SegMaster 3.0

Design and Visualize Your Turning Project

OCTOBER 16, 2020

Meredith, NH

The SegMaster Program

Version 1.0.0

Design your Segmented Bowl or other Turning.

Manipulate it in 3D to know how it will look before your build it.

Part of

The SegMaster Series

The SegMaster Series is a set of short articles provided for woodworkers interested in Segmented Wood Turning. They are short, concise, and filled with tips and techniques that readers may or may not have thought of themselves. They maximize photos and illustrations and can be skimmed quickly or read slowly and studied. They can be printed, taken to the shop, and used as tutorials. Please enjoy them and let me know how they can be improved.

Written By

The SegMaster

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The SegMaster Program

1 Introduction and Overview

Not long ago, I completed a segmented bowl with a complex feature ring that took me a long time to create. But when I took it off the lathe, I was not pleased with the shape of the bowl. I realized that I needed some way to visualize the completed bowl before I started cutting the pieces.

I decided to write a program to do this. I call it SegMaster. Here is how it works.

Sketch the outline of your Turning onto a piece of graph paper. Enter it into SegMaster. SegMaster will produce a complete design providing you with *exact* dimensions of every segment needed to complete the Turning. Just as importantly, SegMaster will show you a 3D rendering as well as a cross section of your design.

Of course, there can be a lot more to it than that, especially if you want to get fancy – which of course, most of us do. But we will start simply and then get to the complicated stuff later.

You can use SegMaster to design bowls, vases, candle sticks or anything else you want. I use the generic term “Turning” to refer to whatever it is you want to design. I might sometimes also use the term “Bowl”. This may also refer to any Turning.

1.1 What you should know to use SegMaster

This program assumes that users would have basic knowledge of operating a PC. This means that you should know what files are, how to find them, how to move them around and how to find them again after doing so.

You will probably find bugs in the program. Hey – I am only one person and I am doing the best I can. When you find them, if you can tell me exactly how to recreate them, I will take a shot at correcting them.

1.2 Integrated Manual

I have done my best to make the program as intuitive as possible. If you see buttons, you can mostly click them without worrying that you will cause problems by doing so. In most cases I show a summary of what you are about to do along with the chance to either cancel or continue. Also, you can view your design while you are trying distinctive features.

Unfortunately, I have not yet included an “Undo” feature. Fortunately, it is easy to save your work. I suggest doing so regularly.

1.3 The 3D view is hollow

The mathematical model that I use for 3D rendering draws surfaces only. From the outside these surfaces usually appear the same as would a solid. This will be evident only if you make the inside diameter greater than the outside diameter – which most wood turners understand is to be avoided. The program will let you do this, but if you do, the inside of the surface will become visible. I have made the inside of the turning bright red to highlight cases where this has happened.

In the 3-D view, you can turn off the outer surface. This allows you to view the inner surface. Of course, as stated above, this inner surface will appear in red.

1.4 Rings and Details

The first step in a new project is to define the shape of your turning by specifying the outer diameter of each ring.

Rings are what you build in the shop. I have set up the program to design rings that are ¾" thick. That is what most of my stock comes with.

Sometimes, you want to visualize more detail than what can be shown by specifying the top and bottom of the inside and outside of a ring. I have therefore built in the ability to break these rings into layers that I call "details". Typically, you would want to break the ring into three details of ¼" each. You can then specify the inner and outer diameters of each detail separately. You will usually find that you want to break some rings into details and leave most of the others at ¾".

I suggest that you start by working with full rings of ¾" each and leave the concept of details until you are more familiar with the program.

Usually, the bottom diameters are not specified. The bottom ring (or detail) defaults to the top diameter of the ring (or detail) below. Activating an Advanced feature allows you to override this.

The values shown after (to the right of) the texture columns are ring calculations. You cannot set these values directly; they are calculated from the values provided mostly by the parameters of the details that make them up.

Rings specify all the information you will need to construct them as a step in creating your turning. For each ring, you can specify the following. Some these are set via defaults on the Overview Window, but you can override any of them on a ring-by-ring basis.

- Number of Details in this Ring
- Number of Segments in this Ring
- Offset Angle (used only for rendering image on your computer)
- Texture Sequence

With this information, the program will compute the Inner and Outer Diameters of the Ring, the Ring Thickness, and the Width and Length of the segments required to make up the Ring.

You should also specify the ***Texture Sequence*** to be used on this ring. Usually, your "*sequence"* will consist of only one ***Texture.*** It is still a sequence, but it is a sequence of only one. The power comes when you specify two or more textures in the sequence. With two textures in a sequence, the two colors will alternate. Complex patterns can be designed in this way.

If you don't yet understand this, don't worry. It is just an overview, so I made it as short as I could. It will become clear in a tutorial.

1.5 Radius and Diameter

Originally, I wrote SegMaster to do specify most everything in terms of radius. As I worked with it, I decided that speaking in terms of diameter was more intuitive. I changed the program. This was a rather

significant undertaking and there are two issues. The first is that I might not have updated all the spots correctly. I may also have introduced a few bugs. The other issue is that some of the illustrations still show radii. I have updated the images where this is important, but you may notice some screen shots that still show radii. Perhaps I will update this later if I get any complaints, but I don't think it will affect anyone's ability to understand the material.

2 Tutorial: Step by step

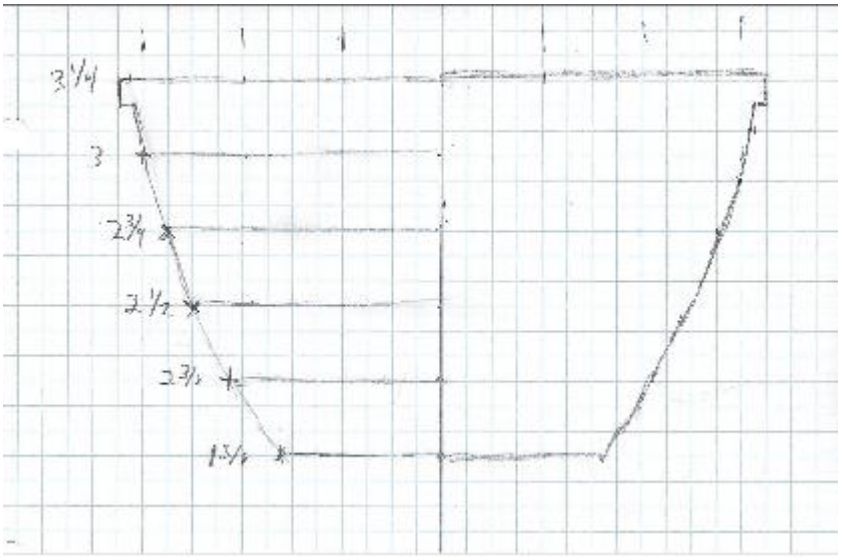
2.1 Installation

Download the software as a "ZIP" file. Place it into C:\Program Files. Right-click on it and select "Extract All". This will create a directory named "SegMaster". Within this directory, there is a subdirectory named "bin" and within this directory is a file named "SegMaster.exe". Right -click and select "Create Shortcut". This will put a shortcut onto your desktop. Use this shortcut to start the program.

If you find these instructions, get a friend (or grand-kid) to help you. Once this is done, you can start the program at any time by double-clicking the shortcut.

2.2 Create a Design

In segmented turning, you need a good idea of the shape you want to have when you finish. Sketch your design onto quarter-ruled graph paper. Measure the radius (half the width) of the bowl every ¾ inch. This is because you will almost certainly be working with ¾" stock.

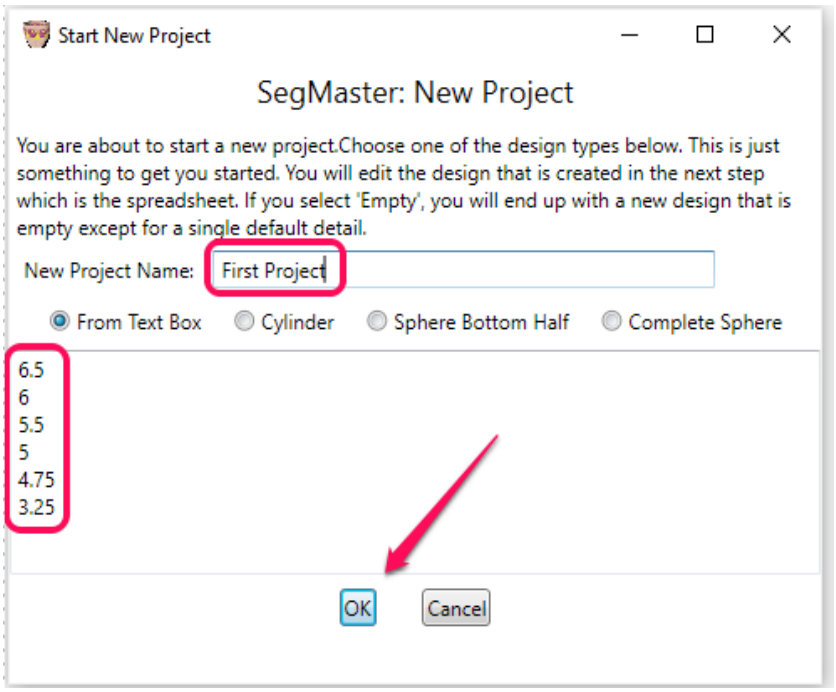


Here is what I did to get started on a very simple small bowl:

2.3 Enter the Design

Start the program. Click "OK" to dismiss the Splash screen. Note that in the sketch above, I measured the distance from the center or the radius. The program expects diameters so double these numbers before entering them.

Ignore any warnings about not having a starting design or not being able to find it or that the program is starting a simple design for you. Just click what you must to get past these info windows.



Eventually two other forms will appear. An “Overview” and a “Spreadsheet” view.

On the menu line in either form, click ***File -> New***. This will bring up the ***New Project*** window. Enter a name for your project such as “First Project”. Make sure that ***From Text Box*** is selected. Copy and paste the following into the large text box:

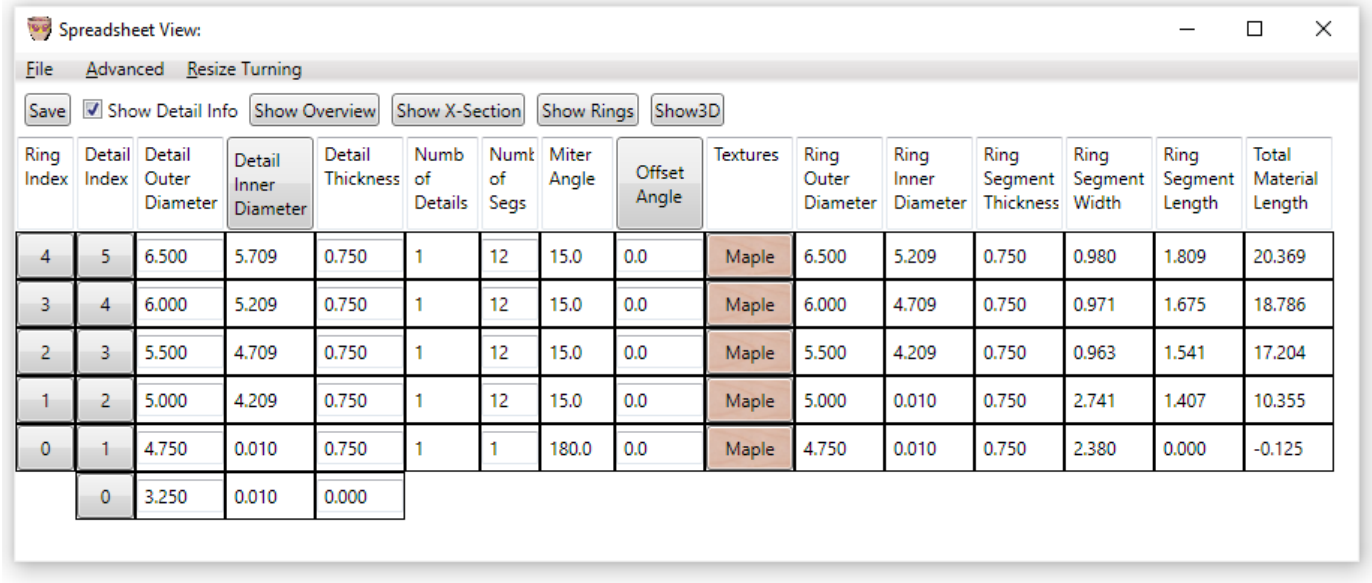
6.5
6
5.5
5
4.75
3.25
Click “OK”.

The numbers you have entered represent the diameters of a bowl that has been designed by or for you. You can start with a sketch or a photo or a bowl that you like. The precision does not have to be to a thousandth of an inch. For now, you will just need a general idea of the dimensions.

A Spreadsheet and an Overview Form will appear:

2.4 The Windows

2.4.1 The Spreadsheet Form



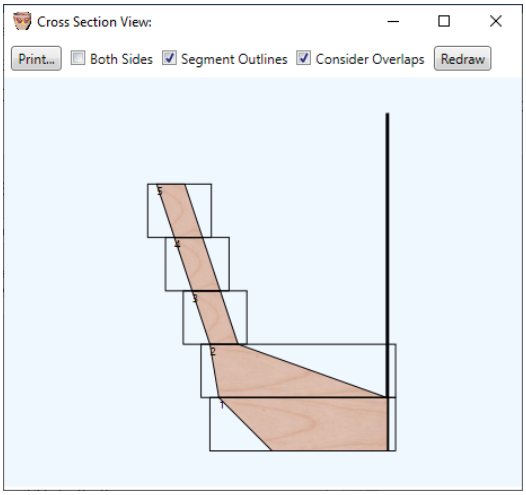
Ring Index	Detail Index	Detail Outer Diameter	Detail Inner Diameter	Detail Thickness	Numb of Details	Numb of Segs	Miter Angle	Offset Angle	Textures	Ring Outer Diameter	Ring Inner Diameter	Ring Segment Thickness	Ring Segment Width	Ring Segment Length	Total Material Length
4	5	6.500	5.709	0.750	1	12	15.0	0.0	Maple	6.500	5.209	0.750	0.980	1.809	20.369
3	4	6.000	5.209	0.750	1	12	15.0	0.0	Maple	6.000	4.709	0.750	0.971	1.675	18.786
2	3	5.500	4.709	0.750	1	12	15.0	0.0	Maple	5.500	4.209	0.750	0.963	1.541	17.204
1	2	5.000	4.209	0.750	1	12	15.0	0.0	Maple	5.000	0.010	0.750	2.741	1.407	10.355
0	1	4.750	0.010	0.750	1	1	180.0	0.0	Maple	4.750	0.010	0.750	2.380	0.000	-0.125
	0	3.250	0.010	0.000											

Look at the column headings. Mostly, they are self-explanatory. You might also see references to both ”rings” and “details”. We will explain this later, but for now, treat them as if they are the same.

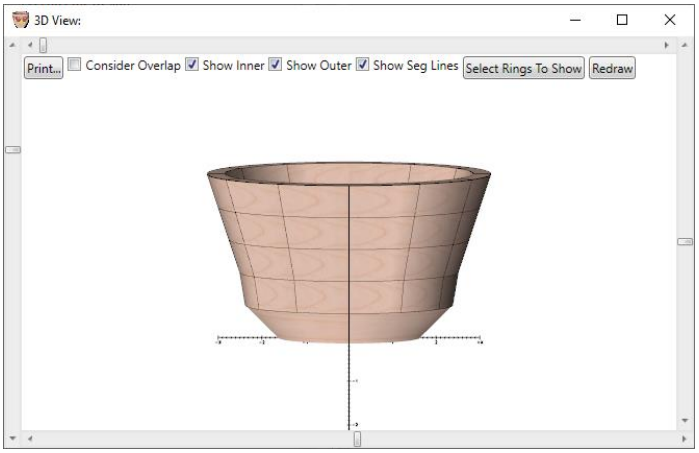
- ***Detail Outer Diameter*** is the diameter you just entered.
- ***Detail Inner Diameter*** is the inner diameter – computed by the program – at least for now. This depends upon the ***Wall Thickness*** as set in the ***Overview Form***.
- ***Detail Thickness*** is the thickness of the ring in the vertical direction. This depends upon the ***Detail Thickness*** set in the ***Overview Form*** but can be overwritten.
- ***Numb of Details*** is set to 1 for now – explained later.
- ***Numb of Segs*** is the number of segments in each ring. 12 is the default that is set in the ***Overview Form***. You can also override this for each ring.
- ***Miter Angle*** is the angle to use when cutting the specified number of segments.
- ***Angle Offset*** is the amount the ring is rotated before as it is drawn.
- ***Texture*** represents the type of wood used for this ring.
- ***Ring Outer Diameter*** is the outer diameter of the ring.
- ***Ring Inner Diameter*** is the calculated inner diameter of the ring that will get you the wall thickness specified in the ***Overview Form***.
- ***Ring Segment Thickness*** is the thickness of the ring. "0.75" is the default.
- ***Ring Segment Width*** is the width of the stock you should use to get the desired inner diameter.
- ***Ring Segment Length*** is the length of each of the 12 segments to get the desired outer diameter.
- ***Total Material Length*** is the amount of stock you will need to cut all the segments in the ring.

2.4.2 The View Forms

Notice the buttons across the top of the form (under the menu). To see a cross section of your bowl, click the button at the top of the spreadsheet form.



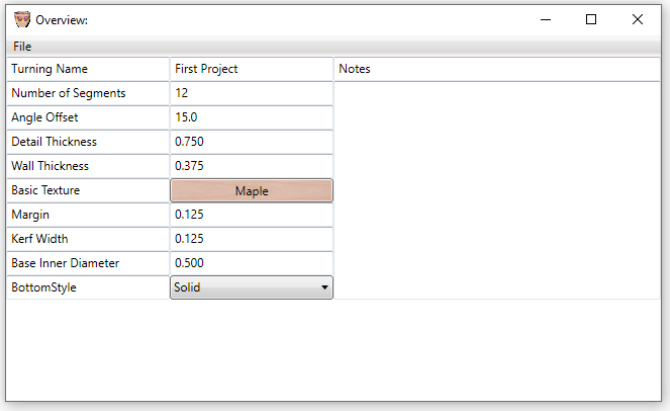
To see a 3D rendering of the bowl, click the "Show 3D" button.



For now, you can ignore the buttons at the top of these forms – or click on them to see what happens. The left slider on the 3D display zooms in and out. The right slider alters the Up Down perspective. The bottom slider rotates the bowl. And the top slider shows the segments that make up the bowl. Try moving them.

2.4.3 The Overview Form

Next look at the Overview window:



Here are some notes as to what these fields mean:

- ***Turning Name*** is the name you have given to this turning.
- ***Notes*** is a text area that is free form for anything you want to remember about the turning.
- ***Number of Segments*** is the default number of segments in each ring. We recommend 12 to get started.
- ***Angle Offset*** is the difference in starting angle between each ring.
- ***Detail Thickness*** is the default thickness for each ring.
- ***Wall Thickness*** is used by the program when computing inner diameter.
- ***Basic Texture*** is the default texture used for drawing the rings.
- ***Margin*** is added to the inner and outer diameters of the rings to compensate for any errors you might make when creating or aligning the rings.
- ***Kerf Width*** is the material that will be lost due to the saw blade when computing the amount of material used to build a ring. SegMaster is extremely precise.
- ***Base Inner Diameter*** is used for bottom styles that use a plug or floating base. This is the inner diameter of the piece that will be used to fill the hole in the base.

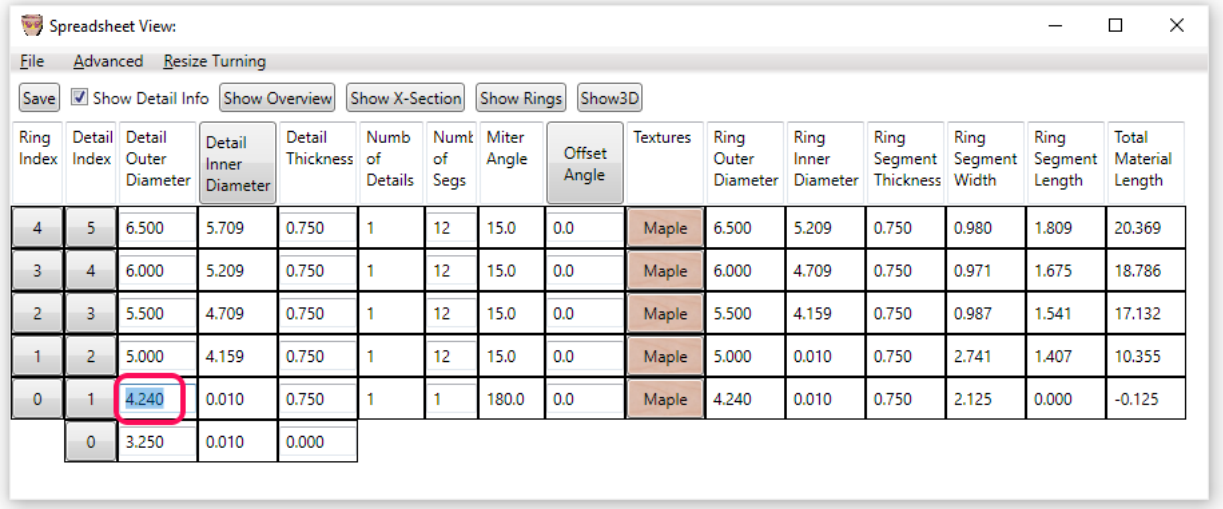
2.4.4 How Defaults Work

The *Overview Form* has several fields that are specified as “Defaults”. In SegMaster, there are lots of fields to fill in. Many of them are essentially “blank” and are filled in by these “Defaults”. In this way, if you change a “Default”, it changes all the blank fields. What might be confusing is that the Spreadsheet

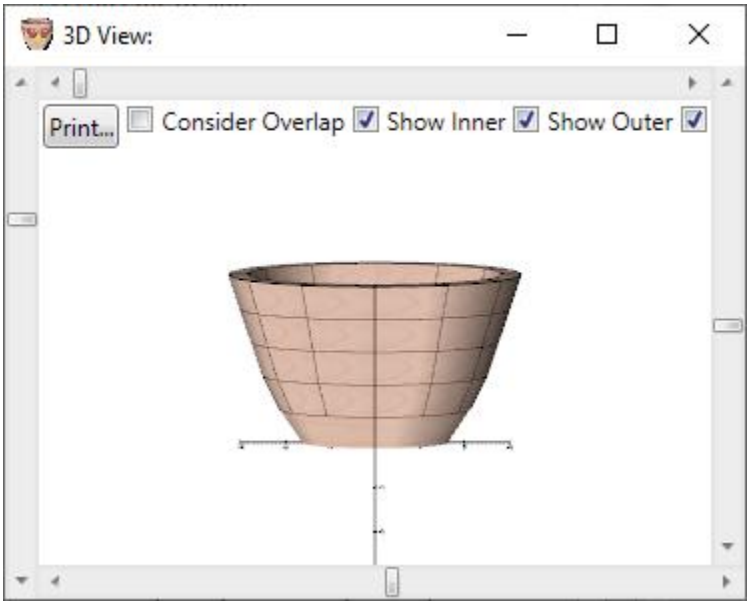
shows these fields filled in. You can overwrite what is filled in to supersede these defaults. After that changing the “Default” will not affect these fields.

2.5 Improving the design

Look at the Cross Section and 3D windows. This is not the shape we desired. Turns out that when I measured the width of the rings, I measured one incorrectly (really). It turns out that instead of 2 3/8, one of the rings should have been 2 1/8. This is easy enough to correct. Simply replace the text as shown below:



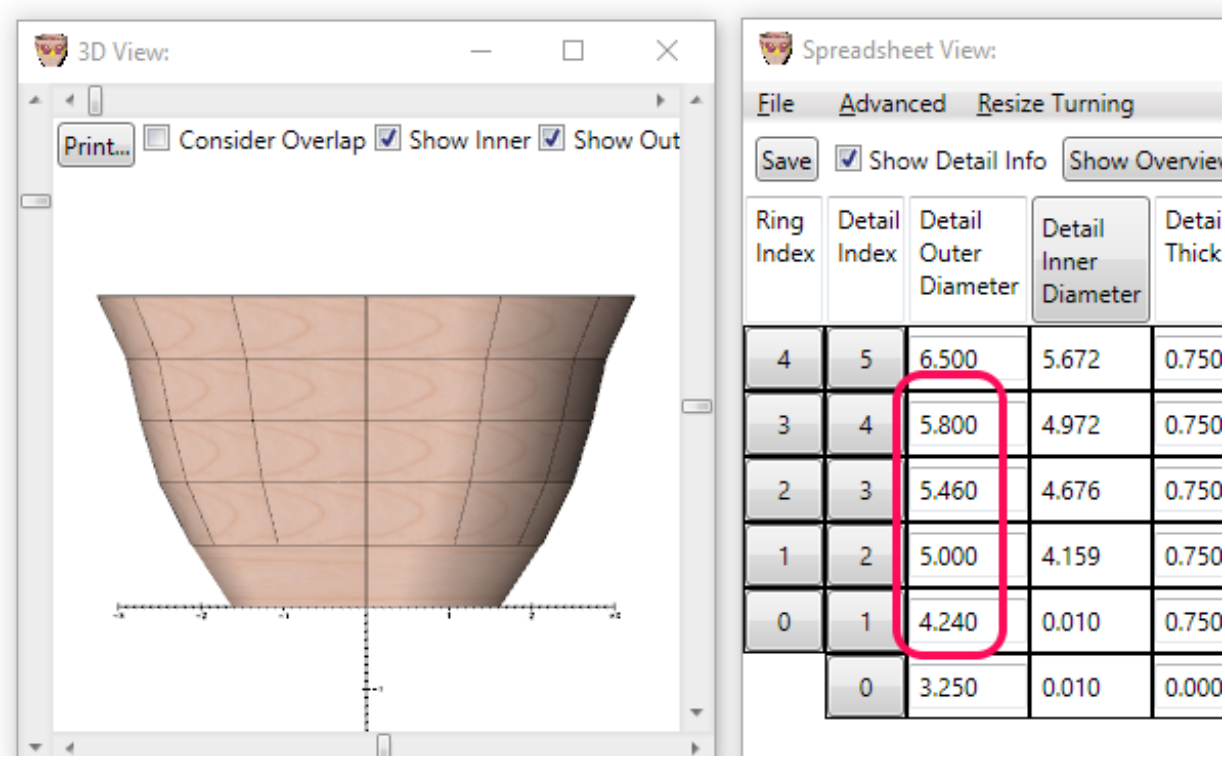
Ring Index	Detail Index	Detail Outer Diameter	Detail Inner Diameter	Detail Thickness	Numb of Details	Numb of Segs	Miter Angle	Offset Angle	Textures	Ring Outer Diameter	Ring Inner Diameter	Ring Segment Thickness	Ring Segment Width	Ring Segment Length	Total Material Length
4	5	6.500	5.709	0.750	1	12	15.0	0.0	Maple	6.500	5.209	0.750	0.980	1.809	20.369
3	4	6.000	5.209	0.750	1	12	15.0	0.0	Maple	6.000	4.709	0.750	0.971	1.675	18.786
2	3	5.500	4.709	0.750	1	12	15.0	0.0	Maple	5.500	4.159	0.750	0.987	1.541	17.132
1	2	5.000	4.159	0.750	1	12	15.0	0.0	Maple	5.000	0.010	0.750	2.741	1.407	10.355
0	1	4.240	0.010	0.750	1	1	180.0	0.0	Maple	4.240	0.010	0.750	2.125	0.000	-0.125
	0	3.250	0.010	0.000											



This immediately improves the shape of our turning:

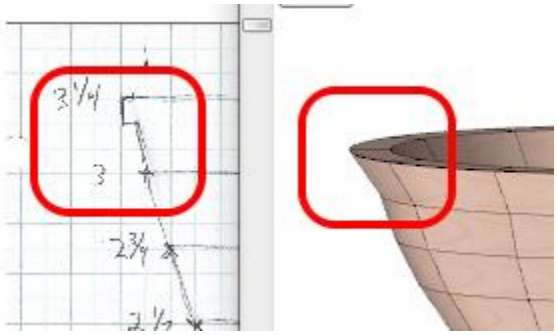
But it is still not exactly what we want. We could at this point manually key in different values for these outer diameters, but this would be tedious and time consuming. Instead, you can put the cursor somewhere in the field and use the “+” and “-“ keys to add to or subtract two hundredths of an inch from the specified outer diameter. Hold the “Shift” key to make a tenth of an inch change with each click (a tenth of an inch). Hold the “Ctrl” key to make changes of .005 inch.

I have been happiest when I “rough out” the shape using the shift key then tune it by making finer adjustments using the +/- keys by themselves. I move between rings using the up / down cursor keys. In this way I can “sculpt” the shape of the bowl. Here is what I ended up with for my design:



2.6 Introducing More Detail

At this point, our design looks pretty good, but we can make it look closer to the bowl we want to end up with. For example, compare the top ring in the 3D display with the initial drawing. There just isn't enough detail to properly represent our design goal.



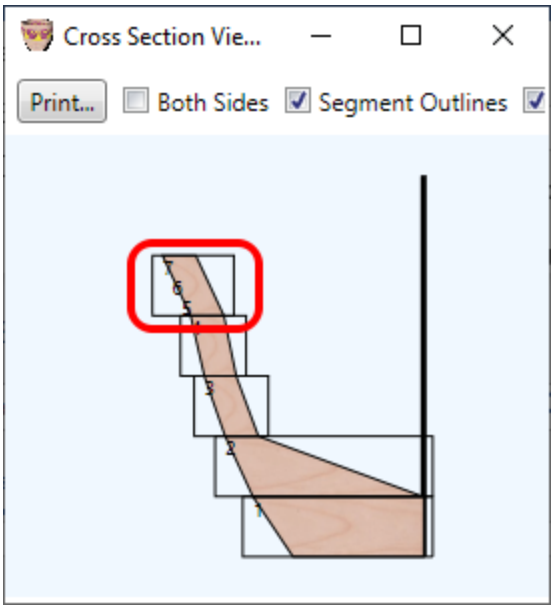
The solution is to split the ring to show more detail. I prefer to start with details that are ¼ inch thick. We can get this by "Trisecting" a ring. To trisect a ring, right click on the corresponding button under the column named "Detail Index". Then select "Trisect Detail Info". The corresponding ring will be split into three "Details". Your "Cross Section" and "3D" views will not look much different, but there will be three rows making up what used to be a single row.

Spreadsheet View:

File Advanced Resize Turning

Save | Show Detail Info | Show Overview | Show X-Section | Show Rings | Show3D

Ring Index	Detail Index	Detail Outer Diameter	Detail Inner Diameter	Detail Thickness	Numb of Details	Numb of Segs	Miter Angle	Offset Angle	Textures	Ring Outer Diameter	Ring Inner Diameter	Ring Segment Thickness	Ring Segment Width	Ring Segment Length	Total Material Length
4	7	6.500	5.672	0.250	3	12	15.0	0.0	Maple	6.500	4.972	0.750	1.094	1.809	20.031
	6	6.267	5.439	0.250											
	5	6.033	5.206	0.250											
3	4	5.800	4.972	0.750	1	12	15.0	0.0	Maple	5.800	4.676	0.750	0.888	1.621	18.390
2	3	5.460	4.676	0.750	1	12	15.0	0.0	Maple	5.460	4.159	0.750	0.967	1.530	17.063
1	2	5.000	4.159	0.750	1	12	15.0	0.0	Maple	5.000	0.010	0.750	2.741	1.407	10.355
0	1	4.240	0.010	0.750	1	1	180.0	0.0	Maple	4.240	0.010	0.750	2.125	0.000	-0.125
	0	3.250	0.010	0.000											

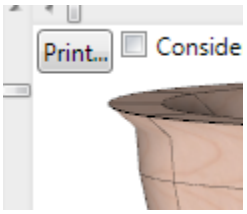


Note that each row has an index (Ring number). This is also the case with details. Take a look at the cross section view. This shows little numbers that indicate the detail number at each level. This helps you know the detail to which you want to make changes.

The outer diameter for each ring can now be manipulated separately. To check this out, make the following changes to the spreadsheet:

Ring Index	Detail Index	Detail Outer Diameter	Detail Inner Diameter	De Thi
4	7	6.500	5.312	0.2
	6	5.886	4.698	0.2
	5	5.834	5.080	0.2
3	4	5.800	5.031	0.7
2	3	5.460	4.666	0.7
1	2	4.940	4.114	0.7
0	1	4.250	0.010	0.7
	0	3.250	0.010	0.0

The lip at the top now looks much more like the design we are working toward, though it is still not exactly what we want. (You might also notice that the inner shape is now distorted. We will correct this later.)

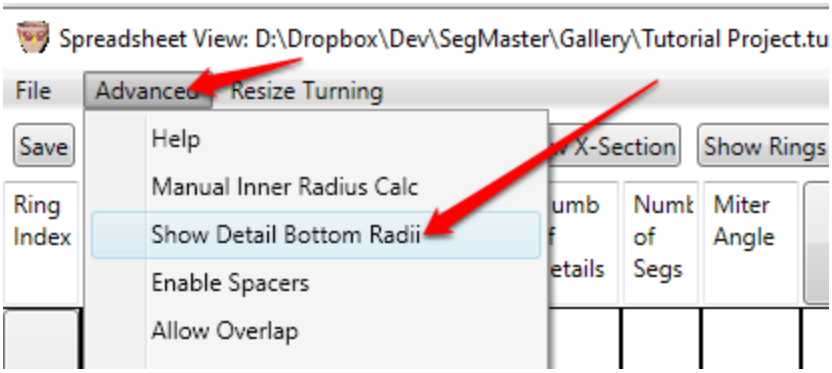


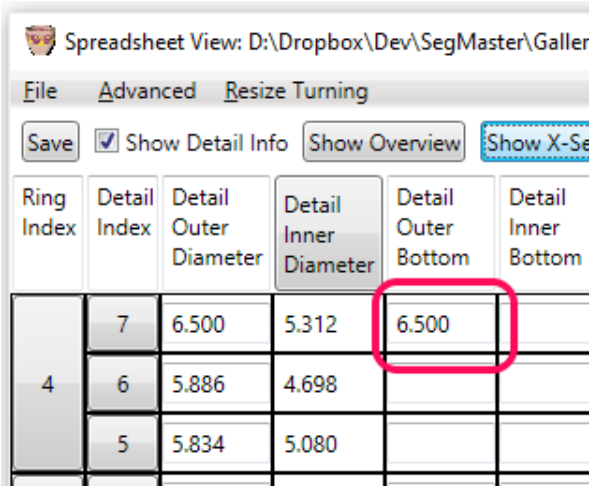
2.7 Showing Bottom Diameters

Each ring has a top diameter and a bottom diameter – for both the inner and outer diameter. In most (almost all) cases, the top of one ring (or detail) is the same as the bottom of the one above it. There is no need to enter it separately.

But sometimes we do want to enter them separately. Such is the case when there is a place in the turning where the cut is perpendicular to the vertical axis. There is such a place in our drawing as shown below:

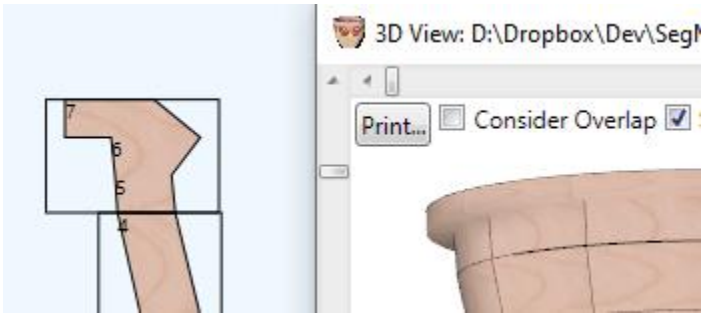
We can deal with this. Using the "Advanced" menu at the top of the spreadsheet, select "Show Detail Bottom Diameters". Two new columns will appear on the spreadsheet.





To start with, these are all blank. Enter a value into the top Inner Diameter Bottom as shown at left:

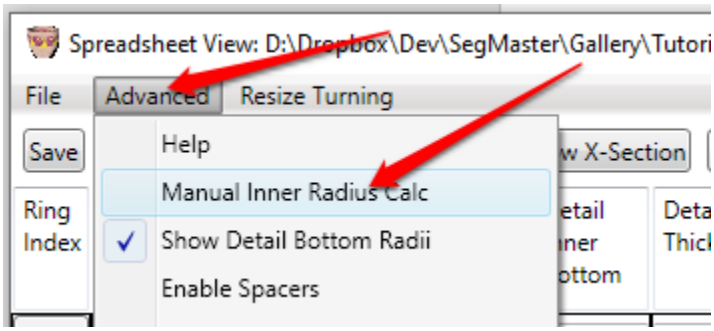
Now look at the cross section and the 3D view. Notice that the lip in the top ring matches the drawing with which we started. Again, the inner diameter is messed up. We will correct that next.



2.8 Inner Diameter Specification

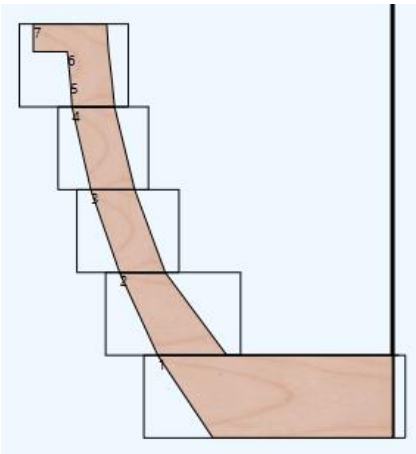
Look at the cross-section view. The inside diameters of the bowl have been computed by SegMaster based on the Wall Thickness specified in the Overview Form. It is good, but not perfect. There are two problems.

SegMaster makes a guess at the inner diameter. For most rings and details, it does a fairly good job, but it can have trouble where there are discontinuities such as at the top and bottom of our design. We can correct these, but first we must activate Manual Inner Diameter Calc. Do this via the Advanced Menu at the top of the Spreadsheet.



Ring Index	Detail Index	Detail Outer Diameter	Detail Inner Diameter	Detail Outer Bottom	Detail Inner Bottom	Det Thic
4	7	6.500	5.172	6.500		0.25
	6	5.886	5.138			0.25
	5	5.834	5.080			0.25
3	4	5.800	5.031			0.75
2	3	5.460	4.666			0.75
1	2	4.940	4.114		3.000	0.75
0	1	4.250	0.010			0.75
	0	3.250	0.010			0.0(

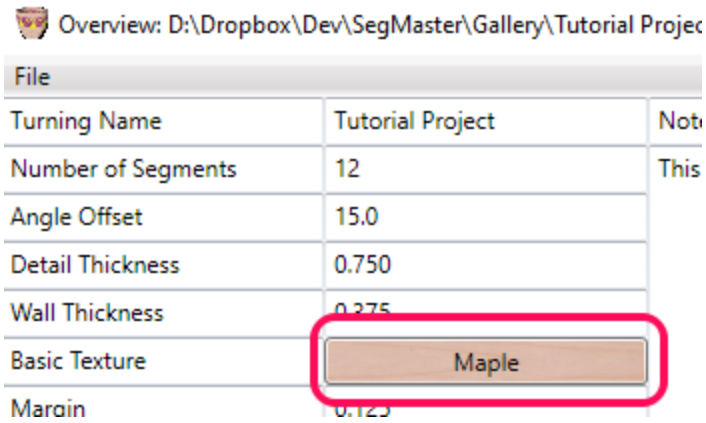
Adjust the inner walls the same way you adjusted the outer diameters. Place the cursor on ***Detail Inner Diameter #6.*** You want to adjust and use the + and – keys to make the adjustment. I also tuned the inner diameter for Detail #7 a bit as well. And finally, I adjusted the Inner Bottom of **Ring 1/ Detail 2.**



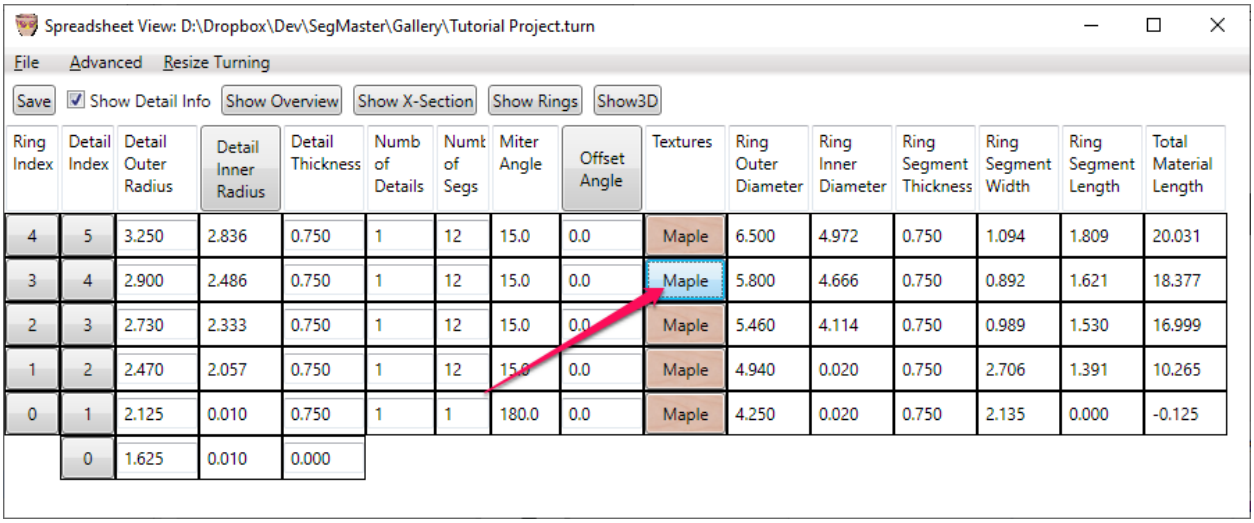
2.9 Wood Textures

SegMaster tries to show simulations of different color woods that will make up your turning. We call these “textures”. Most rings use a single wood texture but you can specify one or two or more textures for a ring.

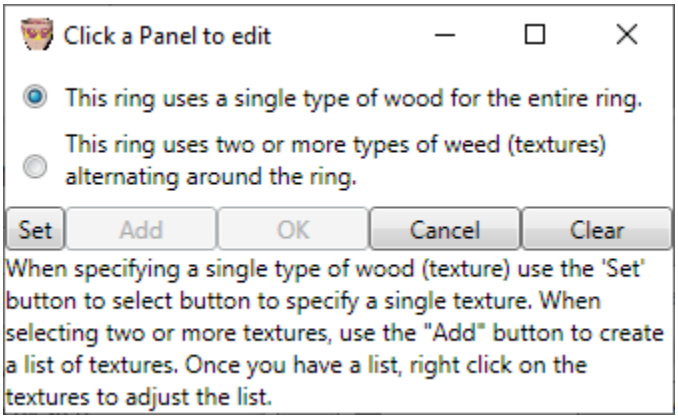
When a ring is first created, no textures are specified for the ring. SegMaster uses the Default Texture from the Overview window:



Clicking in the texture on a ring on the spreadsheet allows you to specify a different texture or textures. It brings up the Texture dialog box. To see this in action, click the texture for Ring 3 on the spreadsheet:



The Texture Dialog Box appears as shown on the right. Notice two radio buttons near the top of the dialog. Here is where you specify whether you want a single texture or more than one. If you say that you want a single texture, you will use the ***Set*** button to select it. Go ahead and click the ***Set*** button.



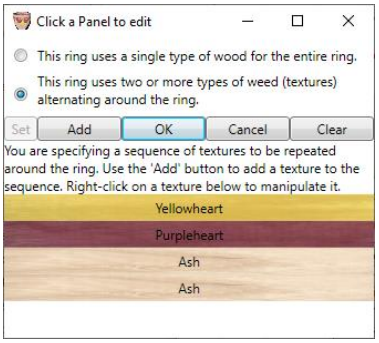
SegMaster shows the texture choices. Click on one to select the texture you want for this ring. This will close the list of textures as well as the Texture Dialog Box.

If instead, you say you want two or more types of wood, The ***Add*** button will be enabled. Clicking this will bring up the list of textures. You can select one of these textures to add it to the list of textures. You can click ***Add*** again to add another texture to the list and so on until the list is the way you want it. When you are satisfied, click ***OK.***

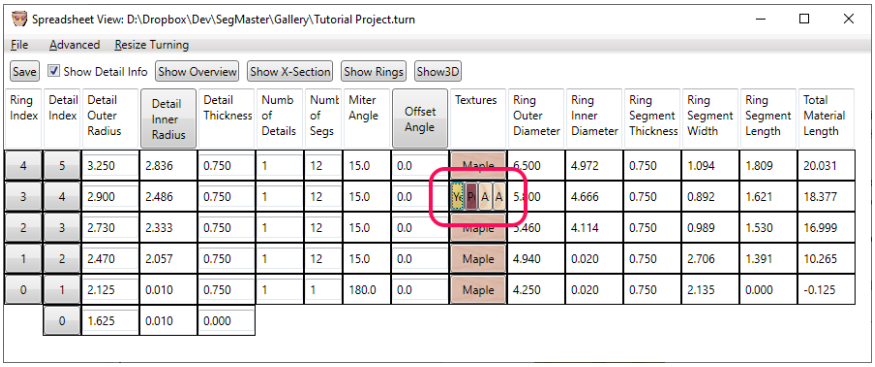
Selecting just one texture for the list is that same as if you had used the ***Set*** button – just not as efficient. Using ***Clear*** will remove all textures from the list and bring you back to the default texture.

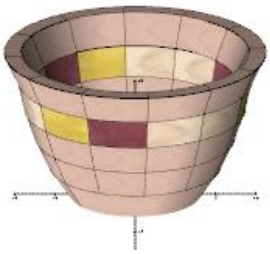
Right clicking the selected textures in the dialog box brings up a context menu where you can organize the colors the way you want them.

For this tutorial, I am selecting two textures: Yellowheart and PurpleHeart interspaced with two segments of Ash.



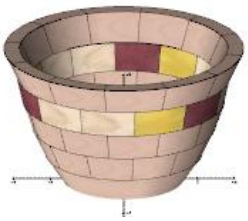
You now see four textures on the Spreadsheet for this ring and you also see these colors on the 3D View.





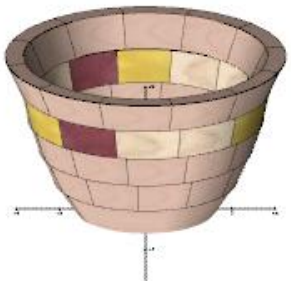
2.10 Angle Offset

When making segmented bowls, we normally shift the rings so that the joints are not on top of each other. It is easy to have the 3D drawing show this. Just click the ***Angle Offset*** button in the spreadsheet.



This will add the Offset Angle specified in the Overview window to each ring as we work our way up the bowl. The offset in our bowl is specified as 15 degrees so the result looks like the one to the right. Notice the difference with the one above it.

This exercise used the default Angle Offset, but look at what happens when we set Angle Offset to 5 degrees. In this case, the angle moves just a little bit between segments.

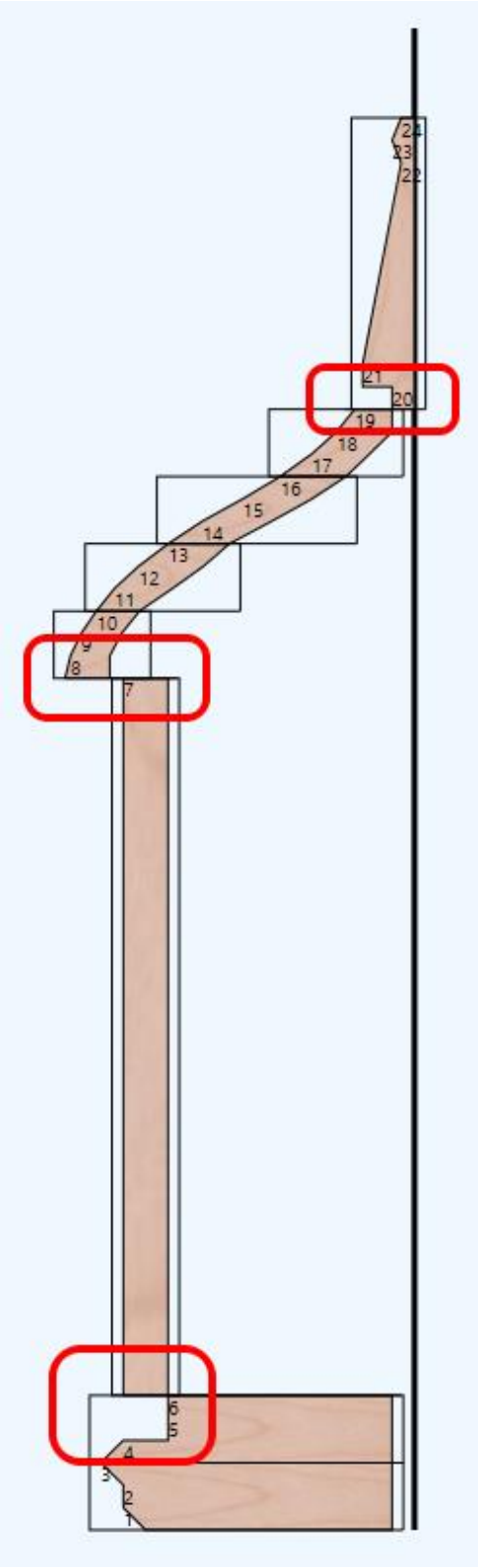


Of course, these features are just to help you visualize your turning. Once you have the design, you can use whatever wood(s) you want and glue the rings together any way you want.

2.11 Beyond the Tutorial

This tutorial above should be enough to get you started. Feel free to explore the program and try different things. Our suggestion at this point it to use SegMaster to design and hopefully build some bowls and other turnings. Once you are familiar with what you have read so far, it will be time to move onto some of the Additional Topics shown below:

3 Additional Topics



3.1 Allow Overlap

The next option under ***Advanced*** is ***Allow Overlap***. This will allow rings to overlap each other. You might be wondering why you would want rings to overlap.

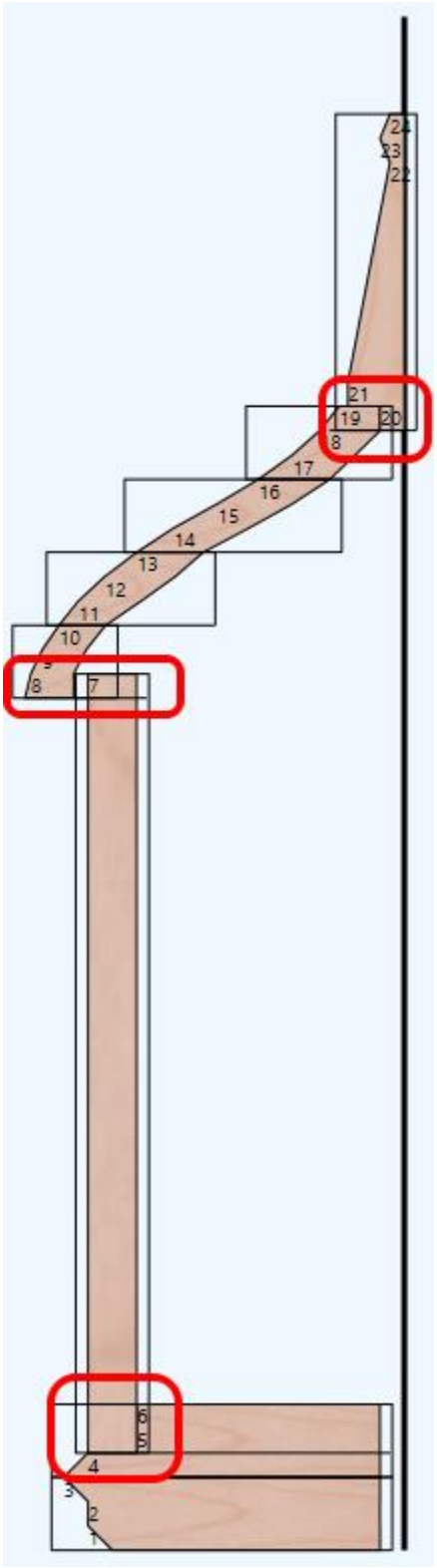
Consider the following design for a *Birdhouse*. Note three places where we might want overlap. We can get this overlap by entering values into the *Overlap* column of the *Spreadsheet*.

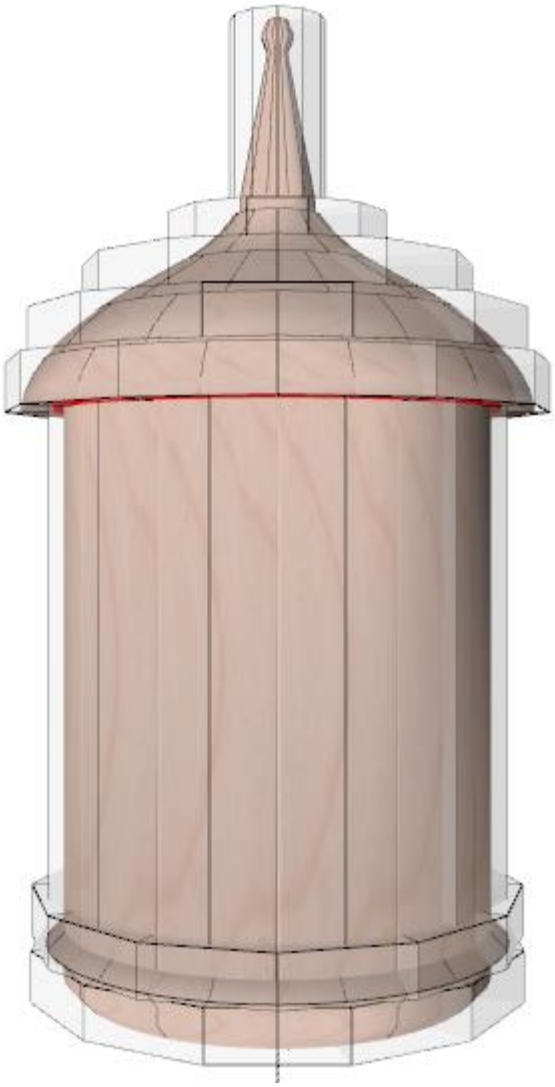
File Edit Advanced Help

Save | Add Slice | Show Slice Info | Show Overview | Show X-Section | Show Rings | Sho

Ring Index	Slice Index	Slice Outer Radius	Slice Inner Radius	Slice Outer Bottom	Slice Inner Bottom	Slice Thickness	Ring Overlap	Numb of Slices
7	24	0.150	0.000			0.250		
	23	0.250	0.000			0.250		
	22	0.150	0.000	0.580		2.250	0.250	5
	21	0.580	0.000	0.580		0.250		
	20	0.250	0.000	0.250	0.000	0.250		
6	19	0.670	0.250			0.250		
	18	0.870	0.250			0.250		3
	17	1.150	0.505			0.250		
5	16	1.500	0.767			0.250		
	15	1.920	1.148			0.250		3
	14	2.370	1.598			0.250		
4	13	2.750	2.068			0.250		
	12	3.080	2.355			0.250		3
	11	3.350	2.705			0.250		
3	10	3.550	3.070			0.250		
	9	3.720	3.270			0.250	0.250	3
	8	3.840	3.400	3.900	3.400	0.250		
2	7	3.250	2.750	3.250	2.750	8.000	0.500	
1	6	2.750	0.250			0.250		
	5	2.750	0.250	2.750		0.250		3
	4	3.250	0.250			0.250		
0	3	3.500	0.250			0.250		
	2	3.250	0.250			0.250		3
	1	3.250	0.250			0.250		
	0	3.000	0.250			0.000		

You can see that the rings now overlap in the views.





You might also note that the finial at the top of the bird house is shown being made of segments. Clearly, I would make this out of a single piece with the grain running vertically. Indeed, the vertical slats making up the main body of the birdhouse would also be made with the grain running vertically.

You can also use *Overlap* for large turnings that you intend to build in two or more pieces. Specify an overlap of minus a quarter inch or so where you intend to separate the pieces. Your renderings will show this as a gap, thus illustrating where the break will be.

4 SegMaster Windows

At this point, I am breaking from the tutorial format and switching to a window by window description and instruction.

4.1 Introduction to SegMaster Windows

You will spend most of your time using the *spreadsheet view*.

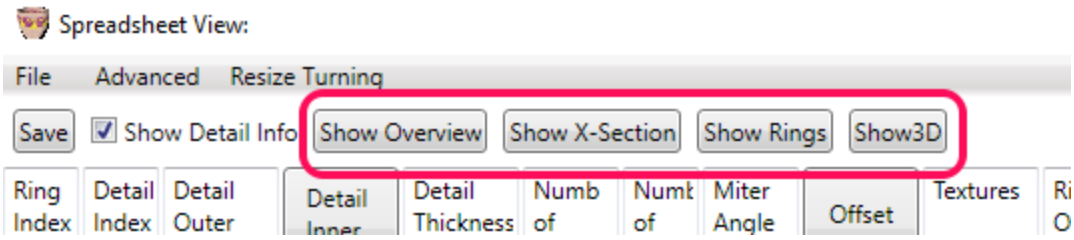
The left side is a list of Rings and Details. The bottom-most of each is numbered “0” (zero). Notice that many rings are made of multiple details.

Along the top are the titles of the columns. These are described in more detail in the section entitled *Spreadsheet View*.

When you start the program, the Spreadsheet View will be the first thing you see. The other window that comes up is the *Overview* window.

The *Spreadsheet* view shows information from the details and rings. The *Overview* window shows parameters that affect all rows and columns. Once your project is set up, you will not need to refer to the *Overview* window very often. You can close it to de-clutter your desktop. It is easy enough to get it back by clicking a button at the top of the Spreadsheet.

Three additional buttons near the top of the Spreadsheet view will display three more windows that show different perspectives of your Turning project.



- Overview – previously mentioned.
- Cross Section (X-Section) is the simplest. As its name suggests, it shows a cross section of your Turning project. You can choose to view one or both sides. You can choose whether you want to see outlines of the segments that will be used to build them. I suggest keeping this view open most of the time.
- Ring View is primarily for planning designs. This perspective of the project is often used by wood turners when they are designing the patterns that will be used on their bowls. I don’t use it much, but it is there if you want it.
- 3D View is the best representation of your project. It is to create this view that I wrote the program. Use this to get a 3D visualization of your project.

I refer to these three windows as *Views*. There are a few things they have in common.

- You can resize these views in the normal way; that is, grab the lower right corner with the mouse and *drag* it to resize the window. The contents of the window will automatically redraw itself to fit within the window.
- Each *View* has a *Redraw* button on it. This should not do anything since the windows should redraw themselves when appropriate. I put the redraw button there to help me with debugging and since it was not hurting anything, I left it. Click it if for some reason you think the drawing might not be up to date.

4.2 New Project Window

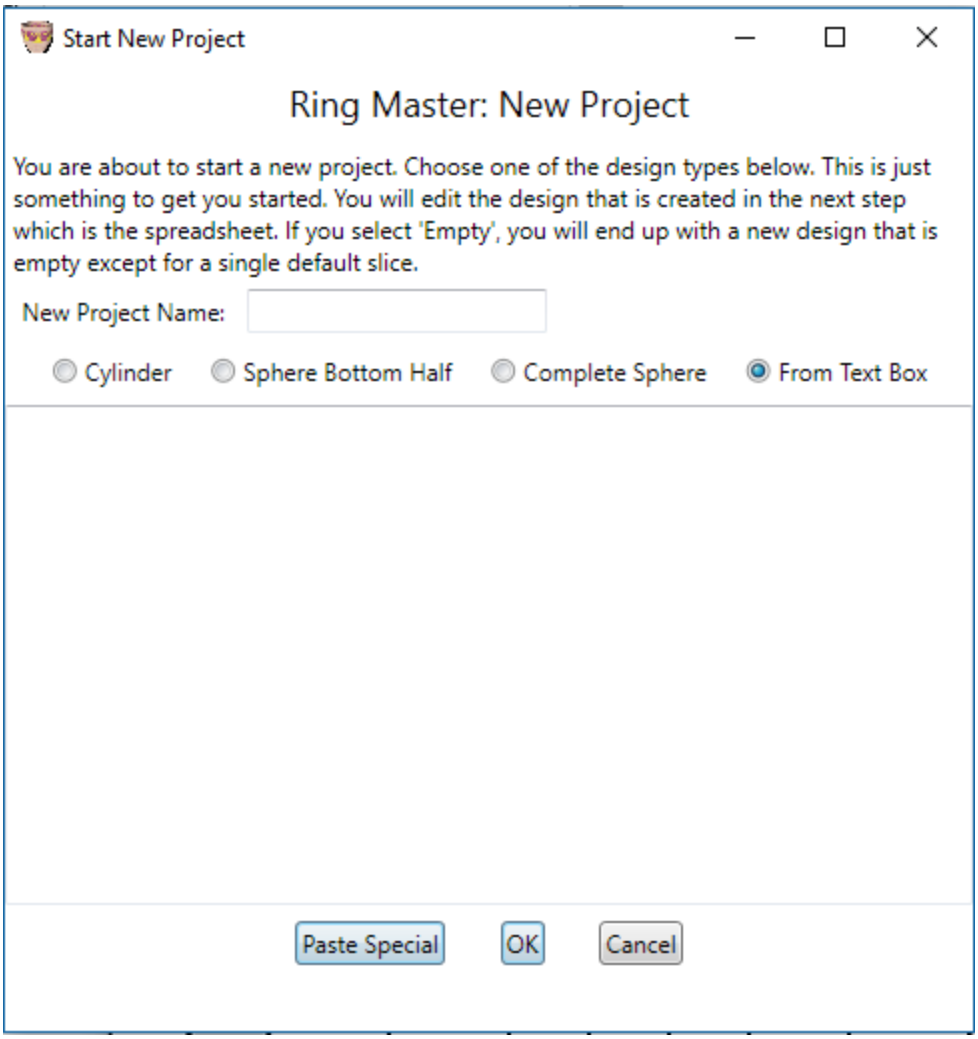
To start a new project, click the ***File -> New…*** menu option. This will bring up the ***New File*** window:

Note that there are four options here:

- Cylinder
- Sphere Bottom Half
- Sphere Top Half
- From Text Box

Clicking each of these brings up a different set of parameters to use to begin your design. However, the one that is the most interesting is the default: *From Text Box.*

Use this option when you know the outline of your project. By this, we mean that you know the diameter of each 3/4" details of your project. Enter these numbers into the text box (top to bottom) and when you are done, click "OK".



You can also *Paste* into the text box. I sometimes enter the numbers into an Excel ™ spreadsheet and then copy the column from Excel and paste it into the text box. (Sometimes normal *Paste* does not work but the *Paste Special Button* does work – I don't know why.)

This should get your project off to a great start.

4.3 Spreadsheet View

You will spend most of your time using the *spreadsheet view*. This section is extensive, so it is broken into parts to help you navigate to the area of interest.

By now, you should be thoroughly familiar with Details and Rings. If not, it might be good to review the first half of this manual.

4.3.1 Spreadsheet Cells

4.3.1.1 Types of Cells

Cells within the spreadsheet can hold:

- Buttons. There are buttons on the left side and buttons across the top. Click them to bring up a context menu that gives you options for performing various actions.

- Read-Only Text. These show fields that are computed by SegMaster. Often, there is an *Advanced* option to switch these from being Automatically Calculated to being Manually Calculated. Clicking on them should tell you if this is the case.
- Read-Write Text. These are fields that you should fill in yourself. When you change these fields, they will usually affect other fields. When they do affect these fields, they will cause these other fields to be updated. ***This update occurs when you leave the field***. You can leave the field by keying *Enter* or *Tab* or by using one of the cursor movement keys (up, down, left or right). If the value you entered is invalid, the system will post a message and go back to the field you are editing. When the field is successfully updated, changes to other fields will happen automatically. If visible, the three *View* windows will be updated.
  You can navigate from these fields by using the *Enter* and *Tab* keys (holding *Shift* to go backwards) or using the *Arrow* keys.
  You can make small changes to these fields by using the *Plus* and *Minus* keys to move in increments of 0.020. Hold the *Ctrl* key for increments of 0.005 and hold the *Shift* key for increments of 0.100. It can be interesting to do this while watching the *Cross Section* or *3-D* views.
- Textures. These are fields that show the texture that will be used when drawing segments for a ring. Usually, one texture will be used for all the segments in the ring, but you can specify a repeating series of textures if you want.

4.3.1.2 Column Definitions and Buttons

Along the top are the titles of the columns. These are:

- Ring Index – a number associated with the ring.
- Detail Index – a number associated with the detail.
- Detail Outer Diameter – The outer diameter of that detail. Note that this is the diameter at the **Top** of that detail. The detail at the bottom of the detail is normally taken from the top of the detail below it. It is possible to override this by selecting *Show Detail Bottom Diameter* from the *Advanced Menu.*
- Detail Inner Diameter. The header for this column is a button. If you have specified (using the *Advanced* menu) that you want *Manual Inner Diameter Calc,* the inner diameter will no longer be calculated automatically. There is a button at the top of this column. Clicking it will force an update. It will allow you to specify the detail where you want to start the recalculation and then work your way upward.
- Detail Outer Bottom – This field is shown only if you have selected *Show Detail Bottom Diameter.* It allows you to specify the outer diameter at the bottom of the detail. If this field is not shown or is blank, the system will assume that the diameter at the bottom of this detail is the same as the diameter of the top of the detail below this one.
- Detail Inner Bottom – This field is shown only if you have selected *Show Detail Bottom Diameter.* It allows you to specify the inner diameter at the bottom of the detail. If this field is not shown or is blank, the system will assume that the diameter at the bottom of this detail is the same as the diameter of the top of the detail below this one.
- Detail Thickness – The thickness of this detail.
- Ring Overlap – This field is present only if you have specified *Allow Overlap* in the *Advanced* menu. When an overlap is allowed and specified, the system allows this ring to overlap the ring

below it. A negative value here allows you to enter a space between two rings – possibly to note a break in a project that will be built in sections. For more information, see the tutorial on this.

- Number of Details in this ring – the program keeps track of how many details there are in this ring. As you split the ring or move details from one ring to another, the number of details in the ring will change and this field tells you how many are remaining.
- Often, when you add details, the system adds a single ring to hold the detail. You end up with many single detail rings. You can reduce these by right-clicking the button for that detail and selecting the option to ***Combine with Detail Info Above***.
- Number of Segments – the number of segments in this ring. Normally, this is set for the entire Turning, but if you want to do designs with different wood textures, you might want to double or triple the number of segments in a ring so that you can input a more interesting design.
- Miter Angle – the angle to which you set your saw to get this number of segments. This equals 180 degrees divided by the number of segments. This field is computed only.
- Offset Angle – when stacking rings, you want to stagger the rings so that the segments look like bricks on a wall. So, if you are doing 12 segments per rings, each ring is 30 degrees wide. To stagger them, one ring wants to start at zero degrees and then next as 15 degrees and then next back to zero. But you can override this if you want to. This allows you to specify more interesting designs. You can also click the button at the top of the column to recalculate the offset angle for each ring. Normally, offset angles are set manually, but the system will set these automatically if you click the button at the top of the column.
- You will sometimes want to insert a decorative piece of wood with parallel sides between each segment. We call these spacers. Enable this column using the *Enable Spacers* item from the *Advanced* menu. Specify the thickness of the spacer in this field. Specify the *Texture Sequence* for the spacers in the following field.
- Textures - the wood texture that will be used in the *Views* of your Turning. Click this to bring up a dialog that allows you to select either a single texture or a sequence of textures for your ring. Sequences repeat as you go along the ring. Usually you will want something that evenly divides your ring count. If you are building a 12 segment Turning, you will want 1, 2, 3, 4, 6 or 12 textures in your sequence. For a 10-segment ring, you would want 1, 2, 5 or 10 textures.
- Ring Outer Diameter – this is calculated as the largest outer diameter of any detail in this ring. This is a read-only field that is computed automatically. You can change this by changing the diameters of the details that make up the ring. You can make a ring larger by increasing the outer diameter of any detail. To make a ring smaller, you must make all the component details smaller because it is the largest of the details that determine the outer diameter.
- Inner Ring Diameter – this is calculated as the smallest inner diameter of any detail subsumed by this ring. This is a read-only field that is computed automatically.
- Ring Segment Thickness – this is the total of all the thicknesses of the detailss that make up this ring. By default, this will be ¾" – the thickness of most wood sold in the US. It is an automatic, read-only field.
- Ring Segment Width – this is the width of the stock from which segments will be cut. It is an automatic, read-only field.
- Ring Segment Length – the length along the longest side of the segments you will cut tor this ring. This is the most critical dimension on the spreadsheet. It is an automatic, read-only field.

- Total Material Length – as a convenience, SegMaster will figure out pretty much exactly how long a piece of wood you will need to make this ring. It considers not only the wood needed, but also considers the kerf width and the fact that the kerf will run through the wood at a specified angle. It is an automatic, read-only field.

4.3.2 Ring Buttons

Ring Buttons appear under the ***Ring Index*** column. Two of these (Duplicate Ring and Delete Ring) affect the detail allocation of the rings above. The others do not.

4.3.2.1 Duplicate Ring

This is the action to use if you wish to add a ring. It adds a ring above the current ring and duplicates all the parameters of the ring being duplicated.

4.3.2.2 Split Ring

This splits a ring into two rings. If there are more than two details in the ring, it asks how many details it should place in each of the resulting rings. It does not affect the rings above the original ring.

4.3.2.3 Combine with Ring Above

This combines with the ring above it. Be careful. The textures and other settings for the ring above are lost.

4.3.2.4 Delete Ring

Does what it says. The ring disappears along with the details in it.

4.3.3 Detail Buttons

Detail buttons appear in the column below ***Detail Index***. Clicking them allows you to manipulate details. Pay attention to how these actions affect Rings.

4.3.3.1 Duplicate Detail

This makes a copy of a detail. The *Number of Details* for its ring is increased to incorporate the new detail in the ring. You will probably want to adjust the diameters to smooth the resulting shape. This has the result of making your Turning a bit taller.

4.3.3.2 Bisect Detail

This cuts the detail in half. The diameters are interpolated to keep the shape reasonably smooth. The *Number of Details* in the associated Ring is increased. Rings are not reallocated.

4.3.3.3 Trisect Detail

Same as ***Bisect*** Detail except that it cuts the detail into three details.

4.3.3.4 Combine with Detail Above

It combines with the detail above using the bottom of the lower detail and the top of the upper detail. The *Number of Details* in its ring is reduced. If the detail above is in a different ring, the number of details in the ring above is reduced.

4.3.3.5 Delete Detail

Drops the detail without attempting to correct the resulting problem with the shape. The number of details in the ring is reduced. If this is the last detail in the ring, the ring is deleted.

4.3.4 Advanced Menu Items

4.3.4.1 Manual Detail Diameter Calculation

SegMaster does a decent job doing inner diameter calculations. But sometimes, you will want to override what it does – especially near the bottom of your turning. Clicking on this option suspends automatic detail calculation. The *Inner Diameter* fields change from read-only to writable fields and you can enter your own values for these.

You can make changes by keying in new values or by using the plus (+) or minus (-) keys as noted above. If you want the program to take another shot at computer calculation of inner diameters, click the button at the top of the column. The resulting dialog will allow you to enter the starting segment for the recalculation. The program will recalculate the diameters in the detailss above the one you specify. You can also go back to automatic inner diameter calculation, but this will erase anything that you have entered manually.

4.3.4.2 Show Detail Bottom Diameters

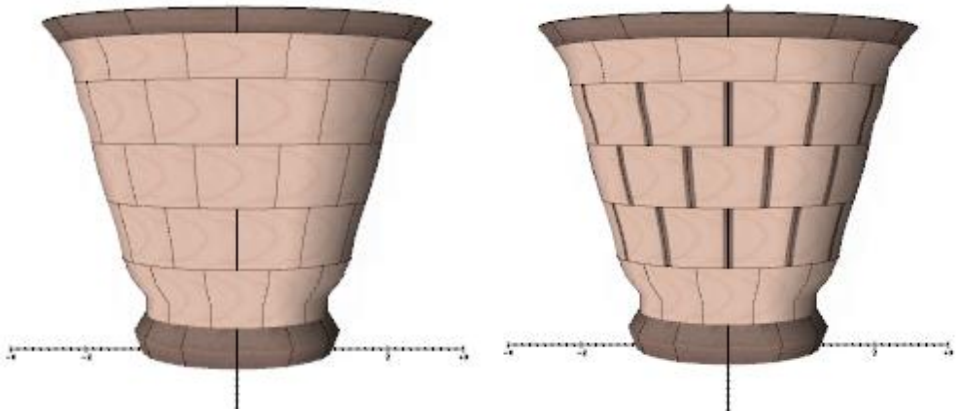
We have already explained that you specify the outline of your project by providing the diameter of details at different heights of your Turning project. This allows you to approximate a smooth curve on the inner and outer surfaces. Even though the details do in fact have thickness, so far, we have been entering only the diameter at the top of the detail. There is usually no reason to enter the diameter at the bottom because that is simply the diameter at the top of the detail below. It would just be a whole lot of additional numbers and they would be redundant.

But what if you want to specify a portion of your Turning that has a surface perpendicular to your axis such as you might make at the bottom of your project with a cut-off tool. In this case, you would want to specify a bottom diameter for a detail that is different from the top of the detail below.

Clicking *Show Detail Bottom Diameter* causes fields to appear on the *Spreadsheet* for inner and outer bottom diameters. Most of these will be blank, indicating that the default should be used – that is, the top of the diameter of the detail below. As you enter values for the detail bottoms, you will see the results in the different *View* windows. There is an example of this in Showing Bottom Diameters section of this manual.

4.3.4.3 Enable Spacers

For one of my early turnings, I wanted to include little walnut pieces between larger pieces of ash. For want of a better term, I have been referring to these as *Spacers*. The best explanation is the following image. There are no spacers in the turning on the left. The turning on the right shows spacers in rings 2 to 4.



Activate this feature using the *Enable Spacers* option from the *Advanced* menu. When you do so, the system will prompt you for the first and last rings that should have spacers. Two new columns will appear on the worksheet: one for the Spacer Thickness and the other to hold the sequence of colors that will be used for the spacer. Usually there is only one color used, but you have the option of using different wood textures in this sequence.

SegMaster will adjust the sizes of the cut segments to adjust for the presence of the spacers. ***Be careful here.*** I often combine spacers having the same color as highlight rings above and below them. If you unintentionally include a spacer in one of these highlight rings and it is the same color or texture as the ring, you may not notice from the 3D view. The system will compensate for the presence of a spacer in the segment length and if you don't put spacers there, your ring will be too small.

The 3D view will show the spacers on the "Turning" view, but it will show the segment pieces without the spacers. You will see the gaps between the segments where the segments would be. This is actually more clear than showing the spacers themselves – and easier for me to program (or not program as the case may be).

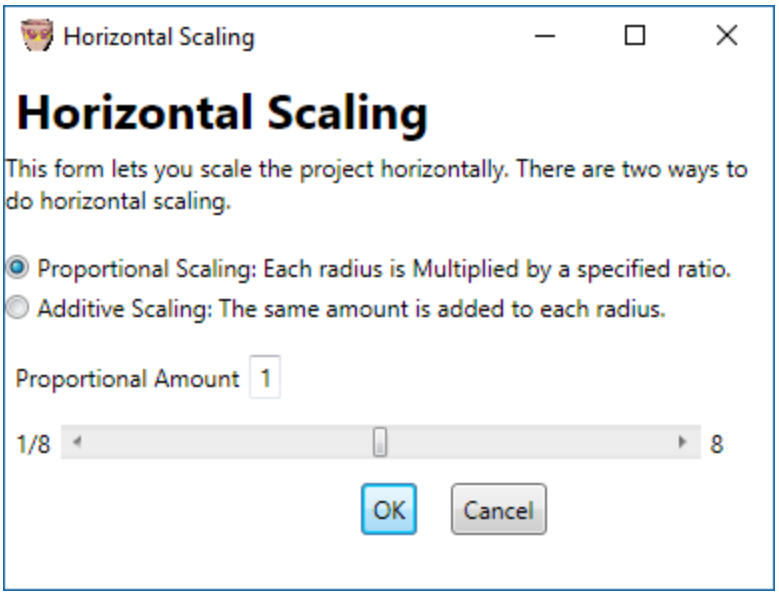
The system does not provide a special column to tell you how large to make the spacer. Your spacer will be little pieces cut across the grain. The thickness (vertical dimension in a bowl or vase) will be the same as for other segments of the ring. The "Length" will be the dimension as stated for the segments. Don't be confused by the fact that this "Length: is almost always the shortest dimension in the spacer – ¼" in the illustration above. And the "width" must be equal to or greater than the final diameter of the ring. Since space on the spreadsheet (viewed and printed) is as a premium and since Spacer dimensions are at a premium, I did not waste a column on this., Glue the spacer so that it lines up with the ***inside*** of the ring joint.

4.3.5 "Resize Turning" Menu Items

These menu items allow you to resize the turning either horizontally orvertically.

4.3.5.1 Radial Scale

Clicking the ***Radial Scale*** selection in the ***Resize Turning*** menu brings up the following form:



Note that there are radio buttons that allow you to choose between ***Proportional*** scaling and ***Additive*** scaling.

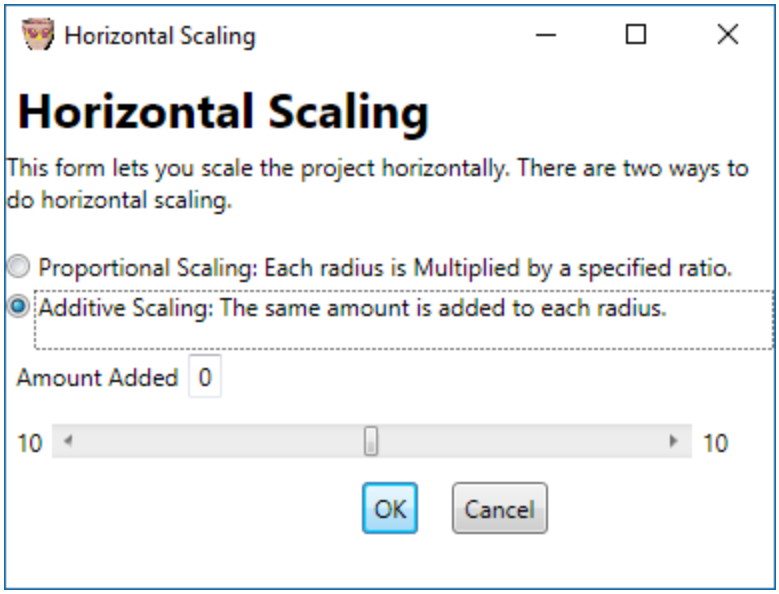
Proportional scaling multiplies every diameter by the amount specified in the form. The default is 1.0 which leaves everything unchanged. If you changed this to 0.5, every diameter will be cut by a factor of two. If you set this to 2.0, every diameter will be doubled.

This form allows you to adjust the sliders and watch in near real time as your design is adjusted.

If you choose the ***Additive*** scaling option, the form will change as shown on the right. In ***Additive*** scaling the same amount is ***added*** to each diameter. Adding a negative amount will make the turning smaller.

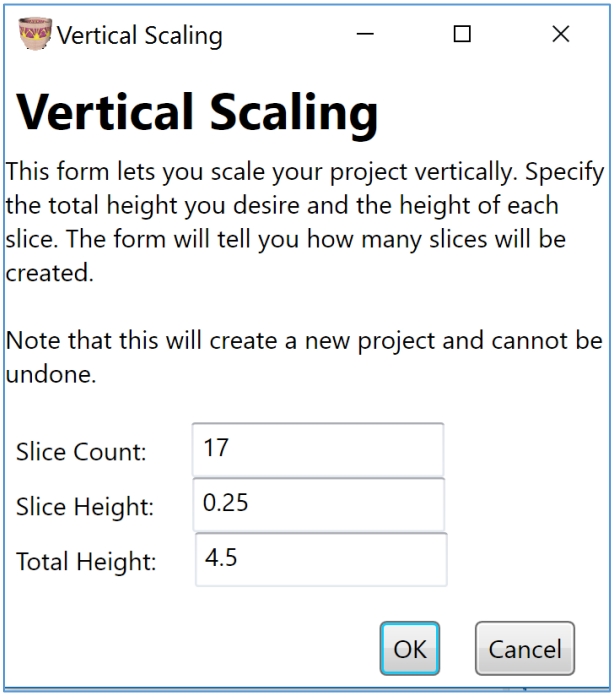
Try adjusting these and watching your design change in the *Cross Section* or *3D* views.

When you are satisfied, click *OK* or *Cancel.*



4.3.5.2 *Vertical Scale*

Clicking the ***Vertical Scale*** selection in the ***Advanced*** menu brings up the following form:



Vertical Scaling is both very powerful and somewhat restricted. You specify the number of details you would like to have in your turning design. You also specify the etail height and the program tells you how tall your turning will be.

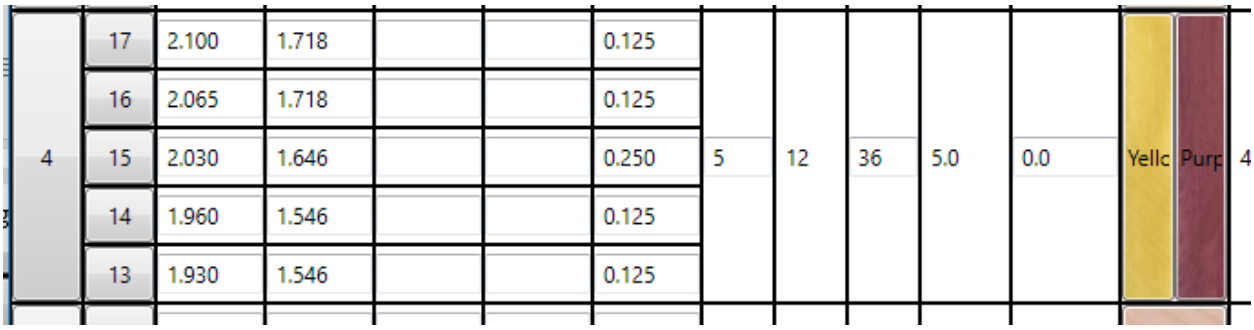
This works extremely well for turnings with smooth curves. However, if you have any sharp edges in your design, these will most likely be lost. But of course, you can manually put them back into your design.

For example, I have a design for a vase that comes out to 14" using ¾" cherry (or other) wood. But I want to build it with some Butternut that is planed to 5/8" (thanks Dad). So I set my details to half of 5/8" (0.3125") and if I ask for 48 details, this results in a design that is 15" tall. Perfect.

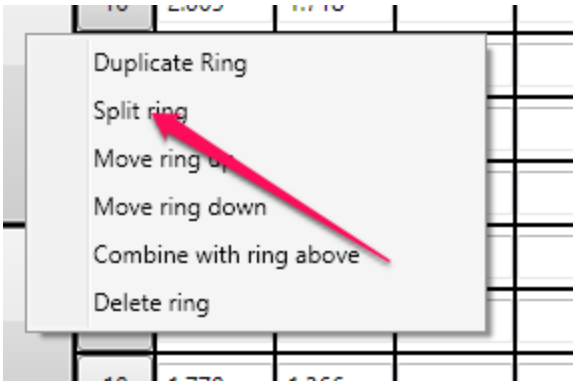
4.4 More fun with Rings and Details

Continuing with the project we had at the end of the Tutorial:

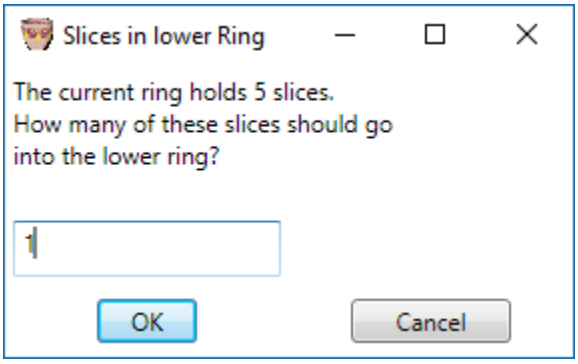
Let's use *Bisecting Details* to make our design even more decorative. Bisect the bottom-most detail in Ring 4 and then Bisect the top-most detail in Ring 4. Ring 4 should now look like the following with 5 details:



Click on the button for Ring 4 and select *Split Ring.*



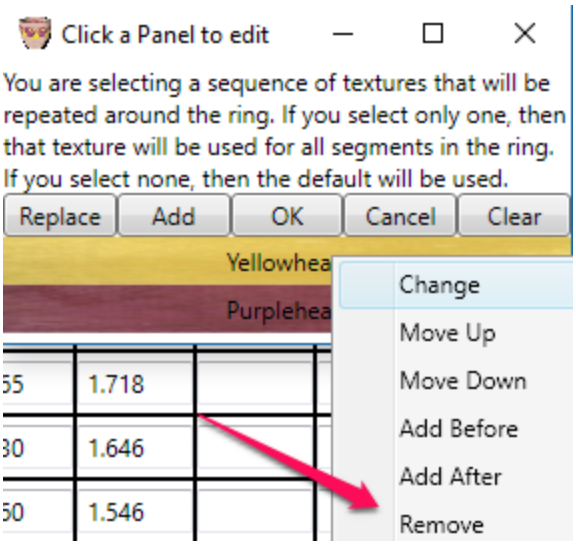
This will pop up a window asking how many rings should go into the lower ring:



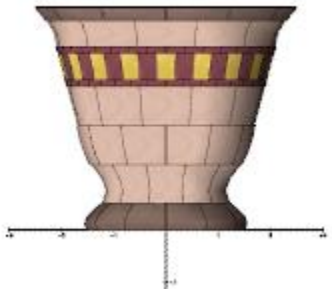
Enter 1 and click OK.

The old Ring 4 has been split into two rings which are now numbered 4 and 5. Ring 4 has one detail and Ring 5 has four details. Click Ring 5 and ask again to *Split Ring.* This time tell the system to place 3 details in the lower ring.

Click on the Texture Sequence for Ring 4. It shows two Textures in the sequence. Click on Yellow Heart and select Remove. Then select OK:



Do the same for Ring 6. Your turning will now look like:



4.5 Overview Window

The Overview window shows information and default values for the overall Turning Project.

- Turning Name – a convenient name. This should probably match the file name you provide while saving.
- Number of Segments – the number of segments for most rings in the Turning. This can be overridden in the spreadsheet on a ring-by-ring basis.
- Angle Offset – when drawing a 3D image, each ring can be shown rotated relative to the ring below it. This gives a more accurate representation of how you will assemble the rings into a bowl or other turning. Normally, this is 360° divided by the number of segments per ring, but you can set it to anything you want. This angle is used when you click the ***Angle Offset*** button on the spreadsheet view.
- Detail Thickness – this defaults to 3/4”. Change this only if you are working with an unusual stock thickness. For example, I have some 5/8” stock, so I might want to set my Detail Separation to 5/8”.
- Wall Thickness – how thick do you want the wall for this Turning. The program uses this when computing inner diameters.
- Basic Texture – what wood texture do you want to use as the default for your rings. It will use this texture if you do not specify anything else for this ring.
- Margin – How good are you at cutting, assembling and stacking your rings? This gives you some space around your rings to allow you to compensate for errors. Here is a ring with n 8” outer diameter, a half inch wall thickness showing the segments with and without a 1/8” *Margin.* Notice that the upper image has a gap between the segment outline and the outer diameter of the turned ring.

- Kerf Width – This is used only for computing Total Material Length. This calculation considers how much of the material is being used by the saw blade itself, including compensating for the fact that the kerf is going through the wood at an angle.
- Base Inner Diameter – SegMaster provides a variety of ways to display and plan bottoms. Many of them need to know the inner diameter of the base.
- Bottom Style – SegMaster provides several base styles that you can plan to use. These are discussed elsewhere in this manual.

4.6 Cross Section View

The *Cross Section* view displays a cross section of your turning, clearly showing the turned outline pieces and with or without black lines drawn the raw segments. The best way to understand these controls is to try them and see how the display changes.

- The ***Print…*** button will print the form. The size of what is printed is determined by the size of the form on the page. Print the page and then if you want your print to be larger or smaller, adjust the size of the window and print again.
- A CheckBox that selects between showing only the left side of the Turning and showing both sides. The center of your turning is indicated by a black line in either view.
- Another CheckBox turns on and off outlines of the uncut segments that you will glue into rings before you put your turning onto the lathe.
- A third CheckBox enables you to *Consider Overlaps*. This is an Advanced Feature that is discussed elsewhere in this manual.

4.7 3-D View

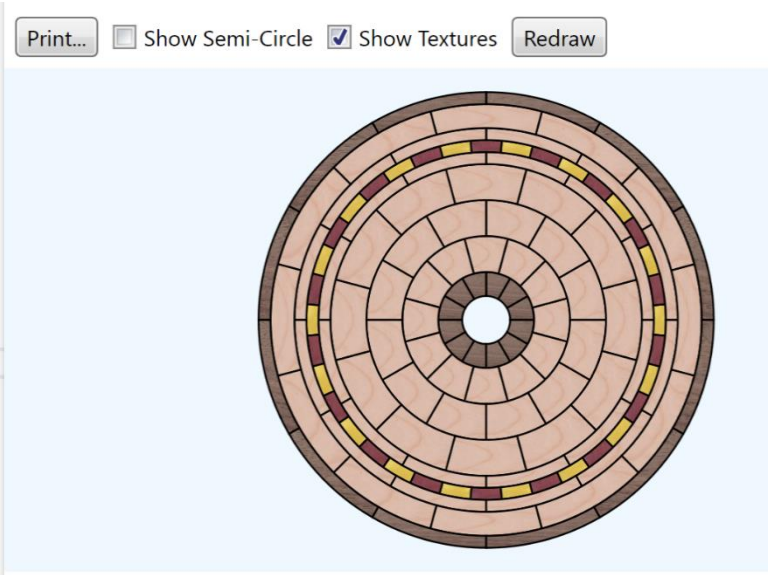
The *3-D* view shows a perspective rendering of your turning from different perspectives. This is a very powerful display with several options. The best way to understand these controls is to try them to see how the display changes.

- A scroll bar across the bottom rotates the Turning so that you can view different sides of it.
- A scroll bar on the left zooms in an out.

- A scroll bar on the right lets you view your turning from the top or bottom or anywhere in between.
- A scroll bar across the top changes the opacity of the segments that you will use to build your bowl. The best way to understand this is to slowly slide the control to the right. Double-clicking the slider causes the lines associated with the segment chunks to toggle. Try it.
- The *Redraw* button across the top causes the Turning to be redisplayed. This should not be needed, since redisplay should happen automatically.
- The *Consider Overlap* checkbox may be visible. It is used for an *Advanced* feature.
- The *Show Outer* checkbox allows you to hide the outer surface of your Turning, thus allowing you to more clearly see the inner portion of your project.
- The *Show Inner* checkbox allows you to hide the inner surface of your Turning, thus allowing you to more clearly see the outer portion of your project.
- The *Show Seg Lines* checkbox turns off the lines on the edges of your turned segments for a clearer view of your project.
- The *Select Rings to Show* button allow you to view a single ring at a time to verify that the design for this ring is just what you want.
- The ***Print…*** button will print the form. The size of what is printed is determined by the size of the form on the page. Print the page and then if you want your print to be larger or smaller, adjust the size of the window and print again.

4.8 Ring View

The *Ring View* shows the Turning as a series of concentric rings. This is an alternative way to view your design, though I personally much prefer the 3-D view. This shows the tumbler from the Tutorial section with the alternating red and yellow wood in Ring 4:



The *Show Semi-Circle* checkbox allows you to view only half of the design, thus allowing a larger display.

Unchecking the *Show Textures* checkbox allows you to create a blank pattern that you can print out and color to easily try some different designs. I included this feature because wood turners at a recent symposium were complaining about the difficulty of getting blank versions of these design aids. This enables you to create a blank outline that you can fill in with different textures for any ring thickness or any number of segments per ring.

5 Printing

Each form has its own way of printing.

From the Spreadsheet or Overview forms, look under the ***File*** menu for the ***Print…*** option. This opens the print dialog box from which you select the printer. It prints its own version of the spreadsheet.

The goal of the output of the spreadsheet is to give you a single sheet that you can take to the shop and use as a reference for your segment cutting. All the fields that you should need will be present.

Note that the spreadsheet is printed top to bottom – so that the lower numbered rings are on the bottom. I prefer to work this way. But there is an option to print the rings with the thickest stock at the top working its way down to rings that require stock that is not as wide. The theory is that you cut a strip of wide stock and cut the segments from this stock. Cut what is remaining of this stock down to the next desired width and cut more stock if necessary and so on until you get to the narrowest stock. This provides optimum use of material.

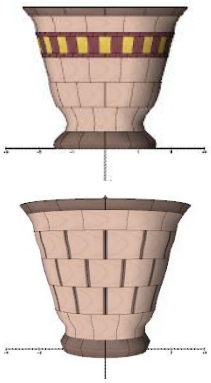
The other forms each have their own ***Print…*** button. This button prints the form as you see it on the screen including the buttons and controls on the form. This has the advantage of allowing you to control what you see. For example, in the 3D view, you can rotate the view as desired and show as much (or none) of the (pre-cut) segment shape. You can also control how large the printed output will be by resizing your forms prior to clicking the ***Print…*** button.

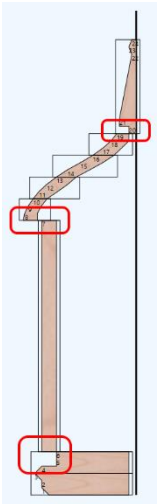
6 More Tutorials

6.1 Don't forget to look in the section on Advance Features.

The sections in this manual on Advanced Menu Features have descriptions that do not rise to the level of full ***Tutorial***, but they are very "tutorial-like". So, I had to decide where to put them. I left them in the Windows section, but compromised by mentioning them here and providing links:

- Enable Spacers
- Allow Overlap
- Radial Scale
- Vertical Scale
- More fun with rings and details



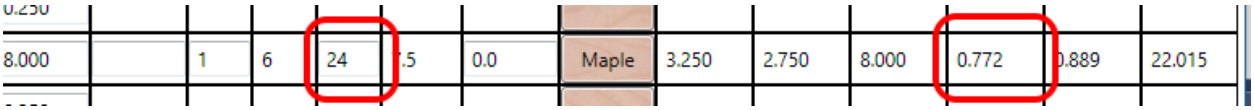


6.2 Backing into Designs (Solving design problems)

I will now go off on a tangent here to mention the ability of the program to help you "back into" some parameters. Consider the long staves making up a central cylinder. The design tells us that for a 12 segment design, we need staves that are 0.839" x 1.809".

That is fine if we have access to wood that is 7/8" thick or 1 7/8" thick. I don't.

So, what if I try changing the number of segments? For example, using 24 segments for this ring allows me to use ¾" stock (close enough):



It turns out that I can also get to ¾" stock by reducing my *Margin* (in the ***Overview View***) from 1/8" to 1/16".

I had another case where I had spent hours on pieces for a very fancy feature ring. I had made them in one long piece that I had planned to slice into the right number of segments for my bowl. Problem was that I had not made the piece long enough to cut 12 segments to the width I needed. I had choices. I could have made the wall thinner, but I did not dare to do so. I cranked up SegMaster and tried several solutions. Turns out that I had enough space on what would be the edges to make a 10 segment bowl with the desired thickness.

Since then, I have made many fancy feature rings and due to their complexity, they don't always come out at exactly the diameter I had planned. The ring might be off by a quarter or half an inch. I now always make the feature ring first. I then go back to SegMaster and adjust the rest of the turning to fit the actual size of the feature ring.

The major point is that although SegMaster was designed to start with the workpiece outline and then compute the diameters and segment sizes, sometimes you want to work backwards.

7 Appendix

This holds information that I did not have another place for.

7.1 File Structure

The SegMaster executable sits in its own directory along with a bunch of other stuff that makes it go – especially Petzold.Media3D.dll. Beneath this directory are several other helper directories.

- **WoodImages** holds the textures that are displayed in the three *View* windows. Notice that they are all "JPG" images. To add choices to your pantheon of available textures, just add jpg files to this directory. The easiest way to get new textures if you have access to a scanner is to take a slice of the wood you plan to use and scan it. If you don't know how to do this, perhaps you have a friend who can help you out. Alternatively, just use the texture that is closest to the

wood you plan to use.

If you are looking at the images in the directory that I am providing with this program, perhaps you will notice the one entitled “Sunrise.jpg”. This is for a feature ring that I have used on a couple of my bowls. I just roughly drew this onto a piece of paper and then scanned it.

- **Illustrations** holds images that I used in the program for illustrations. There are not many images in there yet, but I expect to add more as I improve the help system.
- **Gallery** holds some sample wood turning projects that I have done for myself. Feel free to build them directly or to use them as the basis for you own designs.