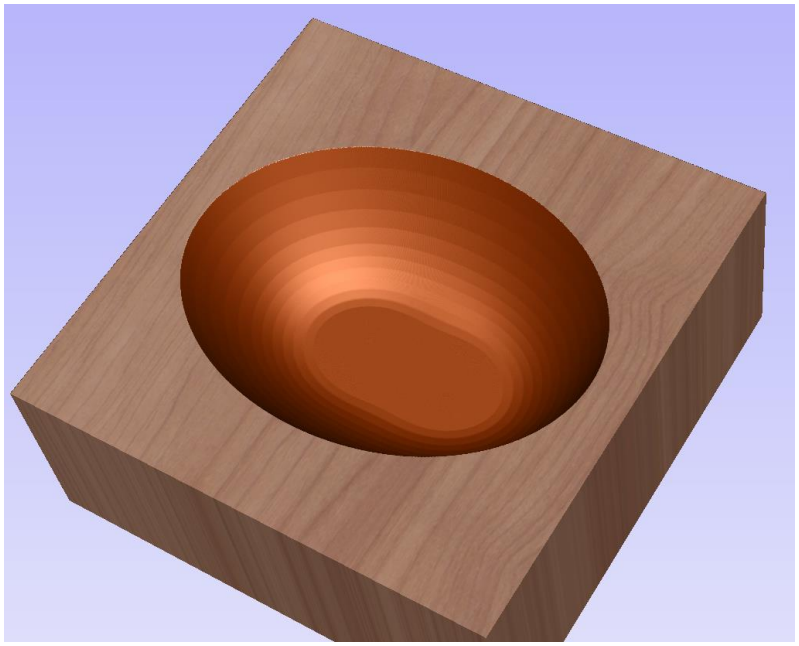
Making Convex Shapes with WarpDriver

Making inverted dish-shapes with Vectric's V-Carve Pro is a recurring theme on the forums. Although the fluting toolpaths can make dishes in VCP, they cannot directly make 'upside-down' dishes (e.g., for the outside surfaces of bowls or spoons). **WarpDriver** gives a couple of ways to do this using 2-sided machining. It takes about 5 minutes or less to create these patterns.

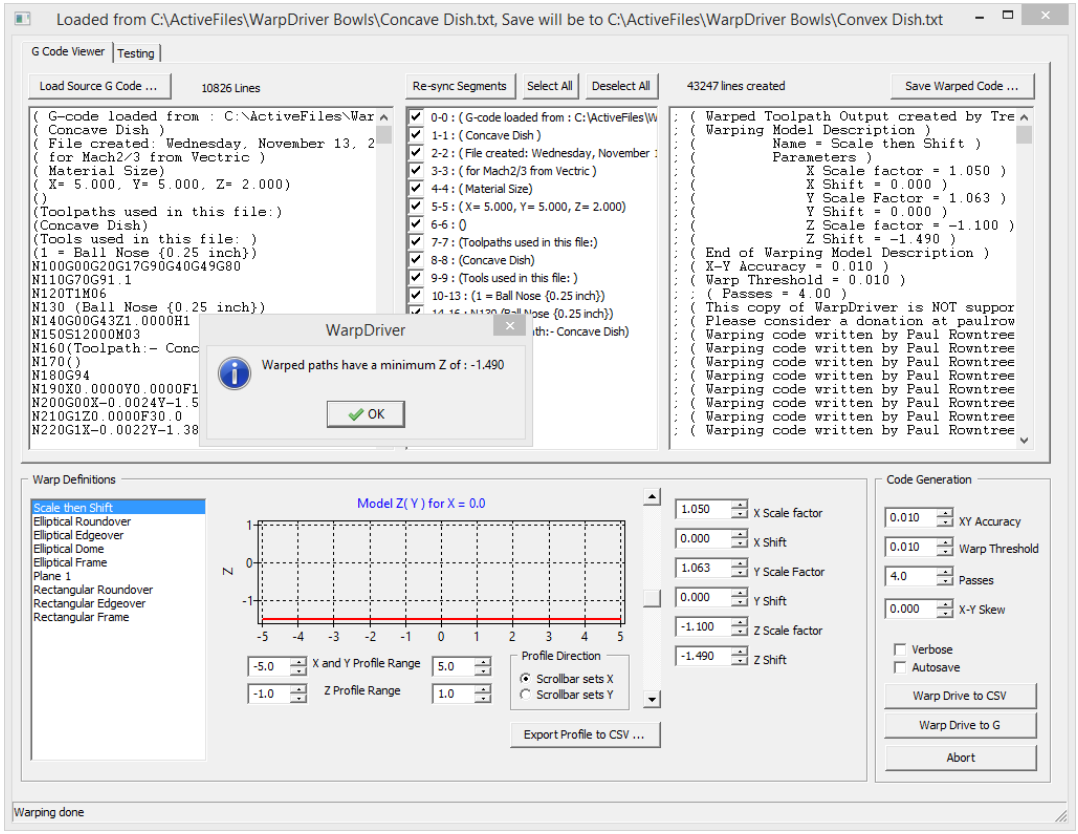
1) **First Route : You already have a nice dish shape that toolpaths the way you want, and if you want to create a similar convex shape for the outside surfaces**
   Here is an example : 4" in X, 3.2" in Y, and 1.25" deep. The material is 1.5" thick.



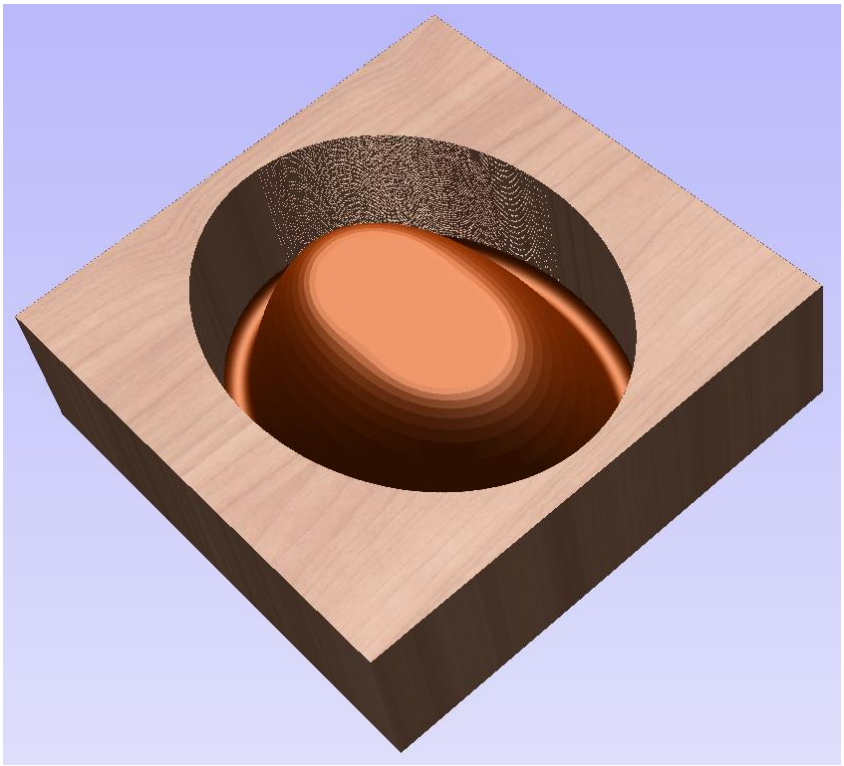
   a) Output the gcode for the inside shape, without any roughing passes. I avoid multiple passes by setting the tool's step down to be a value greater than the depth to be machined.
   b) Load this gcode into **WarpDriver**. and select all segments
   c) Use the "Scale then Shift" model, with a negative value for the Z Scale. The magnitude should be greater than 1, so that the distance from the rim to the bottom of the surface is more than the depth of the inside surface. I used -1.1, so that the height of the bowl shape will be 1.1*1.25"=1.375".

d) Use a negative value of the Z Shift parameter to move the rim down to the bottom surface of the material. If the material is 1.5" thick, set Z Shift = -1.5. If you want to leave a 0.010" onionskin layer to hold the piece, reduce Z Shift to -1.490.
e) So far, you have an exterior surface that will form a sharp rim where the outside meets the inside. If you want to have a rim that is 0.1" on a dish that is 4" across, you want to make the convex shape that is wider in X by a factor of (4.0+2x0.1)/4.0 = 1.05, wider in Y by a factor of (3.2+2x0.1)/3.2=1.063. Use your chosen scale factors for X Scale and Y Scale.
f) If your inner concave shape is asymmetric in X or Y, like a kidney-shaped pool, you need to mirror the pattern in X or Y (not both) because you are going to flip the material over in the machining stage. Change the X scale (or YScale) to be a negative number in this case.
g) If you need to create roughing passes, set 'Passes" to a number greater than 1 accordingly. See the **WarpDriver** manual for help. Roughing passes only work if Z=0 is set to the top of the material. I used 4, so each pass is deeper by 1.49/4~0.4".

h) Press the "Warp" buttons on the right hand side of **WarpDriver** to create new GCode, or CSV code. GCode can be run directly, but previewing in NCSim is probably a good idea first. Another way is to use the 'Warp to CSV' option, and then import the CSV data into VCP (version 7 or higher). If you do this by CSV you can get Vectric previews to make sure that the design is as you expected. If all is well, then make the toolpath and away you go!


Loaded from C:\ActiveFiles\WarpDriver Bowls\Concave Dish.txt, Save will be to C:\ActiveFiles\WarpDriver Bowls\Convex Dish.txt
G Code Viewer
Testing
Load Source G Code ...
10826 Lines
Re-sync Segments
Select All
Deselect All
43247 lines created
Save Warped Code ...
WarpDriver
Warped paths have a minimum Z of : -1.490
OK
Warp Definitions
Scale then Shift
Elliptical Roundover
Elliptical Edgeover
Elliptical Dome
Elliptical Frame
Plane 1
Rectangular Roundover
Rectangular Edgeover
Rectangular Frame
Model Z(Y) for X = 0.0
X Scale factor
X Shift
Y Scale Factor
Y Shift
Z Scale factor
Z Shift
X and Y Profile Range
Z Profile Range
Profile Direction
Scrollbar sets X
Scrollbar sets Y
Export Profile to CSV ...
Code Generation
XY Accuracy
Warp Threshold
Passes
X-Y Skew
Verbose
Autosave
Warp Drive to CSV
Warp Drive to G
Abort
Warping done

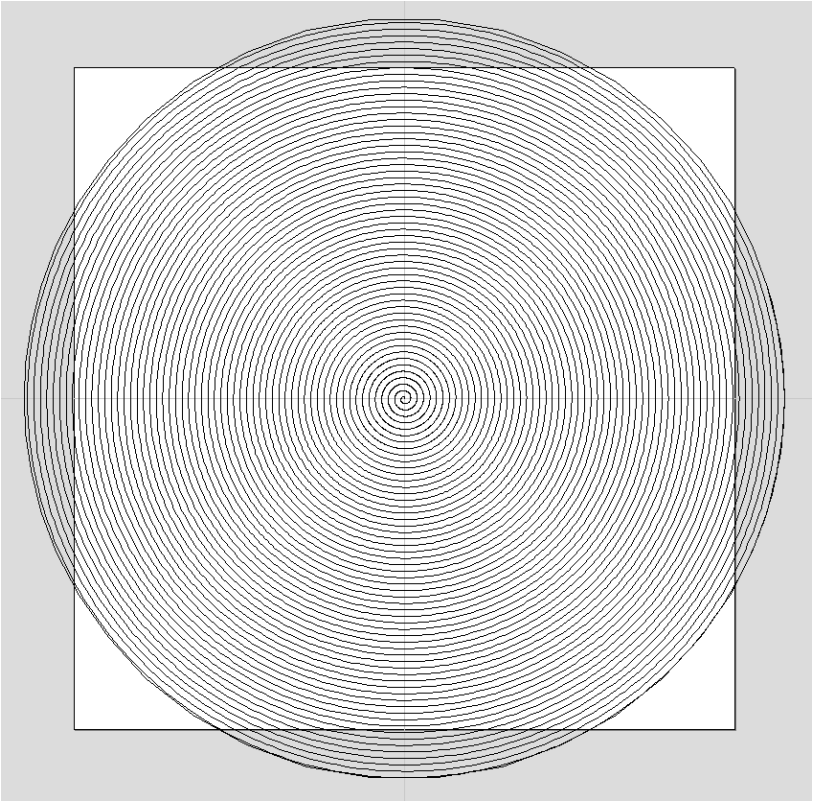
i)



Second Route : You design the concave and convex shapes in WarpDriver, using the zero-depth pockets described in the WarpDriver manual.

a) Choose the size of your bowl. For this example, I am going for 5" in X, 3.2" in Y, with a depth of 1.25", material is 1.5" as before. The shape is going to be different from what flutes can produce.

b) create a zero-depth pocket that covers this working size on the material. I used the Spiral Gadget to make this, for a 0.25" diameter tool, with a 0.010" stepover. Then I profile-cut this vector to a depth of 0.000"



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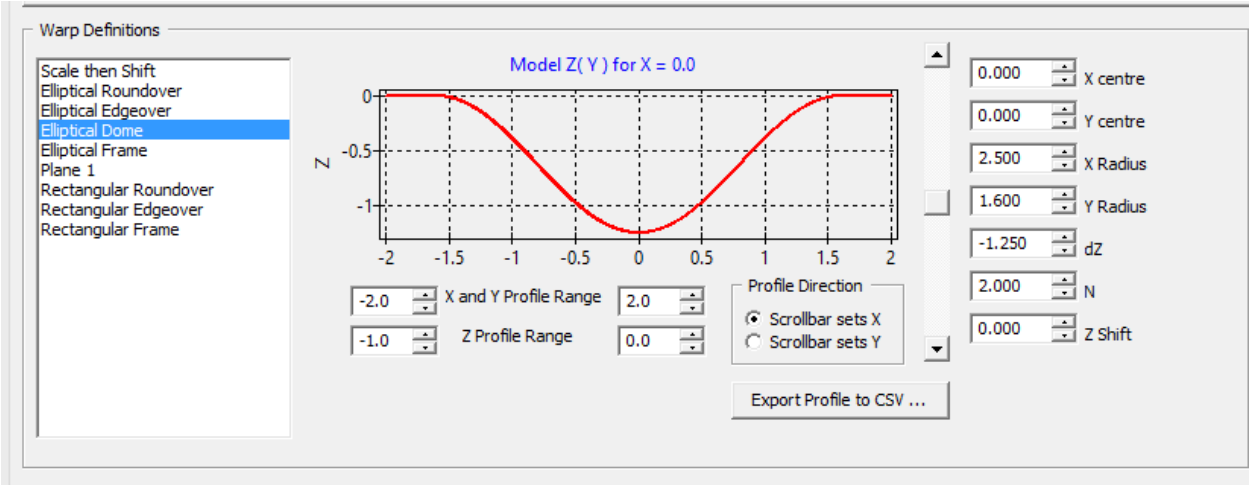
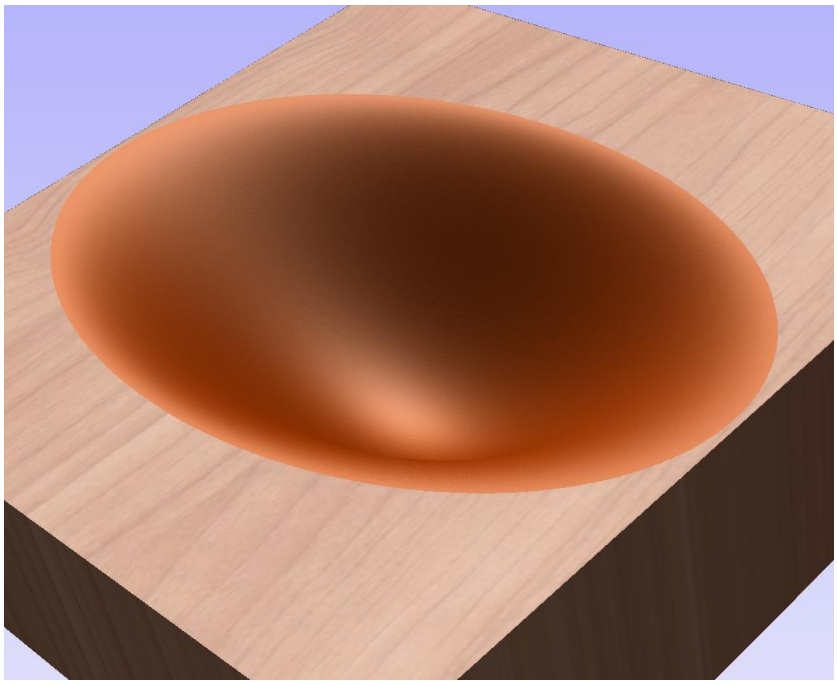
c) Save the gcode to generate this zero-depth pocket, and load it into **WarpDriver**.

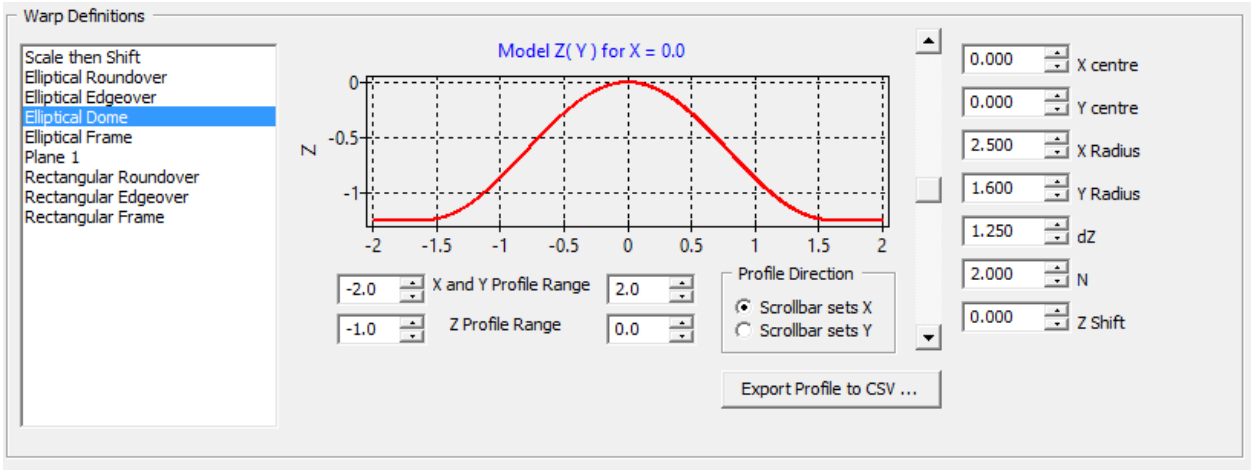
d) You will probably want to use the Elliptical Dome model. I used X and Y radii of 2.5" and 1.6", N=2.

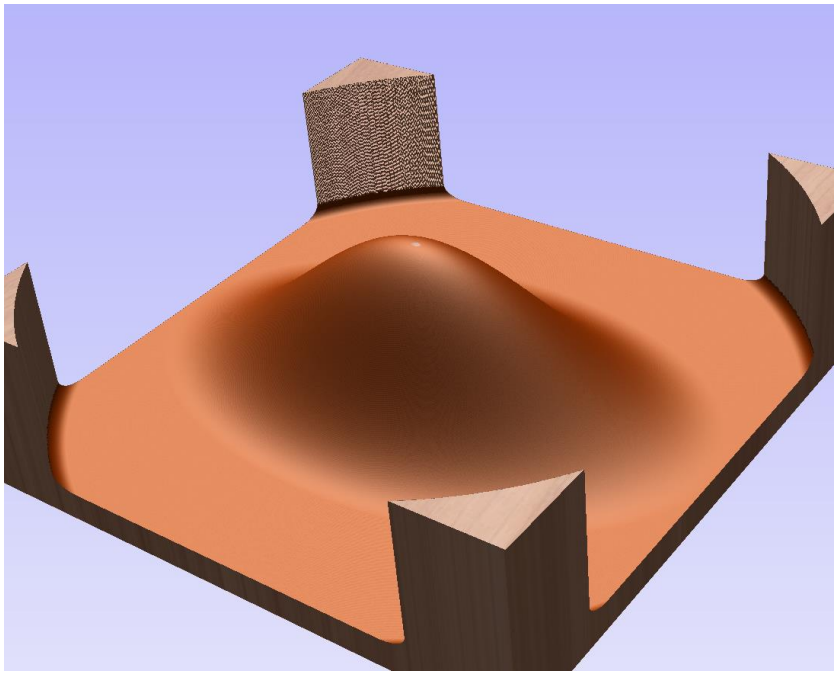


e) Run the **WarpDriver** to create the CSV file, and save this. I put in 4 roughing passes to reach the 1.25" bowl depth. Save the CSV data, and load it into VCP with the CSV gadget. (Too many Three-Letter Acronyms !). Here is the preview. The smoothness of the surface is much better than what I can do with flutes, and it makes the image difficult to see.



f) repeat the process to create the outer surface, using an convex dome with dZ=1.25. You can imagine several different designs, but I am going to use the same shape but shifted so that at the rim there is 0.25" of material left. Keeping all parameter the same, except for the dZ = 1.25 . Make the CSV data, and load it into VCP.





g) The final step would be to do a profile pass to cut out the shape from the bulk material, probably following the 5”x3.2” elliptical shape, using an onionskin to hold it in place.

As you can, this particular shape does not have a flat bottom. It may have been better to have slightly shallower bowl, leaving more material at the base of the bowl, and then machining a flat bottom. You could also do a Z Shift upwards of the convex shape.

Good luck!
Paul Rowntree