

# The Gourd Banjo

Draft

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# Building a Gourd Banjo.

Welcome to the wonderful world of gourd banjo construction! In this document I have tried to capture some of my initial ideas about the process. Be forewarned that this is probably not a complete description of everything you need to know. Hopefully we can add to this over time and may have a good piece someday. Also this was written on a tablet PC that sometimes does funny things in translating my words!

## *Design Variables and Criteria*

When embarking on a gourd banjo building project, there are a number of sometimes interrelated decisions to make. Most of these decisions should be made before beginning construction.

1. **The gourd.** Smaller gourds will produce a punchy, direct sound. Larger gourds will produce a deeper, mellow sound (all other variables equal). It is easier to keep the skin tight on a smaller gourd. Larger gourds may be a bit easier to hold on to when playing. Ditto for gourds that have a canteen shape vs. a cannonball shape. Gourds should be of the hardshell variety and not too thick.
  - Will the gourd have sound holes: If so, what will they look like?
  - Will the gourd be dyed, painted, or sealed?
  - Will the gourd interior be dyed, painted, hardened, or sealed?
  - How will the head material be attached?
  - What is the head material – goat skin, calf skin, or plastic?
  - What should the diameter of the head be?
2. The neck.
  - What wood will be used? Will it have a particular color or figure?
  - Will the neck have a separate fingerboard? (This helps stabilize neck and may create harder playing surface.)
  - Will the peghead have an overlay? This is primarily an aesthetic decision, although it does strengthen the peghead.
  - How will the neck be finished? Stain, toner, sealer, etc.
  - What shape will the peghead have? Curves take longer to complete but are visually interesting.
  - What profile will the neck have?
  - Will the neck be “scooped”? This is a dip in the fingerboard as it intersects the gourd.
  - Will the neck have position markers, or should scale be flexible?
  - How wide will the neck be at the heel and at the nut?
  - How wide will the nut be?
  - At what point on the neck should the short string terminate? Common choices include 5<sup>th</sup>, 7<sup>th</sup>, or 9<sup>th</sup>. Higher positions get the peg out of the way for playing, but produce less tension on the string.
  - How will the pegs lay out on the peghead?
  - Will the short string peg be set perpendicular or parallel from the fingerboard?
  - Will there be any inlay on the neck?
3. General considerations.
  - What kind of tuning pegs will be used?
  - What will be the approximate scale length?
  - How many strings?
  - What gauge/type of strings? Normally we use gut or nylon.

- What will be the nut material?
- How will the neck be attached or pass through the gourd?
- What wood will the bridge be made of?
- What is the tailpiece design and material?

## **Procedures**

Following are the general steps to making the banjo. They are in a general order of normal progression but do not reflect the critical path. Some tasks may be done outside of the sequence presented.

### **Make Decisions/Determine Layout**

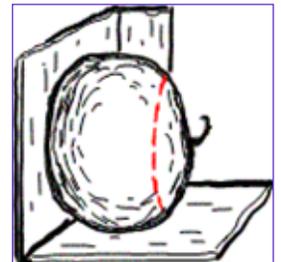
Before beginning, determine all the answers to the design variables. In so doing, consider the dimensions of the materials that you have and/or the availability of materials. Now might be a good time to make a scale drawing on grid paper.

### **Clean gourd exterior**

All of the mildew, residue, etc. on the outside of the dried gourd must be removed. This can be done by washing the gourd in the sink with soapy, water and scrubbing it with green or metal “scrubby” or similar coarse material. The gourd will need to dry overnight after this.

### **Cut top off of gourd.**

The size of the head has been determined in the layout process. You will be cutting somewhere in the top one-third of the gourd; taking off more than that will weaken the gourd. If you are cutting the gourd with a handsaw, you will need some way to stabilize the gourd while cutting. Perhaps a trusting friend can hold it. Otherwise you will need some kind of stabilizing jig. You will need to mark a line around the circumference of the gourd. To get a good line, you will want to spin the gourd on its bottom so that a fixed pencil (in a jig or taped to a ruler, etc.) makes a mark around it. Eyeball the line to see if it “looks right”, and then make the cut. You can cut the top off with a band saw if you make a sled to slide in the miter slot. You *will* want to wear a dust mask during this procedure-gourd dust can be harmful.



### **Clean gourd interior.**

There are at least three ways to do this:

- Soak the gourd. This cleans quite well but you risk the gourd expanding and cracking.
- Scrape the dry materials out with various implements, sharpened spoons, and curved rasps, and sandpaper.
- My favorite: a plastic paint stripper that mounts to a drill motor. You must wear protective goggles and a dust mask-also; it helps to have a vacuum hose in the gourd opening. You can follow up with sandpaper (80/150grit).

## Flatten the sawn edges of the opening.

You will need to flatten the sawn edge of the gourd so that you will get good head contact. The best way to do this is to glue sandpaper to a known flat surface. You can glue regular sandpaper sheets with rubber cement or use adhesive-backed sandpaper. Move the gourd in a circular motion over 100 grit sandpaper until flat. Then do the same procedure with 220 grit. I sometimes wear thin latex gloves while handling the gourd – that makes it a little easier to hold on to. Also you will need to ease the sharp edges of the sawn edge with the 220 grit; that way you will be stretching the skin over a rounded edge.



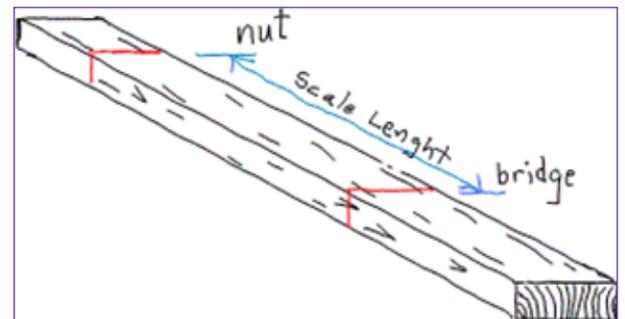
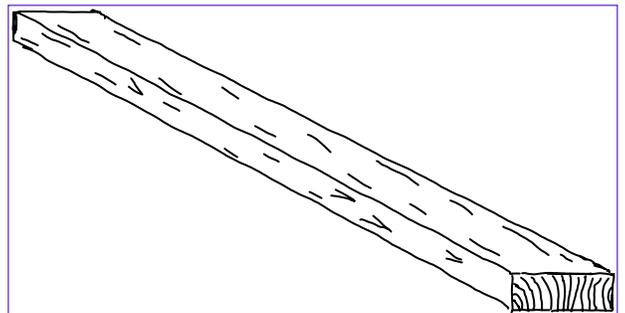
## Treat the interior of gourd.

If you want to treat the inside of the gourd, now is a good time. You might want to color it, harden it chemically, or shellac it. If so, you will need extended drying time.

## Lay out the banjo on the neck blank.

This is the most important and difficult step. We are using a full length piece of wood so that makes it somewhat easier to lay the whole banjo out. There are probably lots of different ways to do this, but this is roughly the way I do it.

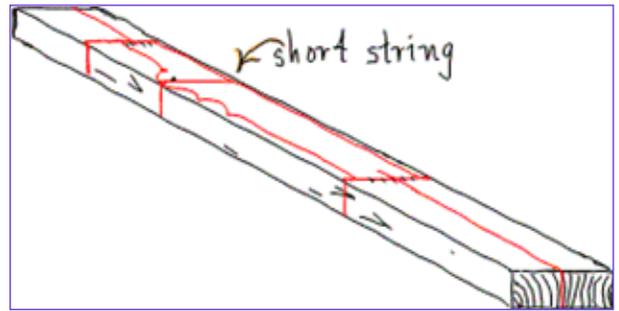
- Straighten and square up the neck. Consult woodworking resources for more information on these procedures.
- Lay the neck down with the fret board side up. (The grain should be vertical for strength.)
- Visually inspecting the way the grain runs in the wood; determine which end will have the peg head and which end will have the tail. Mark the ends and the top with a pencil.
- Lay out the rough length of the peg head and mark the point where it will “intersect” with the neck. This will be the position of the nut. Now measure back towards the tail and make a mark at your desired scale length. Using a square, mark these lines all the way around the neck with a pencil.
- The particulars of your layout may vary this step, but generally you can mark the neck center line on the top of the neck intersecting the lines just drawn marking the nut and bridge placement. Now, layout the string spacing from that center line. This spacing will vary depending on the distance you want between the strings at the nut and bridge. I use  $\frac{7}{16}$ ” spacing at the bridge and  $\frac{3}{8}$ ” at the nut. Depending on the neck profile, I usually will lay out the short string as if it were a long string at this point.
- Now measure out  $\frac{1}{8}$ ” from the outside strings and extend lines down the neck between those points on the side and nut lives. This may define in rough terms the outside profile of the neck. Lay out the termination point of the short string based on your scale length. Draw a line around the neck at this point. Depending on your layout you can also mark other fret positions on the neck at this point. Now lay out the cut between the nut and the short string termination and between the short string edge and



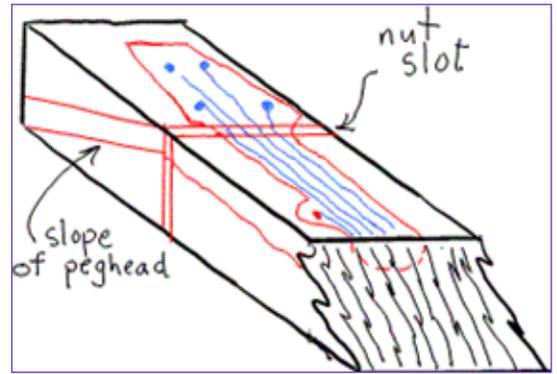
the heel (if different from the line already drawn).

When done the cut lines should exist between the nut and heel on both sides of the neck.

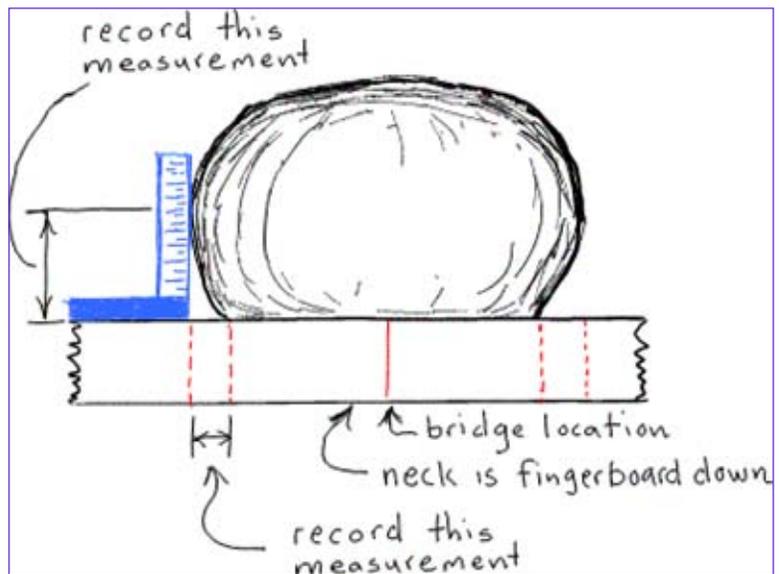
- At some point, I usually draw the strings on the neck from the bridge through nut to the far end of the peg head. This is a good way to double-check your layout and minimize mistakes.
- Now that you know the position of the nut and the strings, you can layout your preferred peg head shape. And, if your pegs will terminate the strings in a straight line, you can mark the location of those using a peg for a template, or you can lay the termination points out differently and mark the peg holes (Later on we'll mark the center of that hole with a sharp scribe.) The important thing is to know where the pegs will be and that there is enough space between them.



- Turn the neck over and place the gourd, cut edge down, roughly centered on the neck, and placed so that the bridge is a bit past center towards the tail. (The neck must be upside down otherwise the position of the gourd will be reversed.) Now mark on the neck along the edge of the gourd.

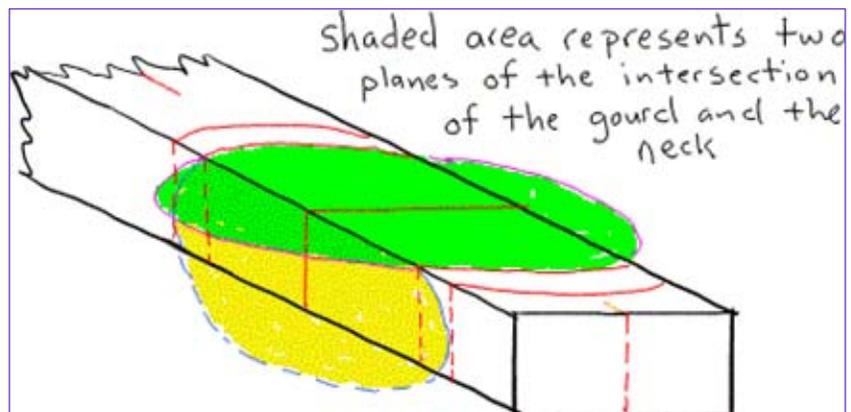


Then using your square, slide it along the center of the neck until it contacts the gourd. Mark this point on the neck and record the distance up the square (with a tape measure) to the point where the square touches the gourd. Do this on both ends of the gourd. Now extend all these lines around the neck. You can also duplicate the layout on your grid paper and label the lines for a good reference. Turning the neck back over, measure down from the top edge along the side the distance recorded earlier. Now you can roughly draw in the shape of the gourd and get a sense of how the neck will intersect the gourd. It will be important to stay true to these dimensions as cutting begins-



otherwise your bridge will shift, or worst case, make the neck unusable.

- Using the neck centerline extended to the tail lay out the dowel stick on the top and sides of the neck. It is helpful at this point to lay the neck on its side and lay out the rake of the gourd, and decide how you want the action. (For an average gourd, I drop the tail end about 1/2" as an estimate.) It is important to get good lines and to make good cuts on the dowel extension.

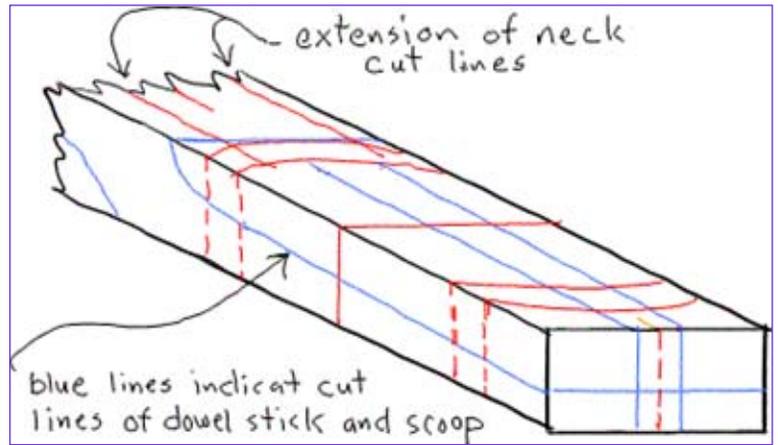


For the last layout, lay the neck on its side and lay out the profile to cut from the back, from the heel to the nut, and then the peg head. You will want to get it pretty close to where you want it. Removing

- material later is more difficult.
- Go back and double check your measurements. It might be good to shade parts of the neck to be removed.

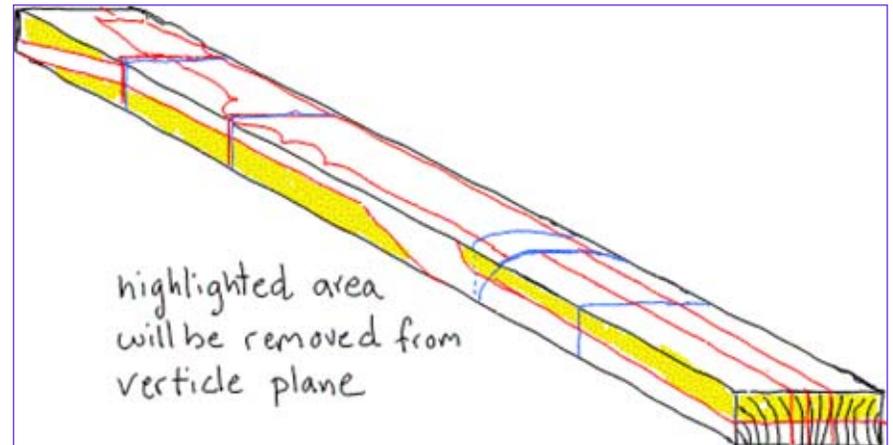
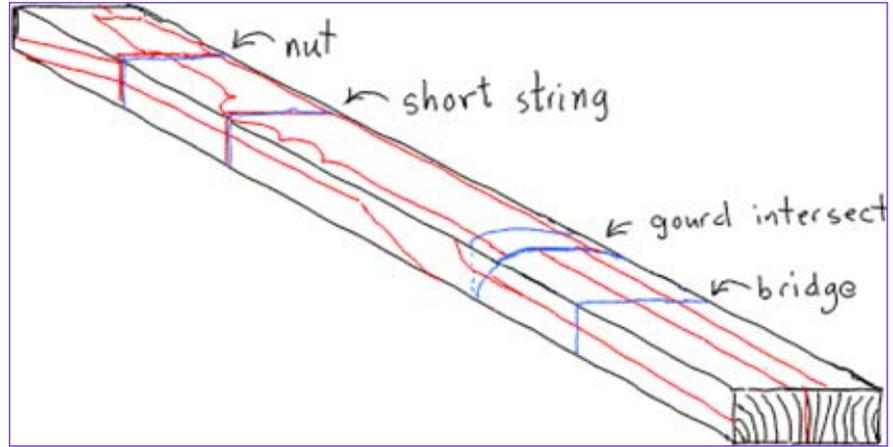
### Rout the nut slot.

If you did not have a separate fret board that terminates the nut, now is the best time to rout the nut slot. You can do this with a router or a dremel. Clamp a straight edge to the neck parallel to the cut to guide the router. Make the cut the same width as your nut. At this point I like to mark the strings in the bottom of the slot for reference. Alternately, you can cut this in with a saw and cut the center out with a chisel. This takes some skill.



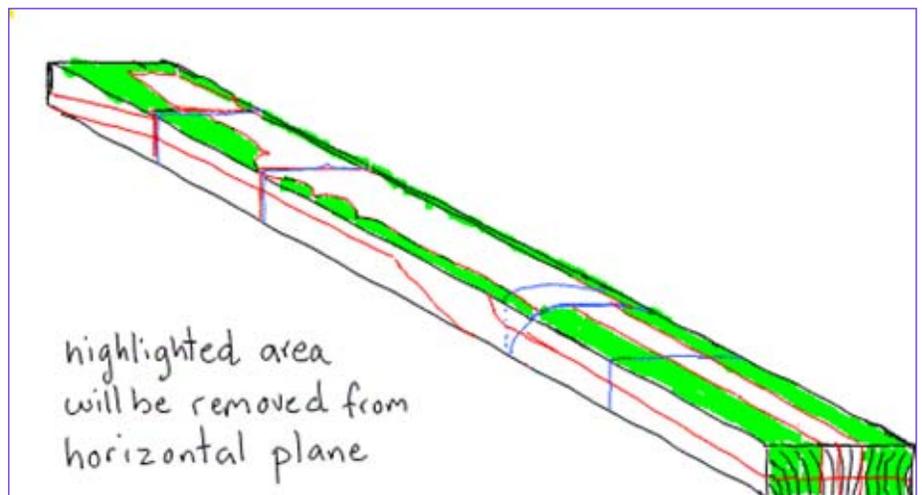
### Cut out the neck on the band saw.

I usually will remove the bottom of the neck first by cutting along the lines made earlier. Then I spot glue it back together so that I still have a nice square piece of wood as a basis for making other cuts. Next I will cut out the sides of the neck, tail and headstock. We have to be careful not to cut too deeply at the intersection of the gourd and neck. Generally we will be cutting to the longest point on each side of the neck (where the neck “wraps around” in gourd.)

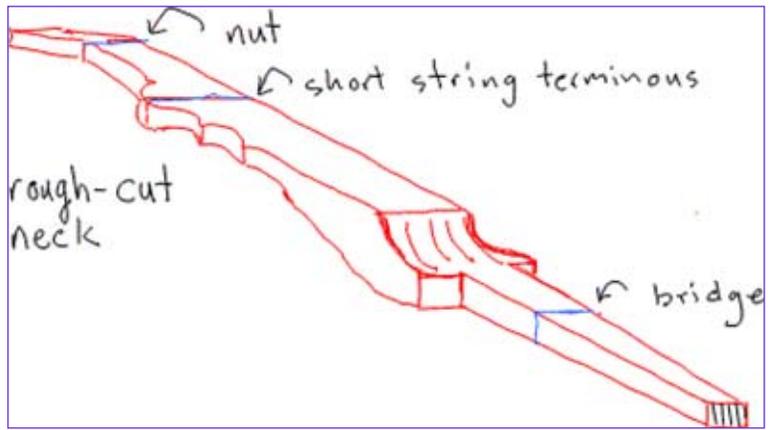


### Fit the neck to the gourd.

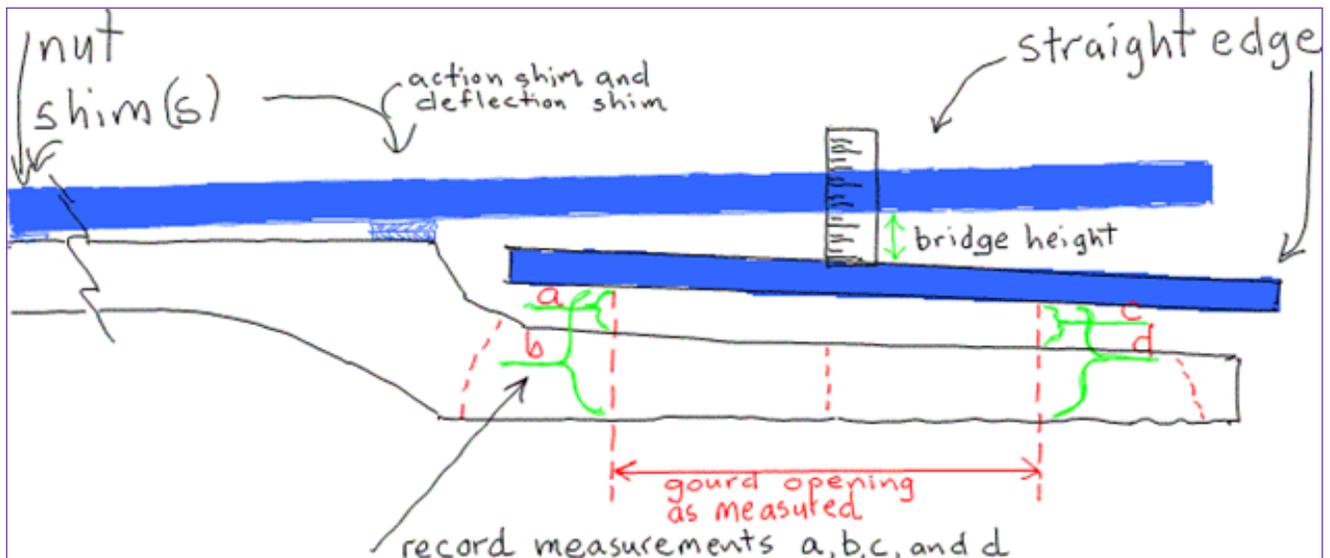
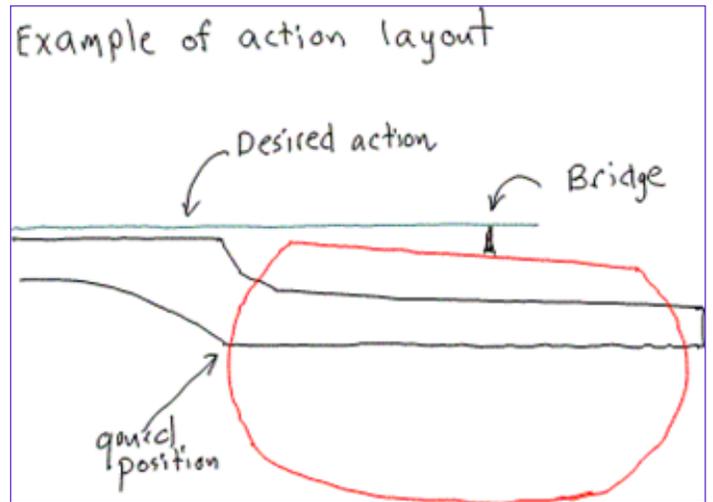
In this process we will determine the layout and make the cuts in the gourd to accept the dowel stick. To get this right we need to determine the action, the bridge height, and the deflection in the head from the pressure of the strings on the bridge. One way to do this is to lay a straightedge along the neck with shims at either end. On the nut end you will need one shim that approximates the



action. At the other end of the fingerboard we need one shim that approximates the action, and another that compensates for skin deflection. In my climate (in winter) a 8-inch head deflects 3/16 inch, and a 6-inch head deflects 1/8 inch. These will easily double in more humid conditions. You might want to consider carrying different bridge sizes with you if you go out to play somewhere.

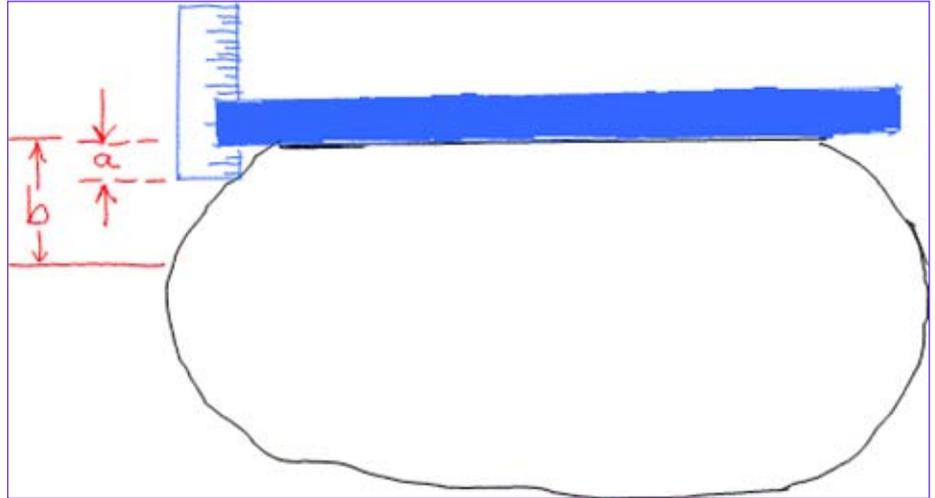


- If you have not done so already, determine the approximate bridge height that you want. This will determine the “rake” of the neck to the gourd. Also, recall approximately how the gourd will sit on the dowel stick from your earlier layout. Ensure that the scale height is correct by measuring to the bridge placement point on the dowel stick.
- Measure out on either side of the bridge location on the dowel stick and mark the approximate gourd opening.
- Lay the neck on its side short strong side up on a flat surface (before any shaping is done).
- Place the action shim at the nut and the heel action shim plus the deflection shim at the heel end of the fingerboard.
- Place a long straightedge against the shims and clamp lightly.
- At the bridge position, lay a short ruler extending down from (perpendicular to) the straightedge towards the dowel stick. You will measure along this rule for the bridge height.
- Lay a long steel rule roughly parallel with the top of the dowel stick and intersecting with the first rule at the bridge height mark. Now pivot the ruler on this point until you find an acceptable angle. Note that this ruler represents the top of the gourd. At this point it may be evident why we have to compensate in the opposite direction for skin deflection. Envision the skin deflecting downwards and moving the strings closer to the fingerboard.
- Measure down from the rule to the gourd opening points laid out on the dowel stick. Measure to the top and bottom of the dowel stick on each end of the gourd. Record these four measurements. Note



that this process will result in holes in the gourd that are slightly smaller than what is required (if the dowel stick is tapered).

- Using an adjustable square or a pair of steel rules, measure down from the top of the gourd and mark parallel lines for the top and bottom of the dowel stick. One way to do this is to mark the two points on either side of the dowel stick and connect the two points with a flexible rule. It



is imperative that the lines and the subsequent cuts be parallel to the plane of the top of the gourd. Otherwise your neck will not be on the same plane as the top of the gourd-one side of the neck will be higher than the other. Of the two lines, the bottom line is most important because we know that the bottom of the dowel stick is parallel with the fingerboard

- Measure the width of the dowel at the marked points and mark those dimensions on the gourd. A good way to do this is to mark it using a square flexible template (like cardboard).
- Now using a knife or dremel cut out inside the lines that you have drawn. Then slowly enlarge the holes so that the dowel will pass thru the gourd. Don't make the hole too big. If you do, you will be figuring how to keep the neck from wobbling or cutting a new gourd.
- If your design has the neck butting up against the gourd, you can now lay out on the neck material that must be removed. The easiest way to remove the material is with a dremel with a carbide rasp bit. This is a very iterative process and is time consuming. You can mark the gourd with chalk to indicate the high spots on the heel. Continue the cycle of marking and removing material until you have a decent fit. We will come back later once the neck is shaped and complete this process.

## Shape the neck.

- Use the straight edge to mark a centerline down the back of the neck. Confirm the profile of the neck that you want and consider the cut around the short string peg.
- Now is a good time to mark and drill the hole for the short string peg.
- There are several tools that can be used to shape the neck; power rasp in drill motor, hand rasps, drawknives, spokeshaves, pocket knives, etc. We will use a rasp, first a coarse cut, and then a finer cut and we will finish with a file. In order that you don't remove too much material you may want to consider drawing a set of lines down the neck and removing material between the lines. When using a rasp, be very careful if you are (unwisely) pushing the rasp in the direction of the fingerboard. That can lift material from the edge of the fingerboard. It will be hard to recover from this, so always rasp away from the fingerboard.
- Beginning with the coarse rasp, get the neck roughly to shape. If you have sawn the neck close to final shape, you will be removing material in a manner that leaves to the center line drawn.
- Moving to the finer rasp and then a file, remove the marks of the previous tool. Make sure you don't get dips and bumps in your workpiece.
- Carve out whatever design you have for the short string termination with knife or chisel and then clean this up with a fine rasp/file.
- Move to the peghead with a file or sandpaper. Be very careful working on the peghead because you might lift material off the face or back. Using needle files works well here.

- Work over the intersection of the peg head and neck. You want nice clean lines here-this is one place that it will show that the neck was hand-shaped and not machine-shaped.
- Use 80 grit sandpaper to sand the neck and peg head. Sight down the neck as you do this; you will be able to see the dips, humps, and scratches from the previous tools. Continue to finer grit (220). Alternately you can use a scraper to do this, but it does not do as good a job of leveling the surface. Through this process leave all the lines of the neck sharp. Generally, you will ease the edges later in the process as a final step. It is easier to see imperfections if you have sharp defined edges to sight along. Also, you don't have to remove every single tool mark if you don't want to. The degree of finish is up to you. Note that when using Tru-Oil practically any surface imperfection will show- normally after you think you are finished!

### **Check the neck for flatness.**

Although the fingerboard was flat when we began, removing material from the back of the neck may have caused the wood to move in one direction or another. Check the neck against a flat surface. If needed, glue sandpaper the flat surface and sand the fingerboard flat.

### **Attach the head to the gourd.**

- Soak the skin until it is pliable (10-15 minutes). Pat the skin dry.
- Apply a layer of glue on top of the flat surface of the gourd and down the side as far as you intend to fasten it.
- Lay the skin on top of the gourd where you want it. Bend the skin down over the edge. Determine where you want the row of tacks, and using the awl, push gently to break through the hard outer surface of the gourd. Then push the tack in. Turn the gourd around, and with your fingers pull the skin taut. Pulling and then holding the skin over the edge, push a hole with the awl at about the same distance from the top as the first, and install another tack. Do the same procedure till there are tacks at 3, 6, 9, and 12 o'clock. All but the first are temporary.
- Then starting from the first tack, start moving around the gourd, pulling the skin taut and installing the tacks. As you get close to the temporary tacks, you can go ahead and pull them out, since the skin may be starting to bunch toward them and/or they will not be aligned with your spacing. As you get towards the end, you may need to adjust your spacing to make the tacks work out. You might start the tacks behind the tailpiece, since that is area where you can conceal some "slop".
- Once all the tacks are installed, then go around the edge of the skin below the tacks with the razor knife – which must be sharp because the skin is wet and tough. Try to make a smooth straight cut. Wash and dry the cutoff and give it to your dog to chew on! (Alternate and recommended process: wait until the skin is dry to make this cut; this will allow you to make a cleaner cut. Clean up the glue with warm water.) Also, if the skin is not laying flat on the gourd, secure the edges with rubber bands.
- Set the finished product aside to dry for as long as necessary (8-24 hours). Don't thump the top until it is dry, no matter how tempting! You don't want to stretch it.

Other things to consider:

- Try to avoid pushing on the skin (over the hole) as you install it – you don't want to stretch it unevenly.
- Your thumb will be sore from pushing the tacks – because the hole you punch should only be a starter and not deep or wide. Your fingers will be sore from the hard pulling you will do on the skin. Remember – this is you only chance for a tight head.
- You will have to work fast. It's nice to have a partner to help. Also work on a soft surface.
- If you wanted to be real precise, you could make a jig for punching the holes so that the tacks were

perfectly aligned.

- If the head size is large or the gourd is not that strong, be careful about how tight the skin is stretched.
- If you have sound holes in the gourd, and the skin is stretched over the hole, I recommend cutting the hole before installing the head.

## **Make holes for pegs.**

- Layout the strings and peg holes on the top of the peghead.
- Use a marking tool to punch an identifying mark where the holes will be drilled.
- The preferred tool is a drill press. The neck peghead should rest on or be clamped to a piece of wood to minimize tear-out.
- Drill the holes with a wood cutting bit.
- Use the peg reamer to enlarge the holes to the proper size. Do this consistently so that the pegs extend equally above the peghead, that distance is a matter of preference, but be sure to leave length on the back side for adjustment as the wood wears over time. Ream the fifth string hole as well.

## **Final fit the neck to the gourd.**

Go back to this step and complete the process of removing neck material until the fit is satisfying to you. Now mark on the tail where it exits the gourd. Determine the final shape of the tail extension and cut that out on the bandsaw or handsaw.

## **Final shaping sanding of neck.**

- Go back over the neck and inspect it closely.
- Repeat any previous steps recessing to make a good finish, including cleaning up the tail.
- Use sandpaper to ease all the sharp edges of the neck. Keep sharp edges where it passes through the gourd.
- Sand the neck to the desired finish using 320, 400, or 600 grit sandpaper.

## **Cut out the tailpiece.**

Determine the shape the tailpiece and cut that out with a coping saw or bandsaw. Determine how you want the holes drilled, and then drill those with a small bit. Go back a now and drill holes in the pegs (around 1/4" inch up the peg from the peghead). Sand and ease the edges of the tailpieces. Drill the holes for attaching the tailpiece.

## **Apply the finish.**

- Check the neck one last time.
- Put a bit of tape in the bottom of the nut slot.
- Apply your finish per manufacturers instructions, you will probably do not want to put any hard finish on hard oily woods like ebony. Note some woods may not require any finish.

## **Attach nut and tailpiece.**

- Cut the nut to length and do any final shaping to the nut.
- Ensure that the nut slot is clear of glue residue or any material that will prevent the nut from seating. Use a nut seat file or small chisel.
- Glue the nut in with a drop of super glue.
- If the tailpiece is one secured by a thick gut string, thread that through the hole and tie off around the tail. Position so that the string terminates at about where the head starts.