TreeSoft : STL & Image to CSV Converter

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Change Log

Date	Change
2013-12-01	• Manual improvements • Improved roughing handling to avoid wasted final pass • Eliminated use of c:\temp for temporary image files • Made screen image an accurate grey-scale representation of data • Changes to R-G-B colour mappers now cause updates to scaling and image • Added status bar to show (X,Y,Z) position at mouse coordinates on image • Image grows/shrinks with window size
2013-11-30	• First version finished and posted

What is the STL & Image Converter?

STL & Image Converter is a program that loads 3D stereolithography (STL) files or image files and produces a comma separated values (CSV) file that describes a raster pattern to cut the pattern on a CNC machine. This CSV file can be loaded into Vectric's V-Carve Pro (version 7 or greater) or Aspire (version 4 or greater) using the CSV Gadget, which generates 3D toolpaths. Although it works with VCP and Aspire equally well (or badly) Aspire users can work with STL and image files directly and more easily, so there is probably not much point for them. For VCP users, it gives an easy way to generate 3D carvings.

STL & Image Converter lets you set the X, Y and Z dimensions of the produced file, and lets you describe the tool that you will use to make the cuts; it will use the shape and size of the tool to avoid overcutting the material.

STL & Image Converter can be used to cut 3D logos based on colour separations. You may also be able to do this by tracing the bitmaps; you can decide which approach is easier or produces a better cut file.

STL & Image Converter can read ASCII and binary STL files. It can read BMP, JPG, PNG and TIF image files, but not all TIF's read well, and can crash the code.

STL, image and CSV files do not contain dimension information. You can use inches or mm, but you must use the same units everywhere in the program; you must also tell the CSV importer what units you have used.

Versions

STL & Image Converter is available free of charge and is distributed 'as-is' with no warranties or suggestions that it well-suited for any particular application. It can be used for anything you wish. The fully-functional program is available for download at http://PaulRowntree.weebly.com. Donations (via PayPal at the download site) lets you bypass the nag-screen that appears on program run, and supports continued development of these programs. If you are using this program, please reflect on how much you are selling your products for, or what your hobby means to you, and consider making an appropriate contribution commensurate with the value added provided by these programs.

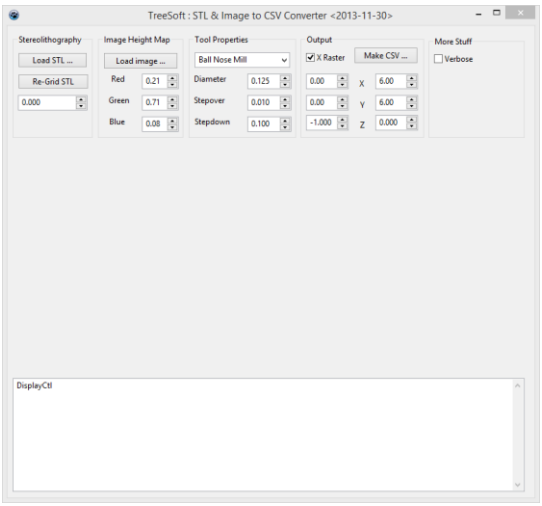
Installation

Download the **STL & Image Converter** ZIP file archive into a directory of your choice. There is no Windows installation, and the program does not use the registry or leave any junk scattered around in your computer. When you are done with the program, just erase the unzipped files, and you are clear and clean.

Using STL & Image Converter

Please read all of these instructions before making designs and toolpaths.

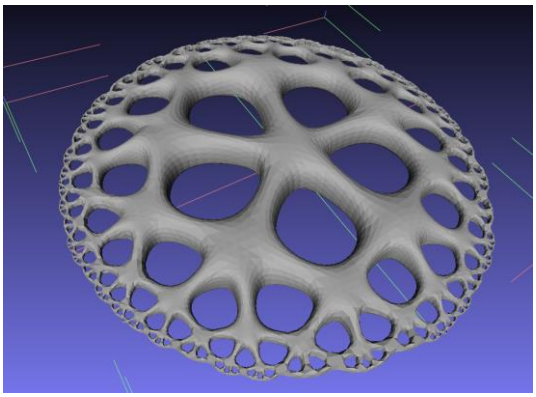
Double click on the program or shortcut icon to run the program. After the very-important-nag screen appears and is dispensed with, it should come up with a window like this.



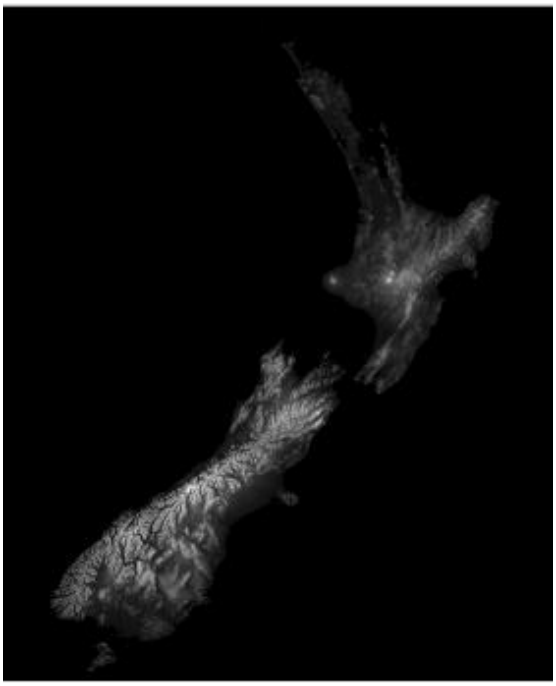
STL to CSV Conversions

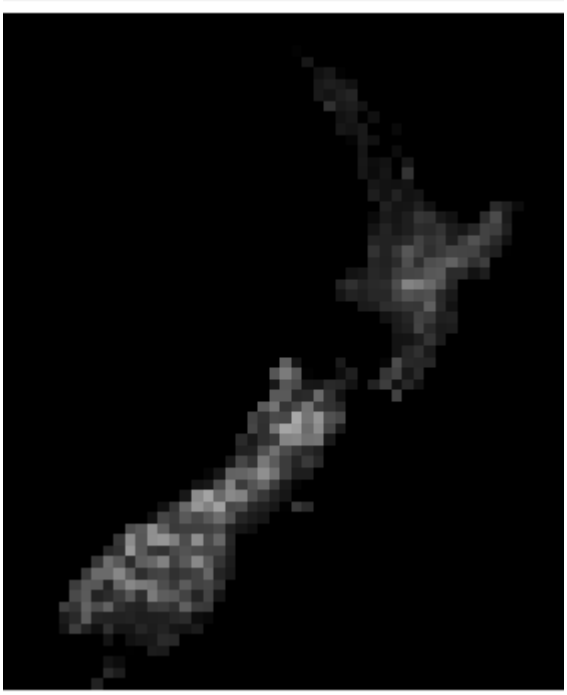
1) Press "Load STL …" and select a STL file. This example will use the topographical map of New Zealand that was prepared using the **BigTopo** program, and is included in the program package (NZ_2.stl). A grey-scale image will appear showing the contents of the STL file, with brighter areas showing higher elevations in both the STL and the machined surfaces. It will fill in the X,Y and Z limits on the right-hand-side of the window with the information extracted from the STL file.
   The number entry box below the 'Regrid' button tells the program what to do if it cannot find a

height at some point (x,y) that it needs. For example, here is the sand dollar STL, posted by George Hart. There is no information in the holes or outside the main shape, so the program fills the missing Z values with whatever you have entered in the Missing Z control. This value is in STL's frame of values, not the final Zmin-to-Zmax values, so you may have to play a bit to know what to use. Meshlab is a great program for poking about with STL files, checking the values, smoothing, etc.



2) Ignore the controls in the "Image Height Map" section.
3) Setup the tool parameters for your preferred cutting tool. If the Stepdown parameter is less than the total depth of the cutting, roughing passes will be created that respect Stepdown. If you want to create roughing passes with a different tool, create two CSV files, one for each tool; make the total depth of the roughing cut slightly shallower than the final cut depth as described above. If you have changed the Stepover, then press "Re-Grid STL" to recreate the image to reflect your choice. The following images are for New Zealand with 0.010 and 0.100 stepovers, respectively.

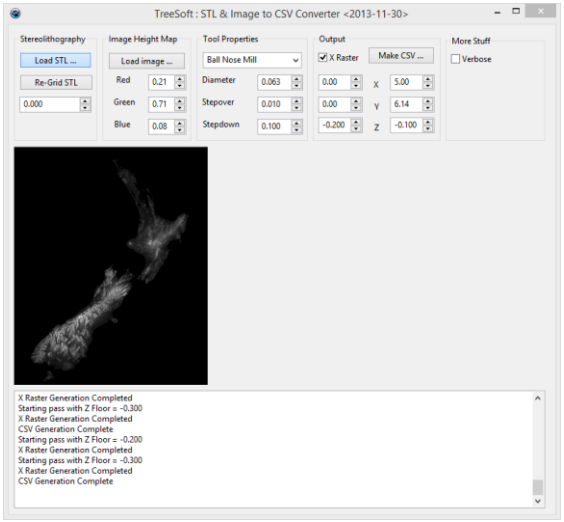




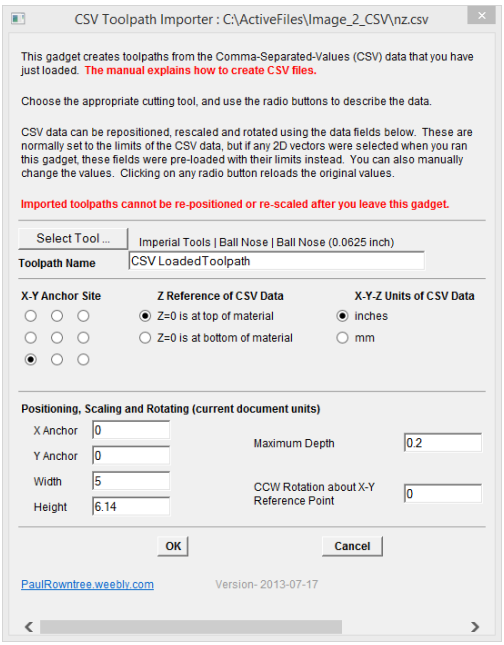
4) Adjust the X,Y and Z limits as you wish. If you are planning on using VCP with Z=0 referenced to the top of the material, then both Z limits should *probably* be less than or equal to 0.0. If Z=0 is set to the bottom of the material, then both Z limits should *probably* be positive. For this

example set Zmin=-0.2, Zmax=-0.10. This is implicitly in inches. The top of the tallest mountain will be 0.1" above the ocean, and 0.1" below the surface of the material.

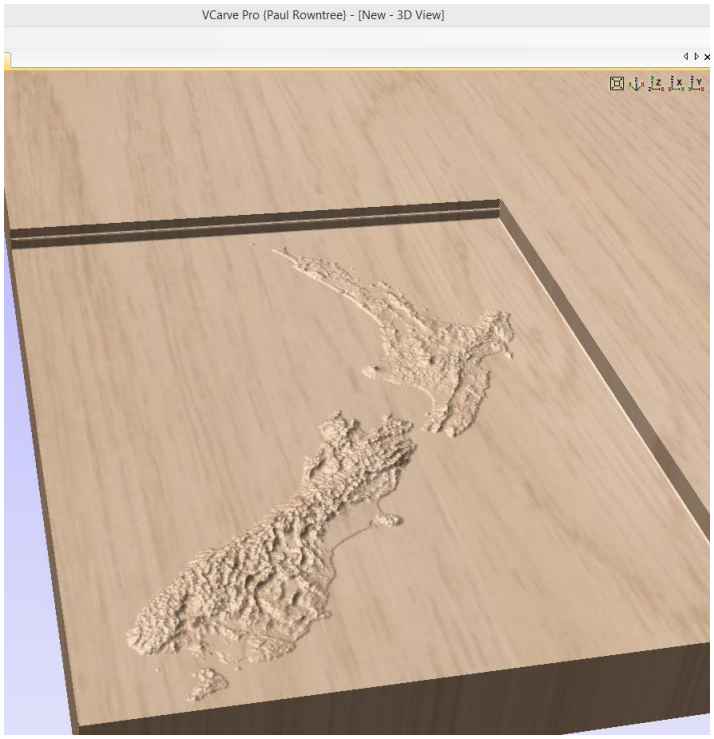
5) If you move the mouse across the greyscale image the information in the status bar will update showing the world coordinates at the tip of the mouse. Maximize the window to get a better view.
6) Select if you want the toolpath to raster along the X or Y directions in VCP.
7) Press the "Make CSV…" button. It will regenerate the preview image, then ask you for a CSV filename, then go through the steps to produce the toolpath, including roughing trajectories if required. Normally this only takes a few seconds. It will show "CSV Generation Complete" when it is done.



8) Now run V-Carve Pro, and start a new project. Set up the material as you want. For this example, use inches with (0,0) in the bottom left corner, and 1.0" thickness.
9) From the Gadgets menu, run the "CSV to 3D Toolpaths" gadget. Select the CSV file that you have just made, and after a few seconds the gadget front panel will open up.



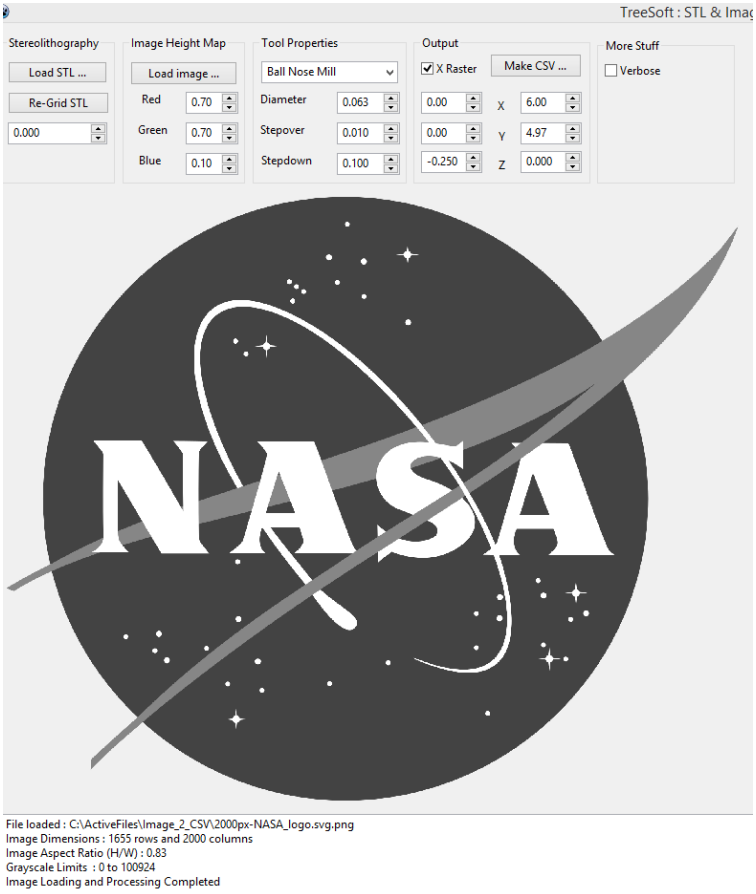
10) Make sure that the selected tool is the same or similar to what you used to create the CSV file, and then press “OK” to create the 3D toolpath. It should appear in the Toolpath selection list, and is available to preview as usual.



That is it!

Image to CSV Conversions

1) Press the "Load Image …" button and choose the image file you want to work with. The NASA logo will be used for this example. IMHO the red line in front of the letters looks great in the original image, but isn't quite right in 3D; edit the images as you see fit, but don't tell NASA. **STL & Image Converter** will scale the Ymax parameter to make the X/Y ratio of the CSV file respect the image aspect ratio, assuming square pixels.



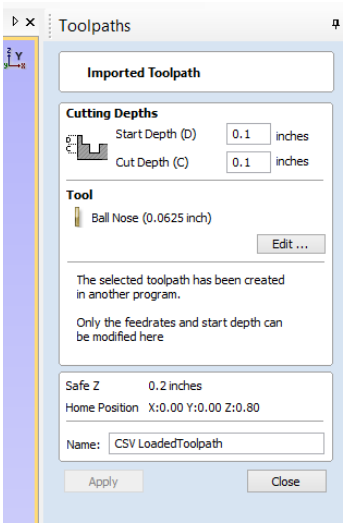
2) The default Weights given to the three colours in setting up a Z scale (0.21, 0.71, 0.07) are used in the 'Luminosity' model (Wikipedia http://en.wikipedia.org/wiki/Grayscale). They work, but here we want more red/blue separation. Try 0.7 / 0.7 / 0.1. These weights must be between 0 and 1.0, but do not have to add up to anything special.
3) If you adjust the weighting factors the image will update to reflect the current greyscale interpretation of the raw data. Moving the mouse across the image shows the world coordinates that will be output to the CSV file. I used Z limits to -0.25 and 0.0, which makes the letters Z=0, the 'red' swoosh Z=-0.12, the blue disk Z=-0.18, and the area outside the disk Z=-0.25.
4) Ignore the Stereolithography controls, and create the CSV file as described above.
5) Load the CSV file into VCP, and preview the results.

That's it!

Making Roughing Passes

If the shape being cut is deeper than the Stepdown parameter, the program will divide the depth into slices, each Stepdown thick, and will work its way down through the material, slice at a time. Stepdown would be set by the strength of the tool and machine, and how much material it can safely hog out at one pass. The top of the first slice is at Zmax, which may be below the top surface of the material (e.g., the example of New Zealand above has Z from -0.2 (sea level) to -0.1 (mountain peak)). A single pass would probably break a fine tool, since it could be as much as 0.1+0.1 (material above the mountain + Stepdown) deep. There are three routes to avoid this.

1) You could use a more robust tool to hog out the bulk of the material, followed by a finer tool for the finish pass. Since **STL & Image Converter** knows about the tool shape, you could use a 0.25 diameter end-mill for roughing with 0.25 StepDown, Z ranging from -0.19 to -0.09; I would use these slightly shifted Z limits to ensure that the finish cutter is cutting everywhere across the surface. Then follow with the small ballnose cutter, with Stepdown=0.25 as well (no need to generate roughing passes with the ball nose now) and the correct Z limits (-0.2, -0.1).
2) You could pre-pocket the area from VCP with the hogging tool of your choice, removing material down to the highest part of the model (the mountain top at Z=-0.1).
3) Create the CSV file for the finishing cutter, but pretend that the top of the 0.1 thick slice (i.e. the top of the New Zealand mountain) is at the surface of the material, so use Z limits of -0.1 and 0.0. Import this CSV into VCP, and verify that it looks right. Now edit the toolpath by double-clicking on it, and set the 'Start Cutting Depth' to the depth of the mountain top below the material surface (0.1). Redo the preview and verify the result.



Avoiding Roughing Passes

In some cases, you know you want to do the cut in one pass. Set the Stepdown to a large number to force a single cut to the minimum Z of the pattern.

Avoiding Too Many Roughing Passes

Avoid setting Stepdown so that it will be exactly at the bottom of one slice' of the model; if it is set this way, rounding errors may end up wasting time by repeating the last raster pass across the entire surface (e.g. if Z limits are -0.2 to 0, set Stepdown to 0.105 instead of 0.1).

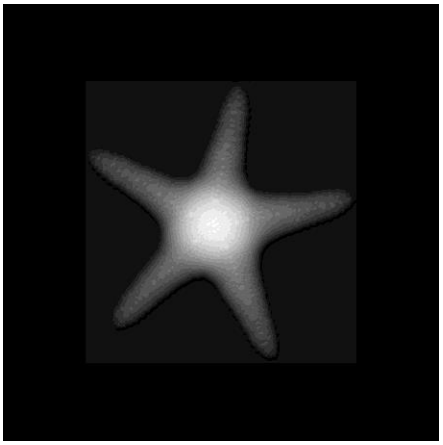
Have fun! Please post anything interesting that you make!

Paul Rowntree, 2013

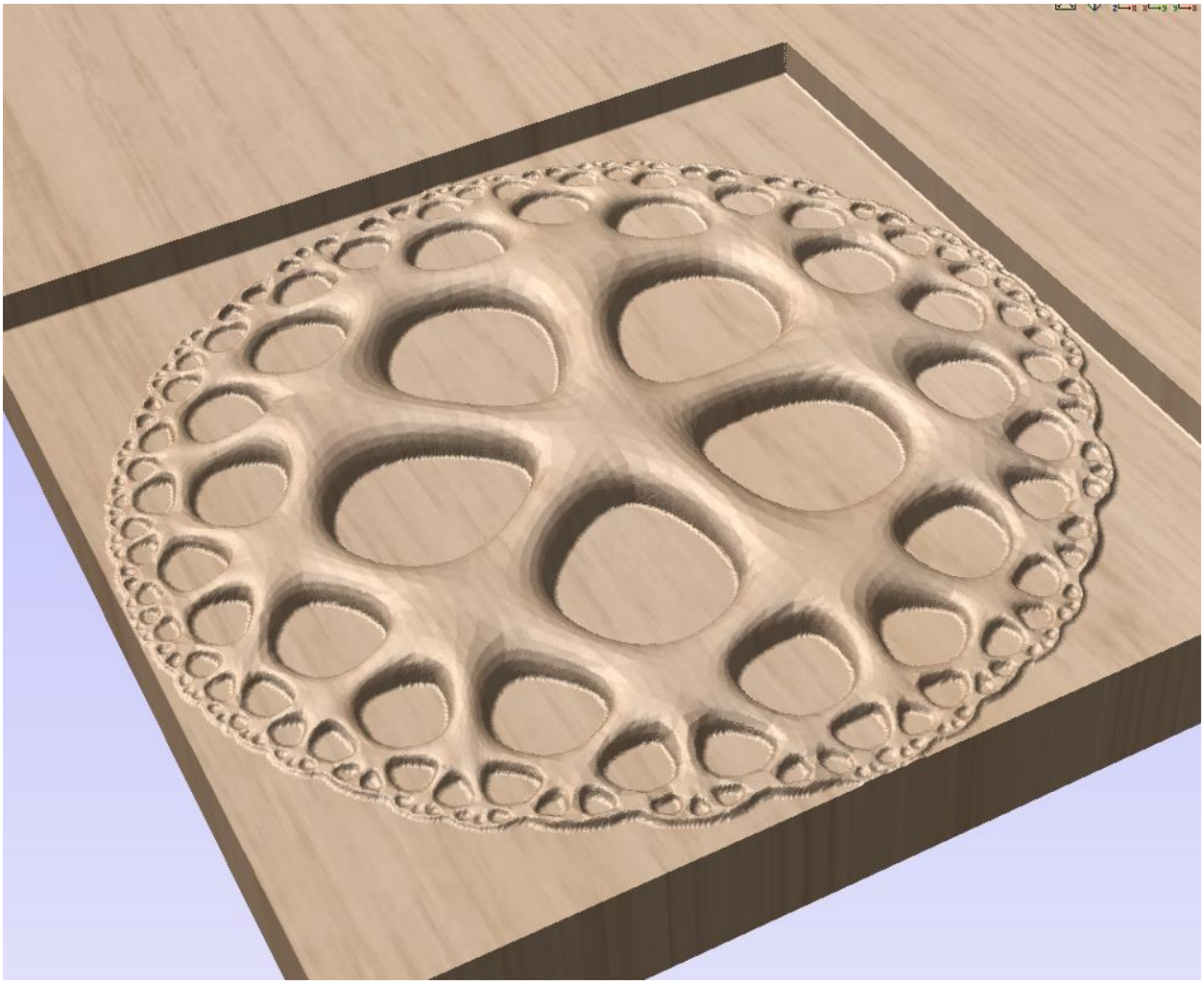
Other Examples (all previews were created in VCP)

Barbados (from STL file created in **BigTopo**)

Starfish (from Greyscale JPG image on Vectric Forum). Be careful with JPG files. Sometimes the colors are not as perfect as they seem because of the compression and anti-aliasing applied to the image, and this can show up as noise in the heights.



Sand Dollar (from STL file posted by George Hart)



'Lena', from web photo (BMP format). The eyes are a bit spooky in the preview …