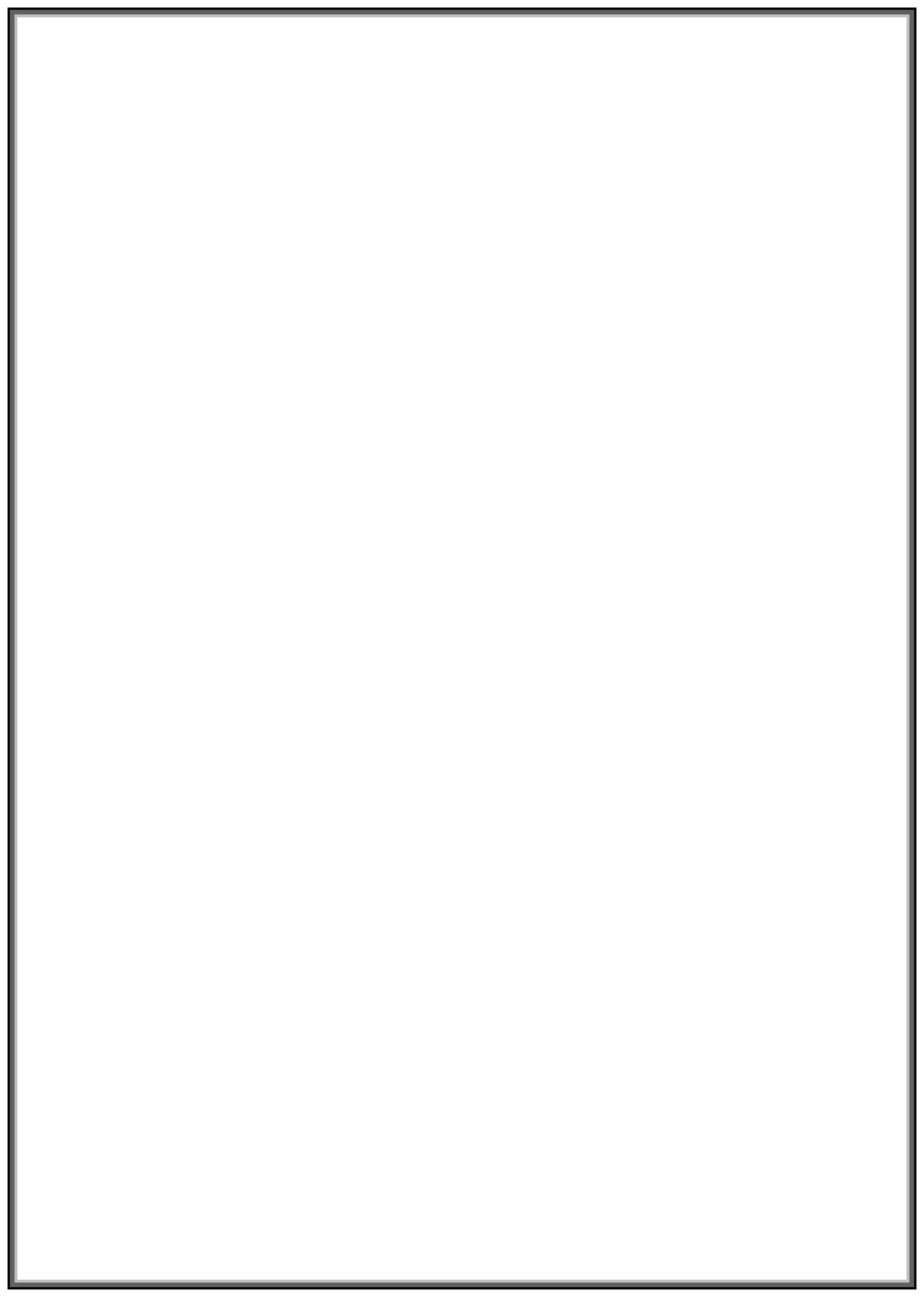


# Getting Started With PartWorks

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**Tutorial 3**  
**Kitchen Cabinet Door**



# PartWorks

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## Disclaimer

All CNC machines (routing, engraving, and milling) are potentially dangerous and because ShopBot Tools Inc has no control over how the software described in this manual might be used. ShopBot Tools Inc or any associated Resellers cannot accept responsibility for any loss or damage to the work piece, machine or any individual, howsoever caused by misusing the software. Extreme care should always be taken and the output from the software thoroughly checked before sending it to a CNC machine.

The information in this manual may be subject to change without any prior notice. The software described in this manual is supplied under the terms and conditions of the software license agreement and may only be used in accordance with the terms of this agreement.

© Vectric Ltd  
26 Peterbrook Close  
Redditch  
B98 7YF  
UK

[www.vectric.com](http://www.vectric.com)

E-mail [info@vectric.com](mailto:info@vectric.com)  
Phone +44 (0) 1527 460 459  
Fax +44 (0) 1527 460 459

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# Introduction

Many businesses use their CNC machine for simply cutting out flat letters and shapes from plastic sheet, or engraving standard badges and nameplates, which are all based on simple 2D machining strategies. This manual will show you how to use your CNC machine to route and engrave jobs that include decorative 3D designs that will be more interesting and hopefully more profitable if you run a business.

The manual takes you step-by-step through a number of illustrated tutorials that show and explain exactly how to use the PartWorks Software. Tips and tricks have also been included that will help you get the most from your CNC machine.

We hope you enjoy using the software.

## What is V-Carving?

V-Carving produces a constantly varying and flowing 3D carved effect on the job, which is similar to how a craftsman would carve by hand. Imagine a 'hand-carver' cutting letters into a piece of wood or stone, starting at a sharp corner, pushing the chisel deeper where the font stroke gets wider and pulling the tool out to form precise, sharp corners. V-Carving, also known as 3D Engrave or Intaglio engraving allows a V shaped or engraving tool to cut at varying Z depths that are directly linked to the width of the geometry in which the cutter is moving.

This effect is difficult to describe in words, but imagine using a flat-bottom end mill to cut 3mm (1/8<sup>th</sup>) deep inside the text shown below. The tool, being round will always leave a fillet radius in the corners and will not actually cut the complete letter where the diameter of the tool is too big to pass through the small gaps.



Sign including V-Carved Text

## What the software allows you to do

V-Carving is typically used in the following industries to add decoration to objects and products such as,

Sign making	House signs, Business, Restaurants, Pubs, Gold Leafed and Gilded
Woodworking	Kitchen cabinet doors, Chairs, Doors, Table tops
Engraving	Commemorative Brass plaques, Company logos
Gifts	Key rings, Personalized gifts
Stone cutting	Memorials, Commemorative engravings

## What file formats can be used?

PartWorks will open files that have been saved in the following formats.

DXF	Drawing Exchange Files from CAD systems
EPS	Encapsulated Postscript from Adobe Illustrator and Corel Draw etc.
AI	Adobe Illustrator
PDF	Portable Document Format for industry standard print data



If the designs are being prepared with software such as Corel Draw or Adobe Illustrator we recommend that you **convert the vector geometry and text to curves** and **switch off all patterns or colour fills** before exporting as **preferably as an EPS file**.

## Getting Help

If you need assistance when using the software there are 5 primary places to look.

1. **Program Help File** - From the Main menu select Help
2. **Video Tutorials** - Can be downloaded from the Vectric website
3. **User Forum** - The Vectric user forum at [www.vectric.com/forum](http://www.vectric.com/forum) is a very useful resource for information on PartWorks along with materials, cutters etc. and also to share knowledge and experiences.
4. **E-mail Support:** - The PartWorks Support Team at [support@shopbottools.com](mailto:support@shopbottools.com)
5. **Frequently Asked Questions (FAQ)** - The support area on the Vectric web site at [www.vectric.com](http://www.vectric.com) maintains a list of the most frequently asked questions along with the answers.

## Watch the supporting tutorial videos



The video camera icon indicates there is a video file for that particular section of the manual.

Many of the tutorials and help files have associated video footage that will make learning to use this software more interesting and enjoyable. These are on the installation CD or Downloadable from the web site. Windows Media Player is required to view the video files.

If you experience problems running these files or need assistance please visit the technical support area on the web site and follow the links.

## Overview of the interface

The screen area is split into 6 main regions.

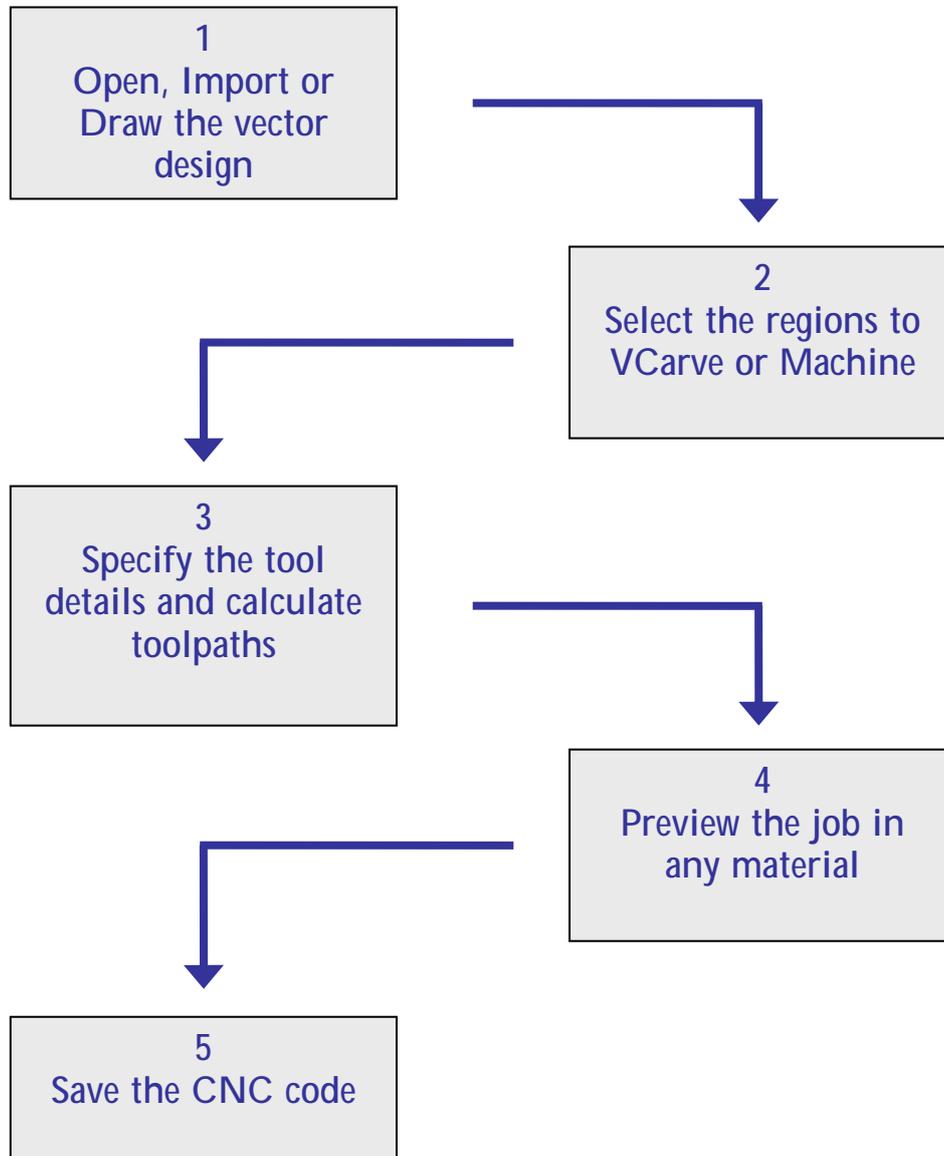
1. The **Main Menu bar** along the top of the screen provides access to additional, less commonly used commands available in the software. Simply click and each option will show a drop-down list of the functions.
2. The **Drawing Tab** on the left side of the screen provides general drawing tools for design modification, sizing, alignment etc. prior to machining.
3. The **Toolpath Tab** on the right side of the screen is where toolpaths are defined, calculated, edited and deleted. The Material set-up and Job Preview tools are also in this area.
4. The **Command forms** automatically appear in the Drawing window and the Toolpath tabs when tools are selected that require details to be entered such as dimensions for sizing or positioning etc.
5. The **2D Design window** is where the design is drawn, edited and selected ready for machining. Designs can be imported or created directly in PartWorks. This occupies the same area as the 3D Preview window and the display can be toggled between the two using F2 and F3 or the tabs at the top of the window.
6. The **3D Preview window** is where toolpaths and the colour shaded job preview are displayed.



The User Interface

## The PartWorks Logic

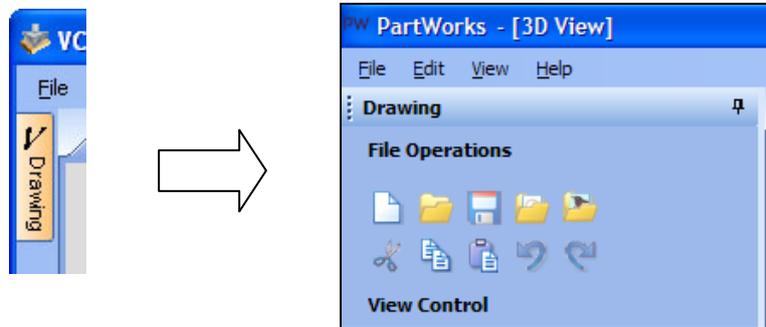
PartWorks has been developed specifically to open decorative designs and calculate perfect 3D V-Carve / 3D Engrave toolpaths as quickly and easily as possible. The general work flow logic to apply to most jobs is explained in the diagram below.



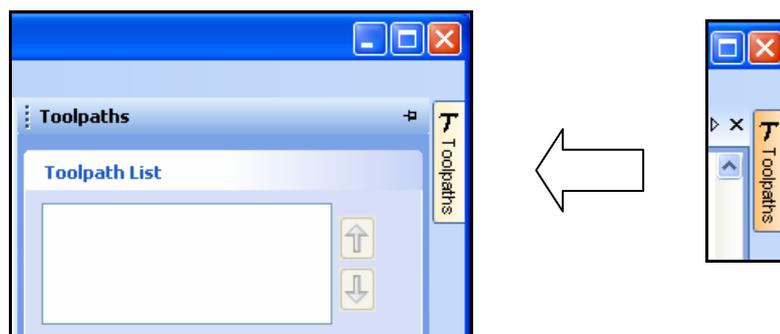
PartWorks is an excellent toolpath engine that also includes drawing and editing tools that allow designs to be created and modified. Tools for drawing, positioning, alignment and node editing are very easy to use and multiple design elements can also be drawn or imported, scaled, positioned and interactively edited to make a new design. Text can also be created using any TrueType font installed on your computer or the Single stroke engraving fonts supplied with the software.

## Managing windows - Auto Show / Hide

The two primary **Drawing** and **Toolpath Tabs** have Auto Hide / Show behaviour which allows them to automatically close when not being used, maximizing the working screen area. They can be opened and closed at any time by clicking the left mouse over the **Drawing** and **Toolpaths** tabs in the **top left** and **top right** corners of the interface.



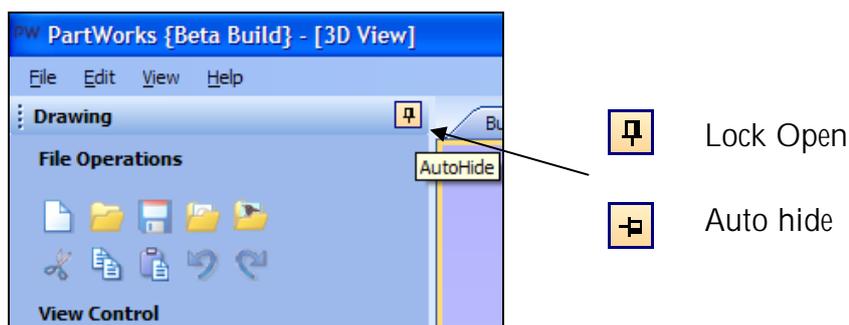
Click on the Drawing Tab to open the Drawing Window



Click on the Toolpaths Tab to open the Toolpaths Window

**i** Clicking on the Drawing or Toolpath tab will also close an open window.

Both windows have Auto Hide / Show behavior and can be locked open by clicking on the **Push-Pin button** in the top right corner of the window region as shown below.



Auto Hide / Show windows

## View Controls

The View Control options available when working in the 2D Design and 3D Preview windows are,

### 2D Design Window

	<b>Zoom Interactive</b>	Mouse with Middle Wheel – Push / Pull
	<b>Zoom Box</b>	Click top left corner Click bottom right corner
	<b>Pan</b>	Click and hold the Left mouse button – Esc to cancel <b>Shortcut:</b> Click and drag the <b>Middle</b> mouse button
	<b>Zoom Extents</b>	Zooms to show all vector geometry in the 2D window
	<b>Zoom Selected</b>	Click to select an object or objects Zooms to the bounding box of the selections

 Mouse with Middle Wheel can be used to interactively zoom in / out.

### 3D Window

	<b>3D Twiddle</b>	Click and drag <b>Left</b> mouse button in the 3D window
	<b>Zoom</b>	<b>Right</b> mouse button – Push / Pull Mouse with Middle Wheel – Push / Pull
	<b>Pan</b>	Click and drag <b>Right</b> mouse button + <b>Ctrl</b> Click and drag <b>Right</b> and <b>Left</b> mouse button
	<b>Plan View</b>	Looks directly down the Z axis onto the design in 3D window
	<b>Isometric View</b>	Shows the model in a 3D isometric view in the 3D window

 Pressing F2 & F3 will toggle between displaying the 2D & 3D windows

## Vectors

Decorative Vector designs and shapes will usually be imported from another drawing package such as Corel Draw, AutoCAD etc. rather than being completely drawn in PartWorks. The imported Vector shape(s) can be modified, moved, scaled, rotated, mirrored or deleted.

### Vector selection methods

Multiple vectors can be selected in the following **4 ways**.

1. Manual multiple selection

Hold down the **Shift** key while clicking the **Left** mouse button on each vector required.

Objects can be deselected simply clicking on the object again with the **Shift** key pressed.

2. Moving the cursor from **Left** to **Right** selects **only FULLY enclosed** objects.

Click and drag the left mouse button moving from **Left to Right** selects all objects fully inside the selection rectangle.

3. Moving the cursor from **Right to Left** selects **all objects INSIDE** the selection rectangle and also any objects that the selection rectangle **TOUCHES**.

Click and drag the left mouse button moving from **Right to Left** selects all objects inside the selection rectangle + any that the selection touches.

4. Pressing the keyboard keys **Ctrl + A** will select **all** vector objects in the design

 Selected vectors are displayed as dotted purple lines.

### Vector deselect

Selections can be cancelled by simply,

1. **Left clicking** on an area outside the selection.
2. Pressing the **Right mouse button** and selecting **Unselect All** (top option) from the list. You must click on the white drawing background to get this option in the menu.

## Vector editing

A design is created from vector lines, arcs and bezier spans, which all have different properties that can be selected, modified and moved at any time.



Vector Selection Tool

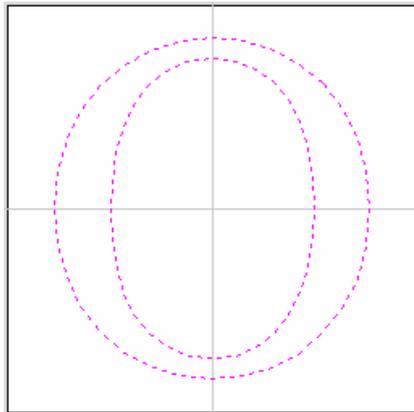
Selected from the Drawing tab on the left

Selected vectors are shown as dotted purple lines. Vectors need to be selected before any of the editing tools such as scaling and moving etc. can be used.

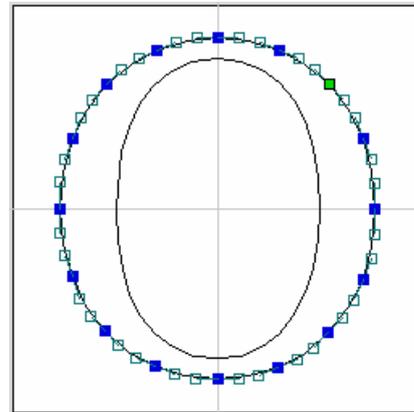


Node Editing Tool

Selected from the Drawing tab on the left



Vectors selected



Bezier node editing

When the Node Editing tool is active the cursor changes to a Black Arrow indicating that individual points (nodes) can be edited. Nodes can be interactively moved by clicking the left mouse button over a node to select it, then clicking left mouse button to move the node to a new position.

The shape of lines, arcs and bezier spans can be edited by clicking on the nodes or control points then clicking where the point is to move to.

## Drawing shapes

Simple shapes and designs can be drawn using the Circle, Oval, Rectangle and Polyline options. These shapes are commonly used to create new borders for signs or as a reference plate for a kitchen cabinet door etc. Shapes can be created by either entering exact dimensions in the Command Window or simply clicking the left mouse button in the 2D window to specify the parameters and coordinates interactively.

Drawing shapes is covered in more detail during the tutorials in this manual.



We recommend that you watch the **10 minute Video** for this Tutorial before proceeding.

The estimated time needed to complete this tutorial is around **15 minutes**.

## Introduction

This tutorial will show you how to V-Carve the Kitchen Cabinet Door shown below in Figure 1, which is approximately 20" (510mm) wide by 26" (660mm) high. This design is based on decorative designs from the commercially available Vector Art clipart library (see [www.vectorart.com](http://www.vectorart.com))

The decorative detail on the job will be carved using a wide angled V-bit tool, followed by an Ogee Edge molding cutter to profile round and clean-up the outer edge to the required size.

0.5" (12mm) diameter 90 degree cutter for the flower and corner decoration

1/4" (6mm) diameter End



Figure 1. The finished carved cabinet door

There are 5 key stages in preparing toolpaths for this door panel.

1. Open / Import the design and specify the material size
2. Calculate the 3D V-Carved toolpath
3. Calculate the Profile Cut-out toolpath
4. Preview the completed job
5. Save the Toolpaths

The files required for this tutorial are installed on your PC in the folder,

**C: Program Files\ ShopBot\PartWorks\Sample Files\Cabinet\_Door.eps**

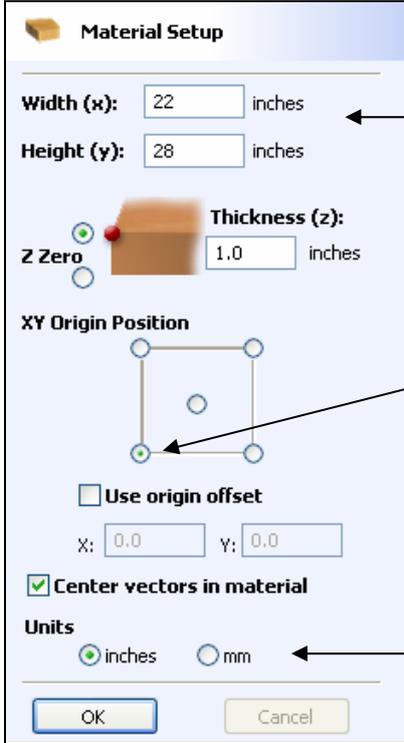
# 1. Opening the Vector Clipart Design

The vector artwork can be directly opened and the material size specified.

1. From the **Startup Tasks** tab toolbar click on the **Open an existing file**  icon, then navigate to the folder,

**C: Program Files\ ShopBot\PartWorks \Sample Files**

2. Select the file named - **Cabinet\_Door.eps**
3. Complete the **Material Setup** form with the width, height and thickness required for this sign, as shown below.



The screenshot shows the 'Material Setup' dialog box with the following fields and options:

- Width (x):** 22 inches
- Height (y):** 28 inches
- Thickness (z):** 1.0 inches
- Z Zero:** A red dot on a material surface icon.
- XY Origin Position:** A square diagram with a blue dot at the bottom-left corner.
- Use origin offset
- X: 0.0, Y: 0.0
- Center vectors in material
- Units:**  inches,  mm
- Buttons: OK, Cancel

Annotations with arrows point to:

- Material Dimensions:** Points to the Width, Height, and Thickness fields.
- XY Origin in the left corner:** Points to the bottom-left corner of the XY Origin Position diagram.
- Units either Inches or Metric:** Points to the Units radio buttons.
- Automatically center vectors in the material:** Points to the 'Center vectors in material' checkbox.

Material dimensions are 22" wide x 28" high x 1" thick

The **Z Zero** origin for setting the datum for the tool is on the **Material** surface.

The **XY Origin** will be the bottom **Left corner** of the job.

Check the option - **Center vectors in material**

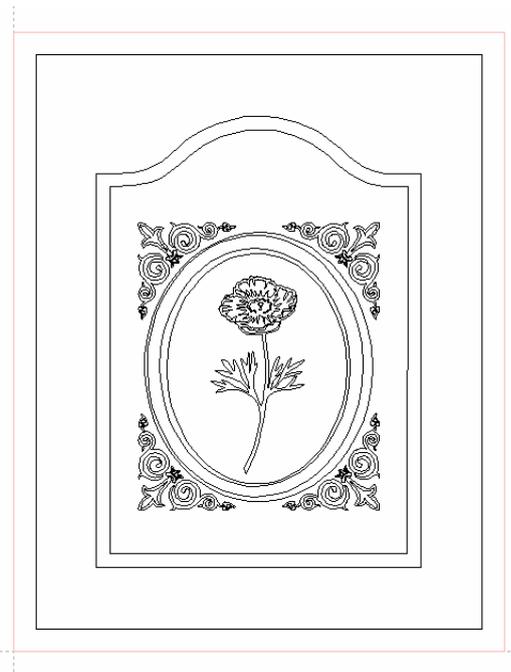
Make sure the Units are set to be in **Inches**

**Note** To work in **Metric** simply select the **Units = mm**

4. Click the **OK** button and the blank job is drawn in pale pink lines in the 2D Window.

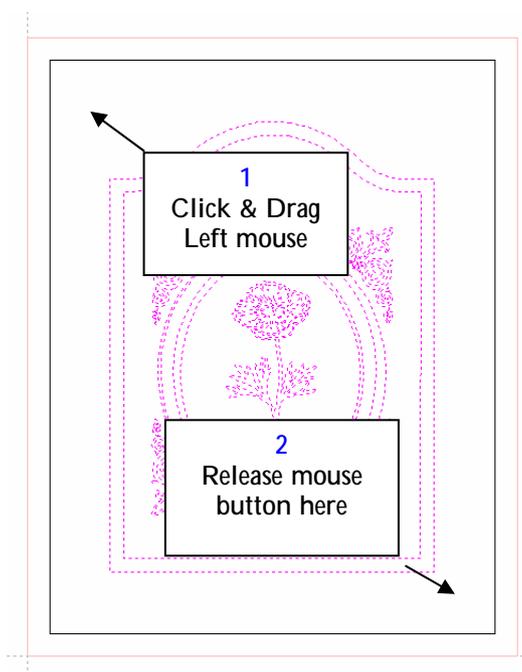
## 2. Calculating the V-Carve Toolpaths

The design will now be displayed in the 2D Window as shown below.



First select the decorative design vectors to be v-carved.

5. **Click and Drag** the **Left mouse** button just **inside** the top **left corner** of the outer rectangle, to the bottom **right corner** of the outer rectangle, to select the detail on the panel as shown below.

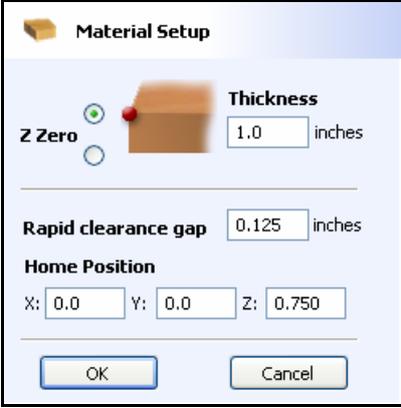


The selected vectors are shown as dotted purple lines

7. Click the **Switch to Toolpaths Tab**  icon. This closes the Drawing Tab and opens the Toolpaths Tab on the right side of the interface

8. Click on the **Setup Material**  icon and specify the **Rapid Clearance Gap** (the height above the job that the tool can move at maximum feedrate).

Enter **0.125"** for the Gap and **0.750"** for the Home Z height as shown below.



The **Material Setup** dialog box is shown. It has a title bar with a material icon and the text "Material Setup". Below the title bar, there is a "Z Zero" section with a radio button selected for the top surface of a material block. To the right, the "Thickness" is set to "1.0 inches". Below this, the "Rapid clearance gap" is set to "0.125 inches". The "Home Position" section shows X: "0.0", Y: "0.0", and Z: "0.750". At the bottom, there are "OK" and "Cancel" buttons.

**Note** the Z Zero is set to the top surface of the material.

9. Click the **OK** button.

10. Click the **Create VCarve Toolpath**  icon and complete the form as shown below,

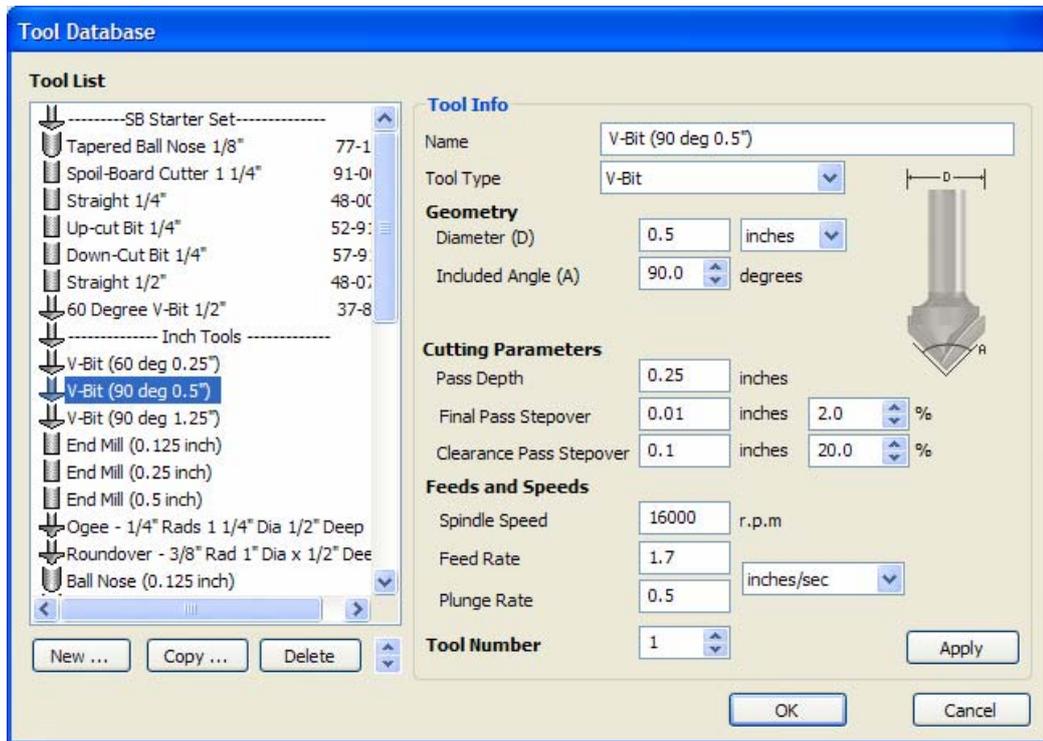


The **Create V-Carve Toolpath** dialog box is shown. It has a title bar with a V-bit icon and the text "Create V-Carve Toolpath". Below the title bar, there is a "Cutting Depths" section with a "Start Depth (D)" set to "0.0 inches" and a "Flat Depth (F)" set to "None inches". The "V-Carving Tool" section shows a dropdown menu with "V-Bit (90 deg 0.5")" selected, and "Select ..." and "Edit ..." buttons. Below this, there is a checked box for "Use Flat Area Clearance Tool" and a "Not using area clear tool" section with "Select ..." and "Edit ..." buttons. The "Safe Z" is set to "0.125 inches" and the "Home Position" is "X:0.00 Y:0.00 Z:0.75". The "Name:" field contains "V-Carve 1". At the bottom, there are "Calculate" and "Cancel" buttons.

Click the **Select button** and choose the V-Bit tool from the Tool Database.

In this example we are using a 0.5" Diameter – 90 Degree included angle V-Bit tool.

**Note** If you are using thin material click **Flat Depth (F)** and enter the maximum depth you wish the carving to be routed to. For example, you could limit the depth to = **0.200"**.



The feed rates should be set to suitable values for your machine and the material being cut.

A unique name can be entered or simply left as the default.

11. Click the **Calculate** button and the V-Carving Toolpath will be calculated. The 3D Window and the Preview form are automatically opened.

12. Click the **ISO View**  icon and the job + toolpath will be shown as below.



13. The name of the calculated toolpath appears in the Toolpath List in the top right corner of the interface as shown below,



Simply **Double click** on the name to edit the toolpath or click the **Edit Toolpath**  icon.

To limit the toolpath depth to **0.200"** check the option – **Flat Depth (F)** on form.

The calculated toolpath will use an area clearance strategy to create a flat pocket region around the rectangular border as shown below. This will take longer to machine because the tool needs to cut multiple passes.



Not limited to a depth



Limited to 0.200" deep

**Note** Move the cursor over the 3D preview model and the X, Y and Z coordinates are displayed in the bottom right corner of the screen. This can be very useful to see exactly how deep the cutter will machine for different regions of a design.

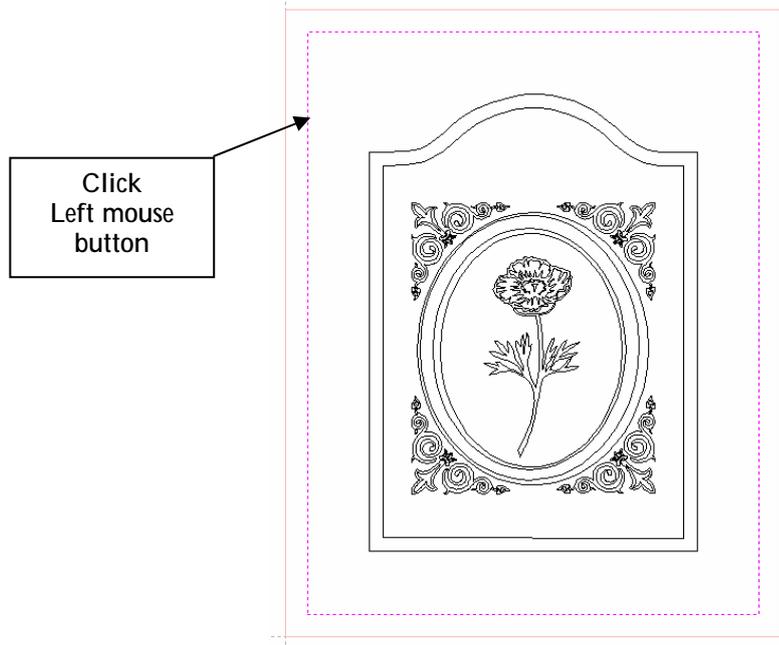
### 3. Calculating the Edge Profile Toolpath

An Ogee or Form cutter can be used with a Profile Toolpath to add a decorative molded edge to the panel, producing a clean machined edge.

**Note** If you do not have an Ogee Form shape cutter go to section 4. and simply cut the panel out

14. Open the **2D Window** by clicking on the **2D Window Tab**  or pressing the **F2** key.

15. Click the **Left mouse** button on the outer rectangle to select it.



16. Click the Create Profile Toolpath  icon and complete the form as shown below.

**2D Profile Toolpath**

**Cutting Depths**

Start Depth (D)  inches

Cut Depth (C)  inches

**Tool**

Ogee - 1/4" Rads 1 1/4" Dia 1/2" Deep

Select ... Edit ...

**Machine Vectors...**

Outside

Inside

On

**Direction**  Climb  Conventional

Allowance offset  inches

Use vector start points (don't optimize)

Add ramps to toolpath  
**Type**  Smooth  Zig Zag  Spiral  
**Specify Ramp ...**  
 Ramp on Lead In  
 Distance  inches  
 Angle  degrees  
 Distance  inches

Safe Z 0.125 inches

Home Position X:0.00 Y:0.00 Z:0.75

Name:

Calculate Cancel

Specify the Cut Depth

The cutter will run on the selected line

Ramping is used to reduce the load on the cutter

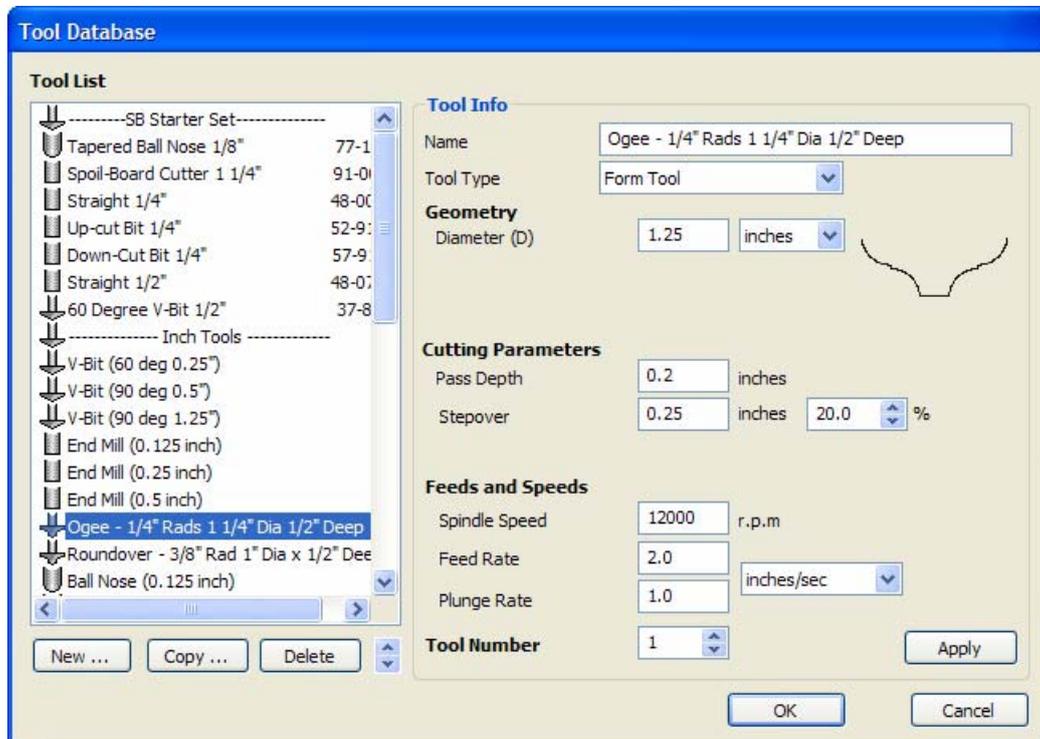
This toolpath is optional as it only adds a decorative border to the door panel

In this example we are using a 1 1/4" diameter 1/4" Radius Ogee Cutter and cutting to a depth of 0.6" in 3 passes.

The feed rates should be set to suitable values for your machine and the material being cut.

A unique name can be entered or simply left as the default.

17. Click the **Select** button and pick the Ogee cutter from the Tool Database

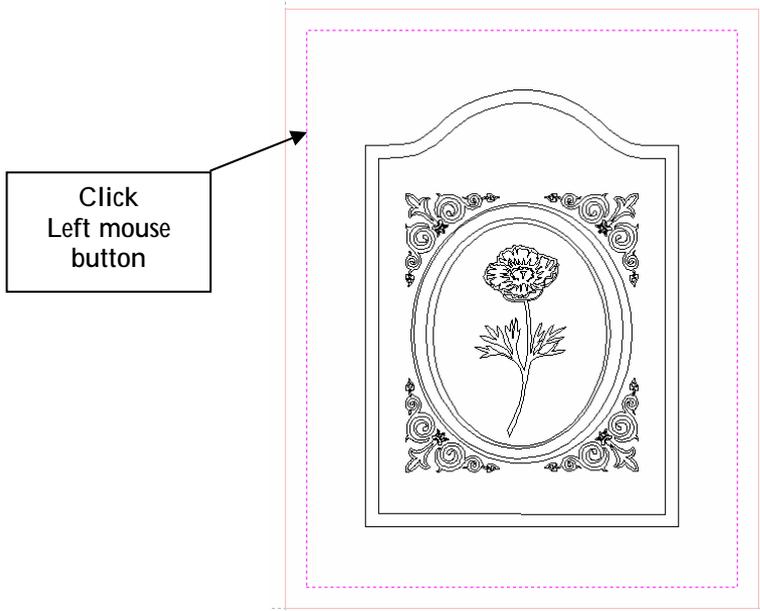


18. The Ramping option is used to reduce the vertical loading on the cutter and ease the large cutter into the wood
19. Click the **Calculate** button and the Profile Toolpath will be calculated. The 3D Window and the Preview form are automatically opened.

#### 4. Calculating the Profile Cut Out Toolpath

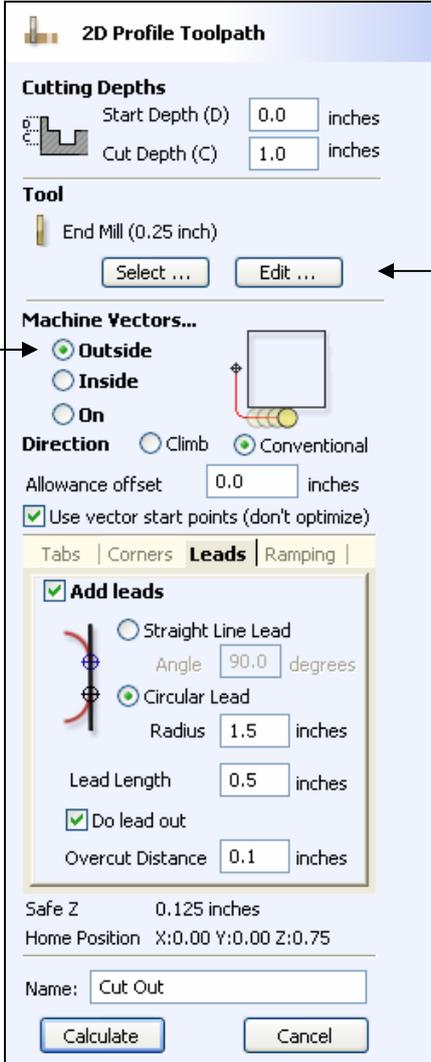
A 1/4" End Mill cutter will be used to cut the panel out of the material using Tabs to hold the job in place and using a lead in and out to ensure a high quality edge on the panel.

20. Open the **2D Window** by clicking on the **2D Window Tab**  or pressing the F2 key.
21. Click the **Left mouse** button on the outer rectangle to select it.

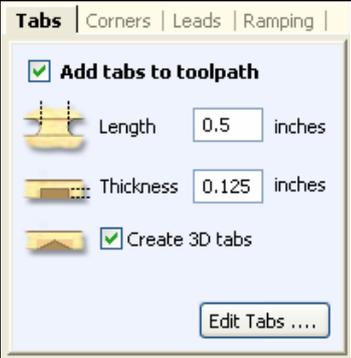


22. Click the **Create Profile Toolpath**  icon and complete the form as shown below

**Cut around the Outside of the vector**

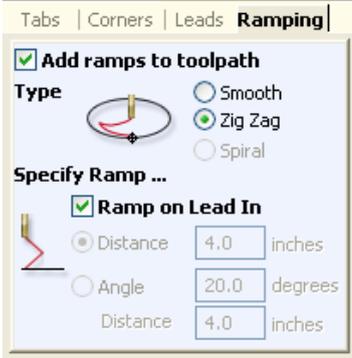


**Select the 1/4" End Mill from the Tool Database**



3D Tabs





Zig-Zag Ramp only on the Lead in region

Complete the Profile Form as shown above

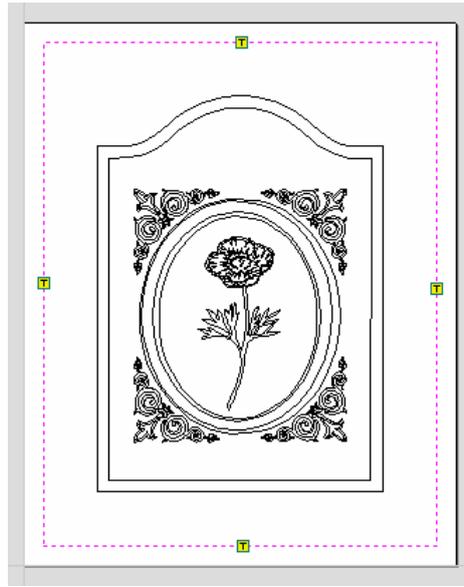
In this example we are using a 1/4" diameter End Mill and cutting through the material in 4 passes.

The Tabs will hold the panel in place and the Lead in and Ramp moves will help create a high quality edge on the job with minimum load on the spindle and Z axis.

The feed rates should be set to suitable values for your machine and the material being cut.

A unique name can be entered or simply left as the default.

23. Click the **Edit Tabs** button and place 4 Tabs around the rectangle as shown below.



24. Click the **Calculate** button and the Profile Toolpath will be calculated. The 3D Window and the Preview form are automatically opened.

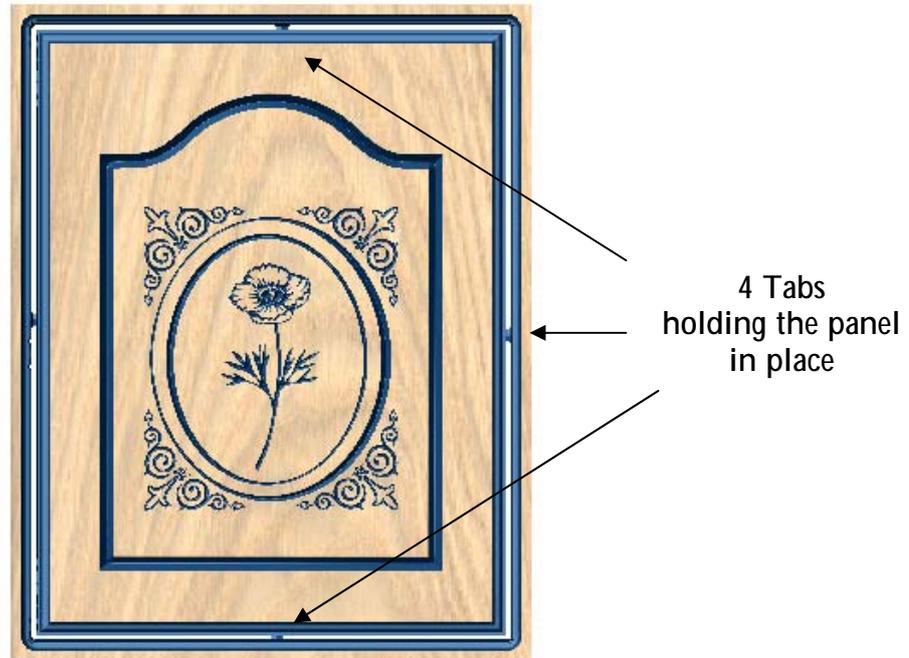


3D Preview showing the calculated toolpaths

#### 4. Previewing the Job

A simulation of the toolpaths cutting into the material can now be shown in the 3D Window

25. Click the **Preview All Toolpaths**  **Preview All Toolpaths** icon and each tool will be shown cutting into the material.

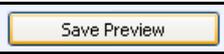


- Notes** The **Delete Waste Material**  **Delete Waste Material** icon will NOT remove the outer material because Tabs are holding the inside and outside shapes together.

For presenting images to customers calculate the Cut Out Toolpath **without Tabs** in place, as this will allow the Waste Material to be Deleted and create preview images of the finished piece

26. Experiment with different **Material types** and **Fill colors** to display the Preview image in the material that the job will be routed from.



27. When the panel looks the way it should, click the **Save Preview**   icon and save the image to a file so it can be printed or e-mailed etc.

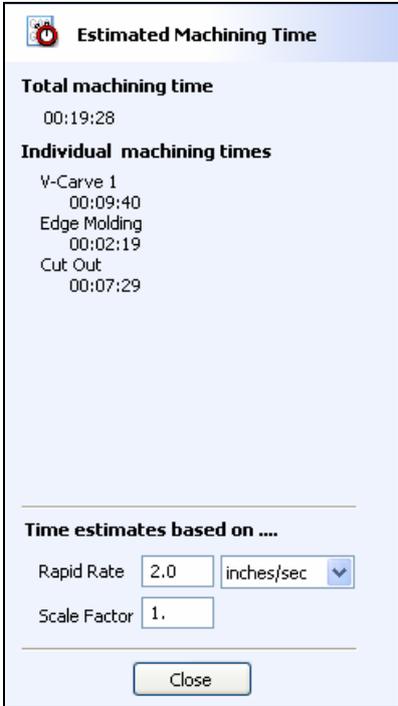
## 5. Estimate Cutting Times and Save Toolpaths

28. The Toolpaths by clicking the Save  icon.

29. Click to select each toolpath in the **Toolpath List** and **Save** each file with a new name.

30. If you have a CNC machine that has an **Automatic Tool Changer (ATC)**, each toolpath must be specified using a different Tool Number before the toolpaths can then be saved into a single file.

31. The machining times can be seen by clicking the **Estimate Machining Times**  icon



**Estimated Machining Time**

**Total machining time**  
00:19:28

**Individual machining times**

V-Carve 1  
00:09:40  
Edge Molding  
00:02:19  
Cut Out  
00:07:29

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**Time estimates based on ....**

Rapid Rate  inches/sec   
Scale Factor

**Important** It is very important that the toolpaths for ATC machines have different tool numbers and are saved in the correct sequence. Use the Arrows on the right side of the Toolpath list to order the toolpaths.

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Thank you for reviewing PartWorks and we hope you enjoyed using the software

If you have any questions or need assistance

E-mail - [support@shopbottools.com](mailto:support@shopbottools.com)

Visit the Vectric User Forum - [www.vectric.com/forum](http://www.vectric.com/forum)