

Procedure for Designing and Machining

V-Inlay Projects



Developed by Paul Zank and Damien Durrant

VCarve Inlay - Rapid , Accurate, Versatile, and Easy to use

- Fast cutting using standard bits
- Eliminates handling of individual pieces
- Inlays with hundreds of pieces in less than an hour
- Extremely fine level of detail without fragile parts
- Sharp interior and exterior points
- Eliminates traditional “bit offset” and associated CAD work

Although the following process is highly detailed to assist the first time user, creating a VCarved inlay is actually very simple. The pocket is VCarved with one set of parameters and the inlay is VCarved with a second set of parameters.

How VCarving Inlay’s works

V Carve Inlay makes beveled inlays using a V bit to carve both the inlay and the inlay pocket. It is VCarve Pro’s unique ability to correctly handle the bevels on lines, arcs and points that allows the inlays to be cut without bit diameter offsets encountered with traditional CNC inlay techniques.

The resulting inlays rest in their respective pockets by contact along the sides of the inlay and pocket. This creates extremely accurate inlays showing little or no gaps between materials and rivaling the very best hand made inlays.

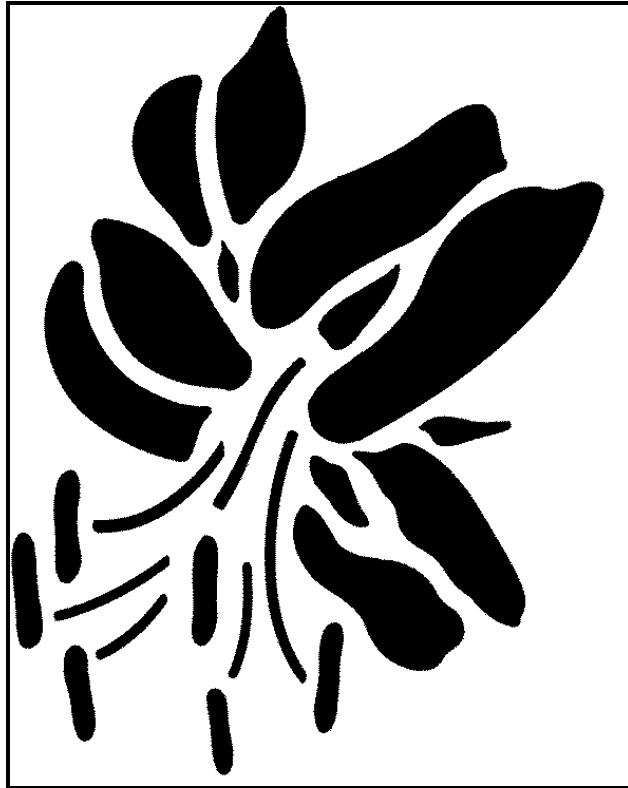
The versatility of V Carve allows both pocket and inlay to be cut using the same software and same V bit but with simple differences in parametrics between the cuts. The optional use of an end mill may be useful to further reduce production time by hogging out large flat areas. (This capability is already native to V Carve.) Note that additional CAD work, such as compensation for bit diameter, is not required.

The inlay itself is created with a backing which provides a base for multiple and otherwise fragile parts.

The process

The process of creating a VCarve inlay was developed to get from artwork to final product quickly and accurately as possible.

Below is the artwork of a flower that will be used as an inlay for this example.



Preparing the Artwork

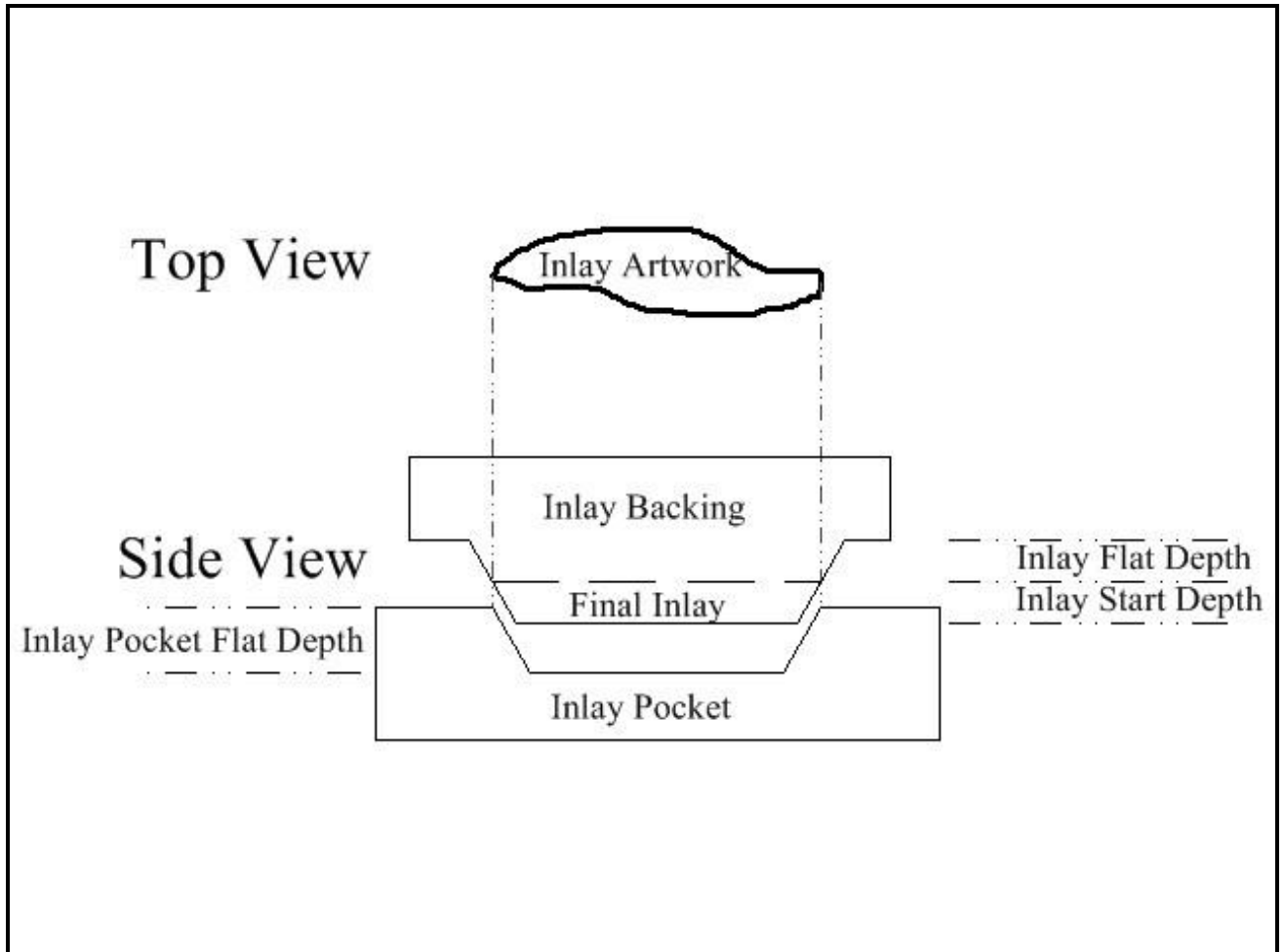
If the artwork is already in one of the following formats, it is ready to be used.

- VCarve native format (.crv)
- DXF format (.dxf)
- Encapsulated Postscript (.eps) in vector format

If the artwork is still in a bitmap format (such as .bmp, .gif, .jpg .tif) **Import** the image and use the image tracing / vectorization tools in VCarve Pro or Aspire to convert the bitmap design to the required vector outlines.

Choosing the inlay depth

The inlay geometry is shown below. This diagram is provided for reference only; you do not need to understand the diagram to make VCarved inlays.



Typical values for the depths are:

Inlay Flat Depth = 0.2"
Inlay Start Depth = 0.1"
Inlay Pocket Flat Depth = 0.3"

(Note that these values assume that the pocket material is at least 0.4" thick and that the inlay material is at least 0.5" thick.)

These values will insure a tight fit on the sides and leave a 0.1" gap between the inlay and the pocket bottom which will be filled with glue. They provide a large margin for error and final sanding. At the end of this process, the inlay backing

(which may be holding many parts of the inlay) will be removed. The final inlay and the inlay pocket will be sanded flush.

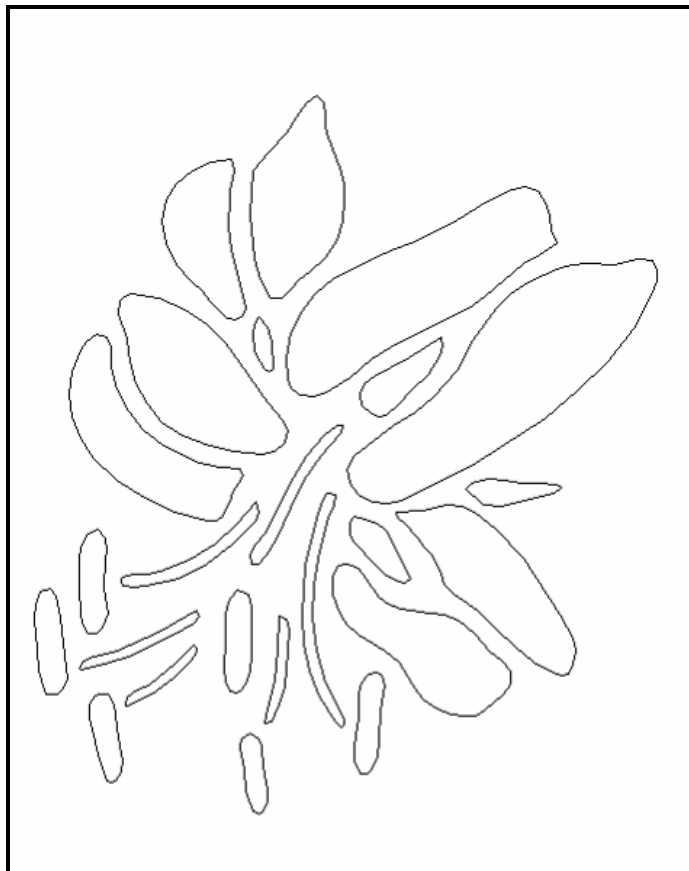
Creating the pocket and the inlay

1. Start VCarve and open the artwork file if it is a .crv / .crv3d file or import the artwork if it is a .dxf or .eps file
2. If an image file .jpg, .bmp, .gif, .tif use the Trace Image tool to vectorize the boundary.
3. Make sure there are no open or duplicate vectors by using the select open vectors and select duplicate vectors functions in the edit menu.
4. Save the file twice under different names. It is suggested that you name one of them as,

Artwork name - Pocket.crv

Artwork name - Inlay.crv

Creating the 'Female' Pocket



Summary of this section – Use V Carve / Engraving toolpath to calculate the inlay pocket using flat depth of 0.2”

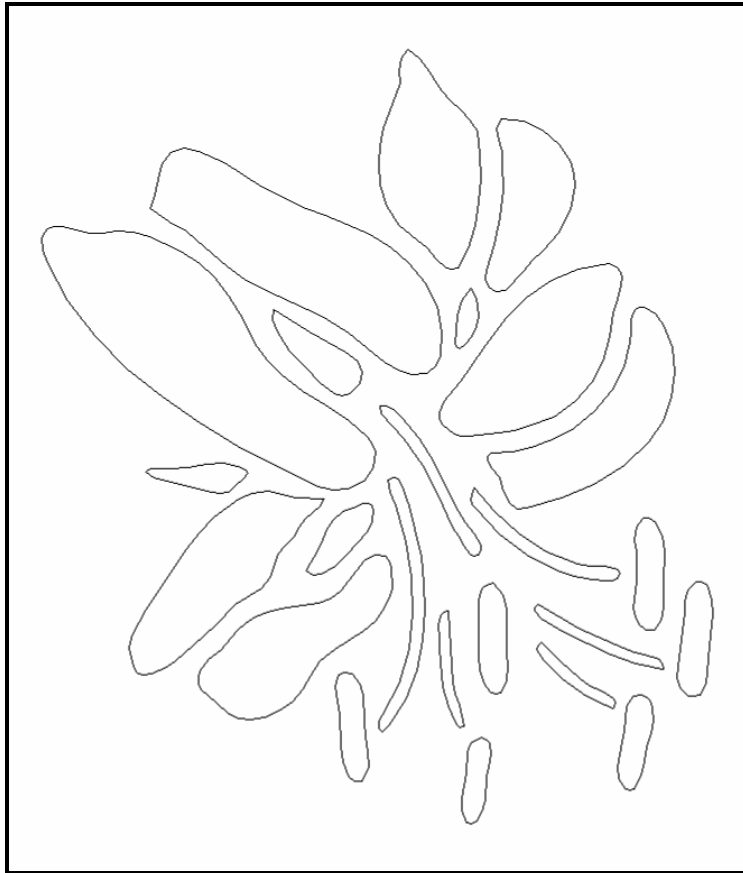
Step by step instructions:

1. Open the **Artwork name - pocket.crv** file
2. Select all of the vectors which define the pocket.
3. Open the Toolpaths Tab on the right side of the interface
4. Select the “create V Carve / Engraving toolpath” icon.
5. Click on the flat depth check box and select a flat depth. (If using the values suggested above, set flat depth to 0.3”)
6. Select the V Tool. NOTE that the same angle V Tool must be used for both the pocket and the inlay. If possible, use the same bit. Use a small final and clearance stepover of not more than 3%.
7. Select “calculate” to create the female pocket toolpath.
8. Optional Step – If there are large areas of the pocket which will be flat, it may be more efficient to also use a flat area clearance tool (an end mill) to cut flat areas very quickly.
9. Using “Save Toolpath”, Select the appropriate post processor and save the cut file(s). Be careful to include the bit description in the file names(s) for future reference.

Below is a preview of the inlay pocket



Creating the 'Male' Inlay



Summary of this section – The pocket artwork must be flipped left to right to create the inlay, A “hog out area” is defined around the inlay, and finally, the inlay cut file is computed with a 0.1” start depth and a 0.2” flat depth.

Step by step instructions:

1. Open the **Artwork name - inlay.crv** file
2. Select all of the vectors which will define the inlay.
3. Using the Mirror Selected Vectors function from the Edit Vectors icons, horizontally flip the vectors left to right. Next select “Close”.
4. Use one of the “Create Vectors” icons to create a rectangle around the inlay. Make sure the rectangle leaves at least double the margin as the cut is deep. The area between the inlay artwork and the rectangle will create the inlay backing.
5. Select all vectors (including outer rectangle).
6. Open the Toolpaths Tab on the right side of the interface
7. Select the “Create V Carve / Engraving Toolpath” icon.

8. Set the pocket start depth. (If using the values suggested above, set the “Start Depth” to 0.1”.)
9. Click on the flat depth check box and select a flat depth to the desired depth. (If using the values suggested above, set flat depth to 0.2”.)
10. Select the V Tool. NOTE that the same angle V Tool must be used for both the pocket and the inlay! If possible, use the same bit. Set final and clearance stepover value of 15%. This will allow us to use the v bit to hog out the area between the inlay and the outer polygon.
11. Select “Calculate” to calculate the cutting path.
12. Optional Step – If there are large areas of the pocket which will be flat, it may be more efficient to also use a flat area clearance tool (an end mill) to cut flat areas very quickly; however, this decrease in cut time is at the expense of a bit change.
13. Using “Save Toolpath”, Select the appropriate post processor and save the cut file(s). Be careful to include the bit description in the file names(s) for future reference.

Below is a preview of the inlay with its backing:



Even though it looks all wrong, it does fit correctly. The ridges are an artifact of the 13% stepover which was used to reduce hog out cut time. They are in the inlay backing and will be removed when the backing is removed. If one decided to use an end mill for hogging, the ridges will not appear.

At this point, the toolpath cut files have been created for both the pocket (on the left) and inlay (on the right).

Assembly

After the inlay and the pocket have been cut, trial fit the inlay into the pocket. The fit should be snug and sort of snap into place. If cut correctly, there will be a gap between the pocket and the inlay base of 0.2”.

This is intentional and provides a space for glue squeeze out and a margin for lateral and angular misalignment. If the fit looks good, apply glue to both the pocket and the inlay. All mating surfaces should be covered but excessive glue should be avoided. With clamps and/or weights at the ready, press the inlay into the pocket and apply pressure with clamps or weights until the glue sets.

When the glue is fully set, cut off the excess part of the inlay (the backing). Using a radial arm saw adjusted to just clear the inlay base is a quick way to accomplish this. A drum sander can also do the work (but very slowly). Yet another option is to remount the assembly back into the cutting machine and mill off the inlay backing.

The process can be repeated as necessary for additional inlay grain directions or for different materials inlaid into the same base.

The Machined Results

Here is the pocket



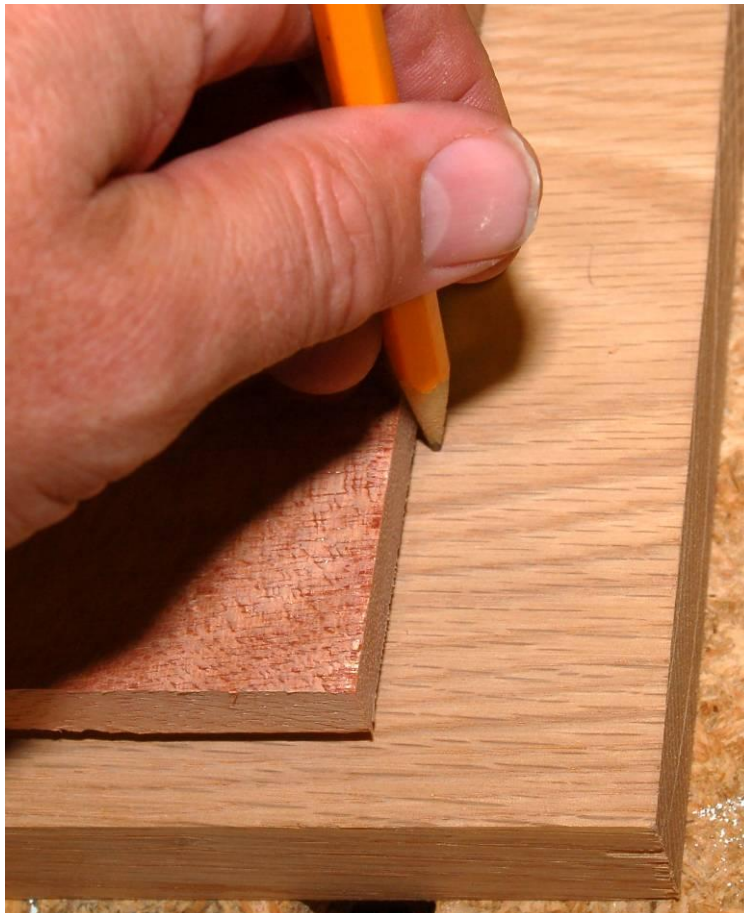
This is the male inlay and backing before the excess wood under the clamps is cut off



This is the inlay setting in the pocket. Note that it rides high but it is obvious when it is in place.



I usually copy the position of the inlay onto the pocket piece with a pencil. This makes it much easier to reposition the inlay after glue has been applied.



This shows the inlay backing being removed.



The backing has been cut off and it is ready for sanding. (The clear shiny stuff is superglue.)



The finished and assembled result:



This is actually the worst inlay I have done to date. The inlay shifted while being cut do to insufficient clamping. Even so, the process is very forgiving.