AUTODESK® **ARTCAM**®

Woodworking software for designers and makers

Training Course

AUTODESK.

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Introducing ArtCAM, A Flourishing Tutorial

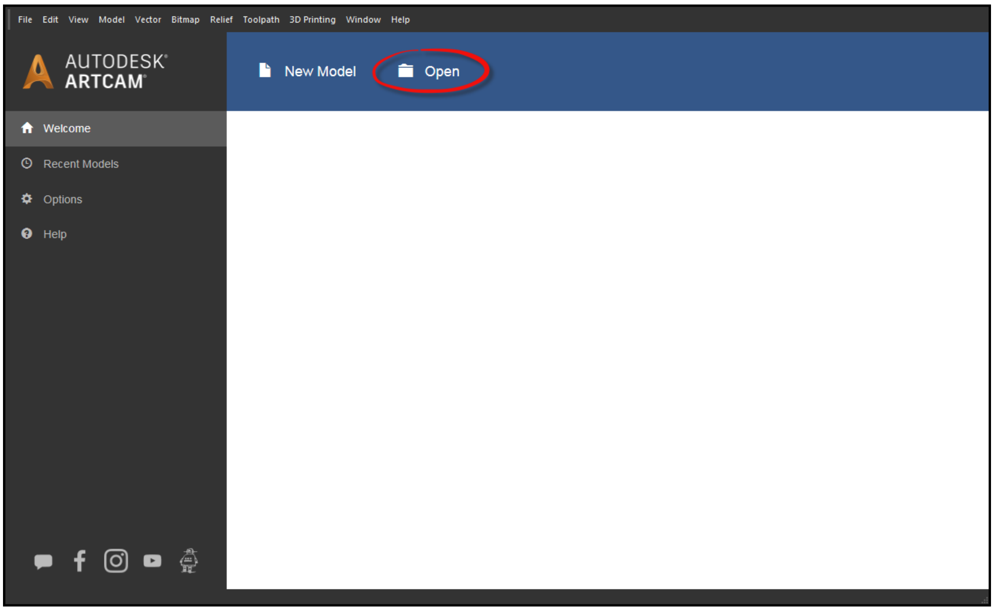
The following tutorial is quick introduction into the world of ArtCAM.

With a few simple steps, an image is imported, traced with vectors, and then modelled into a 3D relief.

1 Open **ArtCAM**

The start up page is displayed. The Open option will load in existing ArtCAM Files and import images.

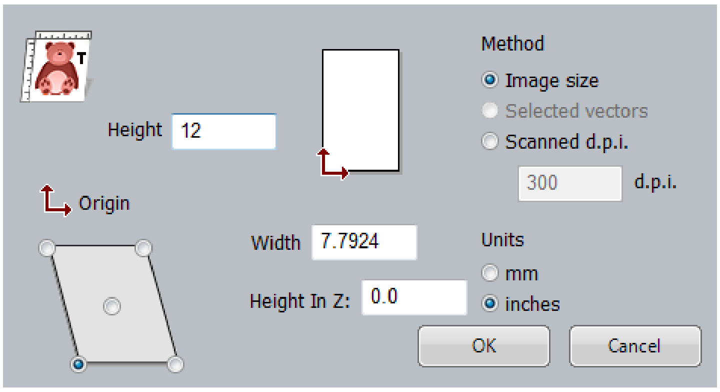
2 Click **Open**


File
Edit
View
Model
Vector
Bitmap
Relief
Toolpath
3D Printing
Window
Help
AUTODESK ARTCAM
New Model
Open
Welcome
Recent Models
Options
Help

3 Navigate to the training Data Files and open **Flourish-Image.jpg**.

4 In the Set Model Size screen, choose the **Units** as mm or inch and change the **Height** as follows then click OK:

- 300 mm or
- 12 inches



Height 12

Width 7.7924

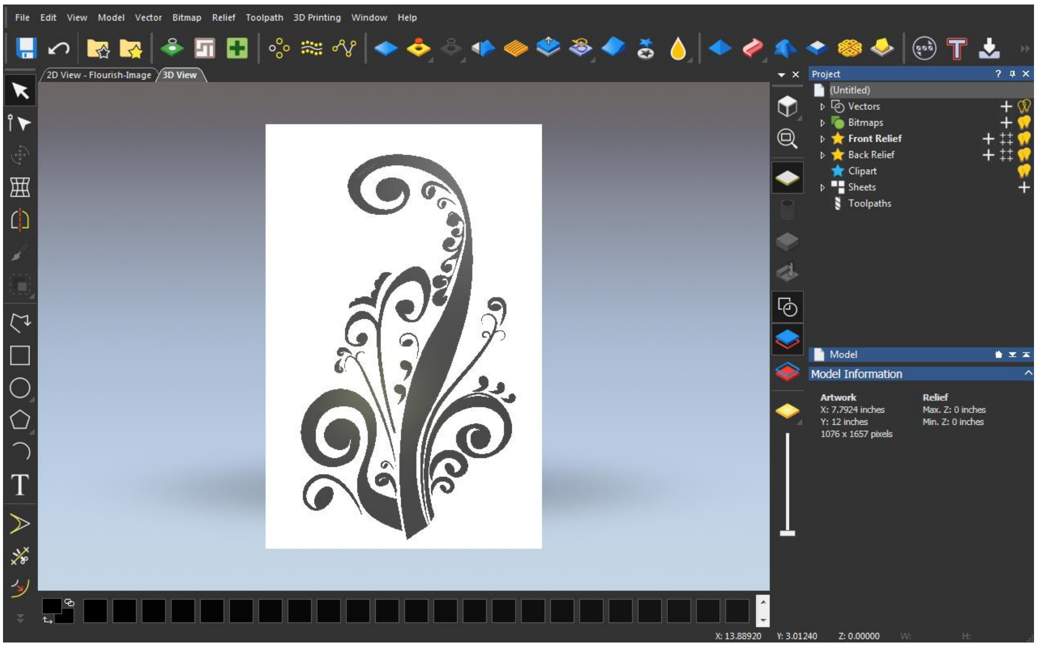
Height In Z: 0.0

Method
● Image size
○ Selected vectors
○ Scanned d.p.i.
300 d.p.i.

Units
○ mm
● inches

Origin
OK
Cancel

The image opens in ArtCAM in the 3D View.



File
Edit
View
Model
Vector
Bitmap
Relief
Toolpath
3D Printing
Window
Help
2D View - Flourish-Image
3D View
Project
(Untitled)
Vectors
Bitmaps
Front Relief
Back Relief
Clipart
Sheets
Toolpaths
Model
Model Information

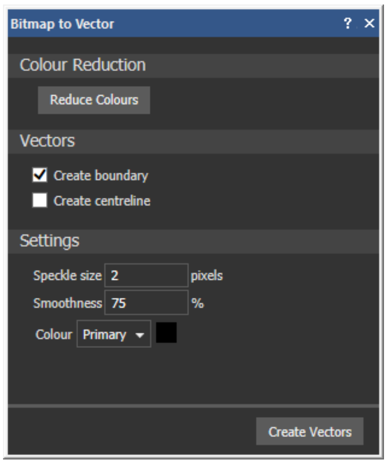
Artwork
X: 7.7924 inches
Y: 12 inches
1076 x 1657 pixels

Relief
Max. Z: 0 inches
Min. Z: 0 inches

X: 13.88920 Y: 3.01240 Z: 0.00000

The images contains multiple shades of black and white and needs to be reduced to allow ArtCAM to quickly trace vector wireframe around the image.

5 Open the **Bitmap to Vector** function


Bitmap to Vector

Colour Reduction

Vectors
☑ Create boundary
☐ Create centreline

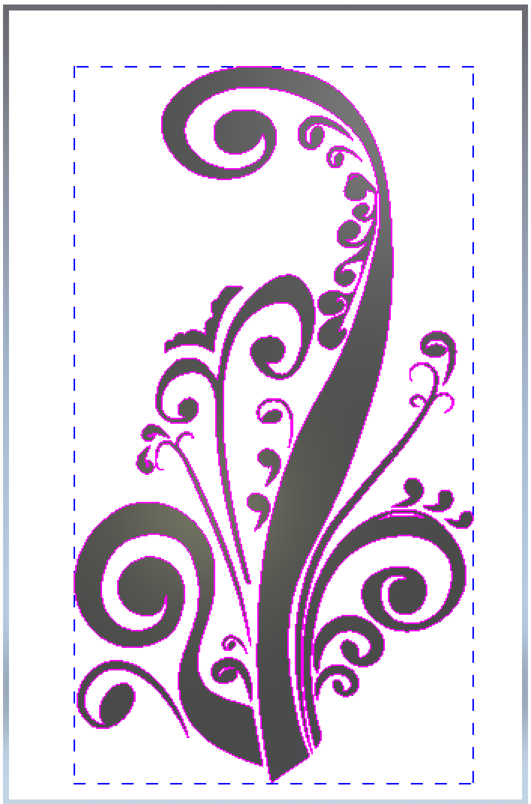
Settings
Speckle size 2 pixels
Smoothness 75 %
Colour Primary

6 Click on the **Reduce Colours** button.

This form allows the number of colours in the Bitmap to be reduced by entering the required number or moving the slider bar.

7 Change the Number of colours to **2** before selecting **Apply.**

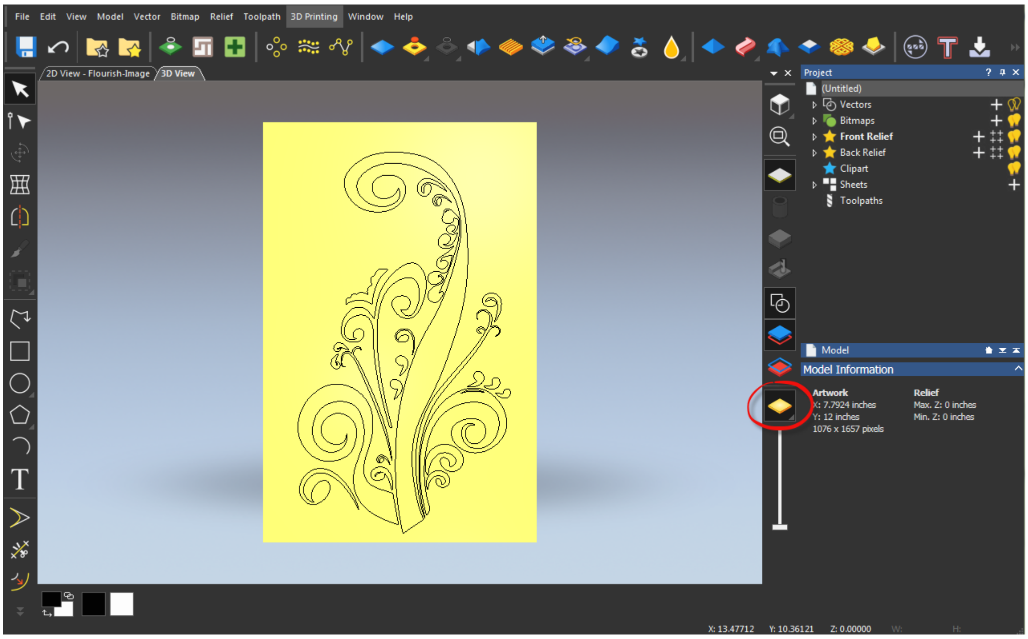
8 Click the **Create Vectors** button



9 Close the Bitmap To Vector page with the X

Next hide the image and use the vectors to create a 3D relief.

10 Click on the **Display Material** button to hide the image and show the model in ArtCAM gold relief colour.

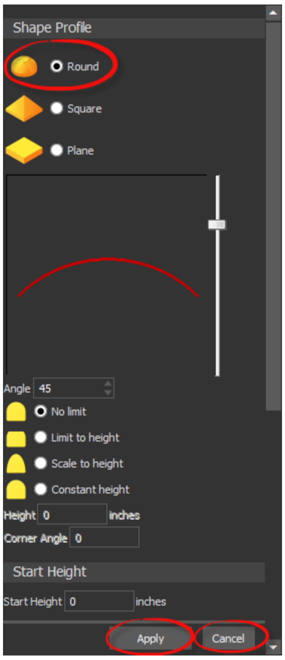

File Edit View Model Vector Bitmap Relief Toolpath 3D Printing Window Help
2D View - Flourish-Image
3D View
Project
(Untitled)
Vectors
Bitmaps
Front Relief
Back Relief
Clipart
Sheets
Toolpaths
Model
Model Information
Artwork
X: 7.7924 inches
Y: 12 inches
1076 x 1657 pixels
Relief
Max. Z: 0 inches
Min. Z: 0 inches
X: 13.47712 Y: 10.36121 Z: 0.00000

11 Drag a window with the mouse to **select** all the vectors.

12 Open the **Shape Editor** function

13 Choose the **Round** as the Shape Profile.

14 Then click **Apply** and **Cancel.**


Shape Profile

● Round
○ Square
○ Plane

Angle 45
● No limit
○ Limit to height
○ Scale to height
○ Constant height
Height 0 inches
Corner Angle 0

Start Height

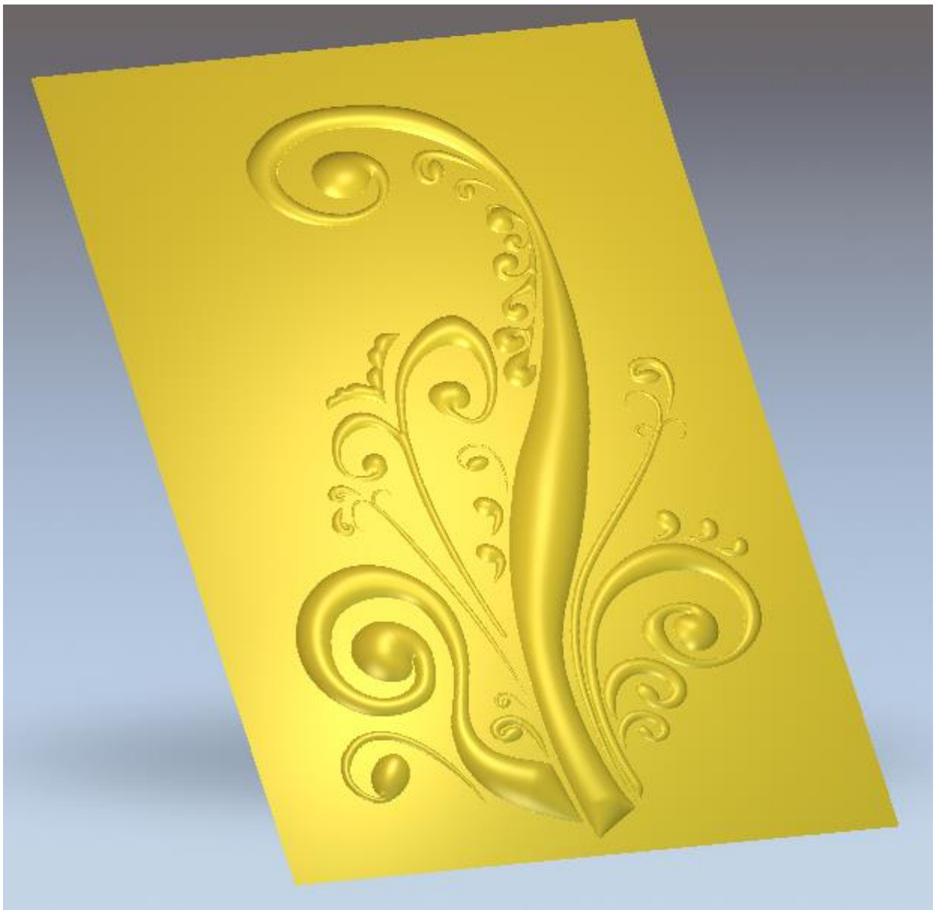
Start Height 0 inches

Apply
Cancel

The relief is now created and visible in the 3D view.

15 Hide the vectors in the 3D by turning off the Toggle Vector Visibility button

16 Rotate the relief by holding down the mouse wheel and moving the mouse.



The tutorial is complete!

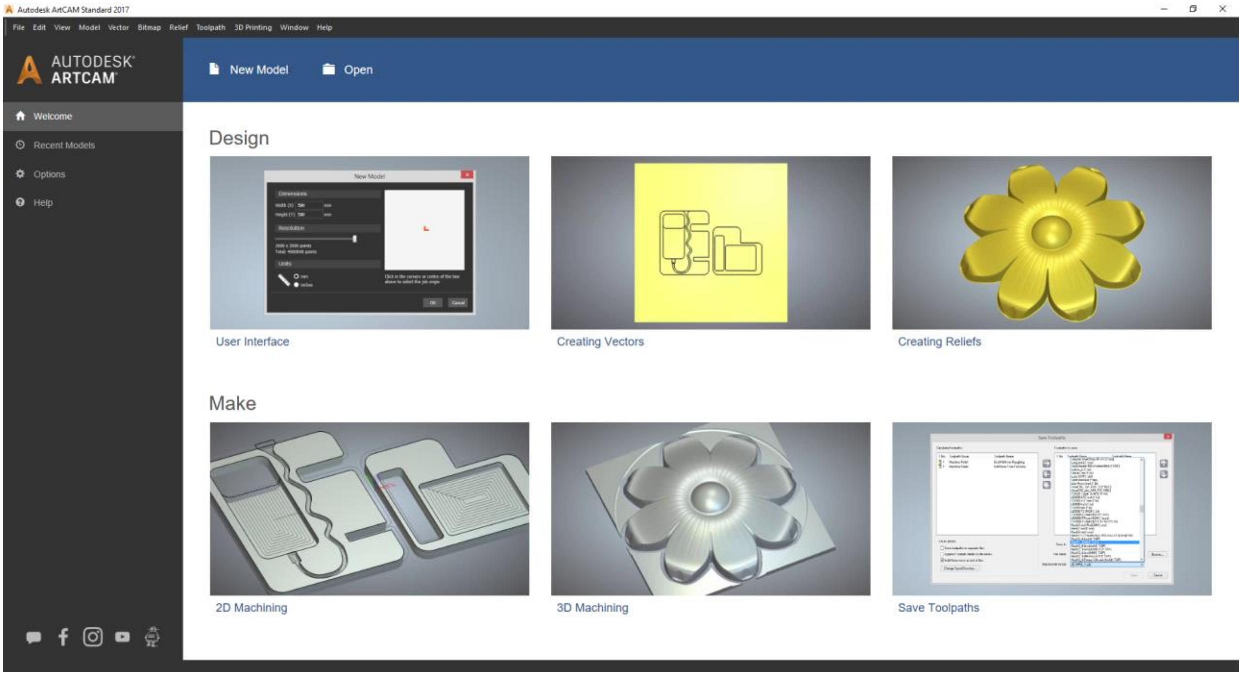
1. Introduction

ArtCAM allows complex reliefs (ArtCAM 3D models) to be created quickly and easily from 2D vectors (ArtCAM Wireframe) or bitmaps (Image files). These vectors and bitmaps can be generated within ArtCAM or imported from other systems. ArtCAM can also import 3D Surface data, which is translated on entry or after as a Relief model.

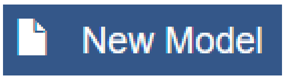
ArtCAM contains tools for editing the reliefs and combining stored reliefs. Once a 3D relief has been created, toolpaths can be generated to machine it. Multiple toolpaths are easily generated for roughing, finishing and engraving. The toolpaths can then be simulated to allow complete visualisation of the product before machining.

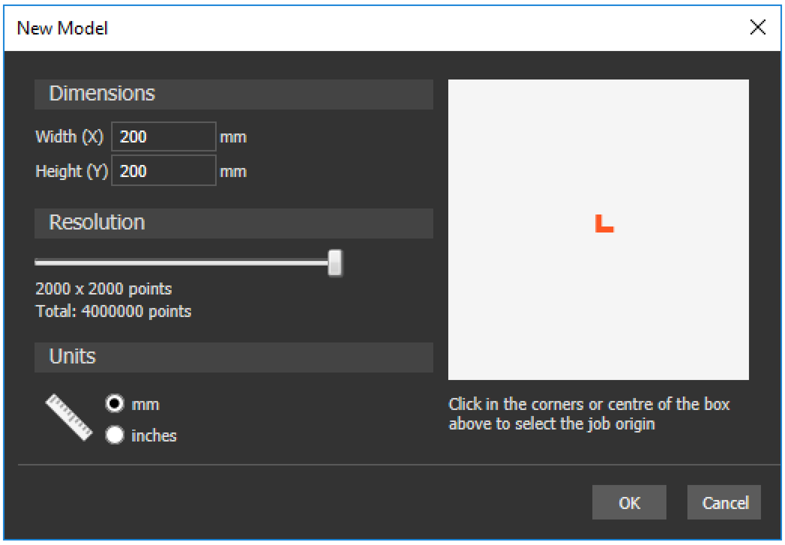
Starting ArtCAM

1 Double click the **ArtCAM** icon on the desktop


Autodesk ArtCAM Standard 2017
File Edit View Model Vector Bitmap Relief Toolpath 3D Printing Window Help
AUTODESK ARTCAM
New Model
Open
Welcome
Recent Models
Options
Help
Design
User Interface
Creating Vectors
Creating Reliefs
Make
2D Machining
3D Machining
Save Toolpaths

The initial screen that appears is called the Start Up screen. To start working, a new model can be created, an existing model can be opened, or an image file can be opened. Projects are a more advanced option for working with multiple assemblies in a 3D world.

2 Select the **Create New Model** 



New Model

Dimensions

Width (X) 200 mm

Height (Y) 200 mm

Resolution

2000 x 2000 points

Total: 4000000 points

Units

● mm

○ inches

Click in the corners or centre of the box above to select the job origin

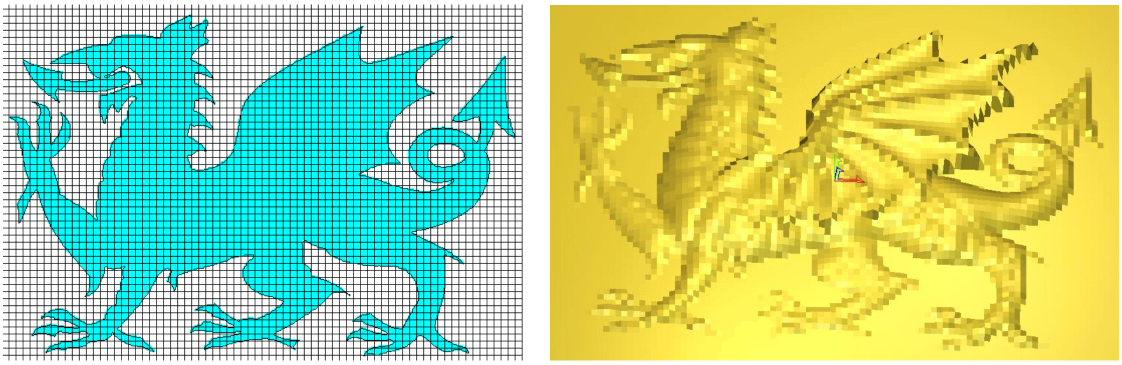
A new model must be given a size to work in, an origin position and a resolution.

The resolution is the total number of squares or pixels for each axis.

If you are working with very fine delicate detail, the resolution should be a high value. A height of 100 mm with a resolution of 1000 gives 10 bitmap squares per millimetre; this is an example of an average resolution.

Resolution

The dragon model shows the 2D view of the model broken up into a number of squares (pixels). Each square is given a height in ArtCAM dependent upon the command used. The first relief uses a low resolution, which means a loss of fine detail in the resulting 3D relief.



If a higher resolution is chosen, the model is broken into many more pixels and therefore the fine detail can be shown in the relief.

The trade-off with having a high resolution can normally result in larger file sizes, calculation and machine cutting times.

3 Decide whether you will work in inches or metric

- Set the **Units** to **mm**, **Height** and **Width** to **300mm**

or

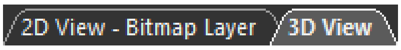
- Set the **Units** to **Inches**, **Height** and **Width** to **12**
- The **resolution** should be around **1300 x 1300** points and make sure the origin is in the bottom left corner
- Select **OK**

The Layout

The entire basic training course is based from the default layout.

From the **Window pull down menu**, choose **Reset Layout**, next click on **Standard.**

ArtCAM opens up displaying the 3D view. You can toggle the views by selecting.



(or F2 or F3 shortcut key).

The 2D view is traditionally used for designing vectors (2D artwork) and bitmaps (images). Reliefs (3D models) created or generated from these entities can be viewed in 3D.

Promoting a more efficient design process, ArtCAM now also allows direct modelling from vectors and bitmaps all within the 3D environment. This will be illustrated within forthcoming exercises.

2D and 3D View Toolbar Functions

Isometric View - Default ¾ view when the relief is first drawn

View Left - View looking down the X-Axis

View Front - View looking down the Y-Axis

View Top - View looking down the Z-Axis

Scale To Fit Model - Fit the artwork in the view

Draw Zero Plane - Toggle visibility of zero plane

Origin - Toggle drawing of the origin

Toggle Material Block Visibility - Toggles visibility of the defined material block for machining

Toggle Simulation Visibility - Toggles visibility of the simulation block (from machining)

Toggle Vector Visibility - Hide and show vectors in the 3D View

Display Material – Toggles display of the default material colour

Display Bitmap – Toggles display of the active Bitmap colours

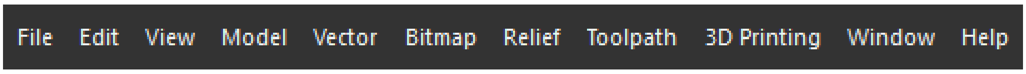
Contrast - Adjust transparency of Bitmap in the 2D view

Toggle Front Relief - Toggle display of the front relief

Toggle Back Relief - Toggle display of the back relief

Pull Down Menu

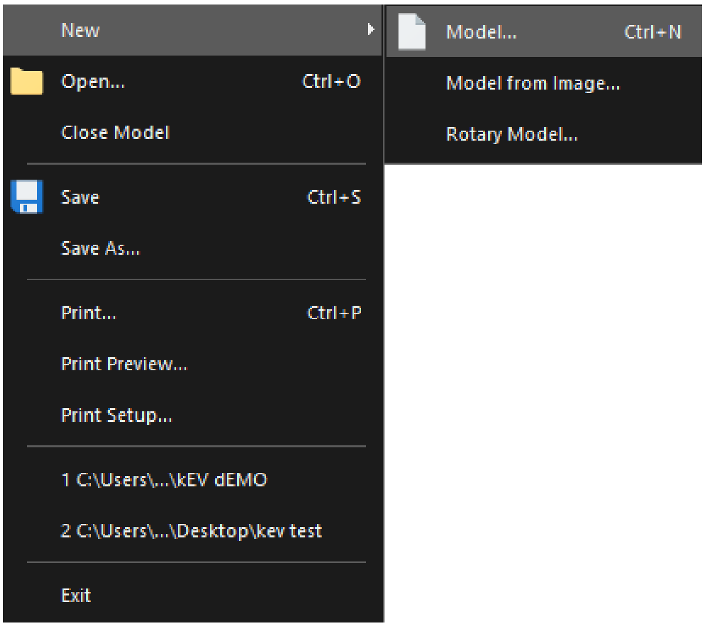
At the top of the Main window, there is a Pull Down Menu Bar.


File
Edit
View
Model
Vector
Bitmap
Relief
Toolpath
3D Printing
Window
Help

Clicking on a menu item opens a pull-down menu that contains submenus and commands. If a menu item does not apply to the currently active view it will be greyed out.

Sub menus are indicated and selected via the arrow ▶ *at the right hand side (where applicable).*

For example, the File menu expands to show the following:


New
Open... Ctrl+O
Close Model
Save Ctrl+S
Save As...
Print... Ctrl+P
Print Preview...
Print Setup...
1 C:\Users\...\kEV dEMO
2 C:\Users\...\Desktop\kev test
Exit
Model... Ctrl+N
Model from Image...
Rotary Model...

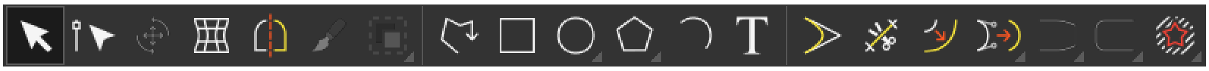
A yellow bar highlights the function over which the mouse cursor passes. Left mouse button then activates the function.

On certain commands, the keyboard shortcut is listed next to the description. For example, the shortcut to create a new model would be to press the CTRL key and then the letter N.

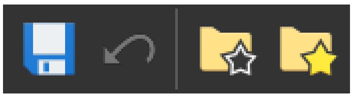
Toolbars

The default toolbars are summarised below

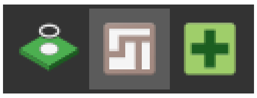
The left hand side of the ArtCAM interface is occupied by a vertical Toolbar. This is the Design Tools Toolbar.



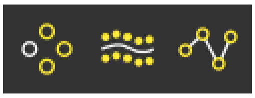
File Toolbar – Contains the standard Windows functionality including the Help reference and Options settings.



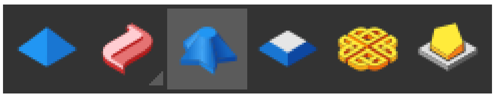
Vector Toolbar - Advanced creation tools for vectors including Offset, Bitmap to vector and Nesting.



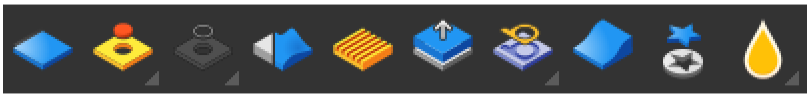
Fill Toolbar - Includes tools to change both vector and relief clipart such as Texture Flow and Paste Along a Curve



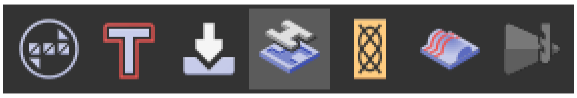
Relief Creation - Tools to create Reliefs including Shape Editor, Weave wizard loading reliefs.



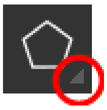
Relief Editing - Tools to edit a current relief such as Scale, Smooth, Invert, Mirror and Offset.



Make Toolbar - Tools to create machining toolpaths and export triangular meshes.



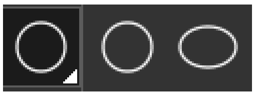
Flyout Toolbars

Several icons have a small arrow  located at the bottom right hand corner.

This indicates that this icon has further hidden functions which can be accessed from a flyout.

Select and hold the left mouse button over an icon (with the arrow) will reveal the functions in the flyout menu. Releasing the mouse over the desired function will activate it.

For example selecting the Circle icon from the Design Tools Toolbar reveals the circle and ellipse functions. Also selecting Draw reveals the Paint and Paint selective functions.



Panels

There are several different types of Panels in ArtCAM. Panel are the windows or pages the functions are displayed on when opened.

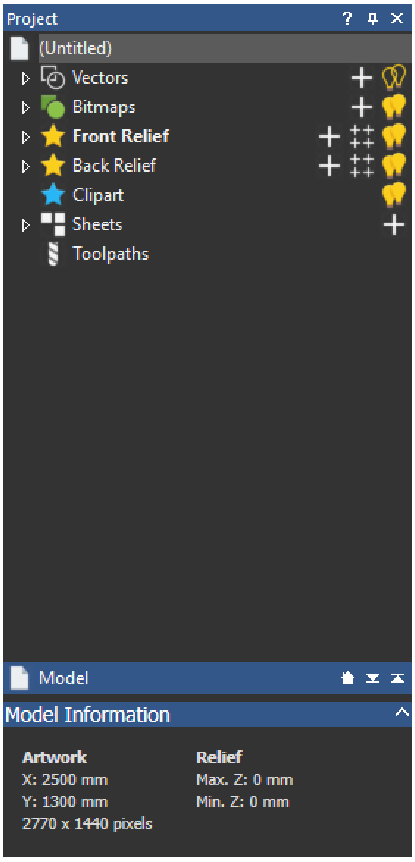
Static Panels like the Project Panel are pinned into position.

Floating Panels are for general functions such as Offset Vectors and Extrude. When the function is opened, the panel pops up floating on the screen. When finished with the function, it can be closed with the ✕ in the top corner.

Flyout Panels remain hidden on the side until pulled out for use.

Project Panel

The right hand side of the ArtCAM interface is occupied by the Project Panel and several Flyout panels.


Project
? ⊓ ✕
(Untitled)
Vectors
Bitmaps
Front Relief
Back Relief
Clipart
Sheets
Toolpaths
Model
Model Information

Artwork
X: 2500 mm
Y: 1300 mm
2770 x 1440 pixels

Relief
Max. Z: 0 mm
Min. Z: 0 mm

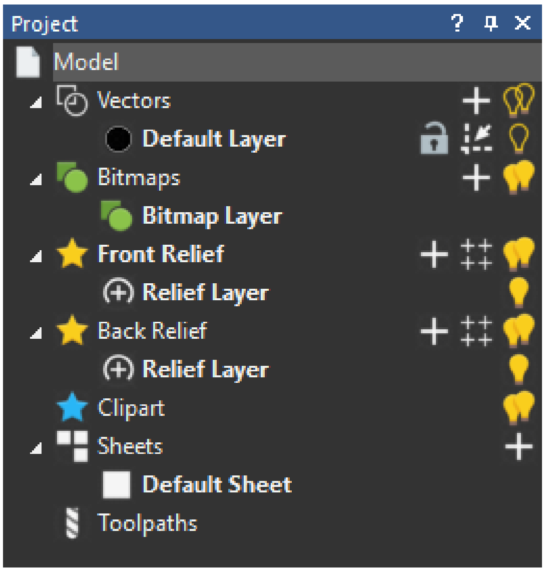
The Project Panel serves as a central area to manage the main design and machining aspects of the ArtCAM model.

When an item is highlighted, the lower half of the panel displays further information in the parameters area.

The main branch of the tree is the name of the file, in this case 'Model'. If the main branch is selected, the parameters area displays the Model Information such as size and resolution.

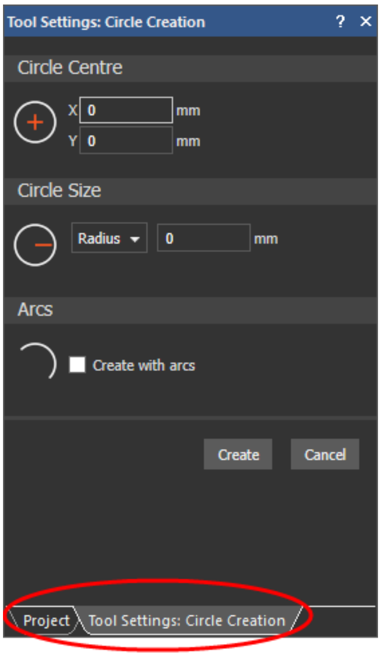
Each branch of the tree controls a different aspect in ArtCAM. The functionality for each sector can be accessed by right clicking on the branch or using the icon in the parameters section.

Key areas of Project Tree:


Project
? ⊓ ✕
Model
Vectors
Default Layer
Bitmaps
Bitmap Layer
Front Relief
Relief Layer
Back Relief
Relief Layer
Clipart
Sheets
Default Sheet
Toolpaths

Tool Setting Panel

The Tool Settings Panel is tabbed next to the Project Panel and will appear when its associated functions are opened. There are a series of functions located on the Design Tools toolbar on the left side of the screen. This series to tools can only be used one at a time (for example it is not possible to draw a rectangle and circle at the same time), and so they all open on the same Panel, the Tool Setting Panel. This is very intuitive work flow, the Tool Settings Panel will show and hide as each function is opened or closed.



Tool Settings: Circle Creation

Circle Centre

X 0 mm

Y 0 mm

Circle Size

Radius 0 mm

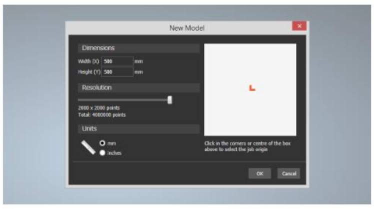
Arcs

☐ Create with arcs

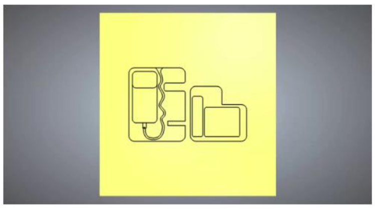
Tutorial Examples

These tutorial examples can be accessed when ArtCAM initially starts up.

Design



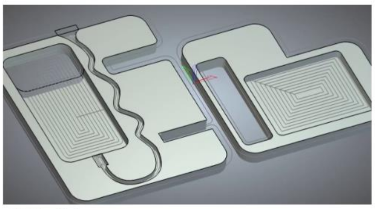
User Interface



Creating Vectors

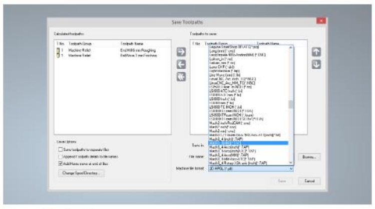
Creating Reliefs

Make



2D Machining

3D Machining



Save Toolpaths

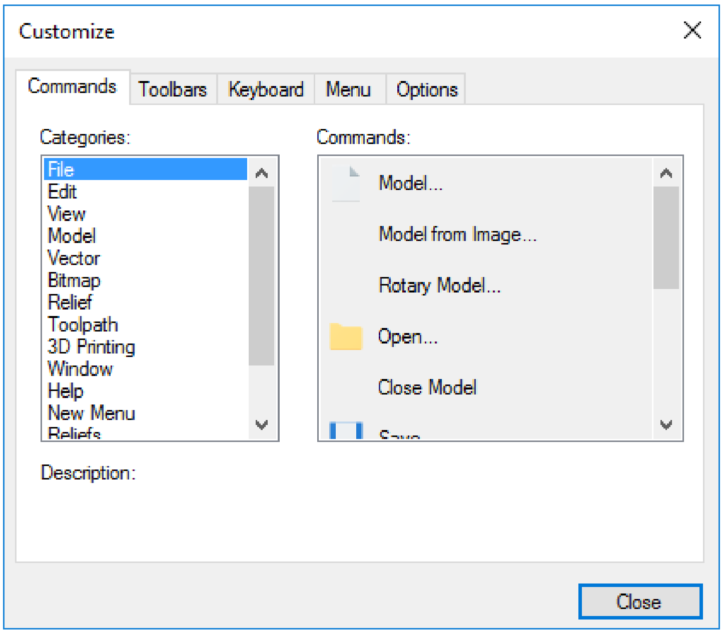
Interface Customisation

The list of available toolbars and panels can be accessed from the Window pull down menu and choosing Toolbars and Docking Windows or by right mouse clicking over any active toolbar.

Also note that the shortcut to hide and show the Project Panel is F4.

Items indicated by the check, ✓ are currently visible. Selecting or unselecting the option will toggle its visibility from the interface. The lower half of this menu lists all the Panels available in ArtCAM. Selecting/unselecting the ✓ will toggle its visibility.

Selecting Customise will display a new menu which allows extensive customisation of the layout. This is outlined below.

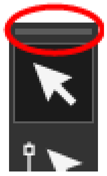

Customize
Commands
Toolbars
Keyboard
Menu
Options
Categories:
File
Edit
View
Model
Vector
Bitmap
Relief
Toolpath
3D Printing
Window
Help
New Menu
Reliefs
Commands:
Model...
Model from Image...
Rotary Model...
Open...
Close Model
Save
Description:
Close

- **Commands** - All Commands are listed here. These can be dragged and dropped into existing visible toolbars.
- **Toolbars** - Toggles Toolbar visibility and ability to create a new customised Toolbar.
- **Keyboard** - Keyboard shortcuts can be assigned here.
- **Menu** - Options to customise menu including animation.
- **Options** - General Toolbar options including Tool tips and icon size.

Docking Toolbars

Toolbars can be dragged into the interface and allowed to ‘float’ in a desired location.

At the end or top of each toolbar there is a solid line.

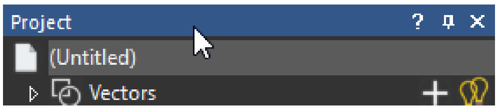


When the mouse cursor is placed over this line, it changes to a cross at which point the toolbar can be selected and dragged.

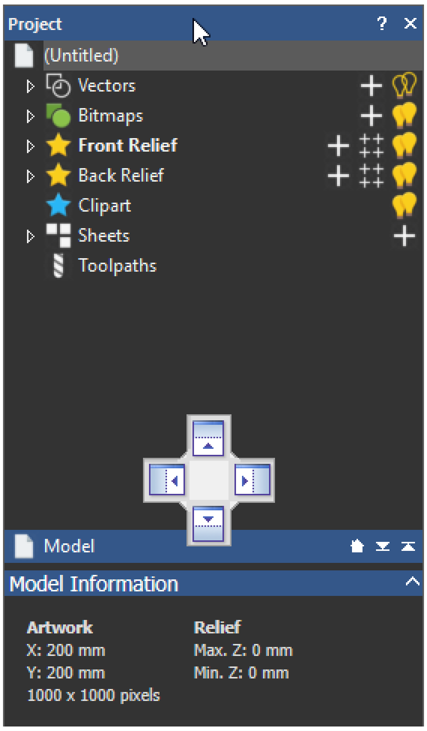
Docking Panels

When a Fly out Panel is pinned, it also can be dragged (to float) or docked in a fixed position at each end of the screen.

Select and Hold the mouse cursor in the top margin to drag the Panel into the screen.


Project
(Untitled)
Vectors

Whilst dragging, the interface displays a cursor pad in the centre and edges of the page. Depending on which arrow the panel is moved over, the screen will display a blue region where the panel will dock. Release the mouse button to dock the panel in this location.


Project
(Untitled)
Vectors
Bitmaps
Front Relief
Back Relief
Clipart
Sheets
Toolpaths
Model
Model Information

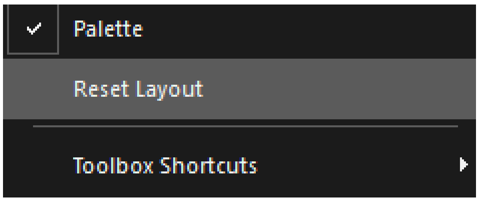
Artwork
X: 200 mm
Y: 200 mm
1000 x 1000 pixels

Relief
Max. Z: 0 mm
Min. Z: 0 mm

Panels can also be docked onto the top or bottom half of other fixed Panels or appended by a tab at the bottom. This is achieved by dragging a panel (as described above) onto another Panel to activate the ‘cursor pad’.

Layout

From Window > Reset Layout……

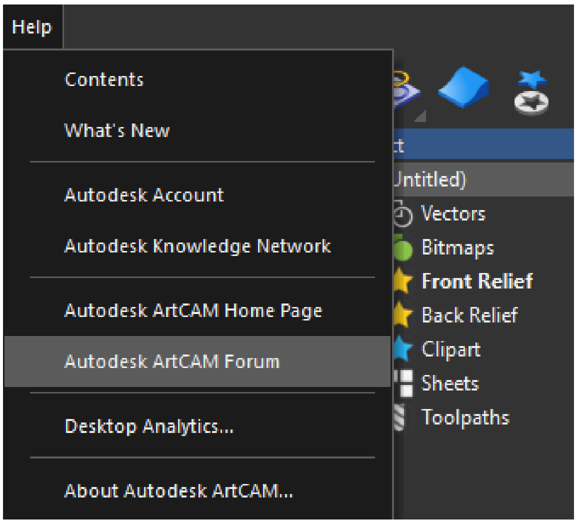

Palette
Reset Layout
Toolbox Shortcuts

Select Reset Layout to quickly reset the interface to default settings.

ArtCAM Help

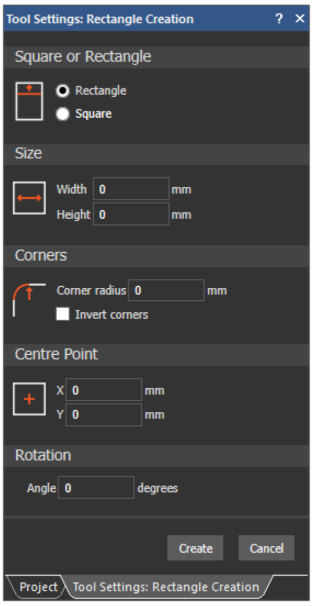
By selecting Help > Index from the top Menu bar (or by pressing the F1 shortcut key) a Help Page will open over the graphics area.

Further sources of information and help can be obtained from the ArtCAM website and dedicated Forum.


Help
Contents
What's New
Autodesk Account
Autodesk Knowledge Network
Autodesk ArtCAM Home Page
Autodesk ArtCAM Forum
Desktop Analytics...
About Autodesk ArtCAM...
Untitled)
Vectors
Bitmaps
Front Relief
Back Relief
Clipart
Sheets
Toolpaths

Individual function forms can be expanded to provide a detailed explanation of each available option/entry.

This is achieved by selecting the Help icon ? in the top right hand corner of the active form. The example below applies Help to the Rectangle Creation function. □



Tool Settings: Rectangle Creation

Square or Rectangle

● Rectangle
○ Square

Size

Width 0 mm
Height 0 mm

Corners

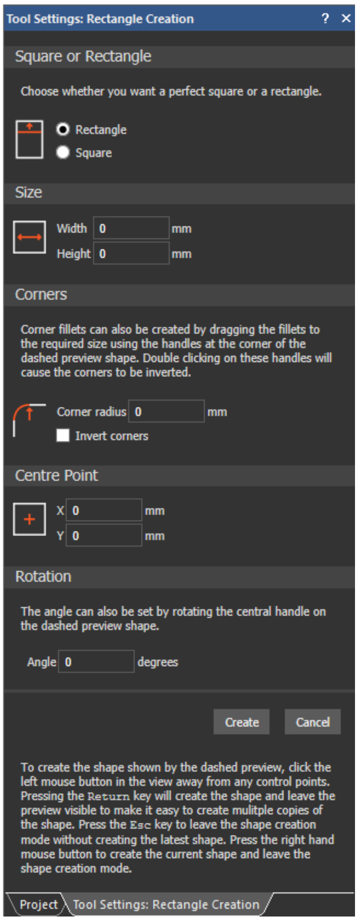
Corner radius 0 mm
☐ Invert corners

Centre Point

X 0 mm
Y 0 mm

Rotation

Angle 0 degrees



Tool Settings: Rectangle Creation

Square or Rectangle

Choose whether you want a perfect square or a rectangle.

● Rectangle
○ Square

Size

Width 0 mm
Height 0 mm

Corners

Corner fillets can also be created by dragging the fillets to the required size using the handles at the corner of the dashed preview shape. Double clicking on these handles will cause the corners to be inverted.

Corner radius 0 mm
☐ Invert corners

Centre Point

X 0 mm
Y 0 mm

Rotation

The angle can also be set by rotating the central handle on the dashed preview shape.

Angle 0 degrees

To create the shape shown by the dashed preview, click the left mouse button in the view away from any control points. Pressing the `Return` key will create the shape and leave the preview visible to make it easy to create mulitple copies of the shape. Press the `Esc` key to leave the shape creation mode without creating the latest shape. Press the right hand mouse button to create the current shape and leave the shape creation mode.

ArtCAM Files

An ArtCAM Model (.art) will contain all entities created within the session such as Bitmaps (image files), Vectors (2D geometry) Reliefs (3D models) and Machining data (Toolpaths). This ArtCAM file is identifiable by having an .art extension and can be saved or exported as a whole.

It is also possible to save/export and import independent entity types from within the ArtCAM Model. These include the Vectors (mainly .eps .dxf .dgk .pic formats), Reliefs (.rlf), Triangle Models (.stl .dmt) and Machining Output (.tap,...).

For more advanced applications where it is required to create an assembled group of separate Relief models (.rlf), an ArtCAM Project is first opened in which several ArtCAM Models can be created and combined as required for an assembled item. When saved, the Artcam Project is identifiable by a (.3dp) extension. To enable the Reliefs to co-exist together, the individual components are converted within the Assembly as Triangle Mesh models. ArtCAM can also import surface models (e.g. iges) directly into an assembly.

Design

ArtCAM Reliefs (*.rlf) or simply the 3D models are created from 2D vectors or bitmaps. These vectors (2D artwork) and bitmaps (images) can be generated within ArtCAM or imported from other systems. ArtCAM can generate reliefs from an imported model.

When dealing with bitmaps and Reliefs it is important to understanding Resolution, which will influence the overall surface detail of the relief and ultimately the final piece.

Manufacture

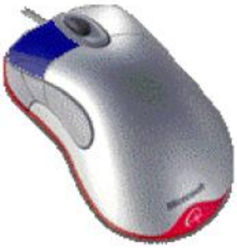
The final stage for most ArtCAM Projects is to manufacture the 3D relief as a real object. Currently there are two major routes to production: via CNC machining or Rapid Prototyping. ArtCAM can realise its models using either method.

ArtCAM can calculate the toolpaths required to machine the individual relief or final assembly. The calculated toolpaths can be then sent directly to the machine (via post-processing) ready for cutting.

Mouse buttons application

Each of the three mouse buttons performs a different operation in ArtCAM's 3D View. By using the ALT, Ctrl or Shift key on your keyboard, these operations can be extended as the following details explain.

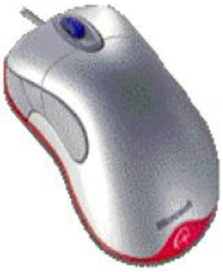
Left mouse button: Picking and selecting



This button is used for selecting items off the main pull down

menus, inputting data and selecting parts of the model.

Middle mouse button or wheel: Dynamics



Zooming: Scroll the middle mouse wheel to Zoom IN/OUT of the model. This applies to the 2D and 3D view. Alternatively, Select the SPACE BAR and Right mouse button together and move the mouse to Zoom IN/OUT. This second option applies to the 3D view only)

Panning: Hold down the Left and Right mouse buttons and move the mouse, to move the view across the component.

- Rotating/Twiddle: Hold down the middle button/wheel and move the mouse. Alternatively Select the SPACE BAR and Left mouse button together and move the mouse. This second option applies to the 3D view only)

Functions – Additional Functions

New Model - Create a new blank ArtCAM Model

Open File - Open an existing ArtCAM file or image (.art, .bmp, .jpg, .rlf, …)

Save - Save the current ArtCAM model

Cut - Move the currently selected object to the clipboard

Copy - Copy the current item onto the clipboard

Paste - Copy the current item on the clipboard into the model

Undo - Undo the last command

Redo - Redo the last undone command

Functions – Tips

Import Vector - Import vector artwork (.eps, .dxf, .dwg, .ai, .pic, .wmf, .dgk).

This function is available from the Vector pull down menu.

Export Vector - Save a copy of the selected vector (.eps, .dxf, .dgk, .pic)

This function is available from the Vector pull down menu.

Help - Launch ArtCAM's online help

ArtCAM Notes - Add written notes to the current ArtCAM file, this function can also be accessed by pressing ALT-N

2. Basic Vector Creation

Introduction

This chapters gives a simple introduction to creating vector shapes.

Functions

The Vector Creation functions are available on View Tools Toolbar.

Polyline Creation - Create vector polylines, straight or curved

Rectangle Creation - Create vector squares and rectangles

Circle Creation - Create vector circles

Ellipse Creation - Create vector ovals

Polygon Creation - Create vector polygons

Star Creation - Create vector stars

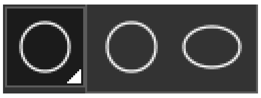
Arc Creation - Create vector arcs

Text Tool - Create vector text

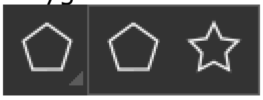
Text on a Curve function is available on Design Tools Toolbar, in the Text flyout.

Bitmap to Vector - Trace primary (current) colour with vector curves

The Ellipse Creation and Circle Creation functions are under a single flyout menu.



Polygon Creation and Start Creation functions are under a single flyout menu.



Example 2-1: Rectangle Creation

Follow along with the teacher to complete Example 2-1.

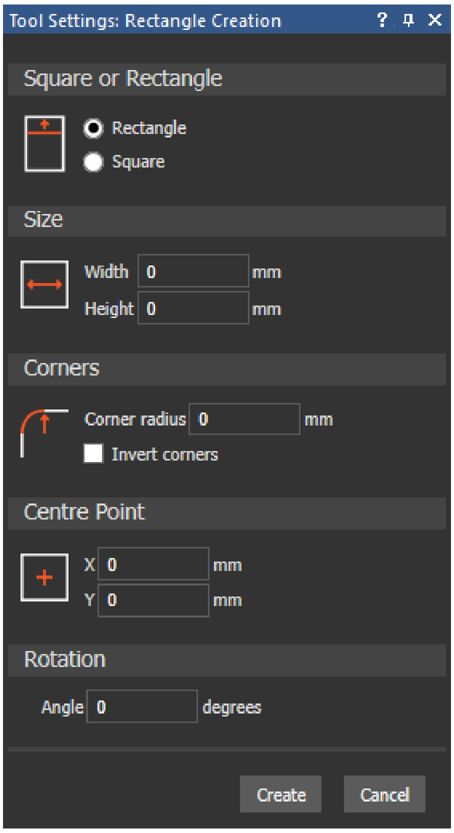
Notes for Example 2-1

Create Rectangle will be used as an example to explain the basics of all vector creation.

1 Open the Create Rectangle function from the Design Tools Toolbar

The Tool Settings Panel appears on the Right Side in the hidden stage.

The rectangle can be created by clicking in the screen and dragging to a size, or by entering in specific values.



Tool Settings: Rectangle Creation

Square or Rectangle

● Rectangle
○ Square

Size

Width 0 mm
Height 0 mm

Corners

Corner radius 0 mm
☐ Invert corners

Centre Point

X 0 mm
Y 0 mm

Rotation

Angle 0 degrees

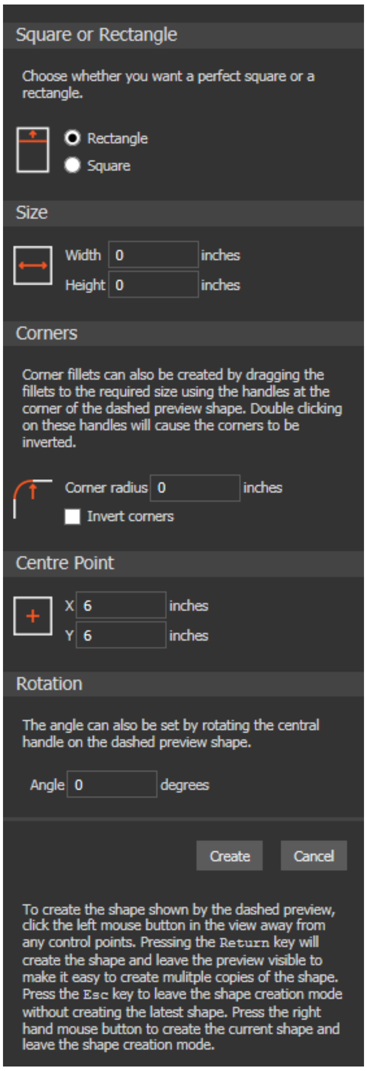
Several rectangles can be created without closing down the function.

The Tool Settings Panel has help available, indicated by the ? Help Icon.

2 Click the Help question mark at the top of the Rectangle Creation panel to hide and show the help

The Panel displays help at the side of each option.

This increases the length of the page and you may have to move the page down to see further instructions, by using the scroll bar.



Square or Rectangle

Choose whether you want a perfect square or a rectangle.

● Rectangle
○ Square

Size

Width 0 inches
Height 0 inches

Corners

Corner fillets can also be created by dragging the fillets to the required size using the handles at the corner of the dashed preview shape. Double clicking on these handles will cause the corners to be inverted.

Corner radius 0 inches
☐ Invert corners

Centre Point

X 6 inches
Y 6 inches

Rotation

The angle can also be set by rotating the central handle on the dashed preview shape.

Angle 0 degrees

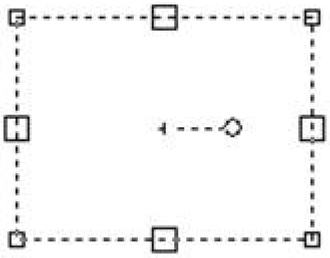
To create the shape shown by the dashed preview, click the left mouse button in the view away from any control points. Pressing the `Return` key will create the shape and leave the preview visible to make it easy to create mulitple copies of the shape. Press the `Esc` key to leave the shape creation mode without creating the latest shape. Press the right hand mouse button to create the current shape and leave the shape creation mode.

Once help is switched on it is displayed for each command. To switch this off, you need to click the Help Icon.

3 Click the Help question mark Icon to Hide Help

4 Hold down the left mouse button in the 2D view and drag a rectangle of any size

5 Release the mouse button when satisfied with the size



The rectangle appears as dotted. The length and height can be dragged by moving the big squares in the middle of the sides. A radius can be put on the corners by dragging in one of the corners.

The rectangle can be rotated by dragging around the lever in the center.

6 Right Click when you are done creating

Right clicking is one of the methods to close or complete the Create Rectangle function. You can also press Esc or click on the Select vectors icons to close the function.

The different ways to draw vectors:

- Drag the mouse to draw
- Type in specific values
- Drag to draw then adjust values by typing

The different ways to create and close

- When draw free hand, show how to continue to draw others
- Close the Create Rectangle function by Right clicking
- Close by clicking on Create and Cancel

Polyline:

There are two basics ways to draw a polyline. You can take the mathematical approach and type in exact values; absolute coordinates, incremental length & angle or incremental distance X & distance Y. The other option for drawing a polyline is to hand sketch it. If you click on the 2D View, you can draw a line, if you hold the mouse button down and drag it, you can draw free-hand.

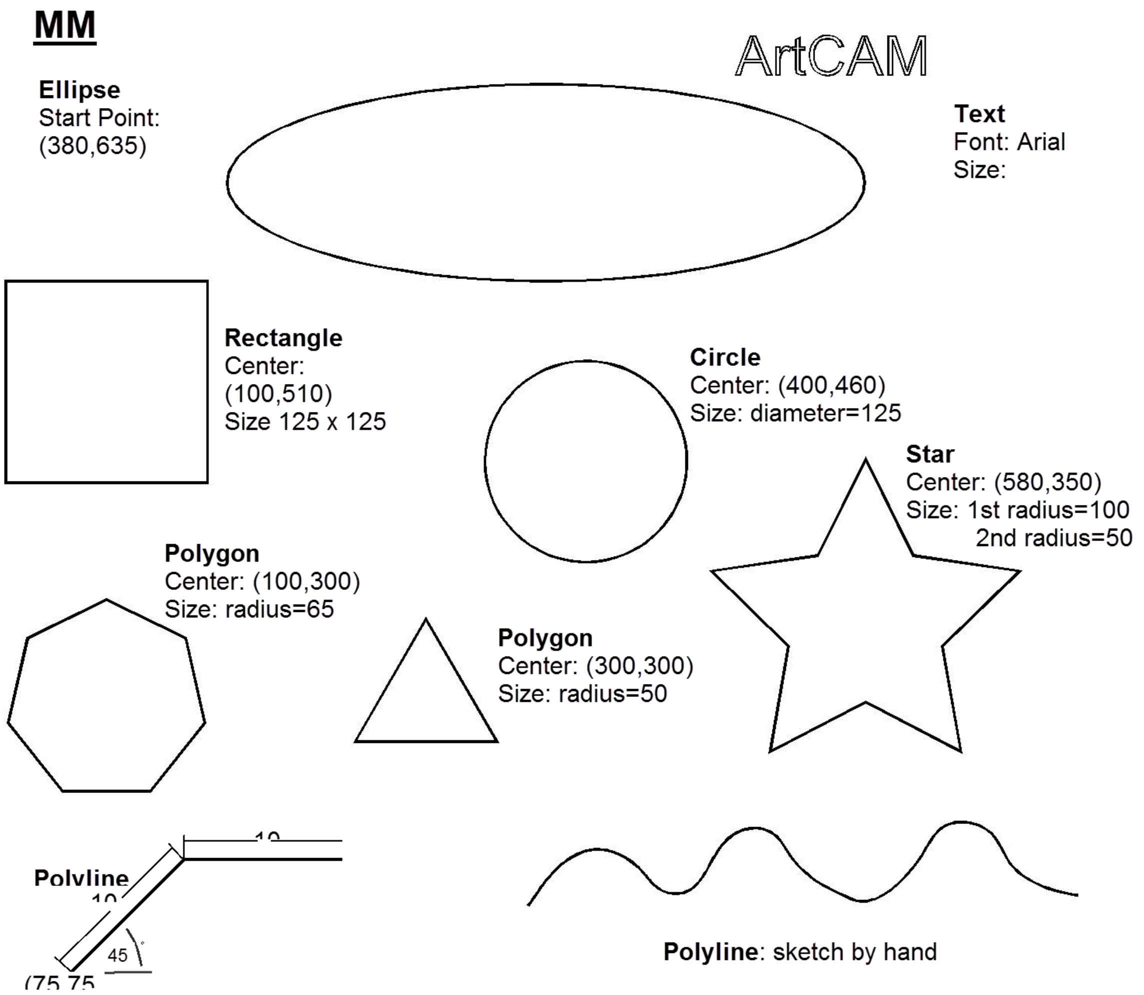
Tutorial: Vector Shapes

This project will go through all the basic vector creation tools.

On the diagram, all dimensions are marked next to the shapes. The center: (_,_) are X and Y coordinates.

1. Create a **New Model** 775mm x 775mm (30" x 30")
2. Origin in the lower left corner
3. Create the following shapes as shown on the diagram on the following pages:

Chose to work either from the MM below or INCH diagram on the following page.


MM
ArtCAM
Ellipse
Start Point:
(380,635)
Text
Font: Arial
Size:
Rectangle
Center:
(100,510)
Size 125 x 125
Circle
Center: (400,460)
Size: diameter=125
Star
Center: (580,350)
Size: 1st radius=100
2nd radius=50
Polygon
Center: (100,300)
Size: radius=65
Polygon
Center: (300,300)
Size: radius=50
Polvline
10
10
45
(75,75
Polyline: sketch by hand

Wrap the ‘ArtCAM Delcam’ Text onto the ellipse

4 Open the Text tool and click on the Text, Select Ellipse and click Select Curve in the Text Tool page

5 Try various options in Text On A Curve function

Example 2-2

Follow along with the teacher to complete the Example.

Bitmap To Vector:

This tool automatically traces a vector around the selected primary colour. The bitmap or image colours can reduced, merging together similar shades until they are condensed to a few main colours for tracing.

3. Vector Tools

Introduction

This section will run through how to use most of the vector editing tools. It will start with the basics, such as selection modes and cursor types and then go into more complex editing tools.

Note, shortcuts are listed in brackets following the function description.

Functions

Select mode - Default mode for standard vector work and multiple vector selection (Esc)

Node Editing mode - Edit the nodes and spans of a vector (‘N’)

Transform Vectors mode - Transform (rotate, move, scale, shear etc.) currently selected vectors (‘T’ to enter mode, ‘TT’ to open Transform function)

Group Vectors - Group a selection of vectors

Ungroup Vectors - Ungroup a previously grouped set of vectors

Vector Doctor - Fix loops and identifies coincident points on a vector

Spline Vectors - Smooth selected vectors by fitting curves and reducing nodes

Block and Rotate Copy - Copy vectors in rectangular or circular array

Centre In Page - Align selected vectors to centre of page (F9)

Mirror Vectors - Mirror selected vectors

Offset Vectors - Offset currently selected vectors inwards or outwards

Fillet / Extend Tool - Radius a corner or extend two vectors to meet

Trim Tool - Trim vector to intersection of another vector

Weld Vectors - Combine selected vectors by merging together and keeping outside

Join Vectors With A Line - Join two selected vectors with a straight line

Join Vectors With A Curve - Join two selected vectors with a smooth curve

Join Vectors by Moving Ends Nodes - Join two selected vectors by moving end points together

Close Vector With A Line -Close a selected vector with a straight line

Close Vector With A Curve - Close a selected vector with a smooth curve

Close Vector Move End Nodes - Close a selected vector by moving end points together

Join Multiple Vectors - Join multiple vectors with coincident start or end nodes

Nesting - Nest multiple vectors inside a boundary

Reduce Colours - Reduce number of colours in the model.

Bitmap to Vector - Trace primary (current) colour with vector curves

Some functions are grouped together in flyout toolbars and others are found in the pull down menus:

Importing Vectors:

Vectors can be imported in 2 different ways, through the Vector pull down menu and through the Vector Layers.

Vector pull down menu: When importing through the Vector pull down menu, it will import the vectors onto the current Vector Layer. Also if there were layers on from the original file, the separate layers will be preserved.

Vector layer: When importing from the Vector Layers, it will create a new vector using the name of the original file and import the vector onto this new layer.

Example 3-1

Follow along with the teacher to complete the Example.

Offset Vectors:

Radiused keeps the exact same distance throughout the entire offset, causing a sharp corner to become radiused. Sharp has the Max Sharp Offset Distance option which the default is 100%. This is used as a limiting factor in case an offset corner is too long at which time it chamfers the corner. If it chamfers a corner to soon, increase the value to 200% or 300%.

Example 3-2

Follow along with the teacher to complete the Example.

Vector Doctor:

Identifies both loops and coincident nodes (nodes on top of each other), but will only remove loops. To fix coincident nodes, remain in Vector Doctor, enter node editing mode, and delete nodes.

Mirror Vectors:

When using About Line, B mirrors about A, select the line and then the object.

Shortcuts:

Ctrl → holding Ctrl while moving a vector, leaves a copy of the original.

Alt → holding Alt while moving a vector, keeps it parallel to the X or Y axis.

Use both at the same time to make a copy of the vector that lines up with the original.

Example 3-3

Follow along with the teacher to complete the Example.

Vector Editing:

All standard vector shapes can be edited using the original creation screen. Standard vectors include rectangle, circle, ellipse, polygon, star, and text. Select the vector and press 'E', where 2D Shape will be rectangle, circle, … etc. The polyline and arc tools cannot be edited. Also if the vector has been changed through node editing or transform, it can no longer be edited.

Selection Modes:

Selection mode → Default mode. Press Esc key to enter mode. Selected vectors are pink. Can select multiple vectors. Many functions require this mode to work.

Node Editing mode → Press 'N' to enter mode. Selected vector is colour of layer. Can only select one vector at a time. All node and span editing is done in this mode.

Transform mode → Press 'T' to enter mode. Press 'TT' to enter mode and open Transform Vectors function within the Tool Setting Pane. Selected vectors are the colour of the layer. Can select multiple vectors.

Cursors:

Selection mode cursor → Standard cursor when in vector Selection mode.

Move Vector cursor → Vectors can be moved when this cursor is visible.

Node Editing mode cursor → Standard cursor when in Node Selection mode.

Span cursor → Available in Node Editing mode, when hovering over a span. It has a specific right mouse click menu to edit spans.

Node cursor → Available in Node Editing mode, when hovering over a node. It has a specific right mouse click menu to edit nodes.

Object Snap Cursors:

Snap to node.

Snap to mid node of line.

Snap to centre of bounding box.

Snap to X axis of start node (for polyline creation only).

Snap to Y axis of start node (for polyline creation only).

Snap to horizontal Guide Line.

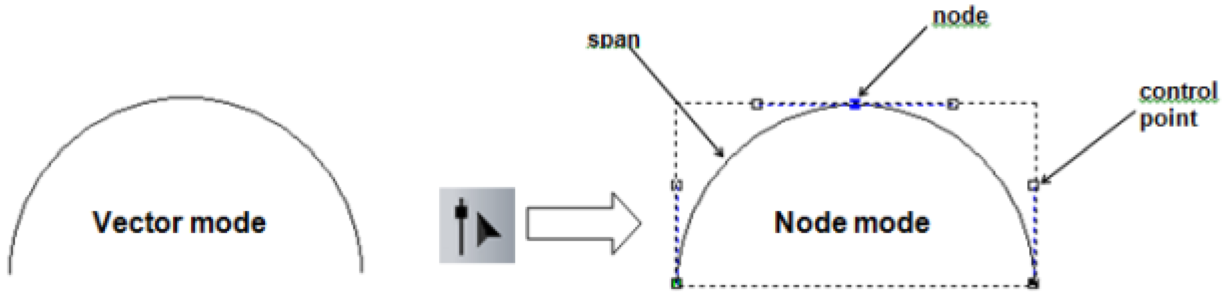
Snap to vertical Guide Line.

Snap to intersection of horizontal and vertical Guide Lines.

Node Editing

The structure and appearance of a vector can be changed using the Node editing options. Vectors are made up of nodes and spans which are displayed only when ArtCAM switches to Node Editing Mode.

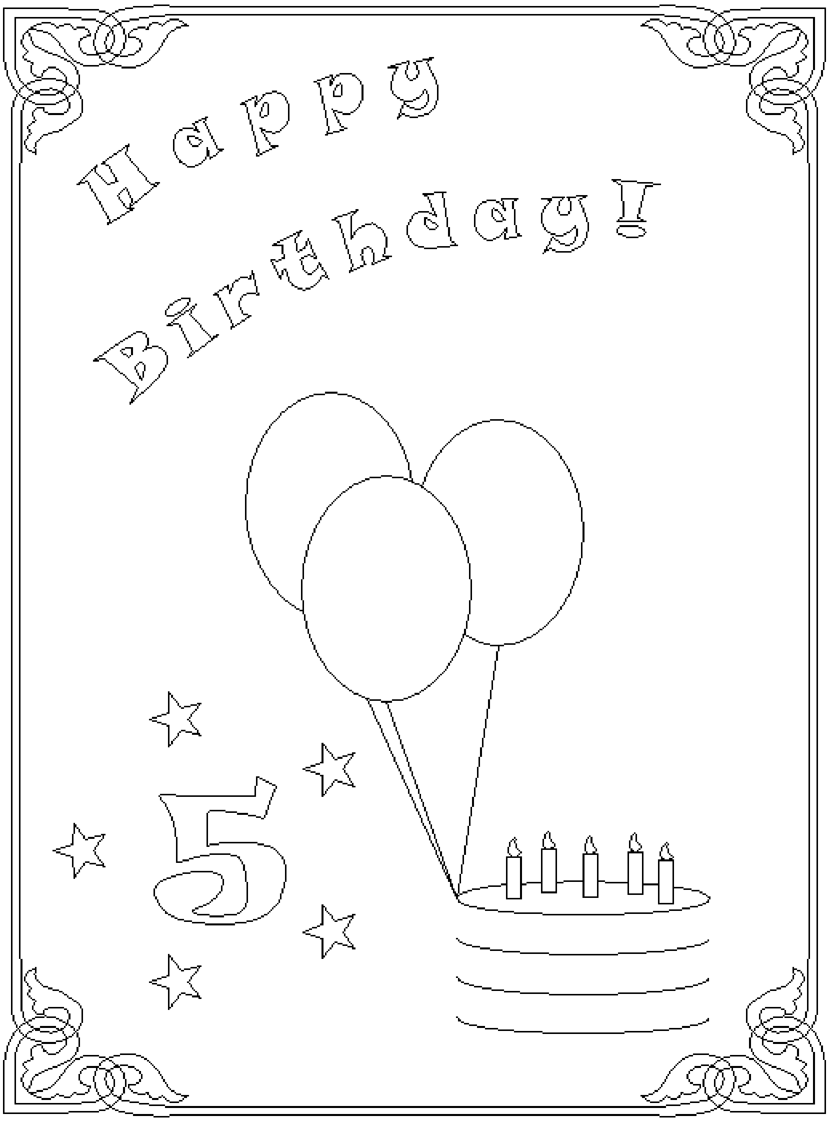
Upon selecting a Vector, Node Editing can be entered by selecting from the Design Tools Toolbar on the left hand side, the Right mouse select menu or simply selecting N on the keyboard.



Tutorial: Birthday Card

Introduction

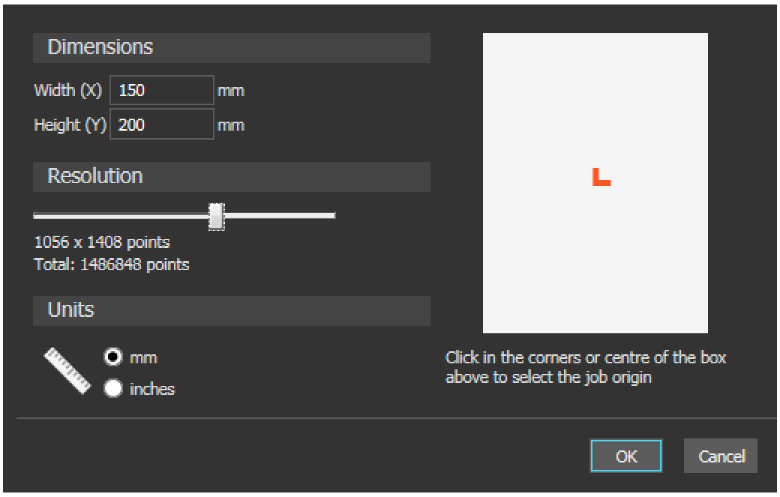
Vector creation will be introduced with the design of a simple Birthday Card for engraving purposes. Functionality demonstrated will include the Vector creation tools, Text on curve, Node Editing, Block Copy/Rotate, Transform Vectors, Paste along Curve and Importing of Vectors.



1 Open **New Model.**

2 Enter a **Height 200mm** *(8″)*, with a **Width 150mm** *(6″).*

- Set the Origin to the centre of the model and a resolution of approximately 1056x1408 points (by moving the slider).



Dimensions

Width (X) 150 mm

Height (Y) 200 mm

Resolution

1056 x 1408 points

Total: 1486848 points

Units

● mm

○ inches

Click in the corners or centre of the box above to select the job origin

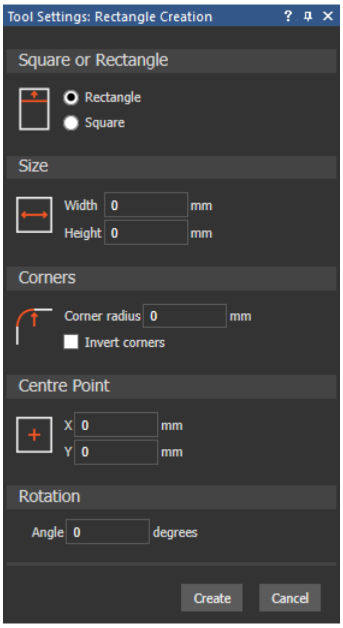
A new ArtCAM Model (sheet) is generated based on the parameters defined above.

Creation tools and various other design commands can be accessed in a number of different ways. For this exercise the Design Tools toolbar on the left hand side of the screen can be used.

Create Boundary and Balloons

The outline of the birthday card will be created first.

1 Using a method outlined above, open **Create Rectangle.**



Tool Settings: Rectangle Creation

Square or Rectangle

● Rectangle

○ Square

Size

Width 0 mm

Height 0 mm

Corners

Corner radius 0 mm

☐ Invert corners

Centre Point

X 0 mm

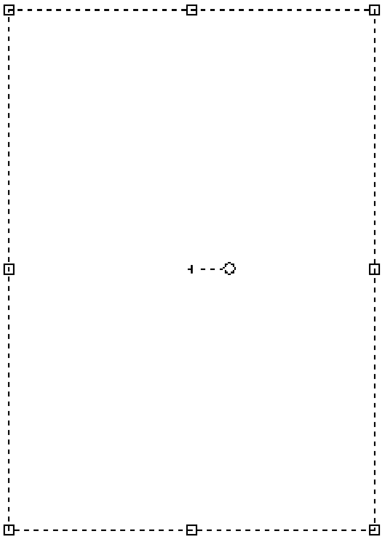
Y 0 mm

Rotation

Angle 0 degrees

The Rectangle Creation form appears in the Tool settings panel.

2 Enter a **Width 130mm** *(5”)*, a **Height 185mm** *(7.25”)*, Corner Radii 0mm and a Centre Point X 0 and Y 0.



3 To create the shape and close the function, single right mouse click in the main window.

The rectangle is created on the model page and the Create Rectangle function is closed.

To create the shape whilst keeping the rectangular creation form open, single left mouse click in the main window. This can be utilised to create additional rectangular shapes.

4 Open **Create Ellipse.**

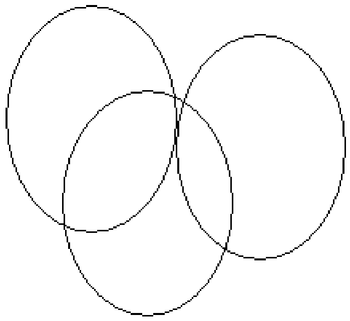
5 Enter a **Start Point X -5** *(-0.2")* **Y -5** *(-0.2")* with a **Width 30mm** *(1.2"),* **Height 40mm** *(1.55")*, and an Angle 0 degrees.

6 Right mouse click to create the shape and close the form.

This creates the first center balloon. The other 2 balloons will be the same size, positioned behind the first one. Instead of creating and positioning 2 new ellipses, we can simply copy the existing ellipse.

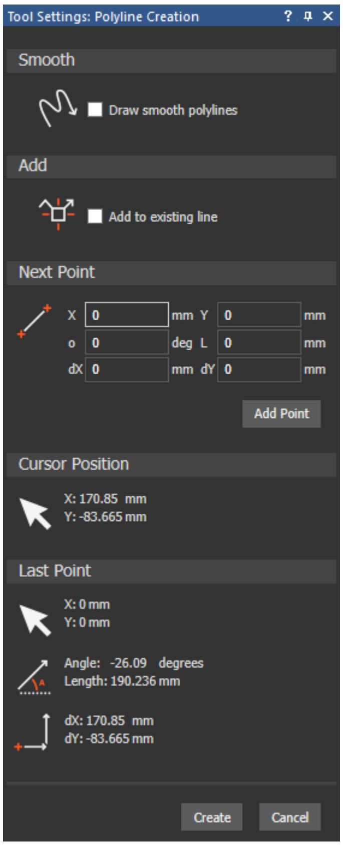
7 Select the ellipse and hold the **Ctrl** key, and drag the balloon slightly up and to the right.

8 Repeat and hold the **Ctrl** key again, this time dragging to create upper left balloon.



Create Text

1 Open **Create Polyline**.



Tool Settings: Polyline Creation

Smooth

☐ Draw smooth polylines

Add

☐ Add to existing line

Next Point

X 0 mm Y 0 mm
o 0 deg L 0 mm
dX 0 mm dY 0 mm

Add Point

Cursor Position

X: 170.85 mm
Y: -83.665 mm

Last Point

X: 0 mm
Y: 0 mm

Angle: -26.09 degrees
Length: 190.236 mm

dX: 170.85 mm
dY: -83.665 mm

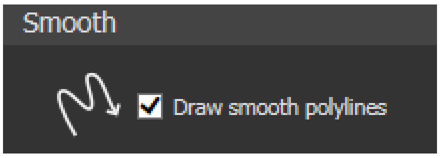
Create Cancel

Polylines can be generated by entering absolute co-ordinates in the X and Y area, by angles and line length and as relative co-ordinates using the dx and dy (distance from last point) or by clicking with the cursor.

Polylines can also be created dynamically in the graphics area either by holding down the left mouse key for freehand sketching, single left mouse clicks to create straight lines.

Sketching smooth curves will be illustrated below.

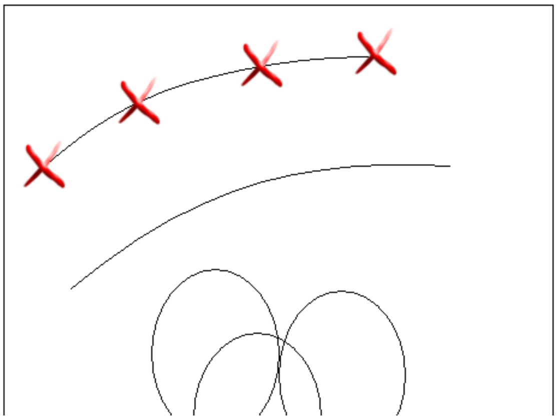
2 Check the option **Draw smooth polylines**.



Smooth

☑ Draw smooth polylines

3 Left mouse click 4 suitably positioned points ☒ to generate a Smooth Polyline as shown.

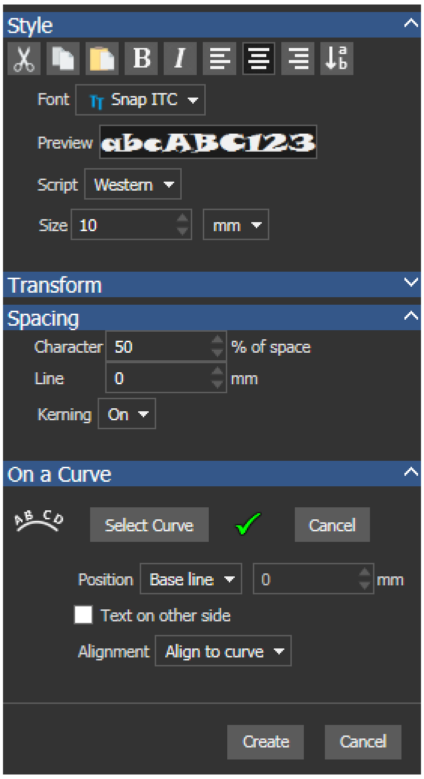


4 Repeat to create a second polyline as shown.

Pressing the Space bar on the keyboard will complete the first polyline but keep the form open to start a new one.

5 Open **Create Vector Text.**

6 Select a preferred font and size or use the following settings.



Font Snap ITC

Preview abcABC123

Script Western

Size 10 mm

Character 50 % of space

Line 0 mm

Kerning On

Position Base line 0 mm

☐ Text on other side

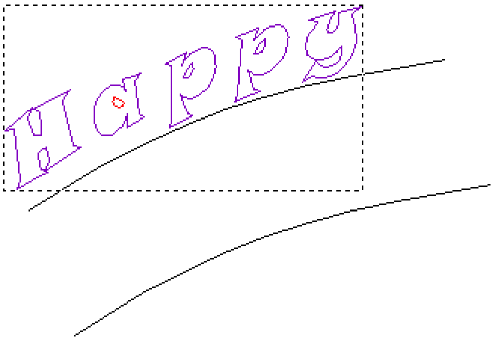
Alignment Align to curve

7 Font as **Snap ITC**, Script as Western, **Size 10mm** *(0.375")* and **Character Spacing 50%.**

8 Select the top Polyline you have created and under the **On a Curve** section in the Text Tool click **Select Curve**

9 Type the word **Happy.**

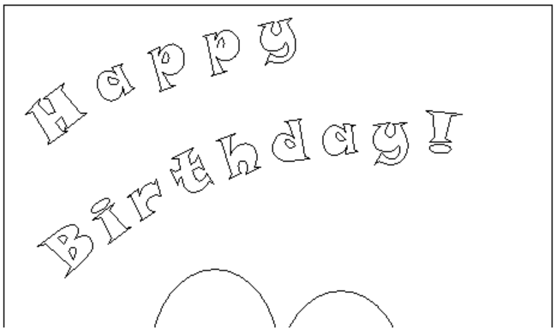
10 Select **Create** on the text form to create the text and close the form.



11 Repeat the above to create the word **Birthday!** On the second Polyline

12 Click **Create**

13 Delete the original two curved polyline vectors to leave the following result.



Create Cake

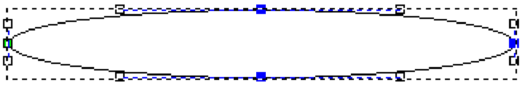
1 Open **Create Ellipse.**

2 Enter a **Start Point X 30** *(1.2")* **Y -60** *(-2.36")* with a **Width 45mm** *(1.75")*, **Height 6mm** *(0.25")*, and an Angle 0 degrees

3 Right mouse click to create the final shape and close the form.

4 With the ellipse vector highlighted, Open **Node Editing.**

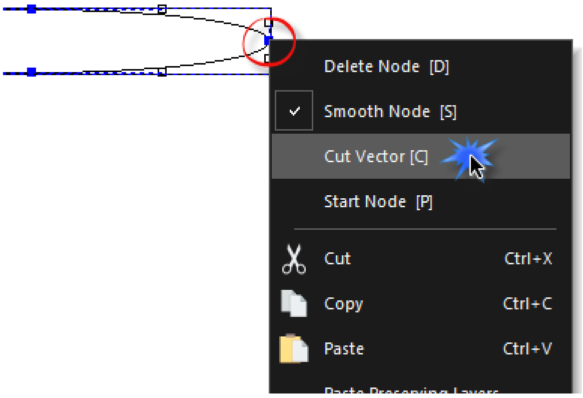
Node Editing is a powerful tool which allows the structure and appearance of a vector to be changed easily. Node Editing will be shown in greater detail in the next chapter (Chapter 3).



The ellipse shape will be split into two halves. This can be achieved in Node Editing by cutting the vector at the end node points.

5 Move the mouse cursor directly over the right hand blue node.

6 Right mouse click and select **Cut vector** from the local menu.

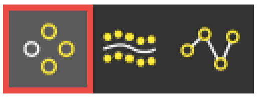

Delete Node [D]
Smooth Node [S]
Cut Vector [C]
Start Node [P]
Cut Ctrl+X
Copy Ctrl+C
Paste Ctrl+V
Paste Preserving Layers

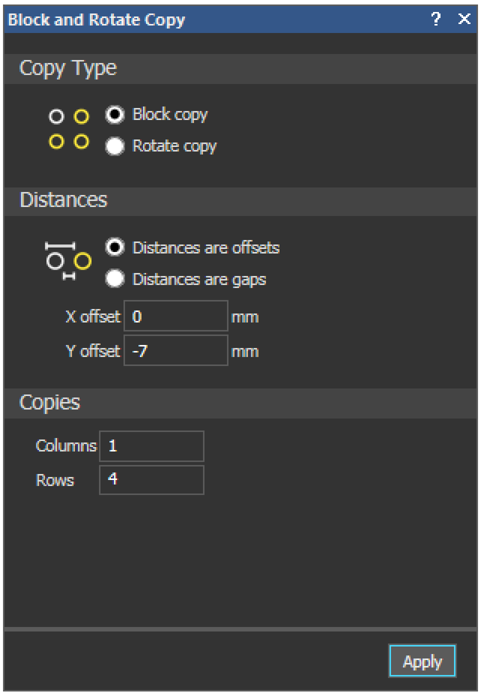
The node itself changes colour from blue to black.

7 Repeat the above to **Cut** the left hand blue node

8 Exit **Node Editing** by selecting **Esc** or **N** on the keyboard.

9 With only the Lower Ellipse selected, click on the **Block and Rotate Copy** ⚬⚬⚬ from the Fill Tools Toolbar.





Block and Rotate Copy

Copy Type

● Block copy
○ Rotate copy

Distances

● Distances are offsets
○ Distances are gaps

X offset 0 mm
Y offset -7 mm

Copies

Columns 1
Rows 4

The Block and Rotate Copy allows you to create a block copy in X and Y or a rotated copy around a point.

The distances can be set as centre offset value or by a gap value between each item.

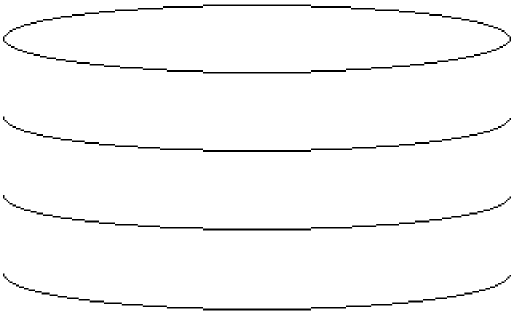
10 Open Block Copy and choose **Distances are offsets** options.

11 Select an **X Offset 0mm**, and a **Y Offset -7mm** *(-0.275")*

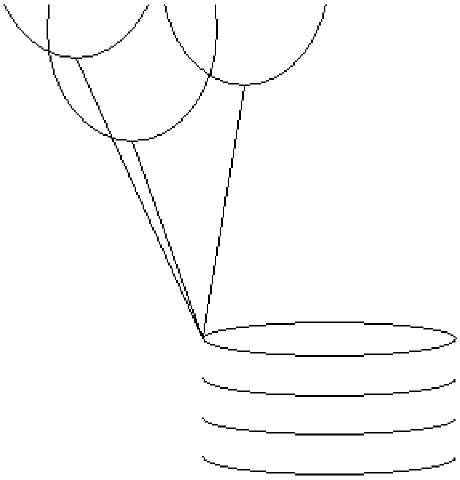
12 Number of **Columns** as **1** and, with Number of **Rows** as **4.**

13 Select Apply and close the panel using the X in the top right corner.

The lower vector has been copied into 4 rows to create the birthday cake.



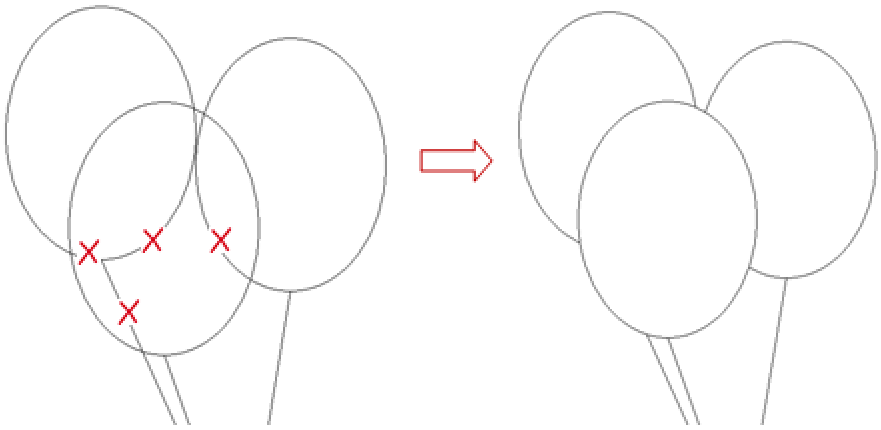
14 Snap a single **polyline** from the bottom of each balloon ellipse to the left hand corner of the cake ellipse as shown below.



15 Open **Trim Vectors** from the Vector Creation Toolbar.

16 The internal vectors representing the balloons will be removed using this tool.

- Select the inner ellipse and polyline vectors to trim as indicated.



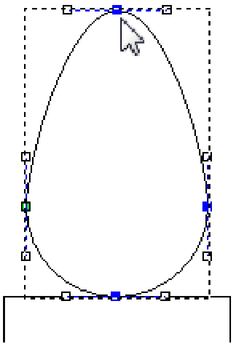
Candles will now be created for the cake itself.

17 Create a **Rectangle** with a **Width 10mm** *(0.375")*, **Height 30mm** *(1.2")*, Corner Radius 0mm and a **Centre Point X -50** *(-2")* and **Y -50** *(-2").*

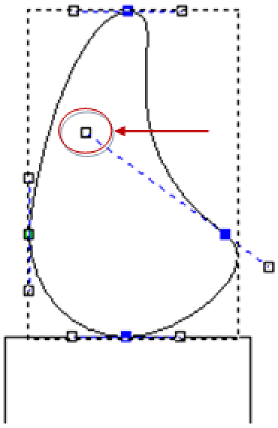
18 Create a **Circle** with a Centre Point X -50 *(-2")*, Y -31 *(-1.25")* and a radius 4mm *(0.15").*

19 With the new circle selected, enter **Node Editing**

20 Use the cursor to select and dynamically drag the top node upwards as shown.

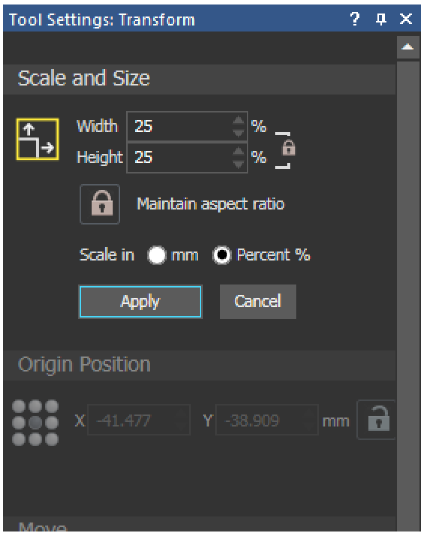


21 Drag the upper control point (white squares) of the right hand node inwards to create a flame effect.



22 Exit Node Editing.

23 Select the rectangle and 'flame' vector and then open **Transform** (or hit T on the keyboard).



Tool Settings: Transform

Scale and Size

Width 25 %
Height 25 %

Maintain aspect ratio

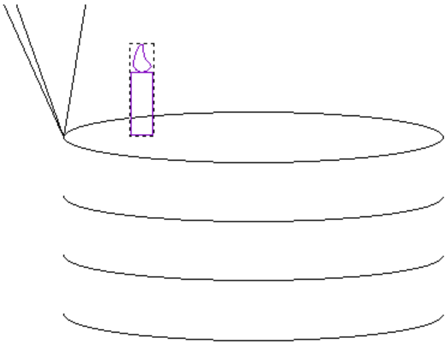
Scale in ○ mm ● Percent %

24 Change Scale to percent % and ensure both width and height are linked.

25 Change the **Scale** to **25%** and then press **Apply.**

Both vectors are relatively scaled down to a realistic size, and will now be moved into position.

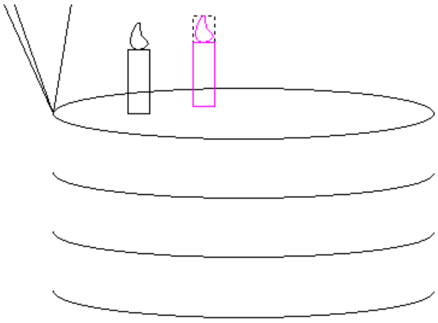
26 With both vectors selected, dynamically drag the vectors onto the cake as shown.



Multiple copies of vectors can quickly be achieved by using/holding the CTRL key.

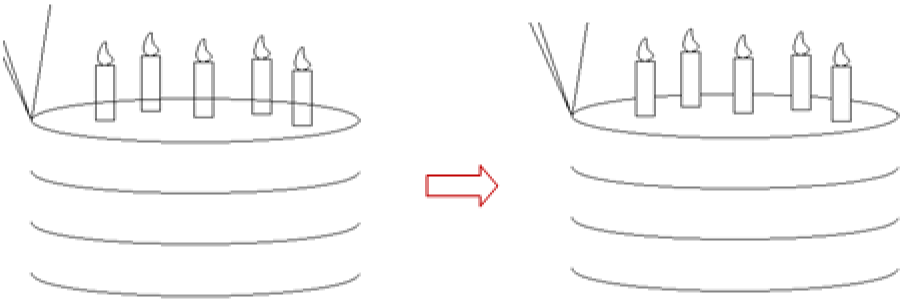
27 Ensure both candle vectors are still selected.

28 With the **Ctrl** key pressed, use the left mouse to select and drag a new copy of the candle to a suitable position on the cake.



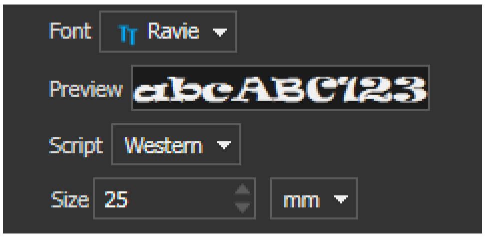
29 Repeat three more times to produce a total of **5** candles.

30 Use **Trim Vectors** to remove the small ellipse vectors passing through the candles.



Create Year Number

1 Open **Create Vector Text** and apply the following settings.



Font Ravie

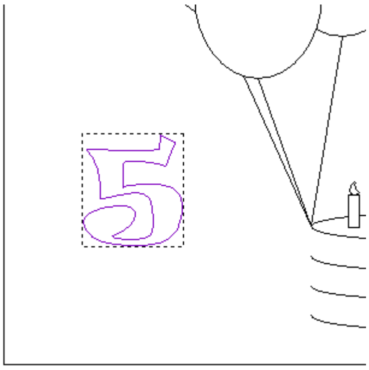
Preview abcABC123

Script Western

Size 25 mm

2 Use a text size **25mm** *(1").*

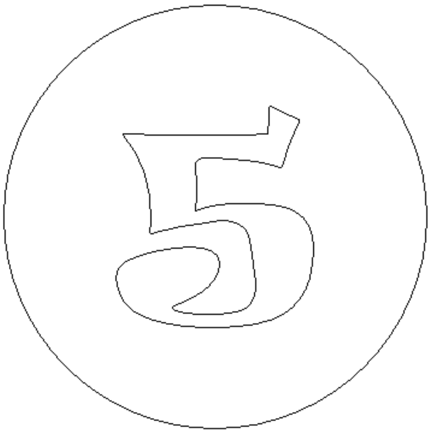
3 Position the cursor in the bottom left area of the model and enter the number **5.**



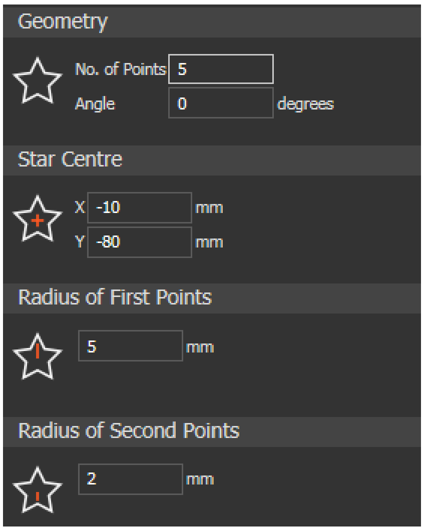
4 Open **Create Circle.**

5 Move the cursor over the centre of the number 5 until it changes to an ⌖ icon indicating the centre is located.

6 Drag out a circle to approximately **25mm** *(1")* radius.



7 Create a **Star** vector with the following settings. No of points **5**, star centre at **X -10** *(-0.375")*, **Y -80** *(-3.15")*, Radius of first points as **5mm** *(0.2")* and second points as **2mm** *(0.075").* Click **Create** and **Cancel**



Geometry

No. of Points 5

Angle 0 degrees

Star Centre

X -10 mm

Y -80 mm

Radius of First Points

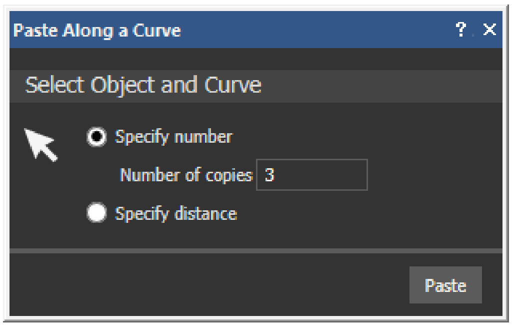
5 mm

Radius of Second Points

2 mm

8 Shift-select the star and the large circle vector around the number 5.

9 From the **Fill Tools** toolbar, open **Paste along Curve.**



Paste Along a Curve

Select Object and Curve

● Specify number

Number of copies 3

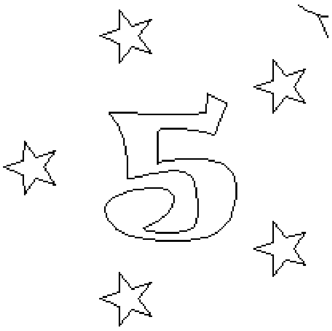
○ Specify distance

The vector is pasted incrementally along the curve either by dividing the curve equally (Specify Number), or by a fixed distance, leaving any surplus at the end of the curve (Specify Distance).

10 Select Specify Number and enter **Number of Copies** as **5.**

11 Select **Paste.**

12 Delete the original Star vector and the large circle.

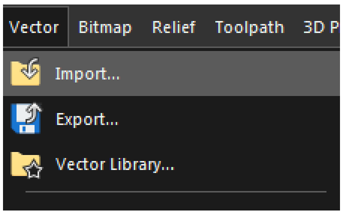


The card will be completed with an imported border feature.

13 Select and delete the large original border rectangle.

Vectors can be imported by using either the vector layers toolbar (to be discussed later) or from the main pull down menu.

14 From the pull down menu, select **Vectors** and then **Import.**

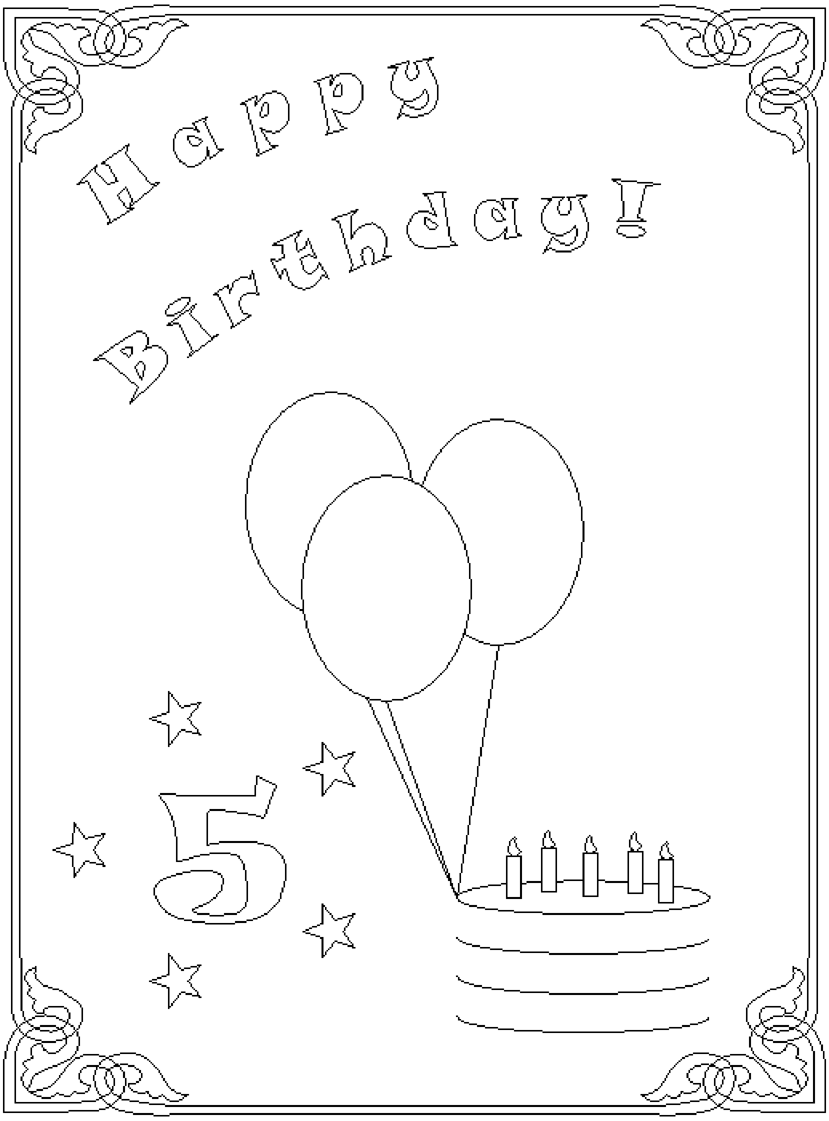

Vector
Bitmap
Relief
Toolpath
3D P
Import...
Export...
Vector Library...

15 Browse to and open **border feature.eps.**

16 (The design is imported into the current model and completes the design).

17 Select **File > Save As** and enter the name **Birthday Card** and then **Save.**

18 Select **File > Close** Model.


Happy
Birthday!
5

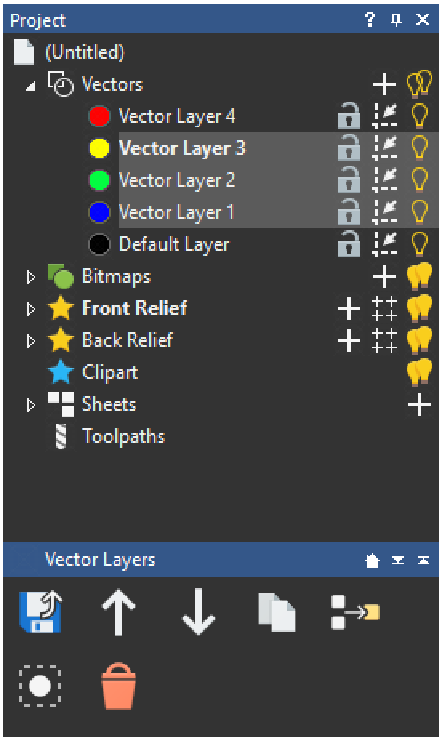
Example 3-4

Follow along with the teacher to complete the Example.

Layers:

Vector Layers provide a more ordered method of managing the selection and display of selected groups of vectors. In default mode, ArtCAM assigns all vectors produced to a layer named the Default Layer (which cannot be deleted). Any additional Vector Layers can be Renamed, Deleted and Merged together. As new Layers are created, specific group of vectors are assigned to them as required.

Vector Layers within ArtCAM can be managed in a number of ways. The most common is Through the Project Panel.


Project
(Untitled)
Vectors
Vector Layer 4
Vector Layer 3
Vector Layer 2
Vector Layer 1
Default Layer
Bitmaps
Front Relief
Back Relief
Clipart
Sheets
Toolpaths
Vector Layers

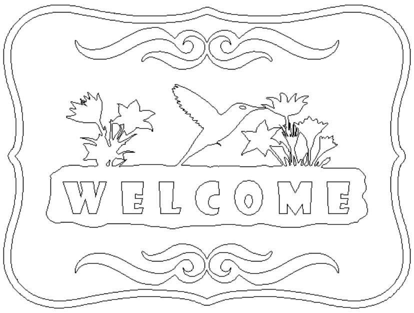
The Project panel allows for an efficient flow for creating and managing all major design and machining aspects of the ArtCAM model.

Example 3-5

Follow along with the teacher to complete the Example.

Summary Tutorial: Welcome Plaque

Students are to complete tutorial.



Welcome Plaque Border Image

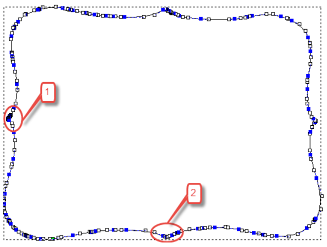
1. **Open base.jpeg**
- **Width** of **1220mm** *(48″),* **Origin** to **lower left corner**
2. **Bitmap to Vector**
- **Reduce Colours - 3**
- dark blue as the **primary colour.**
- **Create Vectors**
3. Click on **lightbulb** to hide **Bitmap Layers.**

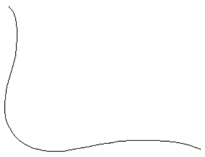
Welcome Plaque Vector Layers

4. **New Vector Layer**
5. change name in lower panel to **border** then **Apply**
6. Select border vector and right click, **Move Vectors To…** **border**

Welcome Plaque Border

7. Delete outer rectangle vector and small cluster of vectors.
8. **Node Editing - Cut Vector**
9. delete large vector to leave only bottom left vector.





10. **Mirror Vectors**
- Check Copy and Join
- Mirror Right
- Mirror Top

11 **F9**

Welcome Plaque Scroll

12 **Bitmaps Layers - Import Image - scroll single.jpeg**

13 **New Vector Layer**

- **Rename - scroll**

14 **Bitmap to Vector**

- **Reduce Colours - 2**
- dark blue as **primary colour.**
- **Create Vectors**

15 **Hide Bitmap Layers**

16 **Transform Vectors -** scroll

- scale **150%** and **Apply.**

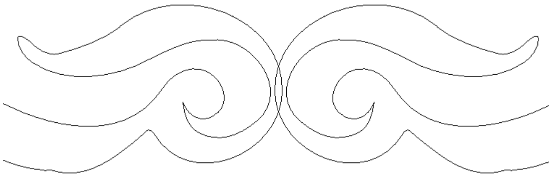
17 **Spline Vectors**

- **Tolerance 1** *(0.05")*

18 **Mirror vectors**

19 Copy - Right

20 Use arrow key to nudge until they slightly overlap



21 **Weld Vectors**

22 **F9**

23 **Alt** and drag it down towards **bottom**

24 **Mirror Vectors - Over Model**

Welcome Plaque Design

25 **Bitmap Layers - Import - welcome bird.jpeg.**

26 **New Vector Layers** and **Rename** it to **design**

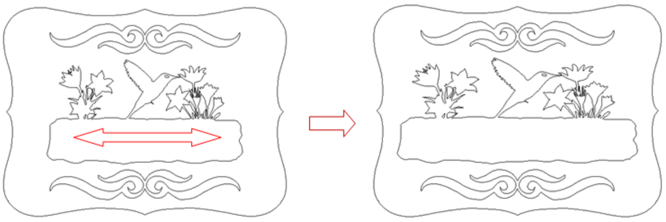
27 **Bitmap to Vector**

- **Reduce Colours - 2**
- black as the **primary colour.**
- **Create Vectors**

28 **Hide** the **Bitmap Layers**

29 **Transform Vectors**

- **scale** to **120%** and **Apply**
- Unlock **Maintain aspect ratio**
- **New Width** to **900mm** *(35.5″)*



30 **New Vector Layers** - **Rename** it to **text**

31 **Create Vector Text.**

- Font **Showcard Gothic**, Size **90mm** *(3.5″)* and Character Spacing of **160%.**
- Type **WELCOME**

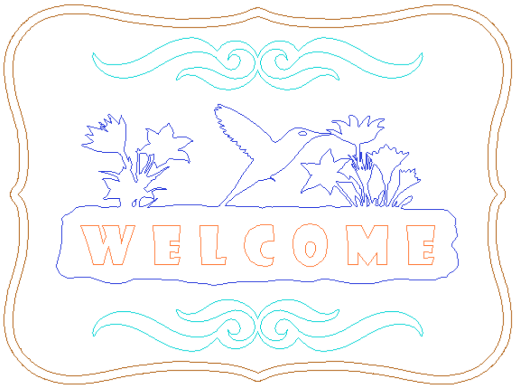
32 Drag to position

33 **Activate** the **border Vector Layer**

34 Offset Vectors - border

- distance **20mm** *(0.75″)* **Outwards** with **Sharp** corners.

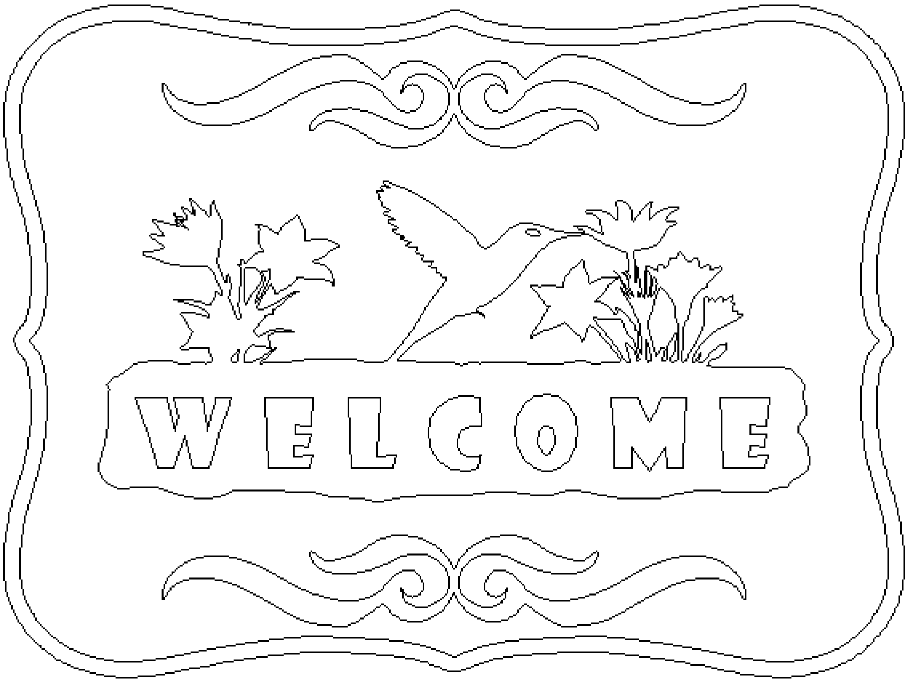
35 Change Vector Layer colours



Tutorial: Welcome Plaque

The second tutorial demonstrates further functionality to create a Welcome Sign/Plaque as shown below. Additional tools shown include Offset Vectors, Weld Vectors and Mirror Vectors.

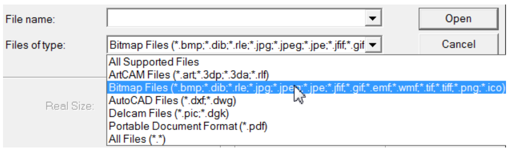
The main design features are generated using Imported Bitmaps. Reducing colours of an imported Bitmap and the powerful Bitmap to Vector will be utilized extensively.



Welcome Plaque Border Image

1 Select **Open** to open an existing model.

2 Change **Files of type**: to **Bitmap Files.**

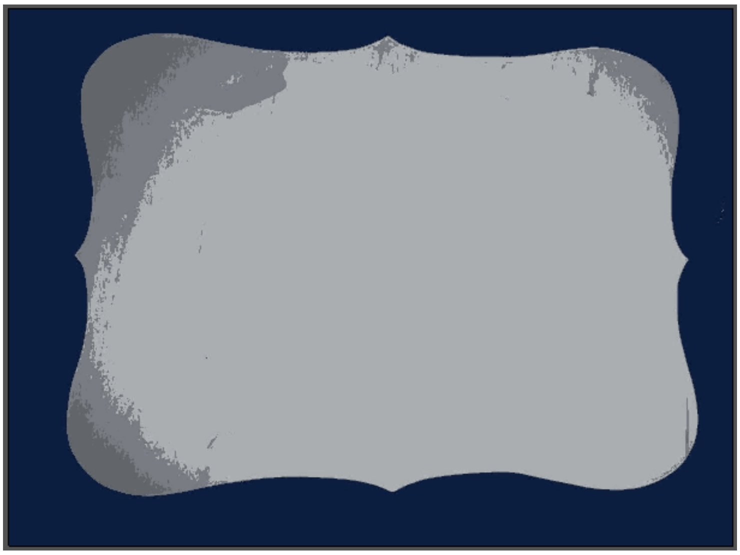

File name:
Open
Cancel
All Supported Files
ArtCAM Files (*.art;*.3dp;*.3da;*.rlf)
Bitmap Files (*.bmp;*.dib;*.rle;*.jpg;*.jpeg;*.jpe;*.jfif;*.gif;*.emf;*.wmf;*.tif;*.tiff;*.png;*.ico)
AutoCAD Files (*.dxf;*.dwg)
Delcam Files (*.pic;*.dgk)
Portable Document Format (*.pdf)
All Files (*.*)
Real Size:

Files of type: Bitmap Files (*.bmp;*.dib;*.rle;*.jpg;*.jpeg;*.jpe;*.jfif;*.gif

3 Open the file plaque **base.jpeg.**

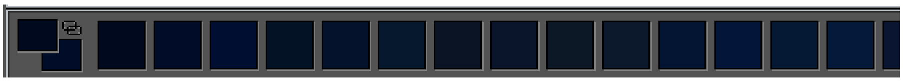
4 Enter a **Width** of **1220mm** *(48”).*

5 Set the **Origin** to the **lower left corner** of the model then **OK.**



The design can done from either 3D View or 2D View. To switch between views, click on the appropriate tab above the view.

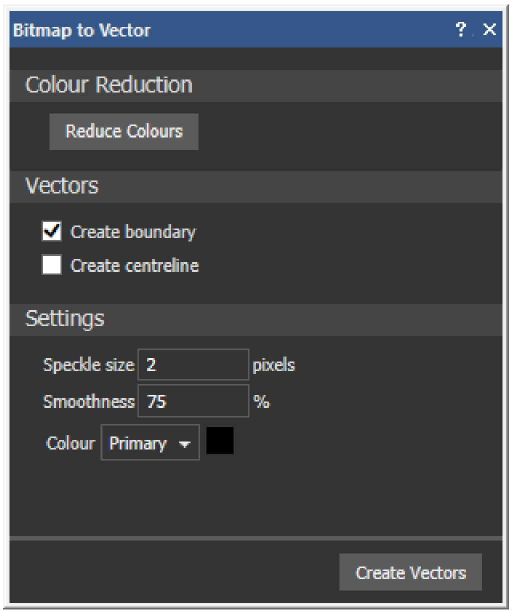
A new model is generated from the Bitmap based on the dimensions. ArtCAM displays all the colours that make this Bitmap at the bottom of the screen. The number of colours will firstly be reduced to a manageable level.



The Bitmap To Vector feature calculates the vector boundary of the selected primary colour in the bitmap image. This will be utilized to generate the outside boundary of the plaque border.

Bitmap or image colours can be reduced using the stand alone function Reduce Colours or directly within the Bitmap To Vector function.

6 Open **Bitmap to Vector.**



Bitmap to Vector

Colour Reduction

Reduce Colours

Vectors

☑ Create boundary

☐ Create centreline

Settings

Speckle size 2 pixels

Smoothness 75 %

Colour Primary ■

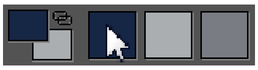
Create Vectors

7 Click on the **Reduce Colours** button.

This form allows the number of colours in the Bitmap to be reduced by entering the required number or moving the slider bar.

8 Change the Number of colours to **3** before selecting **Apply.**

The colour palette now shows the only three colours that represent the Bitmap.

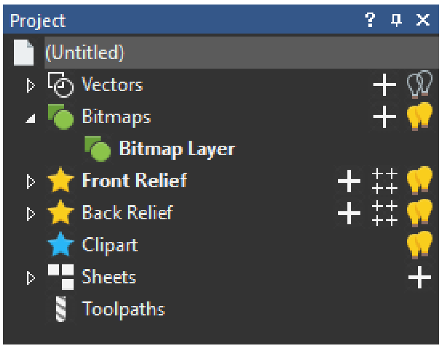
9 Click on the dark blue colour directly from the palette to assign it as the **primary colour.** 

10 With the default settings shown above, Select **Create Vectors** then close the panel.

A vector has been generated on the boundary of the selected primary colour. The Bitmap is not required so will be hidden.

11 In In the Project tree, click the plus **+** next to **Bitmaps** to display the Bitmap Layers.

12 Click on the **lightbulb** to hide the **Bitmap Layers.**



Project
(Untitled)
Vectors
Bitmaps
Bitmap Layer
Front Relief
Back Relief
Clipart
Sheets
Toolpaths

Welcome Plaque Vector Layers

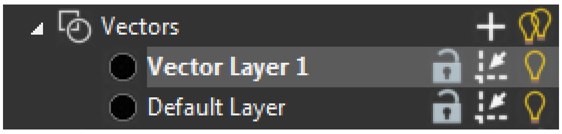
The vector data is currently on the Default Layer. The visibility can be shown and hidden by selecting the light bulb adjacent to the Default Layer name.

Ideally Layers should be generated before vector creation so they can be placed into them. It is good practice to give the layer a sensible name. If a new layer is created and then made active (by selecting it), all newly created vectors are placed on this active layer.

However, a Vector Layer can also be created afterwards and the vector moved to the new layer.

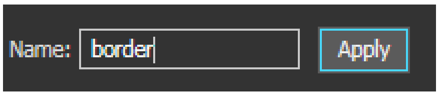
13 Ensure the **Default Layer** is selected in the project panel

14 Select **New Vector Layer** in the lower panel



__Vector Layer 1__ has been created and added to the Vectors tree.

15 Select **Vector Layer 1**, and change the name in the lower panel to **border** then **Apply**


Name: border

The new level is now named and visible (denoted by the light bulb icon).

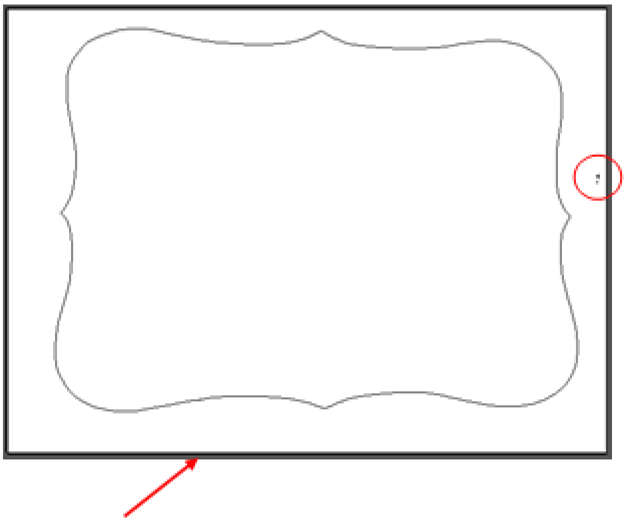
The existing vector can now be moved to the new layer.

16 Select the border vector and right click with the mouse.

17 Select **Move Vectors To…** **border**

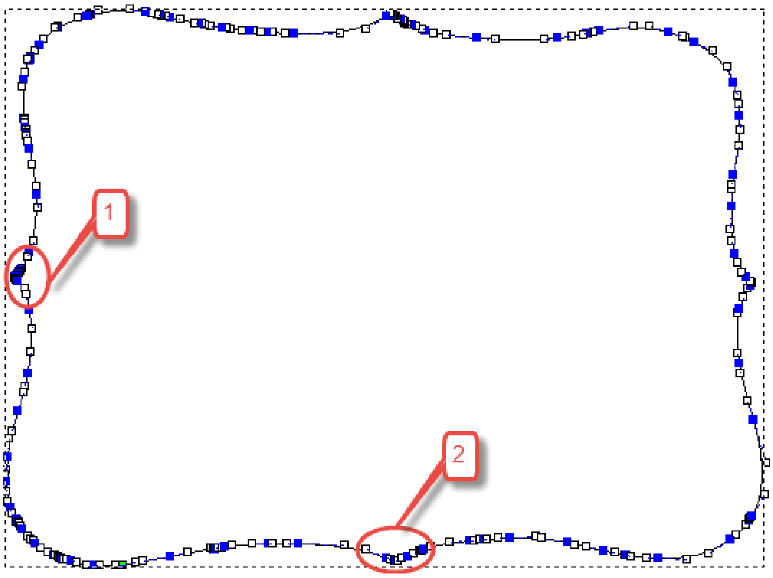
Welcome Plaque Border

1 Delete the outer rectangle vector and small cluster of vectors indicated.



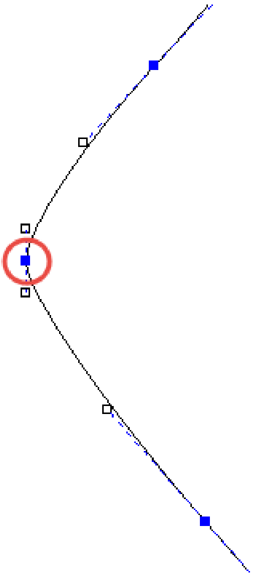
The original Bitmap of the Plaque border is not symmetrical, so the above vectors will be modified to 'improve' the final design.

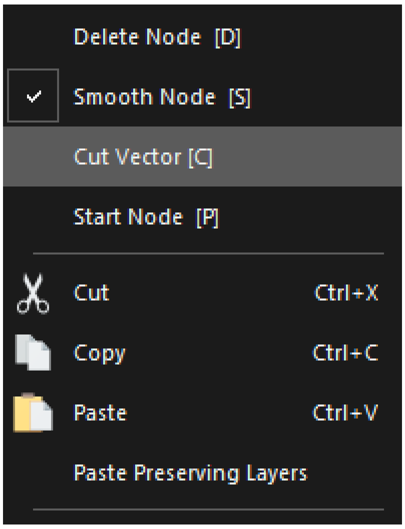
2 With the border vector selected, enter **Node Editing.**



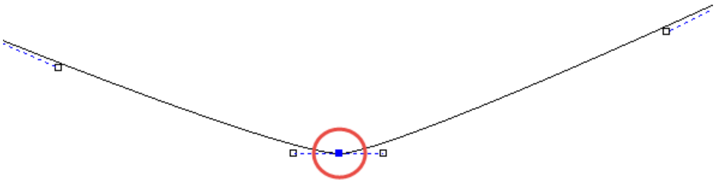
3 Zoom into the area indicated with the number **1**

4 Right mouse click over the left corner node and select **Cut Vector.**



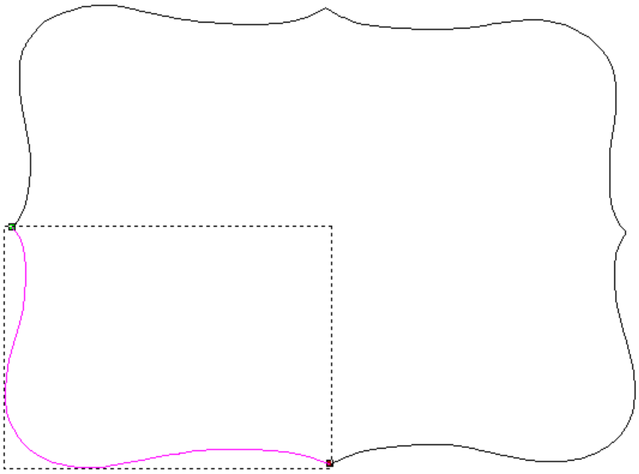

Delete Node [D]
✓ Smooth Node [S]
Cut Vector [C]
Start Node [P]
Cut Ctrl+X
Copy Ctrl+C
Paste Ctrl+V
Paste Preserving Layers

5. Zoom into the area indicated as **2**, and **Cut** the lowest corner node as shown below.

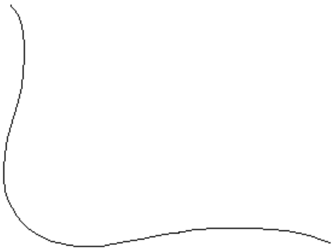


6. Pres **Esc** to exit node editing.

   The lower left section of the initial plaque vector has been seperated at the node cut points.

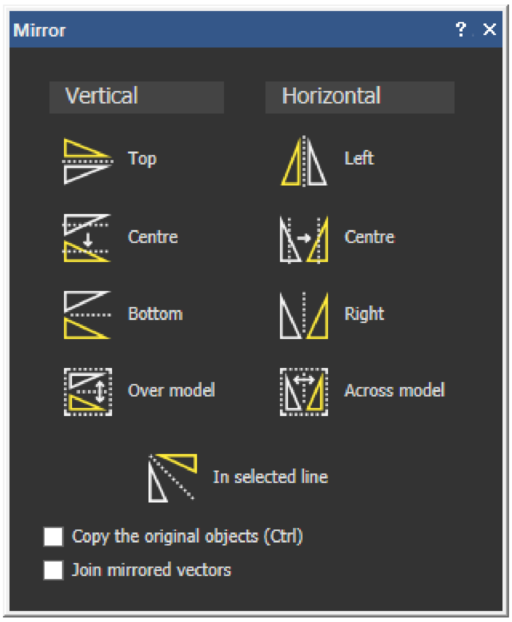


7. Select and delete the large vector to leave only the bottom left vector.



The plaque vector will be recreated symetrically using this vector.

8 Highlight the remaining vector and open **Mirror Vectors** from the **Vector Editing** toolbar.



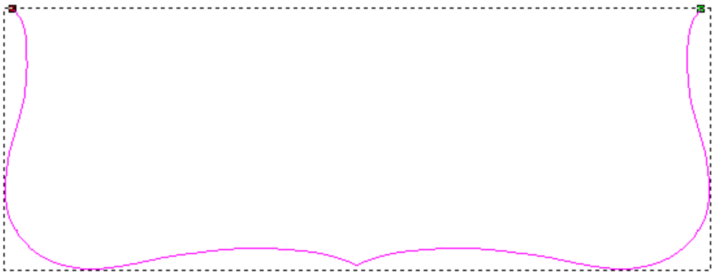
Mirror
?
Vertical
Horizontal
Top
Left
Centre
Centre
Bottom
Right
Over model
Across model
In selected line

☐ Copy the original objects (Ctrl)

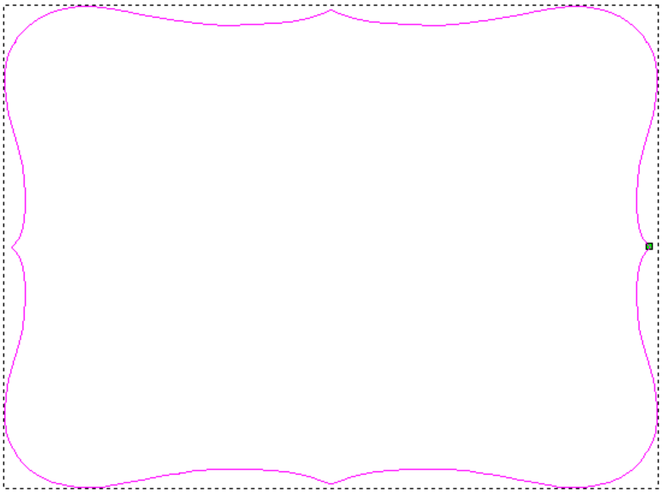
☐ Join mirrored vectors

9 Ensure Copy the Original Vectors is checked, as well as Join mirrored vectors before selecting Right (Do not close the form).

The vector has been mirrored to its right hand side.



10 Select Top to mirror this new vector upwards.



11 Close the **Mirror Vectors** panel.

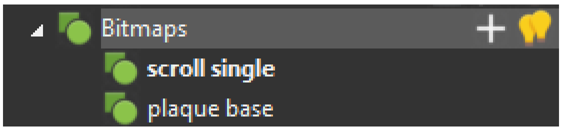
12 With the vector still selected, Select **Centre in Page** or **F9** on the keyboard.

The inner plaque design will now be completed.

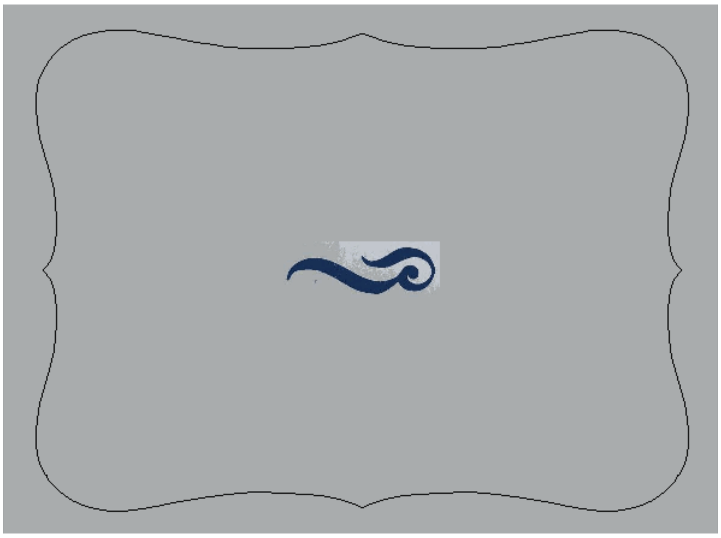
Welcome Plaque Scroll

1 Select to highlight **Bitmaps** in the Project Tree, then **Import Image** from the associated lower panel.

2 Select file **scroll single.jpeg** and open.



The bitmap is loaded into the current model and listed in the Bitmaps Project tree.

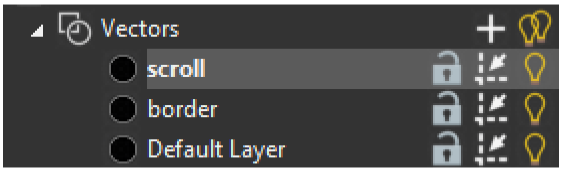


3 Right click on **Vector Layers** in the Project Tree and select **New**

4 Right click the new Vector Layer 1 and choose **Rename.** Call this new layer **scroll.**

Scroll is the current active vector layer, any vectors created will be drawn on the Scroll layer.

The bold layer is the active layer



Next the colours will be reduced and traced.

5 Open **Bitmap to Vector.**

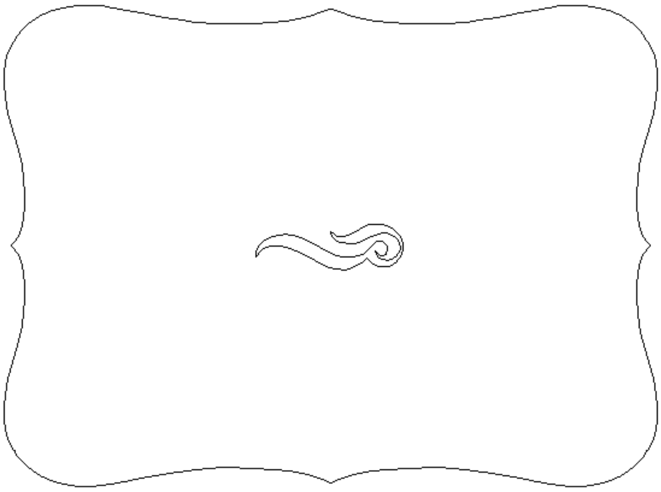
6 Click on the **Reduce Colours** button.

7 Change the Number of colours to **2** before selecting **Apply.**

8 Click on the dark blue colour directly from the palette to assign it as the **primary colour.**

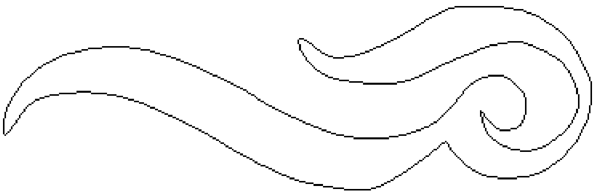
9 Select **Create Vectors** and close the panel.

10 **Hide** the **Bitmap Layers** by clicking on the light bulb in the Project Tree.



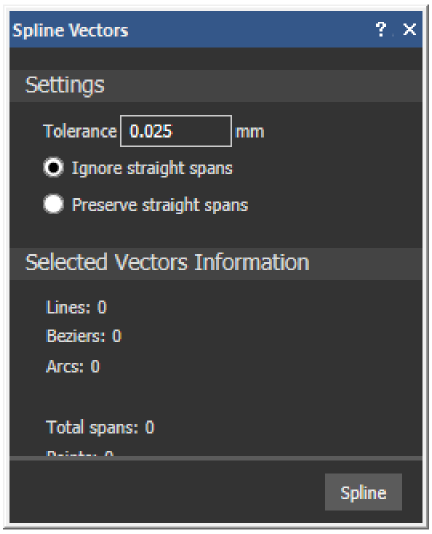
11 Select the new scroll vector and then Open **Transform Vectors.**

12 Increase the scale to **150%** and then **Apply.**



The vector has increased in scale by **50%**. The smoothness of the curves can be improved even further by using Spline Vectors, but this is not necessary.

13 Highlight the scroll vector and then Open **Spline Vectors** (listed with the Arc Fit tool).



Spline Vectors

Settings

Tolerance 0.025 mm

● Ignore straight spans

○ Preserve straight spans

Selected Vectors Information

Lines: 0

Beziers: 0

Arcs: 0

Total spans: 0

The Vectors information area summarizes the number of spans that represent the selected vector. Currently, the scroll vector is made up of 44 Bezier curves, 2 lines and 134 points.

By adjusting the tolerance, the spans will recalculate to produce the shape based on this new fitting tolerance. In this instance, the tolerance will be increased to smooth out the overall shape.

14 Enter a **Tolerance 1** *(0.05")* and press **Spline.**

Total number of span has been reduced to 26 and points to 78. (slightly different if using imperial units). This also makes it easier to edit the shape in Node editing as the number of nodes are reduced.

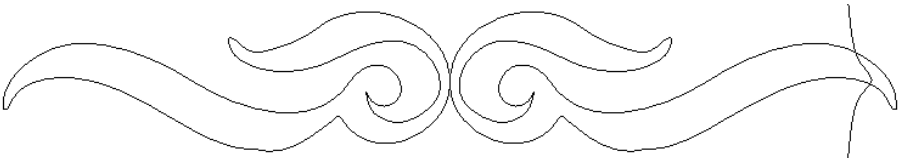
15 With the same tolerance, select **Spline** again. The shape will improve slightly further as the points are redistributed.

16 **Close** the panel.

17 With this vector highlighted, Open **Mirror vectors** .

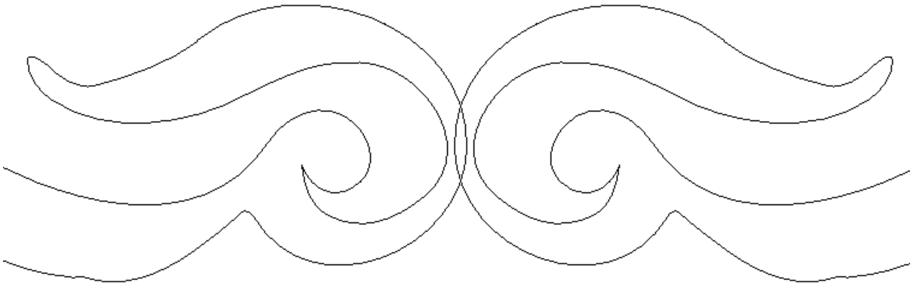
18 Ensure Copy the Original Vectors is checked, before selecting Right.

19 Close the panel.

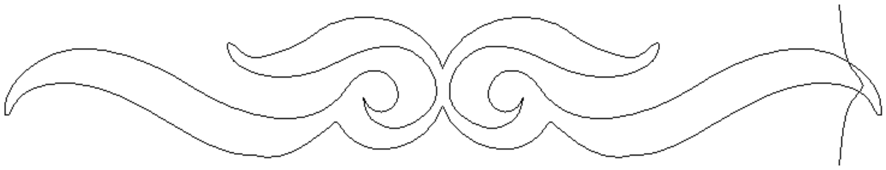


The two vectors will be combined to create a single design.

20 Select the right hand side (mirrored) vector only and use the arrow key on your keyboard to nudge it left until they slightly overlap.



21 With both vectors selected, open **Weld Vectors** .

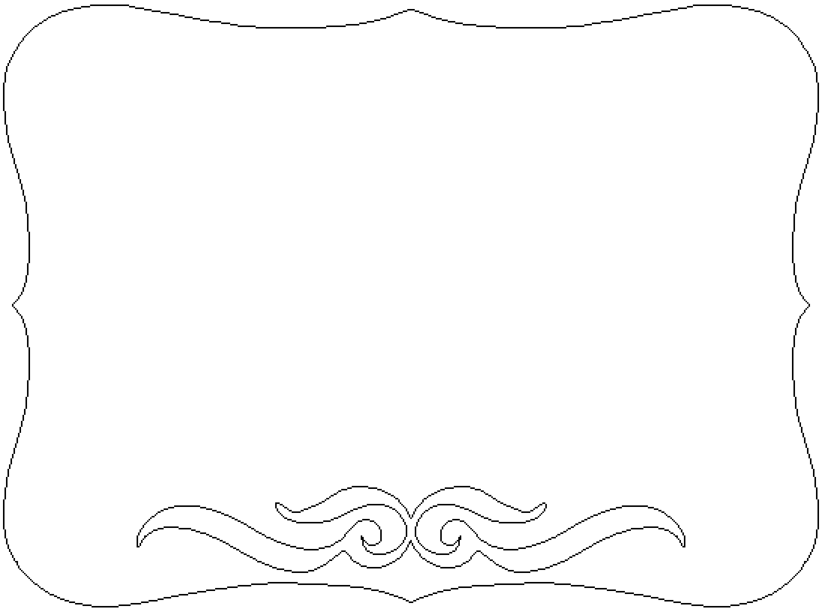


The overlap is removed to create a single closed vector. It will now be moved to a suitable position.

22 With the scroll selected press **F9** to center it.

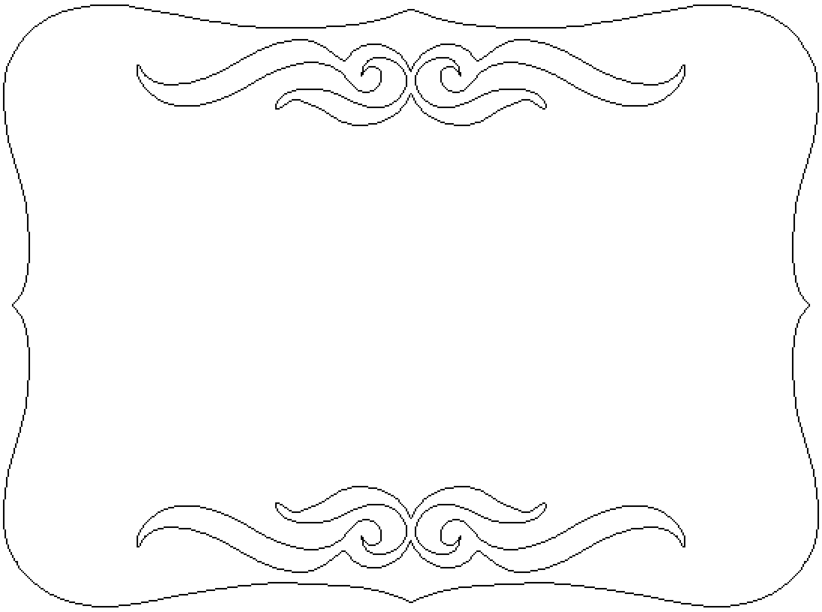
23 Hold the Alt key and drag it down towards the bottom as shown.

The Alt key will hold the vector straight while moving it.



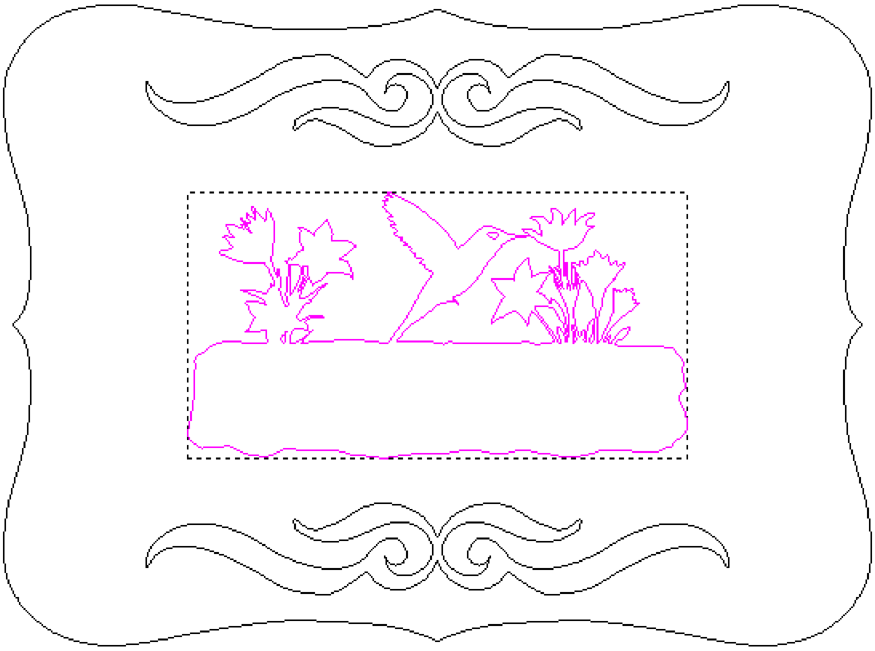
24 Select the scroll vector and open **Mirror Vectors** from the **Vector editing** toolbar.

25 Select **Over Model.**



Welcome Plaque Design

1. From the **Bitmap Layers** in the Project Tree, **Import** the **welcome bird.jpeg.**
2. Click on the **New Vector Layers** +plus sign in the Project Tree next to Vectors to create a new Layer
3. Do a slow double click on the new Vector Layer and **Rename** it to **design**
4. Open **Bitmap to Vector.**
5. Click on the **Reduce Colours** button.
6. Change the Number of colours to **2** before selecting **Apply.**
7. Click on the black from the palette to assign it as the **primary colour.**
8. Select **Create Vectors** and close the panel.
9. **Hide** the **Bitmap Layers** by clicking on the light bulb in the Project Tree.



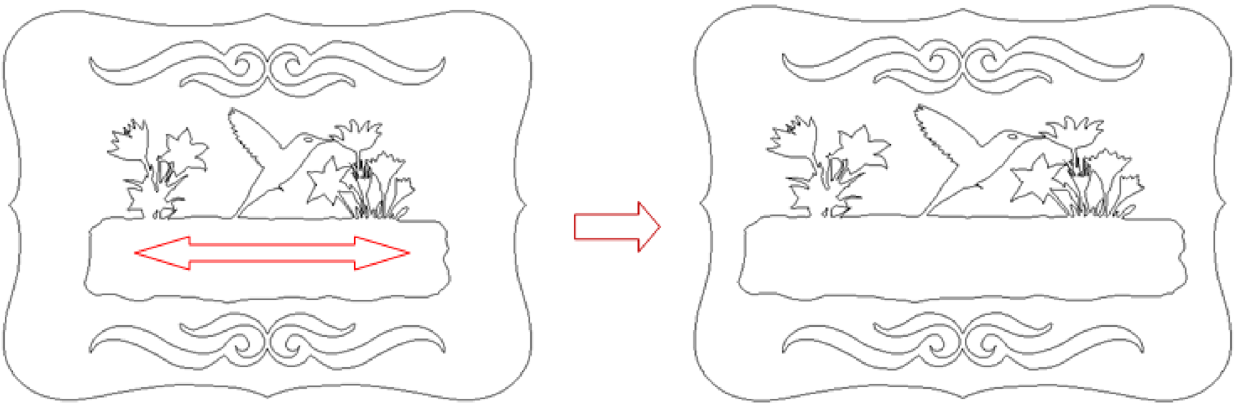
10 Select the vectors as shown above open **Transform Vectors.**

11 Increase the **scale** to **120%** and press **Apply** (Do not close the form).

12 The vectors have scaled relatively in both the X and Y direction. A scaling will be applied again but this time in the X direction only. This will result in the vectors 'stretching' to fill the available space better.

13 Unlock the option **Maintain aspect ratio** in the **Scale and Size** part of the form.

14 Change the scale to mm and increase the **New Width** to **900mm** *(35.5")*.



The Vectors have rescaled but in the X axis (horizontally) only.

15 Click on the **New Vector Layers** +plus sign in the Project Tree next to Vectors to create a new Layer

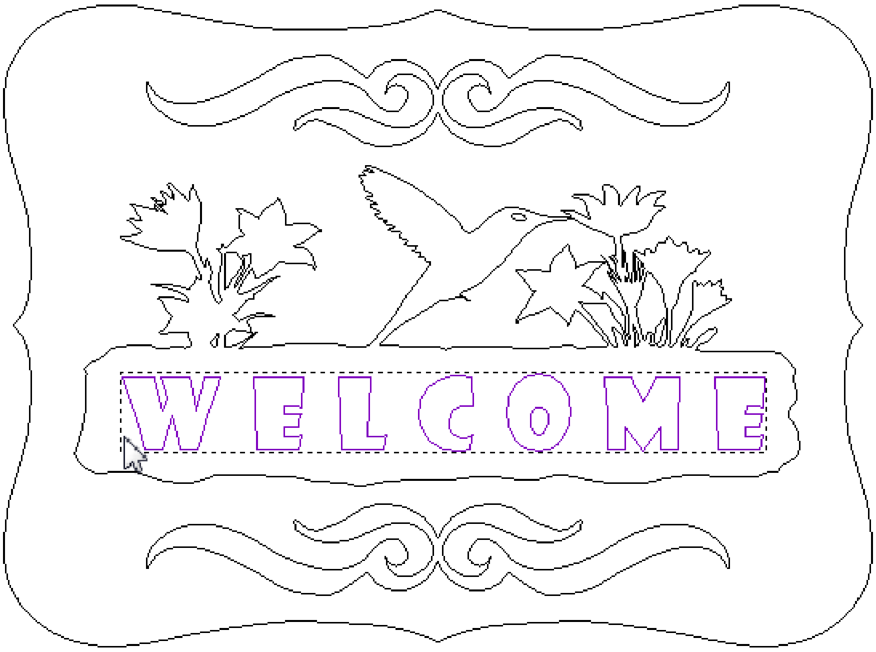
16 Do a slow double click on the new Vector Layer and **Rename** it to **text**

17 Open **Create Vector Text.**

18 Change to Font **Showcard Gothic**, Script Western, Size **90mm** *(3.5")* and Character Spacing of **160%.**

19 Type **WELCOME**

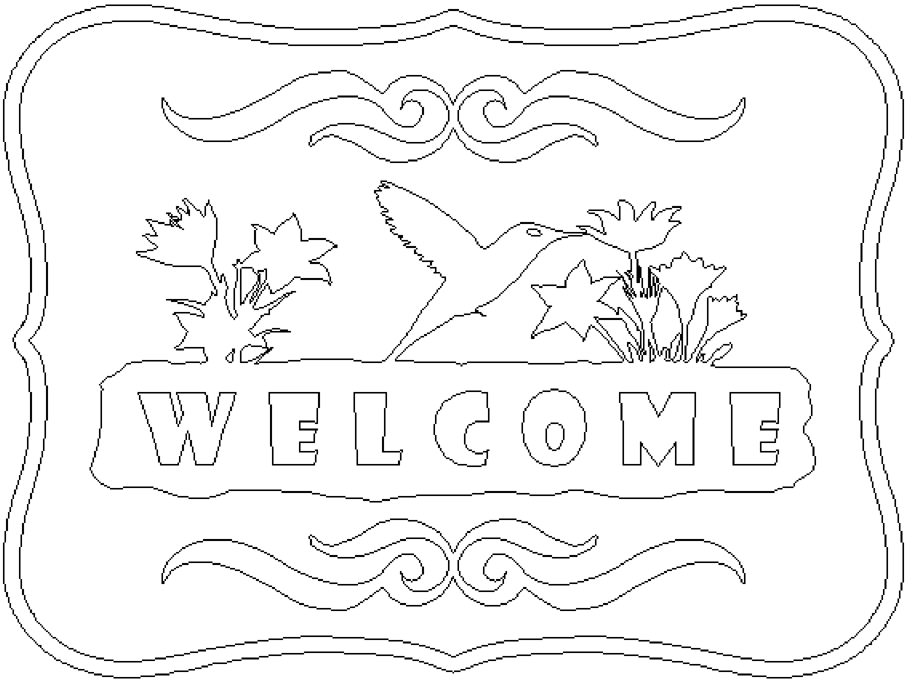
20 Drag to position the text block as shown.



21 **Activate** the **border Vector Layer** by clicking on it

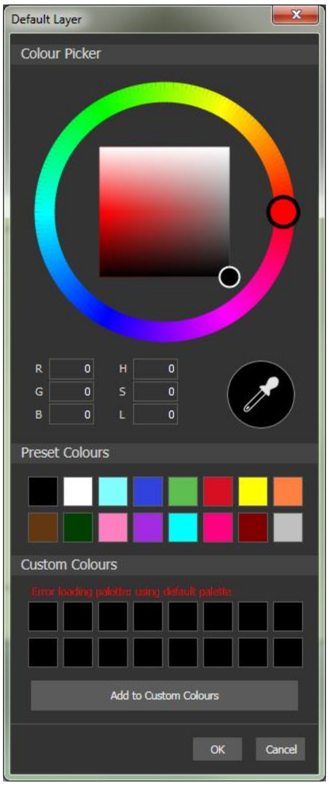
22 Select the outer main border vector and then Offset Vectors from the Vector Creation toolbar.

23 **Offset** a distance **20mm** *(0.75")* **Outwards** with **Sharp** corners.



The design is complete.

Changing the Vector Layer colour is very good way to visually organize the design. If required, selecting the black circle ● to the left of any Layer name allows you to assign a colour.

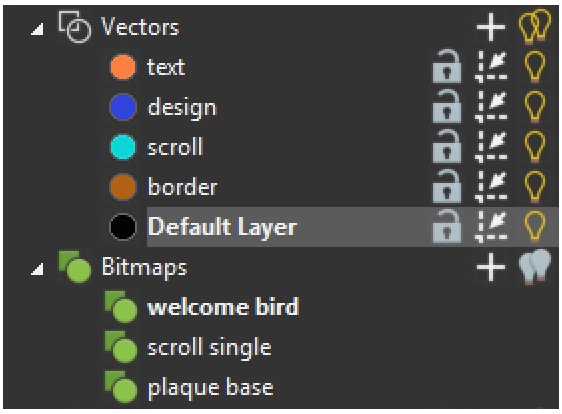

Default Layer
Colour Picker
R 0
G 0
B 0
H 0
S 0
L 0
Preset Colours
Custom Colours
Add to Custom Colours
OK
Cancel

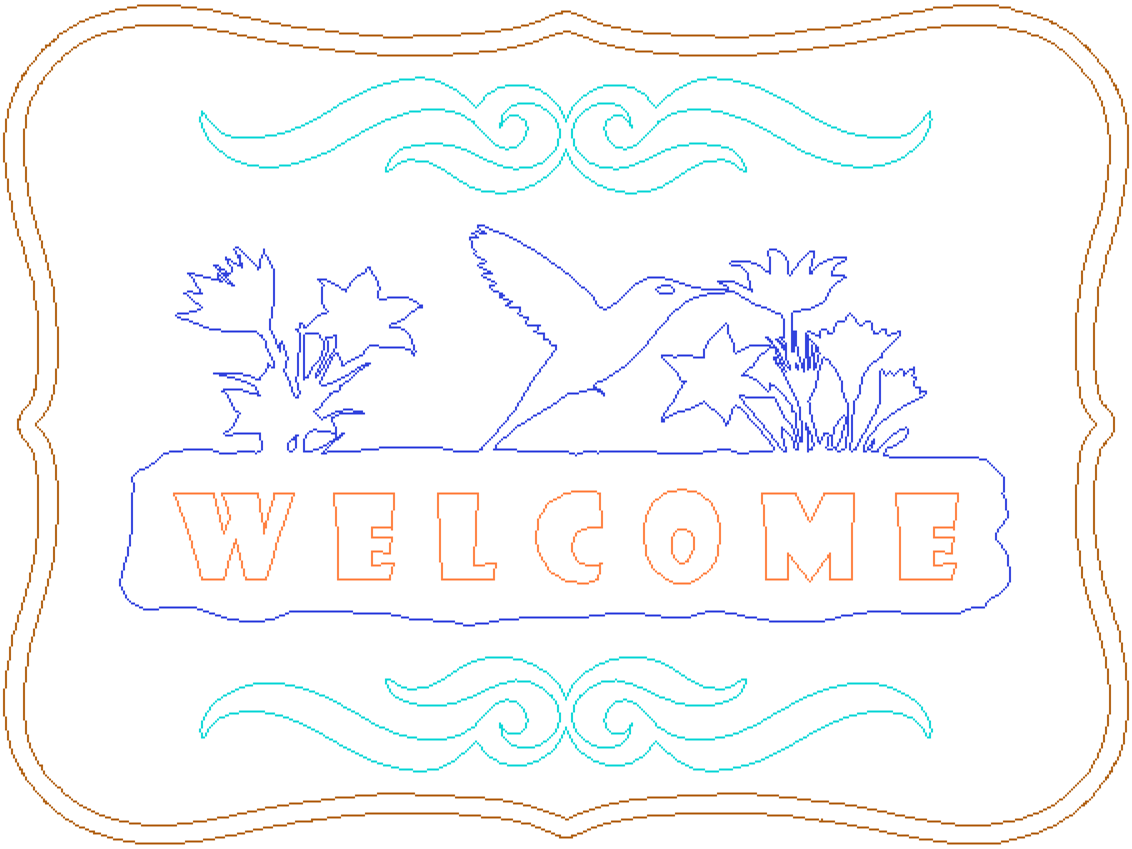
Error loading palette: using default palette

1 Click on the black colour swatch for the **text** Vector Layer

2 Set **Orange** as the new layer colour and press OK

3 Repeat for each Vector Layer, choosing your own colours.


Vectors
text
design
scroll
border
Default Layer
Bitmaps
welcome bird
scroll single
plaque base



4 Select **File > Save.** Enter the name **Welcome Plaque** and then **Save.**

5 Select **File > Close** Model.

4. 2D Machining

Introduction

This section covers the general layout found in most toolpath creation pages and the steps taken to generate a toolpath. Profiling Wizard is used as the example.

Functions

Profiling → Create a single line 2D toolpath that machines either along the vector or the outside or inside edge of a vector

2D Area Clearance → Create a 2D toolpath that machines/pockets out an area inside a vector using rest machining

V-Bit Carving → Create a 2.5D toolpath that engraves a V shape into a vector

Bevel Carving → Creates a 2.5D toolpath that engraves a prismatic/positive V shape into a vector

Drilling → Create a 2D rapid toolpath that plunges into vector areas

Delete Toolpath → Deletes the selected toolpath from the list

Tool Database → A database containing a broad range of pre-defined tools for machining

Material Setup → Specify the dimensions and origin of the material to be machined

Edit Toolpath → Change a previously generated toolpath

Save Toolpaths →Converts the toolpaths to a machine specific format using a post processor while it’s being saved

Simulate Toolpath → Mimics the toolpath machining into the material with video control to speed up or slow down

Delete Simulation → Deletes the current simulation, returning to the relief.

Reset Simulation → Resets the simulation block back to the flat defined sizes.

Toolpaths:

Clicking on Toolpaths in Project Tree will display all the Toolpath creation icons used to create new toolpaths.

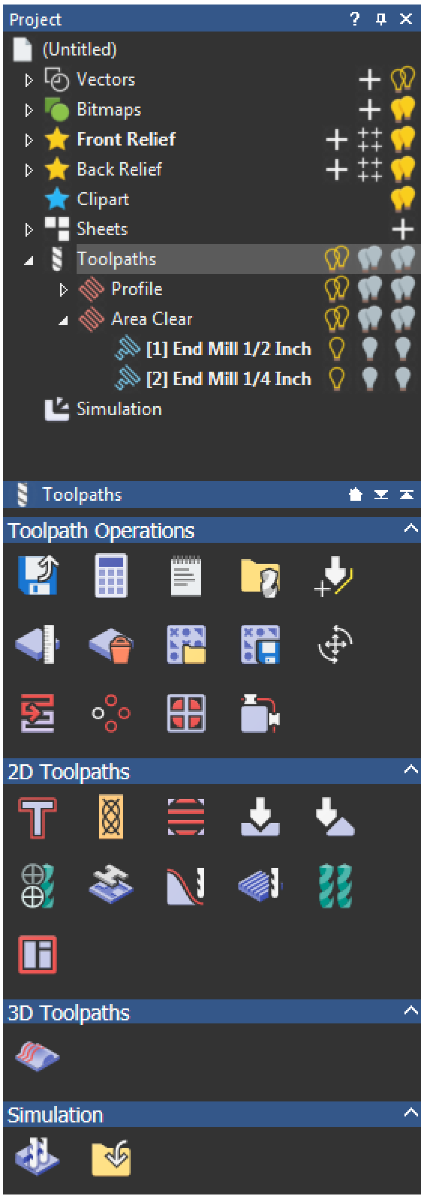
The Toolpaths that have been created are displayed in the Project Tree. Editing, Simulation, and management of all 2D and 3D toolpaths created happen here.

The tools to create new toolpaths are available in the Toolpaths Panel below the Project tree.

Also when you click on Toolpaths in the Project Tree, all the toolpaths that have been created are listed in the tree. The toolpaths are given a name depending on the type of toolpath and the tool used or using the name manually typed in when calculating it. You can control whether the toolpath is shown in the 2D and 3D Views. Simply turn on or off the light bulb icon to hide and show the toolpath.

All toolpaths can be edited using the original creation page for that specific toolpath by double clicking the toolpath name in the list.

Toolpath tree parameters look like this:

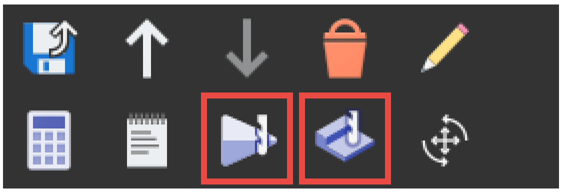

Project
(Untitled)
Vectors
Bitmaps
Front Relief
Back Relief
Clipart
Sheets
Toolpaths
Profile
Area Clear
[1] End Mill 1/2 Inch
[2] End Mill 1/4 Inch
Simulation
Toolpaths
Toolpath Operations
2D Toolpaths
3D Toolpaths
Simulation

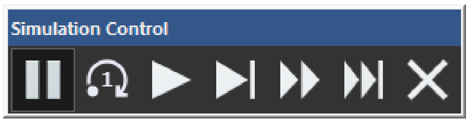
The **Toolpath Operations** section contains functions that are general to all toolpaths; such as save, delete, copy and merge existing toolpaths.

The **2D Toolpath** section contains all 2D and 2.5D toolpaths. These toolpaths must all be generated within a vector boundary and typically to a specific depth (completely ignoring the relief).

The **3D Toolpaths** section contains all 3D toolpaths. These toolpaths are generated around the contour of a relief.

To simulate a toolpath, simply click on the desired toolpath in the Project Tree and select the Simulate Toolpath icon. If Simulate Control is chosen, the Panel will pop up giving you simulation controls.




Simulation Control

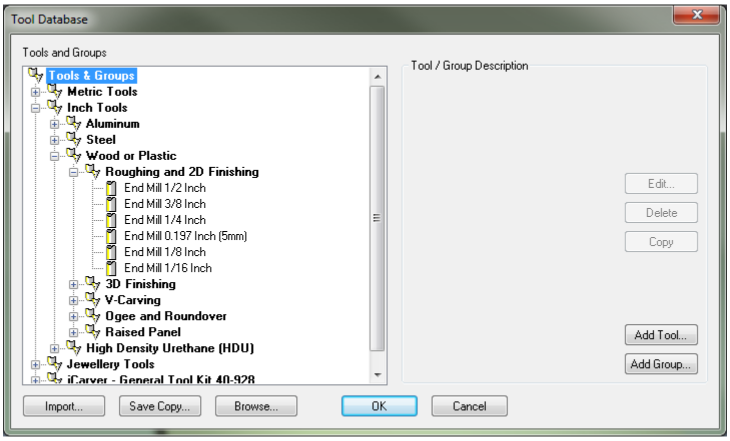
If you click on a toolpath you get the Parameters Panel below the tree. The parameters panel displays information on the selected toolpath and allows you to change certain parameters without having to re-calculate the toolpath.

Example 4-1

Follow along with the teacher to complete the Example.

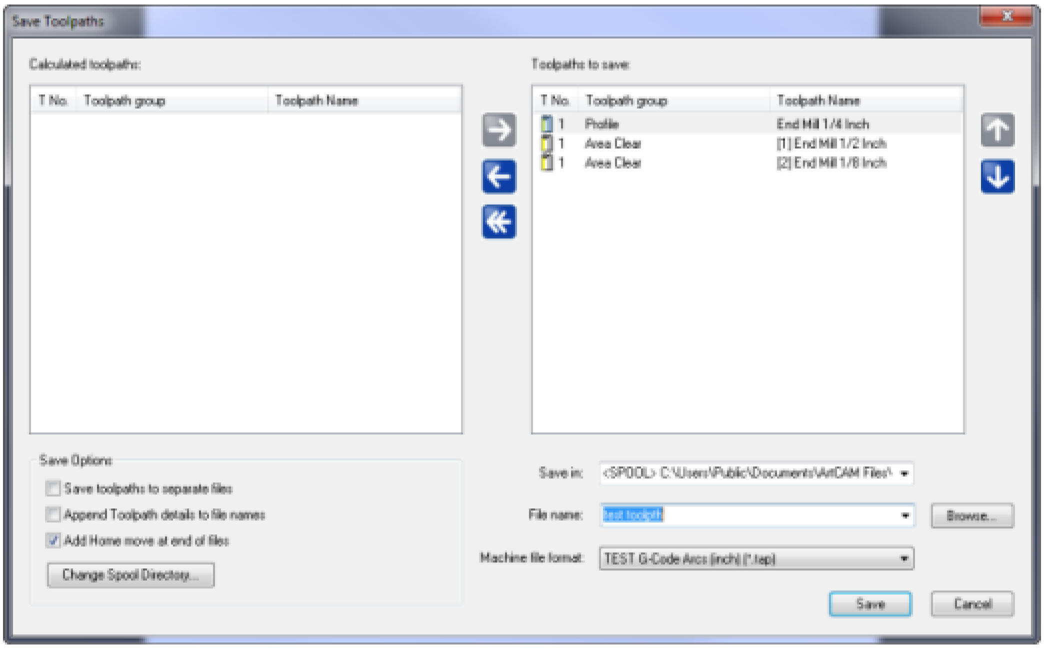
Tool Database:

The Tool Database is split into two main groups, Metric and Inch. Inside the main section, there are material sections such as Steel, Wood or Plastic and HDU. Inside the material section, you will typically find the same sections with the same tools, Roughing and 2D Finishing contain end mills, 3D Finishing contain ball nose tools, and V-Carving contain V-bit tools. Even though similar tools are found in each section, they all have different feeds and speeds, depending on the type of material. This is set up for general use; you can create your own sections and tools according to the materials and tools you use in your shop.


Tool Database
Tools and Groups
Tools & Groups
Metric Tools
Inch Tools
Aluminum
Steel
Wood or Plastic
Roughing and 2D Finishing
End Mill 1/2 Inch
End Mill 3/8 Inch
End Mill 1/4 Inch
End Mill 0.197 Inch (5mm)
End Mill 1/8 Inch
End Mill 1/16 Inch
3D Finishing
V-Carving
Ogee and Roundover
Raised Panel
High Density Urethane (HDU)
Jewellery Tools
iCarver - General Tool Kit 40-928
Tool / Group Description
Edit...
Delete
Copy
Add Tool...
Add Group...
Import...
Save Copy...
Browse...
OK
Cancel

Save Toolpaths:

The Save Toolpath function will save toolpaths created in ArtCAM to a language your machine will understand. The toolpath in the right hand section is the toolpath you are saving. The toolpaths in the left hand sections are all other toolpaths you have created. If you don't have a tool changer, you can only save one toolpath at a time, if you do have a tool changer, you can bring all your toolpaths to the right side by using the arrows in the middle of the screen. Once you are ready to save, look in the pull down menu 'Machine output file is formatted for', to find your CNC router. Click the Save button and it will save the toolpath in NC code specific to your machine.



Calculated toolpaths:

T No.	Toolpath group	Toolpath Name

Toolpaths to save:

T No.	Toolpath group	Toolpath Name
1	Profile	End Mill 1/4 Inch
1	Area Clear	[1] End Mill 1/2 Inch
1	Area Clear	[2] End Mill 1/8 Inch

Save Options

☐ Save toolpaths to separate files
☐ Append Toolpath details to file names
☑ Add Home move at end of files

Save in: <SPOOL> C:\Users\Public\Documents\ArtCAM Files\

File name: test toolpath

Machine file format: TEST G-Code Arcs (inch) (*.tap)

Example 4-2

Follow along with the teacher to complete the Example.

2D Toolpaths:

All 2D toolpaths must be calculated within a vector area. If one vector is selected, it will machine within that vector. If two vectors are selected (one vector inside another), it will machine the area between the two.

Carving, V-Bit and Bevel:

The depth of the V-Bit and height of bevel are dependent on two factors, the width of the vector and angle of the tool. The wider the vector, the deeper it will machine. Also the smaller the angle of v-bit tool the deeper it will machine.

Summary Tutorial: Saw Mill

Complete this tutorial either using the Summary steps or the full instructions on the next page.

1 New Model – Width=635 mm *(25″)*, Height=230 mm *(9″)*

2 Import **Sawmill.eps**

3 F9 (centre in page)

4 Transform Vectors – Uncheck Link, Width=610mm *(24″)*, Height=200mm *(8″)*

5 Ungroup vectors

6 Group text

Machining

1 Area Clearance – between text and inside border
- Finish Depth=0.3″ *(8mm)*
- Tools:
    - 12mm end mill (raster strategy) *(½″)*
    - 6mm end mill (offset strategy) *(¼″)*
    - 1.5mm end mill (offset strategy) *(1/16″)*

2 Material – Thickness=12mm *(0.5″)*, Material Z Zero=top, Top Offset=0
- Calculate and Close

3 Simulate

4 Bevel Carving – Sawmill text
- Finish Depth=7mm *(0.25″)*
- Tool=V-Bit 32mm, 130º *(V-Bit 1.25″, 130º)*
- Calculate and Close

5 Simulate

6 Text Tool – “Reception” – Arial, Size=25mm *(1″)*, Spacing=20%

7 Center Horizontally (select text 1st, then border)

8 Up or down arrows to center vertically

9 V-Bit Carving – Reception text
- Carving Tool=V-Bit 32mm, 90º *(V-Bit 1.25″, 90º)*
- Calculate and Close

10 Simulate

11 Drilling – 2 circles

- Finish Depth=12mm *(0.5″)*
- Tool=12mm end mill *(½″)*
- Drill Center of = All Selected Vectors
- Calculate and Close

12 Simulate

13 Profiling – outside border

- Profile = Outside
- Finish Depth=12mm *(0.5″)*
- Tool=6mm end mill *(¼″)*
- Leads – Circular Arc, Distance=12mm *(0.5″)*, Radius=12mm *(0.5″)*
- Bridges - Constant number=4, Bridge Length=12mm *(0.5″)*, Bridge Thickness=5mm *(0.125″)*
- Edit Bridges - Move, delete, add bridges
- Calculate and Close

14 Simulate

15 Select the Simulation branch in the Project Tree

16 In the Rendering section below, and choose **Light Oak (H)** as the Material to see what the toolpath will look like once cut into the material

SAW Mill
Reception

Tutorial: Saw Mill

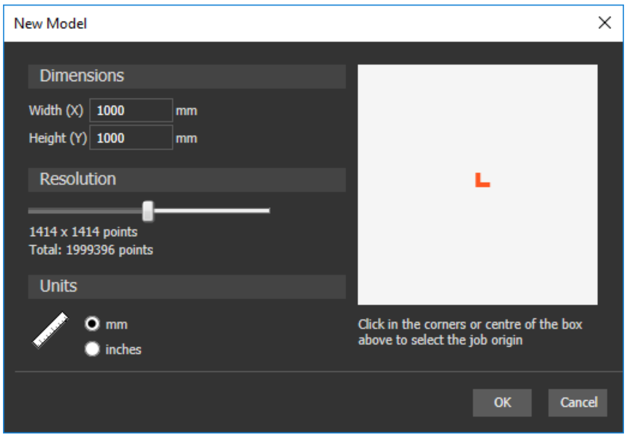
Introduction

This demonstration shows some of the 2D and 2.5D machining features available within ArtCAM Pro. You will use several different types of machining toolpaths; Area Clearance, Bevel Carving, V-Bit Carving, Drilling, and a Profile pass with Bridges.

Saw Mill Tutorial

1. Click **New Model** on the Getting Started page

The Size for New Model dialog box appears:



New Model

Dimensions

Width (X) 1000 mm

Height (Y) 1000 mm

Resolution

1414 x 1414 points

Total: 1999396 points

Units

● mm

○ inches

Click in the corners or centre of the box above to select the job origin

This tutorial is based in the default ArtCAM 2012 function layout. If you have customised your layout and wish to return to the default, from the Window pull down menu choose Reset Layout and then click on Standard

2. Enter in the following values:
    - Units = MM *(or inch)*
    - **Width (X) = 635 mm** *(25")*
    - **Height (Y) = 230 mm** *(9")*
    - Origin = lower left corner
3. Click the **OK** button to accept

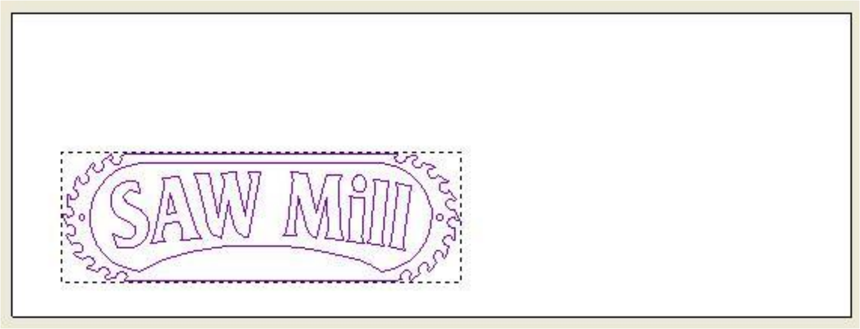
The vectors for this project have already been created. We will import the finished vector artwork.

4. In the **Project Tree**, Right click on **Vectors** and select **Import**...
5. The **Load Vector Layer** dialog box appears:

6. Select the file **Sawmill.eps**, and click the **Open** button
7. Switch to the 2D View

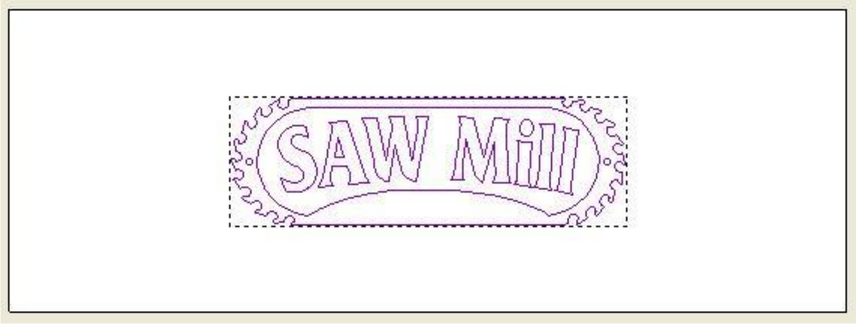
The pre-designed vectors are imported and placed on the white model area.

The vectors should look like this:



8 Press the **F9 key** on the keyboard. This is the shortcut for the **Centre in Page** function

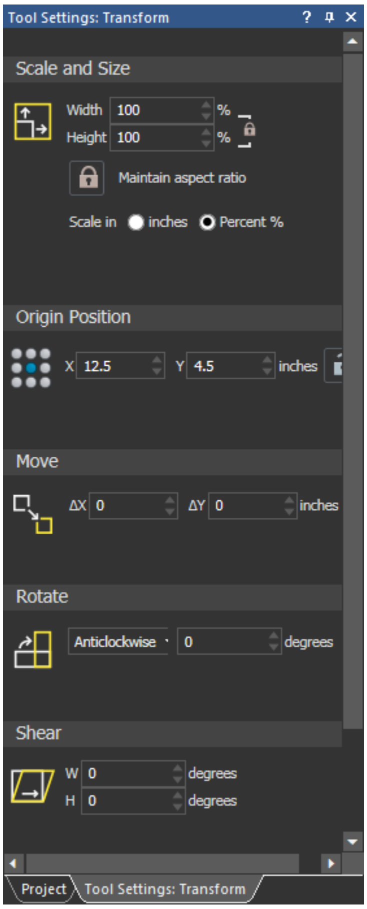
The vectors move into the centre of the model as shown:



Now we will make the vectors bigger, so that they fill the model.

9 Ensure that the vectors are selected, and click the **Transform** function in the **View Tools Toolbar**

The Transform panel appears in the Tool Settings panel:



Tool Settings: Transform

Scale and Size

Width 100 %

Height 100 %

Maintain aspect ratio

Scale in ○ inches ● Percent %

Origin Position

X 12.5 Y 4.5 inches

Move

ΔX 0 ΔY 0 inches

Rotate

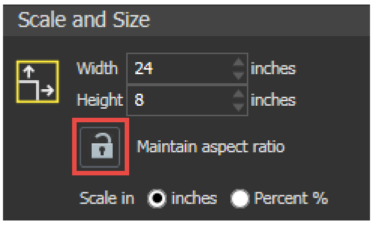
Anticlockwise 0 degrees

Shear

W 0 degrees

H 0 degrees

10 At the top in the **Scale and Size** area, select **mm** *(inch)* for scale and the **padlock icon** to remove the aspect ratio (link) for the Width and Height.



Scale and Size

Width 24 inches

Height 8 inches

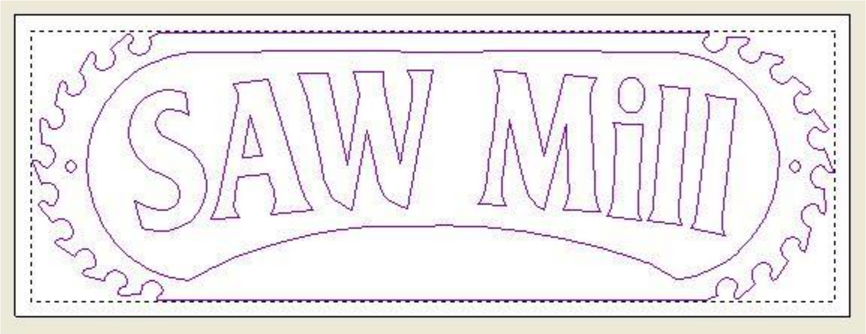
Maintain aspect ratio

Scale in ● inches ○ Percent %

11 Change the **New Width to 610mm** *(24”)* and the **New Height to 200mm** *(8”)*

12 Select **Apply** to make the changes

The 2D view looks like this:



Notice when the vectors are selected, they are purple and they are selected all at once, this means they are grouped. When a set of vectors are imported into ArtCAM, they come in as a grouped entity. For machining purposes, we want to treat the vectors separately.

13 Ensure the grouped vectors are still selected and click the **Ungroup** function in the **Vector Editing Toolbar**

We are now ready to create the toolpaths.

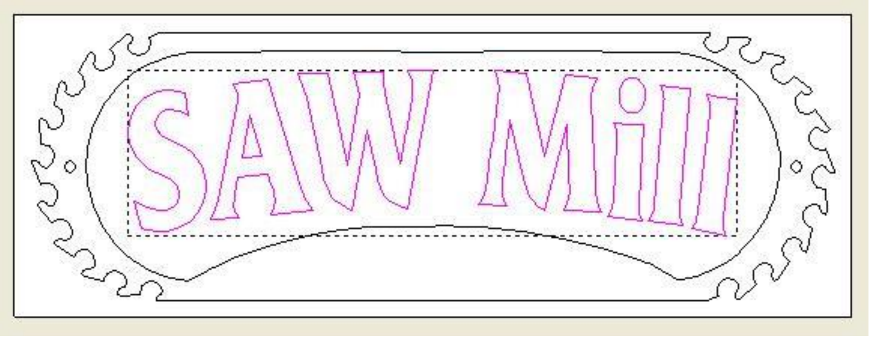
Machining

Area Clearance Toolpath

We will create some toolpaths to clear out the background material around the letters. Since the letters will be used in a few different toolpaths as machining boundaries, we will first group the text together.

1 Using the Left mouse button, drag a box around the **letters (text)** to select them

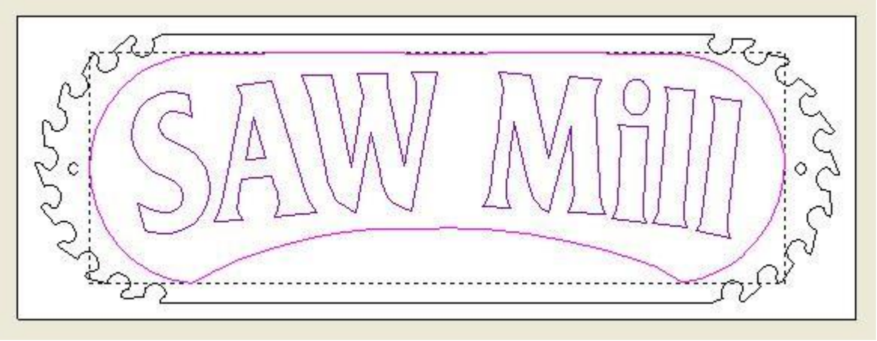
The selected text should look like this:



2 Click the **Group** function in the **Vector Editing Toolbar**

3 Now (make sure the text is still selected) hold down the Shift key for a multiple selection and select the vector border surrounding the letters only

The selected vectors should look like this:

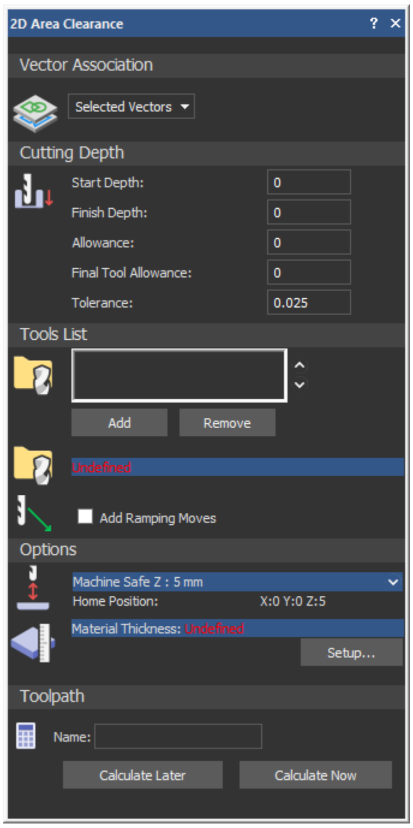


The Area Clearance toolpath can now be generated.

4 On the **Project panel**, click on **Toolpaths** to show the toolpath creation icons

5 Click on the **Area Clearance toolpath** function located in the lower half of the panel

The 2D Area Clearance panel automatically opens:


2D Area Clearance
? ×
Vector Association
Cutting Depth
Tools List
Add
Remove
Options
Setup...
Toolpath
Calculate Later
Calculate Now

Selected Vectors

Start Depth: 0

Finish Depth: 0

Allowance: 0

Final Tool Allowance: 0

Tolerance: 0.025

Undefined

☐ Add Ramping Moves

Machine Safe Z : 5 mm

Home Position: X:0 Y:0 Z:5

Material Thickness: Undefined

Name:

6 Enter a **Finish Depth of 8mm** *(0.3")* and a **Tolerance of 0.02mm** *(0.001")*

7 In the Machine Safe Z section, click the pull down arrow to display the hidden values

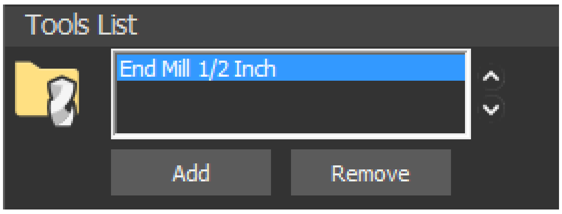
8 Change the **Safe Z and Home Position Z to 10mm** *(0.5")*

Now we can select the tools to be used. Area Clearance allows several tools to be selected for this strategy, and will machine first with the largest tool, then the next sized tool will be used only to machine areas left un-machined by the previous tool, and so on.

9 Click the **Add** button in the **Tools List** section

10 Select the End Mill 12mm (½ Inch) from the **Wood or Plastic > Roughing and 2D Finishing** section of the database

The tool appears in the Tool List section:

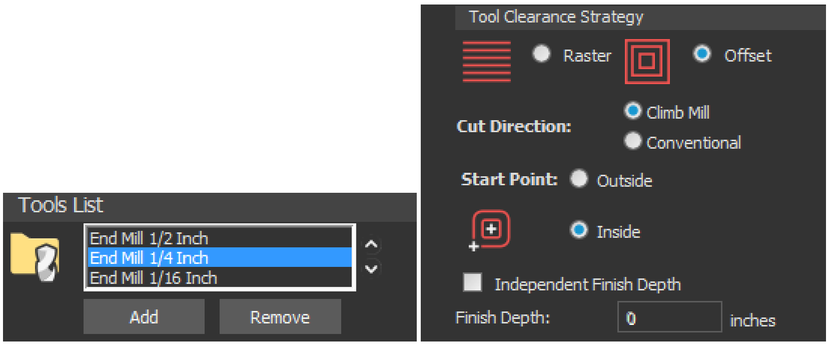

Tools List
End Mill 1/2 Inch
Add
Remove

11 **Repeat** this procedure to select the **End Mill 6mm** *(¼ Inch)* and the **End Mill 1.5mm** *(1/16 Inch)*

There should now be three tools listed. As each one is selected, the options associated with that tool are shown below the Tools List box.

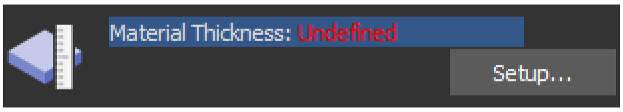
12 Select the **End Mill 6mm** *(¼ Inch)* in the Tool List box

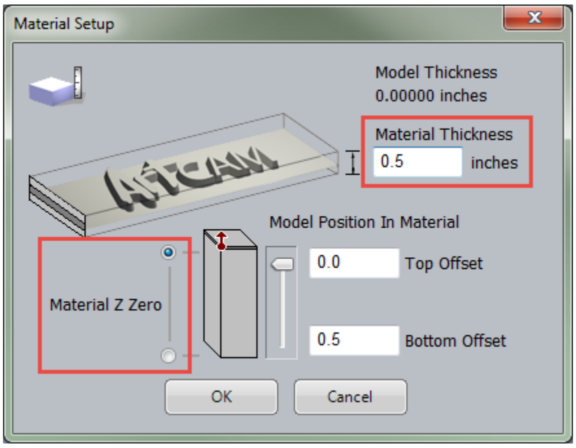
13 Change the Tool Clearance Strategy from Raster to **Offset** as shown:


Tools List
End Mill 1/2 Inch
End Mill 1/4 Inch
End Mill 1/16 Inch
Add
Remove
Tool Clearance Strategy
Raster
Offset
Cut Direction:
Climb Mill
Conventional
Start Point:
Outside
Inside
Independent Finish Depth
Finish Depth:
0
inches

14 Repeat this for the **End Mill 1.5mm** *(1/16 Inch)*

15 Click the **Setup…** button to define the **Material**


Material Thickness: Undefined
Setup…

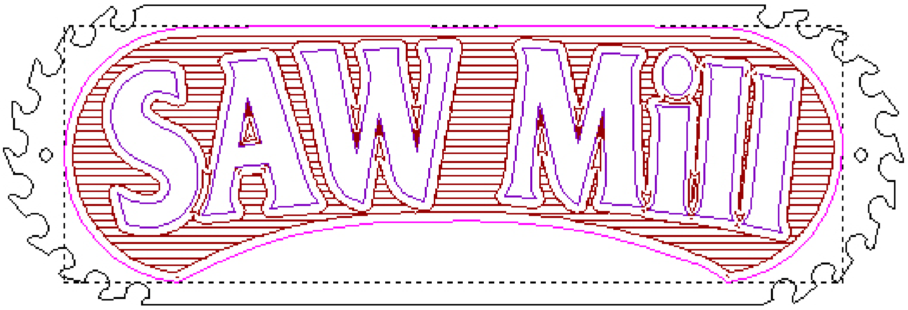

Material Setup
Model Thickness
0.00000 inches
Material Thickness
0.5
inches
Model Position In Material
0.0
Top Offset
0.5
Bottom Offset
Material Z Zero
OK
Cancel

16 Ensure that the **Material Z Zero** is set to **Top** of Block, and the **Thickness** is **12mm** *(0.5″)*

17 **OK** to accept

18 Click the **Calculate Now** button to generate the toolpaths

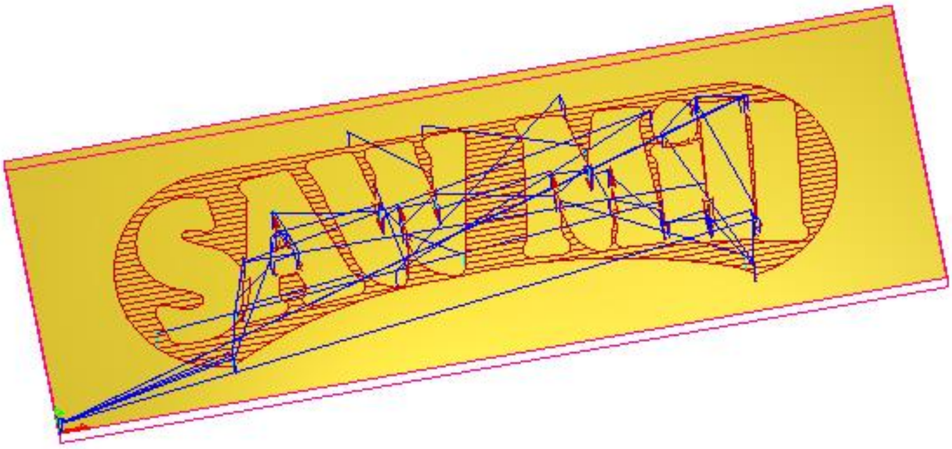
The 2D toolpath preview appears in the 2D view.



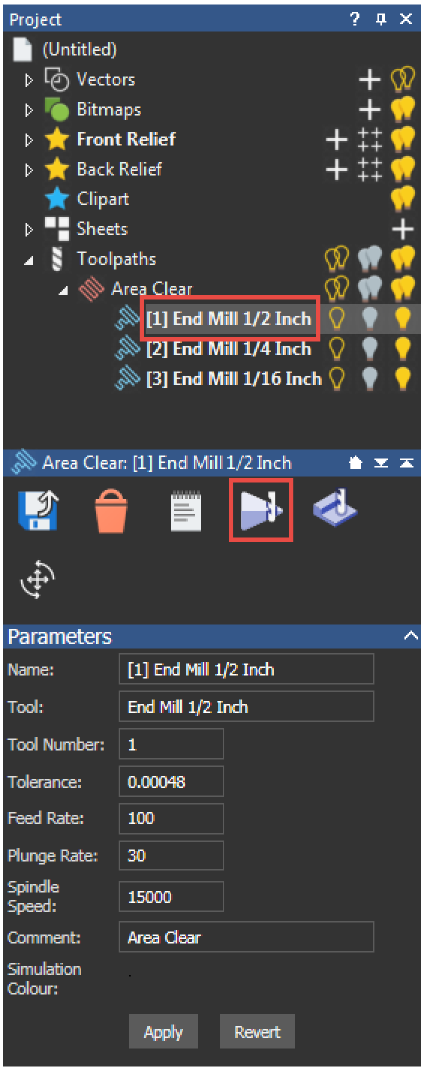
19 Click on the **X** to close the toolpath and panel

20 Click on the 3D View Tab found in the top left corner to switch to the 3D view

The toolpaths look like this:



The Toolpath Manager looks like this:


Project
(Untitled)
Vectors
Bitmaps
Front Relief
Back Relief
Clipart
Sheets
Toolpaths
Area Clear
[1] End Mill 1/2 Inch
[2] End Mill 1/4 Inch
[3] End Mill 1/16 Inch
Area Clear: [1] End Mill 1/2 Inch
Parameters
Apply
Revert

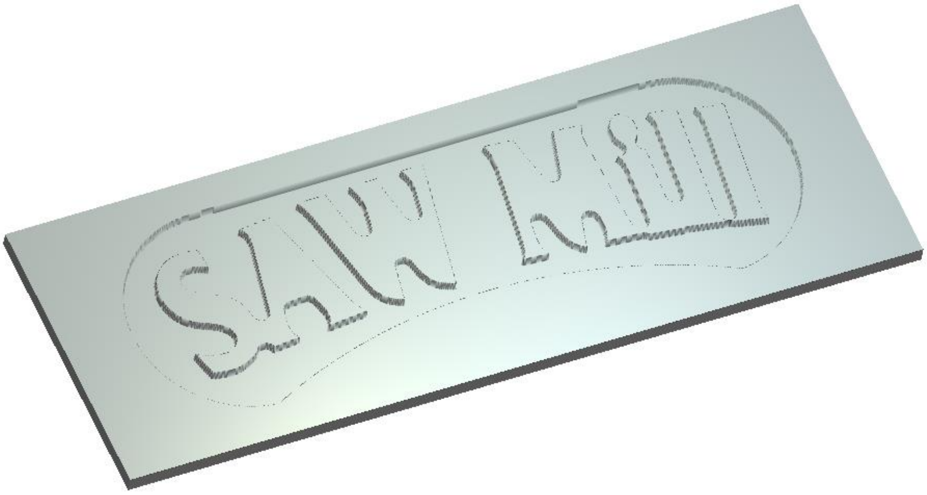
Name: [1] End Mill 1/2 Inch
Tool: End Mill 1/2 Inch
Tool Number: 1
Tolerance: 0.00048
Feed Rate: 100
Plunge Rate: 30
Spindle Speed: 15000
Comment: Area Clear
Simulation Colour:

21 Click on the **End Mill 12mm** *(½ Inch)* toolpath to select it

22 Click on **Simulate Control Bar**

23 Play through the simulation until finished

The simulation in the 3D view looks like this:



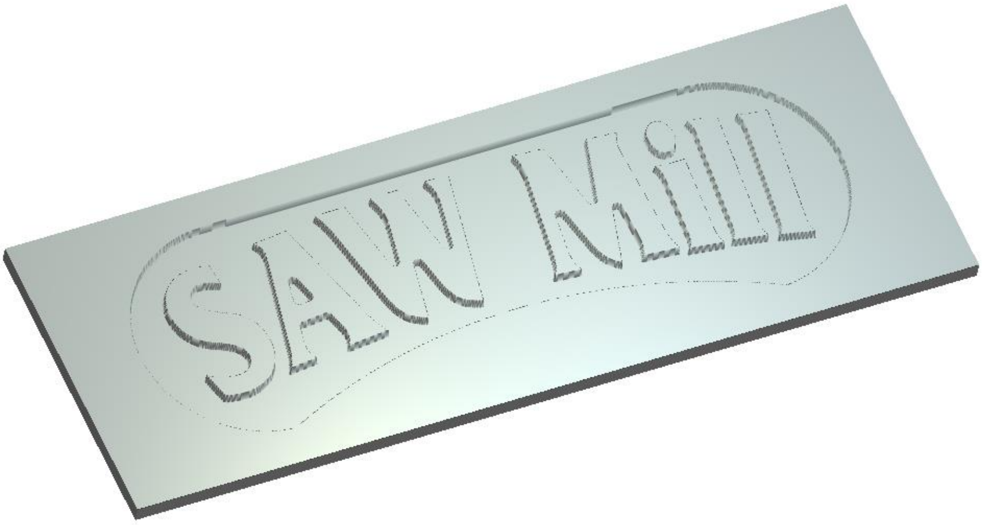
Note that the 12 mm tool is used to machine as much material as possible without violating the letters.

24 Select the **End Mill 6mm** *(¼ Inch)* toolpath in the Project Tree

25 Right click and select **Simulate**

The 6 mm tool is used only in areas that can be safely machined without violating the vectors that the 12 mm tool could not fit into. This is much more efficient than re-machining the whole part.

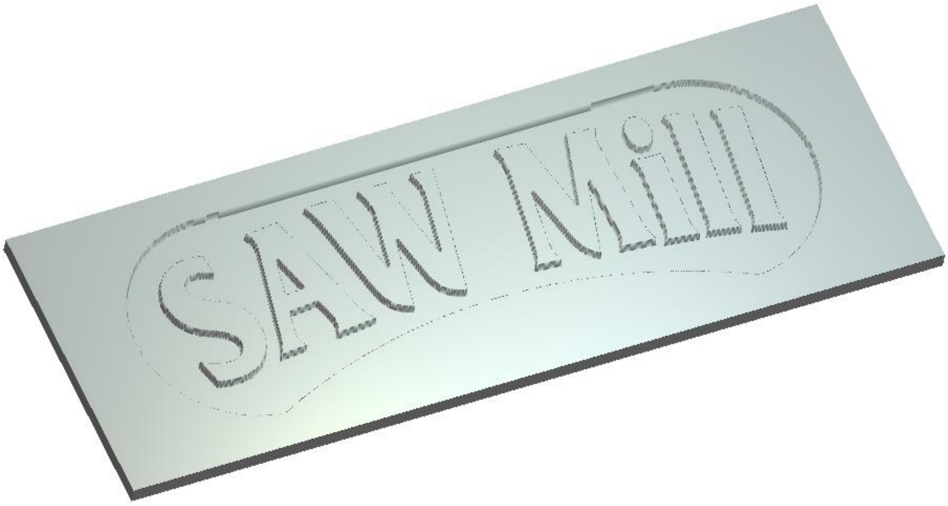
The Simulation looks like this:



The simulation is a mimic of the actual piece after each toolpath has been machined. The simulation of 12 mm end mill was already done. The simulation for the 6 mm tool removes the material from the previous simulation.

26 Select the **End Mill 1.5mm** *(1/16 Inch)* toolpath in the Project Tree

27 Right click and select **Simulate**



The 1.5 mm tool now only cuts areas the 6 mm tool could not fit into. This gives nice tight corners without having to cut the whole part with the 1.5 mm tool.

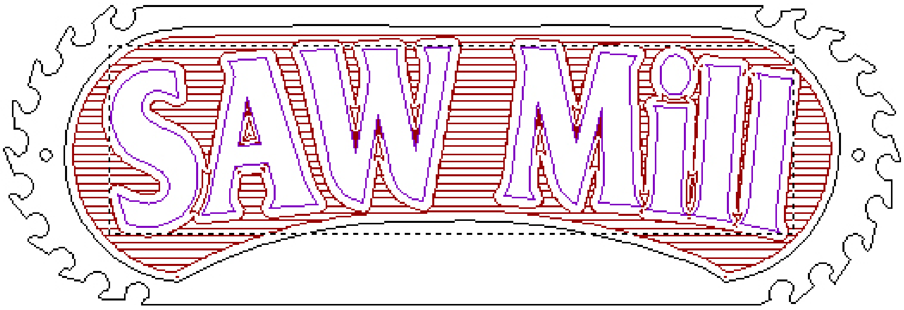
Bevel Toolpath

Now we will generate a Bevel toolpath to create positive prismatic letters.

1 Click on the 2D View Tab

2 Click the **background area** to **de-select** the vectors

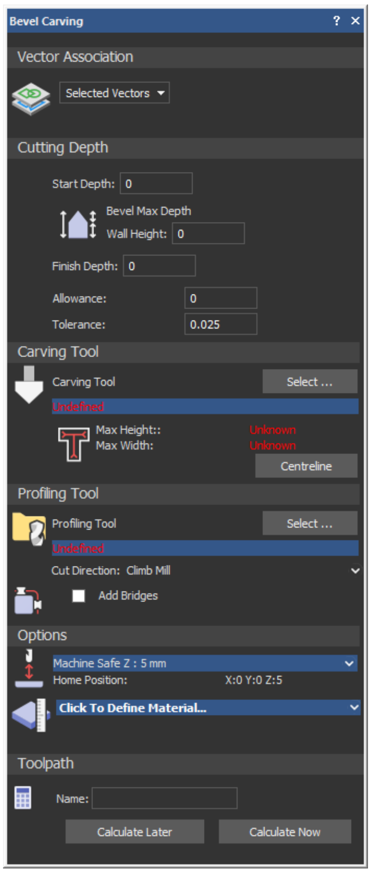
3 Select the grouped vector letters only as shown:



4 Select **Toolpaths** from the Project Tree to view all the toolpath

5 Click the **Bevel Carving** toolpath function in the **Toolpaths Panel**

The 3D Bevel Carving panel appears automatically:


Bevel Carving
? ×
Vector Association
Cutting Depth
Bevel Max Depth
Carving Tool
Select ...
Centreline
Profiling Tool
Select ...
Options
Toolpath
Calculate Later
Calculate Now

Selected Vectors

Start Depth: 0

Wall Height: 0

Finish Depth: 0

Allowance: 0

Tolerance: 0.025

Carving Tool: Undefined

Max Height:: Unknown

Max Width: Unknown

Profiling Tool: Undefined

Cut Direction: Climb Mill

☐ Add Bridges

Machine Safe Z : 5 mm

Home Position: X:0 Y:0 Z:5

Click To Define Material...

Name:

6 Enter a **Finish Depth of 7 mm** *(0.25")*

We are not using a wall height, as the background is already machined and we do not need to cut the letters out, so we will leave it set to 0.

7 Now to define the **Carving Tool**, click the Select... button in the Carving Tool section

8 The **Tool Database** appears, select the **V-Bit 32mm 130 degree** *(V-Bit 1.25 Inch 130º)* from the **Wood or Plastic > V-Carving section** and click the Select button

The V-bit tool should appear on the page.

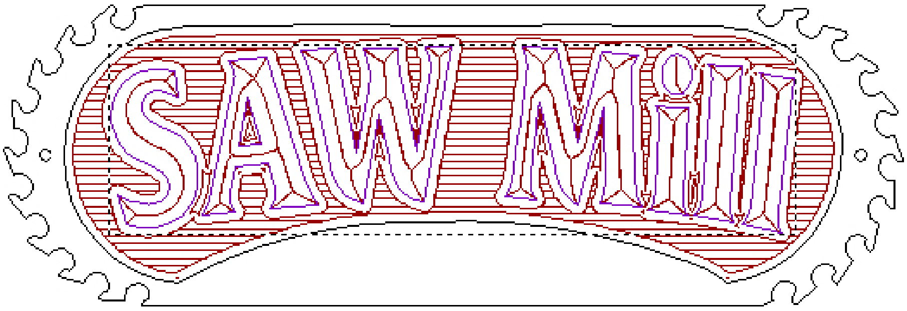
Since we are not creating a Wall Height, we will not select a Profiling Tool. The Profiling Tool would be used to cut the profile of the vector leaving a straight edge.

9 Click the **Calculate Now** button to generate the toolpath

ArtCAM calculates the centrelines of the vectors and then generates the toolpath.

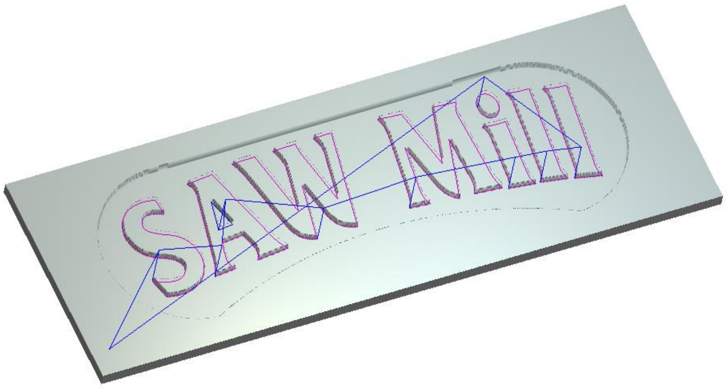
10 Click on the **X** to **close** the toolpath and panel

The Preview Vectors appear in the 2D view, and look like this:



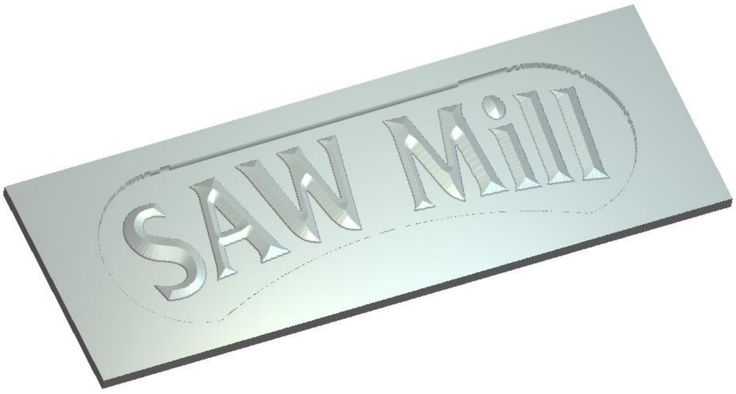
11 Click on the 3D View Tab

The Bevel Toolpath looks like this:



12 Right click on the toolpath and select **Simulate Toolpath**

The Simulation looks like this:



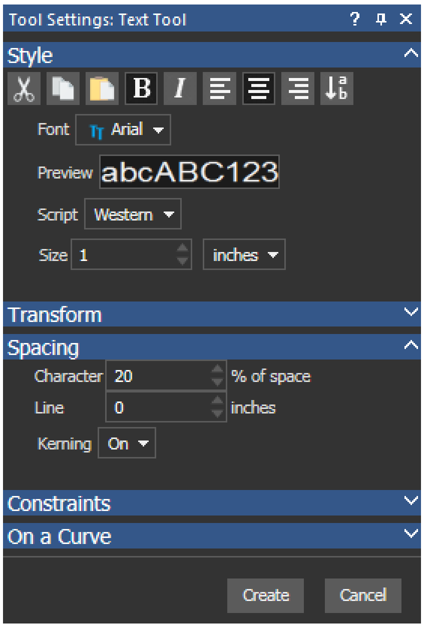
V-Bit Carving

In this section, we will engrave some text. First we need to create the text.

1 Click on the 2D View Tab to go back to the 2D view

2 Click the **Create Vector Text** button in the **View Tools Toolbar**

The Text Tool function appears in the Tool Settings Panel:



Tool Settings: Text Tool

Style

Font: Arial

Preview: abcABC123

Script: Western

Size: 1 inches

Transform

Spacing

Character: 20 % of space

Line: 0 inches

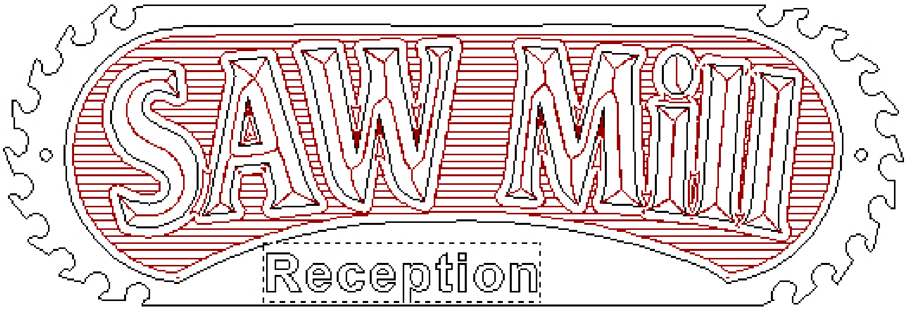
Kerning: On

Constraints

On a Curve

3 Set the Style of text to be **Bold**, **Arial**, with a **Size of 25mm** *(1")* and **Character Spacing at 20**, as shown above:

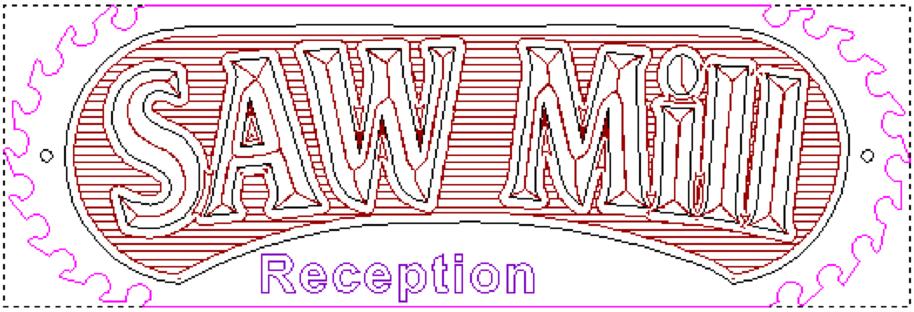
4 Now click the mouse button in the 2D View and type the text **Reception**



5 Right click to finish and exit text creation

We need to make sure that the text is centred in the sign.

6 Select the text, if not already selected, and then Shift-select the outer profile as shown. (The text MUST be selected first.)



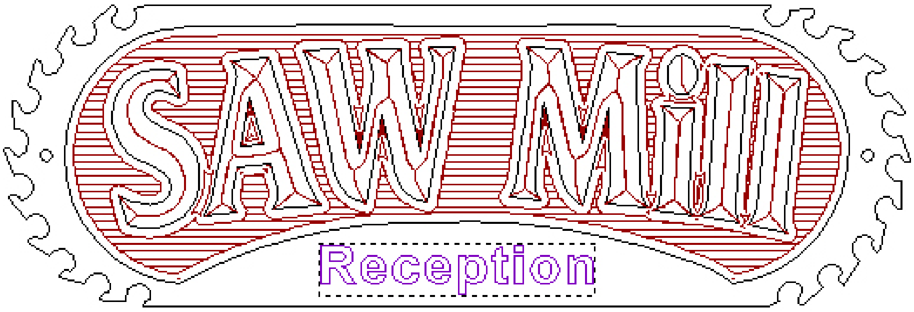
7 Click the **Centre Horizontally** button on the **Vector Editing Toolbar**

8 Click anywhere in the 2D View to de-select the vectors

9 Then select the vector text **only**

10 Now use the Up or Down arrow cursor keys on the keyboard to move the letters approximately into position as shown

The finished Reception text looks like this:



We now apply a toolpath to the text using V-Bit carving.

11 Ensure only the **Reception text** is still selected

12 Click the **V-Bit Carving toolpath** on the **Toolpaths panel**

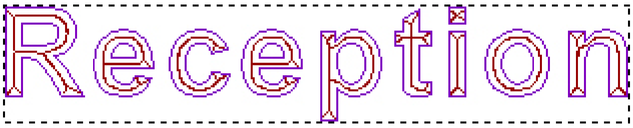
The V-Bit Carving panel appears automatically.

13 Select the **Click to Select...** to select the **Carving Tool**

14 Select the **V-Bit 32mm 90 degree** *(1.25 Inch, 90º)* tool from the list, and click the Select button to select it

15 Next click the **Calculate Now** button to calculate the Toolpath

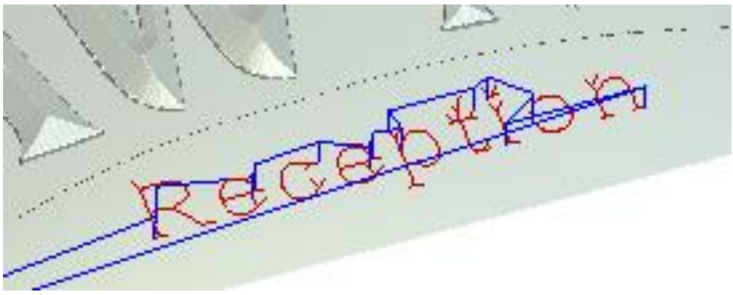
ArtCAM automatically generates the centrelines of the vectors and calculates the toolpath. The Preview Vectors appear in the 2D View and look like this:



16 Click on the X to close the toolpath and panel

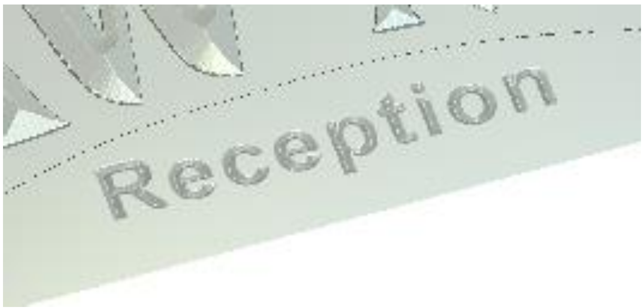
17 Click on the 3D View Tab

The toolpath looks like this:



18 Right click on the **V-Bit Carving** Toolpath in the Project Tree and select **Simulate Toolpath**

The Simulation looks like this:

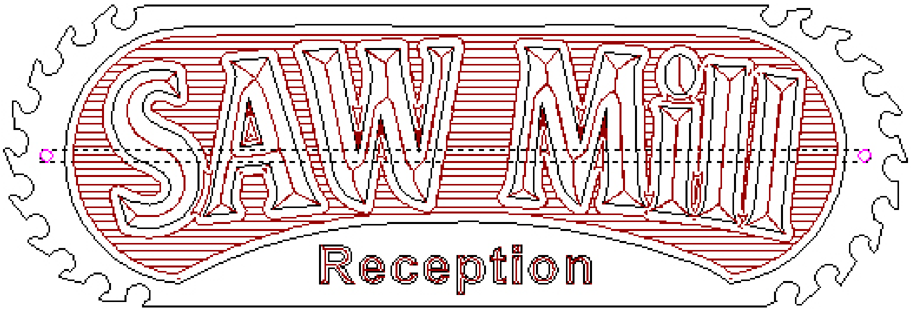


Drilling

Now we can drill the holes needed to mount the sign to the wall.

1 Click on the **2D View** Tab

2 First, select both **hole positions** marked in the 2D View using the left mouse button as shown. (Select one, and then Shift-select the other)



3 Now click the **Drilling toolpath** function on the **Toolpaths panel**

The Drilling function appears automatically:

4 The **Finish Depth is 12mm** *(0.5")* to ensure the holes go all the way through the material

5 Click the **Select...** button to select a Tool

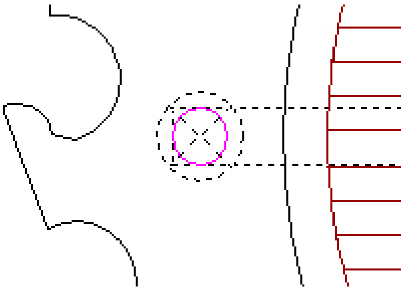
6 Select the **End Mill 12mm** *(1/2 Inch)* by double clicking it

Note as we stretched the vectors un-proportionally, the drill holes are no longer true circles so we will use the all vectors option instead of Circular Vectors.

7 In the **Drill Centre of...** section of the Drilling Page, select the option **All Selected Vectors**

8 Click the **Calculate Now** button to generate the toolpath

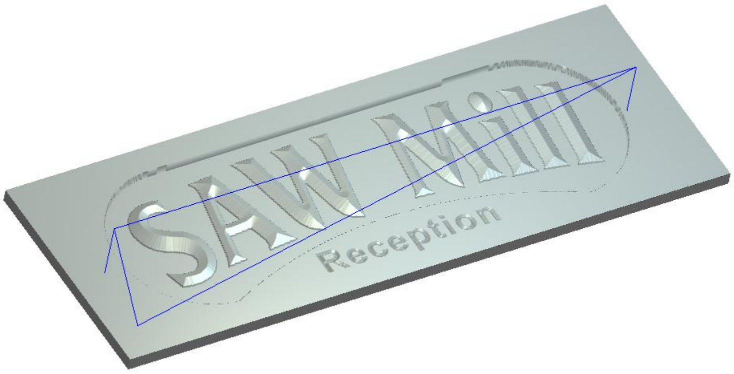
The Preview Vectors look like this:



9 Click on the **X** to close the toolpath and panel

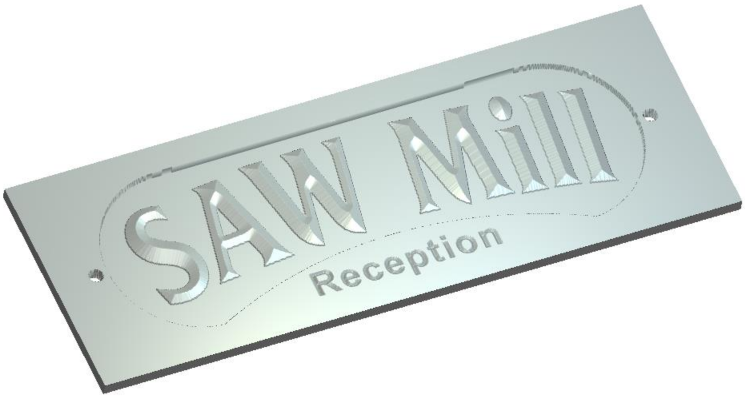
10 Click on the **3D View** Tab

The Drilling Toolpath looks like this:


SAW Mill
Reception

11 Right click on the **Drilling** Toolpath in the Project Tree and select **Simulate Toolpath**

The simulation looks like this:

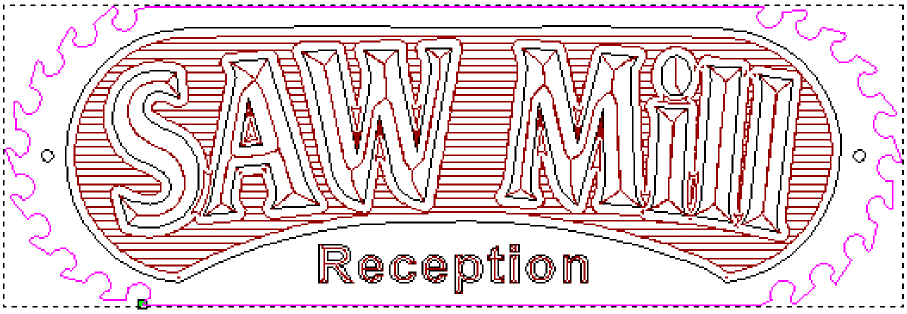

SAW Mill
Reception

Profile Toolpath & Bridges

We are now ready to cut out the sign by profiling around the outermost vector.

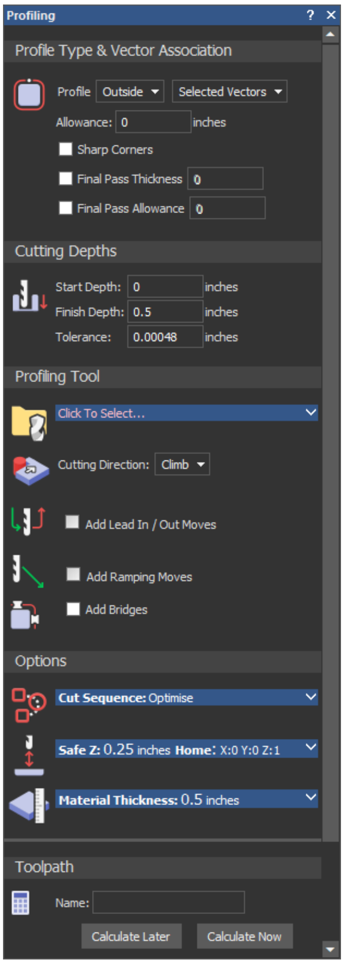
1 Click on the **2D View** Tab

2 Select the outermost vector in the 2D View as shown



3 Select the 2D Profiling toolpath function on the Toolpaths panel

The Profiling function appears automatically:


Profiling

Profile Type & Vector Association

Profile: Outside | Selected Vectors

Allowance: 0 inches

☐ Sharp Corners

☐ Final Pass Thickness 0

☐ Final Pass Allowance 0

Cutting Depths

Start Depth: 0 inches

Finish Depth: 0.5 inches

Tolerance: 0.00048 inches

Profiling Tool

Click To Select...

Cutting Direction: Climb

☐ Add Lead In / Out Moves

☐ Add Ramping Moves

☐ Add Bridges

Options

Cut Sequence: Optimise

Safe Z: 0.25 inches **Home:** X:0 Y:0 Z:1

Material Thickness: 0.5 inches

Toolpath

Name:

4 Change the profile option to **Outside**

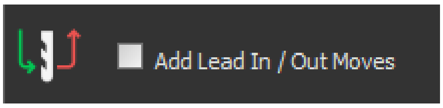
5 The **Finish Depth is 12mm** *(0.5″)*

6 Click the **Click to Select...** button to select the **Profiling Tool**

7 Double click the **End Mill 6mm** *(¼ Inch)* to select it

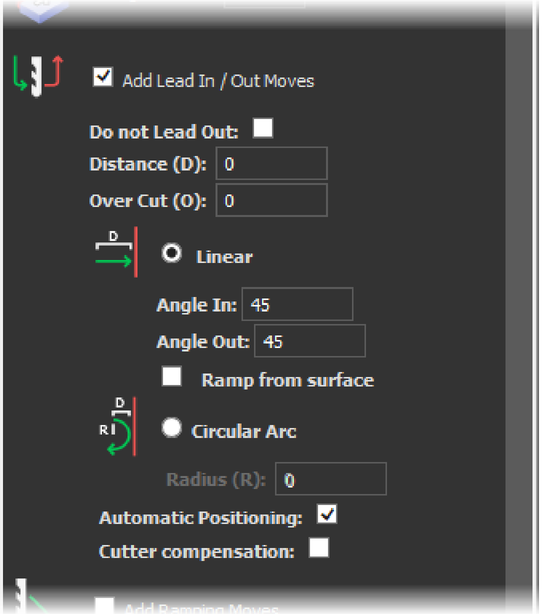
8 Change the **Stepdown to 12mm** *(0.5″)* by using the pull arrow to access the tool parameters

9 **Check** the option **Add Lead In/Out Moves** in the Profiling Panel as shown



☐ Add Lead In / Out Moves

The Panel is expanded to show the options for Leads:



☑ Add Lead In / Out Moves

Do not Lead Out: ☐

Distance (D): 0

Over Cut (O): 0

● Linear

Angle In: 45

Angle Out: 45

☐ Ramp from surface

○ Circular Arc

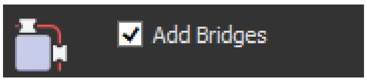
Radius (R): 0

Automatic Positioning: ☑

Cutter compensation: ☐

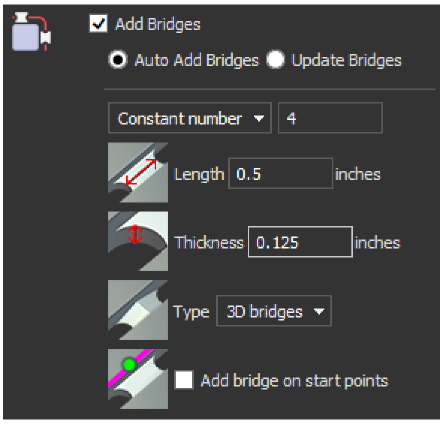
10 Select the option **Circular Arc**, and enter a **Distance of 12mm** *(0.5″)* and a **Radius of 12mm** *(0.5″)*

11 Check the option **Add Bridges.**



☑ Add Bridges

The panel is expanded to show the options for the Bridges:



☑ Add Bridges

● Auto Add Bridges ○ Update Bridges

Constant number 4

Length 0.5 inches

Thickness 0.125 inches

Type 3D bridges

☐ Add bridge on start points

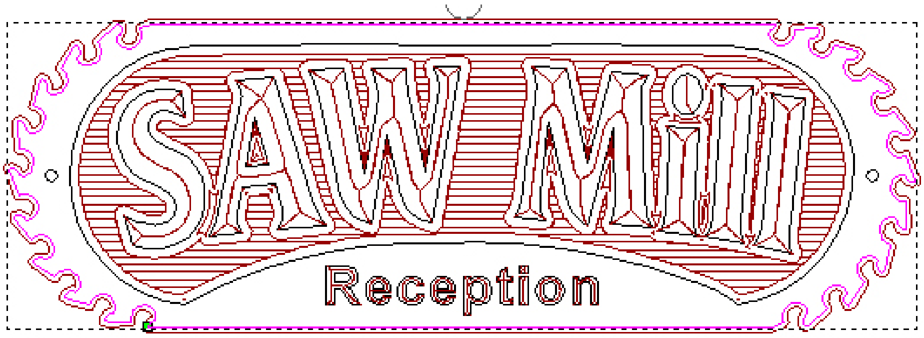
12 In the **Constant Number** section, enter **4.**

13 Enter a Bridge Length of **12mm** (0.5”) and a Bridge Thickness of **5mm** (0.125”).

14 Check the **3D Bridges** option to create a 3D bridge.

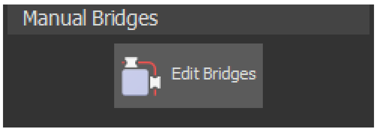
This will leave four bridges or 'tabs' around the profile, a length of 12 mm, and Z height (Thickness) of 1 mm. These will help to keep the sign in place while cutting it out of the material.

15 Click the **Add** button to add the Bridges to the Toolpath.

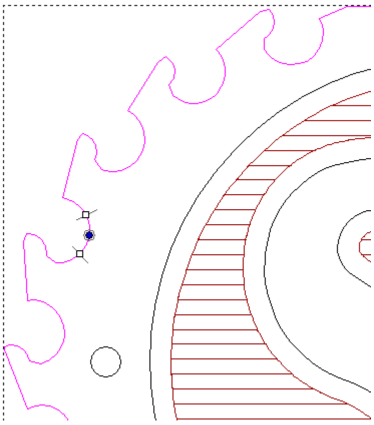


We will now move the bridges to more sensible positions which will be easier to remove the sign.

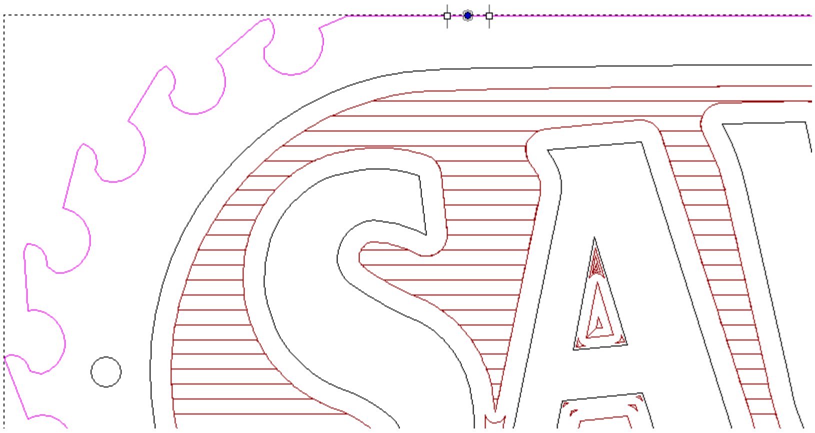
16 Select Edit Bridges.



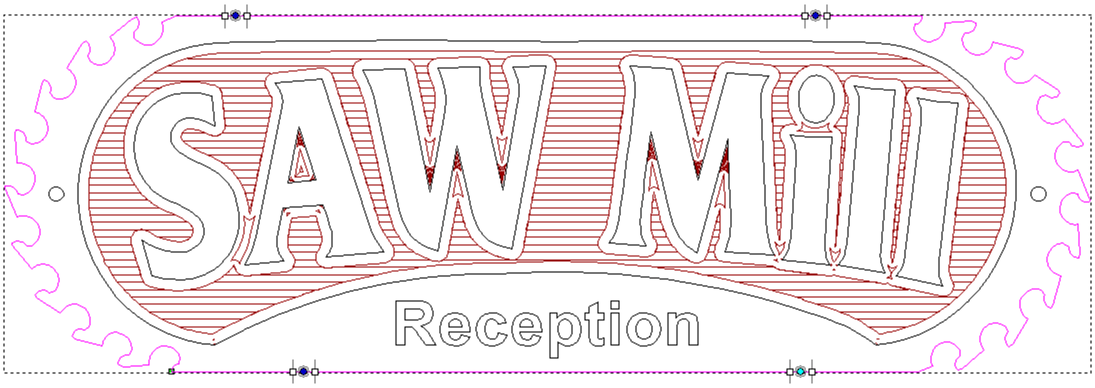
17 Move the mouse over the centre of the left bridge, (Zoom in if necessary using the wheel on the mouse).



18 Hold the Left mouse button down, and drag the Bridge to a more sensible position as shown below.



19 Now move the other bridges in the same way so that they are in positions as shown below.

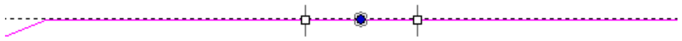


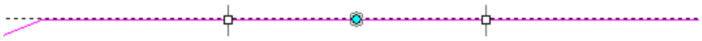
20 Zoom into the **top-left bridge** using the wheel on the mouse.

21 You can remove the bridge by clicking on the centre of the bridge and pressing **d.**

22 Now **add** the Bridge back in by clicking the Profile Toolpath.

23 Move the cursor over one end of the Bridge, and using the Left mouse button, drag the end to extend the Bridge as shown below, (do this for the remaining bridges).



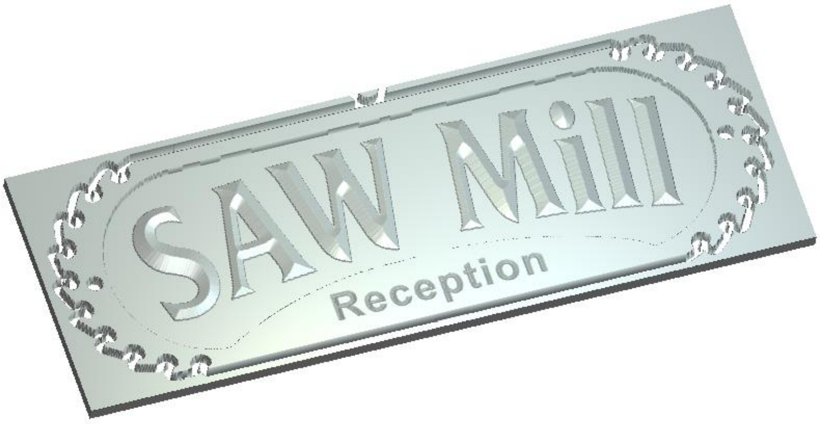


24 Click Calculate **Now** to generate the Toolpath

We can now simulate the Profile Toolpath.

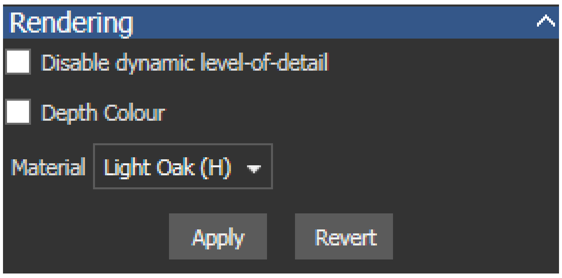
25 Right click on the Toolpath in the Project Tree and select **Simulate Toolpath**

The Simulation looks like this:



26 Select the **Simulation** branch in the Project Tree

27 In the Rendering section below choose Light Oak (H) as the Material to see what the toolpath will look like once cut into the material



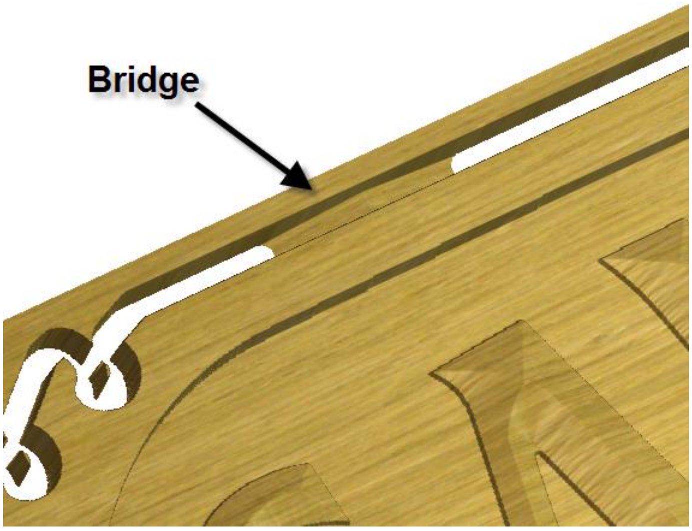
Rendering

☐ Disable dynamic level-of-detail

☐ Depth Colour

Material Light Oak (H)

28 Zoom in to view one of the bridges as shown:



This tutorial is complete.

5. Relief Creation

Introduction

This example shows how to create and work with basic relief shapes.

Functions

Shape Editor → Emboss a basic 3D relief from a vector or image

Preview Relief Layer → interactive golden greyscale representing active relief

Reset Relief → Reset all heights in relief back to zero

Draw Zero Plane → Toggle switch to show and hide the zero plane in 3D view

Origin → A toggle switch to show and hide the origin in the 3D view

Paste Relief From A File → Load a previously saved relief from disk (.rlf)

Save Relief → Save a relief to disk (.rlf)

Relief Clipart Library → Customisable library installed with over 400 3D reliefs

Extrude → Extrude a vector cross section(s) along drive curve to create a relief

Two Rail Sweep → Sweep a vector cross section(s) between two drive rails to create a relief

Create Vector Boundary → Automatically creates a vector around the outside edge the relief

Display Material → show the shaded material (default gold) in 3D view

Display Bitmap → show colours from 2D view on 3D view

Toggle Vector Visibility → Hide and show vectors in the 3D View

Note, some functions are grouped together in Toolset shown by the small arrow the in lower right corner of the function. Hold the mouse down on the icon and continue to hold to pull out the menu.

Relief Creation Information

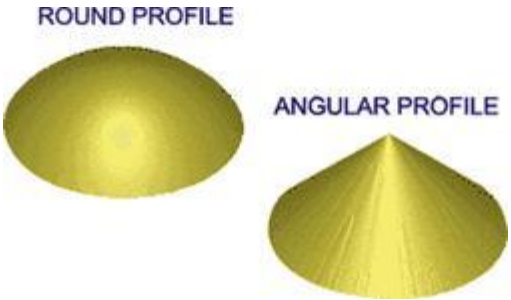
Reliefs are solid 3D models. All reliefs are created (or pushed up or down) from the zero plane.

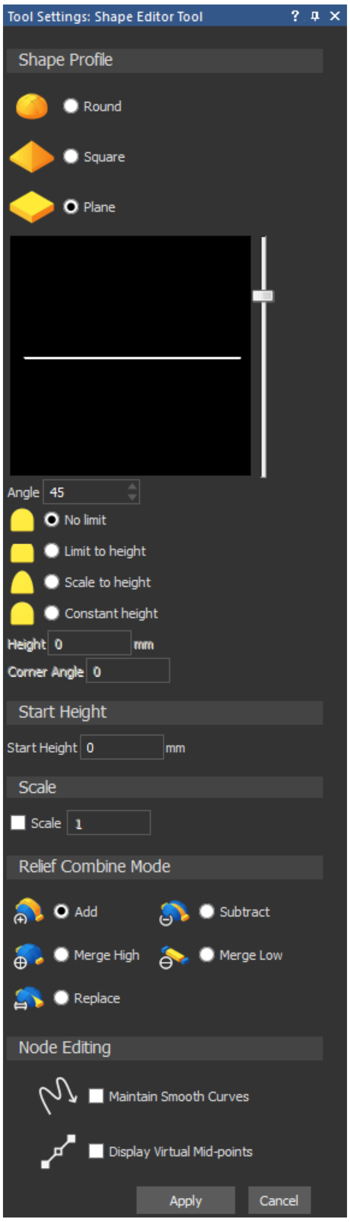
Example 5-1

Follow along with the teacher to complete the Example.

Shape Editor Basics:

Always switch to the 3D View before clicking the Add button. This allows you to see the change when it happens and makes it easier to spot unsatisfactory results.




Tool Settings: Shape Editor Tool

Shape Profile

○ Round
○ Square
● Plane

Angle 45
● No limit
○ Limit to height
○ Scale to height
○ Constant height
Height 0 mm
Corner Angle 0

Start Height

Start Height 0 mm

Scale

☐ Scale 1

Relief Combine Mode

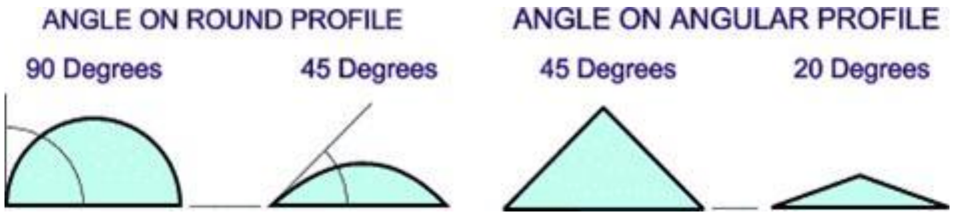
● Add
○ Subtract
○ Merge High
○ Merge Low
○ Replace

Node Editing

☐ Maintain Smooth Curves
☐ Display Virtual Mid-points

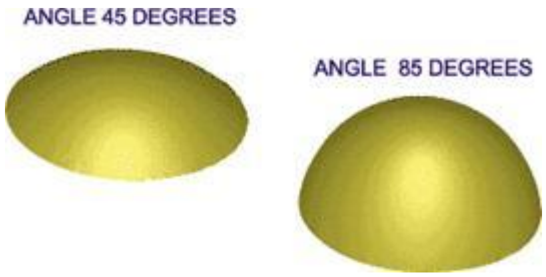
Shape Editor Angle:

The angle is measured from the horizontal plane. An angle of 0 degrees will always produce a plane. A positive angle produces a convex profile and a negative angle produces a concave profile.

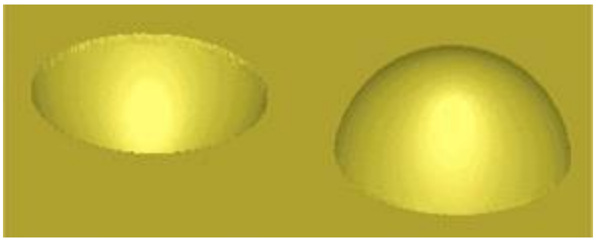

ANGLE ON ROUND PROFILE
90 Degrees
45 Degrees
ANGLE ON ANGULAR PROFILE
45 Degrees
20 Degrees

This field is greyed out when a Plane Profile is selected.

The picture below shows two regions with the same Profile, Start Height, Region Height (No Limit) and Scale. The left one is generated with an Angle of 45 degrees, the other with an Angle of 85 degrees.

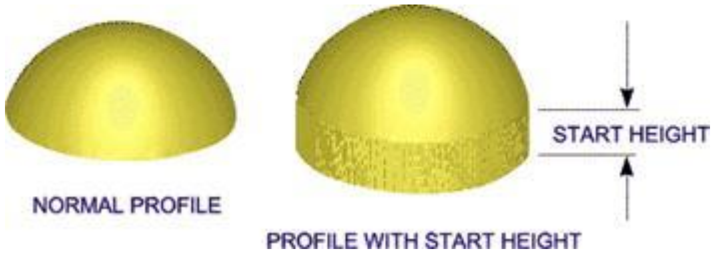

ANGLE 45 DEGREES
ANGLE 85 DEGREES

The picture below shows two regions with the same Profile, Start Height, Limit Height and Scale. The left one is generated with an Angle of -85 degrees, the other with an Angle of +85 degrees. This specifies whether a region will be convex (raised) or concave (recessed).



Shape Editor Start Height:

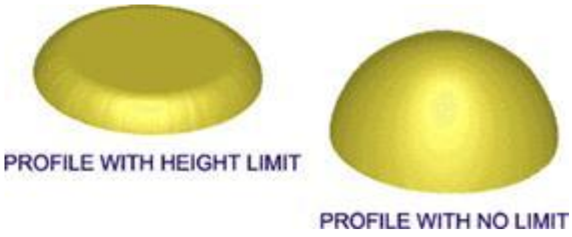
This controls the starting height for the region. The relief for the region is calculated and then the base height value is added to the height calculated for each pixel in the region. If the profile type is Plane, setting this field controls the height of the plane.


START HEIGHT
NORMAL PROFILE
PROFILE WITH START HEIGHT

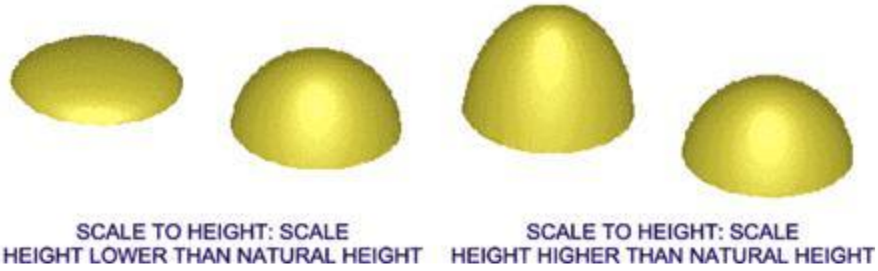
Shape Editor Height:

The default setting is No Limit. In this case the profile is allowed to grow to the height that it will normally reach, depending upon the parameters that have been set.

Limit To Height sets a limit which the profile may not exceed. The profile will "plateau out" at the specified height and will have a flat top, if the natural height is higher than the height limit that is set. Parts of the relief that do not reach the height limit will be unaffected.

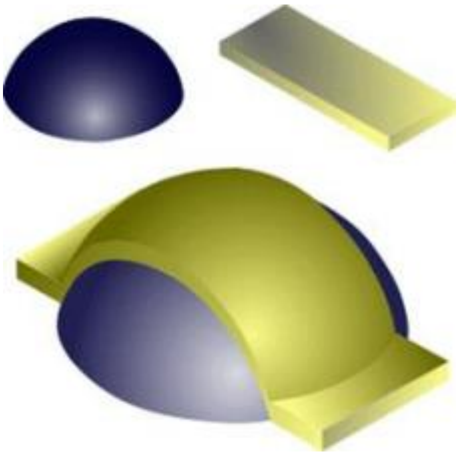

PROFILE WITH HEIGHT LIMIT
PROFILE WITH NO LIMIT

Scale To Height means that a scaling factor will be applied to the natural height so that the profile will reach the specified height. The height that is set may also be smaller than the natural height. Note that this does not produce the same effect as Limit To Height. Scale To Height will not alter the shape of the profile (no flat top), it simply scales the shape in the Z-axis.

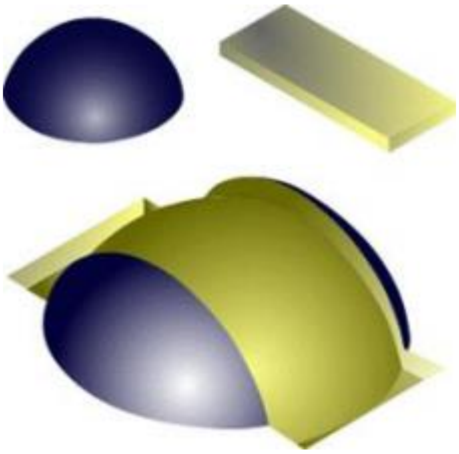

SCALE TO HEIGHT: SCALE HEIGHT LOWER THAN NATURAL HEIGHT
SCALE TO HEIGHT: SCALE HEIGHT HIGHER THAN NATURAL HEIGHT

Relief Operations:

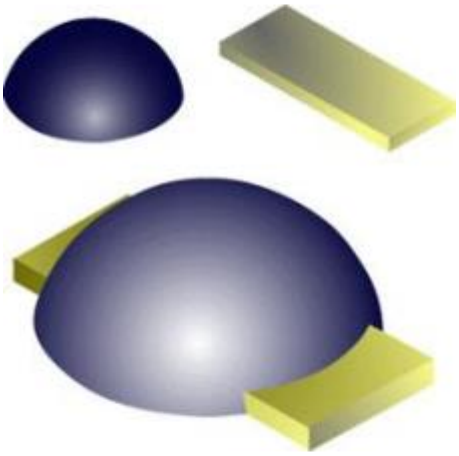
Add Relief



Subtract Relief



Merge High Relief



Summary Tutorial: Anchor Relief

1 Open Model **anchor.art**

2 Shape Editor – **large top bar**

- Flat Plane with Start Height of 0.5 mm (0.02") – Add & Apply

3 Hide Zero Plane

4 Shape Editor – 2 **inner top bar** vectors

- **Round** at **45º**, with Start Height of 0 – **Add & Apply**

5 Shape Editor - **main anchor** vector

- Square at 65º, with Limit to Height 0.75mm (0.03") - Merge High & Apply

6 Shape Editor – **two hook** vectors

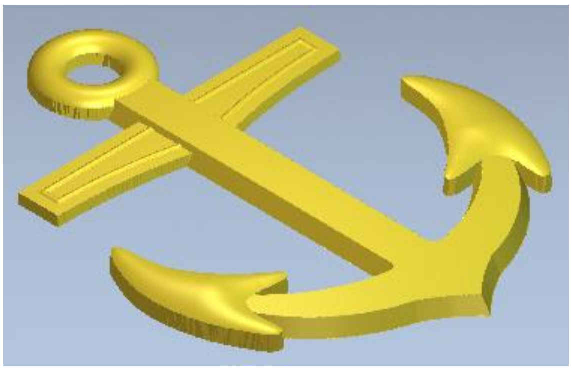
- Round at 30º, with Start Height of 0.75mm (0.03") - Merge High & Apply

7 Shape Editor - **two Circle** vectors

- Round at 65º, with Start Height of 0.5 mm (0.02") - Merge High, Apply & Cancel

8 Toggle Vector Visibility off

The Vectors are hidden, and the final result can be seen.

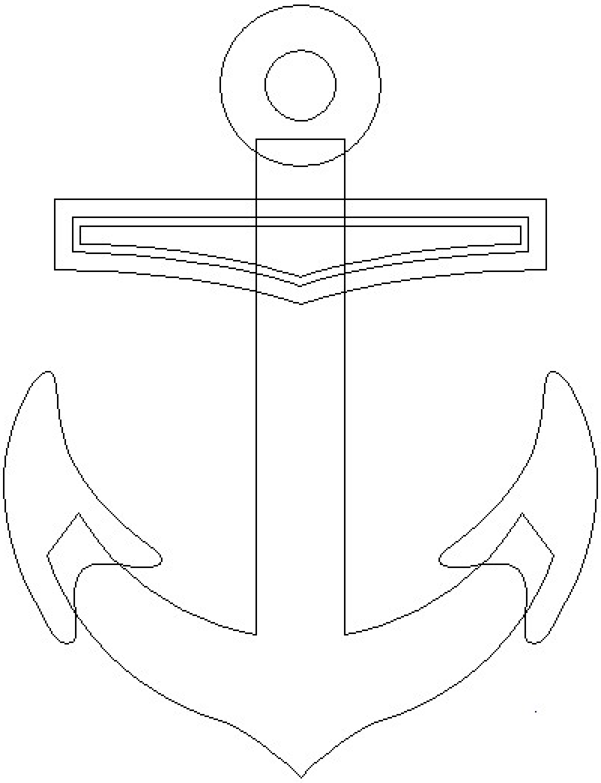


Tutorial: Anchor Relief

This example shows how to create and work with basic relief shapes.

1 Click on the **Open Model** function in the Start Panel to display the Open dialog box

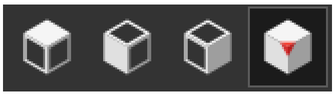
2 Open the model **anchor.art**

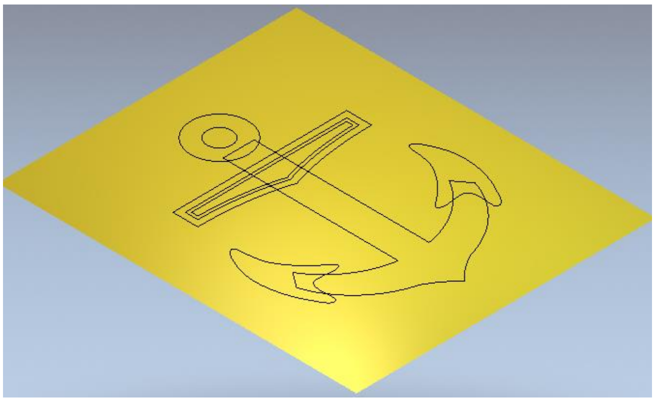


The vectors are displayed in the 2D view and 3D View.

This tutorial is based in the default ArtCAM function layout. If you have customised your layout and wish to return to the default, from the Window pull down menu choose **Reset Layout>Standard**

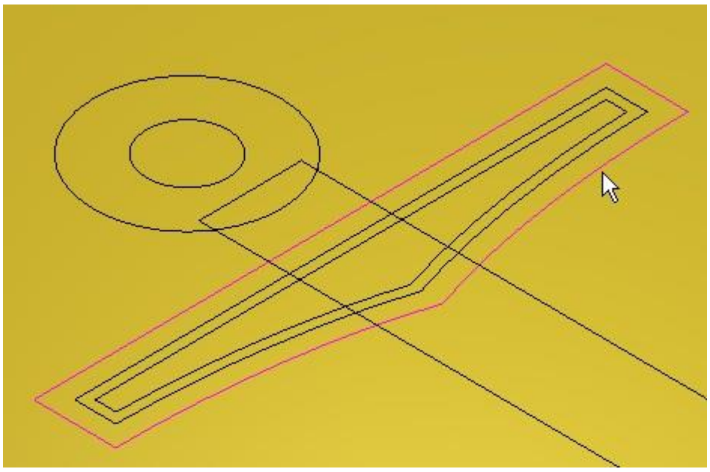
3 Change the 3D View from Top View to Isometric View



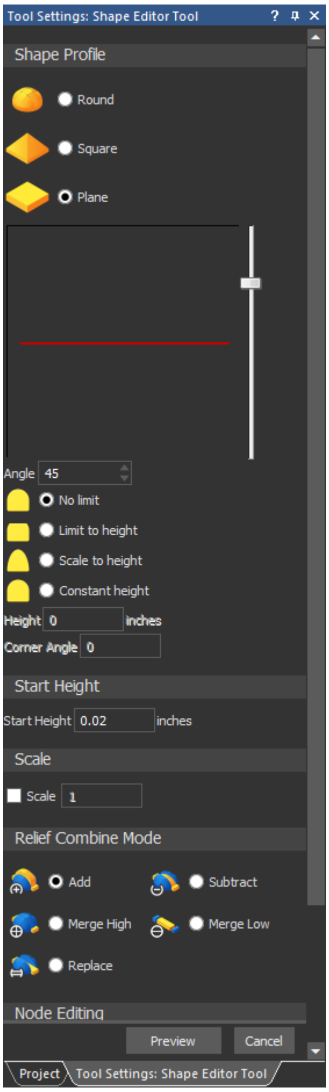


The vectors are displayed on the 3D View.

4 **Double left mouse click** on the vector shown below to open the **Shape Editor** form



5 Select a **Plane** shape with a **Start Height** of **0.5 mm** *(0.02")*


Tool Settings: Shape Editor Tool
Shape Profile
Round
Square
Plane
No limit
Limit to height
Scale to height
Constant height
Start Height
Scale
Relief Combine Mode
Add
Subtract
Merge High
Merge Low
Replace
Node Editing
Preview
Cancel
Project
Tool Settings: Shape Editor Tool

○ Round
○ Square
● Plane

Angle 45

● No limit
○ Limit to height
○ Scale to height
○ Constant height

Height 0 inches

Corner Angle 0

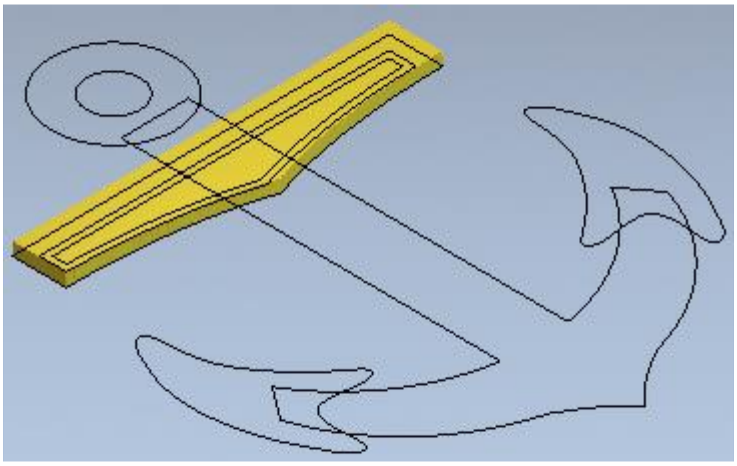
Start Height 0.02 inches

☐ Scale 1

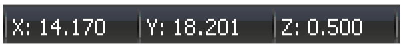
● Add ○ Subtract
○ Merge High ○ Merge Low
○ Replace

For a Plane, The Start Height indicates the very top Z level.

6. Set the Combine Mode to **Add**
7. Click the **Apply** button to generate the shape
8. Click the **Cancel** button
9. From the 3D view toolbar, click on **Draw Zero Plane** to hide the Z zero plane

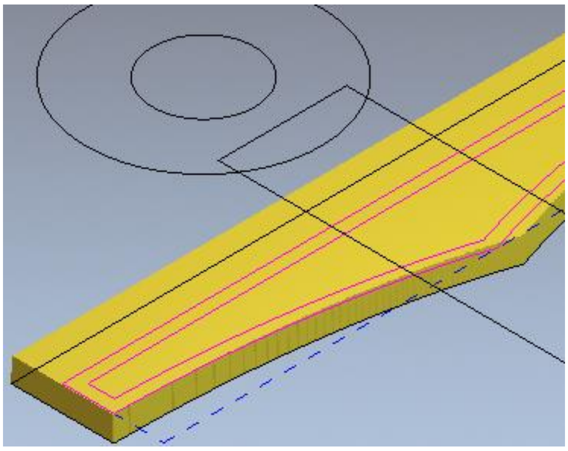


The bar is produced as shown. If you place the mouse on the Relief, the Z height at that point 0.5mm *(0.02")* will be displayed in the information box at the lower right of the graphics area.



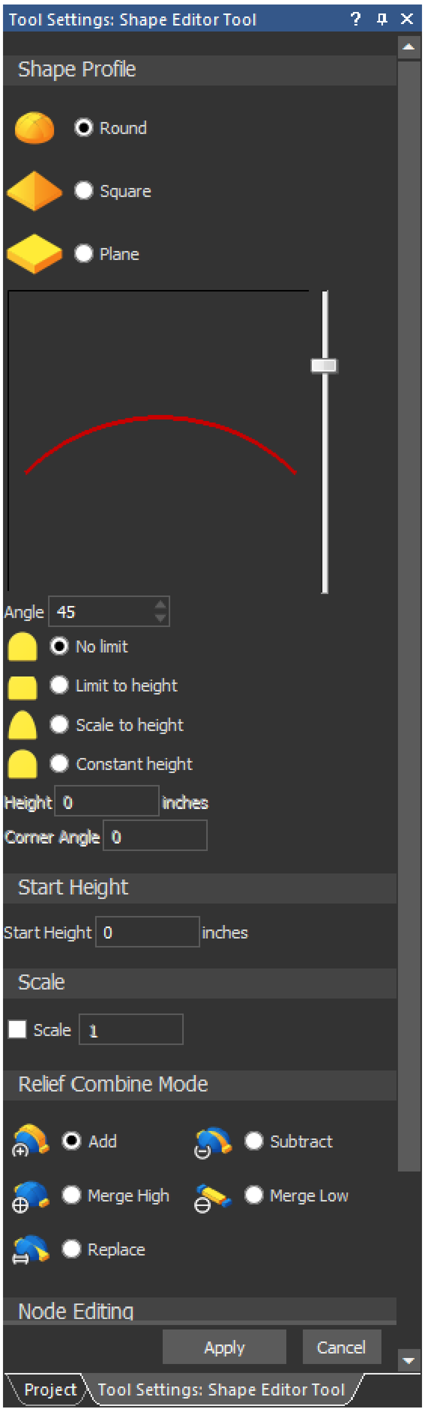
X: 14.170 | Y: 18.201 | Z: 0.500

10. De-select the bar vector by clicking in empty space
11. Hold down the **shift** key and select the **two inner vectors** as shown



A Relief will now be generated inside the two selected vectors.

12 Press **F12** on the keyboard to open the **Shape Editor** form



Tool Settings: Shape Editor Tool

Shape Profile

● Round
○ Square
○ Plane

Angle 45

● No limit
○ Limit to height
○ Scale to height
○ Constant height

Height 0 inches
Corner Angle 0

Start Height

Start Height 0 inches

Scale

☐ Scale 1

Relief Combine Mode

● Add
○ Subtract
○ Merge High
○ Merge Low
○ Replace

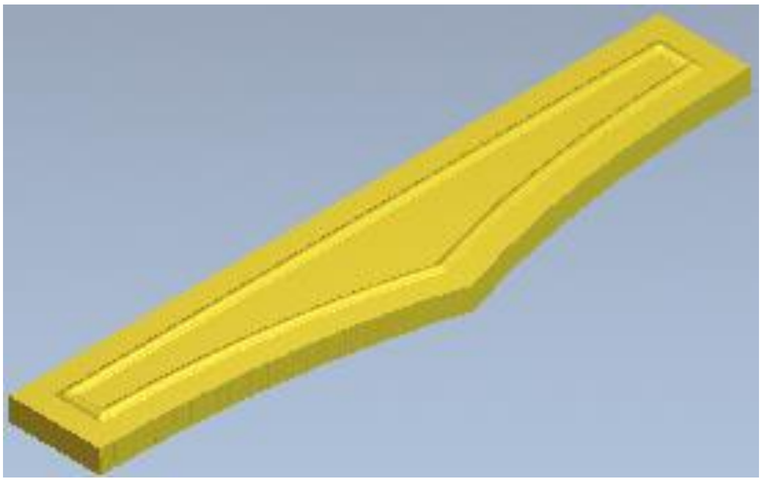
Node Editing

13 Select a **Round shape** with an **Angle of 45 degrees** and **No Limit** with regard to overall height

14 Enter a **Start Height** value of **0** *(0”)*

15 Click the **Apply** Button

16 Click the **Cancel** button

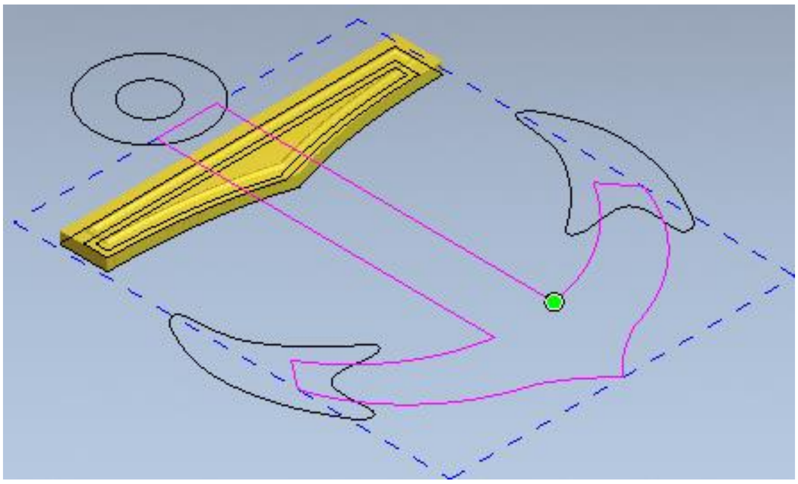


A Dome shape of 45 degrees has been created within the selected vectors. The final height of the dome was dictated by the defined angle (as No limit was selected)

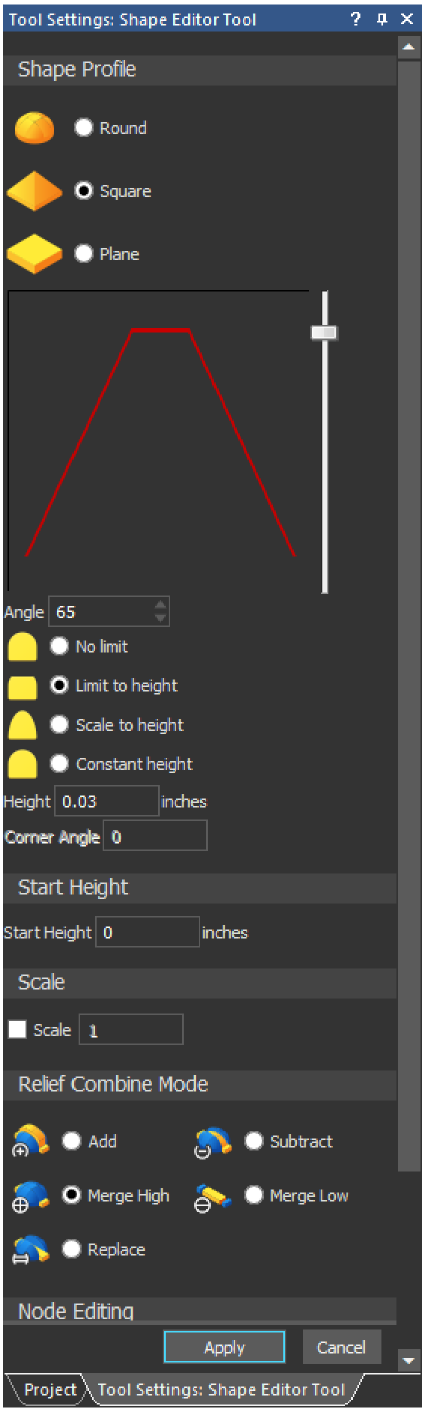
By Selecting Add, the new relief 'added' to the initial bar relief below.

The main body of the Anchor will now be created and **merged** into the current Relief.

17 Select the **main anchor vector** as shown highlighted



18 Press **F12** on the keyboard to open the **Shape Editor** form

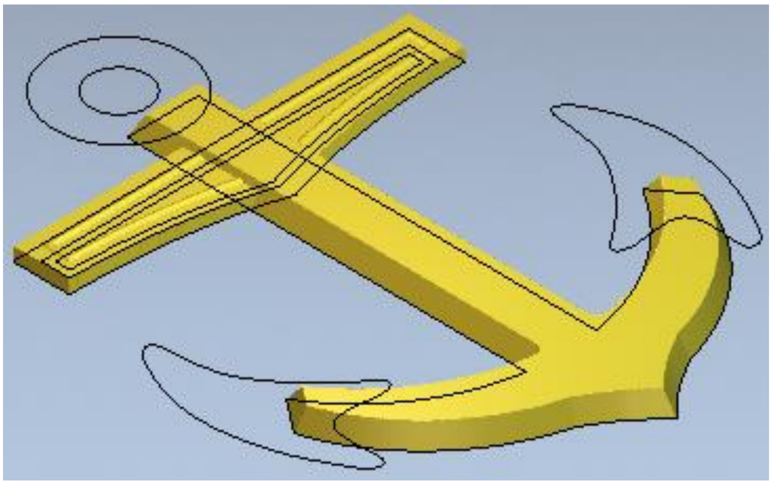

Tool Settings: Shape Editor Tool
Shape Profile
Round
Square
Plane
Angle 65
No limit
Limit to height
Scale to height
Constant height
Height 0.03 inches
Corner Angle 0
Start Height
Start Height 0 inches
Scale
Scale 1
Relief Combine Mode
Add
Subtract
Merge High
Merge Low
Replace
Node Editing
Apply
Cancel
Project
Tool Settings: Shape Editor Tool

19 Select a **Square shape** with an **Angle of 65 degrees**

20 Select **Limit to Height** and Enter a value of **0.75mm** *(0.03")*

21 Click the **Merge High** box and **Apply**

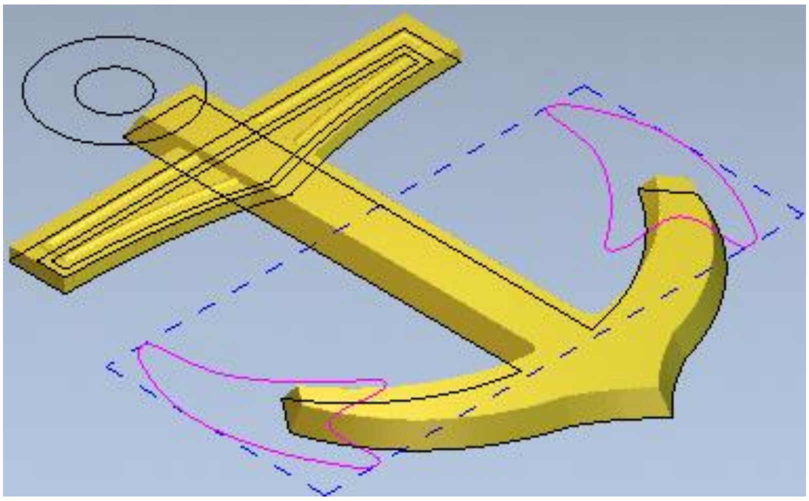
22 Click the **Cancel** button



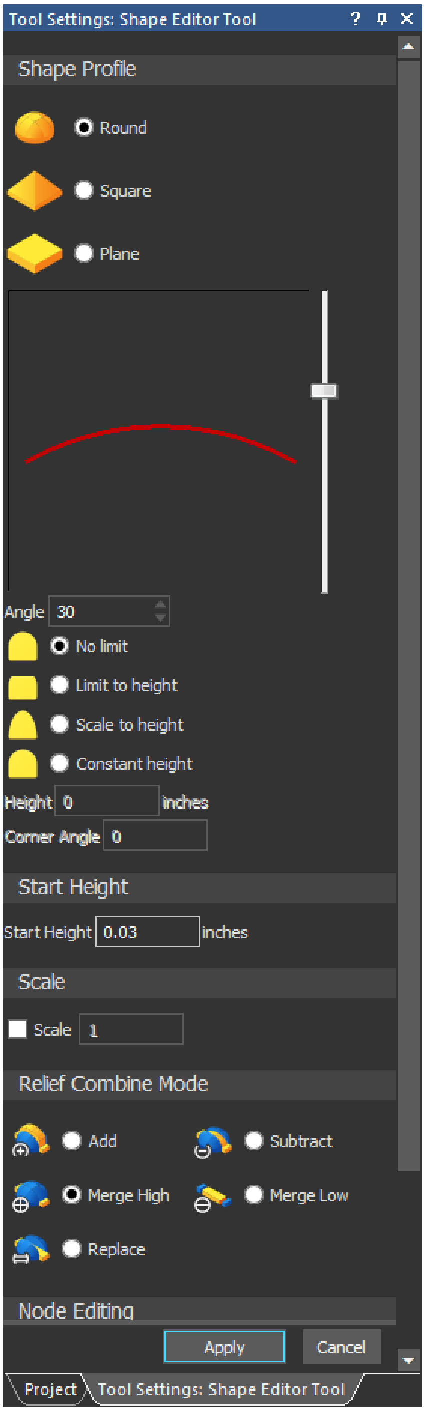
The main anchor shape is created and merged with the bar relief.

This shape was produced from the vectors extruding as a triangular shape of 65 degrees. As it reached a height of 0.65mm, it 'levelled off'.

23 Shift Select the two **hook vectors** as shown



24 Press **F12** on the keyboard to open the **Shape Editor** form



Tool Settings: Shape Editor Tool

Shape Profile

● Round

○ Square

○ Plane

Angle 30

● No limit

○ Limit to height

○ Scale to height

○ Constant height

Height 0 inches

Corner Angle 0

Start Height

Start Height 0.03 inches

Scale

☐ Scale 1

Relief Combine Mode

○ Add ○ Subtract

● Merge High ○ Merge Low

○ Replace

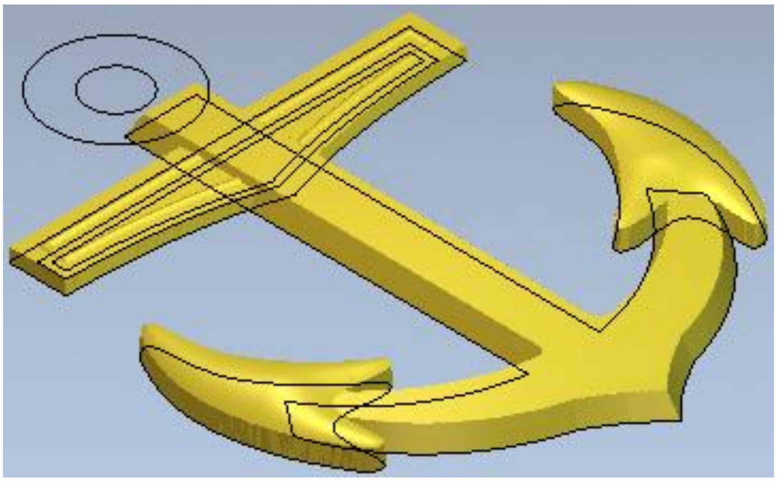
Node Editing

25 Select a **Round shape** with an **Angle of 30 degrees**

26 Enter a **Start Height** value of **0.75mm** *(0.03”)*

27 Click the **Merge High** box and **Apply**

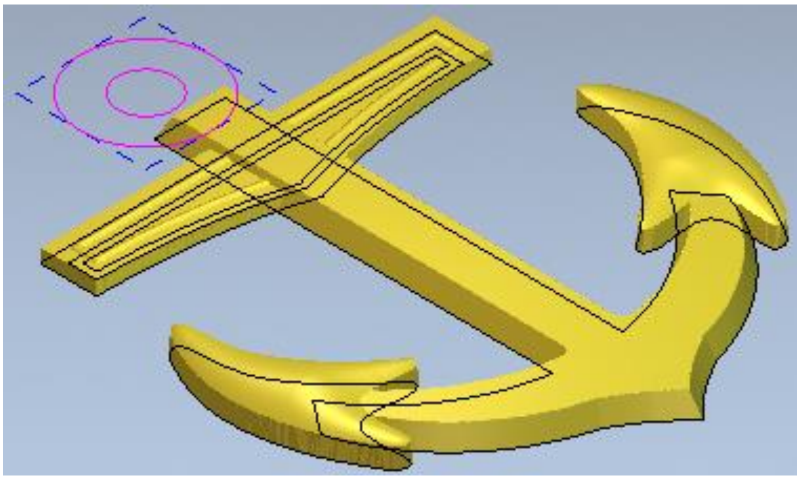
28 Click the **Cancel** button



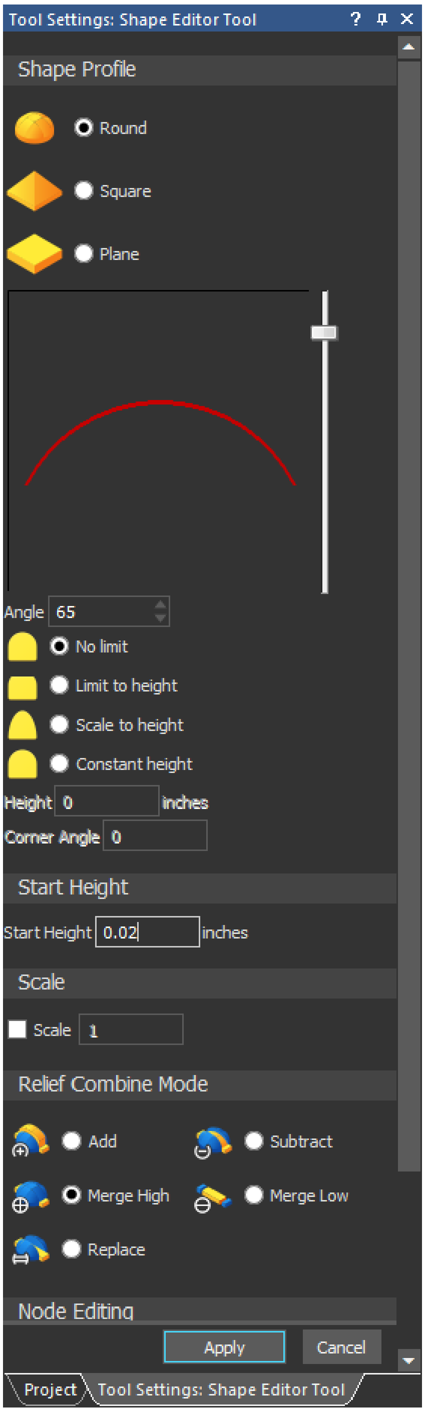
The ‘hook shapes’ have been created and **merged** with the main body.

The Start Height provided a ‘platform’ of 0.75mm before a dome shape of 30 degrees was applied.

29 Shift Select the two **Circle vectors** as shown



30 Press **F12** on the keyboard to open the **Shape Editor** form


Tool Settings: Shape Editor Tool
Shape Profile
Start Height
Scale
Relief Combine Mode
Node Editing
Apply
Cancel
Project
Tool Settings: Shape Editor Tool

● Round
○ Square
○ Plane

Angle 65

● No limit
○ Limit to height
○ Scale to height
○ Constant height

Height 0 inches

Corner Angle 0

Start Height 0.02 inches

☐ Scale 1

○ Add
○ Subtract
● Merge High
○ Merge Low
○ Replace

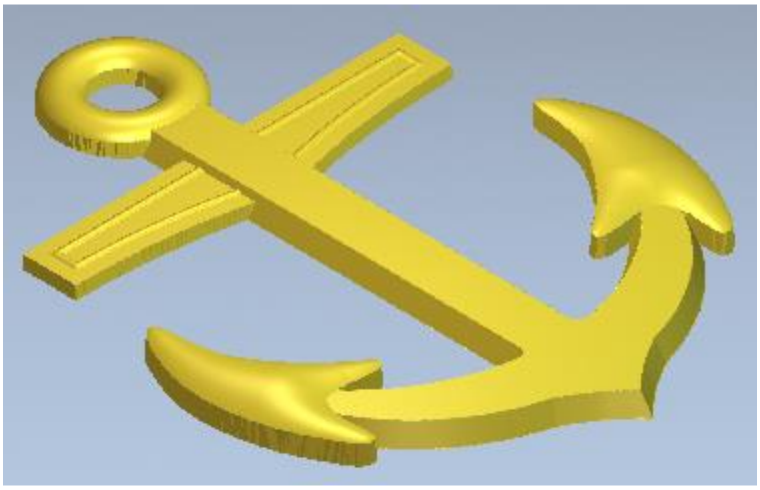
31 Select a **Round shape** with an **Angle of 65 degrees.**

32 Enter a **Start Height** value of **0.5 mm** *(0.02")*

33 Click on **Merge High** box and **Apply**

34 Click the **Cancel** button

35 From the **3D View** toolbar, click on **Toggle Vector Visibility**



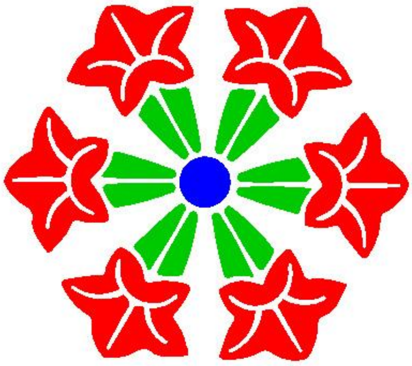
The Vectors are hidden, and the final result can be seen clearly.

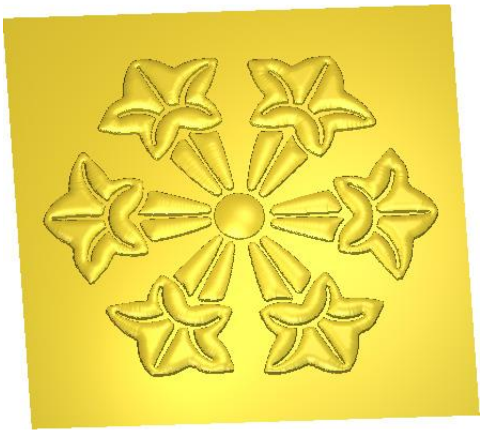
36 **Save** the ArtCAM Model

Tutorial: Bitmap Motif

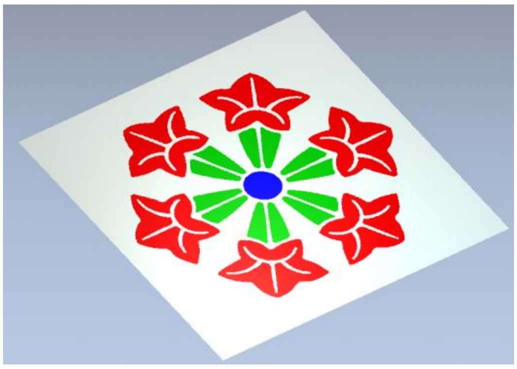
Introduction

The following tutorials demonstrate the creation of a basic relief from bitmap colours.

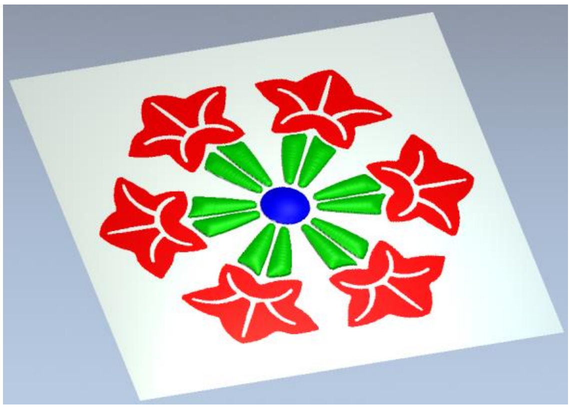




1. Open **BitmapMotif.art**
2. Switch to **3D View**
3. Toggle on **Display Bitmap** icon from the **3D View** toolbar



4. Double click on the colour **blue** directly to open the **Shape Editor**
   - Choose a Round shape with an angle of 30 degrees
   - Enter in a Start Height of 1mm (0.05”)
   - Check Scale To Height and type in a Height of 3.5mm (0.15”)
   - Click Apply and Cancel
5. Double click on the colour **green** to open the **Shape Editor**
   - Choose a Round shape with an angle of 30 degrees
   - Enter in a Start Height of 1.5mm (0.1”)
   - Click Apply and Cancel

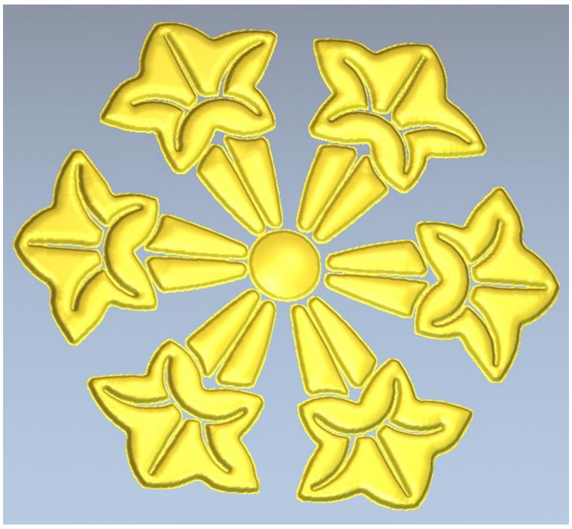


6. Double click on the colour **red** to open the **Shape Editor**
    - Choose a Round shape with an angle of 40 degrees
    - Enter in a Start Height of 2mm (0.1”)
    - Check Limit To Height and type in a Height of 2mm (0.1”)
    - Click Apply and Cancel

7. Select **Display Material** to toggle back to the Relief (material) view.

8. Select **Smooth Relief** from the Relief Editing Toolbar
    - Apply 3 smoothing passes and close the form

9. Toggle **Zero plane** from the **3D view Toolbar** to view the results.



Example 5-2

Follow along with the teacher to complete the Example.

Save and Load Relief:

A .rlf file only contains the 3D relief (no vectors, colour, or bitmap).

When a relief is saved, the origin is taken into consideration. Therefore when it is loaded back in, it always returns to the same position from the origin.

Example 5-3

Follow along with the teacher to complete the Example.

Extrude:

Drive Curve → The curve that the cross-section follows. The tab or hash marks on the line show which side the cross-section will be created on.

Cross-section → A cross-sectional shape that will become the relief. The tabs or hash marks must always be on the inside of the curve, use the Invert curve in Z box to change it.

Two Rail Sweep:

When selecting vectors, you must first select the vector and then press the select button.

Create Vector Boundary:

Create an automatic vector outline around the Composite Relief.

6. Relief Editing

Introduction

This example shows how to use some of the relief editing tools.

Functions

Set Model Size → Set the real physical size of the model

Smooth Relief → Apply smoothing filter to the whole relief or a specific area

Texture Relief → Apply 3D texture to the whole relief or a specific area

Scale Relief Height → Scale relief heights in Z

Smooth Sculpting → Interactive Sculpting tool to smooth areas of the relief

Smudge Sculpting → Interactive Sculpting tool to re-model relief like clay

Deposit Sculpting → Interactive Sculpting tool to add material to the relief

Carve Sculpting → Interactive Sculpting tool to remove material from the relief

Envelope Distortion → Select a floating blue relief clipart to copy, distort, and paste it along a curve

The following can be managed from the Relief Layers section.

Add a new Relief Layer to the model

Import a new Relief Layer from a file

Export the selected/highlighted Relief Layer

Duplicate the selected Relief Layer

Transfer the selected Relief layer to the opposite side (Back Relief Layer)

Create a new Bitmap Layer from the selected Relief Layer

Delete the selected Relief Layer from the model

Merge (combine) the visible layers to form a new Relief Layer

Example 6-1

Follow along with the teacher to complete the Example.

Smooth Relief:

Until you become familiar with the smooth relief function, it is best to only do one pass at a time, each pass can cause a large amount of detail to be lost.

Sculpting:

The Sculpting functions work with the relief as if it were a piece of clay allowing you to interactively alter it.

Example 6-2

Follow along with the teacher to complete the Example.

Texture Relief:

When using From File, typically an .rlf is selected, a texture block that has already been created as a relief. An image file can also be selected, in which case it creates the relief texture for the first time. The downfall of this is most of the time a new texture must first be edited (smoothed and possibly inverted) before it can be used. If you create it and put in on an existing relief all in one step, the texture cannot be edited by itself.

Tutorial: Texture From Image

Intro

Quickly create 3D textures from a series of images. Use the clipart library to store the new textures.

This document was created to coincide with the video. For more details on this tutorial, please watch the video.

Stone Pattern Texture

1 **Open** Model - **stone_pattern.png**

  - Width = 12”

2 Select the stone_pattern **Bitmap Layers** in the Project Tree

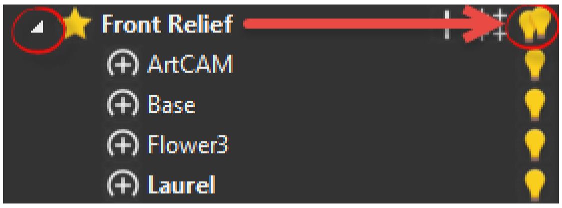
3. **Create Relief Layer** (from bitmap layers)
   - **New Height** = 0.15″
4. **Smooth Relief** - 1 pass

Next you are ready to save your new texture by into your clipart folder

5. Open **Relief Clipart Library**
   - Chose to view the Custom Reliefs clipart folder
   - Using your left mouse button select in your project tree, stone pattern Relief Layer you have just created
   - And drag into the Relief Clipart Library

Tutorial: Relief Layer Badge

1. Open Model **Relief Layer Badge.art**
2. Expand the **Front Relief Layers** section of the **Project Tree**

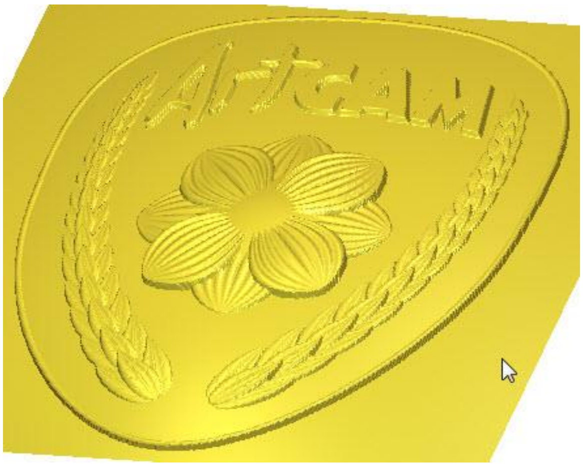


3. **Hide** all Relief Layers by clicking on the **twin light bulb** next to the main branch **Front Relief**

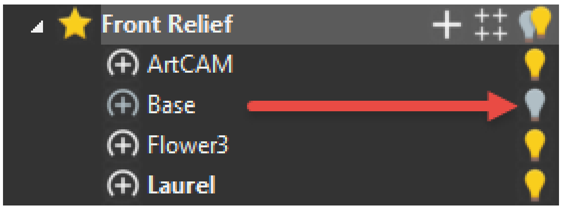
To better understand layers, use the light bulbs to hide and show different relief layers. This will help demonstrate how they interact together. Hide all the layers when finished

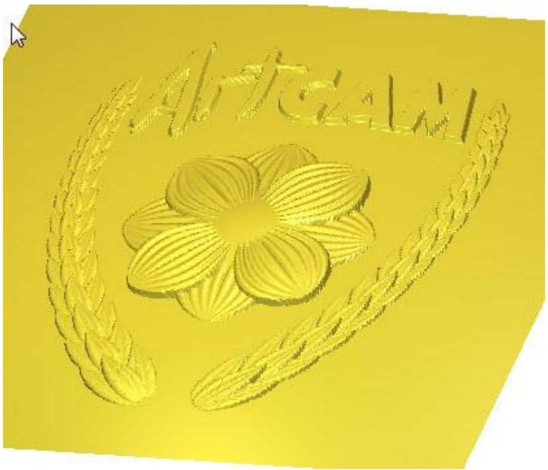
4. In the Project Tree, click on the light bulb to show the **Laurel Relief Layer** and the **Flower3 Relief Layer**
5. Show the **Base Relief Layer** and note how it embosses the other reliefs
6. Show the **ArtCAM** Relief Layer to finally display the text

As demonstrated, a Relief Layer can be switched on/off as required by clicking the adjacent light bulb icon. Any Relief operations assigned to a Relief Layer that is switched off will be temporarily hidden from the model.



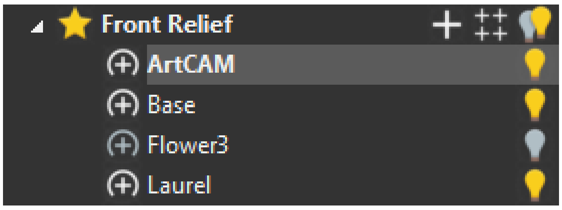
7. **Hide** the **Base Relief Layer** to see the result





8 **Toggle** the **Base layer** back **on** but **Hide** the **Flower3 Relief Layer**

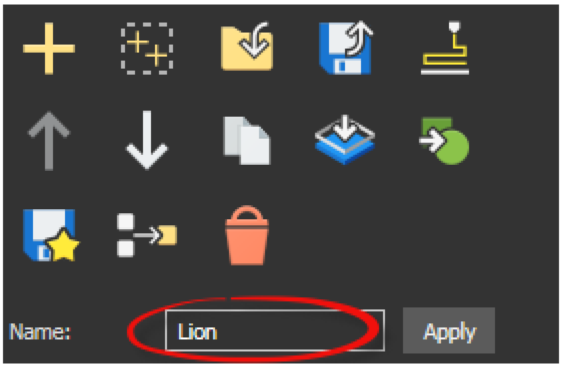
9 Make the **ArtCAM** Relief Layer **active** by clicking on its name to highlight it.



10 Select **New Relief Layer** from the **lower** Project Panel.

The new Relief Layer is created directly above the active Relief Layer.

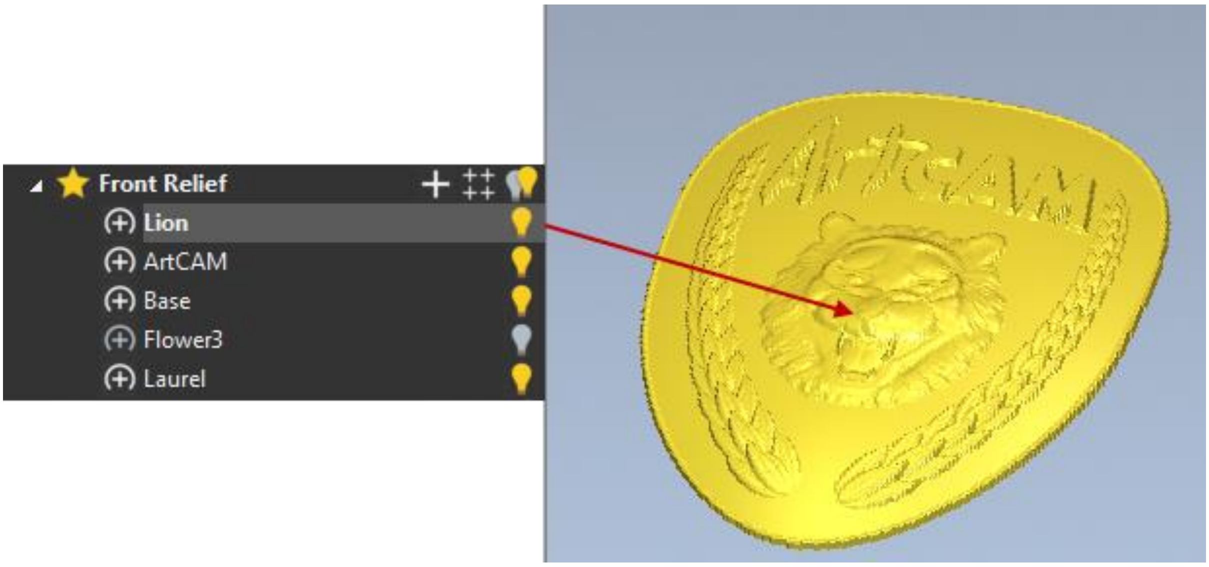
11 Select the new **Relief** layer and rename it to **Lion** from the lower Project Panel


Name: Lion

12 From the Relief pull down menu, chose **Import**, followed by **Import** to load in an existing relief

13 Choose **Lionhead.rlf** from the ArtCAM data folder

14 No changes are required so Click **Paste** on the **Transform** form

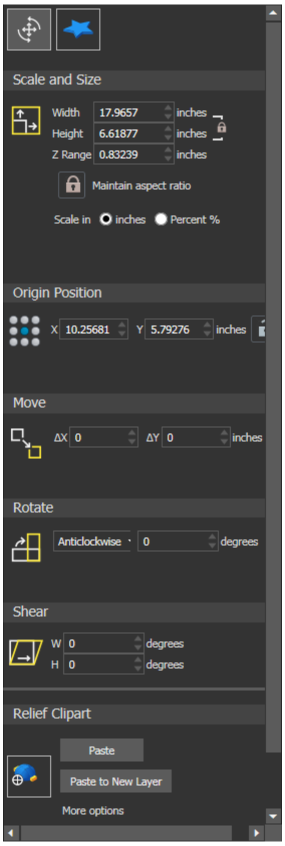

Front Relief
Lion
ArtCAM
Base
Flower3
Laurel

Relief Layers can be utilised to organise work, simplify adjustments, and easily experiment with different variations.

15 Create another **New** Relief Layer and rename it to **Banner.**

16 **Open** the **Relief Clipart Library** from the Relief creation toolbar

- In the pull down list at the top, choose the Banners Library.
- Click on Banner1 to select and import it


Scale and Size
Maintain aspect ratio
Origin Position
Move
Rotate
Shear
Relief Clipart
Paste
Paste to New Layer
More options

Width 17.9657 inches
Height 6.61877 inches
Z Range 0.83239 inches
Scale in ● inches ○ Percent %
X 10.25681 Y 5.79276 inches
ΔX 0 ΔY 0 inches
Anticlockwise 0 degrees
W 0 degrees
H 0 degrees

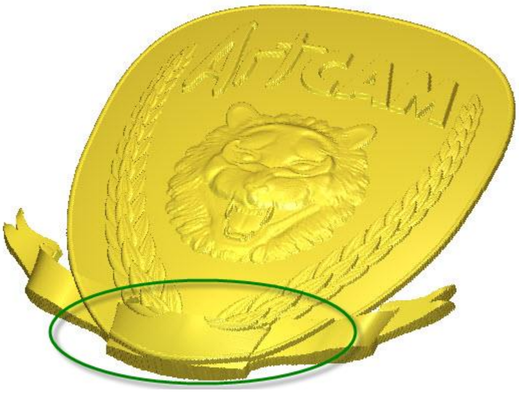
17 Use the Transform tools to resize and position it suitably or use the parameters suggested below.

- Press F9 to centre in the model
- In Scale and Size, enter a new Scale of 50% with all sizes linked then click Apply
- In Origin position, Enter a value of 2 in Y and then Apply (note ArtCAM model is in imperial units)

18 At the top of the Form, Click on More Options icon

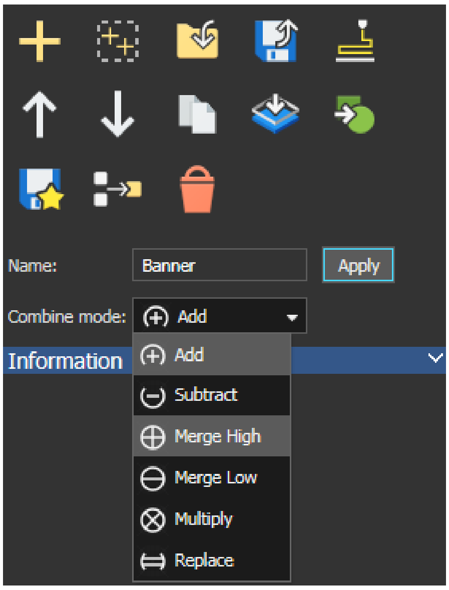
- For now, ignore the Paste Combine Mode but enter a value of 0.1 for Height (start height).
- Select Paste.

The banner appears to be sitting overlapped with the rest of shield. This can be changed by adjusting the Relief Layer Combine mode. The Combine mode dictates how the Relief Layers interact with each other. Currently all the Relief Layers are on the Add Combine mode. If the problem layer, in this case, the new banner layer is changed from Add to Merge High, it will blend in with the relief of the design.



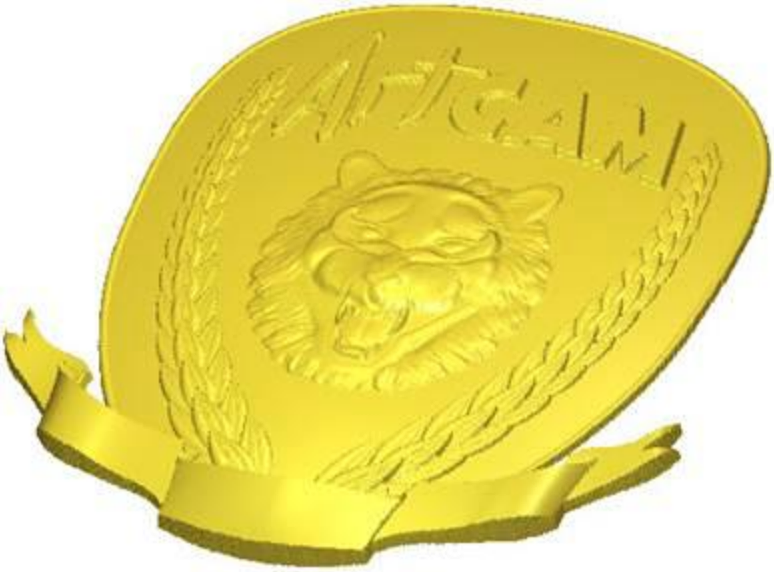
19 Make sure the **Banner** Relief layer is **active**

20 In the lower parameters section on the Project panel, change the Combine mode from Add to **Merge High**


Name: Banner
Combine mode: Add

The banner now blends in with all the other Relief Layers.

The Relief layers are effective from top to bottom. The Combine mode of the top Relief Layer affects everything below it. The Combine mode of the bottom Relief layer affects nothing.



Summary Tutorial: Grape Vine

Complete this tutorial either using the Summary steps or the full instructions on the next page.

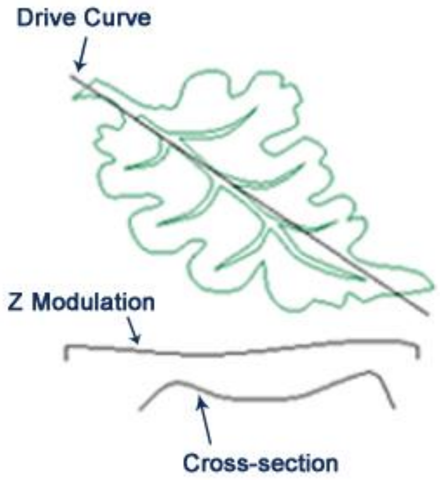
1 Open Grape-Vine.art

2 Toggle Vector Visibility on

3 Vector Layer = Leaf and Construction

4 Relief Layer = 3D Leaf

5 Extrude
  - Drive Curve = diagonal line – use as a centreline
  - Cross Section = bottom curved profile – invert curve in Z
  - Z Modulation = 2nd from bottom curve
  - Apply, Cancel



6 Select leaf vector - Zero Outside Vector

7 Shape Editor – Select leaf vector
  - Add (Round -5º, Start Height=1mm (.05”)
  - Apply

8 Select leaf veins
  - Add (Round -25º, Start Height =-0.5 mm (-0.02”))
  - Apply, Cancel

9 Vector Layer = Vines

10 Relief Layer = 3D Vine

11 Shape Editor – Merge and Apply each vine

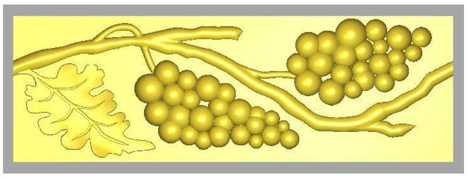
12 Greyscale, primary colour = yellow

13 Sculpting – smooth crease where branches meet main vine
  - Smooth, Mask Material Safety Plane 0.25 mm (0.01”)

14 Vector Layer = Grapes

15 Relief Layer = 3D Grapes

16 Shape Editor – Merge and Apply each set of grapes

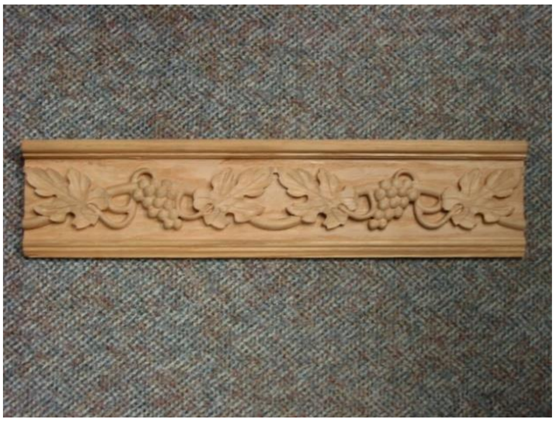


This tutorial is complete!

Tutorial: Grape Vine

Introduction Scenario

A customer has asked us to reproduce an existing moulding. He has indicated to us that it doesn’t need to be an exact duplicate, but if the end results produced in ArtCAM were similar to the original, then that would be fine.



Getting the Design into ArtCAM

There are several different ways that an ArtCAM user could go about getting the design vectors into the software.

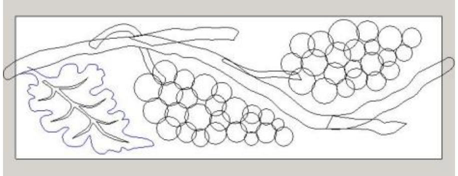
The first method, the designer would visually inspect the piece of moulding and with part in hand would build the vectors in ArtCAM by eye. This is actually the way that the vectors we will be using have been created.

A second method to get this data into ArtCAM could be, to take a digital photograph of the moulding and use it as a template. The photo could be opened in ArtCAM and the user could trace the necessary outline vectors. This method may be a bit easier for someone who may not be very artistic. Using a digital photo would give the user the ability to follow the outlines of the picture and basically trace it.

The third possibility could be to use the plastic transparency sheet on the Wacom Pressure sensitive tablet and manually trace the outline of a printed photograph. This option is similar to the second method but may apply more to someone who may not have the image in digital format. If it was a small 5” X 7” photo it could be blown up in size before it was used for tracing, this is of course providing the size of the photo stays within the limits of the Wacom tablet’s transparency envelope.

Analysing the Design Vectors of the Grapevine

If you look and see how the designer of this file has set up the design vectors you should notice a few things.



The vectors for each modelling section are on separate layers, making it much easier to work with.

You can see that there are several separate vector entities that represent the different branches of this vine. These parts of the vine have been separated out so that there is a certain effect achieved when the vine is built. If these areas were all combined into one main branch then the results of building the vine shape would not look natural or organic. What would end up happening is the large common area where the main vine and the smaller vine meet up would have a very balloon like and bubbly appearance. The only way that a user would know this information would be from trial and error and/or from experience. Having the small branches of this vine set up the way they are is going to give us the most natural looking effects possible with the least amount of relief modelling effort. ArtCAM contains useful tools that we can use to go in and alter these areas to look more natural after we have built them into 3D.

If you select the circular vectors representing the grapes, you will notice that they have not all been grouped together as one entity. Random diameter circles within the bunch have been grouped together in order to give the relief of the grapes a varying effect. This varying effect for the grapes is achieved by the difference in the diameter of the various circular vectors.

The way it has been set up is that the different groups have been assigned unique characteristics for relief modelling and since the circles have varying diameters they will individually reach unique heights. The way that ArtCAM works is, when using the Shape Editor to build reliefs the software associates width with height, therefore the wider something is the higher that it is going to have to be in 3D space so that it looks proportional.

The leaf has two design vectors showing the shape, there are other vectors on another layer that will be used to achieve an underlying sweep.

One last detail to pay attention to in this design is the resolution. Resolution is a very important factor of an ArtCAM job. The resolution is set at 1991 X 663 pixels; normally the rule of thumb (depending on job sizes and relief modelling technique) is that the shortest side of the model should contain approximately 1000 pixels. Having said this you can see that the shortest side of this job only contains 663 pixels. The reason for this is that the entire piece is going to be modelled using vector modelling. When you are doing vector modelling it is possible to work with a resolution that is approximately 1/3 less than what you would normally use if you were colour modelling. The 1000 pixel rule outline above is for colour modelling so that is why you are seeing a lower resolution then normally recommended.

Strategy for Building the Grapevine

As with most projects it is important that before you begin to work that you think about how you are going to get to the final result. The same rules apply to ArtCAM, before we start to build our relief, we should take a few minutes to look at it and think about the best way to build our design into a 3D relief.

As in many cases with ArtCAM, when you are going to be building a design that contains several parts or pieces, it is best to try and isolate the smaller parts and build these in separate relief layers.

For the Grapevine the plan is going to be as follows:

- Create three different relief layers for Grape Leaf, Main Vine and Grapes and construct them in individual relief layer.
- Build the leaf is several steps. Since the Shape Editor is not going to give us enough control over how the shape is built, the designer has decided to utilize one of the more user definable relief modelling tools; Extrude.
- The extrusion function will be used to build the underlying shape of the leaf.
- Build up the vine shape using the main vine vector as well as the branch vectors.
- Since the piece needs to look as natural and organic as possible we will have to do some sculpting on certain areas of the relief.
- The third relief that is going to be built will be the grapes. The grapes should be quite straightforward and easy to build since we will just use the Shape Editor to build the shapes.
- Once building the individual relief is done all the layers will be made visible.

Building the Grapevine

1 Open the file **Grape-Vine.art**

This tutorial is based in the default ArtCAM function layout. If you have customised your layout and wish to return to the standard, from the Window pull down menu choose Reset Layout.

2 Toggle Vector Visibility to on to show vectors in the 3D View

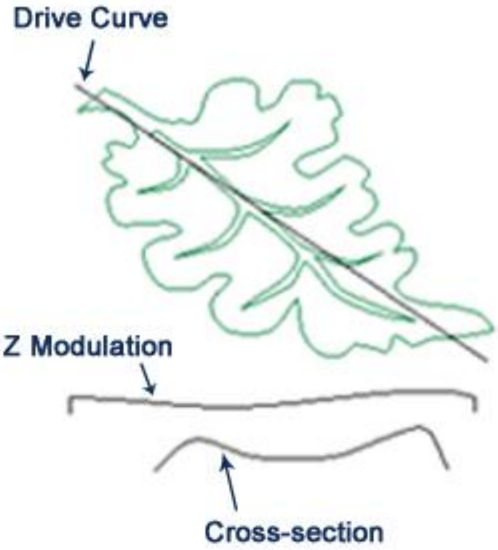
Grape Leaf

1 From the Project Tree, show the **Leaf** and **Construction Vector Layers**, hide all other Vector Layers

2 Make **3D Leaf** the active **Relief Layer**

The Leaf layer contains the vector representing the size and shape of the leaf.

The Construction layer has additional vectors used to assist us in building the underlining relief.



3 Open the **Extrude** function from the flyout toolbar located on the Relief Creation toolbar

4 In the model area pick the straight vector that runs through the leaf for the drive curve and click **Select** button in the panel next to **Drive curve**

5 Check the **Use as centreline** box

6 Pick the vector that represents the profile (Cross-Section) for this extrusion, click the **Select** button next to **Start Profile**

7 Check the **Invert curve in Z** box to make sure that the hash marks are on the inside of this vector shape

8 Pick the vector that represents the Z modulation and click the **Select** button next to **Z Modulation**

9 Make sure that **Add** is the option that is selected and then click the **Apply** button to build the underlying shape of the Grape Leaf

10 Close the Extrude panel

Notice that the underlying shape for this leaf that has been extruded is larger than the actual leaf itself. This is a pretty common technique used for relief modelling in ArtCAM where the underlying shape is created much larger than needed and then the required area gets trimmed out.

11 Select the vector outline of the leaf and press the **Zero Outside Vector** function

This should trim out the shape of your leaf.

12 With the leaf outline vector still selected, press **F12** to open the **Shape Editor**

13 Click **Add** in the Shape Editor window then Close

- Dome, Angle=-5º, Start Height=1mm (0.04”), Apply

This will add the concave shape of -5º with a small start height to the leaf. You will not see much of a change when the vector attributes are added to the existing relief. The leaf will get a bit higher and it will also provide a bit more of a dish shape to the leaf. By doing this we are trying to add a more natural look.

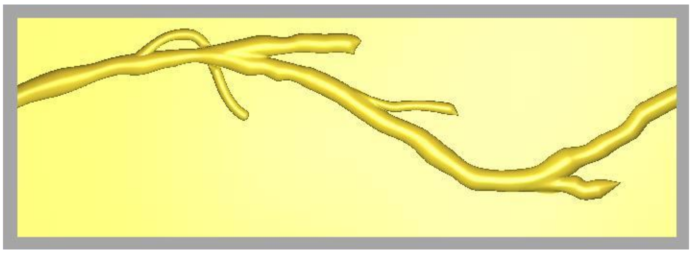
14 Select the vectors that represent the vein detail for the leaf

15 Press **F12** to open the Shape Editor

- **Add** Dome, Angle= -25º, Start Height= -0.5 mm *(-0.02”) , Apply*

16 In the Project Tree, click on the light bulb next to 3D Leaf to **hide the 3D Leaf Relief Layer**

Main Vine



1. Make **3D Vines** the active **Relief Layer**
2. Show the **Vines Vector Layer**, hide all other Vector Layers
3. Select the vine vectors one by one, open the **Shape Editor** with F12 and Add or Merge high. The values are already applied to the vector shape;
   - Main vine (Dome 68º, Start Height=1mm (0.05”), Add), Apply
   - 1st and 2nd branch (Dome 83º, Start Height 1mm (0.04”), Merge High), Apply
   - 3rd branch (Dome 70º, Start Height=1mm (0.04”), Merge High), Apply
   - 4th branch (Dome 83º, Start Height=1mm (0.04”), Merge High), Apply
   - 5th branch (Dome 70º, Start Height=1mm (0.04”), Merge High), Apply

Observe the creases in the areas where the branches have been merged into the main vine. Ideally, we want to smooth these areas in order to make the vine look more organic.

4. Zoom into the first area where you can see the creases
5. Activate the **Smooth Sculpting** tool
6. In the Tool Setting Panel, set the following:
   - Radius = 25
   - Strength = 50
   - Smoothness = 100
   - In the Mask area, check the **Material Safety Plane** and enter in a value of .025mm *(0.01”)*

By making adjustments to the Mask section of the Sculpting panel, we ensure that when we are smoothing the relief, the smooth tool will not affect the background (zero plane), causing a radius at the edge where the relief meets the zero plane.

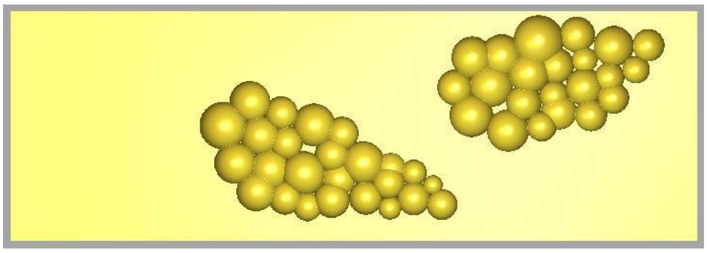
7. While using the Smooth tool, vary the diameter and strength of this tool accordingly to achieve the desired results
8. Smooth the creases where the smaller branches attach to the larger branch

Basically we just want to get rid of the creases and make the vine look more natural. Individual results may vary.

To zoom in & out you need to hold the Alt key down while using the mouse as you would in a regular 3D view, or use the icons at the top of the screen.

9 Click on the light bulb next to 3D Vines to **hide** the **3D Vines Relief Layer**

Grapes



1 Make **3D Grapes** the active **Relief Layer**

2 Show the **Grapes Vector Layer**, hide all other layers

3 Select the different groups of circles that represent the grapes and use the **Shape Editor** to build these shapes and use Merge Highest. The values are already applied to the vector shape;

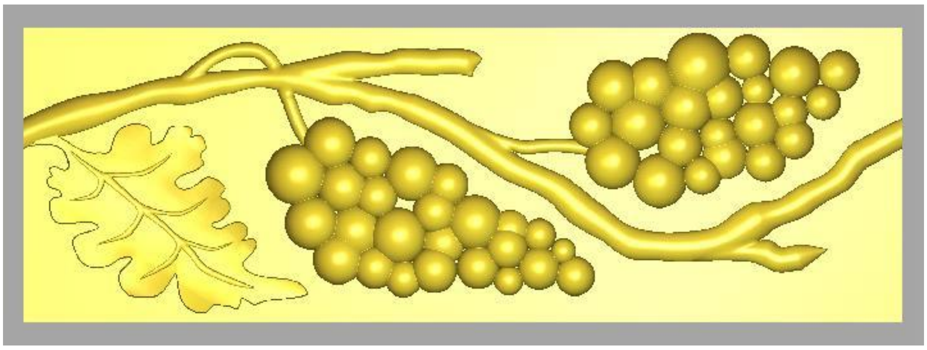
- 1st set (Dome 86º, Start Height= 3 mm (0.13”), Merge High), Apply
- 2nd set (Dome 80º, Start Height= 2 mm (0.11”), Merge High) , Apply
- 3rd set (Dome 89º, Start Height= 1 mm (0.06”), Merge High) , Apply
- 4th set (Dome 68º, Start Height= 2 mm (0.10”), Merge High) , Apply

Use the Merge High option so that the grapes are blended into one another.

It can be useful to use the preview Relief Layer function if working from the 2D view to track the progress of your relief in the 2D view. Doing this will display an interactive greyscale of the areas as they built.

Viewing Combined Reliefs

Now that we have built all of the pieces for our finished part we can now bring them all together.



4 **Show** all **Relief Layers**

5 **Toggle Vector Visibility** to hide the vectors in the 3D View

6 Save the finished ArtCAM files as Finished Grape Vine.art

The design is now complete and ready for machining.

For this project the grape vine relief has already been created and is now ready to be machined. In a later tutorial you will generate three toolpaths in order to machine this part in an efficient manner. The first toolpath will machine away the flat background. The second toolpath will rough out the area immediately surrounding the relief and the third creates a 3D toolpath to machine the shape of the vine and grapes.

Example 6-3

Follow along with the teacher to complete the Example.

Envelope Distortion:

Envelope Distortion can be used with vectors or reliefs. The relief must be free float blue clipart.

If you wish to distort an existing relief in the model, use the Cookie Cutter to convert it to blue clipart first.

7. 3D Machining

Introduction

This example shows how to generate 3D toolpaths.

Functions

Machine Relief → Create a 3D toolpath that follows the contour of the 3D relief. The Machine Relief toolpath also allows for Z level roughing within the toolpath

Example 7-1

Follow along with the teacher to complete the Example.

Z level Roughing:

If any value is changed in the tool parameters, make sure to click the Apply button to update the Z Slices section.

Toolpath Summary:

The time scale factor is very important in regards to the machining time. When ArtCAM calculates the time, it takes the length of the red toolpath lines times the feeds and speeds you entered. It does not take into consideration that your machine slows down when it changes direction. Each CNC router speeds up and slows down at a different rate. The time scale factor makes up for this difference.

For starters, set the time scale factor to 1 and make note of the value. Then machine a few parts and compare them to the output the estimation given by ArtCAM and adjust the value accordingly. So if ArtCAM estimates 30 minutes with a Time Scale Factor of 1, but it actually takes 60 minutes to machine, the Time Scale Factor for that specific machine must be set to 2.

You may need two time scale factors, one for 2D machining and one for 3D machining.

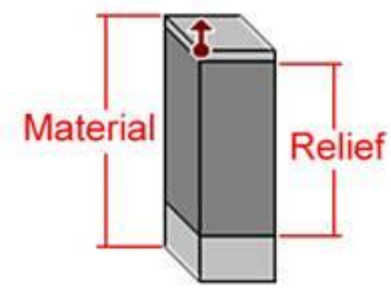
Material Setup for Reliefs

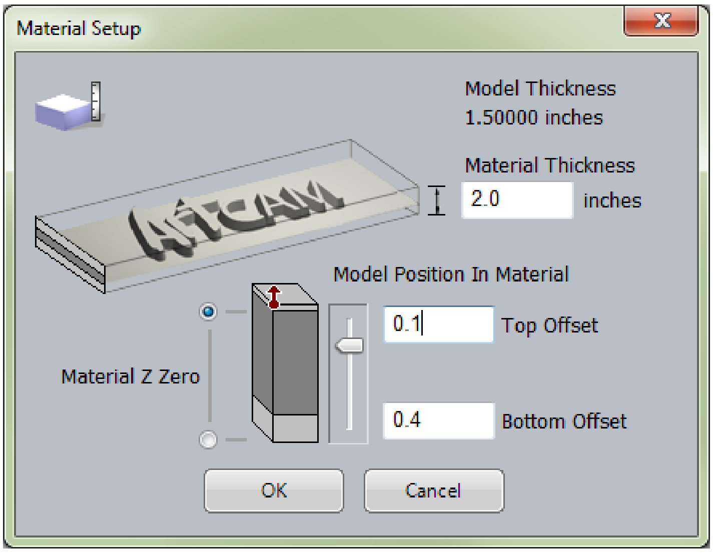
In the pictures shown below, the Material for machining is 2 inches *(50 mm)* thick and the relief is 1.5 *(40 mm)* inches thick.

The material Z Zero is set to the top, meaning the CNC machine will be zeroed from the top of the material.

You have the choice of where to place the relief in the 2″ *(50 mm)* material. Currently the Top Offset is set to 0.1″ *(2 mm)*, meaning the relief will be dropped into the material 0.1″ *(2 mm)*. During machining, the top 0.1″ *(2 mm)* of material will be cut away, removing any imperfections. The 1.5″ relief is machined, leaving 0.4″ *(8 mm)* of stock under the part.

You can use the slider bar or type a specific value to position the relief within the material. For example, if you do not want stock left under the part, change the Bottom Offset to 0.





Model Thickness
1.50000 inches

Material Thickness
2.0 inches

Model Position In Material

0.1 Top Offset

0.4 Bottom Offset

Tutorial: Lizard machining

Introduction

For this project we will machine the finished lizard into a soft material such as HDU. The lizard will then be cut out of the material. We will start by using a Machine Relief toolpath within a selected vector area so as to avoid machining the flat background which in this case we do not need. The lizard will be then cut out of the material using a Profile toolpath. We would like the finished lizard to have total height of 1.5", but the lizard relief is currently 1.545", so the lizard must first be scaled down in the Z prior to machining.

Preparing the Lizard for Machining

1 **Open** the file **Lizard.art**

The relief must be scaled down in the Z only.

2 Open **Scale Relief Height** from the Relief Editing Toolbar

- Scaling = Height
- Mask = None
- **New Height** to 35mm (1.5")
- Detail = None
- Click the **Apply** button

3 Create a **New Vector Layer** called **Machining**

4 **Hide** the Default layer

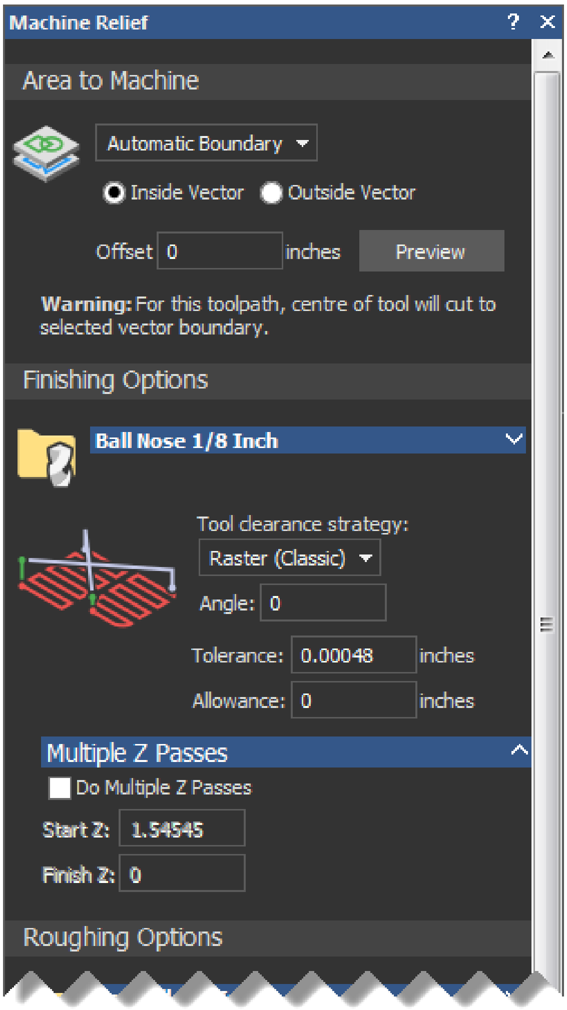
5 Toggle on **Preview Relief** in the 2D view

For the 3D toolpath, we will machine within a vector boundary. When generating a Machine Relief toolpath within a specific area, it is good practice to offset the vector outwards by a little more than the radius of the tool you will use to cut it. The reason being, that during a Machine Relief toolpath, the center of the tool stops on the vector. Since the vector is right up against the relief, the tool cannot drop down to reach the bottom edge of the relief. If we offset the machining vector by the radius of the tool, there will be enough room for the tool to reach down to the base of the relief. However in the Machine Relief we can have ArtCAM create a machining vector for us containing the correct offset (radius of tool) for the required cutting tool. The **Automatic Boundary** option will automate this whole process.

Machining the Lizard

1 Open the **Machine Relief** toolpath strategy

- Select the Automatic Boundary function
- Offset = 0
- **Finish Tool** = 3mm ball nose (1/8 Inch ball nose)
- **Rough Tool** = 6mm end mill (1/4 Inch end mill)
- **Stepdown** = 13mm (0.5”)



Machine Relief ? ✕

Area to Machine

Automatic Boundary

● Inside Vector ○ Outside Vector

Offset 0 inches

Warning: For this toolpath, centre of tool will cut to selected vector boundary.

Finishing Options

Ball Nose 1/8 Inch

Tool clearance strategy: Raster (Classic)

Angle: 0

Tolerance: 0.00048 inches

Allowance: 0 inches

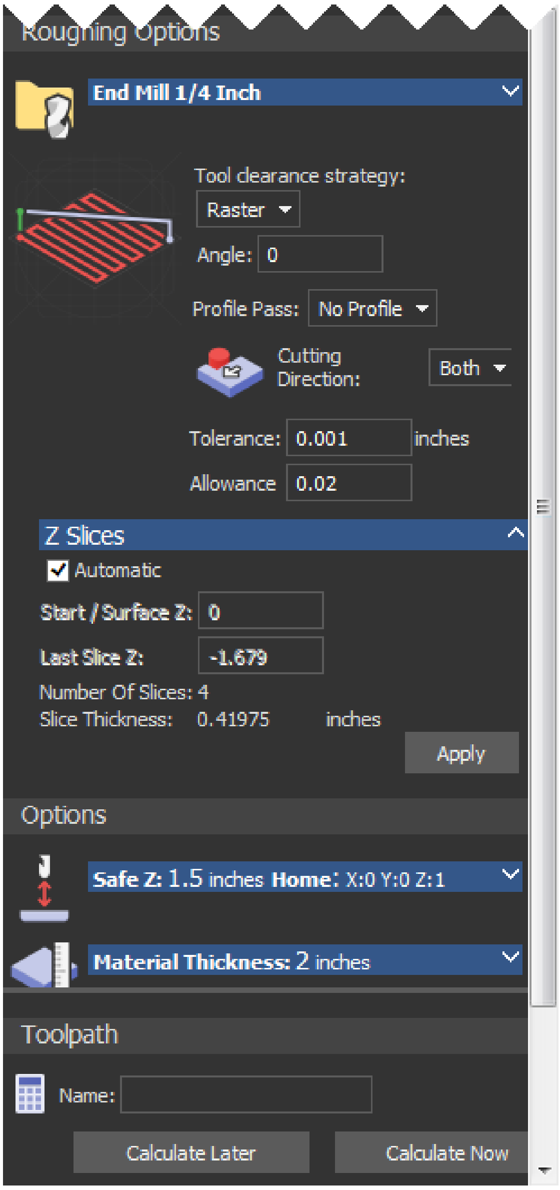
Multiple Z Passes

☐ Do Multiple Z Passes

Start Z: 1.54545

Finish Z: 0

Roughing Options



Roughing Options

End Mill 1/4 Inch

Tool clearance strategy: Raster

Angle: 0

Profile Pass: No Profile

Cutting Direction: Both

Tolerance: 0.001 inches

Allowance 0.02

Z Slices

☑ Automatic

Start / Surface Z: 0

Last Slice Z: -1.679

Number Of Slices: 4

Slice Thickness: 0.41975 inches

Options

Safe Z: 1.5 inches **Home:** X:0 Y:0 Z:1

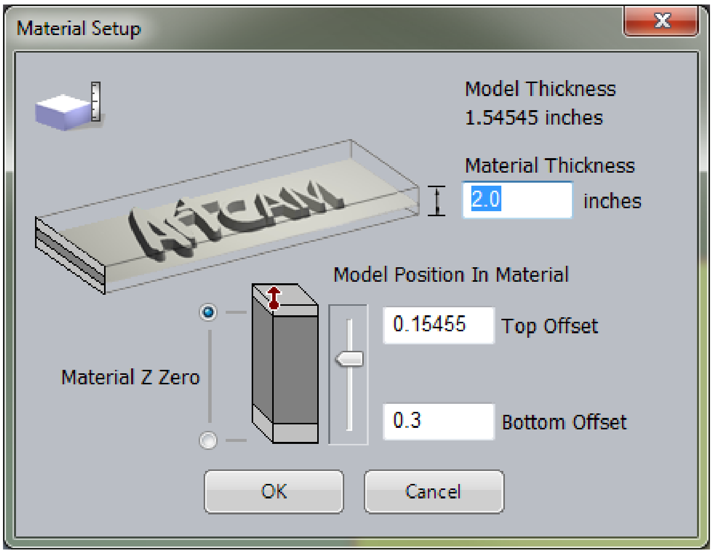
Material Thickness: 2 inches

Toolpath

Name:

2 … continue Machine Relief Toolpath:

- **Material**
    - Thickness = 50mm (2”)
    - Material Z Zero= top
    - Bottom Offset = 8mm (0.3”)


Material Setup

Model Thickness
1.54545 inches

Material Thickness
2.0 inches

Model Position In Material

Material Z Zero

0.15455 Top Offset

0.3 Bottom Offset

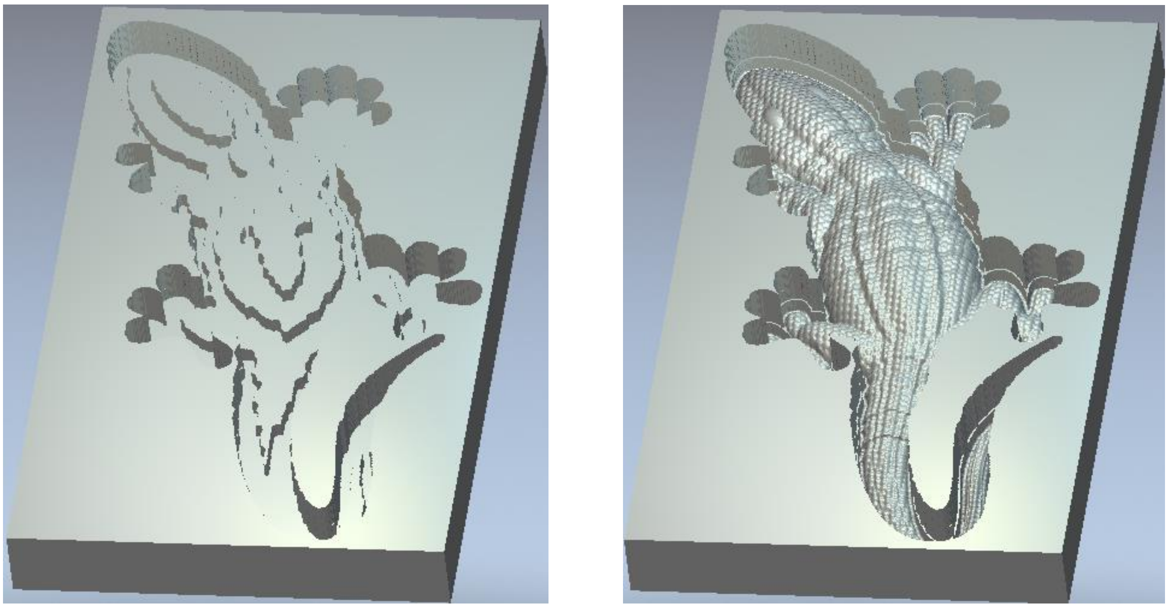
We are leaving 0.3” (8 mm) of stock material underneath the lizard, this will help strengthen the finished part.

3 3D View

4 Click the **Calculate Now** button

5 Close

6 **Simulate Toolpaths**



7. 2D View

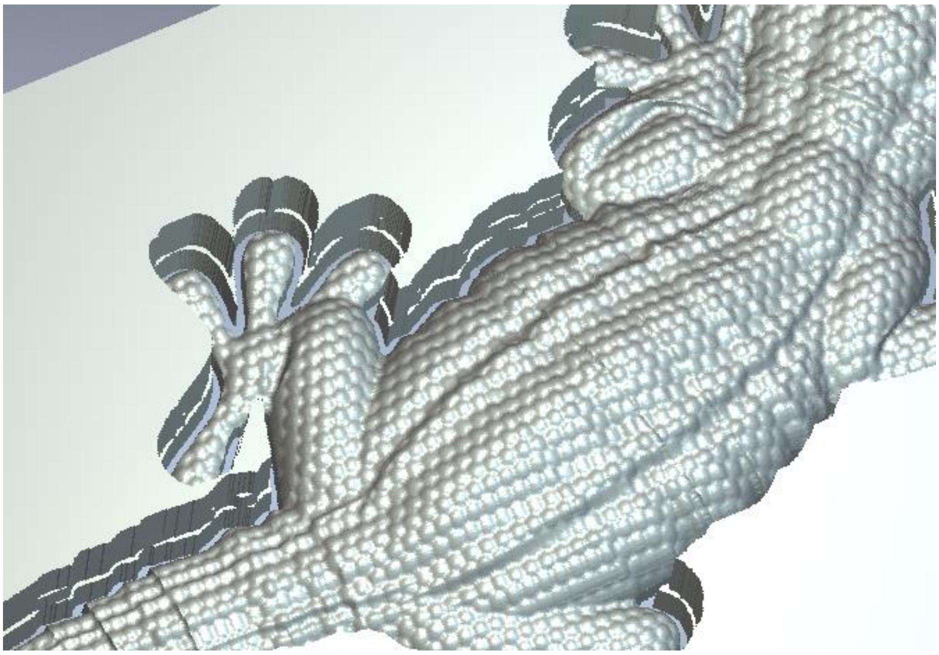
8. Open the **Create Vector Boundary** tool
   - Create a vector boundary around the Composite Relief

The vector we have just created follows along the outside edge of the lizard. This vector will be used for the Profile cut out pass, the last toolpath we will create. When a Profile pass is created, you have the choice to run the tool on the inside or the outside of the vector. In this case, we will choose the outside.

9. Select the new boundary vector on the edge of the lizard

10. Open the **Profiling toolpath** function
    - Finish Depth = 50mm (2”)
    - Tool = 3mm end mill (1/8 Inch)
    - Stepdown = 13mm (0.5”)
11. Click the **Calculate Now** button
12. Click the Close button
13. 3D View
14. Choose the Profiling toolpath

15. **Simulate Toolpath**



The toolpaths are now ready to be sent to the router to be machined.

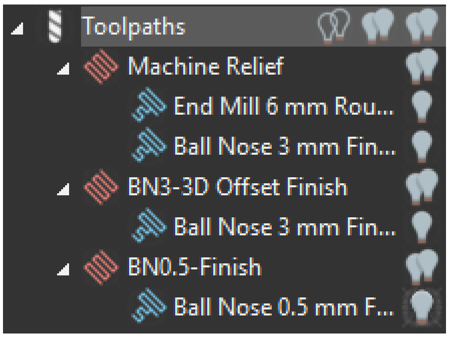
8. Post Processing Toolpaths

Introduction

The Toolpaths produced in ArtCAM must be translated into a different format as an exported file for a specific machine tool controller. The collective name for one of these files is NC data and the operation is called **Post-Processing** which is accessed via the **Save Toolpaths** option.

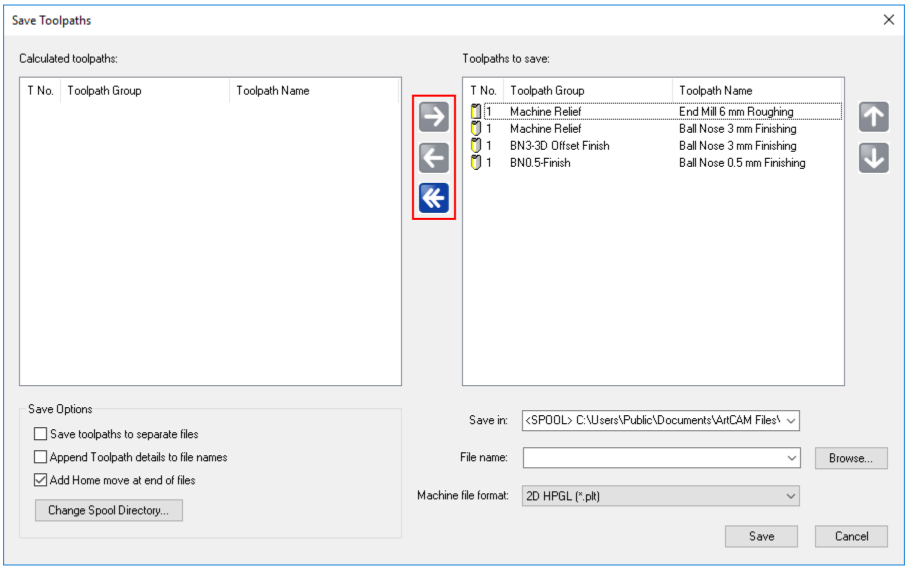
1 **Open** a previously machined model. **8 - machine-ted_completed.art.**

2 **Activate** the Project panel if not already visible.



- Toolpaths
  - Machine Relief
    - End Mill 6 mm Rou...
    - Ball Nose 3 mm Fin...
  - BN3-3D Offset Finish
    - Ball Nose 3 mm Fin...
  - BN0.5-Finish
    - Ball Nose 0.5 mm F...

3 Highlight **Toolpaths** from the List then **Save Toolpaths** from the **Toolpath Operations** area in the lower **Project panel**.



T No.	Toolpath Group	Toolpath Name
1	Machine Relief	End Mill 6 mm Roughing
1	Machine Relief	Ball Nose 3 mm Finishing
1	BN3-3D Offset Finish	Ball Nose 3 mm Finishing
1	BN0.5-Finish	Ball Nose 0.5 mm Finishing

Save Options

☐ Save toolpaths to separate files

☐ Append Toolpath details to file names

☑ Add Home move at end of files

Change Spool Directory...

Save in: <SPOOL> C:\Users\Public\Documents\ArtCAM Files\

File name:

Machine file format: 2D HPGL (*.plt)

When the **Save Toolpaths** form is opened all existing toolpaths are listed in the right hand window (as Toolpaths group was highlighted). Toolpaths are selected and transferred from one side to the other using the central Arrow buttons as highlighted above.

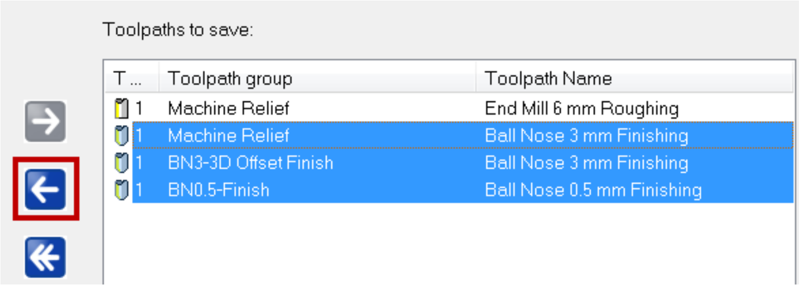
All the files in the **right hand window** (Toolpaths to save/post process) will be included for output into a single NC data file. If the machine tool uses a **manual tool changer** then it will only be possible to include Toolpaths in the NC data file that share the same cutting tool.

If the machine tool has an **automatic tool changer** then any combination of the available toolpaths can be include in the NC data file (as long as the selected machine supports it).

Post Processing of Toolpaths for a Manual Tool Changer

1 Shift select **all** Toolpaths apart from the first **Machine Relief-End Mill 6mm Roughing.**

2 **Click** the **Left arrow** ← to transfer into the **Calculated toolpaths.**

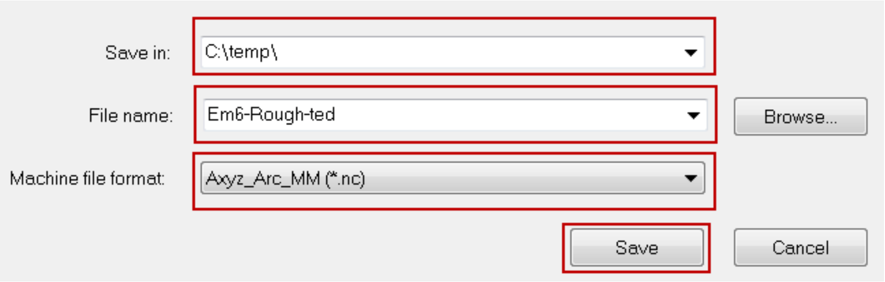


T ...	Toolpath group	Toolpath Name
1	Machine Relief	End Mill 6 mm Roughing
1	Machine Relief	Ball Nose 3 mm Finishing
1	BN3-3D Offset Finish	Ball Nose 3 mm Finishing
1	BN0.5-Finish	Ball Nose 0.5 mm Finishing

3 **Browse...** to a suitable location (e.g C:\Temp)and enter **File name** as **Em6-Rough-ted.**

4 Select **Open** on the **Browse window** to return to the Save Toolpaths window.

5 From Machine file format select **Axyz_Arc_MM(*.nc)**.



Save in: C:\temp\

File name: Em6-Rough-ted

Machine file format: Axyz_Arc_MM (*.nc)

This machine does not support an automatic tool changer hence only Toolpaths that use the same tool can be included in the ncdata output file.

6 Select Save to post process the Toolpath.

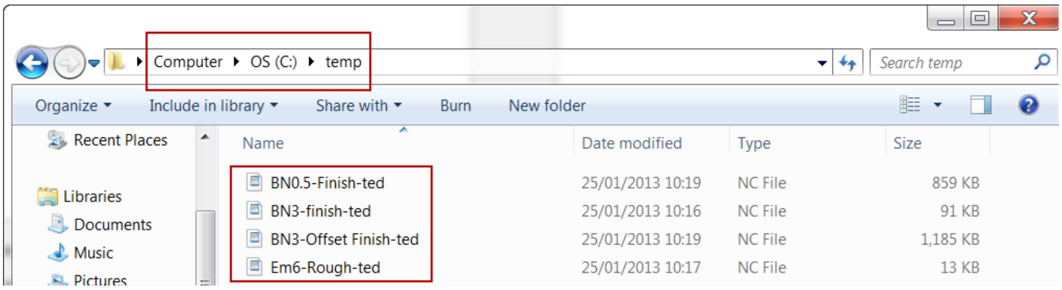
7 Select the left arrow ← to transfer the toolpath back to the left window.

8 Select the toolpath **Machine Relief-Ball nose 3mm finishing** and then the right arrow. →

9 Enter a filename **BN3-finish-ted** and then **Save**.

10 Repeat the above procedure for the remaining **two** Toolpaths providing suitable file names.

11 Browse to the **C:\Temp** directory to see the saves toolpaths.



Computer ▸ OS (C:) ▸ temp

Name	Date modified	Type	Size
BN0.5-Finish-ted	25/01/2013 10:19	NC File	859 KB
BN3-finish-ted	25/01/2013 10:16	NC File	91 KB
BN3-Offset Finish-ted	25/01/2013 10:19	NC File	1,185 KB
Em6-Rough-ted	25/01/2013 10:17	NC File	13 KB

All the post-processed Toolpaths have been saved outside ArtCAM and translated in the format required for an Axyz machine controller. These files can now transferred to the machine controller itself, ready for manufacture.

If the Toolpath itself is modified within ArtCAM, the above process must be repeated for that specific file.

C:\Temp as a location is not recommended for production. A structured folder system according to best practice must be utilised.

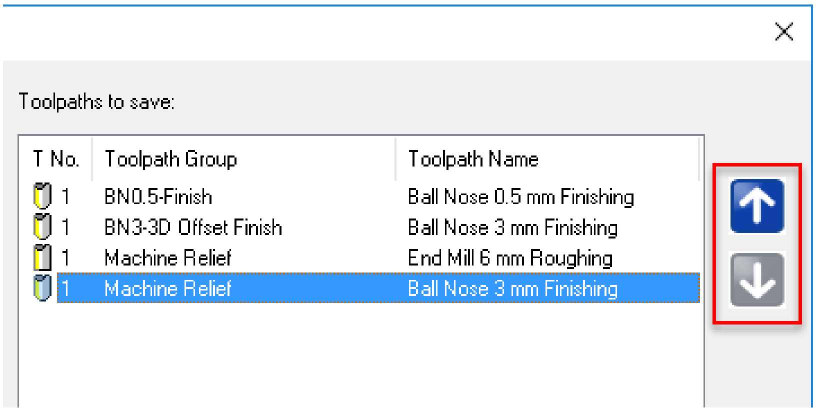
12 Do not close the model as it is required again in the next section.

Post Processing of Toolpaths for an Automatic Tool Changer

If a Machine Tool is fitted with an Automatic Tool Changer then the control of this feature will be available in the Post Processor translation.

If toolpaths containing different tools are passed over to the right hand window of the Save Toolpaths form and the selected Post Processor does not support an Automatic Tool Changer then a box with an error message will appear.

1 Using the arrow → Transfer all the toolpaths into the right hand window as shown.



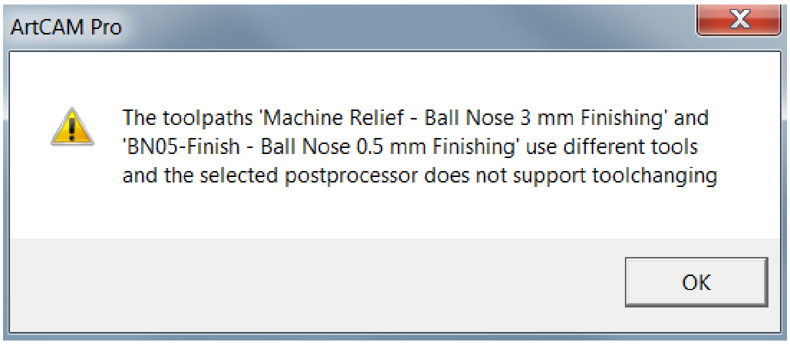
Toolpaths to save:

T No.	Toolpath Group	Toolpath Name
1	BN0.5-Finish	Ball Nose 0.5 mm Finishing
1	BN3-3D Offset Finish	Ball Nose 3 mm Finishing
1	Machine Relief	End Mill 6 mm Roughing
1	Machine Relief	Ball Nose 3 mm Finishing

The Vertical arrows can be used to reorder the toolpaths for a single output file.

2 Ensure the same machine output file is selected as before.

3 Select Save to output the combined files.



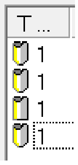
ArtCAM Pro

The toolpaths 'Machine Relief - Ball Nose 3 mm Finishing' and 'BN05-Finish - Ball Nose 0.5 mm Finishing' use different tools and the selected postprocessor does not support toolchanging

The operation has failed and the above error message appears. The files were unable to be processed for two reasons.

- The selected Machine (post processor) does not support tool changing itself.

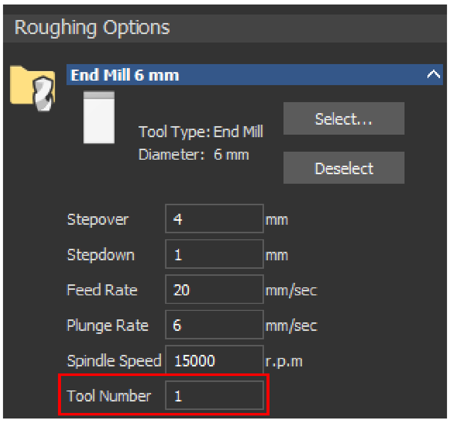
- All tools are currently identified as Tool number 1. The Tool Number is essential to identify the location of an individual Tool in the tool changer or carousel.



T ...
1
1
1
1

The Tool Number can be specified in a number of ways.

- Entering the tool number within the defined tool of the **toolpath**. The Toolpath must be recalculated.



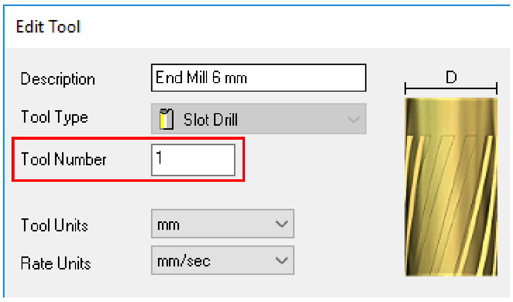
Roughing Options

End Mill 6 mm

Tool Type: End Mill
Diameter: 6 mm

Stepover: 4 mm
Stepdown: 1 mm
Feed Rate: 20 mm/sec
Plunge Rate: 6 mm/sec
Spindle Speed: 15000 r.p.m
Tool Number: 1

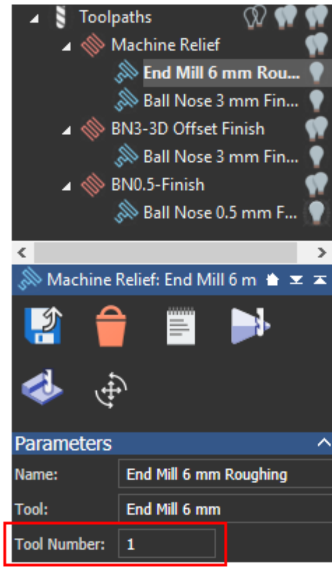
- Entering/Editing the default tool number defined in the **Tool database**.



Edit Tool

Description: End Mill 6 mm
Tool Type: Slot Drill
Tool Number: 1
Tool Units: mm
Rate Units: mm/sec

- The quickest way is to change the tool number by first highlighting the tool in the **Toolpaths Project Panel**.



Toolpaths
Machine Relief
End Mill 6 mm Rou...
Ball Nose 3 mm Fin...
BN3-3D Offset Finish
Ball Nose 3 mm Fin...
BN0.5-Finish
Ball Nose 0.5 mm F...

Machine Relief: End Mill 6 m

Parameters
Name: End Mill 6 mm Roughing
Tool: End Mill 6 mm
Tool Number: 1

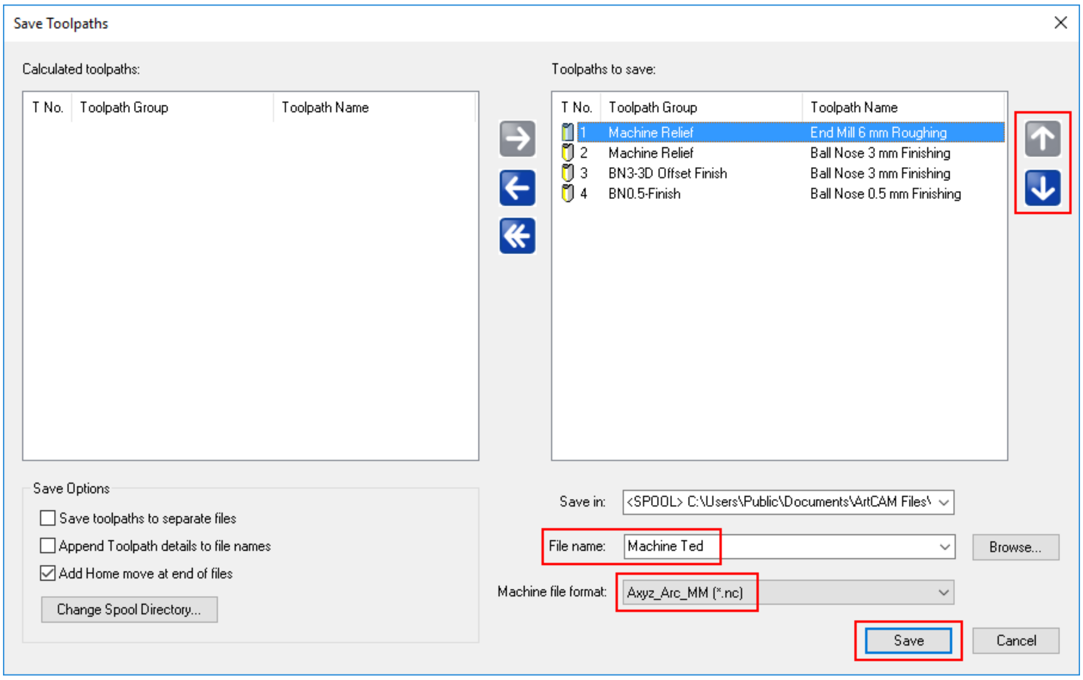
- Then changing the Tool number in the lower window before selecting **Apply**.

4 Use any of the methods described above to assign different Tool numbers as shown in the image below.

5 Select **Save Toolpaths** from the **Toolpath Operations** area.

6 Move **all** the Toolpaths to the **right hand window**.

7 **Reorder** the Toolpaths as required.


Save Toolpaths
Calculated toolpaths:
T No.
Toolpath Group
Toolpath Name
Toolpaths to save:
Save Options
Change Spool Directory...
Browse...
Save
Cancel

Toolpaths to save:

T No.	Toolpath Group	Toolpath Name
1	Machine Relief	End Mill 6 mm Roughing
2	Machine Relief	Ball Nose 3 mm Finishing
3	BN3-3D Offset Finish	Ball Nose 3 mm Finishing
4	BN0.5-Finish	Ball Nose 0.5 mm Finishing

☐ Save toolpaths to separate files
☐ Append Toolpath details to file names
☑ Add Home move at end of files

Save in: <SPOOL> C:\Users\Public\Documents\ArtCAM Files\
File name: Machine Ted
Machine file format: Axyz_Arc_MM (*.nc)

8 Enter file name as **Machine Ted**.

9 Change the Machine output file **to Axyz_MultiTool_Arc_MM**.

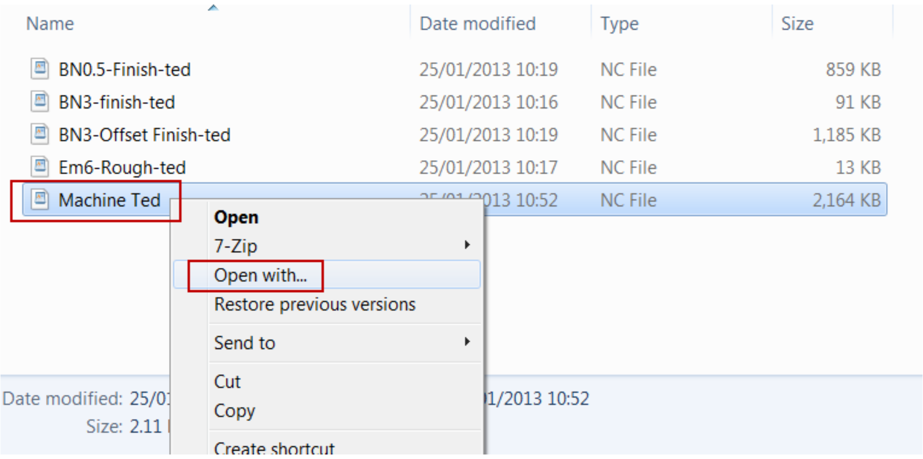
10 Select **Save**.

No Error message is displayed and now allows the files to be saved as one.

11 **Browse** to the **C:\Temp** directory to see the saved toolpaths.

NC code can be viewed in WordPad for analysis or editing if required.

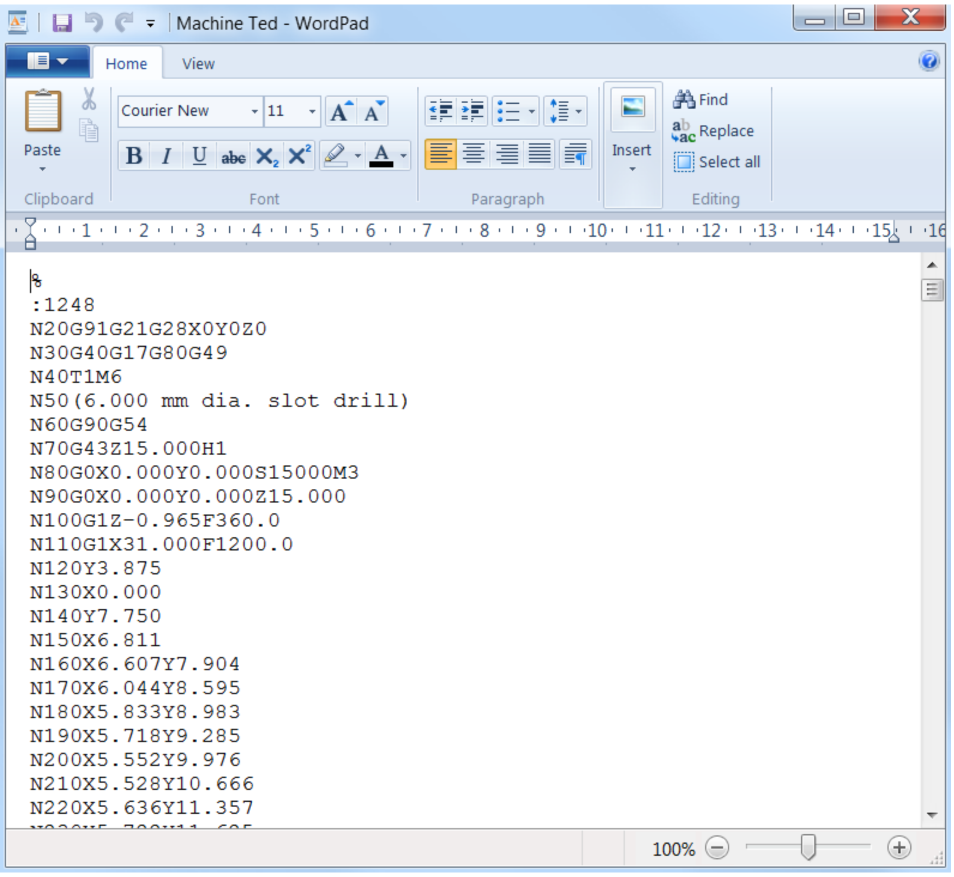
12 **Right mouse click** on the Toolpath **Machine Ted** an open with **WordPad**.



Name	Date modified	Type	Size
BN0.5-Finish-ted	25/01/2013 10:19	NC File	859 KB
BN3-finish-ted	25/01/2013 10:16	NC File	91 KB
BN3-Offset Finish-ted	25/01/2013 10:19	NC File	1,185 KB
Em6-Rough-ted	25/01/2013 10:17	NC File	13 KB
Machine Ted	2013 10:52	NC File	2,164 KB

Open
7-Zip
Open with...
Restore previous versions
Send to
Cut
Copy
Create shortcut
Date modified: 25/0
1/2013 10:52
Size: 2.11

The outputted NC code can be viewed.



Machine Ted - WordPad
Home
View
Paste
Courier New
11
Clipboard
Font
Paragraph
Insert
Find
Replace
Select all
Editing
100%

```
%
:1248
N20G91G21G28X0Y0Z0
N30G40G17G80G49
N40T1M6
N50(6.000 mm dia. slot drill)
N60G90G54
N70G43Z15.000H1
N80G0X0.000Y0.000S15000M3
N90G0X0.000Y0.000Z15.000
N100G1Z-0.965F360.0
N110G1X31.000F1200.0
N120Y3.875
N130X0.000
N140Y7.750
N150X6.811
N160X6.607Y7.904
N170X6.044Y8.595
N180X5.833Y8.983
N190X5.718Y9.285
N200X5.552Y9.976
N210X5.528Y10.666
N220X5.636Y11.357
```