreetshipyard.com. (As a caveat MSBJ makes nothing from the sale of any authors products or services, we just like to point out a good deal when we see one).

Next up are some great pictures of Ruediger Eschker's armed long boat shown on the front cover of this issue.

In his column this month Donnie Driskell carries on his milling by showing you a practical example of how to make a mast step on the end of a mast. He even provides you a link to his Youtube video showing how it's done!

Michael Shanks in the Makerspace brings you a discussion on 3D printing, with some comments, suggestions an some great pictures.

And this issue finishes off with another great book in the Book Nook and Gene's Nautical Trivia!

Hope you enjoy this issue. Now, on to start the April issue!

Until next time

As you slide down the banister of life,
May the splinters never point the wrong way!

Winston Scoville

HMCSS *Victoria* – Diagonal Hull Planking

By Pat Majewelski

This is a follow-on discussion relating to the article about HMCSS *Victoria* published in the February 2023 edition. This article hopefully provides some insights into a very unique form of hull construction and hull planking that may be of interest to readers.

For brevity this discussion has been restricted to the key elements of this planking system. The author would also be very grateful for any additional information readers may be aware of related to this method of construction.

Background

The Contract Specification for HMCSS *Victoria* infers, rather than states, that the hull was to be constructed on diagonal planking principles. However, sufficient details are given, which can be corroborated with supporting evidence in the regular detailed reports made by the ship's build superintendent, Commander William Lockyer RN, to confirm the vessel was built using this form of construction.

Specifically, the Specification required:

> *Bottom Plank: – Mahogany. Thick, 2 inches; hair felt, the thinnest made, to be placed between the bottom plank and the outer diagonal thickness. Diagonal Plank - Mahogany. Two thicknesses 1¼ inches each thickness, the outer thickness to be fastened to the inner one with copper nails well clenched on washers, and to be caulked before the plank of the bottom is brought on. Oiled paper well coated with white lead to be placed between the two thicknesses of diagonal planking. The keel in midships to be worked in two thicknesses as shewn in the section to allow of the diagonal plank passing under the bottom.*

The obituary for Oliver W. Lang, the ship's designer, published in Grace's Guide UK), informs that the *Porcupine*, *Spitfire* and two other vessels (the *Vivid* and the *Elfin*) which he had designed, were built on the diagonal principle which he had introduced into the RN, but which had never been implemented widely.

Lang was thus well aware of the major issues associated with the introduction of screw propulsion in wooden ships. Two of the more problematic of these issues being excessive vibration and structural weakness. This was particularly a problem in early screw vessels that used a lifting screw when under sail alone.

The cavity into which the screw was raised was the cause for much of the hull vibration and weakness of the stern timbers. Additionally, the turning of the screw itself, and the requirement for a large hull width machinery space that occupied a third of the vessel's length, also caused weakness in the hull. The vibration caused the hull timbers to be placed under excessive strain and 'working' of the planking resulted in traditional hull forms (full framed ships) being weakened over time.

To overcome these inherent problems in the *Victoria*, Lang specified the use of a non-lifting differential (feathering) screw recently patented by Maudslay, and the use of diagonal planking to his (Lang's) modified design in her construction. George Campbell, 'China Tea Clippers', page 66, writes:

> *This [diagonal planking] was an exceptionally strong form of construction, very rigid and thoroughly watertight, and used timber of smaller scantlings than the traditional method. The frames were smaller and more widely spaced …*

David MacGregor in 'Fast Sailing Ships', 1973, advises that diagonal construction was employed intermittently for first class work where money was no object, such as in the Royal Yacht *Victoria and Albert* launched at Pembroke, Wales, in 1854, where Oliver Lang was the Master Shipwright at the time.

Naval Architect, John White, presented a paper titled "On an Improved Method of Building Diagonal Ships" at the inaugural meeting of the 'Institute of Naval Architects', which was published in Volume 1 of the Institute's Journal, edited by E. J. Reed, 1860. Page 116 provides some interesting background information on this planking system, in particular:

> *The diagonal system is particularly adapted for screw steam-ships, from the transverse strength given to the after-body by the diagonal planking crossing the dead-wood, which enables it to stand against the lateral motion produced by the propeller.*

The diagonal planking method of construction was much more expensive and, despite being much stronger than traditional hull planking, did not gain higher Classifications from Lloyds Register. Despite the additional strength it afforded, it was never widely taken up in mercantile or naval ship construction.

A technical drawing and short description of the screw as fitted to HMCSS *Victoria* may be of interest. The drawing can be found in Chapter 14 (page 164) of 'A Practical Treatise on Modern Screw Propellers', edited by NP Burgh, 1869.

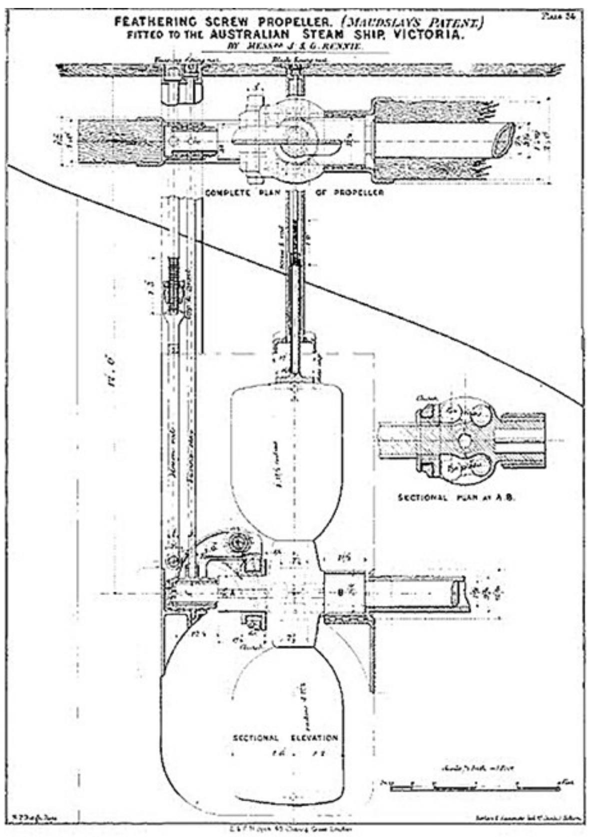


Figure 1 – Screw Propeller fitted to HMCSS Victoria
'A Practical Treatise on Modern Screw Propellers', NP Burgh, 1869, Plate 34.

Hull Framing

HMCSS *Victoria* was not built with the traditional skeletal framing structure. Rather, the traditional frames extended only as far as the 'round' which provided a solid bottom for the ship, but the sides relied on the strength imparted by the planking and fitted timbers, supplemented with iron fittings. The fitted timbers were referred to as 'stout planks' by Lockyer in his correspondence with the Governor, Sir Charles Hotham, KCB. In his report of 4th April 1855, he wrote:

> *Afterwards stout planks in lieu of timbers will be placed at intervals and all the planking bolted to it.*

According to MacGregor, page 140, while there were several methods of diagonal planking practiced, these were grouped into two major systems. The first was that developed by 'Alexander Hall and Sons' and the second using the White Brothers' system. The Hall's method retained the traditional framing but with a wider spacing than typical wooden ships; whereas the White's plan used a spacing of 3' 4" and only retained the framing up to the head of the first futtock (round of the hull).

Macgregor describes the White's system as:

> *There was a keel, floor timbers, keelson, and external longitudinal planking in the normal way, but there were no frame timbers above the head of the first futtocks. The floor timbers were spaced at about 3ft 4in centres. Then skeleton frames were erected with longitudinal ribbands outside them, over which two skins of thin diagonal planking were laid in opposite directions, and finally the third layer which was the longitudinal one. By degrees the skeleton frames were struck as beams and planking were added, but the ribbands were retained as part of the structure. There were long hanging knees to alternate beams, and in the hold these knees reached sufficiently far down to allow a single bolt to be driven into the heads of the floor timbers.*

The post-reading discussion of the Paper presented by John White (mentioned earlier) records the following pertinent comments:

> *It should be observed that the frame-timbers are not entirely done away with in Mr. Whites vessels but are carried to a certain height. I would also call attention to the compensation which Mr. White has introduced, viz. four thicknesses of planking instead of two; and iron diagonal plates, and long iron knees likewise. The Chairman has, as he said, adopted the principle of doing away with the vertical frames in iron ships.*

Due to a general shortage of suitable timbers during this period of accelerated shipbuilding (Crimean War), extensive use of ironwork was made in the construction of ships. James Peake, in his book 'The Rudiments of Naval Architecture', 1851, also informs that:

> *The additional strength afforded by the use of iron for knees, beams, hold pillars and diagonal trussing permitted large wooden ships to be constructed without the cumbersome timber members which would otherwise be indispensable. With the building of very long ships which only possessed a comparatively narrow beam, the need for longitudinal stiffness became essential…*

The Contract Specification for *Victoria* required the fitting of iron knees to support the deck beams:

> *Iron Knees under Beams.—To be about ¾ cwt. each and spaced as shewn on drawing.*

Unfortunately, again this drawing cannot be located requiring some speculation about the type and number used, and for the beam and knee spacing.

As Victoria was a long vessel, and to meet the requirements of the White's method of diagonal construction, it is probable that Lang would have used his father's designs for the ironwork wherever possible; these are also discussed in greater detail by Peake, page 167. These plates will have included long hanging iron knees to alternate beams. In the machinery space, these knees would have extended further down to allow a single bolt to be driven into the heads of the floor timbers. *(continued next page)*

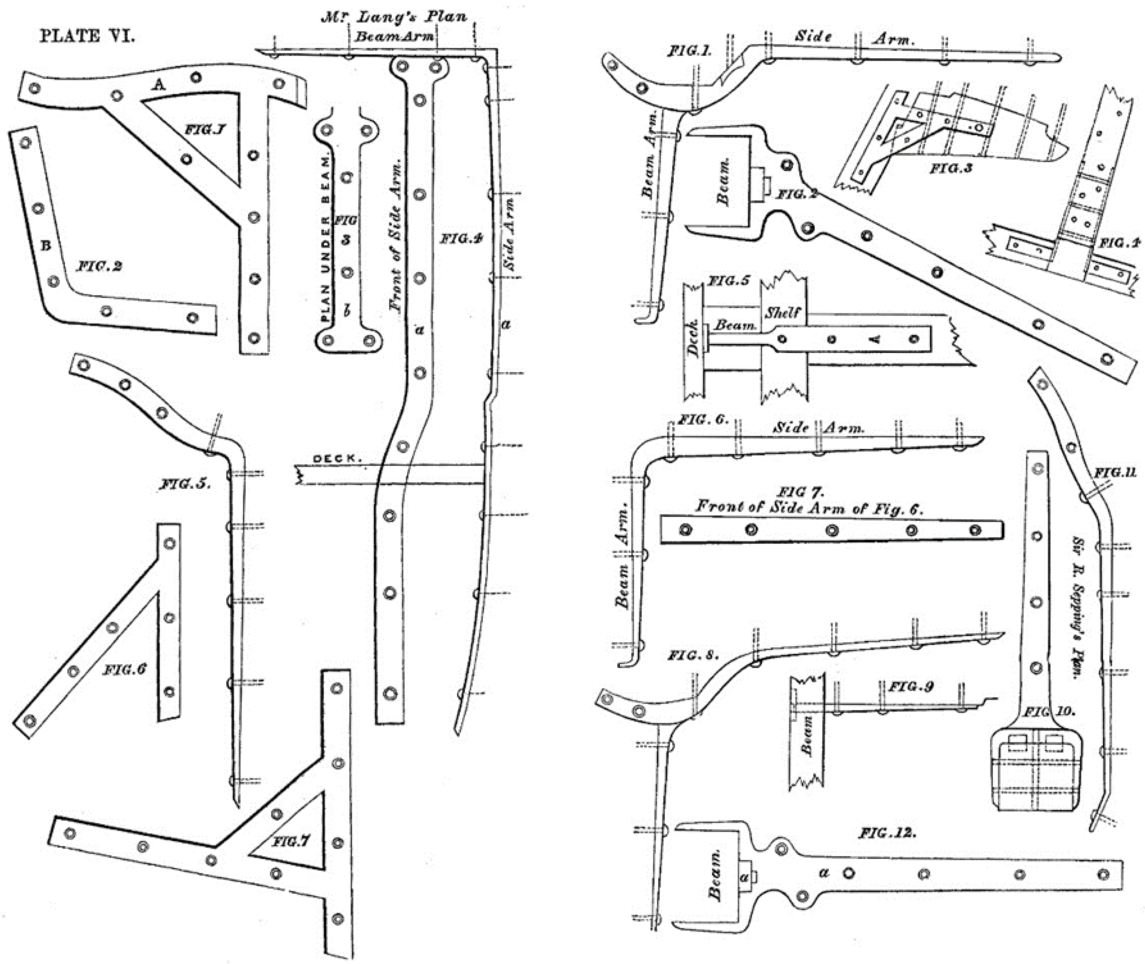


Figure 91 – A Sketch of Lang's Plates
'Rudiments of Naval Architecture' by James Peake, 1851, Plates VI and VII.

Peake also informs that:

The mode of working these plates has been the subject of much controversy among the practical builders of the navy. In some instances they have been bent to the inside of the timbers without being inserted into them; while in others they have been buried half their thickness in the frame timbers, and in some cases, the practice has been sanctioned of letting them in their whole thickness : but surely the insertion of them into the frame must be erroneous, — the frame of a large ship is always difficult to obtain the moulding way, and the axiom of nothing being stronger than its weakest part, would cause the practical builder to ponder well before he weakened the frame of the ship, by the score necessary to receive a plate that has little tendency, when worked, beyond the stringing, as it were, of the timbers of that frame together. These plates are bolted through the frame timbers and outside plank; and the bolts in them should form part of the regular fastening of the bottom. *(continued next page)*

Diagonal Planking

According to MacGregor, the White brothers had started experimenting with diagonal construction in 1850 and had patented their process in March 1852. It is therefore reasonable to assume that the 60-degree diagonal 'crossings' they recommended, were employed in constructing Victoria.

An indistinct sketch of the White's method of diagonal planking can be found in Scott Russell's ''The Modern System of Naval Architecture' Volume 3, Plate 125. A better, coloured version of this image can also be found in the Danish online digital museum.

An illustration by Charles Desmond provides greater detail of the diagonal planking system as shown below.

HMCSS *Victoria* appears to have been built using a modified version of the White's system designed by Oliver Lang. Some of the modifications include using only two layers of diagonal planking (rather than three), a different method of attaching the major parts of the keel, and a more extensive use of iron plates. The more extensive use of iron plates probably compensated for one less layer of planking.

The actual 'system' used in the *Victoria* is best described by Lockyer in his report to Hotham, of 4th April 1855:

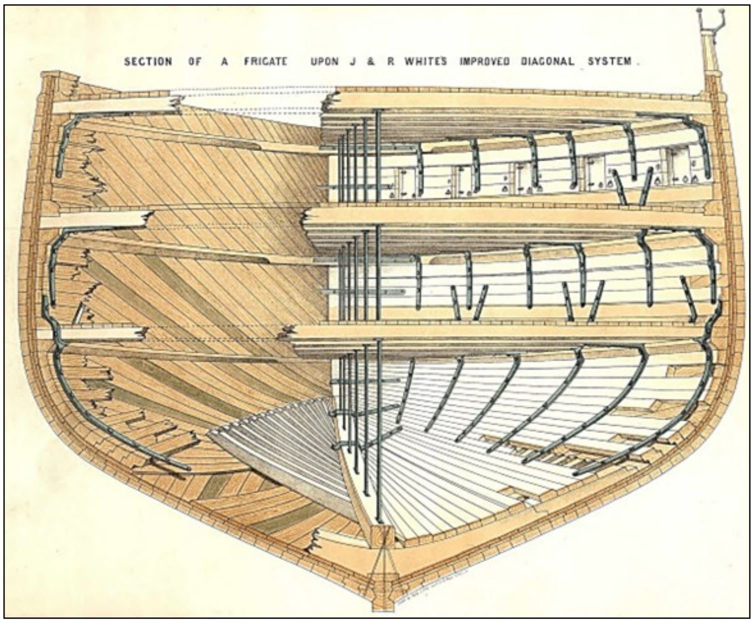


Figure 2 – White Brothers' Patented Method of Diagonal Planking
Danish Maritime Museum (Rigsarkivit) Digital Collection, bid=31917902

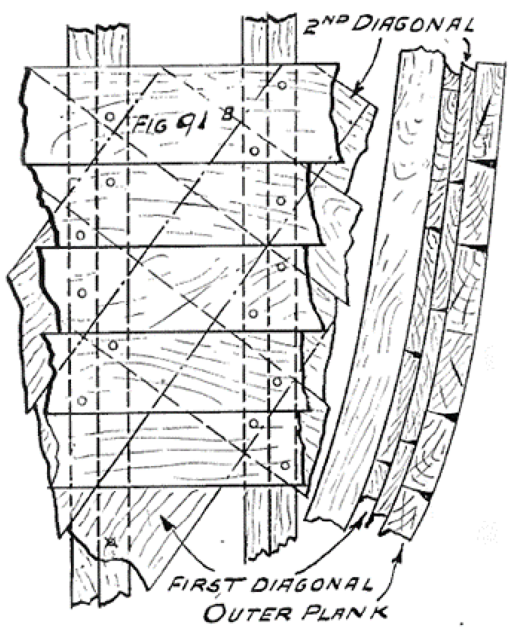


Figure 3 – The Principles of Diagonal Planking
'Wooden Ship Building', by Charles Desmond, 1919, page 102, fig 91b.

This diagonal system of building is extremely interesting and must make a vessel very strong as well as very light.

Instead of the keel being laid as in all ordinary ships and the quantity of timber bolted to it, we have in the first place about thirty feet of the keel forward with the stem as usual, and about forty feet abaft with the inner and outer stern posts. Three rows of rabbets are then cut on these portions of the keel and on the stem and inner stern post, for the but ends of the two diagonal rows of planking to rest on, and for the outer fore and aft planking to fit on.

The shadow moulds are then put up next to the keelson and has battens fore and aft from stem to stern showing all the lines of the ship. To these moulds the inner skin of diagonal planking is fastened with iron nails, being only temporary fastenings, as the moulds and battens are chipped out after the whole of the planking is done. This planking all runs one way and the butts rest on the rabbet on the stem, stern post and keel, as far as the keel goes, then the planks go from the upper deck shelf piece right under the bottom of the moulds, and in some cases reach a long way up on the other side. No plank is allowed to finish under the bottom, it is obliged to join another some feet higher up.

The second skin is put on after the first is painted, and goes up the opposite direction having paper covered with white lead on both sides placed between the two, the second planking is fastened to the first by copper nails. After this second skin is complete, the main keel will be continued, and bolted through both skins and the keelson. After the second planking has been completed and been caulked, the outer fore and aft planking will be put on, being rabbeted into the main keel, stem and stern post.

Afterwards stout planks in lieu of timbers will be placed at intervals and all the planking bolted to it. Great care is required at first to prevent the vessel from getting out of shape, and unless the moulds are well made and sufficiently strengthened it is sure to be the case. In this instance however it has been well managed.

In separate correspondence, Lockyer also informed Hotham that the “First layer painted, then paper laid and payed on both sides with white lead, then second diagonal layer fastened with copper nails,” and “*Victoria’s* second diagonal planking is completed, caulked, and covered in thin felt. ... The outer planking would soon be finished.”

Some additional detail can also be gleaned from an article by Captain H.R. Watson in the ‘Port of Melbourne Quarterly’, Jan-Mar 1953, page 21, in which he stated:

… as there were 6-inch copper nails every foot between her skins, beside there were copper bolts right through her hull and timbers. …

Additionally, Campbell, page 66, writes that the White brothers, secured the upper ends of the diagonal planks under a full thickness longitudinal strake immediately below the sheer strake.

I hope this article has been of some interest, and again I ask that if anyone has further, or better, information on this system of planking, I would be most grateful to receive it.

Planking the Hull of a Model Ship—Part II

Second Layer of Planking

In the first part, I discussed hull analysis and shown how to apply a single layer of planking on a typical hull. The second layer of planking is much easier to apply for several reasons.

The first layer has provided you with the analysis of the hull and should now show you where you will need to taper planks and where you will need to use stealers. On a blunt bow ship, the first layer will also show you where you will need to apply joggle planks

The first layer of planking also provides a smooth surface for you to attach the second layer of planking. Before you apply the second layer, you should apply a layer of wood filler to fill in any gaps between your planks and any dips or low areas on the hull.

There is only one filler that I recommend for this job. It is made by the Elmer's company; the same company that makes the white glue commonly known as Elmer's Glue. Elmer's makes a wood filler that is beige in color and has fibers of wood in it. It dries hard, can be sanded, cut, drilled and painted.

Photo 1 shows a tub of this wood filler which you can find at any home improvement store. (If you are in Europe there may be similar products, however, I am not aware of the names of such products.)

Photo 1

To apply this paste to the hull of a model, I like to use a cake icing spatula like the one shown in Photo 2.

Photo 2

Notice the bend in the metal just in front of the handle. It is this bend that allows you to smooth out the wood filler without interference from the handle or your hand.

I usually spread a generous amount of the filler over the entire hull on both sides, as shown in Photo 3. I try to cover all of the planking and smooth it out as much as possible. Then, I let it set overnight so that it can dry and harden.

Photo 3

After the filler has dried, I sand it with 100 grit sandpaper. Then I do a final sanding with something finer such as 220 grit. Photo 4 shows the same hull after sanding .

Photo 4

Because this wood filler has wood fibers in it, it is suitable for gluing the second layer of planking. It sands quite easily. I would advise that you take the model outside to sand it and wear a paint mask so that you don't inhale any of the dust.

Approaching the second layer of planking is similar to the first layer. Since you now have a solid surface to work with, battens are not necessary. I still follow the same procedure of marking the hull off in belts of five planks or six planks each, starting at the wale plank.

The wale plank is usually the first plank you want to install on the second layer. It is usually shown on your plans and may include one or more thicker planks. On the next page, Photo 5 and Photo 6 show the wale plank on the Bluenose II model. You can see that I've written some measurements taken from the kit's profile plan to properly locate the wale across the full length of the hull. I used Zap-A-Gap to glue the wale in place.

Photo 5

Usually the planking above the wale(s) will not require any tapering at the bow. Using the bottom edge of the wale, I then break the lower hull down in 5 plank belts the same way I did when I set up the first layer of planking.

Photo 7 shows how I created lines using a pencil to break the hull down into 5 plank belts. This model is the HMAV Bounty by Caldercraft. This ship had a very wide belt of wales planks which have already been installed. NOTE: The stem, keel and sternpost were installed after the second layer of planking had been completed. This is typical of some kits. Your kit plans and instructions should point out this type of design.

Photo 6

Photo 7

I first made marks at the center part of the hull that were the width of 5 planks. Then using a single plank, I placed it's lower edge on the first mark and held it in place as I pressed it against the hull letting it flow naturally towards the bow. I made several marks across the hull which I then connected using a ruler. I repeated this process across the stern area on each marked line. This is similar to the process of attaching battens for the first layer.

Once these five plank belts were laid out, I glued on a strip of planking as shown in Photo 8.

Photo 8

This plank serves as the first batten. There is a single plank beneath the wales in this photo that is called the diminishing plank. The diminishing plank is usually thinner than the wales but thicker than the lower hull planks.

You can see that the wales on this model were three rows wide and are a lighter color than the rest of the hull planking. Your kit plans should show the different thicknesses of the wales, diminishing plank and other hull planks.

With the first batten in place, you can now plank between it and the diminishing plank using the same techniques outlined in the first layer of planking. Photo 9 shows the first belt after planking it.

Photo 9

As you can see in this photo, the two lower belts curve upward at the stern. These areas require that stealers be used. I found that as I added more planks coming down the hull, I was able to reduce the upward sweep at the stern as shown in Photo 10.

Photo 10

By leaving the planks their full width at the stern, the original lines I had sectioned off became altered. Again, this is just part of the planking process. Each time you lay another plank, you should take a moment to see if changes need to be made to your original analysis and layout lines. As long as the lie of the planks remains natural without any significant sideways bends, such adjustments are okay.

Photo 11 shows the hull after all of the planks in the second layer have been added. The hull has been sanded and given several coats of Minwax Wipe on Polyurethane.

Photo 11

The stem, keel, and sternpost still have not been added. (By adding those parts after both sides of the hull have been planked, you can be sure that the planking is locked in place). This is a common design method in European kits. This completes my discussion on how to add the second layer of planking to a model ship. I hope you find it helpful in your modeling.

Armed Longboat

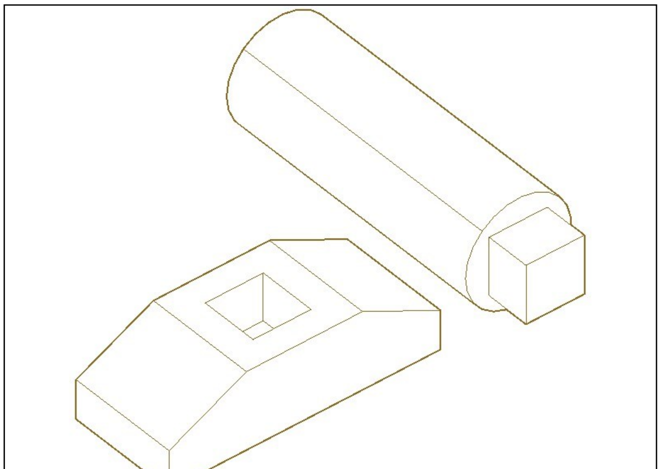
by Ruediger Eschker

The Ship Builders Machines - Mills Part II

A practical Guide

By Donald B. Driskell

Welcome to Part II of the Basics of Milling Machines. In this article, I want to demonstrate how to make a Mast Step (on the Mast end). This practice is good for scratch builders and even some kits might give you the opportunity to do such.



Typical Mast Step and Mast End

Here are some points:

1. It is important to realize that this is just a demonstration and I am not seeking perfect accuracy. It is the *technique* that I want to focus on. When I did this demo, the dowel was not true round. What I mean is that the dowel that you would use in a real life situation should have the dowel machined in a lathe (turned) to make the dowel rounded true. Otherwise, the extrusion at the end of the Mast will be slightly off center depending on how the raw stock you are using if the dowel is not true round.
2. This is wood (of course) and not metal. With metal you can make things more precise. With wood, you can get a certain amount of precision, and depending on your skills and patience. I might add that certain woods like Boxwood does in fact Mill with great precision as it is very hard with nearly zero grain.
3. Anytime you have to move a part in a vise, you must re establish your "0" reference points. In other words, at the beginning you must establish your "home" position of where your End Mill is in relation to your part. I included a video (YouTube) that will give you a basic operation with the attention on technique and not precision.
4. Don't we all love math? Ha, well, to take the guesswork out of the side of the square at Mast end, I came up with a basic equation that will determine the center location of the end mast step extrusion.

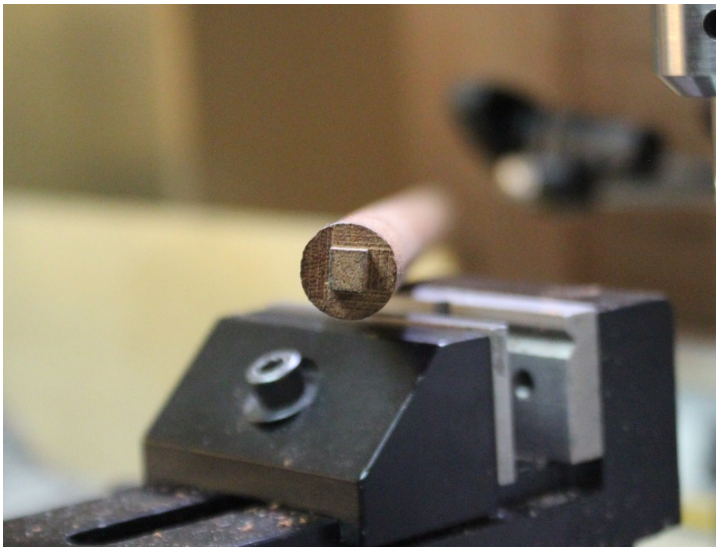
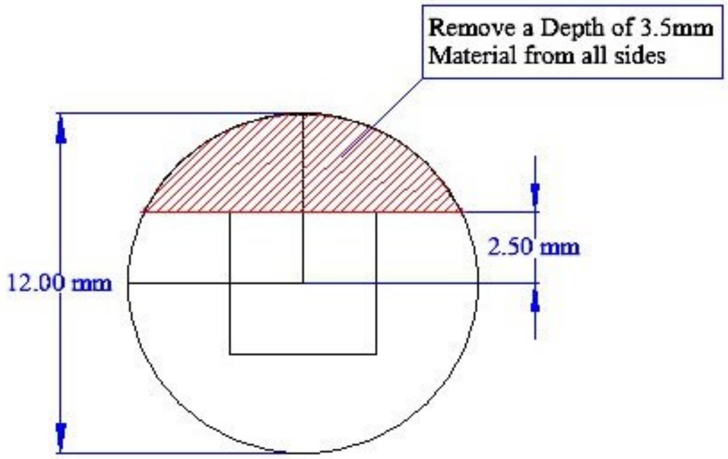


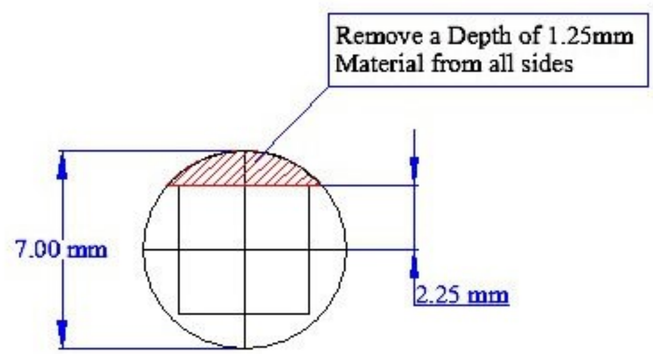
FIG. 1

Figure 1. Shows the end result (no pun intended).

Ok, so now comes the fun part (that is if you like math), and even if you don't, I think you will find the equation fairly simple. Before we dive into that, study the drawing as it shows the mast end with the square extruded that will insert into the Mast Step.



12mm Mast



7mm Mast

Remember that you are looking at the "END VIEW" of the Mast. As an example, the 12mm. The plans call for a 5mm square (step). So, the given is 12mm (dowel) and 5mm (step)

Divide 12mm / 2 to get radius of dowel = **6mm**

Divide 5mm step / 2 to get length of **2.5mm**

Now subtract **2.5mm** – **6mm** = **3.5mm**

Measure from *any edge* of dowel down 3.5mm and that is the depth of cut on **one side.**

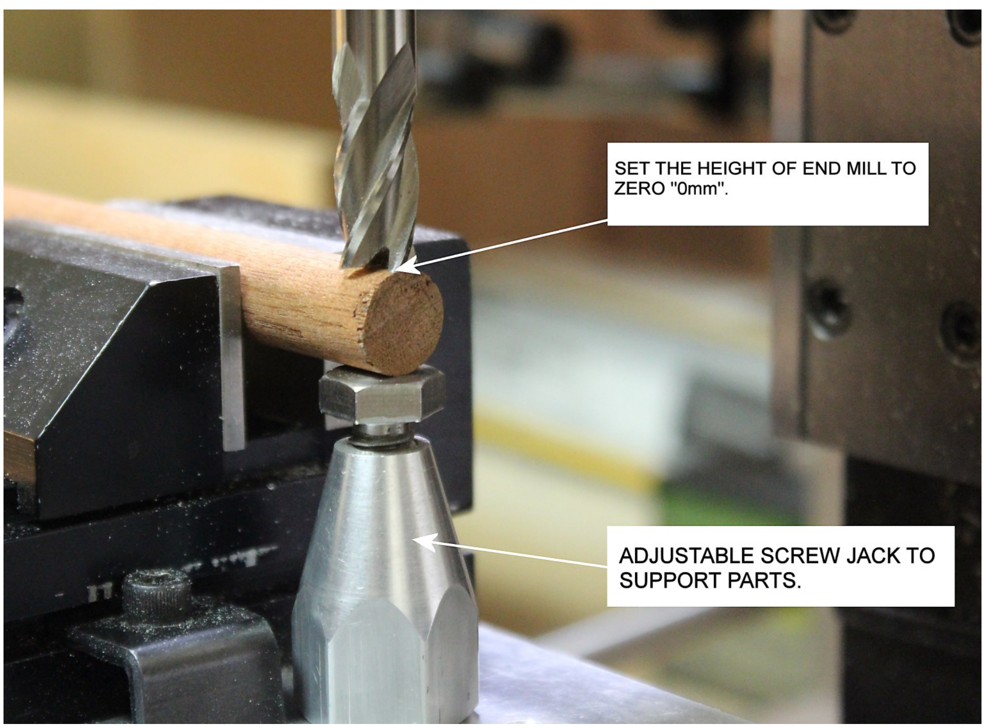


FIG. 2

So, by now you are ready to make your first cut. And I might add that in machining, it always takes longer to "setup" than the actual cut. Some "setups" can take hours depending on how complicated your mill operation is going to be.

Now, you are not going to lower your End Mill to 3.5mm and make the cut all at once. You really want to make 1mm depth cuts and finish off with the .5mm. One reason is that if you see a problem with that 1mm cut, you can easily correct it and make your adjustments. With wood, I usually will set my RPM of the Mill to about 1000 RPM.

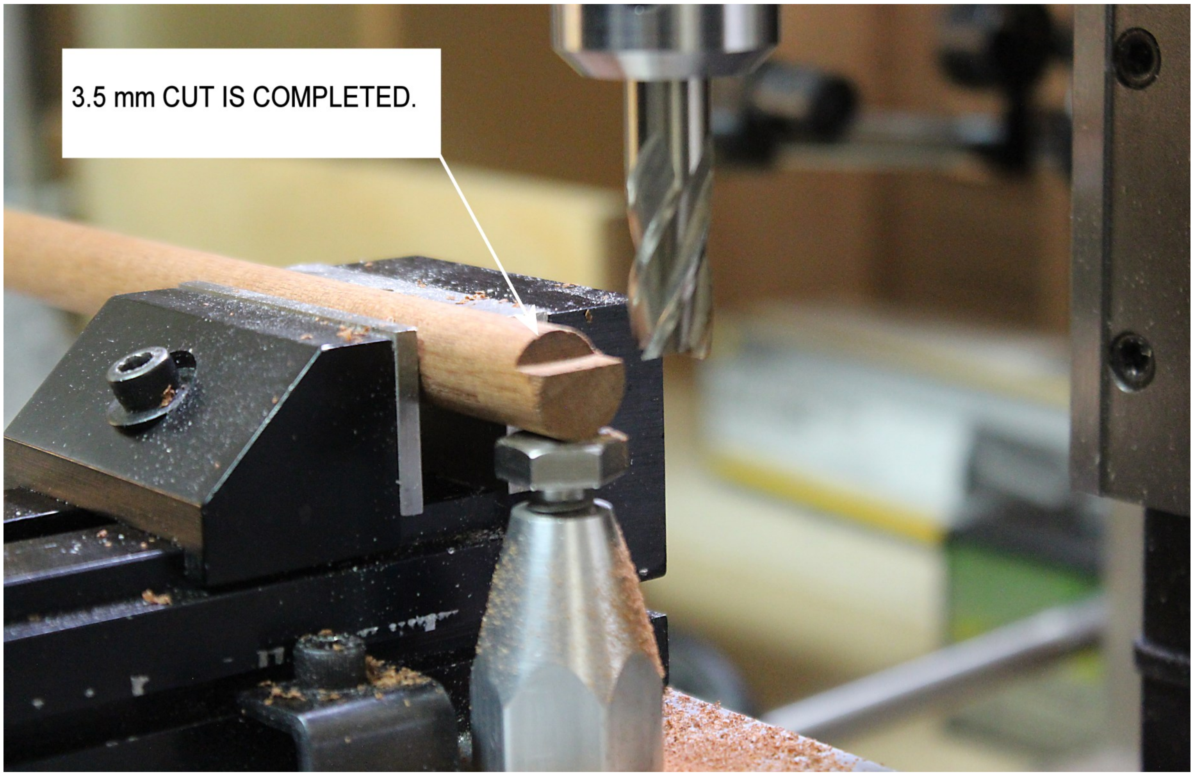


FIG. 3

Figure 3 shows that the 3.5 mm depth of cut is completed. This is after a cut of 1mm three times and a final pass of .5 mm. It is important to note that this flat edge is flat parallel to your Mill Base Plate.

Next we will rotate the dowel 180 ° to do the other side. The Jack will serve as a level flat surface. In this example, I am cutting the square 5 mm into the dowel (to make the extrusion 5mm). *(continued next page)*

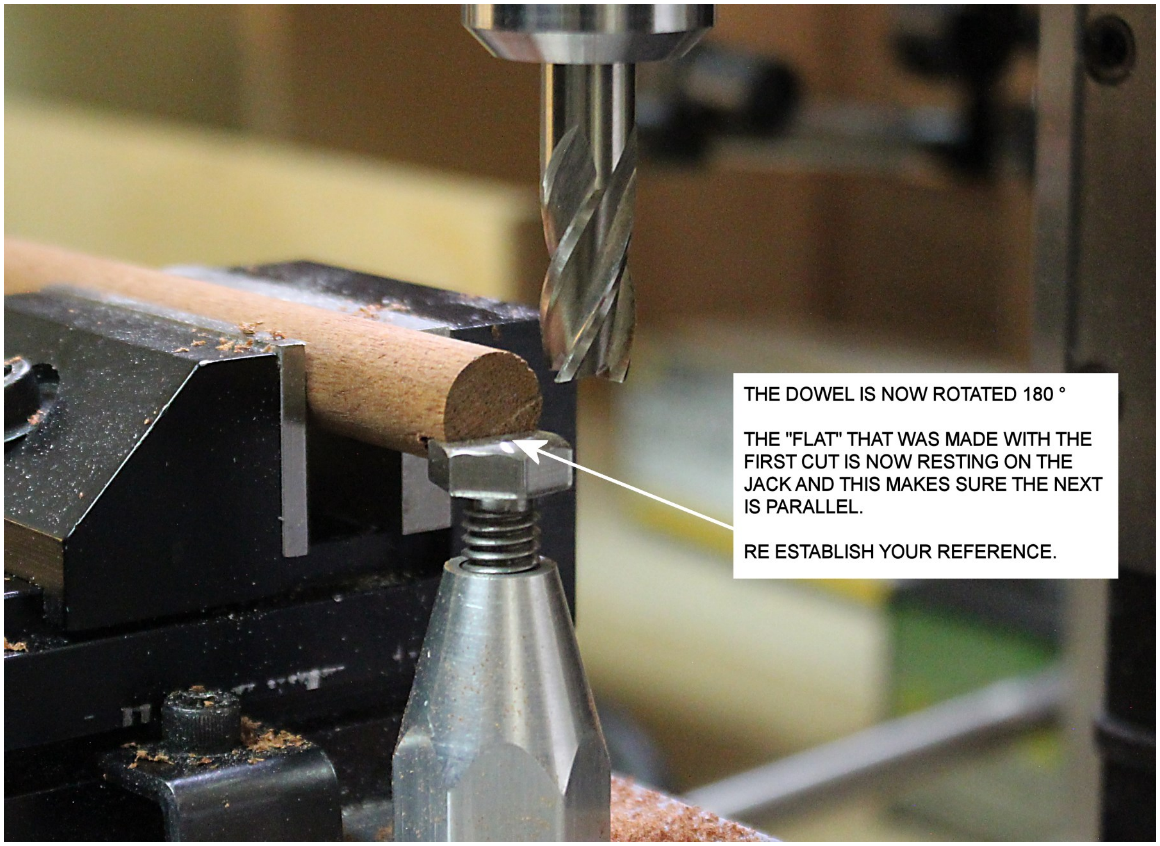


FIG. 4

Figure 4. The dowel has been turned 180 ° and the flat side is now resting on the screw jack. The part is now parallel with Mill Base again.

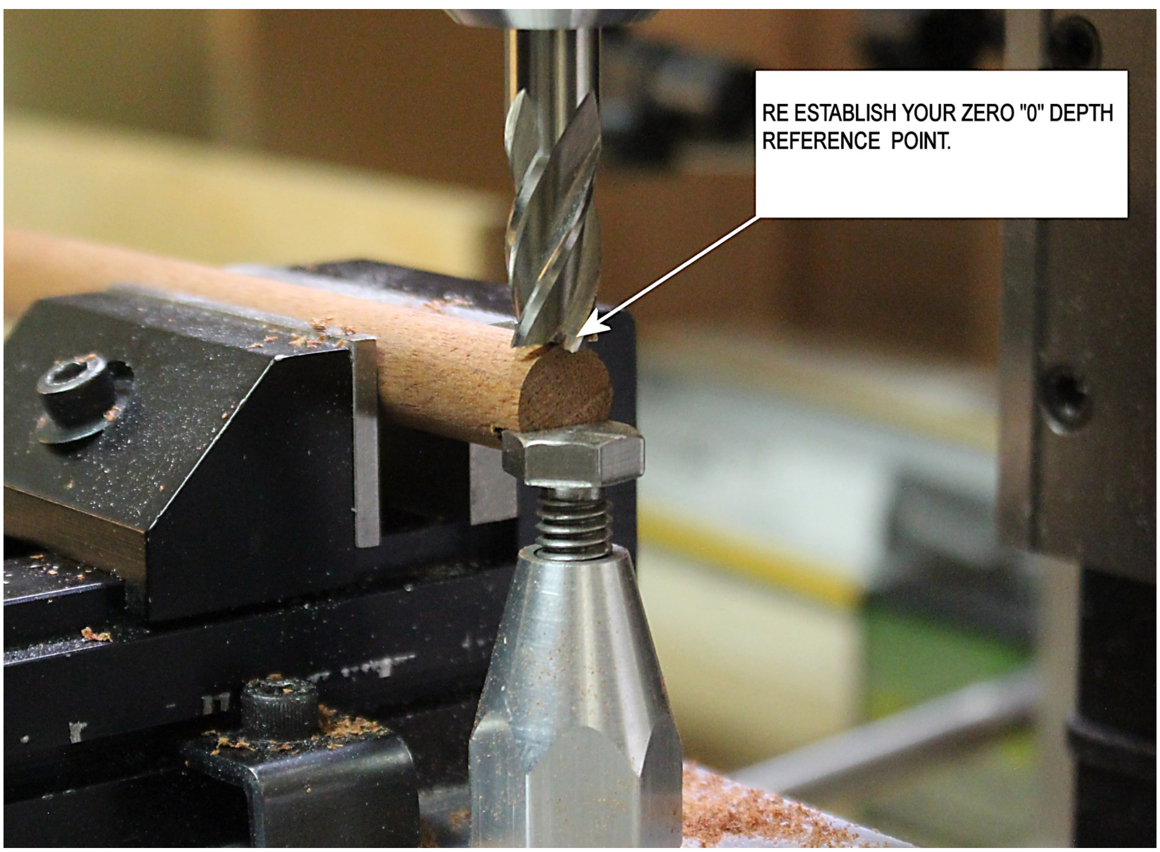


FIG. 5

Figure 5. Now is the time to reset your zero “0” mm reference point and start the process again.

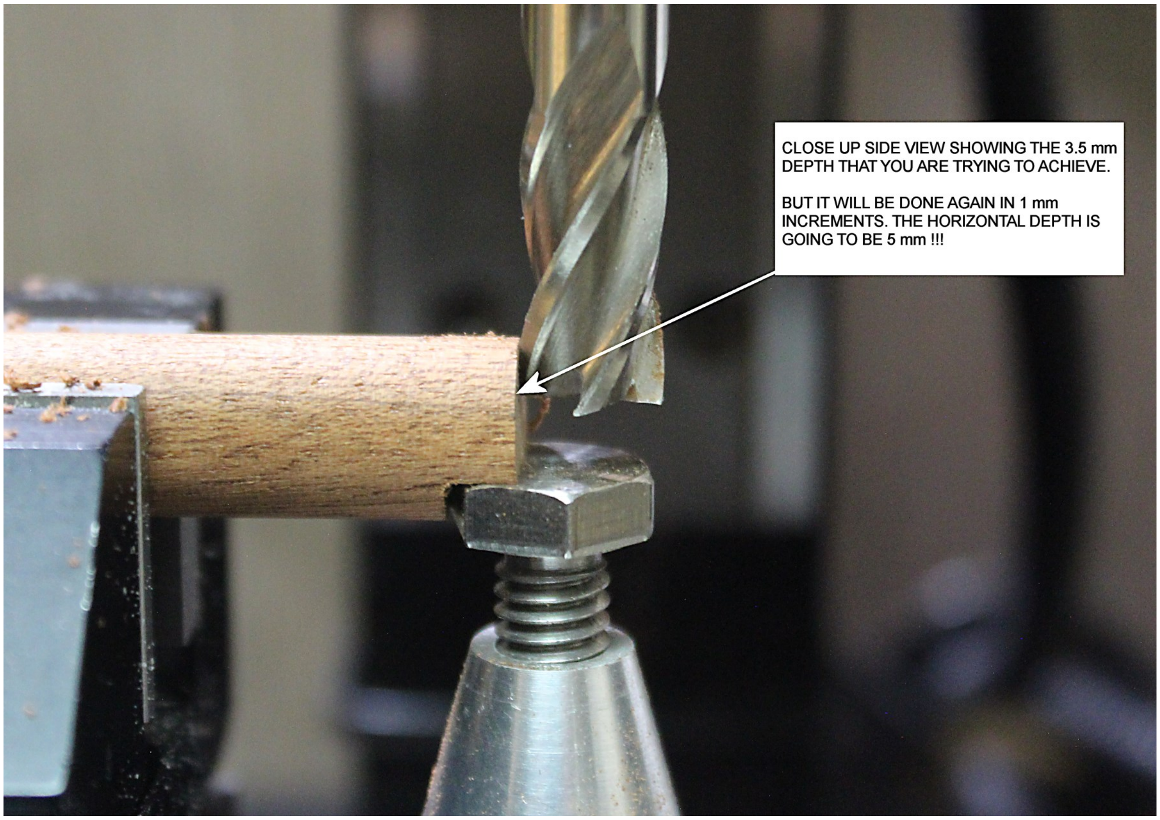


FIG. 6

Figure 6 is only a demonstration (a side view) showing the full 3.5 mm depth required for this part.

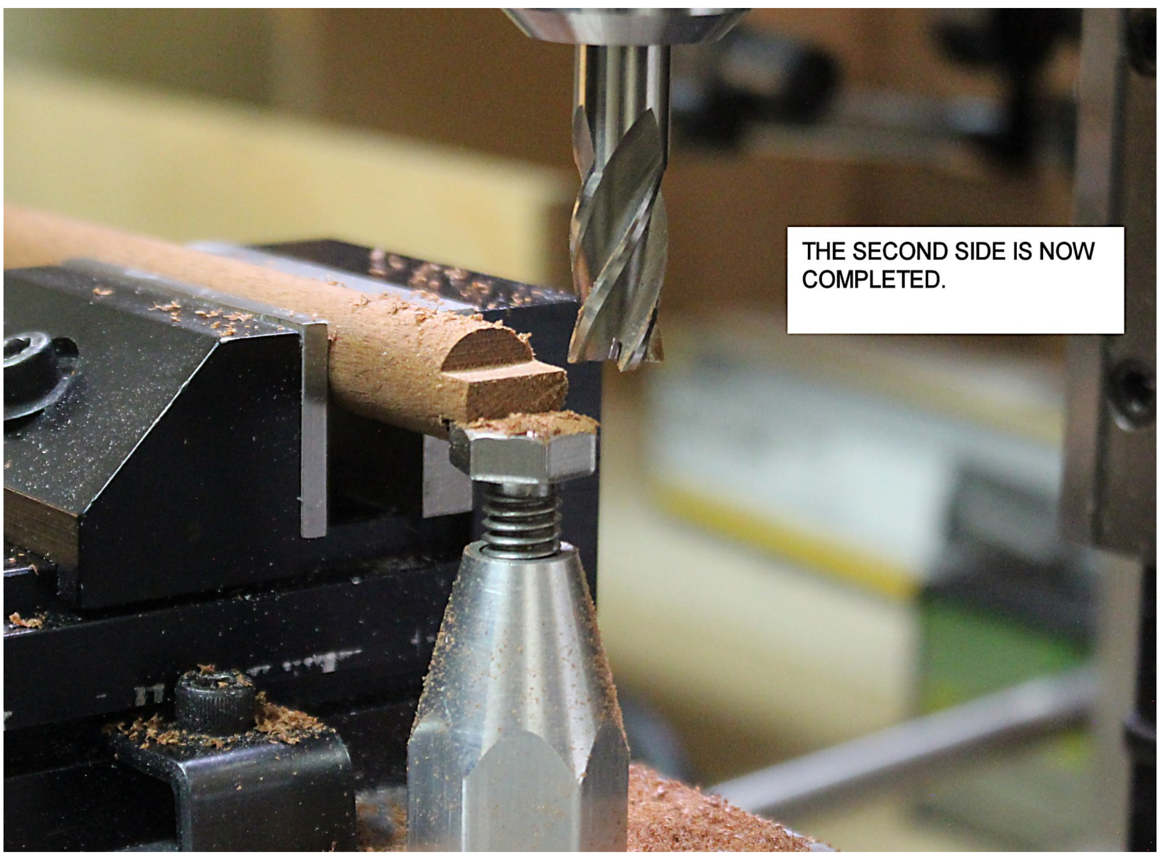


FIG. 7

Figure 7 showing both sides are now cut and are should be exactly parallel. Also if you wish to measure, the extrusion should be 5 mm wide.

FIG 8.

The part is now rotated 90 °. Care must be taken to make sure that the Extrusion is true to a triangle measuring device.

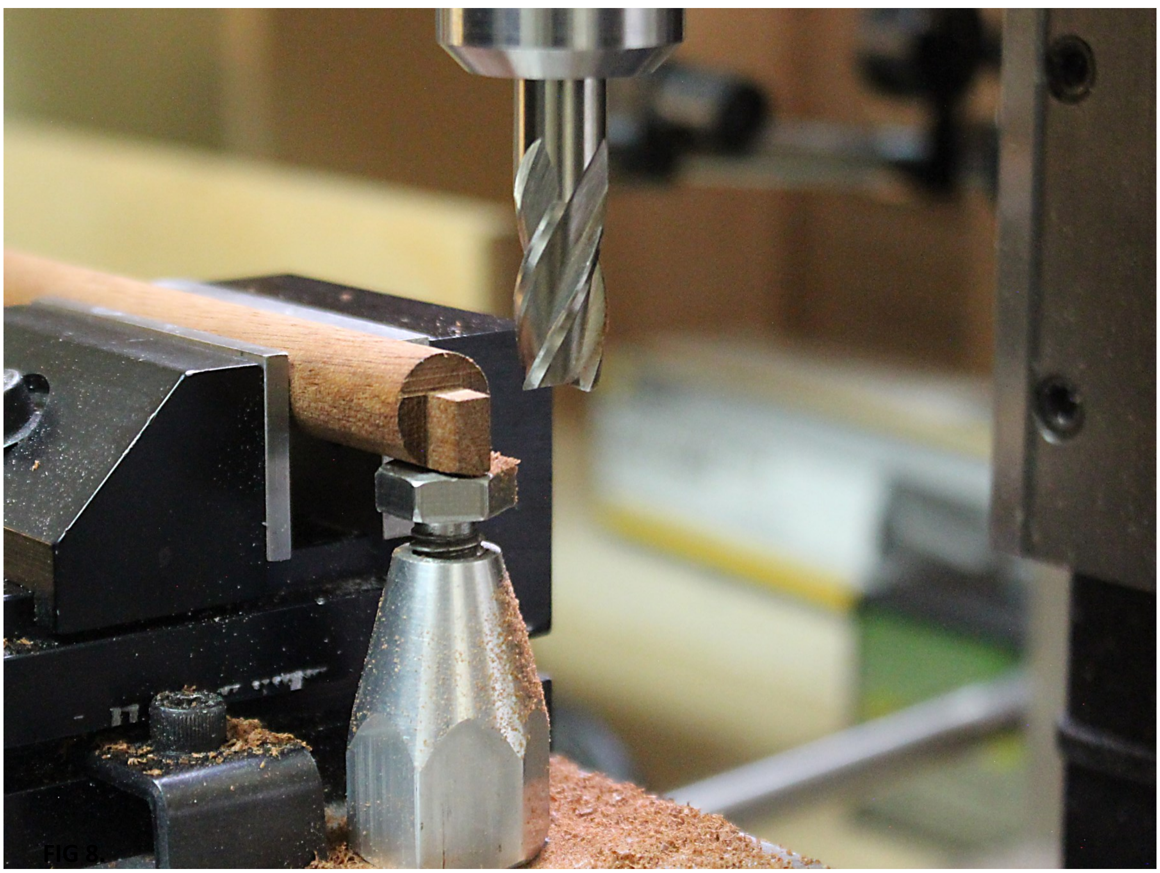


FIG. 9

The third surface has now been cut. Next (just as critical), we will cut the last forth cut.

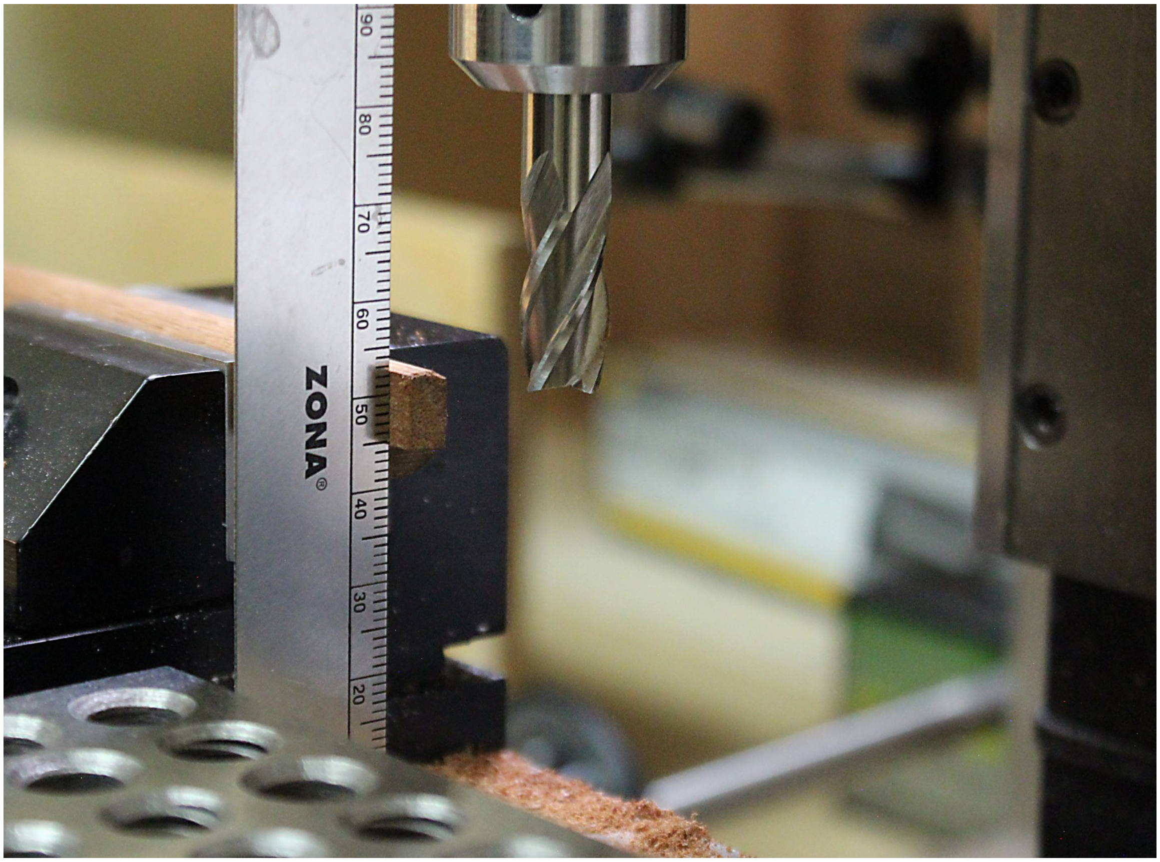


FIG. 10

Figure 10. For the forth cut, again, you are going to use a right triangle measuring device to make sure it is true.

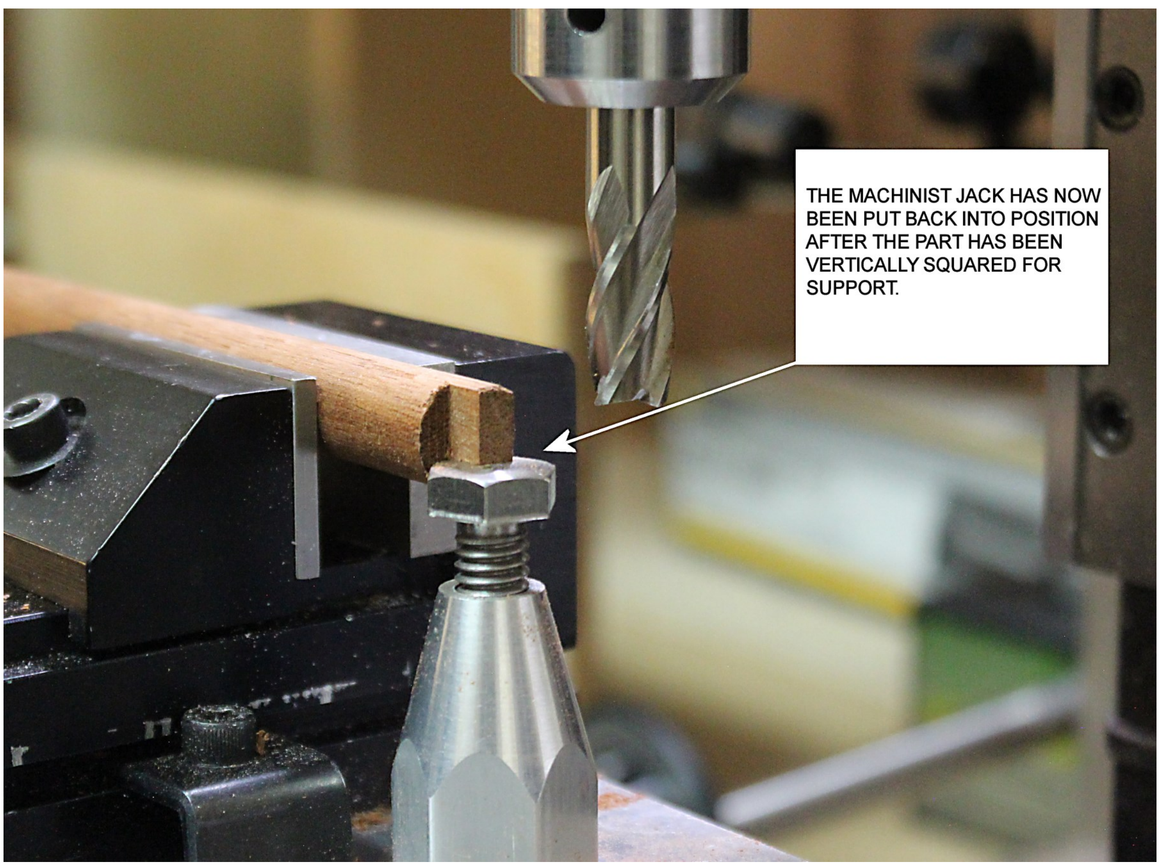


FIG. 11

Figure 11. The Machinist Jack is now put back into place to aid in support and squareness.

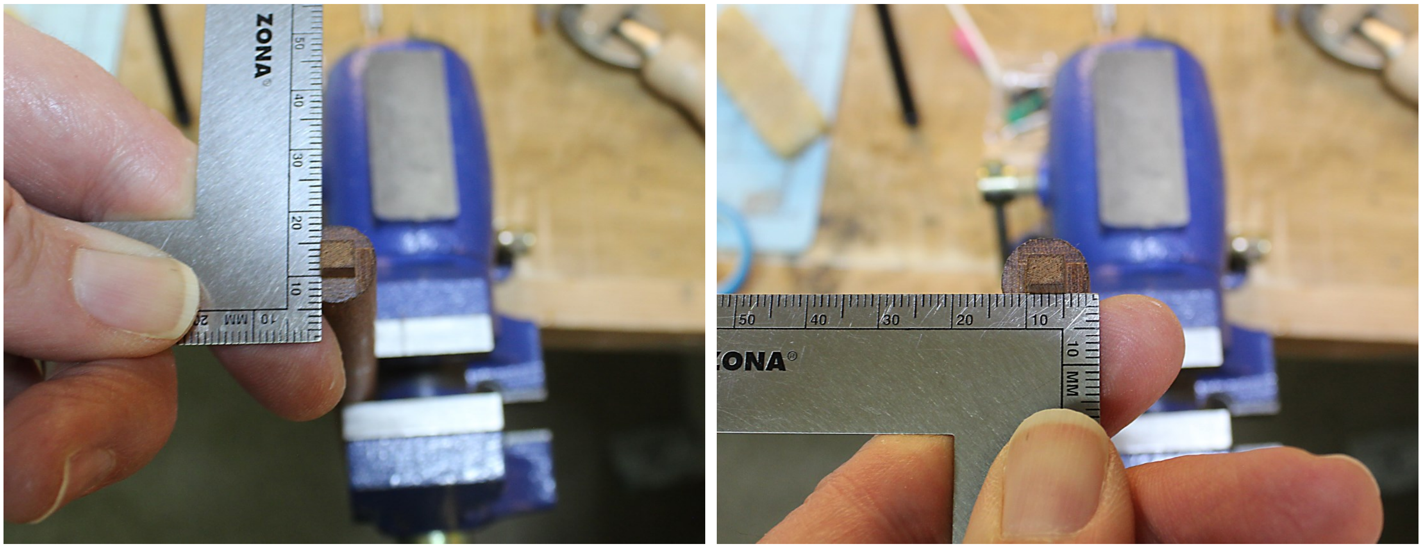


FIG. 12

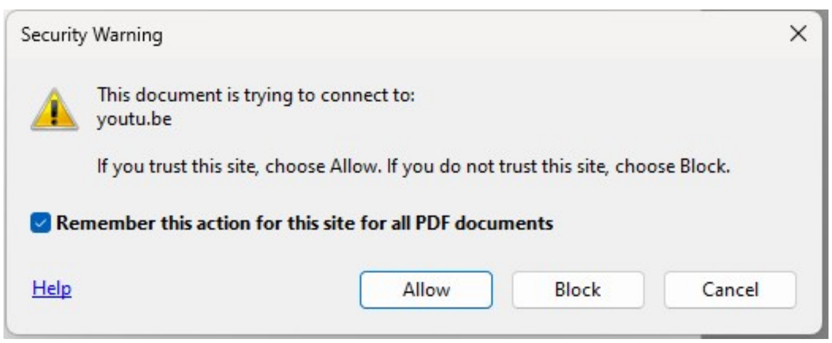
Figure 12. So given the fact that the dowel was not tuned true in a lathe, the extrusion turned out fair.

+/- **.25 %** was the tolerance on this. If the dowel had been first turned true and using a harder wood with less grain, it is possible to get the tolerance down to less than +/- **.1 %**

LINK TO VIDEO BELOW

Making a Mast Step

Note: If you do not get a message box, (like the one below) your computer might ask you to hold your **CTRL** key down and at the same time, **LEFT click** your mouse and the video will open .



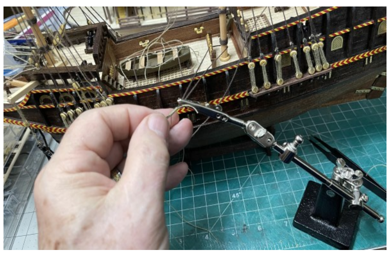
Well, this concludes Part II. Just LEFT click on the link and the Video will open in your Internet Browser such as Edge, Chrome, Firefox, or which ever browser you use for internet. Then you might have a “message box” (shown above that opens up asking you to “allow” this link to open. So click on “Allow”.

The College of Model Shipbuilding

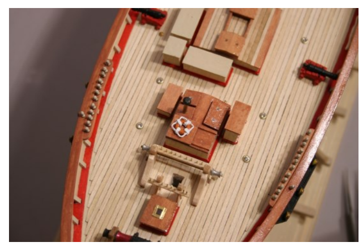
by Robert E. Hunt @ www.lauckstreetshipyard.com

Hello, my name is Bob Hunt. I own a small business called Lauck Street Shipyard. I specialize in providing very detailed instruction on how to build model ships from kits or from scratch. Other subjects are also covered in detail as well, which are all part of my College of Model Ship Building

The college of Model Shipbuilding has courses for all levels of experience. For beginners, we have Prep School Courses. These are based on kits that are easier to plank, such as Artesania Latina kit, Bluenose II.



Our Freshman Courses are also a good place to start if you are a beginner. We have a number of these courses to choose from including our most recent Golden Hind, which is based on the Ocre kit. It also has an optional masting and rigging course.



Our Sophomore Courses are designed for modelers with some experience who want to advance their skills and Techniques. One of the most popular Sophomore Courses is the Pride of Baltimore which is based on the Model Shipways kit.

Our Junior Courses are for modelers with much more experience who want to start learning kit bashing and scratch building. These courses include the Mamoli kit Rattlesnake and the Panart kit HMS Victory.

I hope you'll check out my website today to see all of the course I offer. Just go to https://www.lauckstreetshipyard.com. We also have video Practicums, and other very detailed Practicums on special subjects as learning CAD, learning different planking techniques, and how to rig a model ship. I also provide a private support forum for those who purchase one of my courses. If you have any questions please send me an email at lauckstreet@gmail.com

Lauuck Street Shipyard is a division of LSS Enterprises Inc. (A West Virginia S Corp)

Makerspace

By Mike Shanks

Some may find it surprising, 3D printing has been around nearly 40 years now. Originally developed in the 1980's by S. Scott Crump, 3D printing has found its way into many different industries including ship model building. This month we will do an overview of this amazing technology, how it works and how it increases model building productivity by adding yet another tool to our arsenal. So, grab some coffee or tea and let's talk about 3D printing.

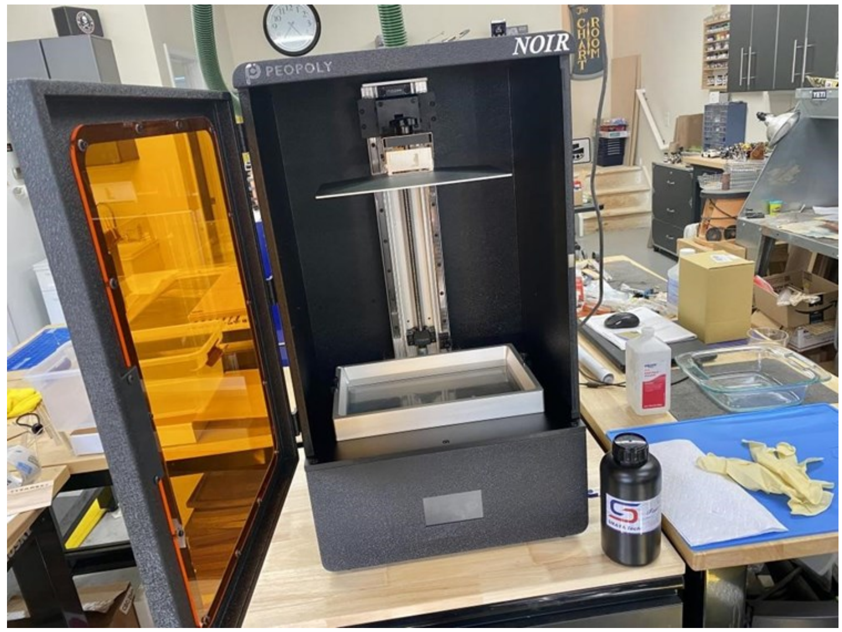
Designers and inventors have always needed a way to visualize their ideas via physical objects that can be viewed from all perspectives. The classic approach was to hand or machine carve a prototype from wood, clay or other materials. A very time-consuming task that also required a skilled artisan to accomplish. Back in the day, the time needed to create a prototype model was not so concerning since design drawings were also very time consuming having to be drafted by pencil, paper, straight edge, manual measurements and slide rule calculations. With the advent of computers, designers were able to use Computer Aided Design (CAD) to vastly speed up the process of drawing parts, assemblies, and 3D objects. Professional model makers could no longer keep up with architects, engineers, and draftsmen using computers to create their drawings. This led to Rapid Prototyping (RP), a set of fabrication techniques to generate physical models from computer generated drawings. Rapid prototyping resulted in the invention of multiple technologies enabling the creation of real-world models in hours versus weeks or months. This was the point where large-scale manufacturing went from handmade to machine made prototypes. 3D printing was one of those inventions to evolve from Rapid Prototyping.

Prusa MK3S FDM Printer. Photo courtesy Jodie Grein

Unlike subtractive manufacturing where material is removed from a larger object such as the case with mills, lasers, saws, and carving; 3D printing is an additive technology. Material is built up in very thin layers to produce the part. The layers are very thin ranging from 10 – 100 microns depending on printer type and model.

There are two primary types of 3D printers:

Fused Deposition Modeling (FDM), more commonly called filament or string printers use material on spools extruded through a nozzle under heat and pressure onto a build plate from bottom to top. FDM printers are able to print a variety of materials, primarily plastics such as ABS, nylon, PLA, and PETG. They can also printc arbon fiber impregnated plastics, wood filled sandable filaments, soft metals, and even food. FDM printers have become popular for hobbyists with entry level models starting at just a few hundred dollars (USD). Several companies also sell FDM printers as kits allowing the enthusiast to build their own and upgrade it as the technology evolves.



Peopoly Noir 4K DLP Resin Printer

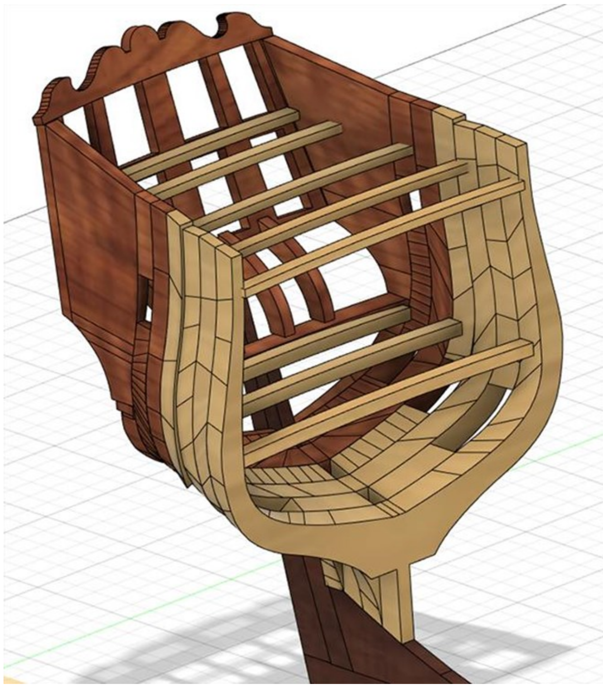
Resin 3D printers are more expensive than FDM printers ranging in price from around $1,000 to many thousands USD. They work by mechanically lowering a build plate into a vat of photopolymer resin and exposing the resin to an image one layer at a time either via a digitally controlled laser Stereo Lithography (SLA) or an LED panel Digital Light Processing (DLP). The resin cures instantly and builds in reverse from an FDM printer, hanging upside down from the build plate adhering via electrostatic stiction. Similar to FDM printers, resin comes in many different types and colors with ABS-like plastic being the most common.

While there are many overlaps between the two types of the 3D printers and an endless array of options depending on price point; some of the comparative differences between the two include:

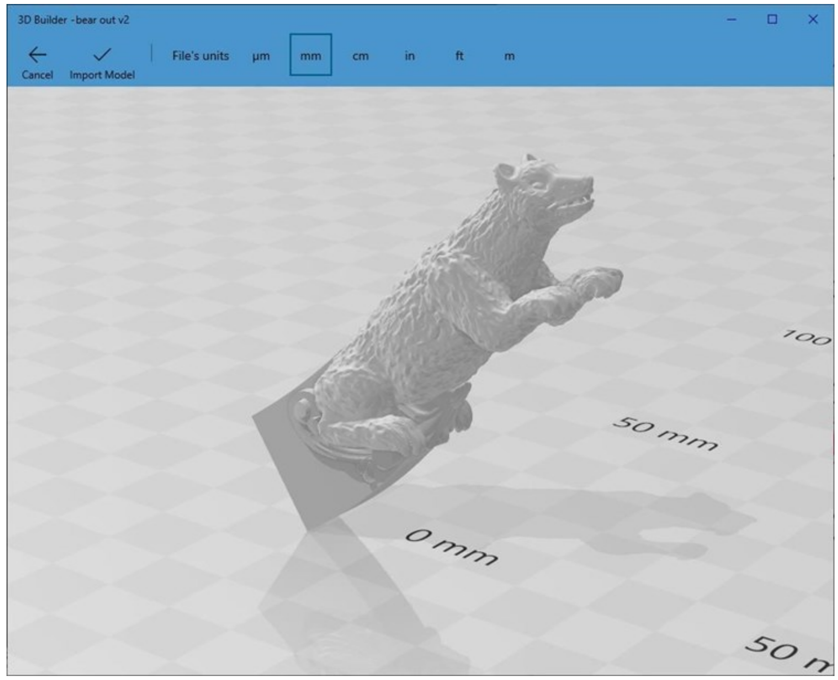
- FDM printers are generally easier to learn and use, lower consumable costs, more consumer choices, somewhat faster, and have a higher variety of filament types than resins. They also have become plug and play operating much like a standard printer.
- Resin printers are more expensive but offer higher resolution, a smoother model surface, and the potential to build larger size models or more quantity of smaller models per job. Resin printing can be somewhat complex as it requires a post process rinsing and curing of the parts.

Regardless of 3D printer technology, all will need a source of computer-generated artwork to create the models. Along with price, the 3D artwork itself is the one aspect that slowed the emergence of 3D printing into the consumer market place. Drawing in 3D on a computer takes a lot of practice and powerful software that can sometimes be nearly as expensive as the printer itself. 3D printers will typically accept files in either a *.OBJ or *.STL format. OBJ files are the most universal of all 3D file types and are generally used natively by most 3D manufacturing devices such as printers, CNC machines, rapid prototyping, and injection molding machines. STL files are similar to OBJ but are optimized exclusively for 3D printing. The drawing and creation of 3D computer models can be a hobby or career on its own using software such as

Fusion360, MudBox, Blender, ZBrush, 3DS Max, or Vectric Aspire. Luckily for model builders who don't want to draw, there are now a lot of places to obtain 3D objects for download such as Thingiverse, HeroForge, MakerBot, Myminifactory, and more.



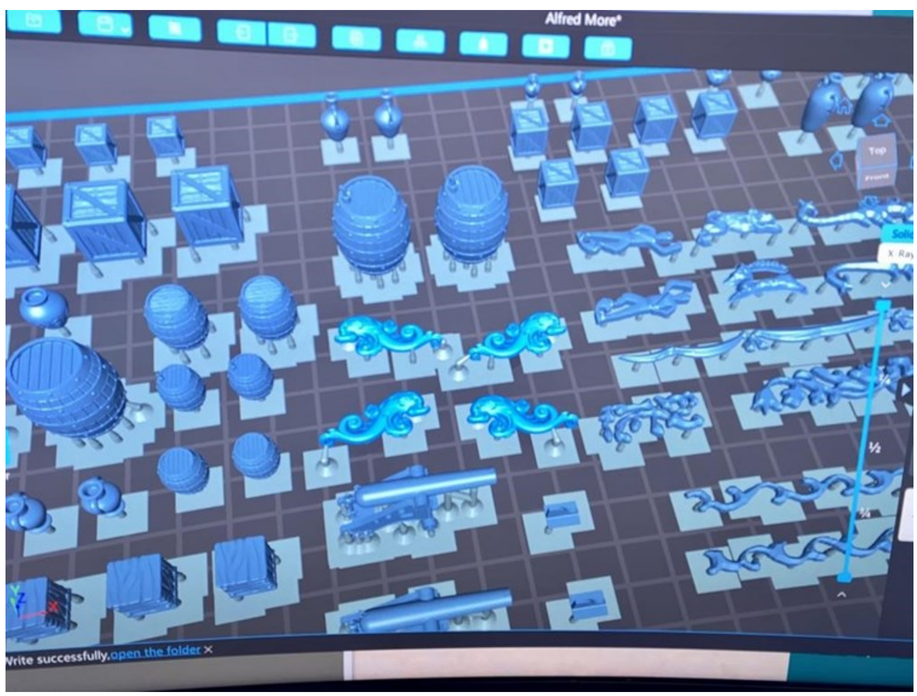
3D CAD drawing. Courtesy Jodie Grein



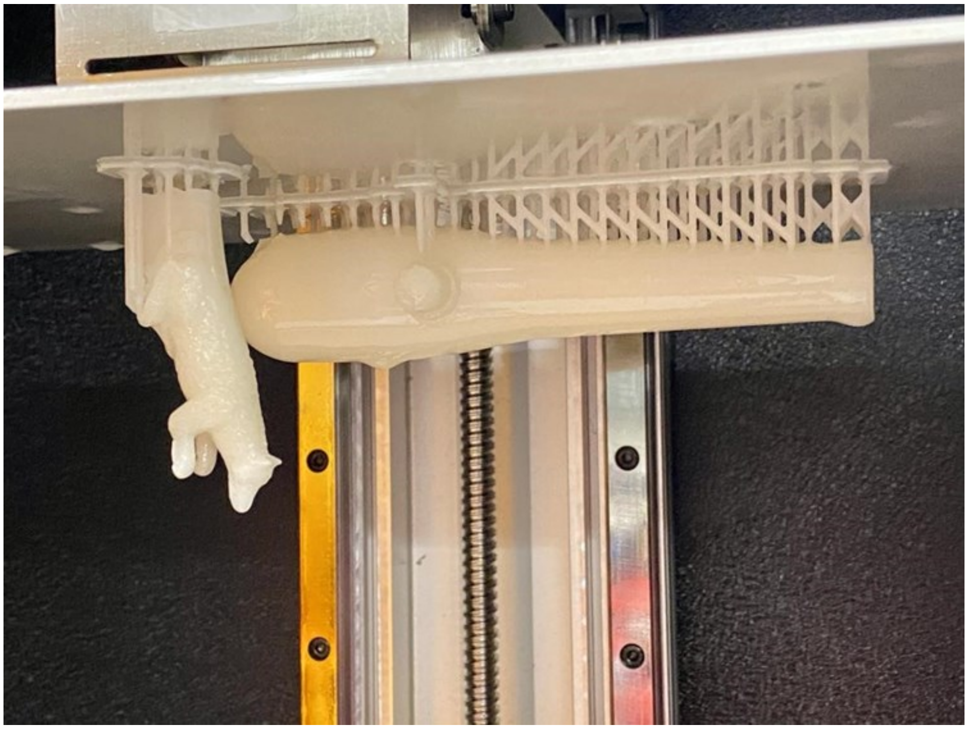
USRC Bear figurehead STL. By Team Szkutnik

When creating 3D models from scratch there is an additional software step required before they can be printed. Slicer software acts similar to a CNC toolpath in that it translates the digital model into machine instructions the printer can understand known as G-Code. The slicer software helps to orient the model for optimal registration, segmentation, and resin drainage to produce the best quality physical model in the shortest amount of time. The Slicer also allows you to scale, duplicate and mirror your models as needed.

Slicing adds supports ensuring structural integrity while curing and as a means to secure itself to the build plate. Similar to plastic models, the supports are clipped off after the print has cured.

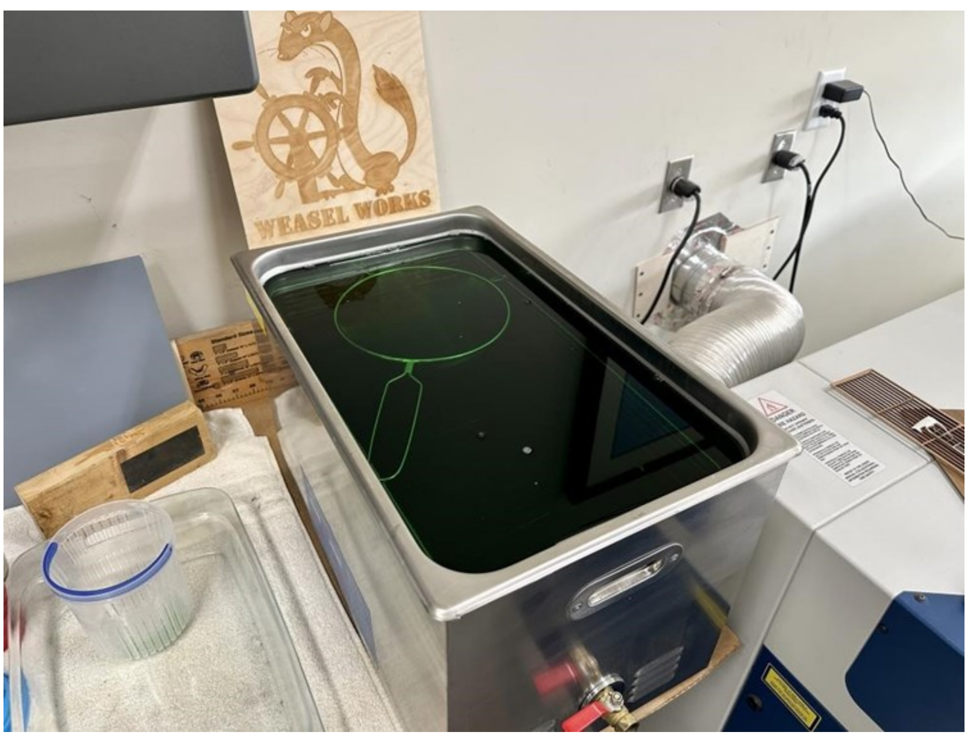


Chitubox Slicing Software



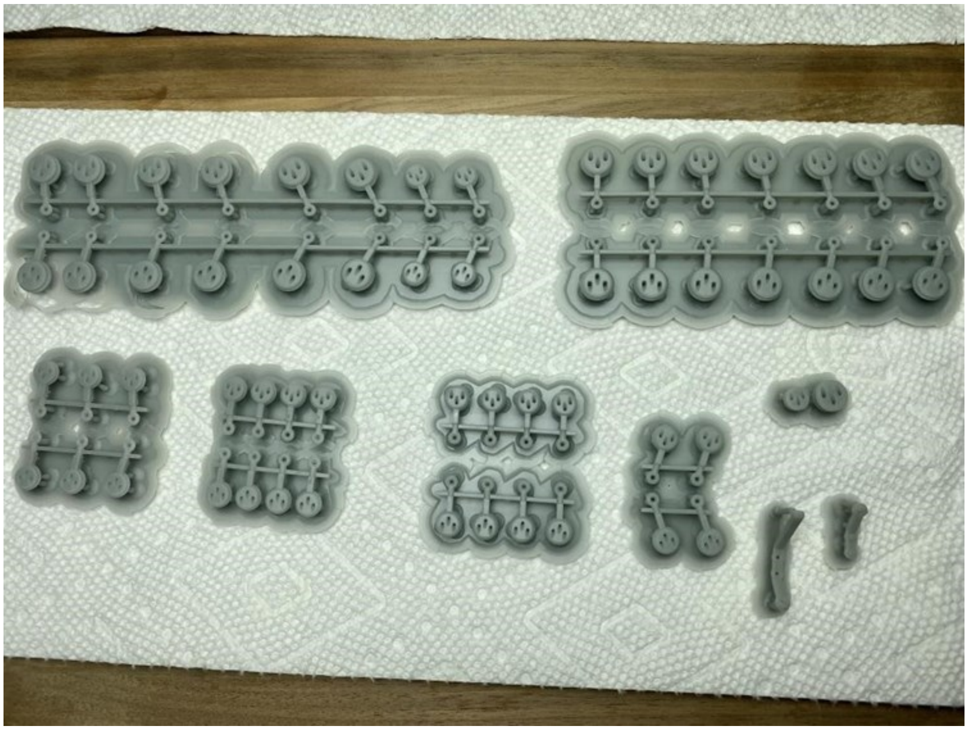
Resin 3D printed models

3D resin parts require rinsing after printing. The most common means is to simply rinse them in water to remove the excess liquid resin that was not activated during the light exposure process. At Weasel Works, we use an ultrasonic cleaner for this purpose. Ultrasonic cleaners were first made for cleaning jewelry and small machine parts. Like a lot of tools, they used to be very small and somewhat expensive. Comprised of a stainless -steel vessel holding a liquid (usually water) the machine produces an ultrasonic vibration, through the cabinet, in the form of microscopic "scrubbing waves". When combined with a water-based degreaser like Simple Green it is the perfect tool for rinsing resin parts. A bath of only 5 - 10 minutes is all it takes to clean a batch.



10 Gallon Ultrasonic Cleaner

Sunlight is the cheapest solution for curing 3D printed parts. Even the UV produced by the lights in your shop or coming through a window is all you need. Of course, placing parts outside during the summer in direct sunlight will quicken the curing process significantly. Beware, some filaments and resins are more flexible than others. Some become brittle once cured and may not be suitable for model building.



3D printed deadeyes curing under UV light

3D printed parts can be sanded, primed, and painted nearly identical to plastic model parts. This is good for those modelers who enjoy painting. Perhaps not so good for those who don't.

3D printed and painted cargo

3D printing has been around a long time in the plastic model, radio control, and fantasy miniature gaming world. To the best of my knowledge, the first retail wooden ship model kit was the 2015 Lauck Street Armed Virginia Sloop by Robert Hunt. The kit included 3D printed window frames, lantern, anchors, cannon, stove, and capstan.

LSS AVS Patrick Henry kit included 3D printed parts

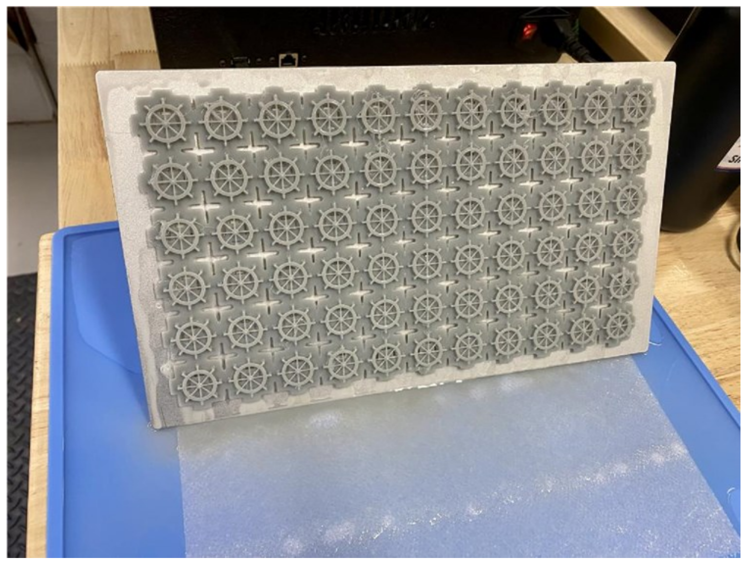
3D printed window frames and lantern was a kit first in 2015

3D printed parts have since become popular in the ship modeling industry. They are great for elements difficult to create by other means such as: deadeyes, window frames, crew figures, anchors, cannon, stoves, cargo, ship's wheel, furniture, lanterns, filagree, figureheads, and other décor. Design once, make many. Full 3D. Go from idea to physical model rapidly.

Assorted models in 3 colors of resin

Fine details and hollow barrel in these Dahlgren cannon at 1:64 scale

Custom 3D printed filagree for HMS Alfred



A batch of 66 wheels for Bluenose

3D printing, particularly FDM printing has reached consumer affordability with a good printer in the few hundred-dollar range. Resin printing has also dropped a lot in the past 2 years but still might be considered on the higher end of what hobbyists want to spend on tools. Cheaper than both CNC machines and lasers but more expensive than typical shop tools.

While 3D printing is within reach of the casual hobbyist, there are some lifecycle costs involved with owning and running a 3D resin printer. The resin is a consumable that typically comes in a 1-liter light proof container. You can reuse leftover portions of the liquid resin after pouring it through a filter. However, it does have a shelf life. Even a brand-new unopened bottle will expire after 1 year from the date on the label. I learned this the hard way after stocking up on too much. It is better to purchase your resin “on demand” and fresh, as you need it. You will also go through a lot of 99% Isopropyl Alcohol keeping your equipment clean and rinsing parts. Consumable surgical type gloves are recommended as uncured resin can be a skin irritant. There can be quite a lot of odors from both the resin and alcohol so printing and curing in a wellventilated area is recommended. Resin printing is not something I would recommend in a spare bedroom. The clear plastic film on the bottom of the vat will need to be replaced occasionally and you will go through a lot of lint free cloths. The most expensive consumable is the LED projector panel itself. Every printer has a maximum number of exposures before the panel begins to fail and must be replaced. With the declining cost of printers, replacing the panel could be more expensive than just buying a new printer depending on situation.

3D printing for ship modeling has reached mainstream status. Probably the highest tech tool available for a reasonable cost. There was a time when plastic parts on a wooden ship model might be criticized. The same could be said for CA glues and laser cut parts. Contemporary model ships from 200 years ago were built with only hand tools – no scroll saw, table saws, or disc sanders. Today we are seeing custom model parts being produced via 3D printing and other fabrication methods. As technology progresses so does the potential for model building. Leveraging technology to make better models is what we do at Weasel Works. Stay tuned to Makerspace for more in future issues of the MSB Journal

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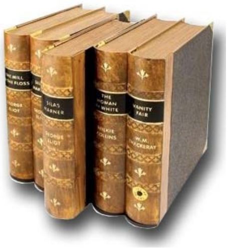
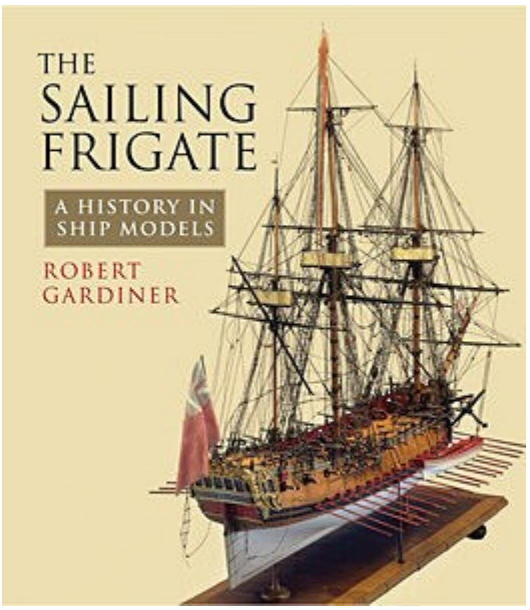


The Book Nook

Books of interest for the Model Ship Builder

New & Old



The Sailing Frigate: A History in Ship Models

Author: Robert Gardiner

ISBN 10: 184832295X
ISBN 13: 9781848322950
Illustration: photos & illus.
Pages: 128
Published: 2016

First of a series which will take selections of the best models in the National Maritime Museum in Greenwich to tell the story of specific ship types – in this case, the evolution of the cruising ship under sail. Each volume reproduces a large number of model photos, all in full colour, and including many close-up and detail views with many captions and annotations. Although pictorial in emphasis, the book weaves the pictures into an authoritative text, producing an unusual and attractive form of technical history.

Genes Nautical Trivia

Ship Names

P	A	I	N	T	S	H	S	I	N	R	A	V	R
D	S	N	P	L	R	E	P	I	L	A	C	R	E
I	F	T	L	N	I	A	T	S	D	H	E	W	V
V	H	I	A	R	E	M	I	R	P	M	S	O	I
I	R	U	L	E	A	P	O	T	M	V	N	R	R
D	S	K	E	E	L	C	L	A	M	P	I	K	D
E	B	W	P	U	N	C	H	I	K	W	P	B	W
R	A	M	A	G	N	I	F	I	E	R	E	E	E
S	O	L	D	E	R	I	N	G	I	R	O	N	R
S	R	E	Z	E	E	W	T	L	A	D	S	C	C
U	J	S	D	R	A	Y	R	U	L	E	R	H	S
Z	K	N	I	F	E	W	Q	E	R	T	S	A	M
T	A	P	E	B	Y	S	V	I	C	E	S	A	C
S	K	C	O	L	B	J	W	S	P	M	A	L	C

BLOCKS	CALIPER	CASE
CARD	CLAMPS	CLEATS
CORD	DIVIDERS	DRILL
FILE	GLUE	HAMMER
KEELCLAMP	KNIFE	MAGNIFIER
MAST	PAINT	PINS
PLIERS	PRIMER	PUNCH
RULER	SANDER	SAW
SCREWDRIVER	KEELCLAMP	SQUARE
STAIN	TAPE	TWEEZERS
VARNISH	VICE	WIRE
WORKBENCH	YARDS	

Genes Nautical Trivia

James Cook

Each letter in the phrase has been replaced by a number
Solve this quote by James Cook

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

15 13 / 4 7 8 23 / 13 11 18 22 / 2 12 1 23 / 13 23 12 22 16 8

8 1 26 / 26 13 7 / 18 1 11 23 / 15 13 / 1 11 15 / 26 13 7

2 10 25 25 / 11 22 21 22 16 / 6 1 26 / 1 23 23 22 11 23 10 13 11 / 23 13

23 12 22 10 16 / 25 10 20 10 23 1 23 10 13 11 8 / 1 5 1 10 11

Genes Nautical Trivia

Answers

This is the code used to encode the quotation made by James Cook

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	14	18	15	22	3	5	12	10	4	19	25	20	11	13	6	9	16	8	23	7	21	2	17	26	24