
ArtCAM Pro

Tutorials

By Delcam plc

ArtCAM PRO



THE QUEEN'S AWARDS
FOR ENTERPRISE
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Overview

Tutorials

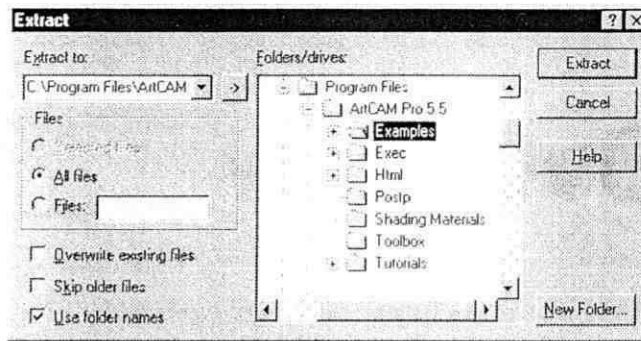
The tutorials contained within this manual are designed to help you to understand the practical uses of the design tools and toolpaths available in ArtCAM Pro.

The majority of the tutorials use example files from the ArtCAM Pro 6.0\Examples\ directory. If you cannot locate the example files used in a specific tutorial here, you must download the *TutorialExamples.zip* archive from the Downloads area at <http://www.artcam.com/>.

You will require the Winzip application to use the files contained within the archive. If you do not already have Winzip installed on your computer, you can download a free evaluation copy of the latest version from <http://www.winzip.com/>.

Extract the contents of the archive to the ArtCAM Pro 6.0\Examples\ directory, which is located wherever you have installed ArtCAM Pro 6.0 on your computer. To do so:

1. Using Windows Explorer, go to the directory to where you have downloaded the archive named *TutorialExamples.zip*.
2. Right-click on the archive to display the context menu, then click on the **Extract to...** option to launch Winzip and display the **Extract** dialog box:



3. In the **Folders/drives** window, go to the ArtCAM Pro 6.0\Examples\ directory on your computer.
4. Click on the **Extract** button to extract the files to the ArtCAM Pro 6.0\Examples\ directory.
5. From Winzip's **File** menu, click on the **Exit** option to shut it down.

You are now ready to use any of the tutorials contained within this manual.

3D Modelling

Overview

The following tutorials demonstrate various aspects of three-dimensional modelling in ArtCAM Pro:

- “Tutorial – Creating a Relief from Vectors” on page 4.
- “Tutorial – Creating a Relief from a Bitmap” on page 16.
- “Tutorial – Swept Profiles” on page 33.
- “Tutorial – 3D Blend” on page 62.
- “Tutorial – 3D Clipart” on page 73.
- “Tutorial – Texturing” on page 87.
- “Tutorial – Lizard” on page 93.
- “Tutorial – Simple Jewellery Designs” on page 105.
- “Tutorial – Pendant” on page 115.
- “Tutorial – Casino Chip” on page 124.
- “Tutorial – ISO-FORM Lettering” on page 137.
- “Tutorial – Interactive Sculpting” on page 143.
- “Tutorial – Scanning” on page 148.

Tutorial – Creating a Relief from Vectors

Overview

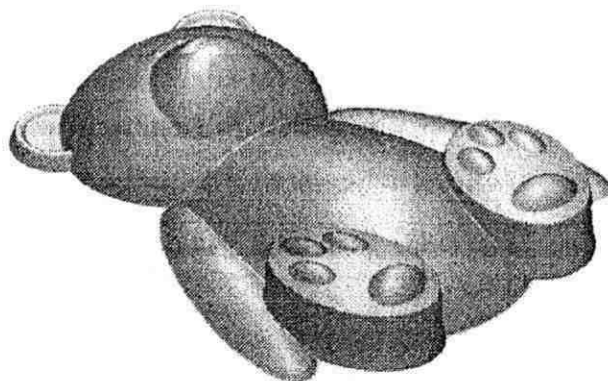
The following tutorial demonstrates how to create three-dimensional shapes from vectors and combine them to create a relief using the relief operations.

Teddy Bear

The stages that you will cover during the course of this tutorial are:


- Preparing the model.
- Creating the teddy bear.

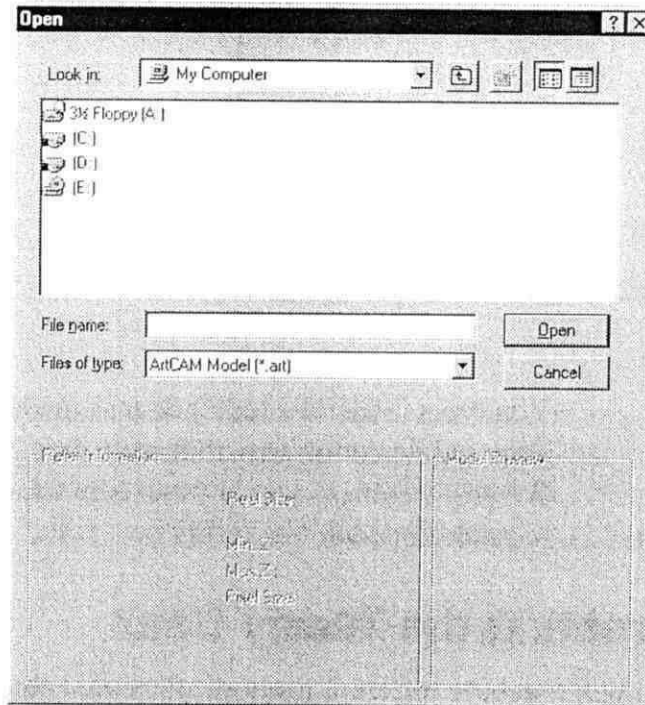
The tutorial will lead you through each of these stages, guiding you through the complete process of applying three-dimensional shapes to vectors, then combining these shapes with the relief to produce the teddy bear shown below:



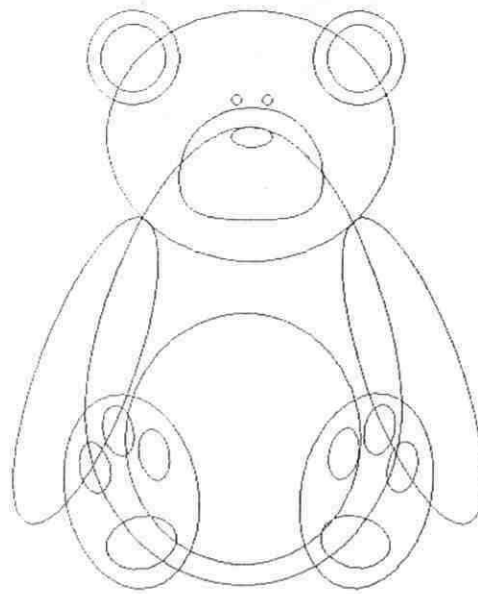
Preparing the Model

First, we will open the ArtCAM model containing the artwork that you will use to create the teddy bear relief:

1. Click on the **Open Existing Model**  icon in the **Assistant** window to display the **Open** dialog box:



2. Click on the **Look In** list box and select *C:\Program Files\ArtCAMPro 6.0\Examples\NewTeddy* (assuming ArtCAM was installed into the default location – the files can also be found on the installation CD under the Examples directory).
3. Click on the .art file named *NewTeddy* to select it.
The file name appears in the **File name** box.
4. Click on the **Open** button to open the *NewTeddy* model.
The following artwork appears in the **2D View** window:



You can see that the teddy bear is made up mostly of elliptical vector objects that were created in ArtCAM Pro. We will use these vector objects in the course of the tutorial to gradually build the teddy bear relief.

Creating the Teddy Bear

We will combine different three-dimensional shapes to create the finished teddy bear relief. We will create the shapes that represent the teddy's body parts in the following order:

- Body.
- Ears.
- Head and arms.
- Stomach and feet.
- Snout and paw-prints.
- Eyes and nose.

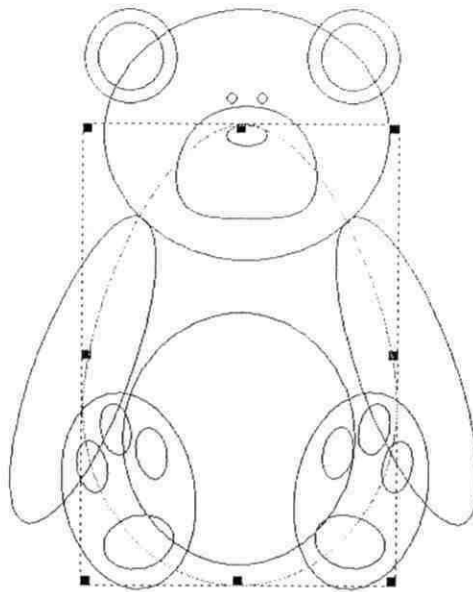
The file has been saved with the 3D relief already created. If you look at the 3d view (Click on the 3D View button **3D** in the 2D View toolbar or press the **F3** key to display the relief in the 3D View window). After looking at the relief we are going to build, reset the relief back to zero – click *Relief – Reset* from the menu bar to return to a flat plane on which we will build our teddy relief. Click on the 2D

View button **2D** in the 3D View toolbar or use the **F2** key to return to the 2D View window.

Creating the Body

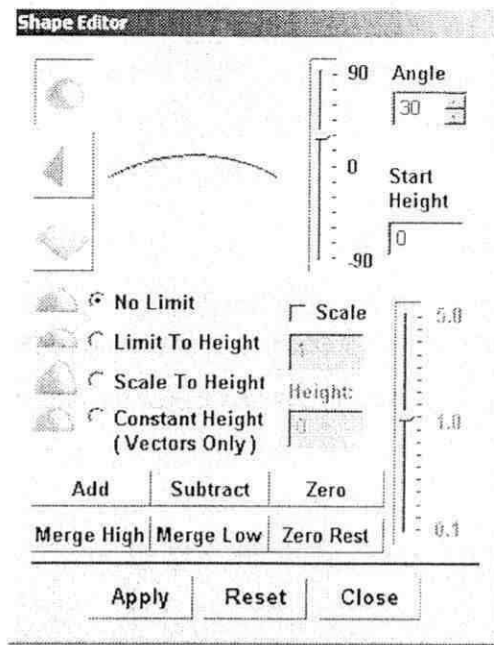
First, we will create a three-dimensional shape representing the body of the teddy bear then combine this with the existing relief.



1. Click on the vector representing the teddy's body to select it.

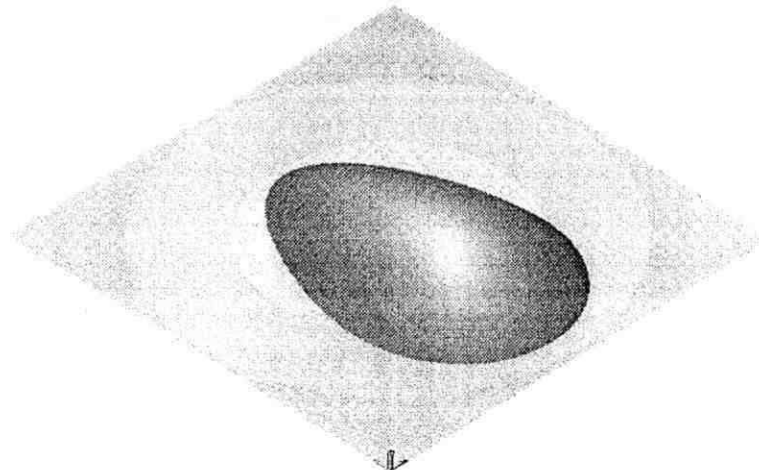


The selected vector turns magenta.

2. Right-click on the selected vector object to display the **Vector Editing** menu, then click on the **Shape Editor** option to display the **Shape Editor** dialog box (the **F12** key is a shortcut to display this dialog).




3. Click on the **Round** button , and then type 30° in the **Angle** box.
4. Click on the **Add** button. This option instructs ArtCAM Pro to add the points in the shape to the current relief.
A progress bar appears beneath the **2D View** window indicating the progress ArtCAM Pro is making in calculating the relief.
5. Click on the **Close** button to close the **Shape Editor** dialog box.
6. Click on the **3D View** button  in the **2D View** toolbar or press **F3** to display the relief in the **3D View** window:




Creating the Ears

Next, we will create the three-dimensional shapes that represent the ears then combine them with the existing relief.

1. Click on the **2D View** button  in the **3D View** toolbar or press **F2** to display the **2D View** window.
2. Click on the vector representing the outside of the left ear of the teddy's head to select it.

The vector representing the outside of the left ear of the teddy's head is grouped along with the vector representing the outside of its right ear. Therefore, both vectors turn magenta and are surrounded by a bounding box.

3. Right-click on either of the selected vector objects or use **F12** to display the **Vector Editing** menu, then click on the **Shape Editor** option to display the **Shape Editor** dialog box.


4. Click on the **PLANE** button .
5. Type *0.5 mm (0.02")* in the **Start Height** box.
6. Click on the **Merge High** button. This option instructs ArtCAM Pro to merge the points in the shapes with the current relief, so that only the highest points show in the new relief.

A progress bar appears beneath the **2D View** window indicating the progress ArtCAM Pro is making in calculating the new relief.

7. Hold the **Shift** key on your keyboard, then click on the vector for the inside of the teddy's left ear to select it.

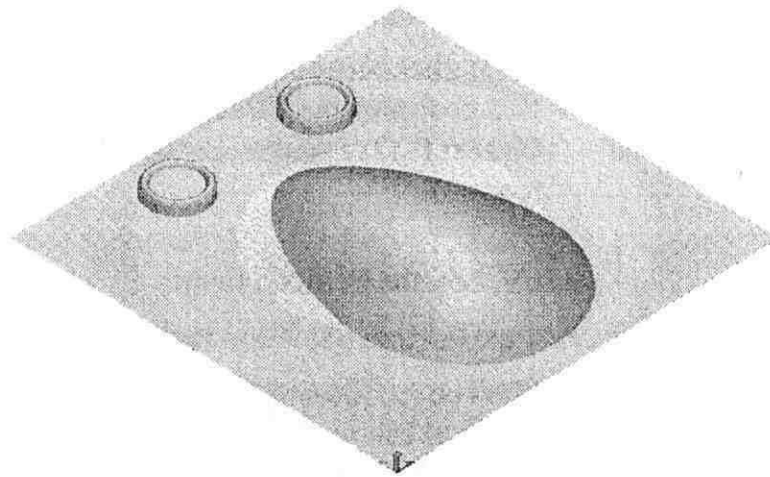
The vector for the inside of the teddy's left ear is grouped along with the vector for the inside of its right ear.

Therefore, both vector objects turn magenta and are surrounded by a bounding box. All of the vector objects representing the teddy's ears are now selected.

8. Press the **F12** key to display the **Shape Editor** dialog box if it is not currently visible.
9. Click on the **Round** button .
10. Make sure that the **Start Height** is set to *0.5 mm (0.02")*.

11. Click on the **Scale** option to turn it on ☒, then type 2 in the box below.
12. Click on the **Merge High** button.


A progress bar appears beneath the **2D View** window indicating the progress ArtCAM Pro is making in calculating the new relief.
13. Click on the **Close** button to close the **Shape Editor** dialog box.
14. Press the **F3** key to display the relief in the **3D View** window:



Creating the Head and Arms

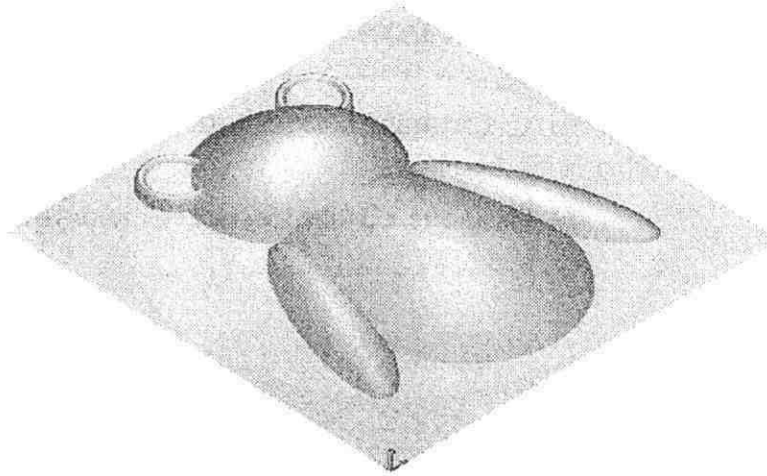
We are now ready to create the three-dimensional shapes that represent the head and arms of the teddy bear, then combine them with the existing relief.

1. Press the **F2** key to display the **2D View** window.
2. Click on the vector for the teddy's left arm to select it.

The vector for the teddy's left arm is grouped along with the vectors for its right arm and its head. Therefore, all three vector objects turn magenta and are surrounded by a bounding box.
3. Press the **F12** key to display the **Shape Editor** dialog box if it is not currently visible.
4. Click on the **Round** button , and ensure that the angle field is set at 45°.
5. Click on the **Merge High** button.

A progress bar appears beneath the **2D View** window indicating the progress ArtCAM Pro is making in calculating the new relief.

6. Press the **F3** key to display the new relief in the **3D View** window:



Creating the Stomach and Feet

We are now ready to create the three-dimensional shapes that represent the stomach and feet of the teddy bear, then combine them with the existing relief.

1. Press the **F2** key to display the **2D View** window.
2. Click on the circular vector representing the teddy's stomach to select it.
3. Use the **F12** key to display the **Shape Editor** dialog box.

4. Click on the **Round** button , and then type 20° in the **Angle** box.


5. Click on the **Add** button.

A progress bar appears beneath the **2D View** window indicating the progress ArtCAM Pro is making in calculating the new relief.

6. Click on the vector for the teddy's left foot to select it.

The vector representing the teddy's left foot is grouped along with the vector representing its right foot. Therefore, both vectors turn magenta and are surrounded by a bounding box.

7. Use the **F12** key to display the **Shape Editor** dialog box if it is not currently visible.

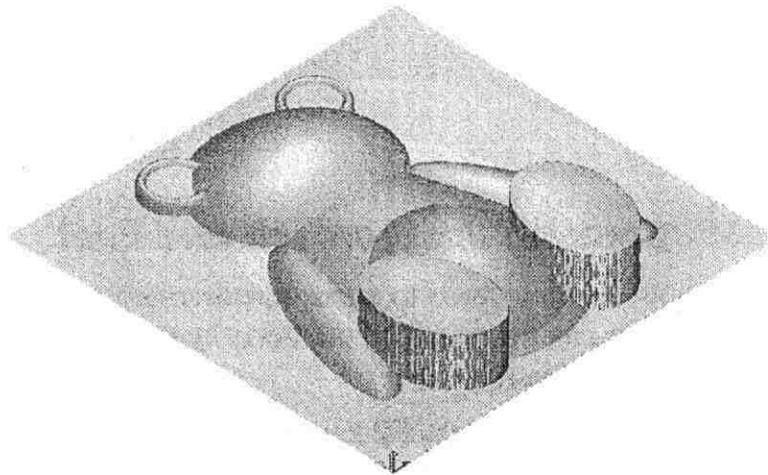
8. Click on the **Round** button , and then type 10° in the **Angle** box and 3 mm (0.12") in the **Start Height** box.

9. Click on the **Merge High** button.

A progress bar appears beneath the **2D View** window indicating the progress ArtCAM Pro is making in calculating the new relief.


10. Click on the **Close** button to close the **Shape Editor** dialog box.

11. Press the **F3** key to display the new relief in the **3D View** window:



Creating the Snout and Paw-Prints

We are now ready to create the shapes that represent the snout and paw-prints of the teddy bear.

1. Press the **F2** key to display the **2D View** window.
2. Click on the vector object representing the teddy's snout to select it.
3. Press the **F12** key to display the **Shape Editor** dialog box if it is not currently visible.
4. Click on the **Round** button , and enter 45° into the angle field and ensure that a start height of 0 is set.
5. Click on the **Add** button.
6. Click on the **Close** button to close the **Shape Editor** dialog box.

7. Click on the vector representing the paw-prints on the teddy's left foot to select it.

The vectors representing the paw-prints on the teddy's left foot are grouped along with the vectors representing the paw-prints on the teddy's right foot. Therefore, all of these vector objects turn magenta and are surrounded by a bounding box.

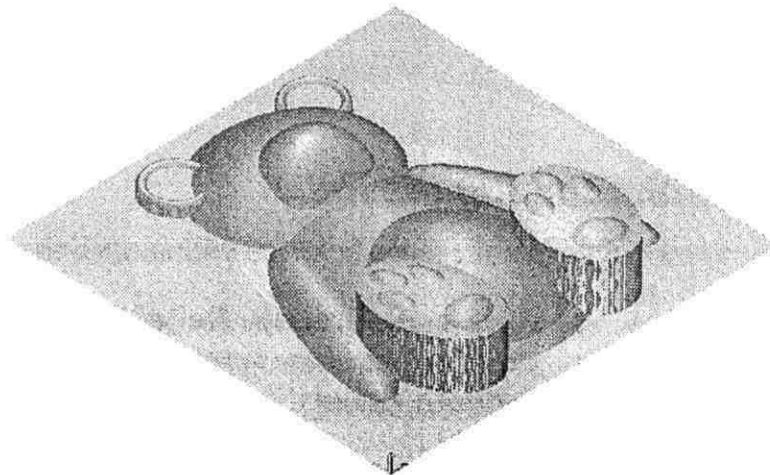
8. Press the **F12** key to display the **Shape Editor** dialog box if it is not currently visible.

9. Click on the **Round** button , and then type 20° in the **Angle** box.

10. Click on the **Add** button.

A progress bar appears beneath the **2D View** window indicating the progress ArtCAM Pro is making in calculating the new relief.

11. Press the **F3** key to display the new relief in the **3D View** window:




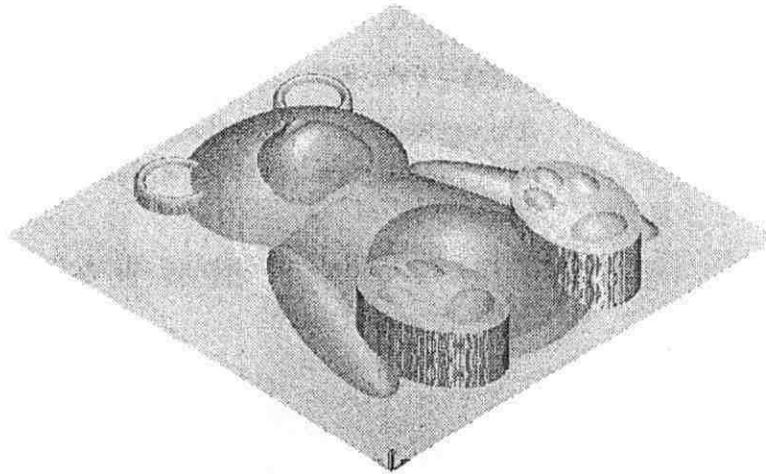
Creating the Eyes and Nose

We are now ready to create the eyes and nose of the teddy bear

1. Press the **F2** key to display the **2D View** window.
2. Click on the vector representing the teddy's nose to select it.


The vector representing the teddy's nose is grouped along with the vectors representing the teddy's eyes. Therefore, all of these vector objects turn magenta and are surrounded by a bounding box.

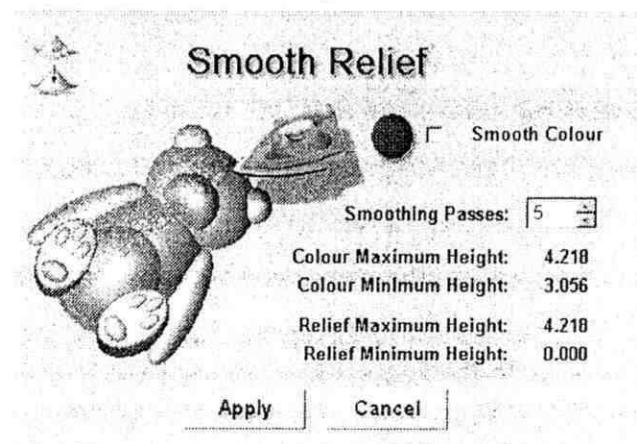
3. Press the **F12** key to display the **Shape Editor** dialog box if it is not already visible.
4. Click on the **Round** button , and then type 90° in the **Angle** box.
5. Click on the **Add** button.
6. Click on the **Close** button to close the **Shape Editor** dialog box.
7. Press the **F3** key to display the new relief in the **3D View** window:



Smoothing the Relief

To complete the teddy bear, we will smooth the current relief.

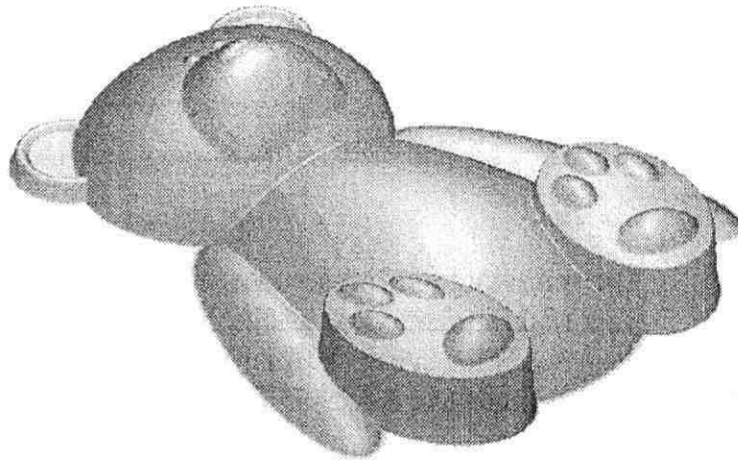
1. Click on the **Smooth Relief** button  in the **Relief Editing** area of the **Assistant's** Home page to display the **Smooth Relief** dialog box:



2. Type 3 in the **Smoothing Passes** box.

3. Click on the **Apply** button.
4. Click on the **Cancel** button to close the **Smooth Relief** dialog box.

The smoothed finished relief is displayed in the **3D View** window.



Tutorial – Creating a Relief from a Bitmap

Overview

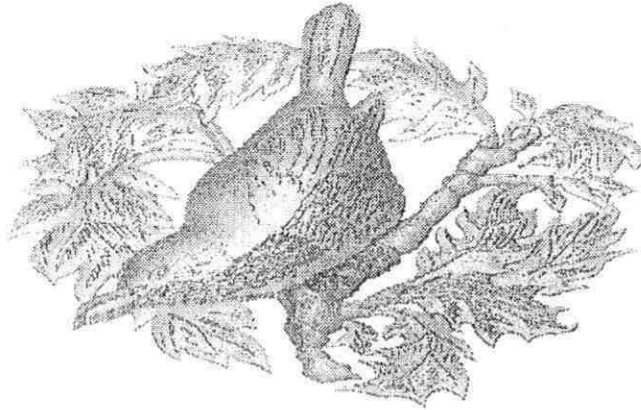
The following tutorial demonstrates how to create a relief from an imported bitmap image using colour linking techniques in multiple design windows, together with the bitmap editing and relief operation tools available in ArtCAM Pro.

Bird

The stages that you will cover during the course of this tutorial are:


- Preparing the model.
- Colouring the bitmap image.
- Editing the colour image.
- Creating new views.
- Creating the relief.

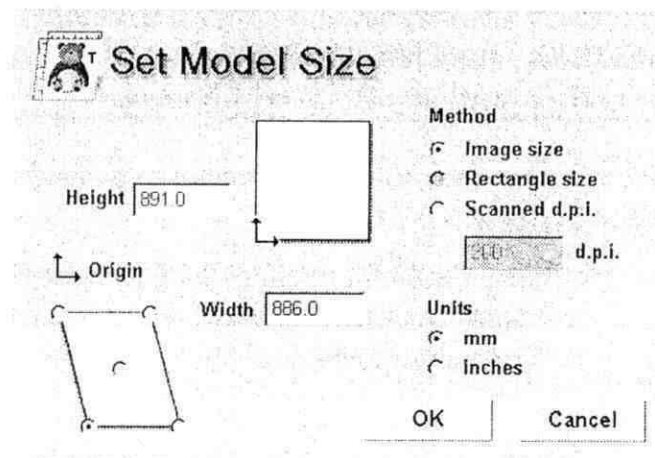
The tutorial will lead you through each of these stages, guiding you through the complete process of opening a bitmap image, adding colour to the image, editing the image, creating multiple design windows, creating colour links within these windows, applying shape attributes to selected colours, then calculating and combining separate reliefs to form the following relief:



Preparing the Model

First, we will open the bitmap file containing the image from which we will create a relief:

1. Click on the **Open Existing Model** icon  in the **Assistant** window to display the **Open** dialog box.
2. Click on the **Files of type** list box, then click on the **Windows Bitmap (*.bmp)** option to select it.
3. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples\Bird.
4. Click on the .bmp file named *bird* to select it.
The file name appears in the **File name** box.
5. Click on the **Open** button to display the **Set Model Size** dialog box:



6. Click on the **OK** button to close the **Set Model Size** dialog box and open the bitmap image.

The following artwork appears in a **2D View** window automatically named **Bird:0**.



Colouring the Bitmap Image

Now we will colour the bitmap image using the **Paint Selective** and **Flood Fill** tools in ArtCAM Pro and a previously saved, custom Colour Palette.

We will use the **Paint Selective** tool to paint the current Primary Colour in all areas of the image currently using the Secondary Colour.

Then we will replace areas of *any* selected colour, using the **Flood Fill** tool.

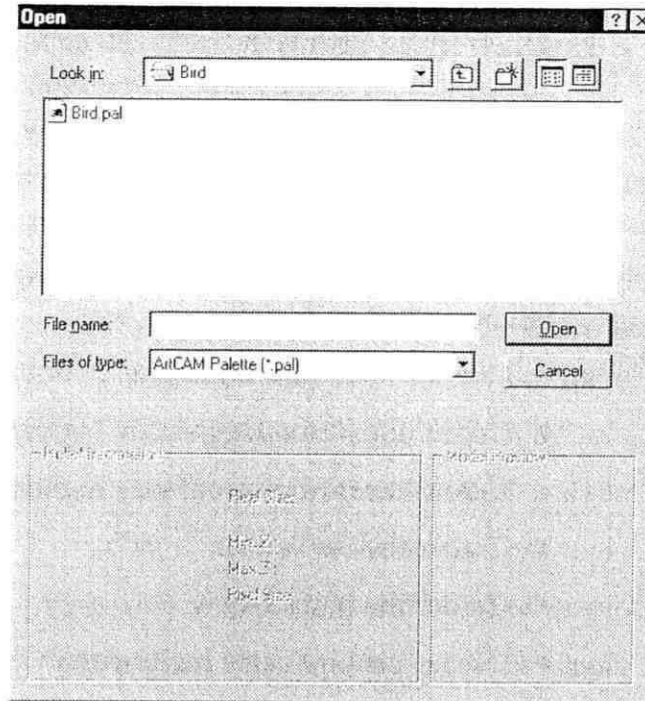





Note: Examples of what the bird looks like after each stage are provided in the ArtCAM Pro 6.0\Examples\Bird directory.


Bird01.art shows how the **Paint Selective** tool is used. **Bird02.art** shows the image after the flood-fill tool has been used.

Before we use the tools, however, we must load a customised Colour Palette into ArtCAM Pro.


1. From the Main menu bar, click on the **Colour** option to display the **Colour** menu, then click on the **Load** option to display the **Open** dialog box:



2. Click on the .pal file named *Bird* to select it.
3. Click on the **Open** button to display the *Bird* Colour Palette beneath the **Bird:0** window.
4. Click on the  button in the top-right corner of the **Bird:0** window to maximise it, then click on the **Window Fit** button  in the **Bird:0** toolbar to fit the image to the window size.
5. Click on the light-green colour in the Colour Palette beneath the **Bird:0** window to select it as the Primary Colour.
6. Right-click on the white colour in the Colour Palette to select it as the Secondary Colour.
7. Click on the **Paint Selective** button  in the **Bitmap Editing** area of the **Assistant's** Home page.
8. Click and drag on the **Brush Diameter** slider in the **Bitmap Editing** area and set the brush diameter to 7.
9. Click and drag on the areas in the bitmap image representing the spines of the leaves.



If you make a mistake, use the **Undo** button  in the **File** area to restore the image as it was prior to your last action.

10. Click and drag on the **Brush Diameter** slider in the **Bitmap Editing** area and set the brush diameter to 3.

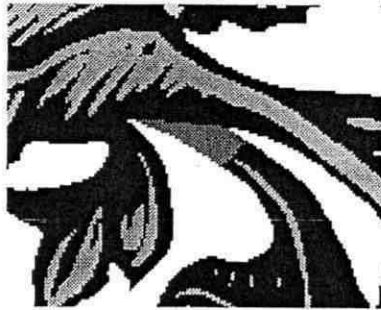
11. Click on the **Zoom In** button  in the **Bird:0** toolbar, then click and drag to form a bounding box around the leaves. Release the mouse button to zoom in on this area.
12. Click and drag on any white areas in the spines of the leaves to make sure that they are coloured completely.
13. Using the same method as detailed, colour the rest of the bitmap image in the following way:
 - Colour the branch highlights in orange.
 - Colour the bird's upper-body highlights in purple.
 - Colour the bird's lower-body highlights in cyan.
 - Colour the bird's beak in yellow.
 - Colour the bird's feet in dark-grey.
 - Colour the bird's feet highlights in light grey.

The bitmap image should now look something like this:



14. Click on the dark-green colour in the Colour Palette to select it as the Primary Colour.
15. Click and drag on the areas between where a leaf starts and branch ends to mark it in the current Primary Colour. This prevents the Flood Fill tool from flood-filling unwanted areas in the Primary Colour.
16. Move the  cursor over the leaf that you have marked, and then click on the **Flood Fill** button  in the **Bitmap Editing** area to flood-fill the leaf in green.

Before...



After...



17. Using the same method as detailed, flood-fill the rest of the bitmap image in the following way:

- Flood-fill the leaves in dark-green.
- Flood-fill the bird's body in dark-blue.
- Flood-fill the bird's feet in dark-grey.
- Flood-fill the tree in dark-brown.
- Flood-fill the line that divides the bird's beak in beige.
- Flood-fill the bird's eye in blue.
- Flood-fill the pupil in the bird's eye in blue.

The bitmap image should now look something like this:



Editing the Colour Image



Now that we have finished colouring the bitmap image, there are several areas in the colour bitmap image that need to be edited. Before we can create a relief, we must:

- Make sure that the outline of each leaf is clearly defined in white.
- Make sure that all spines in the leaves are clearly defined in light green.
- Make sure that the point at which a branch ends and a leaf begins is clearly defined.
- Make sure that each claw in the bird's feet is clearly defined.
- Make sure that there are no rogue pixels in the image. For example, black pixels in an area coloured in dark-green.

We must edit the bitmap image in this way because the relief is calculated using the three-dimensional shape attributes applied to each of the colours. The larger the area of colour, the higher the relief.




Note: You can open an example of the edited bitmap image, which is saved as **bird03.art** in the ArtCAM Pro 6.0\Examples\Bird directory.

1. Zoom in on the leaves above the bird using the **Zoom In** button .
2. Click on the white colour in the Colour Palette to select it as the Primary Colour.
3. Click on the **Draw** button  in the **Bitmap Editing** area.
4. Click and drag to draw a line marking the outline of the leaf in the current Primary Colour.

Before...

After...



5. Repeat these steps to create outlines for all of the leaves in the image.
6. Use the **Zoom In** button  to zoom in on the claws in the bird's feet.
7. Click on the brown colour in the Colour Palette to select it as the Primary Colour.


8. Click and drag to draw brown lines between each of the bird's claws.

Before...



After...



9. Zoom in on the bird's eye using the **Zoom In** button .
10. Click on the dark-purple colour in the Colour Palette to select it as the Primary Colour.
11. Click on each of the rogue black pixels in the bird's eye to colour them all purple.

Before...



After...



12. Continue editing the bitmap image in this way until you are satisfied that it will produce a relief without any surface irregularities.

The bitmap image should now look something like this:

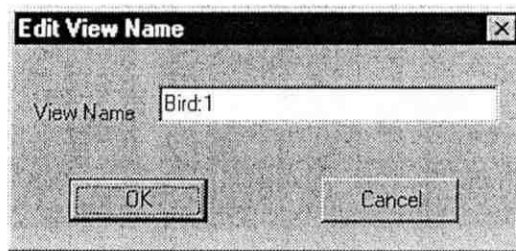


Creating New Views

Before we can create the relief, we need to create duplicate copies of the **Bird:0** window. These windows represent the number of layers

required to produce the finished relief. Each successive window contains exactly the same image as the original, but we will alter their appearance by applying different colour links to them.

1. From the Main menu bar, click on the **2D View** menu, then click on the **New View** option to create a new window named **Bird:1**.
2. Repeat the previous step three times to create three more windows named **Bird:2**, **Bird:3** and **Bird:4**.
3. Click on the **Bird:1** window to make it active.
4. From the Main menu bar, click on the **2D View** option to display the **2D View** menu, then click on the **Edit View Name** option:



5. Type *Leaves and Main Body:1* in the **View Name** box.
It is good practice to number each of the windows that you create, as it makes it easier to recall how the finished relief was built at a later date. Each window should also be named to reflect what aspect of the relief it will be used for.
6. Click on the **OK** button to apply the name change and close the **Edit View Name** dialog box.
7. Re-name the **Bird:2** window as *Highlights:2*, the **Bird:3** window as *Eyes and Claws:3* and the **Bird:4** window as *Pupils:4*.

Creating the Relief

In this tutorial, we want the leaves, bird and branches in the bitmap image to become the main features in the relief, with the highlighted areas of the image as the detail in the relief. The bird is the most prominent part of the image, and therefore requires more height than the other features.

To create the finished relief, we must manipulate each of the windows so that the bitmap image represents the overall shape of each layer of the relief that we want to create.

Linking the Colours

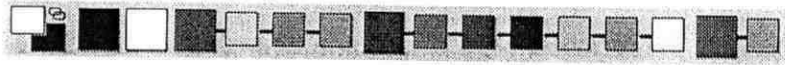
First, we will link colours in the Colour Palette for each of the windows to alter the appearance of the bitmap image and define the areas to which we want to apply a three-dimensional shape.



Note: You can open an example of the colour links used for each of the windows, which is saved as **bird04.art** in the ArtCAM Pro 6.0\Examples\Bird directory.

1. Click on the **Leaves and Main Body:1** window to make it active.
2. Click on the dark-green colour in the Colour Palette to select it as the Primary Colour.
3. Double-click the right mouse button on the light-green colour to link it to the Primary Colour. The leaves now appear entirely as dark-green.
4. Using the method detailed in the previous steps, create the following colour links:
 - Select the colour representing the main-body of the bird as the Primary Colour, then link the colours representing the bird's wing, under-body, beak, beak dividing-line, eye and its pupil to it.
 - Select the colour representing the branch as the Primary Colour, then link the colours representing the branch highlights and the bird's feet to it.

The Colour Palette should look as follows:



The bitmap image should now only contain the colours representing the leaves, the branch and the bird:



5. Create the following colour links for the other windows:
 - **Highlights: 2** – Select the colour representing the main-body of the bird as the Primary Colour, then link the colours representing the bird's eye and its pupil to it. Next, select the colour representing the birds' feet as the Primary Colour, then link the colour representing the feet highlights to it.
 - **Eyes and Claws:3** – Select the colour representing the birds eye as the Primary Colour, then link the colour representing its pupil to it.

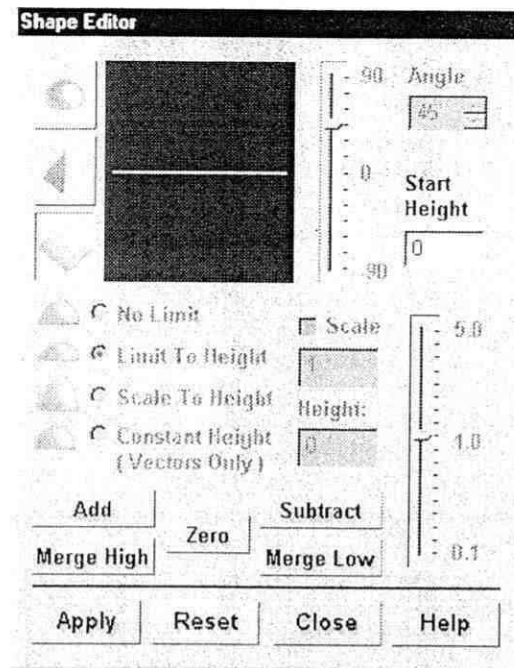
Applying Shapes to the Colours



Now that all of the necessary colour links have been made, we are ready to create the shapes that will be combined to form the relief.







Note: You can open an example of the shapes applied to each of the windows, which is saved as **bird05.art** in the ArtCAM Pro 6.0\Examples\Bird directory.

1. Click on the **Leaves and Main Body:1** window to make it active.
2. Double-click on the dark-blue colour in the Colour Palette that represents the bird to display the **Shape Editor** dialog box:












3. Click on the **Round** button , and then type 30° in the **Angle** box.
4. Type 0.5 mm (0.02") in the **Start Height** box.
5. Click on the **No Limit** radio button  to select this option.
6. Click on the **Apply** button, followed by the **Close** button.
7. Using the method detailed in these steps, apply the following shape attributes to the remaining parts of the **Leaves and Main Body:1** window:

Part	Shape	Angle	Start Height	Region Height	Scale
Leaves		15°	0.3 mm (0.012")	 Limit To Height Height: 1 mm (0.04")	-
Branches		45°	0.3 mm (0.012")	 No Limit	-

The Colour Palette beneath the **Leaves and Main Body:1** window should now look as follows:







8. Apply the following shape attributes to the colours representing the following parts of the **Highlights:2** window:

Part	Shape	Angle	Start Height	Region Height	Scale
Beak		-	0.75 mm (0.03")	-	-
Wing		-	0.5 mm (0.02")	-	-
Body/Eyes		-	0.5 mm (0.02")	-	-
Branch Highlights		45°	0	 No Limit	-
Leaf Spines		45°	0.2 mm (0.008")	 No Limit	-
Feet		45°	0.2 mm (0.008")	 No Limit	-

The Colour Palette beneath the **Highlights:2** window should now look as follows:




9. Apply the following shape attributes to the colours representing the following parts of the **Eyes and Claws:3** window:

Part	Shape	Angle	Start Height	Region Height	Scale
Eye		45°	0	 No Limit	-
Feet Highlights		45°	0.3 mm (0.012")	 Limit To Height Height: 3 mm (0.12")	-

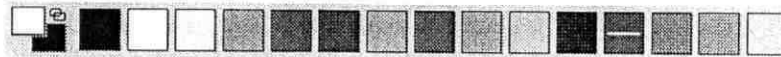
The Colour Palette beneath the **Eyes and Claws:3** window should now look as follows:



10. Apply the following shape attributes to the colour representing the following part of the **Pupils:4** window:

Part	Shape	Angle	Start Height	Region Height	Scale
Pupil		-	0.15 mm (0.006")	-	-

The Colour Palette beneath the **Pupils:4** window should now look as follows:



Calculating and Saving the Relief

Having applied all of the shape attributes to the necessary colours in each of the four windows, we are now ready to calculate the reliefs associated with them. We will also save the relief at selected intervals.




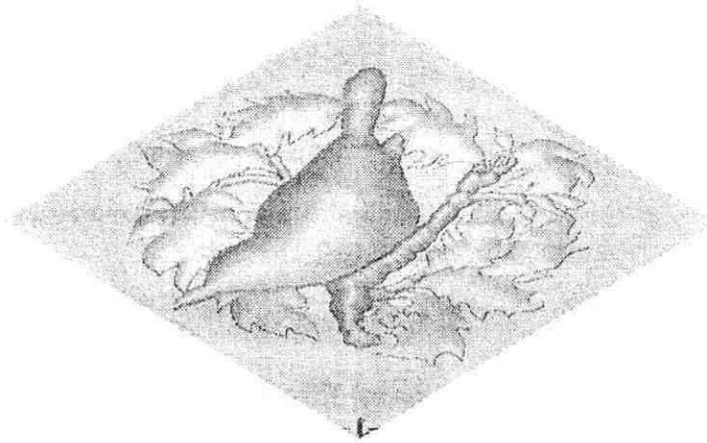
Note: You can open an example of the relief created from the **Leaves and Main Body:1** window, which is saved as **bird01.art** in the ArtCAM Pro 6.0\Examples\Bird directory. You can also open an example of the finished relief, which is saved as **bird04.art** in the same directory.


1. Click on the **Leaves and Main Body:1** window to make it active.

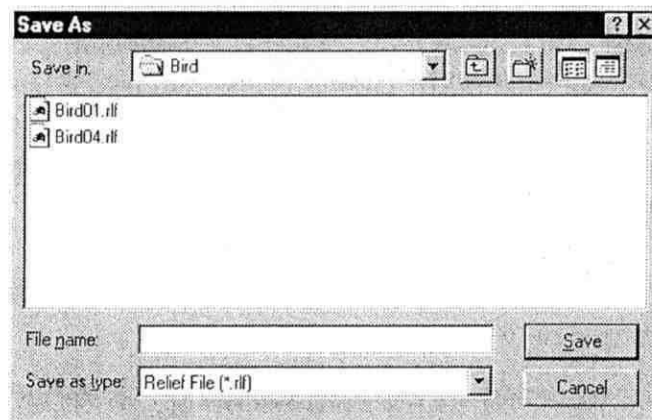
2. Click on the **Add Relief** button  in the **Relief Operations** area of the **Assistant's** Home page.

A progress bar appears beneath the window indicating the progress ArtCAM Pro is making in calculating the relief. As a rule, larger reliefs take longer to process than smaller areas. In this tutorial, calculating the relief from the **Leaves and Main Body:1** window takes significantly longer than for any of the other windows.


3. Click on the **3D View** button  in the **2D View** toolbar to display the relief in the **3D View** window:



4. Click on the **Save Relief** button  in the **Relief Operations** area to display the **Save As** dialog box:



It is worthwhile saving this relief due to the time it takes to calculate. Also, if you wanted to amend any of the reliefs created from successive windows, you could now do so without having to re-calculate the base to which they are added.

5. Click on the **Save In** list box and select the directory where you want to save the relief.
6. Type *BaseRelief* in the **File Name** box.
7. Click on the **Save** button.
8. Click on the **2D View** button  in the **3D View** toolbar to display the **Leaves and Main Body:1** window.
9. Calculate the **Highlights:2**, **Eyes and Claws:3** and **Pupils:4** windows in the same way as the **Leaves and Main Body:1** window. The finished relief should look something like this:



10. Save this relief as *BirdRelief*.

The benefit of saving the finished relief is that it is then available for you to load and machine at any time.

Tutorial – Swept Profiles

Overview

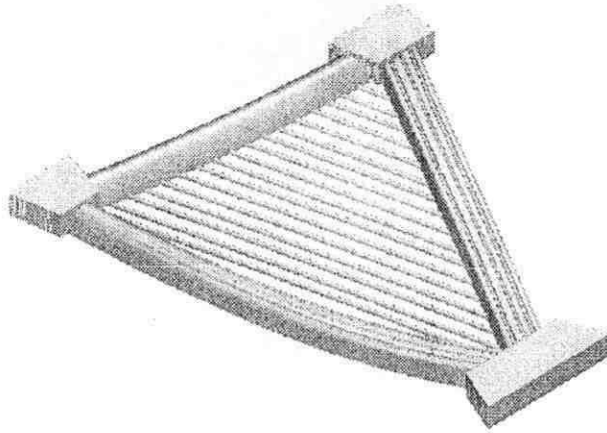
The following tutorial demonstrates how to create three different types of swept profiles using the vector drawing and vector based relief creation tools available in ArtCAM Pro. The techniques used for creating the swept profiles in this tutorial are extruding, spinning and turning.

Extruded Profile

The stages that you will cover during the course of this tutorial are:


- Preparing the model.
- Creating the joints in the harp's frame.
- Creating the harp's frame.
- Creating the harp's strings.

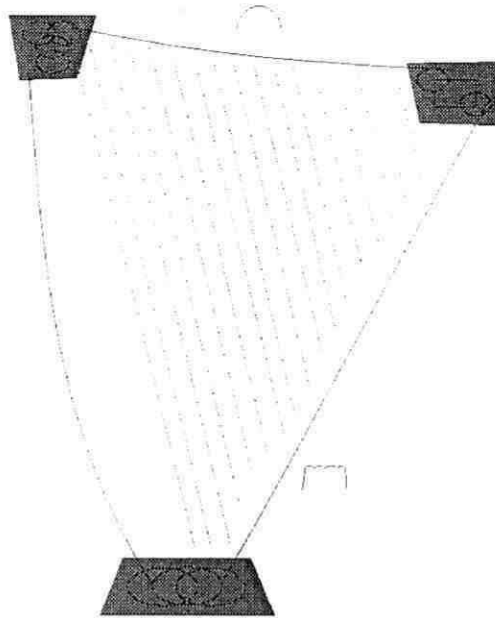
The tutorial will lead you through each of these stages, guiding you through the complete process of creating an extruded profile that produces a relief in the shape of a harp:



Preparing the Model

First, we will open the ArtCAM model containing the artwork that will be used to create the harp relief:

1. Click on the **Open Existing Model**  icon in the **Assistant** window to display the **Open** dialog box.
2. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples\Swept_p.
3. Click on the .art file named *Harp* to select it.
The file name appears in the **File name** box.
4. Click on the **Open** button to open the Harp model.
The following artwork appears in the **2D View** window:



The .art file that you have opened is a model previously created in ArtCAM Pro. The model contains bitmap colours and vector objects that will be used to create different shapes. These shapes are combined to create the harp relief.


Creating the Joints in the Harp's Frame

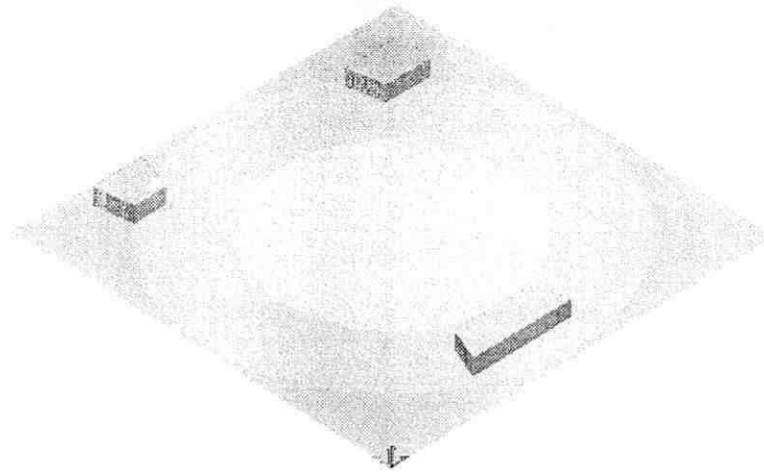
You can see that a flat shape has already been applied to the red colour. This is shown by the line on the red colour in the Colour Palette beneath the **2D View** window.

We will create the joints in the harp's frame from the red bitmap colour.

1. Click on the **Replace Relief** button  in the **Relief Operations** area of the **Assistant's** Home page.

A progress bar appears beneath the **2D View** window indicating the progress ArtCAM Pro is making in calculating the relief.

2. Click on the **3D View** button  in the **2D View** toolbar to display the current relief in the **3D View** window:





Creating the Harp's Frame

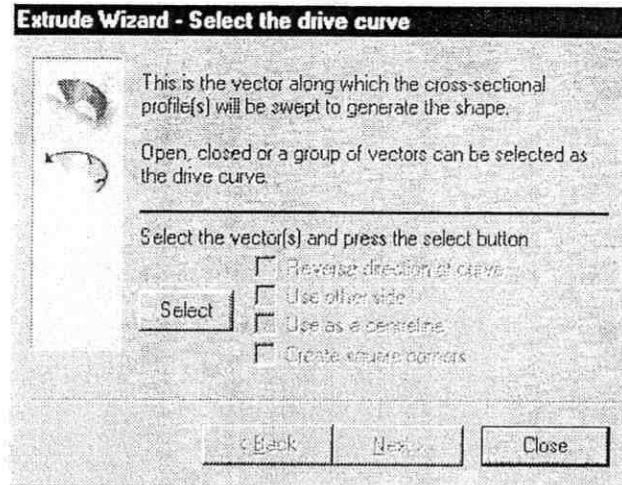
Next, we will extrude the shapes that represent the harp's frame and combine them with the existing relief. We will extrude these shapes along the vector objects representing each side of the harp's frame. These vector objects are referred to as drive curves. We will set the profile of the cross-section in the harp's frame using another vector object.

You will be guided through the process of selecting the drive curves and cross-sectional profiles in the model that will be used along with the **Extrude Wizard** to create shapes and combine them with the existing relief.

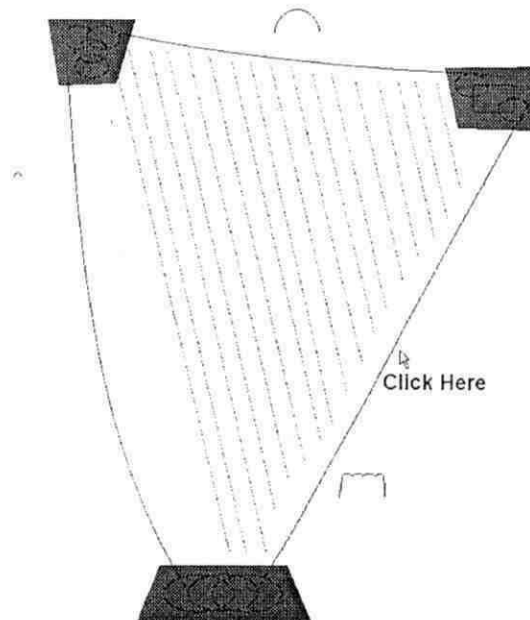
Creating the Right Side of the Frame

First we will create the right side of the harp's frame:

1. Click on the **2D View** button  in the **3D View** toolbar to display the **2D View** window.
2. Click on the **Extrude** button  in the **Vector Based Relief Creation** area to display the **Extrude Wizard**:

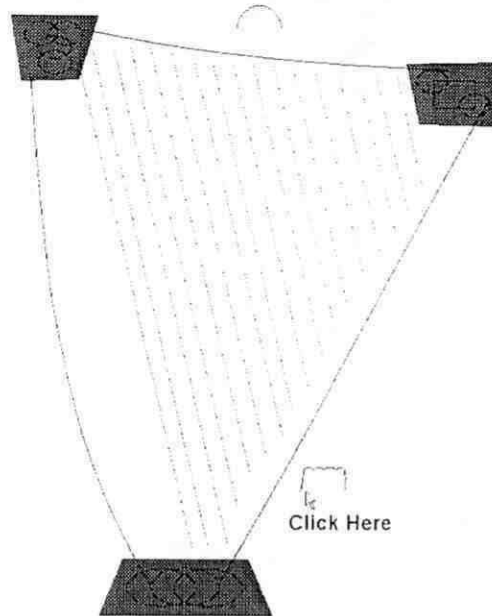


3. In the **2D View** window, click on the polyline for the right edge, as shown below, to select it.



A bounding box surrounds the polyline.

4. Click on the **Select** button in the **Extrude Wizard** to select the right edge of the harp as the drive curve. The drive curve turns red and you can see a direction arrow in its middle.
5. Click on the **Next** button.
6. In the **2D View** window, click on the vector object that we want to use as the cross-section at the start of the extruded shape, as shown, to select it:



A bounding box surrounds the polyline.

7. Click on the **Select** button in the **Extrude Wizard** to select the vector object as the start profile. The start profile is blue and you can see direction arrows all along its inside edge.

This vector object will also be used as the cross-sectional profile at the end of the extruded shape. If you wanted to have a blend between two different shapes at either end of the harp's frame on this edge, you could use two cross-sectional profiles.


8. Click on the **Next** button.
9. Make sure that the **End profile is the same as the start profile** option is turned on ☒, then click on the **Next** button.
10. Since no z modulation vector is used in this tutorial, click on the **Next** button.

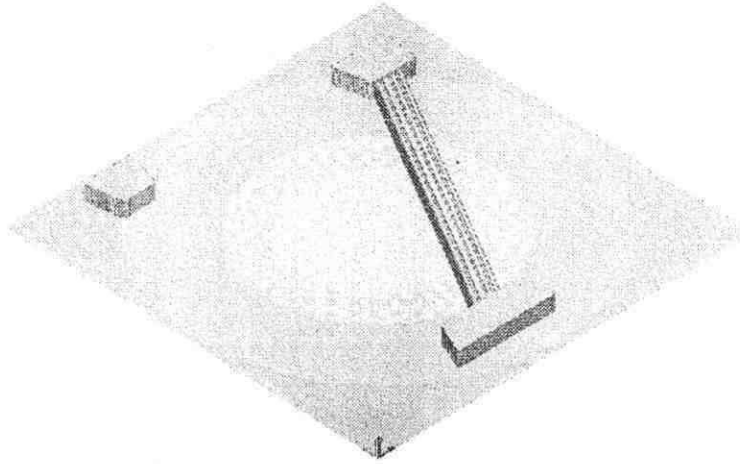
If you wanted to control the height and contour of the cross-section in the extruded shape, you could use a z modulation vector.

11. Click on the **Merge Highest** radio button ☒ to select it.

This option instructs ArtCAM Pro to merge the points in the extruded shape with the existing relief, so that only the highest points of the two show in the relief.



12. Click on the **Extrude** button in the **Extrude Wizard** to extrude the shape and then calculate the relief.

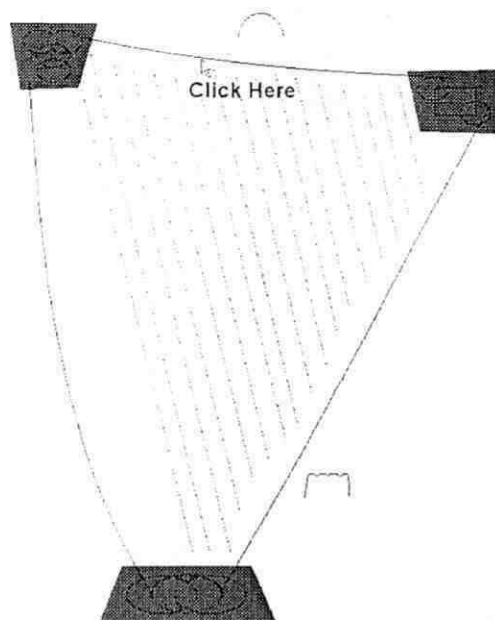
13. Click on the **Close** button to close the **Extrude Wizard**.
14. Click on the **3D View** button  in the **2D View** toolbar to display the new relief in the **3D View** window:



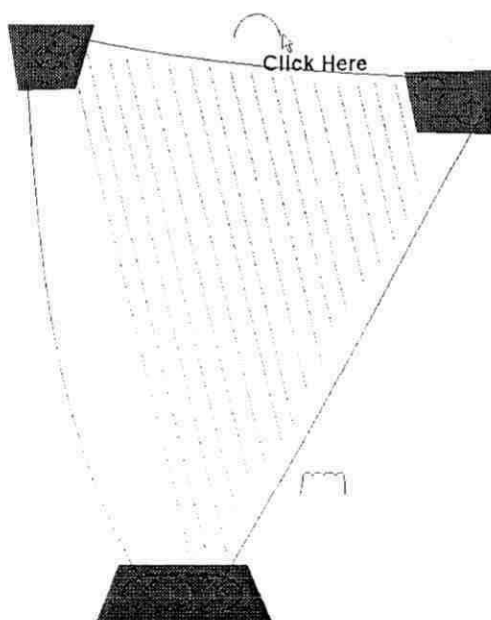
Creating the Top of the Frame

In this section, we will create the top of the harp's frame. We will use the polyline representing the top of the harp's frame as the drive curve, and the curved vector object directly above it as the start and end cross-sectional profile in the extruded shape.

1. Click on the **2D View** button  in the **3D View** toolbar to display the **2D View** window.
2. Click on the **Extrude** button .
3. In the **2D View** window, click on the polyline for the top of the harp, as shown:



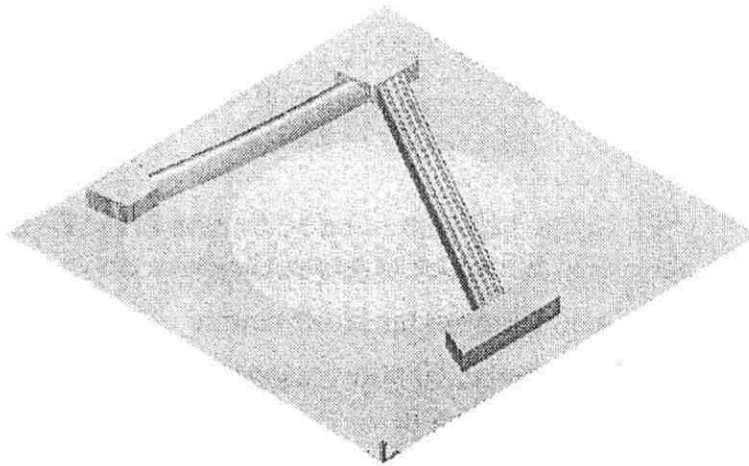
4. Click on the **Select** button in the **Extrude Wizard** to select it as the drive curve.
5. Click on the **Next** button.
6. In the **2D View** window, click on the vector object that we want to use as the cross-section at the start and the end of the extruded shape:



7. Click on the **Select** button in the **Extrude Wizard** to select it as the start profile.


8. Click on the **Next** button.
9. Make sure that the **End profile is the same as the start profile** option is turned on ☒, then click on the **Next** button.
10. Click on the **Next** button.
11. Click on the **Merge Highest** radio button ☒ to select it, then click on the **Extrude** button in the **Extrude Wizard** to extrude the shape and calculate the relief.
12. Click on the **Close** button to close the **Extrude Wizard**.

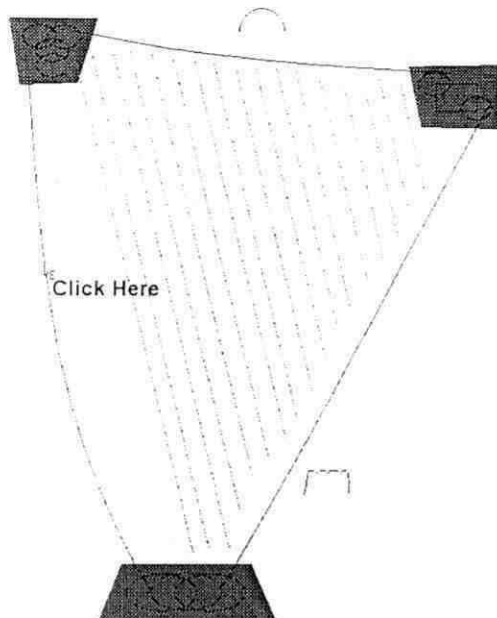
The relief in the **3D View** window now looks like this:



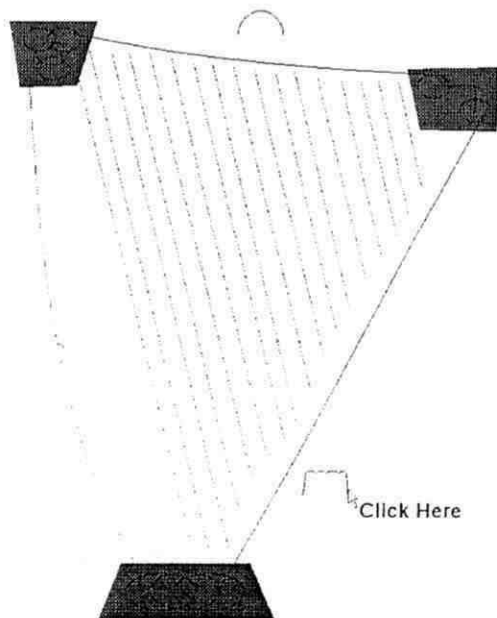
Creating the Left Side of the Frame

We are now ready to create the left side of the harp's frame using the same techniques. However, for this shape we will use a different cross-sectional profile for each end of this part of the harp's frame:

1. Click on the **Extrude** button .
2. In the **2D View** window, click on the polyline for the left-edge of the harp, as shown:

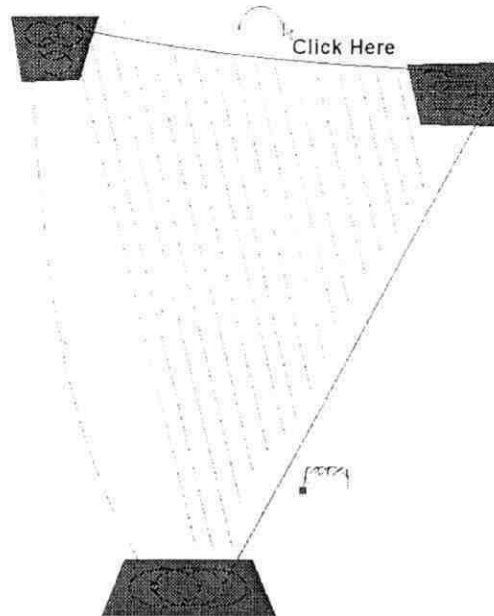


3. Click on the **Select** button in the **Extrude Wizard** to select the vector object as the drive curve.
4. Click on the **Next** button.
5. In the **2D View** window, click on the polyline shown below to select it:



6. Click on the **Select** button in the **Extrude Wizard** to select the vector object as the start profile.
7. Click on the **Next** button.

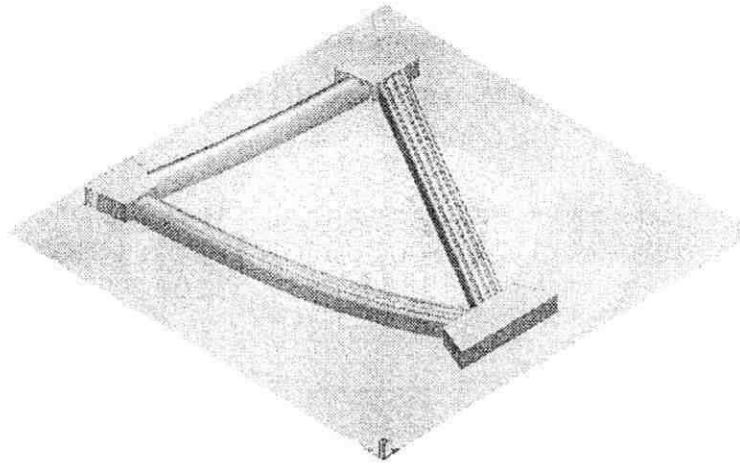
8. Click on the **End profile is the same as the start profile** option to turn it off ☐.
9. In the **2D View** window, click on the polyline shown below to select it:



A bounding box surrounds the polyline.



10. Click on the **Select** button in the **Extrude Wizard** to select the vector object as the end profile.
The end profile is blue and you can see a direction arrow in the middle of its inside edge.
11. Click on the **Next** button.
12. Click on the **Merge Highest** radio button ☒ to select it, then click on the **Extrude** button in the **Extrude Wizard** to extrude the shape and calculate the relief.
13. Click on the **Close** button.

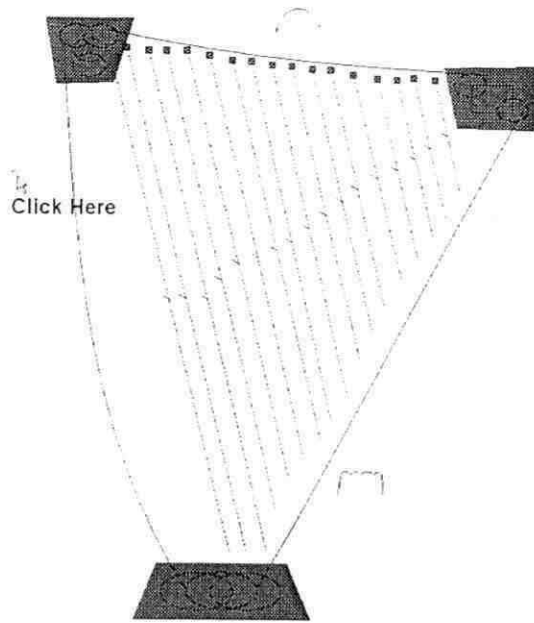
The harp's frame is now complete, as you can see in the **3D View** window:




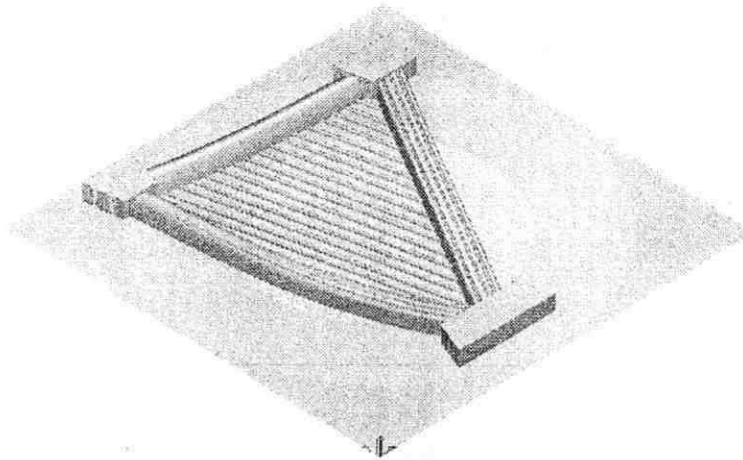
Creating the Harp's Strings


We are now ready to create the strings in the harp using the same techniques as for the harp's frame, but here we can extrude all of the strings at once as the vector objects representing them all have the same shape and are grouped together:

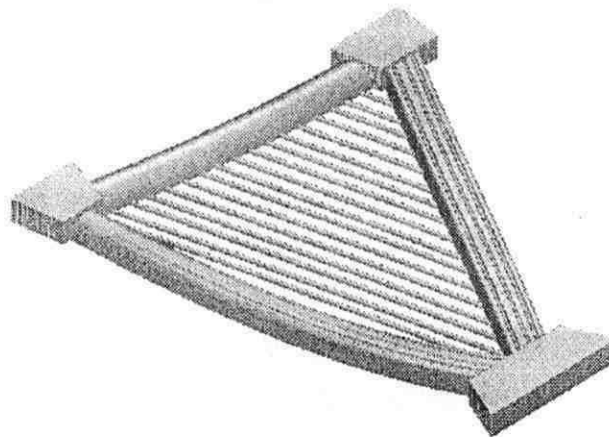
1. Click on the **2D View** button  in the **3D View** toolbar to display the **2D View** window.
2. Click on the **Extrude** button .
3. In the **2D View** window, click on any of the strings. As the strings are grouped together, all of them are selected.
4. Click on the **Select** button in the **Extrude Wizard** to select each string as a drive curve.
5. Click on the **Next** button.
6. Click on the cross-sectional profile we will use for the strings, as shown:



7. Click on the **Select** button in the **Extrude Wizard** to use the vector object as the start profile.
8. Click on the **Next** button.
9. Make sure that the **End profile is the same as the start profile** option is turned on ☒, then click on the **Next** button.
10. Click on the **Next** button.
11. Click on the **Merge Highest** radio button ☒ to select it, then click on the **Extrude** button in the **Extrude Wizard** to extrude the shape and calculate the relief.
12. Click on the **Close** button.
13. Click on the **3D View** button  in the **2D View** toolbar to display the relief in the **3D View** window:



14. Click on the **Draw Zero Plane** button  in the **3D View** toolbar to hide the zero plane in the relief and view the finished harp more clearly:

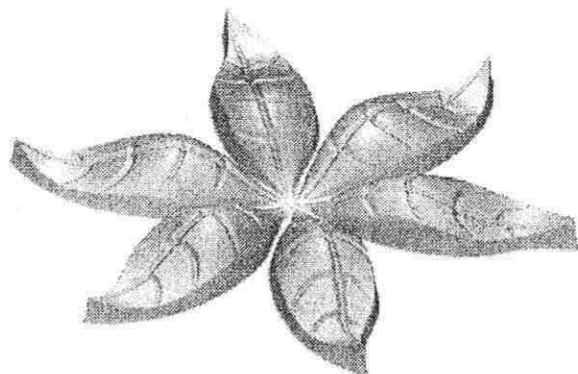


Spun Profile

The stages that you will cover during the course of this tutorial are:


- Preparing the model.
- Creating the spun shape.
- Creating the shape of the leaves.
- Creating the spine in the leaves.
- Smoothing the relief.

The tutorial will lead you through each of these stages, guiding you through the complete process of creating a spun profile that produces a relief in the shape of a group of leaves:

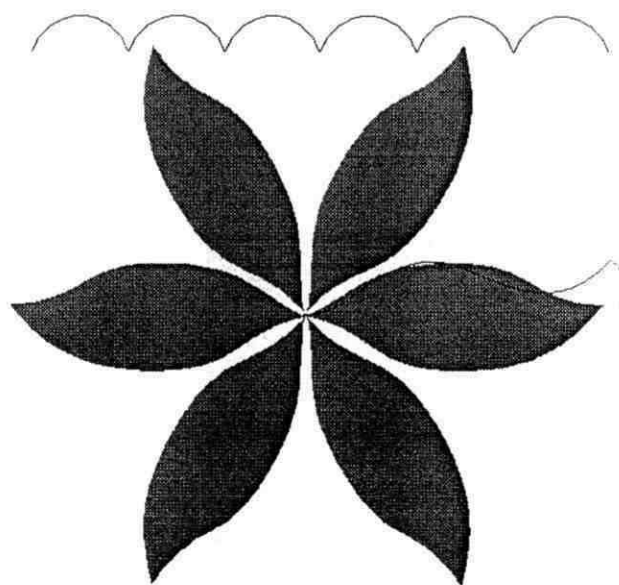


Preparing the Model

First, we will open the ArtCAM model containing the artwork that will be used to create the relief:

1. Click on the **Open Existing Model**  icon in the **Assistant** window to display the **Open** dialog box.
2. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples\Swept_p.
3. Click on the .art file named *Spinleaf* to select it.
The file name appears in the **File name** box.
4. Click on the **Open** button to open the model.

The following artwork appears in the **2D View** window:




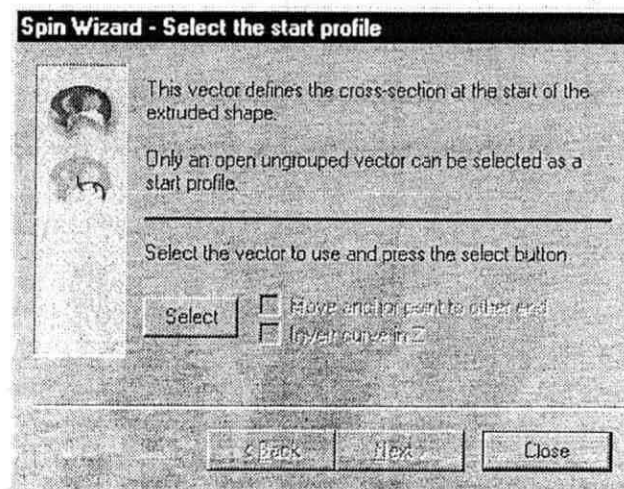
The .art file that you have opened is a model previously created in ArtCAM Pro. The model contains bitmap colours and vector objects that will be used to create different shapes. These shapes are combined to create the relief.

Creating the Spun Shape

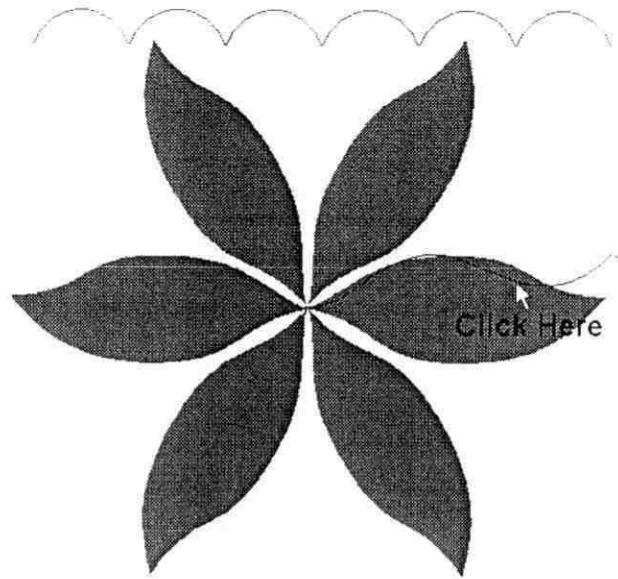
Next, we will spin the shape of a rippled disc, from which we will create the shape of the leaves. We will spin this shape using the vector object starting in the centre of the bitmap image of the leaves. This is referred to as the cross-sectional profile. We will set the height and contour of the cross-section in the spun shape using the vector object above the bitmap image of the leaves. This is referred to as the z modulation vector.

You will be guided through the process of selecting the cross-sectional profile and the z modulation vector in the model that will be used along with the Spin Wizard to create a shape and combine it with the existing relief.

1. Click on the **Spin** button  in the **Vector Based Relief Creation** area to display the **Spin Wizard**:



2. In the **2D View** window, click on the polyline for the start profile, as shown:

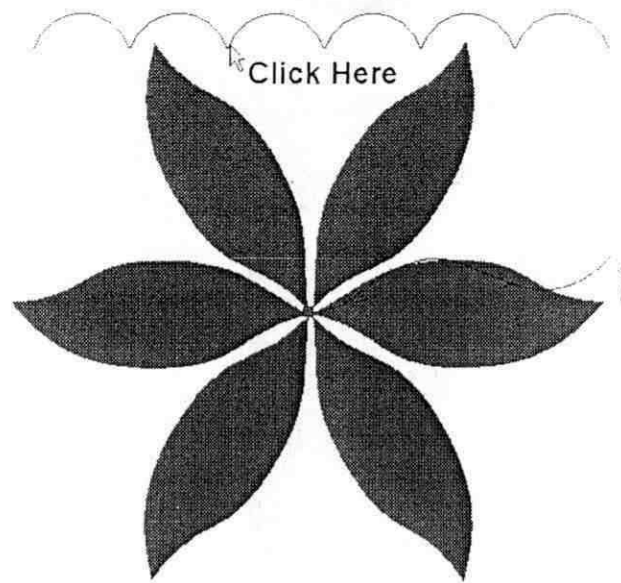


A bounding box surrounds the polyline.

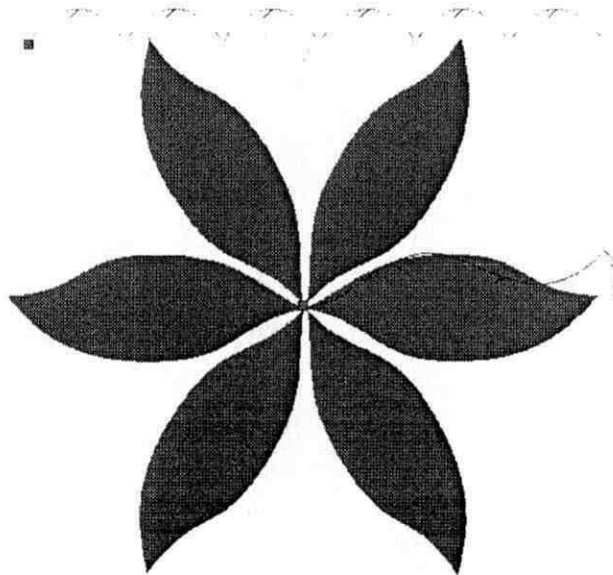
3. Click on the **Select** button in the **Spin Wizard** to select the vector object as the start profile.

The start profile is blue and you can see direction arrows all along its inside edge.


4. Click on the **Next** button.
5. Make sure that the **End profile is the same as the start profile** option is turned on ☒, then click on the **Next** button.
6. Make sure that the **Sweep through 360 degrees** option is turned on ☒, and then click on the **Next** button.
7. Click on the **Use a z modulation vector** option to turn it on ☒.
8. In the **2D View** window, click on the polyline for the z modulation vector, as shown:




9. Click on the **Select** button in the **Spin Wizard** to select the vector object as the z modulation vector:

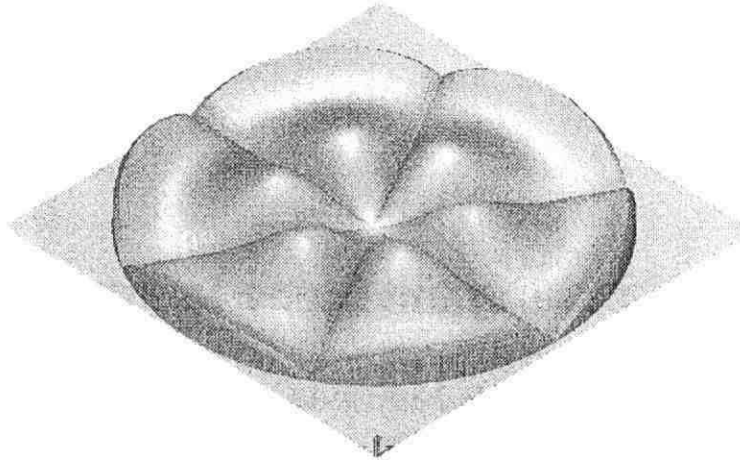


This instructs ArtCAM Pro to use the shape of the z modulation vector to control the height of the cross-section in the spun shape. The z modulation vector is green and you can see direction arrows all along its inside edge.

10. Click on the **Add** radio button  to select it.


This option instructs ArtCAM Pro to add the points in the shape to the current relief.

11. Click on the **Spin** button in the **Spin Wizard** to spin the shape and then calculate the relief.
12. Click on the **Close** button to close the **Spin Wizard**.
13. Click on the **3D View** button  in the **2D View** toolbar to display the relief in the **3D View** window:

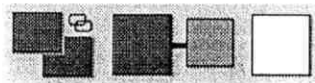


Creating the Shape of the Leaves


Next, we will create the shape of the leaves from the existing relief.

1. Click on the **2D View** button  in the **3D View** toolbar to display the **2D View** window.
2. Click on red in the Colour Palette beneath the **2D View** window to select it as the Primary Colour.

The Colour Palette appears as follows:

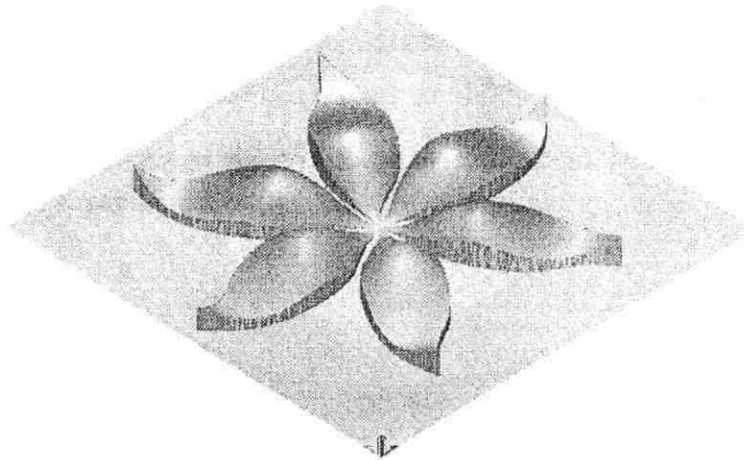


You can see that the red and green colours are linked together. This means that the green colour is treated as the same as the red.

3. Click on the **Zero Relief NOT Under Colour** button  in the **Relief Editing** area of the **Assistant's** Home page.

This option instructs ArtCAM Pro to reset the height of all areas of the existing relief not under the current Primary Colour to zero.


The shape of the leaves is made, as you can see in the **3D View** window:



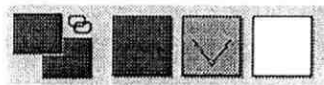
Creating the Spine in the Leaves

An angled shape with an angle of -45° has already been applied to the green colour in the *Spinleaf* model. This can be confirmed by double-clicking on the colour to display the **Shape Editor** dialog box.

We will create the spine in the leaves from the green bitmap colour used in the *Spinleaf* model.

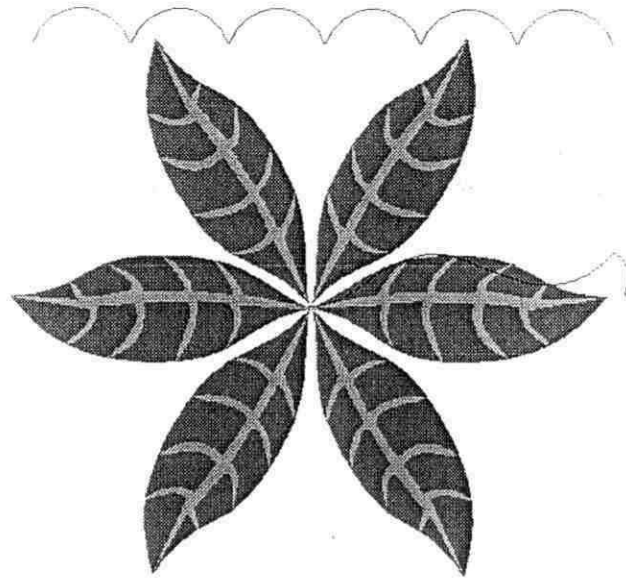
1. Click on the **2D View** button  in the **3D View** toolbar to display the **2D View** window.
2. From the Main menu bar, click on the **Colour** option to display the **Colour** menu, then click on the **Reset All Links** option to unlink the red and green colours in the Colour Palette.


The Colour Palette appears as follows:



The line drawn over the green colour indicates that an angled shape has already been applied to the colour.

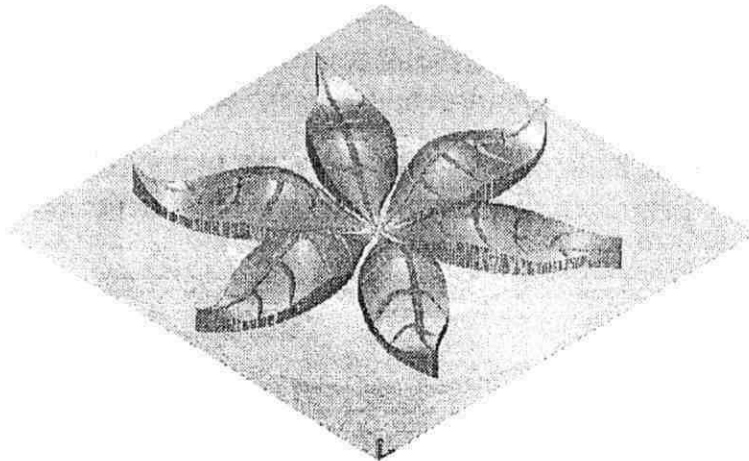
You can see that the green colour in the Colour Palette represents the spine in the leaves:



3. Click on the **Add Relief** button  in the **Relief Operations** area of the **Assistant's** Home page to calculate the new relief.

This option instructs ArtCAM Pro to add the points in the angled shape to the current relief.

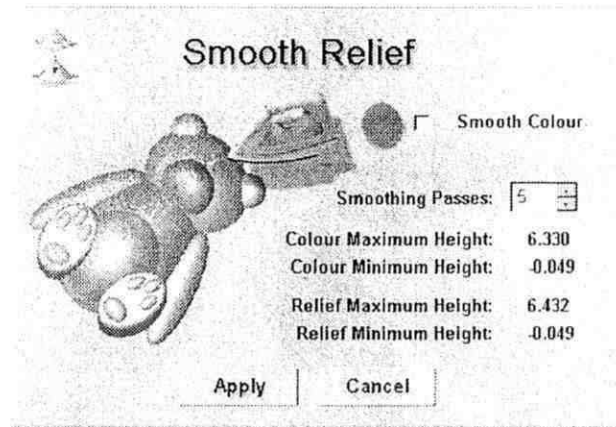
The leaves are now complete, as you can see in the **3D View** window:



Smoothing the Relief

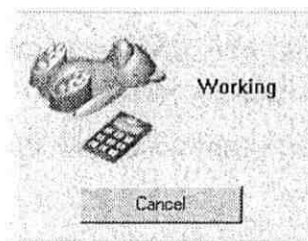
Finally, we will smooth the relief to improve the appearance of its surface.


1. Click on the **Smooth Relief** button  in the **Relief Editing** area of the **Assistant's** Home page to display the **Smooth Relief** dialog box:

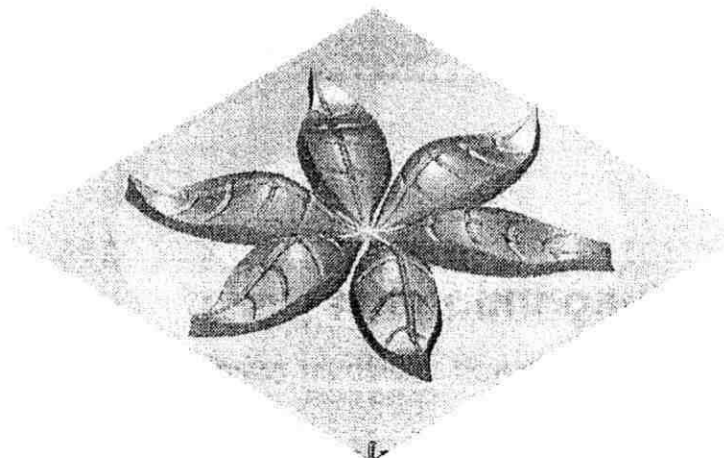


2. Type 5 in the **Smoothing Passes** box.
3. Click on the **Apply** button to smooth the relief.

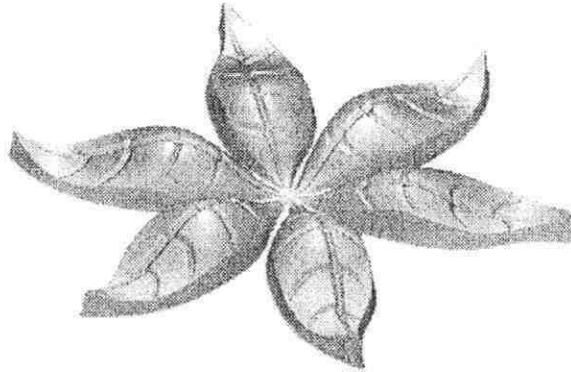
The **Working** dialog box appears during the smoothing process:



4. Once the smoothing process is complete, click on the **Cancel** button in the **Smooth Relief** dialog box to close it.
5. Click on the **3D View** button  in the **2D View** toolbar to display the smoothed relief in the **3D View** window:



6. Click on the **Draw Zero Plane** button  in the **3D View** toolbar to hide the zero plane and view the finished leaves more clearly:

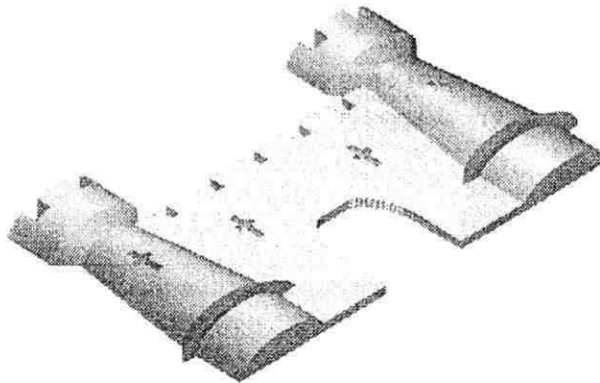


Turned Profile

The stages that you will cover during the course of this tutorial are:


- Preparing the model.
- Creating the turned shapes.
- Creating the turret crenellations.
- Creating the face of the castle.
- Creating the arrow-slits in the castle.
- Saving the model.

The tutorial will lead you through each of these stages, guiding you through the complete process of creating a relief in the shape of the castle. This includes the turned profiles for each of the castle's towers.



Preparing the Model


First, we will open the ArtCAM model containing the artwork that will be used to create the castle relief:

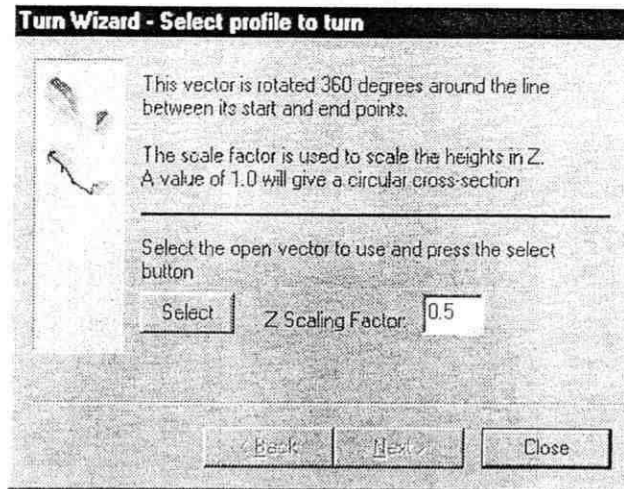
1. Click on the **Open Existing Model**  icon in the **Assistant** window to display the **Open** dialog box.
2. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples\Castle.
3. Click on the .art file named *Castle* to select it.
The file name appears in the **File name** box.
4. Click on the **Open** button to open the model.

The .art file that you have opened is a model previously created in ArtCAM Pro. The model contains three **2D View** windows, each of them containing different views of the castle artwork. We will use the bitmap colours and vector objects in each of these views to create different shapes and combine them to form the castle relief. The **Castle View1** window will be used to create the castle turrets, the **Castle View2** window will be used to create the face of the castle and the **Castle View3** window will be used to create the arrow-slits in the castle.

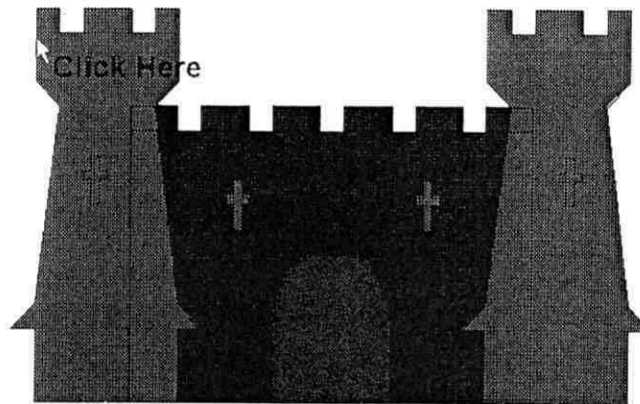
Creating the Turned Shapes

We will create the castle turrets using two turned profiles.


1. Click on the **Castle View1** window to select it as the current view.
2. Click on the **Turn** button  in the **Vector Based Relief Creation** area of the **Assistant's** Home page to display the **Turn Wizard**:



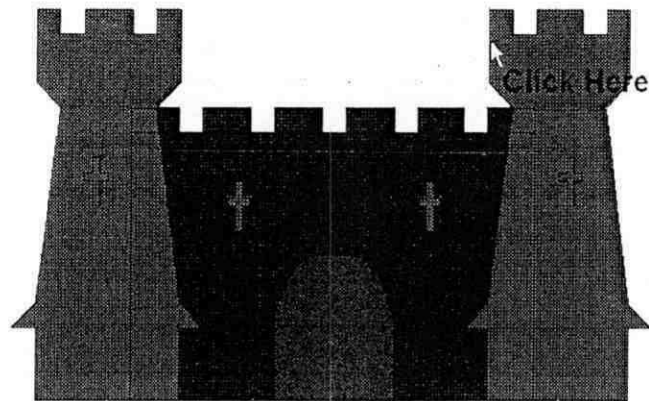
3. In the **Castle View1** window, click on the polyline along the edge of the left turret, as shown below, to select it:




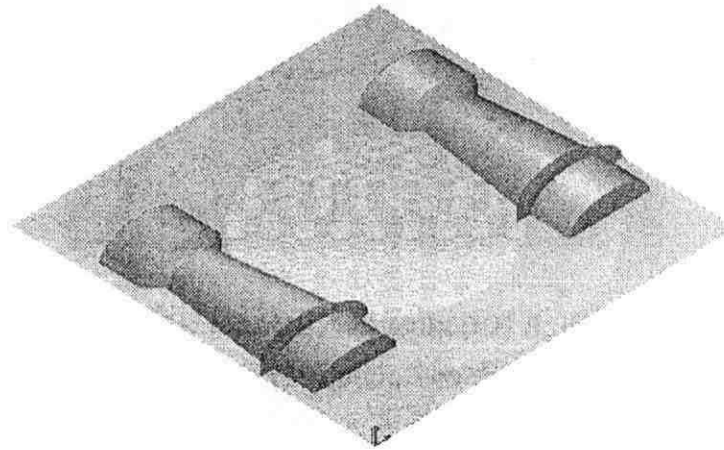
A bounding box surrounds the selected polyline.

4. Click on the **Select** button in the **Turn Wizard** to select it as the profile to turn.
The profile is blue and you can see direction arrows all along its outside edge.
5. Type *0.5* in the **Z Scaling Factor** box.
6. Click on the **Next** button.
7. Click on the **Add** radio button  to select it.
This option instructs ArtCAM Pro to add the points in the turned shape to the current relief.
8. Click on the **Turn** button in the **Turn Wizard** to create the turret's turned shape and calculate the relief.

9. Repeat these steps to create the right turret using the profile shown below:





10. When you have created the second turret, click on the **Close** button to close the **Turn Wizard**.
11. Click on the **3D View** button  to display the relief in the **3D View** window:




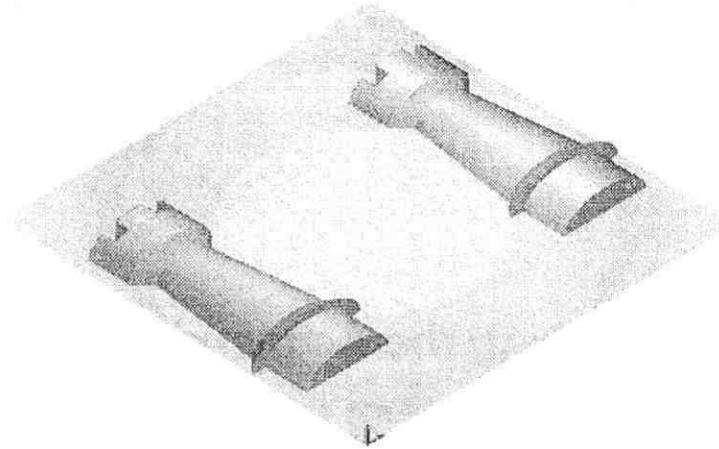
Creating the Turret Crenellations

We will now create the crenellations in both of the castle turrets from the existing relief:

1. Click on the **2D View** button  in the **3D View** toolbar to display the **Castle View1** window.
2. Click on the white colour in the Colour Palette beneath the **Castle View1** window to select it as the Primary Colour.
3. Click on the **Zero Relief Under Colour** button  in the **Relief Editing** area of the **Assistant's** Home page.

All areas of the current relief under the current Primary Colour are set to zero.

4. Click on the **3D View** button  in the **2D View** toolbar to display the new relief in the **3D View** window:




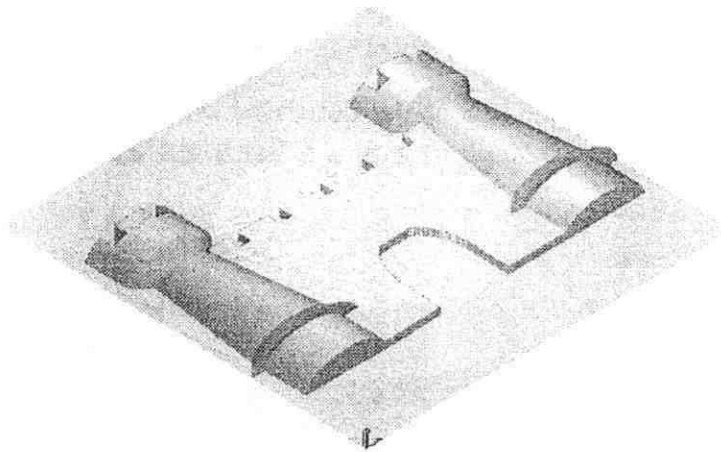
Creating the Face of the Castle

When the *Castle* model was created, the artisan applied a flat shape to the blue bitmap colour used in the **Castle View 2** window. This is shown by the line drawn on the blue colour in the Colour Palette beneath the window. We will create a shape from this colour, combining it with the existing relief, which is shown in the **3D View** window.

1. Click on the **2D View** button  in the **3D View** toolbar to display the **Castle View1** window.
2. Click on the **Castle View 2** window to make it active.
3. Click on the **Merge High** button  in the **Relief Operations** area of the **Assistant's** Home page.



This option instructs ArtCAM Pro to merge the points in the flat shape with the existing relief, so that only the highest points of the two show in the new relief.

4. Click on the **3D View** button  in the **2D View** toolbar to display the new relief in the **3D View** window:





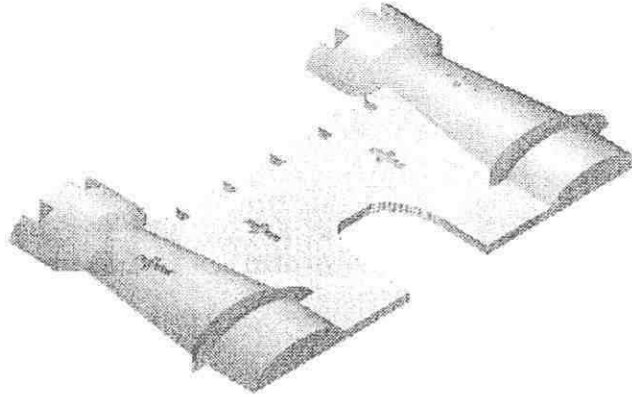
Creating the Arrow-slits in the Castle

When the *Castle* model was created, the artisan applied an angled shape to the green bitmap colour used in the **Castle View 3** window. This is shown by the line drawn on the green colour in the Colour Palette beneath the window. We will create shapes from this colour, combining them with the existing relief, which is shown in the **3D View** window.

1. Click on the **2D View** button  in the **3D View** toolbar to display the **Castle View 2** window.
2. Click on the **Castle View 3** window to make it active.
3. Click on the **Add Relief** button .

This option instructs ArtCAM Pro to add the points in the angled shape to the current relief. As the angled shape has a negative value, this has the effect of removing material from the relief.

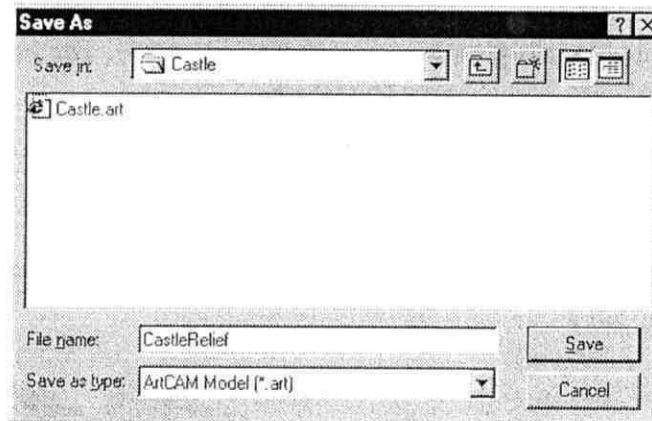
4. Click on the **3D View** button  in the **2D View** toolbar to display the new relief in the **3D View** window.
5. Click on the **Draw Zero Plane** button  in the **3D View** toolbar to hide the zero plane and view the finished castle more clearly:



Saving the Model

We are now ready to save the finished model:

1. From the Main menu bar, click on the **File** option to display the **File** menu, then click on the **Save As...** option to display the **Save As** dialog box:



You should already be in the ArtCAM Pro 6.0\Examples\Castle directory. If you are not, go to this directory before continuing to the next step.

2. Type *CastleRelief* in the **File name** box.
3. Click on the **Save** button to close the **Save As** dialog box and save the ArtCAM Pro model.

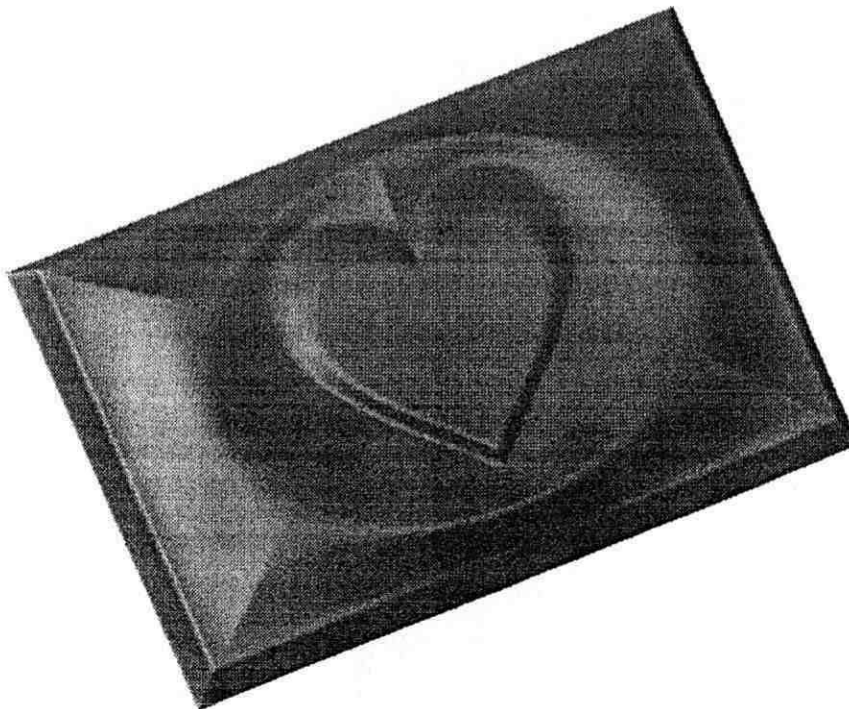
Tutorial – 3D Blend


Overview

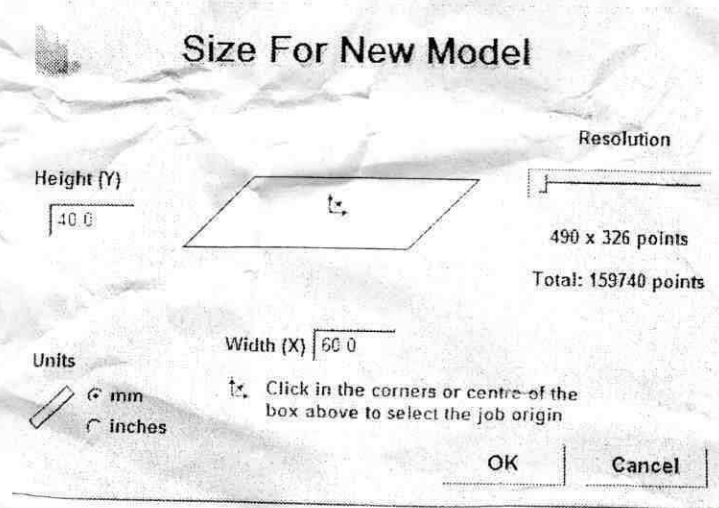
In this tutorial the 3D-Blend tool is used to create the smooth shapes forming the design for a chocolate mould. The amount of chocolate can also be calculated by creating a mesh. The model can also be rendered to look like the finished product.

Chocolate Mould

The finished chocolate mould design detailed in this tutorial will look like this:




1. Click on the Create New Model  icon in the Assistant window to display the Size For New Model dialog box:



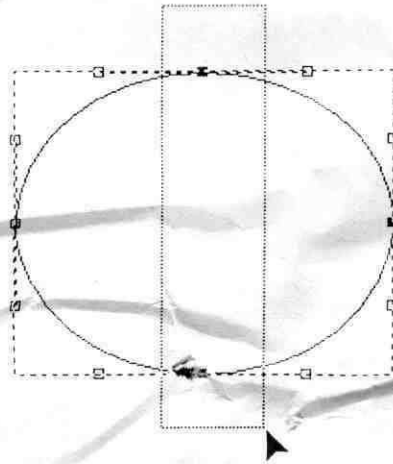
2. Click on the mm option under Units.
3. Type 40 mm (1.57") in the **Height** box and 40mm (2.36") in the **Width** box.
4. Click and drag on the **Resolution** slider to the far left to set the resolution of the model to 159740 points.
5. Click on the **OK** button to close the **Size For New Model** dialog box.
6. A **2D View** and a **3D View** window are created.

Creating the 2D Artwork

To create the central heart motif we will begin by drawing an ellipse.

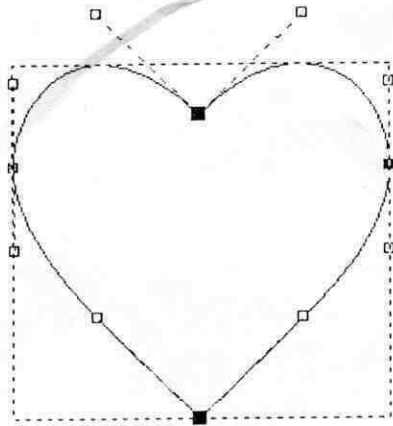
1. Click on the **Create Ellipse** button  in the **Vector Editing** area to display the **Ellipse Creation** page.
2. Type 20 mm in the **Height** box and 25 mm in the **Width** box.
3. Make sure that the value in the **Angle** box remains at the default setting of 0°.
4. Click on the **Preview** button to view the ellipse.
5. Click on the **Create** button to create the ellipse, centred on the origin.

6. Click on the **Close** button to return to the **Assistant's** Home page.
7. Make sure that the ellipse is selected.
8. Press the **N** key to enter **Node Editing Mode**.
9. Click and drag a box over the central two nodes of the ellipse:






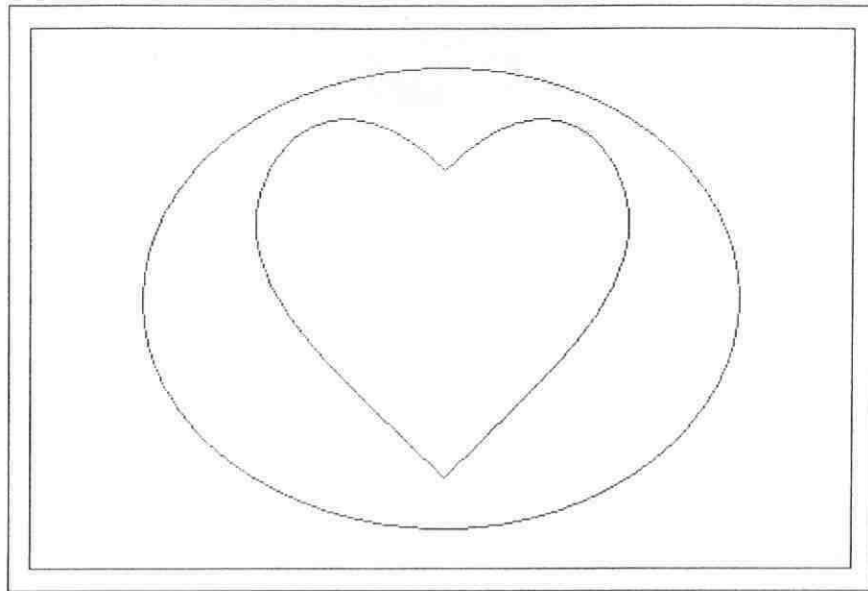
The selected nodes become red to indicate that they are selected.

1. Use the down arrow key to 'nudge' the nodes vertically.
2. Keep nudging the nodes until you have formed a pleasing heart shape:




1. When you have finished, press the Esc key to return to Selection Mode.
2. With the heart vector still selected, press the **F9** key to centre the shape in the page.

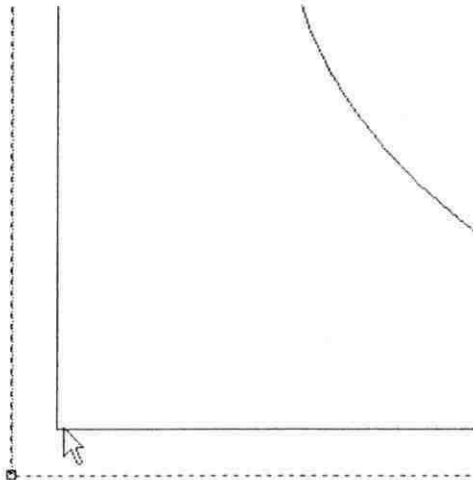
3. Now we will create another ellipse.
 4. Click on the **Create Ellipse** button  in the **Vector Editing** area to display the **Ellipse Creation** page.
 5. Type 30 mm in the **Height** box and 40 mm in the **Width** box.
 6. Make sure that the value in the **Angle** box remains at the default setting of 0°.
 7. Click on the **Create** button to create the ellipse.
 8. Click on the **Close** button to return to the **Assistant's** Home page.
 9. With the new ellipse vector still selected, press the **F9** key to centre this shape in the page.
 10. The border of the model will be created using two rectangles.
 11. Click on the **Create Rectangle** button  in the **Vector Editing** area to display the **Rectangle Creation** page.
 12. Make sure that the **Rectangle** option is selected .
 13. Type 55 mm in the **Height** box and 35 mm in the **Width** box.
 14. Now type 58 mm in the **Height** box and 38 mm in the **Width** box.
 15. Click on the **Create** button to create the second rectangle in your model.
 16. Click on the **Close** button to return to the **Assistant's** Home page.
 17. Select the first rectangle by clicking on it.
 18. Press the **F9** key to centre the rectangle in the page.
 19. Select the second rectangle by clicking on it.
 20. Press the **F9** key to centre this rectangle in the page also.
- You have now created all the 2D artwork need to build the model.





Creating the 3D Model

1. Click the **Create 3D Blend** button , this is found under **Relief Editing** on the **Assistant** page.
2. Select the outermost rectangle by clicking on it.
3. Hold down the **Shift** key, this allows multiple selections.
4. With the **Shift** key still held down, click on the inner rectangle.


Both shapes will now be selected.



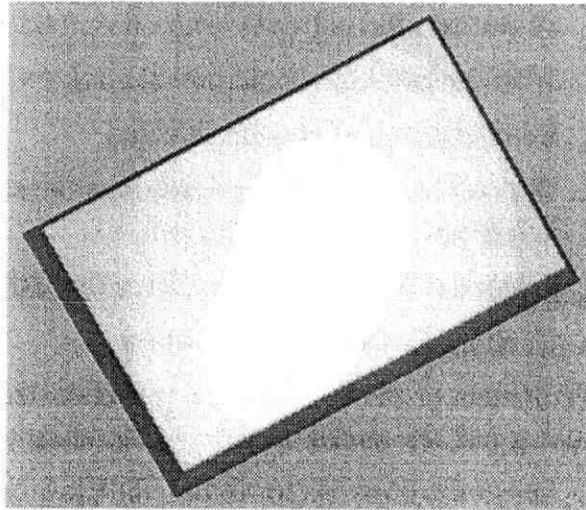
1. In the **3D Blend** page select the **Linear** option  in the **Profile** section.

2. In the **Heights** section, make sure that neither of the **From Relief** check boxes are ticked (this will cause the associated height edit boxes to be greyed out).
3. Set the **Inner** height to 4 and the **Border** height to 0.
4. In the **Blend From Border To:** section, select the **Inner Vector Edge** option .
5. Ensure that the **Fill Inner Vector** checkbox is ticked.
6. Ensure that the **Proportion** slider is set to 100%.


These settings tell ArtCAM to blend the outermost (or border) rectangle with a height of 0, to inner rectangle shape filled with a height of 4 mm. The profile of the blend will be a simple linear shape.

7. Select the **Add** option  in the **Combine** section.
8. Click the **Create Blend** button.

After the calculation you will see the base of the design has been created in the **3D View**.

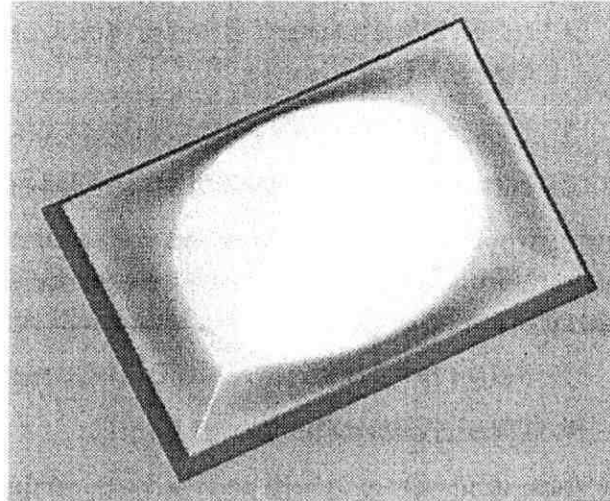



Now we will create a smoothly blended shape from the top of the base (defined by the inner rectangle) to the oval surrounding the heart motif.

1. Select the inner rectangle by clicking on it in the **2D View**.
2. With the **Shift** key still held down, click on the ellipse.
3. Both shapes will now be selected.
4. In the **3D Blend** page select the **Smooth** option  in the **Profile** section.

5. With all the previous page settings the same, click the Create Blend button.

After the calculation the model will look like this:





1. Select the ellipse by clicking on it in the 2D view
2. With the **Shift** key held down, click on the heart.
3. Both shapes will now be selected.
4. With all the previous page settings the same, set the **Inner** height in the **Heights** section to 2.
5. Select the **Subtract** option  in the **Combine** section.
6. Click the **Create Blend** button.

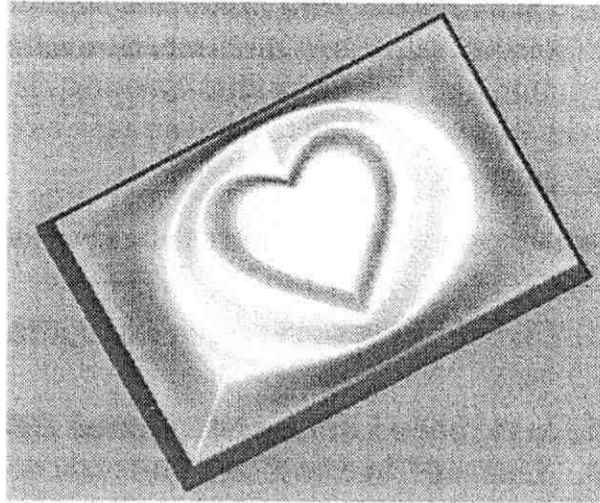
The final element of the design is the raised central heart. This is created using just one vector shape and blending to a specified point.

1. Select the heart vector in the 2D View by clicking on it.

In the 3D Blend page you will see that some options have been highlighted in red. This means that these options are not compatible with the number, or properties, of the current selection. In this case there is only one vector selected and the highlighted options require two.


2. In the Blend From Border To: section, select the Middle of Border Vector option .
3. Move the Proportion slider to 25%.
4. Select the Add option  in the Combine section.
5. Click the Create Blend button.

This operation creates a blend from the edge of the heart shape towards a point at its centre. The proportion setting means the blend reaches its specified height of 2 mm at a distance that is only 25% of the total distance between the border and centre of the shape. In effect this creates a smoothly blended and filled shape 2 mm high:



Rendering the Model


By default, the model is rendered in ArtCAM's basic colour scheme. To see how the finished product will look, perhaps for customer approval, we can render it as if it were made from chocolate.

1. Click the **Lights and Materials** button , this is found under **Model** on the **Assistant** page.
2. Click the drop-down list box in the **Shading Setup** section to see the list of preset materials.

Chocolate is not included by default, so we will create it.

3. Select '*Blue Wax*' from the **Shading Setup** drop-down list.

This is a good starting point for our new material since, apart from the colour, the shading properties are likely to be quite similar to chocolate. Starting with the closest matching preset is generally a good method for creating new material types.

4. In the **Material** section (you may need to click the **Material** section header bar if the section content is hidden) click the palette button  next to the currently selected colour.

This opens the standard colour selection dialog.

5. Choose a brown colour that is close to the colour of chocolate (**Red**, **Green** and **Blue** values of 140, 90 and 55, respectively, are a good starting point).
6. When you are happy with the colour click the **OK** button.
7. On the **Lights And Materials** page in the **Material** section, select 'ArtCAM' from the available options in the drop-down list under **Background**. This will set a background image rather than a plain colour.
8. Click the **Apply** button.



If you are happy with the result, it can be saved as a new preset to use in the future.

1. Click the **Save...** button on the **Lights And Materials** page.
2. In the **Save Lights and Material Settings** dialog, type 'Chocolate' into the **File name:** edit box.
3. Click the **Save** button.

The Chocolate shading setup will now be added to the preset list.

Creating an STL File and Finding the Weight of the Finished Product

The Relief we have created can be used directly to generate the toolpaths for male or female moulds. Alternatively a rapid prototype of the model can be created. To do this the model needs to be converted into a closed triangle mesh suitable for output as an STL file to a rapid prototype machine. Creating a triangle mesh can also be useful for other reasons, some of which we will explore in this section.

1. Click on the **Create Triangle Mesh** button  in the **Relief Operations** section to display the **Mesh Creator** page.
2. Type 0.01 mm in the **Tolerance** box.
3. Under the heading **Backface**, select the **Close With A Flat Plane** option .
4. Click the **Create Triangles** button.

5. When the calculation process has finished, twiddle the model in the **3D View**.

You can see that the mesh is now a complete solid.

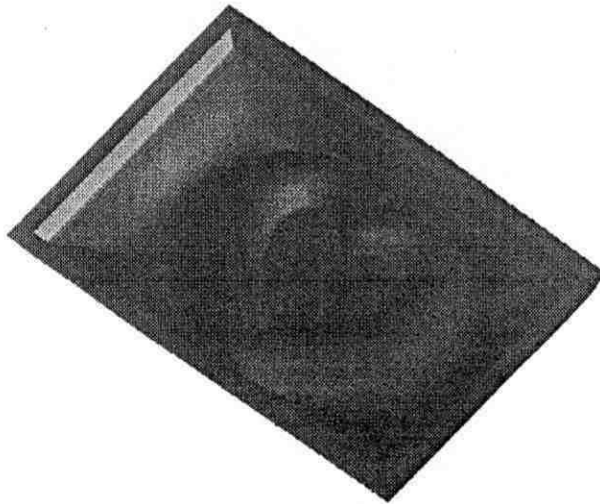
6. Select '*Chocolate*' from the drop-down list next to **Weight:**.
7. With the **Shrinkage:** value set to 0%, Click the **Update** button.

As a solid piece, ArtCAM tells us that it will use just under 17g of Chocolate.

8. Now select the **Create Offset Back Face** option ☒ under the heading **Backface**.
9. Set the **Thickness:** value to 2 mm.
10. Click the **Create Triangles** button again.

This will create a new closed mesh representing the model created as a hollow piece, with a 2 mm wall thickness.

Twiddle the model in the **3D View** to see the finished design.



In the **Result** section ArtCAM now tells us that this design will require approximately 7g of chocolate

To save the file ready for creation on a rapid prototype machine:

1. Click the Save Triangles button on the Mesh Creator page.
2. Enter a suitable file name and click the Save button on the Save Triangle Mesh dialog.

This creates an STL file which can usually be sent directly to your rapid prototype machine.

Tutorial – 3D Clipart

Overview

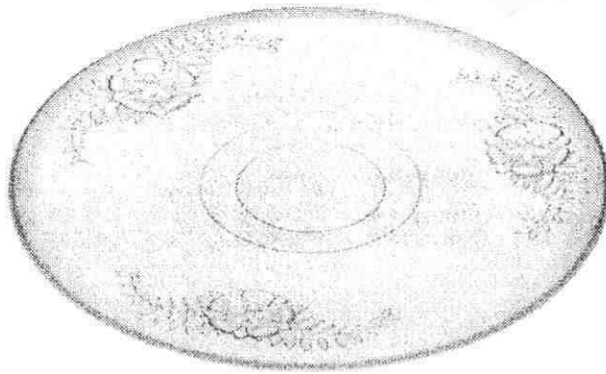
The following tutorial demonstrates how to import a clipart relief and paste it onto the surface of an existing relief using the relief operations tools available in ArtCAM Pro.

Plate Design

The stages that you will cover during the course of this tutorial are:


- Preparing the model.
- Creating the leaves.
- Creating the flower.
- Saving the relief.
- Creating the plate.

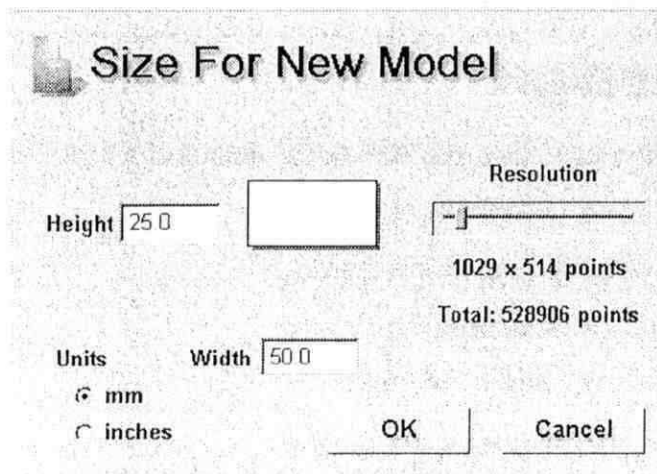
The tutorial will lead you through each of these stages, guiding you through the complete process of loading and manipulating a clipart relief to produce the plate shown below:




Preparing the Model

First, we will set up the dimensions of the block of material needed for this particular job:

1. Click on the **Create New Model**  icon in the **Assistant** window to display the **Size For New Model** dialog box:



2. Click on the **Units** option  that you want to use (millimetres or inches).
3. Type 25 mm (0.98") in the **Height** box and 50 mm (1.97") in the **Width** box.
4. Click and drag on the **Resolution** slider to set the resolution of the model to 528906 points.
5. Click on the **OK** button to close the **Size For New Model** dialog box.

A **2D View** window automatically fills the previously empty design window area. This window represents the block of material viewed down the Z-axis.

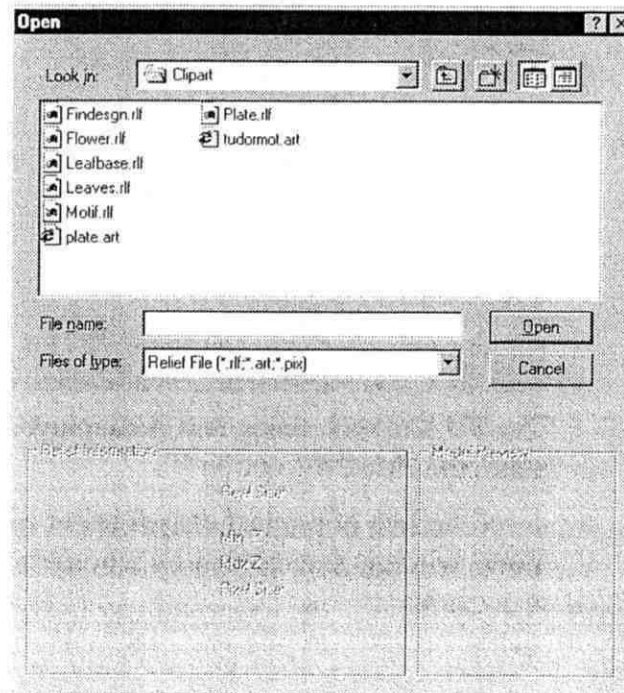
Creating the Leaves

Next, we will create a relief that represents the leaves in the plate design. The plate itself will be created later and the leaves design will be added to it.

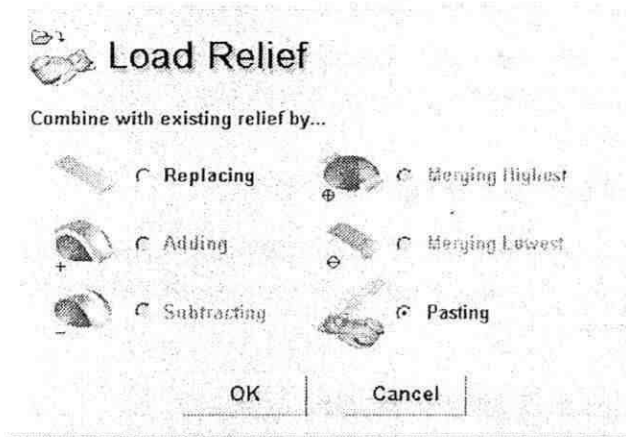
Loading the Clipart Relief


First, we will load the clipart relief that will be used to create the leaves design on the plate.

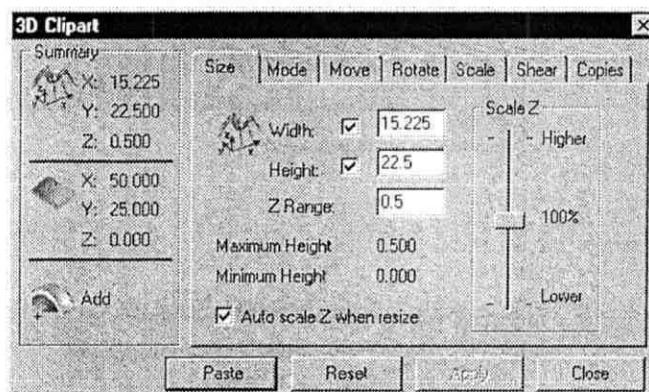
1. Click on the **Load Relief** button  in the **Relief Operations** area of the **Assistant's** Home page to display the **Open** dialog box:




2. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples\Clipart.
3. Click on the .rlf file named *Leaves* to select it.
4. Click on the **Open** button to display the **Load Relief** dialog box:

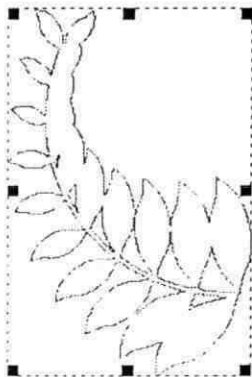


5. Make sure that the **Pasting** option  is selected by clicking on it. This is because we want to paste the clipart relief onto the existing relief.
6. Click on the **OK** button to close the **Load Relief** dialog box and display the **3D Clipart** dialog box:



The **3D Clipart** dialog box is displayed because we are using the **Pasting** option .

A red outline of the leaf clipart relief appears in the **2D View** window surrounded by a bounding box:



This is a vector outline indicating the current shape of the leaf clipart relief and its position in relation to the existing relief in the model.

The bounding box indicates that this vector outline can be manipulated in the same way as any grouped vector object in ArtCAM Pro. However, when using the **3D Clipart** dialog box, the changes that you make to this outline are also applied to the clipart relief.

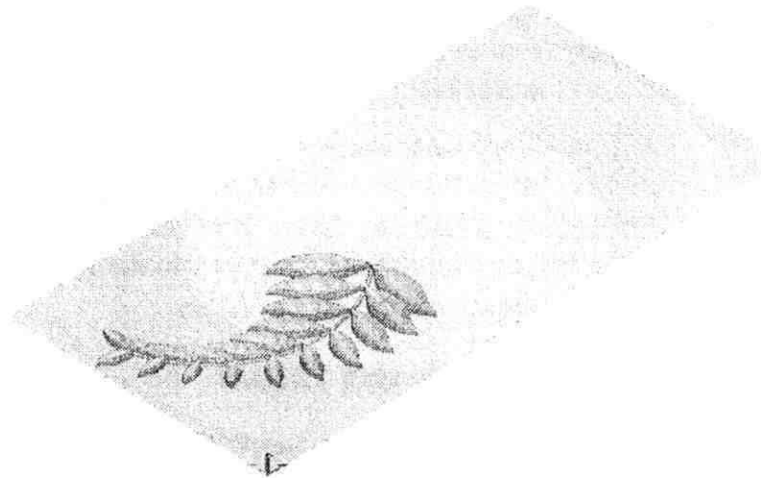
Manipulating the Clipart Relief


We are now ready to manipulate the leaf clipart relief and paste it onto the existing relief to form the leaves in the plate design. We will change the position of the leaf clipart relief before pasting it onto the plate relief by rotating it. We also want to create a second, mirrored copy of the leaf clipart relief and also paste this onto the plate relief.

1. Click on the **Rotate** tab in the **3D Clipart** dialog box to display the **Rotate** page.
2. Type -40° in the **Rotate by angle** box.
3. Click on the **Apply** button to rotate the clipart relief. The outline in the **2D View** window is rotated as shown:

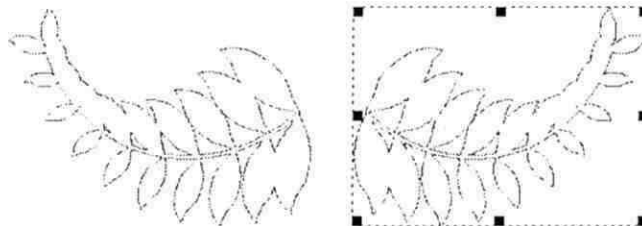



4. Click on the **Paste** button in the **3D Clipart** dialog box to paste the clipart relief onto the current relief.
5. Click on the **3D View** button **3D** in the **2D View** toolbar to display the new relief in the **3D View** window:

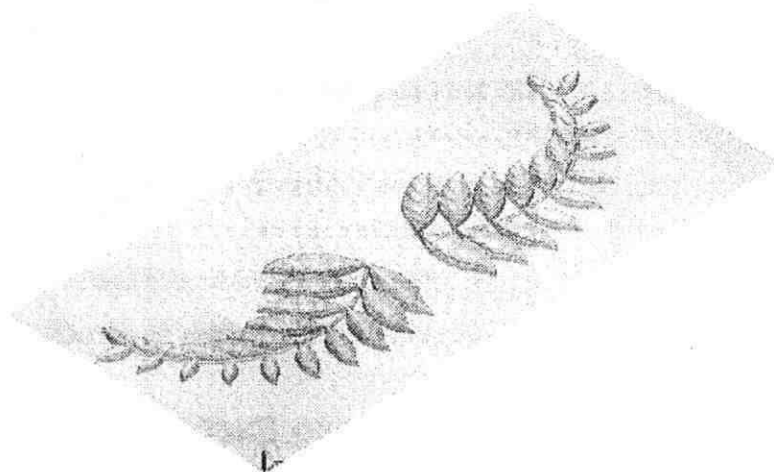




6. Click on the **2D View** button  to return to the **2D View** window.
7. On the **Rotate** tab, click on the **Horizontal** button to create a preview image of the clipart relief as it would look when mirrored.
8. Click on the **Move** tab.
9. Type 25 in the **Move X origin** by box.
10. Click on the **Apply** button to move the clipart relief along the X-axis to the right.

The outline in the **2D View** window is mirrored and moved as shown:



11. Click on the **Paste** button to paste the clipart relief onto the current relief.
12. Click on the **Close** button to close the **3D Clipart** dialog box.
13. Click on the **3D View** button  in the **2D View** toolbar to see what the relief now looks like:



14. Click on the **2D View** button  to return to the **2D View** window.
15. Click on the **Grayscale from Relief** button  in the **Model** area of the **Assistant's** Home page to display the relief as a greyscale image in the **2D View** window.

A greyscale is an image in which the only colours are shades of grey. This allows you to see where you are pasting relief clipart on the current relief.
16. Click on the red vector outline of the leaf on the left to select it. A bounding box surrounds the leaf.
17. Hold down the **Shift** key on your keyboard, and then click on the red vector outline of the leaf on the right.



A bounding box surrounds both leaves.
18. Press the **Delete** key on your keyboard to delete the vector outline of both leaves from the **2D View** window. Now that the leaves have been pasted onto the existing relief, we no longer need the vector outline representing the leaf clipart relief.

Creating the Flower

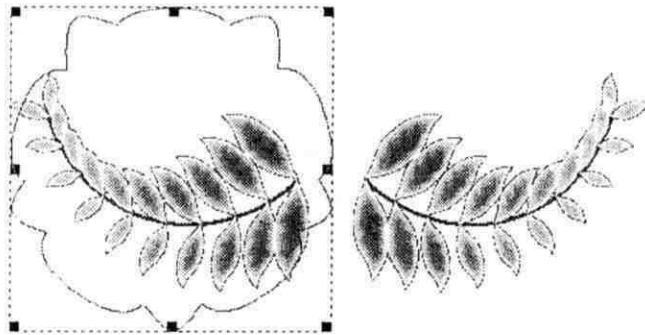
Next, we will create a relief that represents the flower in the plate design.

Loading the Clipart Relief

First, we will load the clipart relief that will be used to create the flower.

1. Click on the **Load Relief** button  in the **Relief Operations** area of the **Assistant's** Home page to display the **Open** dialog box.
2. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples\Clipart.
3. Click on the .rlf file named *Flower* to select it.
4. Click on the **Open** button to display the **Load Relief** dialog box.
5. Make sure that the **Pasting** option  is selected by clicking on it.
6. Click on the **OK** button to close the **Load Relief** dialog box and display the **3D Clipart** dialog box.

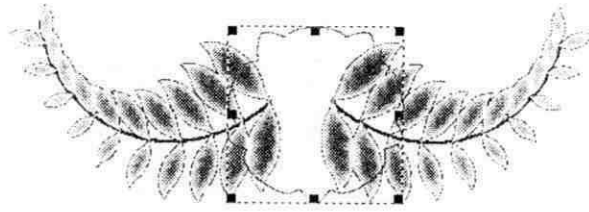
A red outline of the clipart relief also appears in the **2D View** window surrounded by a bounding box:



Manipulating the Clipart Relief



We will adjust the size of the clipart relief so that it fits between the two leaves.

1. Click on the **Scale** tab in the **3D Clipart** dialog box to display the **Scale** page.
2. Type *60* in the **New scale %** box, and then click on the **Apply** button.
3. In the **2D View** window, click and drag on the red vector outline of the clipart relief to position it between the two leaves, as shown below:



Pasting the Clipart Relief

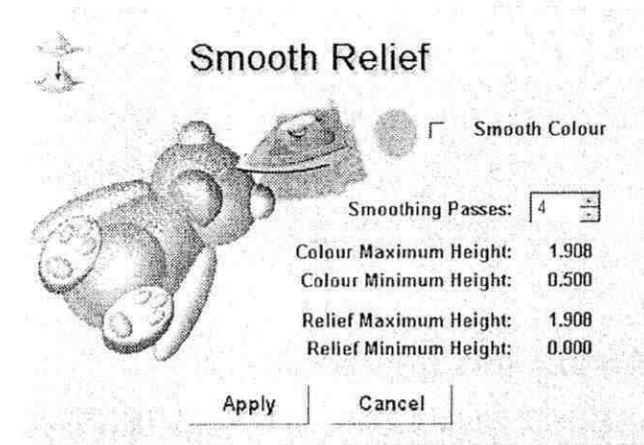
We are now ready to paste the clipart relief onto the relief to form the flower.


1. Click on the **Mode** tab, then click on the **From Current** radio button  to select it. This option instructs ArtCAM Pro to paste the clipart relief onto the existing relief at the current Z height.
2. Click on the **Merge Highest** radio button  to select it. This option instructs ArtCAM Pro to merge the points in the clipart relief with the existing relief, so that only the highest points of the two show in a new relief.
3. Click on the **Paste** button in the **3D Clipart** dialog box to paste the clipart relief onto the current relief.
4. Click on the **Close** button in the **3D Clipart** dialog box.

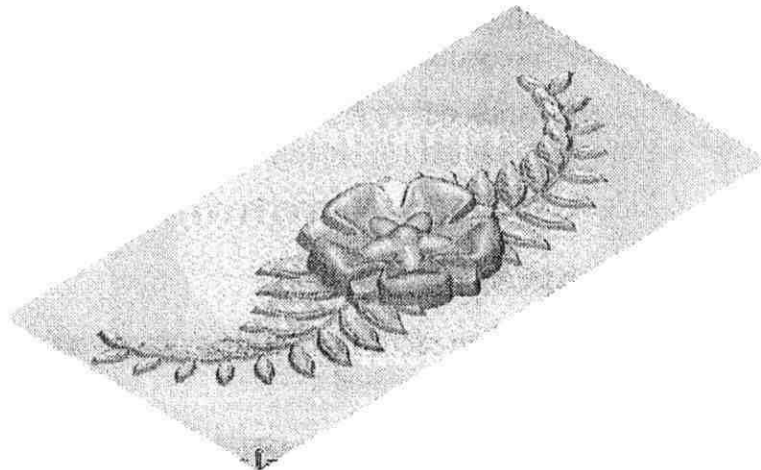
Smoothing the Relief

To complete the motif that we want to use for the plate, we will smooth the current relief.

1. Click on the **Smooth Relief** button  in the **Relief Editing** area of the **Assistant's** Home page to display the **Smooth Relief** dialog box:




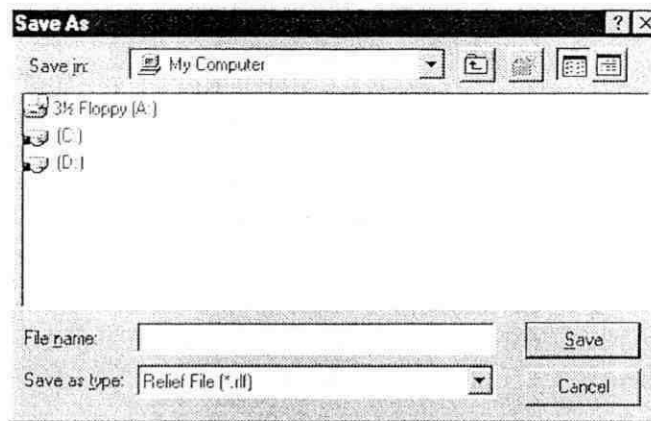
2. Type 4 in the **Smoothing Passes** box, and then click on the **Apply** button.
3. Click on the **Cancel** button to close the **Smooth Relief** dialog box.
4. Click on the **3D View** button  in the **2D View** toolbar to display the new relief in the **3D View** window:



Saving the Relief

We need to save the relief so that it can be pasted onto the plate relief later.

1. Click on the **Save Relief** button  in the **Relief Operations** area to display the **Save As** dialog box:



2. Click on the **Save In** list box and select the directory where you want to save the relief.
3. Type *Motif* in the **File Name** box.
4. Click on the **Save** button to close the **Save As** dialog box and save the relief.



Note: You can open an example of the motif relief, which is saved as **Motif.rlf** in the ArtCAM Pro 6.0\Examples\Clipart directory.

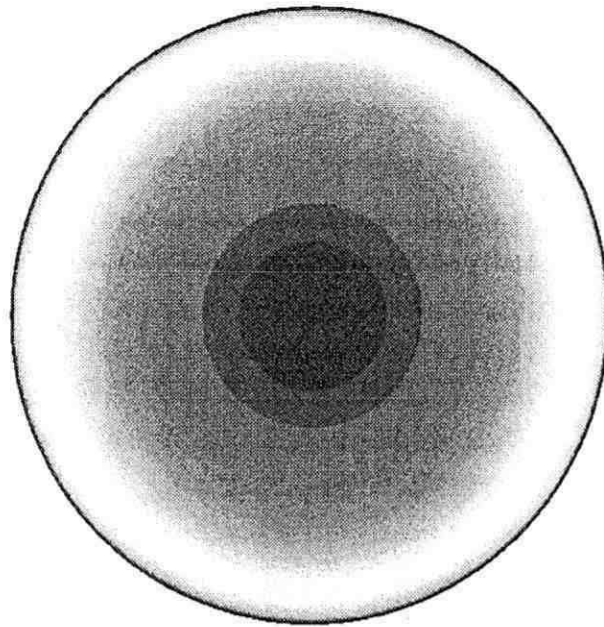
Creating the Plate

We are now ready to load the plate relief and apply the motif that you have created to the plate.

Replacing the Relief



First, we will replace the current relief with a relief in the shape of a plate:

1. From the Main menu bar, click on the **Relief** option to display the **Relief** menu, then click on the **Load > Replace** option to display the **Open** dialog box.
This option deletes the current relief and prompts you to open an existing relief file with which to replace it.
2. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples\Clipart.
3. Click on the .rlf file named *Plate* to select it.
4. Click on the **Open** button to load the relief.
5. Click on the **2D View** window to make it active. You can see the following greyscale image of the plate:



Loading the Clipart Relief

We will load the motif that is to be pasted onto the current relief:

1. Click on the **Load Relief** button  in the **Relief Operations** area of the **Assistant's** Home page to display the **Open** dialog box.
2. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples\Clipart.
3. Click on the .rlf file named *Motif* to select it.
4. Click on the **Open** button to display the **Load Relief** dialog box.
5. Make sure that the **Pasting** option  is selected by clicking on it.
6. Click on the **OK** button to close the **Load Relief** dialog box and display the **3D Clipart** dialog box.

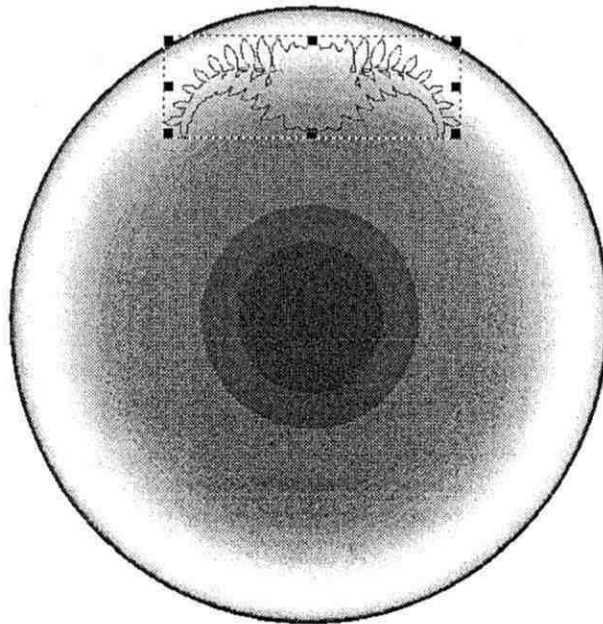
A red vector outline of the leaves appears in the **2D View** window. The red vector outline is much larger than the greyscale image of the plate.

Manipulating the Clipart Relief

We are now ready to adjust the size and position of the motif, then paste it onto the plate relief. As we want three sets of the motif on the

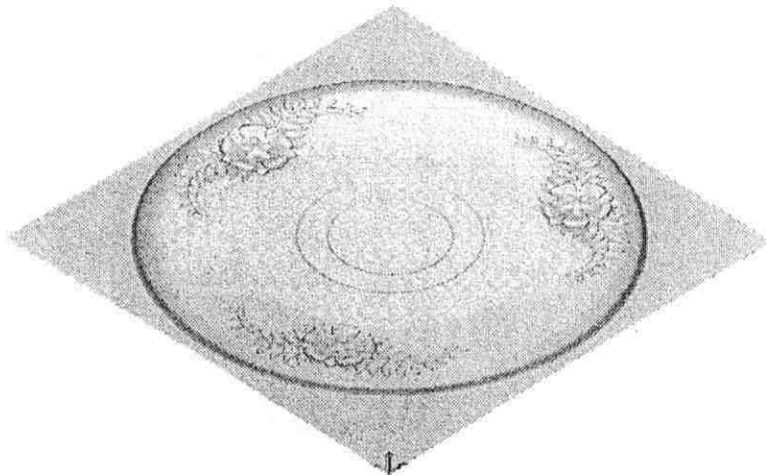
plate design, we will rotate and paste the motif clipart relief a further two times.

1. Click on the **Scale** tab in the **3D Clipart** dialog box to display the **Scale** page.
2. Type 25 in the **New scale %** box, and then click on the **Apply** button.
3. Click on the **Rotate** tab.
4. Click on the **Vertical** button to mirror the scaled motif clipart relief in the Y-axis, then click on the **Apply** button.
5. Click on the **Size** tab.
6. Type 0.2 mm (0.008") in the **Z Range** box, and then click on the **Apply** button.
7. In the **2D View** window, click and drag on the red vector outline of the motif and position it in the middle at the top of the plate.



8. Click on the **Paste** button to paste the motif onto the current relief.
9. Click on the **Rotate** tab.
10. Type 120° in the **Rotate by angle** box.
11. Click on the **Rotate about centre** option to turn it off ☐.

12. Type *12.5* in both the **X** and **Y** boxes, then click on the **Apply** button. This defines the centre of the plate, around which the motif can now be rotated.
13. Click on the **Paste** button to paste a new copy of the motif onto the plate relief.
14. Type *120°* in the **Rotate by angle** box, and then click on the **Apply** button to rotate the motif again.
15. Click on the **Paste** button to paste the final motif onto the plate relief, followed by the **Close** button to close the **3D Clipart** dialog box.
16. Click on the **3D View** button **3D** in the **2D View** toolbar to display the new relief in the **3D View** window:



You can see that three duplicate copies of the motif clipart relief have been pasted onto the plate relief to make the finished plate design.



Note: You can open an example of the finished plate relief, which is saved as **Findesgn.rlf** in the ArtCAM Pro 6.0\Examples\Clipart directory.

Tutorial – Texturing

Overview

The following tutorial demonstrates how to add texture to the relief using the relief editing tools available in ArtCAM Pro.

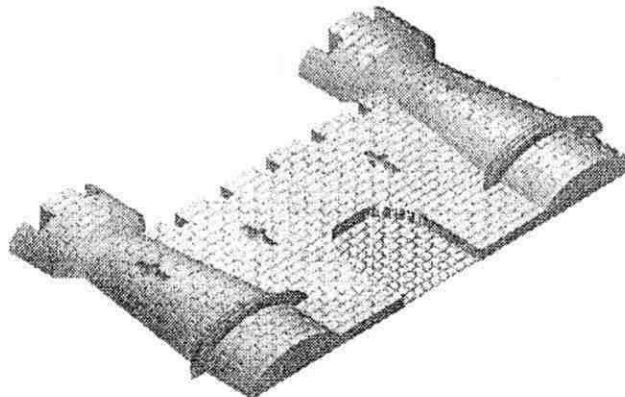
Before starting this tutorial, you must have created the castle relief, as described in "Tutorial – Swept Profiles" on page 33.

Adding Textures to a Relief

The stages that you will cover during the course of this tutorial are:


- Preparing the model.
- Adding texture to the relief.
- Creating a portcullis for the castle.

The tutorial will lead you through each of these stages, guiding you through the complete process of adding textures to a relief in the shape of a castle, which will produce a brick-effect on its surface and create a portcullis in its entrance:




Preparing the Model

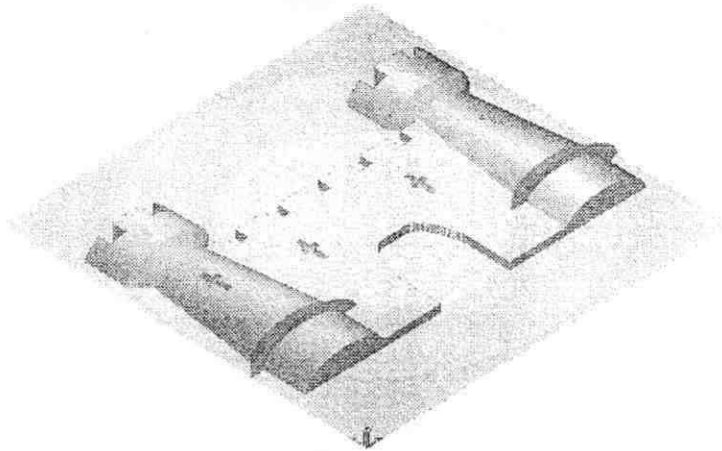
First, we will open the ArtCAM model containing the castle relief to which textures will be added:

1. Click on the **Open Existing Model**  icon in the **Assistant** window to display the **Open** dialog box.
2. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples\Castle.
3. Click on the .art file named *CastleRelief* to select it.
The file name appears in the **File name** box.
4. Click on the **Open** button to open the *CastleRelief* model.
Three **2D View** windows appear, each of them containing different views of castle artwork. The active window is named **Castle View 3**.

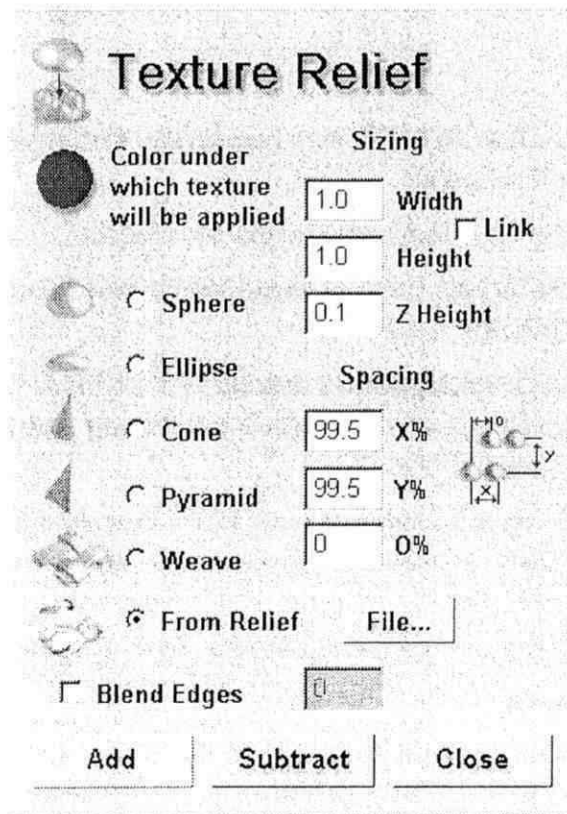
Adding Texture to the Relief


Now we will add a texture to the castle relief to create a brick-effect on its surface. The brick-effect texture is saved as a relief file. We cannot see the results of adding a texture to the castle relief in the **2D View** window, therefore we will make the **3D View** window the active view for this tutorial.

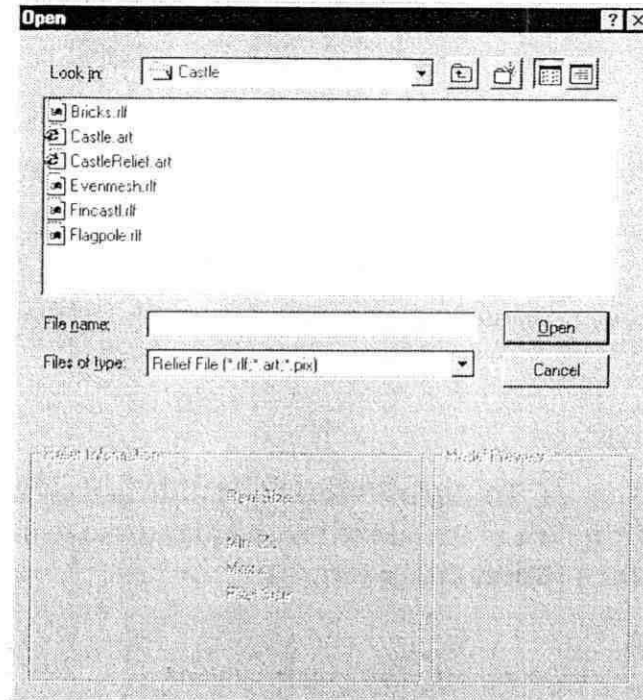
1. Click on the red colour in the Colour Palette beneath the **Castle View 3** window to select it as the Primary Colour.
Textures can only be applied to areas of the relief under the current Primary Colour.
2. Click on the **3D View** button  in the **2D View** toolbar to display the current relief in the **3D View** window:



3. Click on the **Texture Relief** button  in the **Relief Editing** area of the **Assistant's** Home page to display the **Texture Relief** dialog box:

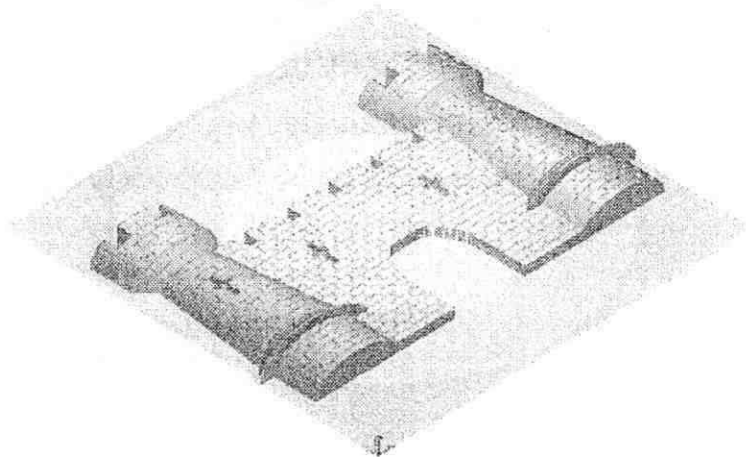


4. Click on the **From Relief** radio button  to select this option.
5. Click on the **File** button to display the **Open** dialog box:






6. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples\Castle.
7. Click on the .rlf file named *Bricks* to select it.
8. Click on the **Open** button to load the relief file and close the **Open** dialog box.
9. Click on the **Link** option to turn it off ☐. This is because we do not want to adjust the texture's height and width proportionately.
10. In the **Sizing** area, type 1.0 mm (0.04") in the **Height** and **Width** boxes. This sets the height and width of each brick in the texture.
11. Type 0.1 mm (0.004") in the **Z Height** box. This sets the Z height of each brick in the texture.
12. In the **Spacing** area, type 99.5 in the **X%** and **Y%** boxes, then type 0 in the **O%** box. This sets the space between each of the bricks in the texture.
13. Click on the **Add** button. This option instructs ArtCAM Pro to add the points in the texture to the current relief.
14. Click on the **Close** button to close the **Texture Relief** dialog box.

The new relief is displayed in the **3D View** window.

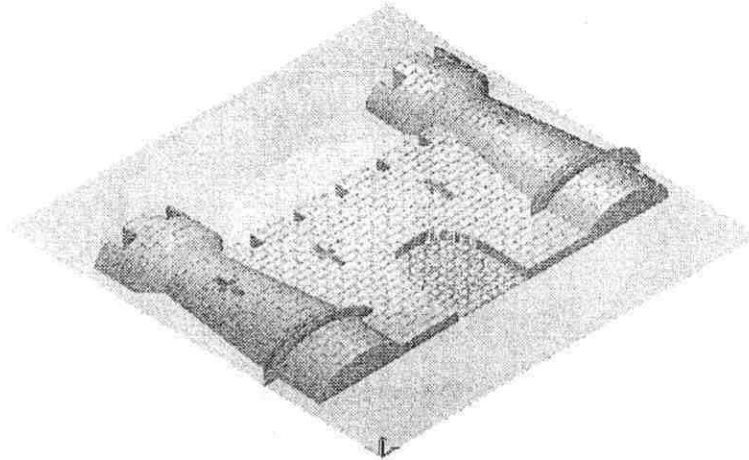




Creating a Portcullis for the Castle

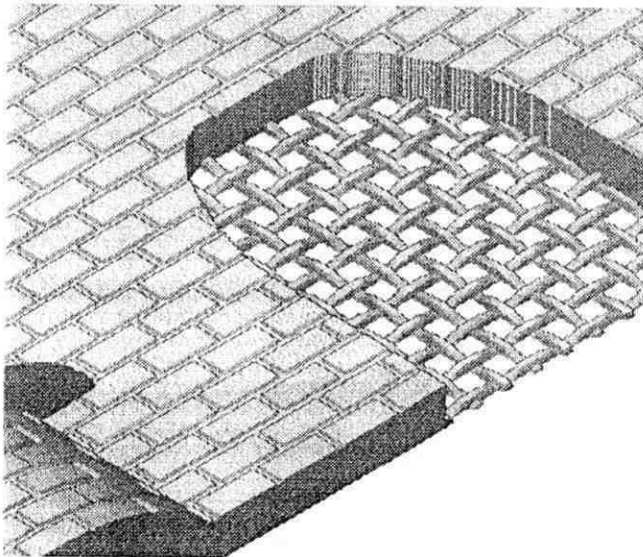
We are now ready to add another texture to the relief to create a portcullis for the castle entrance.

1. Press the **F2** key on your keyboard to return to the **Castle View 3** window.
2. Click on the plum colour in the Colour Palette to select it as the Primary Colour.
3. Press the **F3** key on your keyboard to view the castle relief in the **3D View** window.
4. Click on the **Texture Relief** button  in the **Relief Editing** area of the **Assistant's** Home page to display the **Texture Relief** dialog box.
5. Click on the **From Relief** radio button  to select this option.
6. Click on the **File** button to display the **Open** dialog box.
7. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples\Castle.
8. Click on the .rlf file named *EvenMesh* to select it.
9. Click on the **Open** button to load the relief file and close the **Open** dialog box.
10. Click on the **Link** option to turn it off .
11. In the **Sizing** area, type 1.0 mm (0.04") in the **Height** and **Width** boxes.
12. Type 0.1 mm (0.004") in the **Z Height** box.

13. In the **Spacing** area, type 99.5 in the **X%** and **Y%** boxes, and then type 0 in the **O%** box.
14. Click on the **Add** button, followed by the **Close** button.
The new relief is displayed in the **3D View** window.



15. Click on the **Draw Zero Plane** button  in the **3D View** toolbar to hide the zero plane and view the textures on the relief more clearly.
16. Click on the **Zoom** button  in the **3D View** toolbar.
17. Click and drag to form a bounding box around the castle entrance, then release the mouse button to zoom in on it.



You can see the brick-effect on the castle walls and the portcullis clearly.

Tutorial – Lizard

Overview

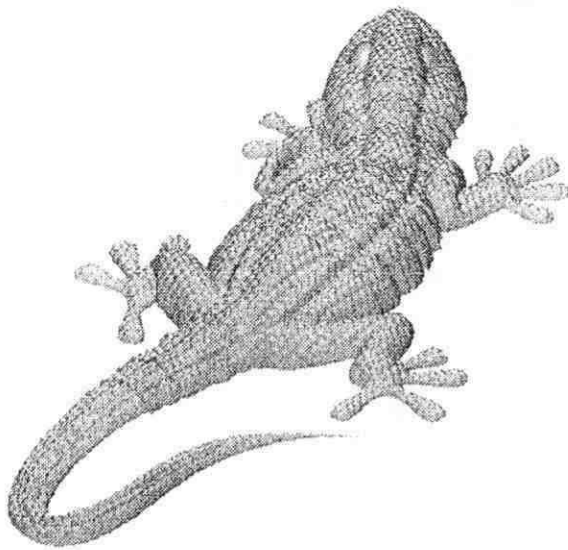
The following tutorial demonstrates how to create a relief from vector objects and apply a texture to it using the vector based relief creation and relief editing tools available in ArtCAM Pro.

Lizard

The stages that you will cover during the course of this tutorial are:


- Preparing the model.
- Creating the main body.
- Creating the legs.
- Creating the feet.
- Adding texture to the lizard.
- Adding the eyes.

The tutorial will lead you through each of these stages, guiding you through the complete process of creating three-dimensional shapes using vector objects and combining these shapes to form a relief in the shape of a lizard. Finally, you will apply a texture to the lizard relief to add the effect of scales on the lizards' skin:

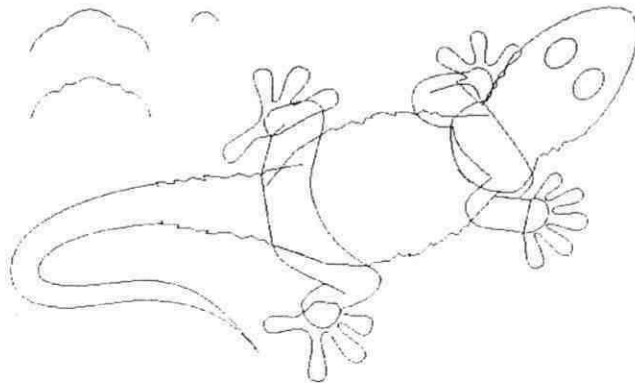


Preparing the Model

First, we will open the ArtCAM model containing the artwork from which we will create the lizard relief:


1. Click on the **Open Existing Model** icon  in the **Assistant** window to display the **Open** dialog box.
2. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples\Lizard.
3. Click on the .art file named *Lizard* to select it.
The file name appears in the **File name** box.
4. Click on the **Open** button.

The following artwork appears in the **2D View** window:



The .art file that you have opened is a model previously created in ArtCAM Pro. The model contains vector objects that will be used to create the different parts of a lizard.

Some of the vector objects will be used as drive rails, others as cross-sections, from which shapes will be two-rail swept. Other vector objects will only have shape attributes applied to them, from which a shape will then be calculated and combined with the relief.



5. Click on the **Reset Relief** button  in the **Relief Operations** area of the **Assistant's** Home page to delete the relief that was saved as part of the *Lizard.art* model.

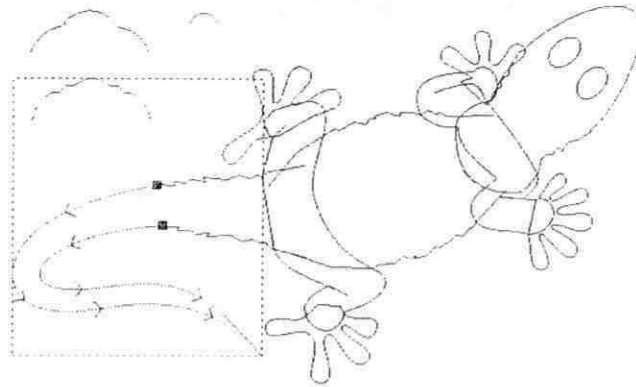
Creating the Main Body

First we will create the main body of the lizard using the three cross-sections drawn in the top-left corner of the model and the pairs of vector objects that represent each part of the lizard. As you will see, almost the entire lizard is created using a process where a three-dimensional shape is created by sweeping a cross-section between two vectors, referred to as drive rails. This process is called a two-rail sweep.

Creating the Tail

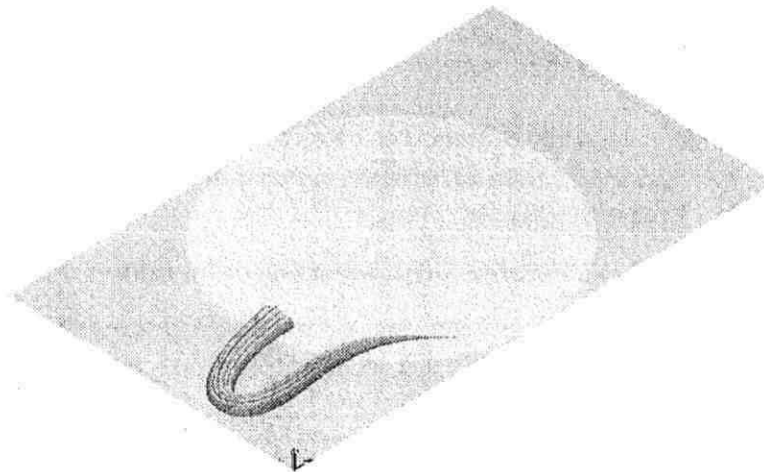
We will start with the lizards' tail.

1. Click on the **Two Rail Sweep** button  in the **Vector Based Relief Creation** area to display the **Two Rail Sweep** page.
In the **Combine** area, the **Add** radio button  is selected.
2. Click on the vector object representing the left-edge of the lizard's tail to select it. A bounding box surrounds the selected vector object.
3. Hold the **Shift** key on your keyboard then click on the vector object representing the right-edge of the lizards' tail, followed by the cross-section vector nearest to it to select them. The vector objects representing the tail are red and you can see direction arrows along them. The cross-section vector is blue.



In the **Status** area, the **First Drive Rail**, **Second Drive Rail** and **Cross Section 1** options are indicated as **Valid**.

4. Click on the **Calculate** button to accept the default settings on the page and create the two-rail swept shape. ArtCAM Pro adds the points in the two-rail swept shape to the current relief.
5. Press the **F3** key on your keyboard to display the relief in the **3D View** window:

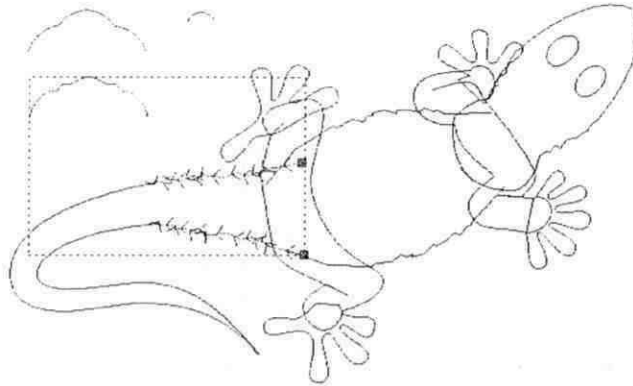


Creating the Tail-Base


Now we will combine the base of the tail with the part of the tail that we have already added to the relief.

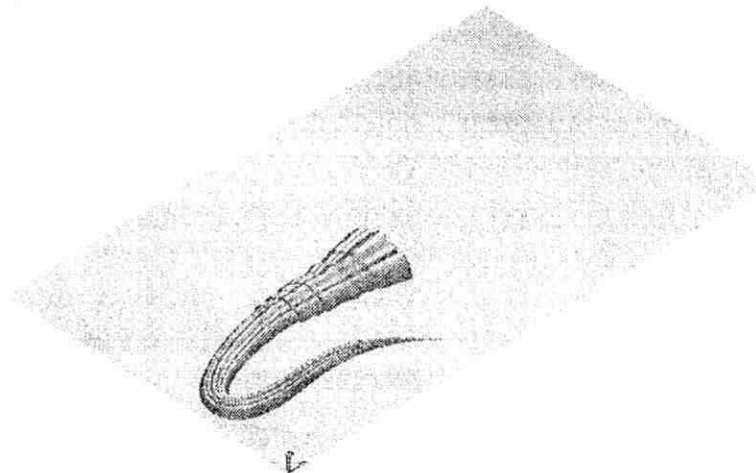
1. Press the **F2** key on your keyboard to display the **2D View** window.
2. Click on the vector object representing the left-edge of the lizard's tail-base to select it. A bounding box surrounds the selected vector object.

3. Hold the **Shift** key on your keyboard then click on the the right-edge of the lizards' tail-base, followed by the same cross-section used for the end of the tail. The selected vector objects representing the tail-base are red and you can see direction arrows along them. The cross-section vector is blue.



In the **Status** area, the **First Drive Rail**, **Second Drive Rail** and **Cross Section 1** options are indicated as **Valid**.

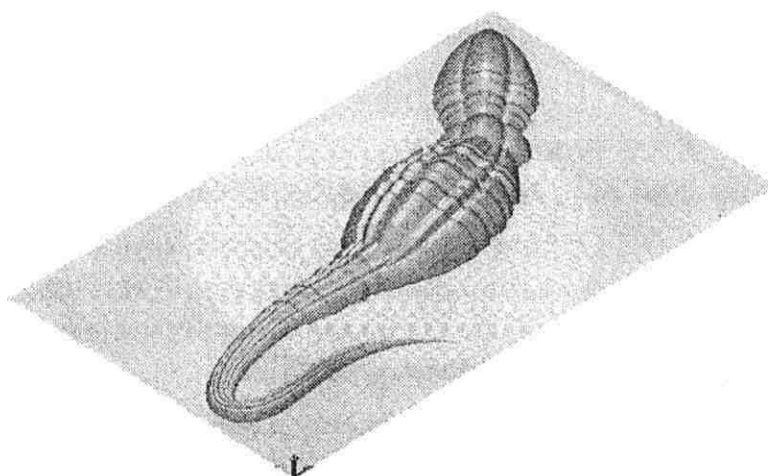
4. In the **Combine** area, click on the **Highest** radio button  to select it. This option instructs ArtCAM Pro to merge the tail-base with the tail-end, so that only the highest points of the two show in the new relief.
5. Click on the **Calculate** button to accept the other default settings on the page and merge the two-rail swept shape with the current relief.
6. Press the **F3** key on your keyboard to display the relief in the **3D View** window:



Creating the Head and Body

Next we will combine the lizards' head and body with its tail.

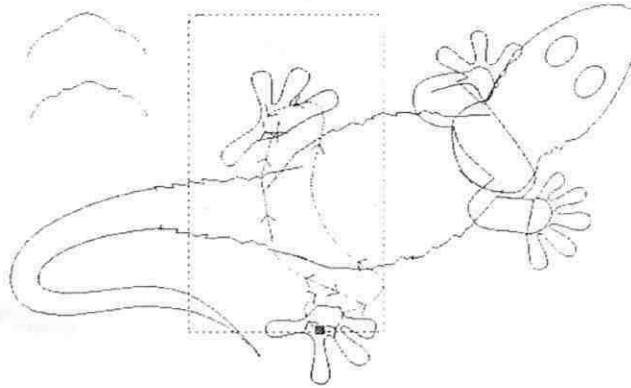
1. Press the **F2** key to display the **2D View** window.
2. Repeat the steps used to create the lizards' tail base, this time selecting the vector objects representing the lizards' body, and using the same cross-section as before.
3. Repeat the steps used to create the lizards' body, this time selecting the vector objects representing the lizards' head and the cross-section above that which was previously used.
4. Press the **F3** key to display the relief in the **3D View** window:




Creating the Legs

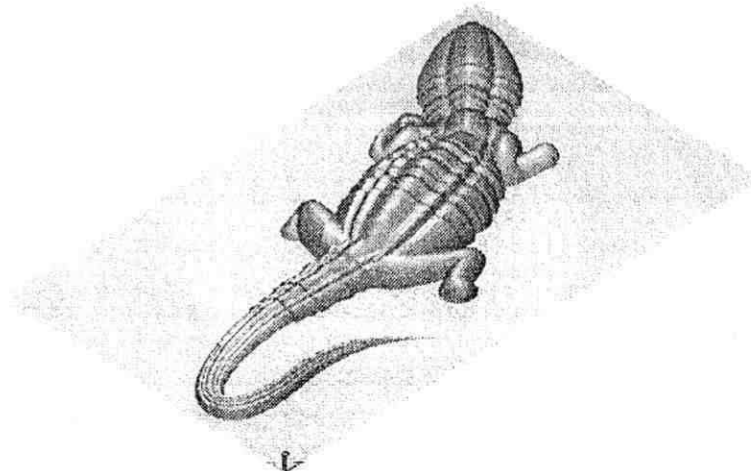
We are now ready to create the lizards' legs in the same way as its head and body.

1. Click on the vector object representing the lower part of the lizards' back legs to select it. A bounding box surrounds the selected vector object.
2. Hold the **Shift** key on your keyboard then click on the upper part of the lizards' back legs, followed by the smallest of the cross-section vectors. The vector objects representing the lizards' back legs are red and you can see direction arrows along them. The cross-section vector is blue.



In the **Status** area, the **First Drive Rail**, **Second Drive Rail** and **Cross Section 1** options are indicated as **Valid**.

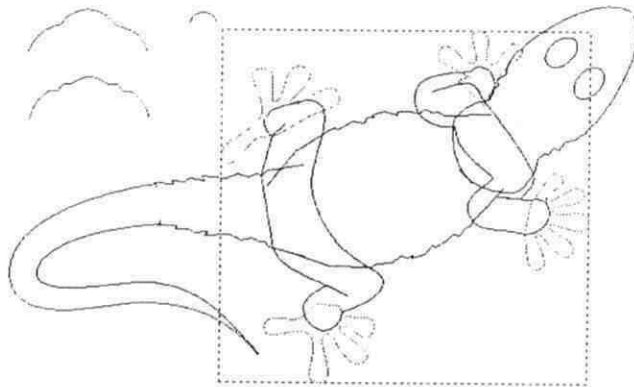
3. In the **Combine** area, make sure that the **Highest** option is selected by clicking on its radio button .
4. Click on the **Calculate** button to accept the other default settings on the page and merge the legs with the lizards' body.
5. Click on the **Close** button to return to the **Assistant's** Home page.
6. Press the **F3** key on your keyboard to see what the relief now looks like.
7. Using the **2D View** window, repeat the steps used to create the lizards' back legs, this time selecting the vector objects representing the lizards' front legs, and using the same cross-section as before.
8. Press the **F3** key on your keyboard to display the relief in the **3D View** window:



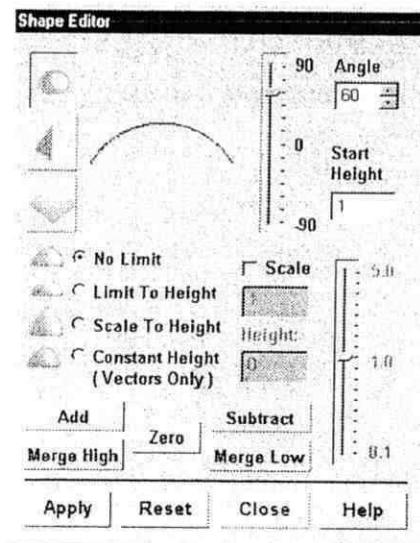
Creating the Feet

The lizards' feet can be created directly from the vector objects representing their outline. Applying shape attributes to the vectors, then combining these shapes with the current relief does this.

1. Press the **F2** key on your keyboard to display the **2D View** window.
2. Hold the **Shift** key on your keyboard, and then click on each of the four vector objects representing the lizards' feet. The vector objects are magenta and surrounded by a bounding box.



3. Right-click on one of the lizards' feet to display the **Vector Editing** menu, then click on the **Shape Editor** option to display the **Shape Editor** dialog box:



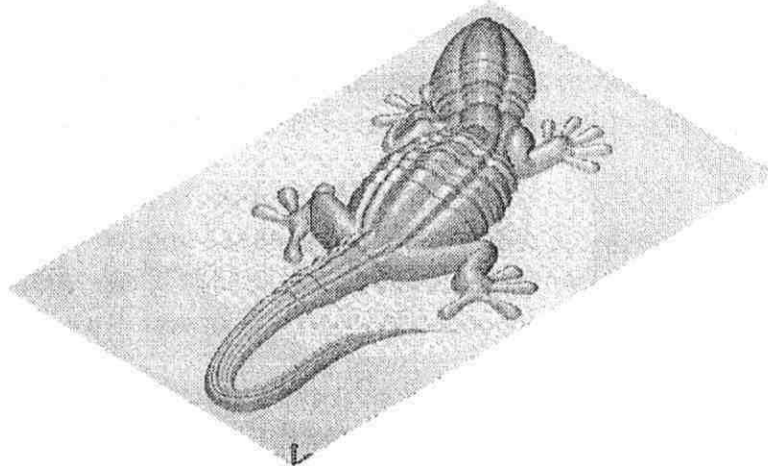
4. In the **Shape Editor**, set the options to create a rounded shape with an angle of 60° and a start height of 1 mm

(0.04"), then click on the **Apply** button to apply these settings to the selected vector objects.

5. Click on the **Merge High** button. This option instructs ArtCAM Pro to merge the points in the shapes with the current relief, so that only the highest points of the two show in a new relief.


A progress bar appears beneath the **2D View** window indicating the progress ArtCAM Pro is making in calculating the relief.

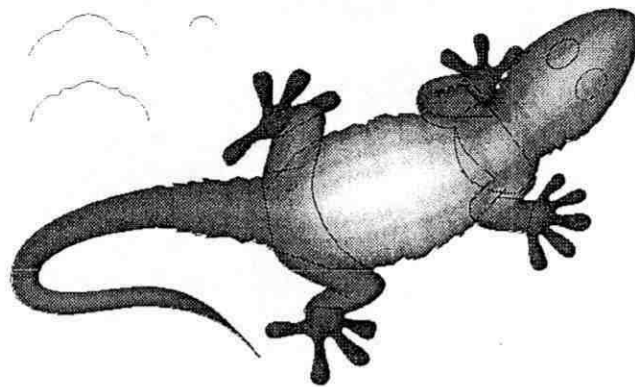
6. Click on the **Close** button, then press the **F3** key on your keyboard to display the relief in the **3D View** window:






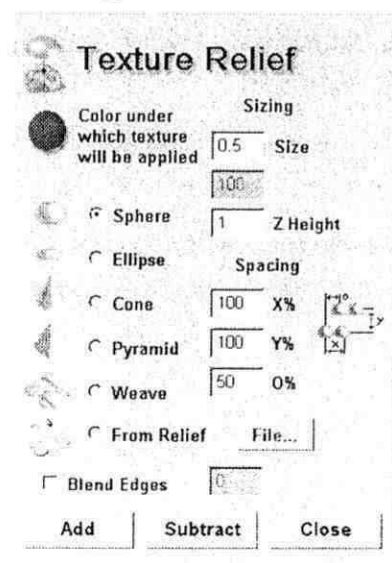
Adding Texture to the Lizard

To add the effect of scales on the lizards' skin, we will apply small spheres across the relief surface.


1. Press the **F2** key on your keyboard to display the **2D View** window.
2. Click on the **Grayscale From Relief** button  in the **Model** area to create a greyscale image of the current relief.



3. Click on the blue colour next to the yellow colour in the Colour Palette beneath the **2D View** window to select it as the Primary Colour.
4. Right-click on the yellow colour in the Colour Palette to select it as the Secondary Colour.
5. Click on the **Flood Fill Selective** button  in the **Bitmap Editing** area. This allows you to flood-fill areas of any colour with the current Primary Colour, until it meets pixels of the current Secondary Colour.
6. Move the  cursor over the grey area of the greyscale image, and then click to flood-fill the lizard in blue.
7. Click on the **Texture Relief** button  in the **Relief Editing** area.




The blue colour in the **Colour under which texture which texture will be applied** area is the same as that of the lizard in the greyscale image.

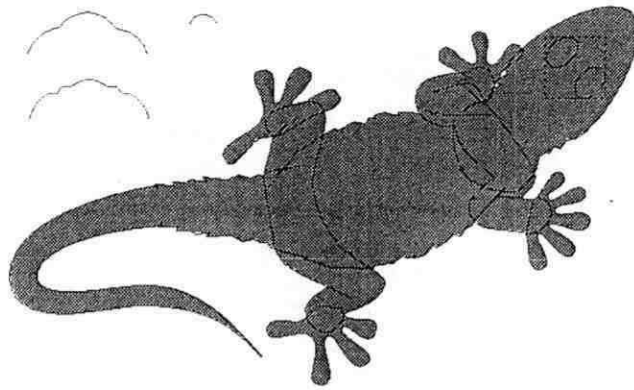
8. Click on the **Sphere** radio button  to select it as the texture shape.
9. In the **Sizing** area, type *0.5 mm (0.02")* in the **Size** box and *1 mm (0.04")* in the **Z Height** box. This defines the dimensions of each sphere.
10. In the **Spacing** area, type *50* in the **O%** box. This offsets each row of spheres in the texture by 50% of their actual size. We will use the default values in the **X%** and **Y%** boxes.
11. Click on the **Add** button. This option instructs ArtCAM Pro to add the points in the texture to the current relief.

A progress bar appears beneath the **2D View** window indicating the progress ArtCAM Pro is making in adding the texture to the relief.
12. Click on the **Close** button, and then press the **F3** key on your keyboard to display the textured relief in the **3D View** window.

Adding the Eyes

Finally, we will add the lizards' eyes to the relief using the same process that was used to create its feet.

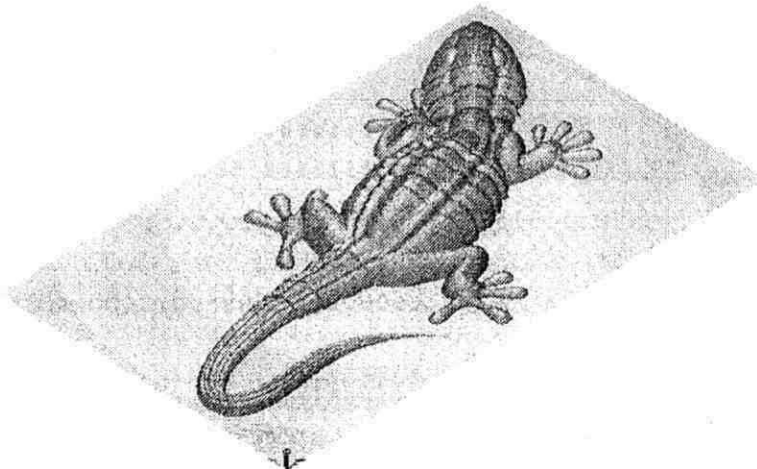
1. Press the **F2** key on your keyboard to display the **2D View** window.
2. Click on the **Select Vectors** button  in the **Vector Editing** area.
3. Hold the **Shift** key on your keyboard, and then click on the vector objects representing the lizards' eyes. The vector objects are magenta and surrounded by a bounding box.



4. Right-click on one of the lizards' eyes to display the **Vector Editing** menu, then click on the **Shape Editor** option to display the **Shape Editor** dialog box.
5. In the **Shape Editor**, set the options to create a rounded shape with an angle of 60° and a start height of *15 mm (0.6")* then click on the **Apply** button to apply these settings to the selected vector objects.
6. Click on the **Merge High** button, followed by the **Close** button.

A progress bar appears beneath the **2D View** window indicating the progress ArtCAM Pro is making in calculating the relief.

7. Click on the **Close** button, then press the **F3** key on your keyboard to display the finished relief in the **3D View** window:



Tutorial – Simple Jewellery Designs

Overview

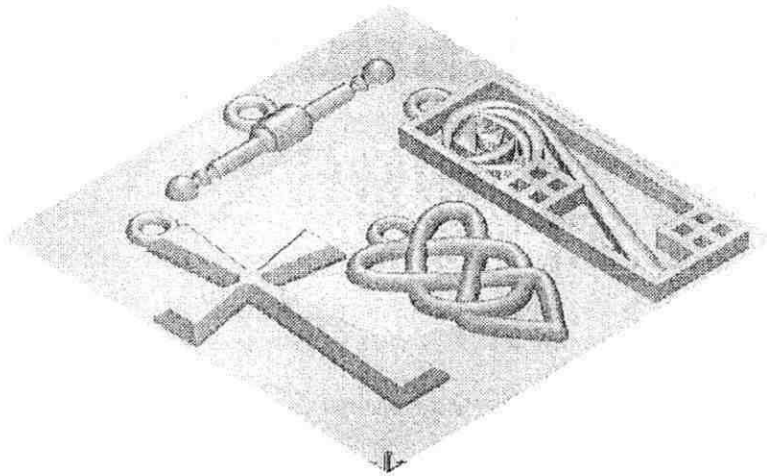
The following tutorial demonstrates how to create three-dimensional shapes that can be used as jewellery designs, using vector objects together with the vector based relief creation tools in ArtCAM Pro.

Jewellery

The stages that you will cover during the course of this tutorial are:

- Preparing the model.
- Creating a t-bar.
- Creating a crucifix and a Mackintosh-style pendant.
- Creating a weave pendant.

The tutorial will lead you through each of these stages, guiding you through the complete process of creating complex three-dimensional shapes using vector objects, combining these shapes to form a relief in the shape of four items of jewellery as shown:

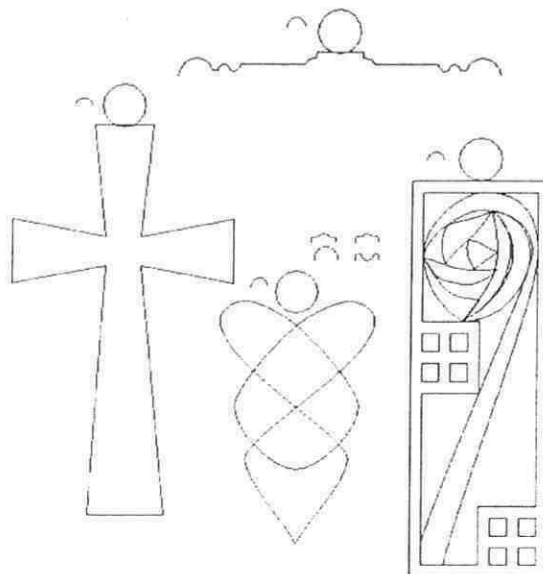


Preparing the Model

First, we will open the ArtCAM model containing the artwork from which we will create the jewellery relief:

1. Click on the **Open Existing Model** icon  in the **Assistant** window to display the **Open** dialog box.
2. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples\Jewellery.
3. Click on the .art file named *Jewellery* to select it.
The file name appears in the **File name** box.
4. Click on the **Open** button.

The following artwork appears in the **2D View** window:




The .art file that you have opened is a model previously created in ArtCAM Pro. The model contains vector objects that will be used to create the different items of jewellery in the relief. Some of the vector objects will be used as drive curves, others as cross-sectional profiles, from which shapes will either be turned or extruded. Other vector objects will only have shape attributes applied to them, from which a shape will then be calculated and combined with the relief.

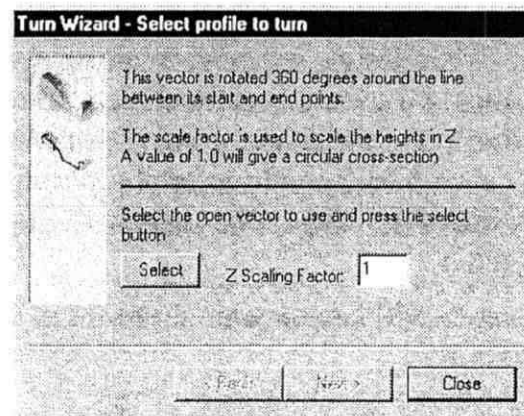
Creating a T-Bar

The first item of jewellery that we will create is a T-bar design. This can be created in two stages, firstly the bar itself and then the eyelet which will be attached to it.

Creating the Bar

First we will create the bar itself by turning the profile vector object. An imaginary line between the start point (node) and end point (node) in the selected vector object acts as an axis about which the profile is turned to create the cross-section of the shape. This shape will then be added to the relief.

1. Click on the **Turn** button  in the **Vector Based Relief Creation** area of the **Assistant's** Home page to display the **Turn Wizard**:



2. Click on the following vector object for the bar to select it.

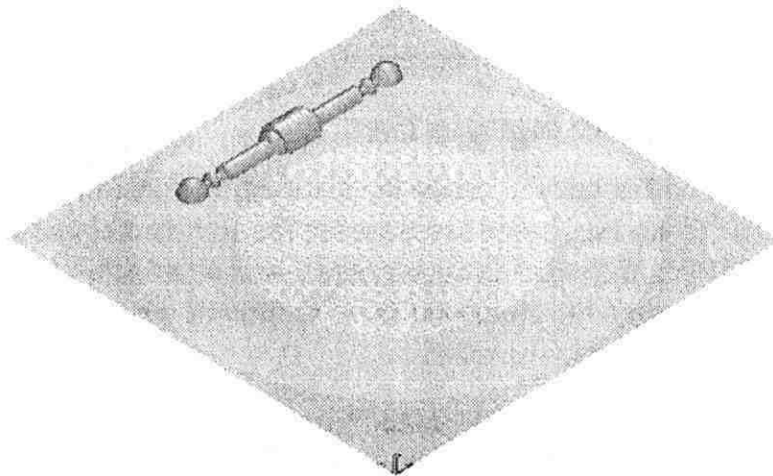


A bounding box surrounds the vector object.

3. Click on the **Select** button in the **Turn Wizard**. The vector object is blue and you can see direction arrows all along its inside-edge. These indicate the side of the vector object to which the cross-section will be attached.

The default **Z Scaling Factor** value of *1* produces a semi-circular cross-section.

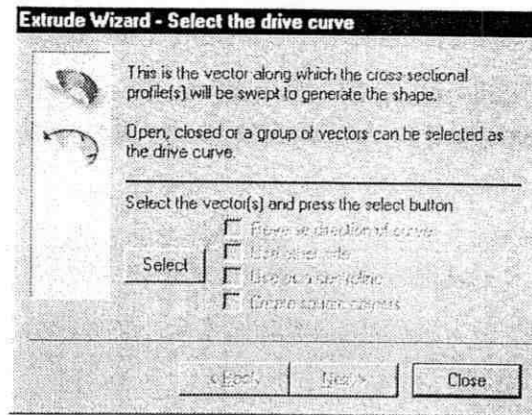
4. Click on the **Next** button, followed by the **Turn** button to add the points in the turned shape to the relief.
5. Click on the **Close** button, then press the **F3** key on your keyboard to display the relief in the **3D View** window:



Creating the Eyelet

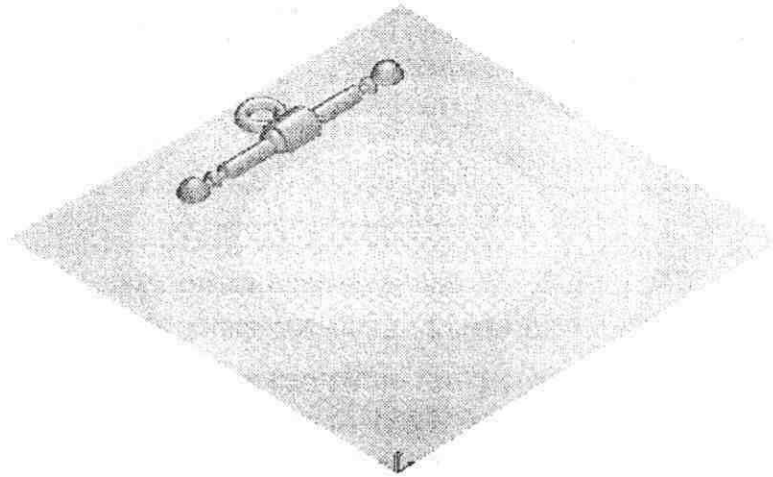
To finish the T-bar design, we must create an eyelet. We will extrude this shape using two selected vector objects. The first vector object defines the line along which the shape is extruded. This is referred to as the drive curve. The second vector object defines the cross-sectional profile of the shape. The shape will then be combined with the existing relief.

1. Press the **F2** key on your keyboard to display the **2D View** window.
2. Click on the **Extrude** button  in the **Vector Based Relief Creation** area to display the **Extrude Wizard**:



3. Click on the circular vector object for the eyelet to select it. A bounding box surrounds the vector object.
4. Click on the **Select** button in the **Extrude Wizard**. The vector object is red and you can see direction arrows around its outside-edge. These indicate the side of the vector object to which the cross-section will be attached.
5. Click on the **Use as centreline** option to turn it on ☒. This option instructs ArtCAM Pro to extrude the middle of the shape along this vector object. You can see direction arrows along the inside-edge of the selected vector object.
6. Click on the **Next** button.
7. Click on the semi-circular vector object to the left of the eyelet to select it. A bounding box surrounds the vector object.
8. Click on the **Select** button. The vector object is blue and you can see a direction arrow on its inside-edge. The arrow shows the current Z-axis direction, which determines the side on which the shape will be extruded.
9. Click on the **Next** button.
10. Make sure that the **End profile is the same as the start profile** option is turned on ☒, then click on the **Next** button.
11. Since we do not want to use a z modulation vector to add a contour and scale the shape in the Z-axis along its length, click on the **Next** button.
12. Click on the **Merge Highest** radio button ☒ to select it. This option instructs ArtCAM Pro to merge the points in the extruded shape with the current relief, so that only the highest points of the two show in a new relief.

13. Click on the **Extrude** button to create the extruded shape.
14. Click on the **Close** button, then press the **F3** key on your keyboard to display the new relief in the **3D View** window:



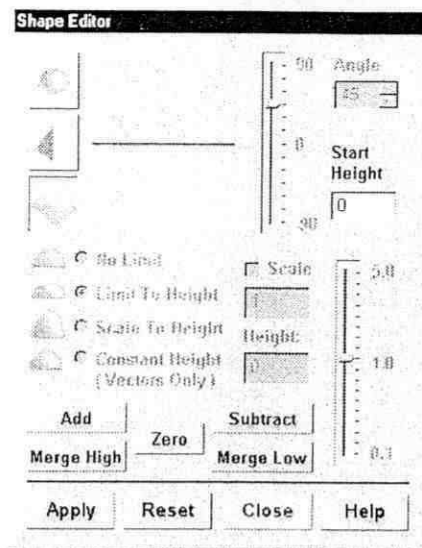
Creating a Crucifix and a Mackintosh-Style Pendant



The second and third items of jewellery that we will create are a crucifix and a Mackintosh-style pendant design.

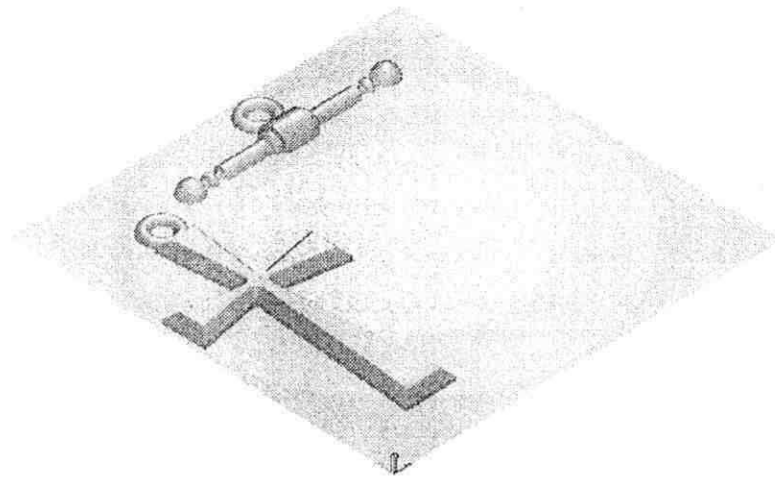
Creating the Crucifix

We are now ready to create the crucifix relief by applying shape attributes to the vector object representing the crucifix and combining the shape with the existing relief.

1. Click on the crucifix design to select it. A bounding box surrounds the selected vector object.
2. Right-click on the selected vector object to display the **Vector Editing** menu, then click on the **Shape Editor** option to display the **Shape Editor** dialog box:




3. Click on the **Angular** button . This will create angled walls in the crucifix.
4. Click on the **Limit To Height** radio button , and then type 2 mm (0.079") in the **Height** box. This will create a flat-top for the crucifix.
5. Type 1 mm (0.039") in the **Start Height** box.
6. Click on the **Apply** button.
7. Click on the **Add** button to add the points in the shape to the current relief.
8. Click on the **Close** button.
9. Repeat the steps used to create the eyelet in the T-bar design, this time using the circular and semi-circular vector objects above the crucifix.
10. Press the **F3** key on your keyboard to display the new relief in the **3D View** window:

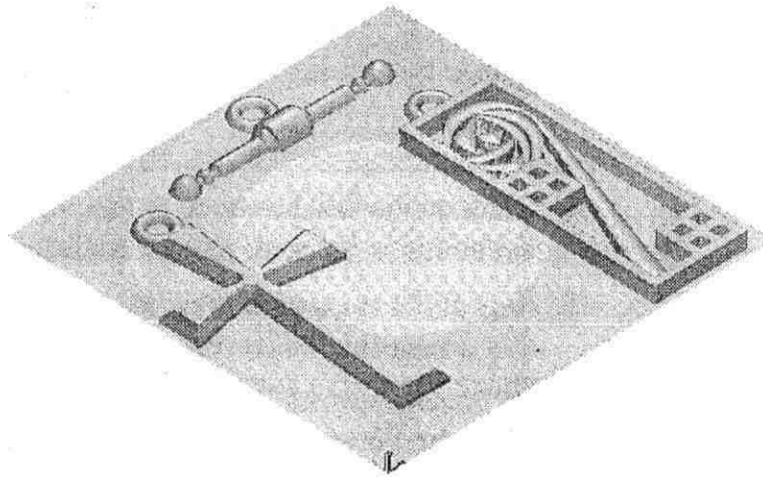


Creating the Pendant

Next, we will create a pendant design by applying shape attributes to a selected vector object, then combining the shape with the existing relief.

1. Press the **F2** key on your keyboard to display the **2D View** window.
2. Click on the group of vector objects representing the outside-edge of the pendant to select them. The selected group of vector objects is magenta and surrounded by a bounding box.
3. Right-click on the selected group of vector objects to display the **Vector Editing** menu, then click on the **Shape Editor** option to display the **Shape Editor** dialog box.
4. Type 2 mm (0.079") in the **Start Height** box. This sets the height at which the pendant's edges are created.
5. Click on the **Add** button to add the points in the shape to the current relief.
6. Click on the **Close** button.
7. Click on the group of vector objects representing the flower in the pendant to select them. The selected group of vector objects is magenta and surrounded by a bounding box.
8. Right-click on the selected vector object to display the **Vector Editing** menu, then click on the **Shape Editor** option to display the **Shape Editor** dialog box.


9. Click on the **Round** button . This sets the shape of the flower in the pendant.
10. Type 20° in the **Angle** box. This sets the angle of the rounded shape.
11. Type 2.5 mm (0.098") in the **Start Height** box. This sets the height at which the rounded shape is created.
12. Click on the **Merge High** button to merge the points in the shape with the current relief, so that only the highest points of the two show in a new relief.
13. Click on the **Close** button.
14. Repeat the steps used to create the eyelet in the T-bar design, this time using the circular and semi-circular vector objects above the pendant.
15. Press the **F3** key on your keyboard to display the new relief in the **3D View** window:



Creating a Weave Pendant

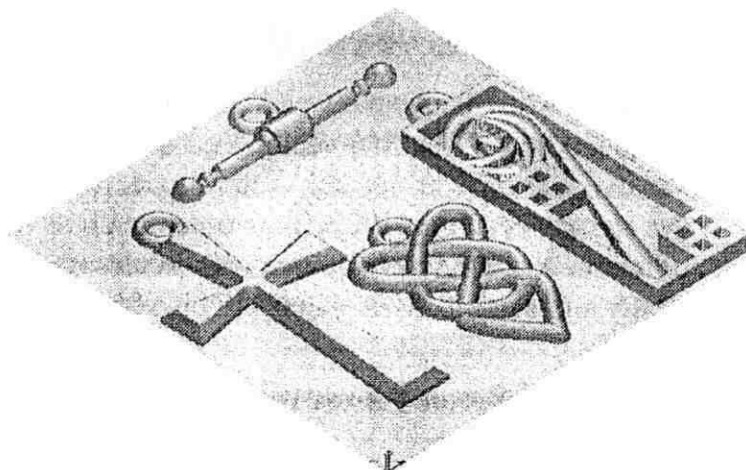
Finally, we will create a weave pendant design using two selected vector objects. The first vector object overlaps itself and represents the weave pattern. The second vector object represents the cross-section of the weave shape. We will extrude the cross-section along the weave pattern. ArtCAM Pro automatically scales its height up and down at each intersection. This shape will also be combined with the existing relief.

1. Press the **F2** key on your keyboard to display the **2D View** window.

2. Hold the **Shift** key on your keyboard, and then click on the vector object representing the weave pattern, followed by the arched cross-section in the set of four above it to select them. The selected vector objects are magenta and surrounded by a bounding box.
3. Click on the **Weave Wizard** button  in the **Vector Based Relief Creation** area to display the **Weave Wizard** dialog box:



4. Click on the **OK** button to accept the default settings and add the points in the weave shape to the current relief.
5. Repeat the steps used to create the eyelet in the T-bar design, this time using the circular and semi-circular vector objects above the weave pattern.
6. Press the **F3** key on your keyboard to display the new relief in the **3D View** window:



Tutorial – Pendant

Overview

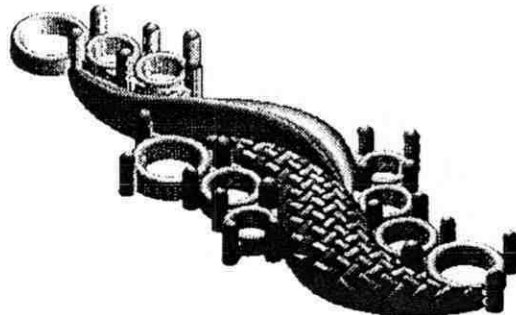
The following tutorial demonstrates how to create a complex pendant design from bitmap colours and vector objects using the relief operations and relief editing tools available in ArtCAM Pro.

Pendant

The stages that you will cover during the course of this tutorial are:


- Preparing the model.
- Creating the basic shapes.
- Adding the texture.
- Creating the overall shape.

The tutorial will lead you through each of these stages, guiding you through the complete process of creating three-dimensional shapes using linked bitmap colours and vector objects. You will also create a two-rail swept shape using vector objects, and combine this with the other shapes to form a relief containing the pendant's features. A weave texture will also be applied to the relief surface. Finally, you will combine a shape with the relief to act as a base for the finished pendant, as shown:




Preparing the Model

First, we will open the ArtCAM model containing the artwork that will be used to create the pendant relief:

1. Click on the **Open Existing Model** icon  in the **Assistant** window to display the **Open** dialog box.
2. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples\Jewellery.
3. Click on the .art file named *pendant_demo* to select it.
The file name appears in the **File name** box.
4. Click on the **Open** button.

The .art file that you have opened is a model previously created in ArtCAM Pro. The model contains two **2D View** windows, each of them containing different views of the pendant artwork. We will use the bitmap colours and vector objects in each of these views to create different shapes and combine them to form the pendant relief. The **Add Colours/MergeVectors:1** window will be used to create the features of the pendant, and the **Add Plane Under Blue:2** window will be used to create a base for the pendant itself.

5. Click on the **Reset Relief** button  in the **Relief Operations** area of the **Assistant's** Home page to delete the relief that was saved as part of the *pendant_demo.art* model.

Creating the Basic Shapes

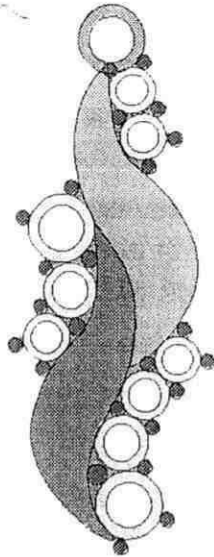
Next we will calculate the features in the pendant relief.

The artisan who created this model has already applied shape attributes to the bitmap colours and vector objects representing the features in the pendant artwork. We will use these colours and vector objects to build up the relief.

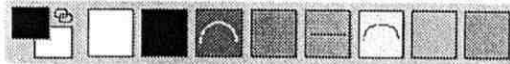
Creating Shapes from Bitmap Colours

We are ready to calculate the relief from the shape attributes applied to selected bitmap colours in the model, and those colours that have been linked to them.

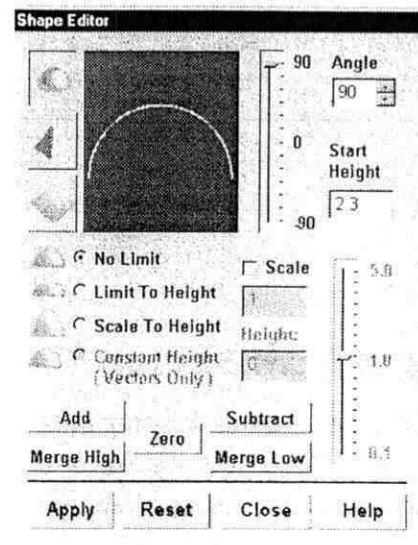
1. Click on the **Add Colours/Merge Vectors:1** window to make it active. This window contains the following artwork:



You can see that different colours have been used to represent the features in the pendant design. The lines drawn over the three colours in the Colour Palette beneath the window indicate that a shape has already been applied to each of them.



2. Double-click on the dark-blue colour in the Colour Palette to display the **Shape Editor** dialog box.




You can see that a round shape with an angle of 90° and a start height of 2.3 mm (0.091") has been applied to this colour.

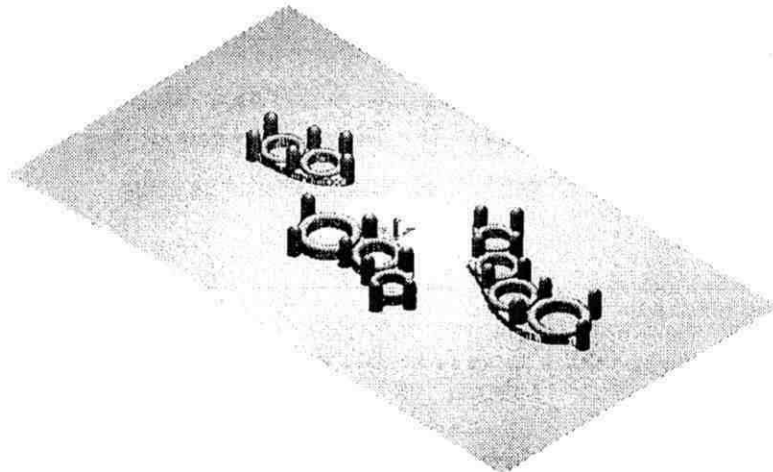
3. Click on the **Close** button.
4. Double-click on the yellow colour in the Colour Palette to display the **Shape Editor** dialog box.

You can see that a round shape with an angle of 45° , a start height of 1 mm (0.039") and a height limit of 0.2 mm (0.0079") has been applied to this colour.

5. Click on the **Close** button.
6. Double-click on the green colour in the Colour Palette to display the **Shape Editor** dialog box.

You can see that a flat shape with a start height of 0.8 mm (0.0315") has been applied to this colour.


7. Click on the **Add Relief** button  in the **Relief Operations** area of the **Assistant's** Home page to add the points in the shapes to the relief.
8. Press the **F3** key on your keyboard to display the relief in the **3D View** window:



Creating Shapes from Vector Objects

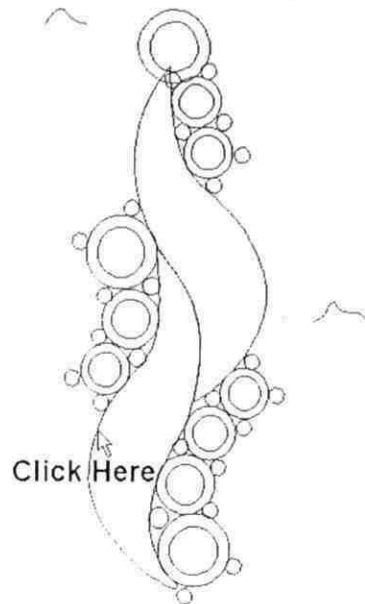
Now we will calculate the relief from shape attributes applied to selected vector objects in the model. We will also create a two-rail swept shape using four vector objects, then combine it with the relief.

1. Press the **F2** key on your keyboard to display the **Add Colours/Merge Vectors:1** window.

2. Click on the **Bitmap On/Off** button  in the **Add Colours/Merge Vectors:1** toolbar to hide the bitmap colours used in the window.
3. Click on the group of two circular vector objects representing the eyelet at the top of the design to select it. The group of vector objects is magenta and surrounded by a bounding box.
4. Right-click on the selected group of vector objects to display the **Vector Editing** menu, then click on the **Shape Editor** option to display the **Shape Editor** dialog box.

You can see that a round shape with an angle of 90° , a start height of 0.5 mm (0.0197") has been applied to this group of vector objects.

5. Click on the **Merge High** button to merge the points in the shape with the current relief, so that only the highest points of the two show in a new relief.
6. Click on the **Close** button.
7. Click on the vector object as shown below to select it.

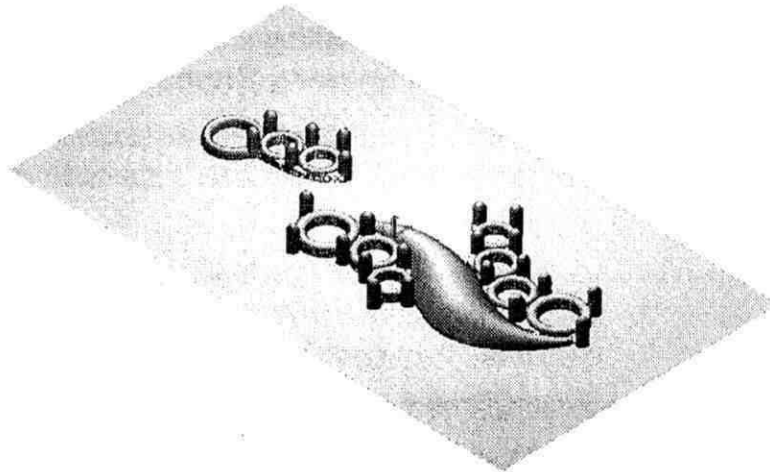


A bounding box surrounds the selected vector object.

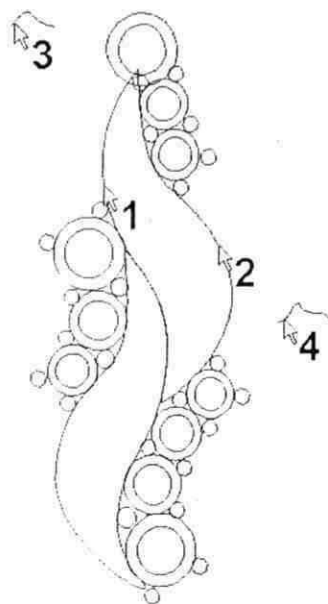
8. Right-click on the selected vector object to display the **Vector Editing** menu, then click on the **Shape Editor** option to display the **Shape Editor** dialog box.

You can see that a round shape with an angle of 45° , a start height of 0.5 mm (0.0197") has been applied to this vector object.

9. Click on the **Merge High** button, followed by the **Close** button.
10. Press the **F3** key on your keyboard to display the new relief in the **3D View** window:




11. Press the **F2** key on your keyboard to display the **Add Colours/MergeVectors:1** window.
12. Hold the **Shift** key on your keyboard, and then click on the four vector objects shown below in sequence to select them.

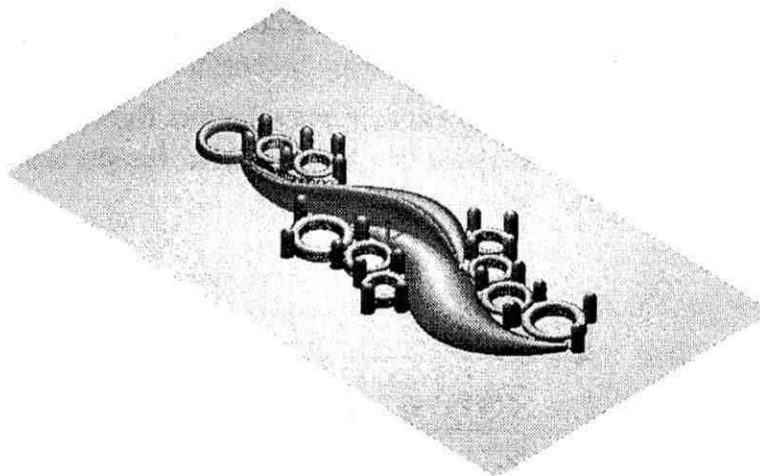


The selected vector objects are magenta and surrounded by a bounding box.

13. Click on the **Two Rail Sweep** button  in the **Vector Based Relief Creation** area to display the **Two Rail Sweep** page.

In the **Status** area, the **First Drive Rail**, **Second Drive Rail**, **Cross Section 1** and **Cross Section 2** options are indicated as **Valid**. Both of the vector objects selected as the drive rails are red with direction arrows along them, while both the cross-sections are blue.

14. Click on the **Highest** radio button  to select it. This option instructs ArtCAM Pro to merge the points in the two-rail swept shape with the current relief, so that only the highest points of the two show in a new relief.
15. Click on the **Calculate** button, followed the **Close** button.
16. Press the **F3** key on your keyboard to display the new relief in the **3D View** window:

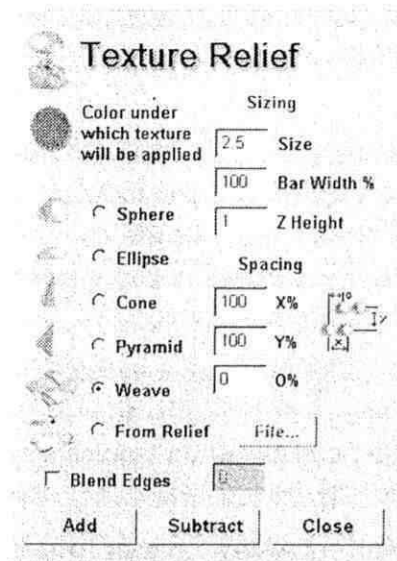



Adding the Texture

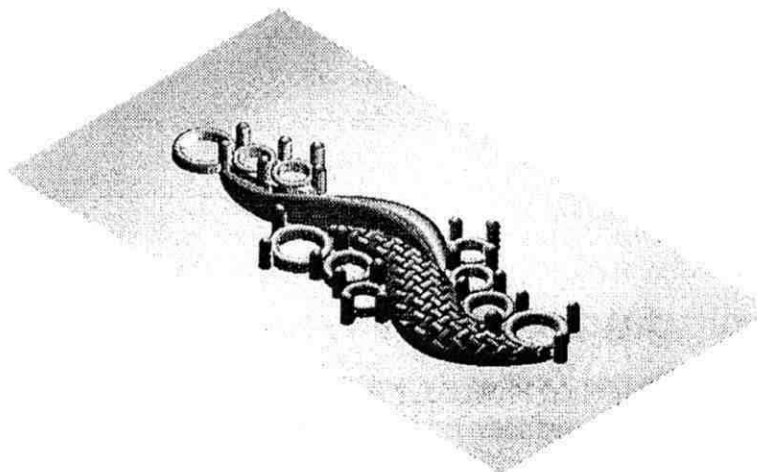
In this section, we will apply a weave texture to a selected area of the relief surface.

1. Press the **F2** key on your keyboard to display the **Add Colours/Merge Vectors:1** window.
2. Make sure that the red colour in the Colour Palette is selected as the Primary Colour by clicking on it.

3. Click on the **Texture Relief** button  in the **Relief Editing** area.



4. In the **Texture Relief** dialog box, click on the **Weave** radio button .
5. Click on the **Add** button to accept the default values and add the points in the texture to the current relief.
6. Click on the **Close** button, then press the **F3** key on your keyboard to display the textured relief in the **3D View** window:

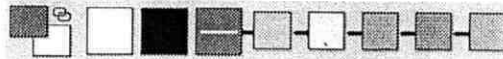


Creating the Overall Shape

Finally, we will combine another shape with the relief to act as the base for the overall pendant shape.

1. Press the **F2** key on your keyboard to display the **Add Colours/MergeVectors:1** window.
2. Click on the **Add Plane Under Blue:2** window to make it active.

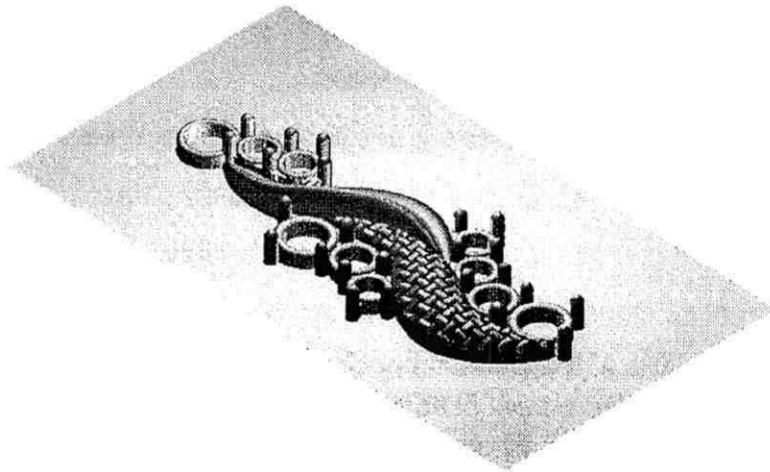
In the Colour Palette below the **Add Plane Under Blue:2** window, you can see that all except two of the colours have been linked to the dark blue colour. These linked colours appear as and are treated as the Primary Colour to which they are linked.



3. Double-click on the dark blue colour in the Colour Palette to display the **Shape Editor** dialog box.

You can see that a flat shape with a start height of *0.5 mm (0.0197")* has been applied to this colour.

4. Click on the **Add** button to add the points in this shape to the current relief.
5. Click on the **Close** button, then press the **F3** key to display the new relief in the **3D View** window:



You have now created the finished pendant relief.

Tutorial – Casino Chip

Overview

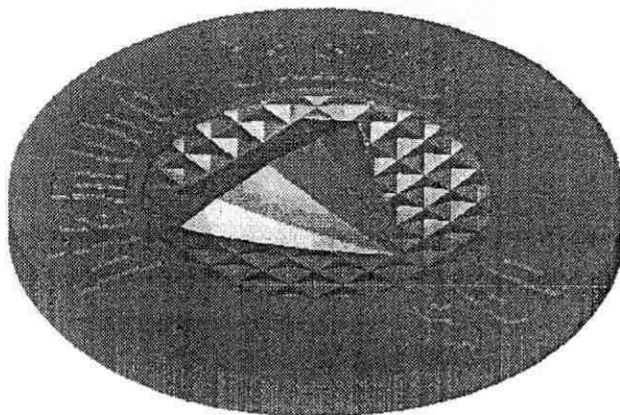
The following tutorial demonstrates how to create an angled plane, a cross-section from an existing model and a triangle mesh using the relief operations and relief editing tools available in ArtCAM Pro.

Casino Chip

The stages that you will cover during the course of this tutorial are:


- Preparing the diamond model.
- Creating the angled planes.
- Saving the relief.
- Preparing the damaged chip model.
- Repairing the damaged chip relief.
- Creating the finished casino chip relief.
- Creating a triangle mesh.

We will create a three-dimensional diamond shape relief by creating angled planes from a piece of two-dimensional artwork. This diamond relief will be used as the centrepiece of a casino chip face, for which we have a damaged model. Once we have created the diamond relief, we will repair the casino chip face by creating a spun shape and combining it with the damaged relief. With the casino chip face relief repaired, we will then combine it with the diamond relief to form the basis of the finished casino chip face. A texture will be added to this relief around the diamond centrepiece to complete it. Finally, we will create a closed triangulated mesh by combining the casino chip face relief with an imported relief representing its back-face.

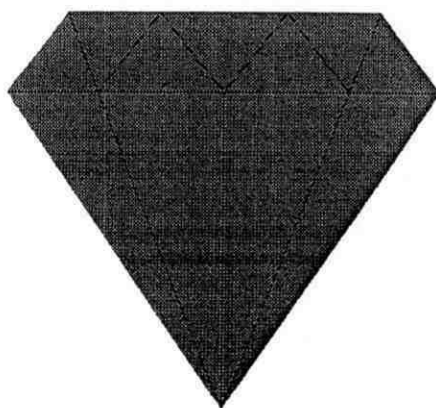


Preparing the Diamond Model

First, we will open the ArtCAM model containing the artwork from which we will create a diamond relief:

1. Click on the **Open Existing Model** icon  in the **Assistant** window to display the **Open** dialog box.
2. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples\Casino Chip - STL.
3. Click on the .art file named *Jewel* to select it.
The file name appears in the **File name** box.
4. Click on the **Open** button.


The following artwork appears in the **2D View** window:

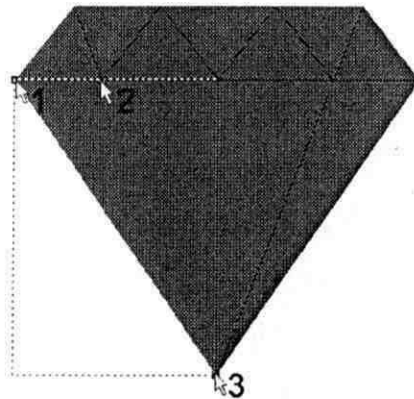


The .art file that you have opened is a model previously created in ArtCAM Pro. We will use the bitmap colours and vector objects the diamond artwork to create a number of angled planes that will be combined to form a diamond relief. This relief will be saved and used as the centrepiece of a casino chip relief.

Creating the Angled Planes

First, we will create nine angled planes from the diamond vector object and combine them to form a relief in the shape of a diamond.

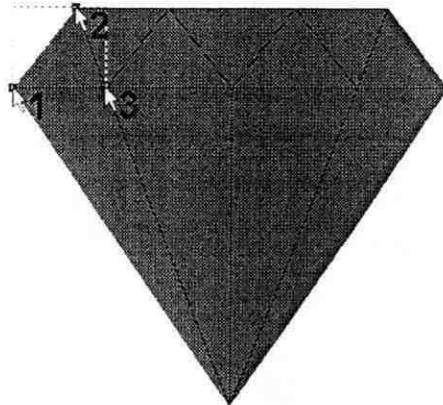
1. Click on the diagonal polyline on the bottom-left edge of the diamond to select it. A bounding box surrounds the bottom-left section of the diamond.
2. Click on the **Create Angled Plane** button  in the **Relief Editing** area of the **Assistant's** Home page to display the **Create Angled Plane** page.
3. Click on the **Set Third Point** option to turn it on ☒. This is because we will select three points for our angled plane.
4. Click on the **Start** button, then click on the points (nodes) on the diamond vector object in the following order to select them:



The co-ordinates of the selected points (nodes) are displayed in the **Z** boxes on the page.

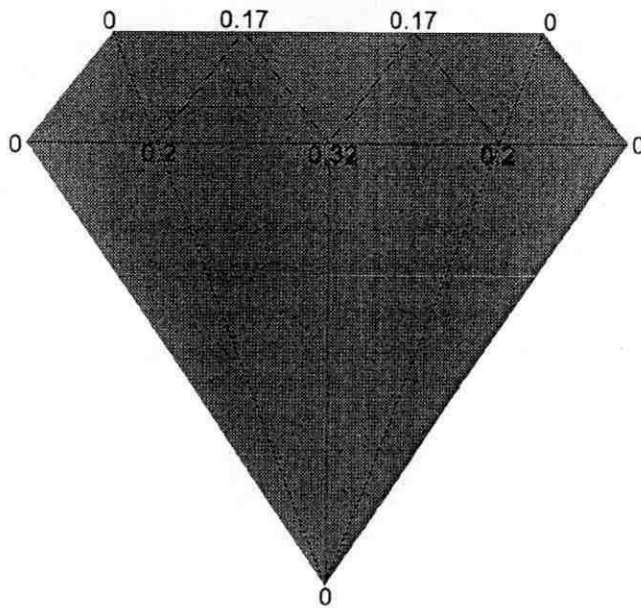
5. In the **First Point on Plane** area, type 0 in the **Z** box.
6. In the **Second Point on Plane** area, type 0.2 in the **Z** box.
7. In the **Third Point on Plane** area, type 0 in the **Z** box.
8. Click on the **Create** button to create the angled plane. This creates a relief that looks like one of the angled-edges in the face of a diamond.
9. Click on the diagonal polyline on the top left-edge of the diamond to select it. A bounding box surrounds the top-left section of the diamond.


10. Click on the **Start** button, then click on the points (nodes) on the diamond vector object in the following order to select them:




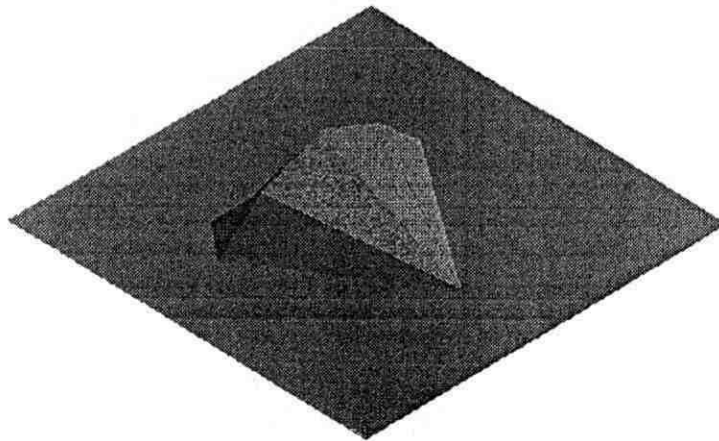
The co-ordinates of the selected points (nodes) are displayed in the **Z** boxes on the page.


11. In the **First Point on Plane** area, type 0 in the **Z** box.
12. In the **Second Point on Plane** area, type 0 in the **Z** box.
13. In the **Third Point on Plane** area, type 0.2 in the **Z** box.
14. Click on the **Highest** radio button ☒ to select this option.
This option instructs ArtCAM Pro to merge the points in the angled plane with the existing relief, so that only the highest points of the two show in the relief.
15. Click on the **Create** button to create the angled plane.
16. Repeat this process for all of the polylines in the diamond vector object, typing the co-ordinates shown in the following diagram in the appropriate **Z** box.



Remember to click on the **Start** button before selecting each set of three points (nodes) on the diamond vector object, and to make sure that the **Highest** option  is selected before creating each angled plane.


17. Click on the **Close** button to return to the **Assistant's** Home page.
18. Click on the **3D View** button  in the **2D View** toolbar to display the relief in the **3D View** window:

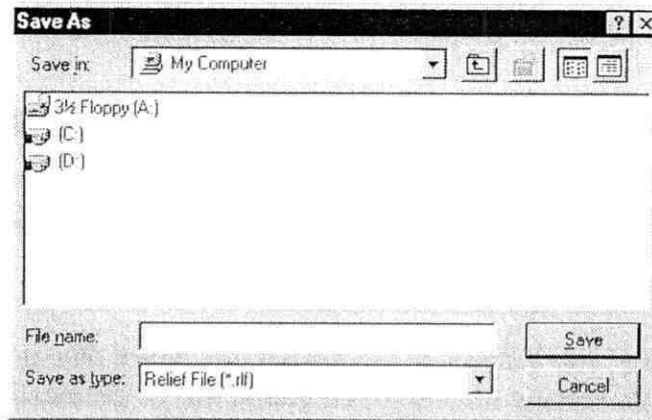


19. Click on the **Draw Zero Plane** button  to hide the zero plane and view the relief more clearly.

Saving the Relief

We will now save the current relief so that we can import it later as 3D clipart.




1. Click on the **Save Relief** button  in the **Relief Operations** area to display the **Save As** dialog box:




2. Click on the **Save In** list box and select the directory where you want to save the relief.
3. Type *Diamond* in the **File Name** box.
4. Click on the **Save** button.

Preparing the Damaged Chip Model

Now that we have saved the diamond relief, we are ready to import the ArtCAM model containing a bitmap image of a damaged casino chip and its corresponding relief. We will then repair the damage using the relief editing and vector based relief creation tools in ArtCAM Pro.

1. Click on the **Open File** button  in the **File** area to display the **Open** dialog box.
2. Click on the .art file named *Casino_Chip_Demo* to select it, then click on the **Open** button.
3. Press **F3** to display the current relief in the **3D View** window.
4. Press **F2** to display the **2D View** window.
5. Click on the **Grayscale From Relief** button  in the **Model** area to create a grayscale image in the **2D View** window from the current relief.
6. Click on the yellow colour in the Colour Palette beneath the **2D View** window to select it as the Primary Colour.
7. Click on the **Flood Fill** button  in the **Bitmap Editing** area.


8. Move the  cursor over any area of the greyscale image coloured black, and then click. The area surrounding the chip turns yellow, allowing you to see the damage more clearly.

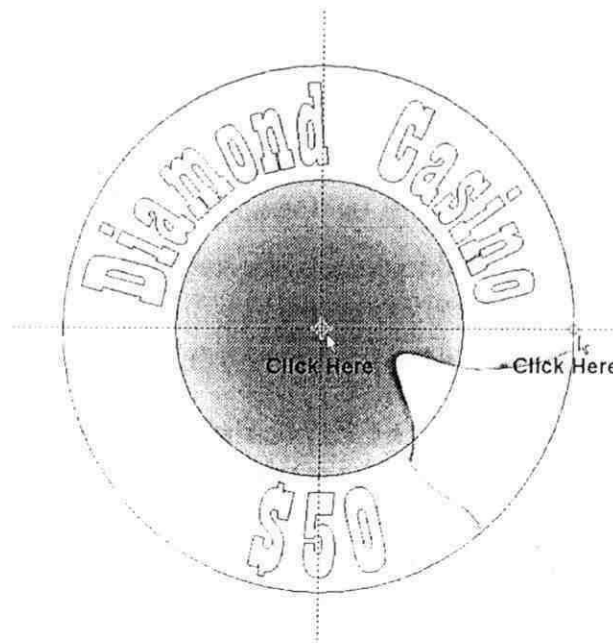
Repairing the Damaged Chip Relief

We will now repair the damaged area of the casino chip relief using the relief editing and vector based relief creation tools in ArtCAM Pro.

Creating the Cross-Section

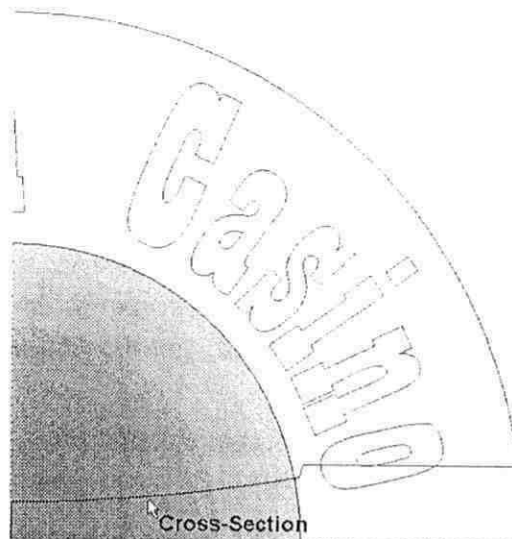
First, we will create a cross-section using the vector object representing the casino chip, and the guidelines in the model. This cross-section can then be used to create a spun shape that will replace the missing part of the casino chip.

1. Click on the **Create Cross-Section**  button in the **Relief Operations** area to display the **Create Relief Cross-Section** page.
2. Move the mouse over the position where the guidelines intersect in the centre and click.
3. Move the mouse over the position where the guideline intersects with the circular vector object on the outside right and click.




4. Click on the **Create** button, followed by the **Close** button.

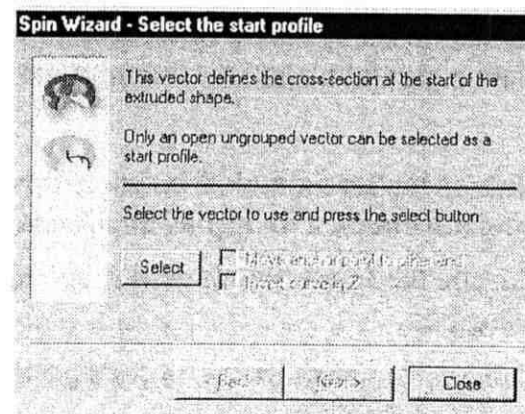
The cross-section appears as shown below:




Creating the Spun Shape

Now we will create a spun shape using the cross-section that we have created. This spun shape will be calculated and combined with the existing relief to repair the damage on the current casino chip relief.

1. Click on the **Spin** button  in the vector **Based Relief Creation** area to display the **Spin Wizard**:



2. Click on the cross-section to select it. A bounding box surrounds the cross-section.
3. Click on the **Select** button to select the cross-section as the start profile. The start profile is blue and you can see direction arrows all along its inside edge.
4. Click on the **Next** button.


5. Make sure that the **End profile is the same as the start profile** option is turned on ☒, then click on the **Next** button.
6. Make sure that the **Sweep through 360 degrees** option is turned on ☒, and then click on the **Next** button.
7. Since we are not using a z modulation vector in this tutorial, click on the **Next** button.
8. Click on the **Merge Highest** option  to select it. This tells ArtCAM Pro to merge the points in the spun shape with the current relief, so that only the highest points of the two show in a new relief.
9. Click on the **Spin** button to create the spun shape, then click on the **Close** button.
10. Press **F3** to display the new relief in the **3D View** window.

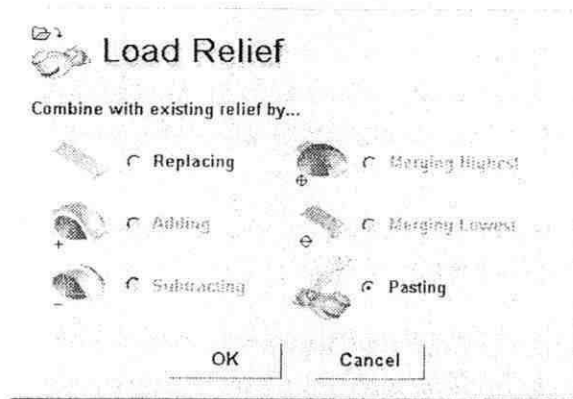
Creating the Finished Casino Chip Relief




To create the relief representing the face of the casino chip, we will combine the current relief with the diamond relief that we created earlier and then apply a texture to a selected area of the new relief.

Combining Reliefs

First, we will import the diamond relief that we created earlier as clipart, alter its scale and height, then combine it with the current relief.

1. Click on the **Load Relief** button  in the **Relief Operations** area to display the **Open** dialog box.
2. Click on the **Open** button to display the **Load Relief** dialog box.
3. Click on the **Look In** list box and go to the directory where you saved the diamond relief.
4. Click on the .rlf file named *diamond* to select it, then click on the **Open** button to display the **Load Relief** dialog box:






5. Click on the **Pasting** radio button  to select it, followed by the **OK** button.
6. Click on the **Centre In Page** button  in the **Position Size Align Vectors** area of the **Assistant's** Home page to place the red vector outline of the diamond clipart relief in the centre of the model.
7. Click on the **Scale** tab, and then type *60* in the **New Scale %** box. This scales the diamond clipart relief to 60% of its original size.
8. Click on the **Size** tab, and then type *1.2 mm (0.05")* in the **Z Range** box. This sets the Z height of the diamond clipart relief.
9. Click on the **Mode** tab, and then make sure that the **Add** radio button  is selected by clicking on it. This option instructs ArtCAM Pro to add the points in the diamond clipart relief to the current relief.
10. Click on the **Paste** button, followed by the **Close** button.
11. Press **F3** to display the new relief in the **3D View** window.

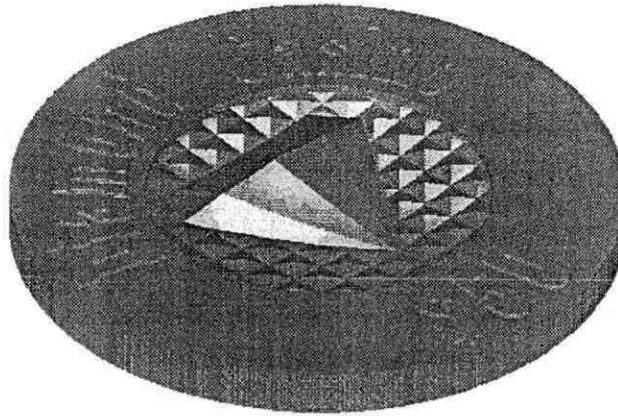
Adding Texture to the Relief

To produce the finished casino chip relief, we shall add a texture to a selected area in the current relief. Texture can only be applied to areas of the relief marked in the current Primary Colour. When creating the texture, we will select its shape, define the size of the shape, the repeat distance in the X and Y axes, and the overlap distance.

1. Press **F2** to display the **2D View** window.
2. Click on the red vector outline of the diamond to select it. A bounding box surrounds the red vector outline.



3. Hold the **Shift** key on your keyboard, and then click on the inner-circle vector in the casino chip to select it. A bounding box surrounds both vector objects and the inner-circle vector is magenta.
4. Click on the pink colour in the Colour Palette to select it as the Primary Colour.
5. Click on the **Flood Fill Vectors** button  in the **Bitmap – Vector** area to colour the area between the two selected vector objects in the current Primary Colour. This is the area to which we will apply texture.
6. Click on the **Texture Relief** button  in the **Relief Editing** area to display the **Texture Relief** page.
7. Click on the **Pyramid** radio button  to select it as the texture's shape.
8. In the **Sizing** area, type 2.5 mm (0.1") in the **Size** box and 1 mm (0.04") in the **Z Height** box.
9. Click on the **Blend Edges** option to turn it on ☒, then type 10 mm (0.4") in the adjacent box. This instructs ArtCAM Pro to begin blending the edges of the texture at this distance from the edges in the selected relief area.
10. Click on the **Add** button. This option instructs ArtCAM Pro to add the points in the texture to the current relief.

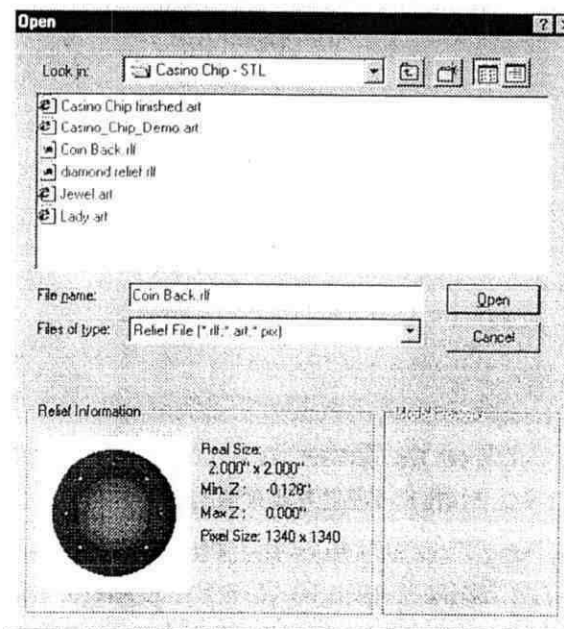
A progress bar appears beneath the **2D View** window indicating the progress ArtCAM Pro is making in calculating the textured relief.
11. Click on the **Close** button.
12. Press the **F3** key to display the new relief in the **3D View** window:



Creating a Triangle Mesh

Finally, we will create a closed triangle mesh model using the current relief and an imported relief representing the back face of the casino chip.

1. Click on the **Create Triangle Mesh** button  in the **Relief Operations** area to display the **Mesh Creator** page.
2. Type *0.01 mm (0.0004")* in the **Tolerance** box.
3. Click on the **Use Relief From File** radio button  to select it, followed by the **Load** button to display the **Open** dialog box:



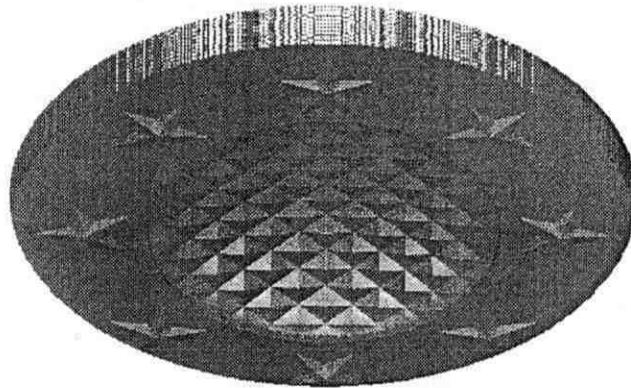
4. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples\Casino Chip - STL.

5. Click on the .rlf file named *Coin Back*, followed by the **Open** button.

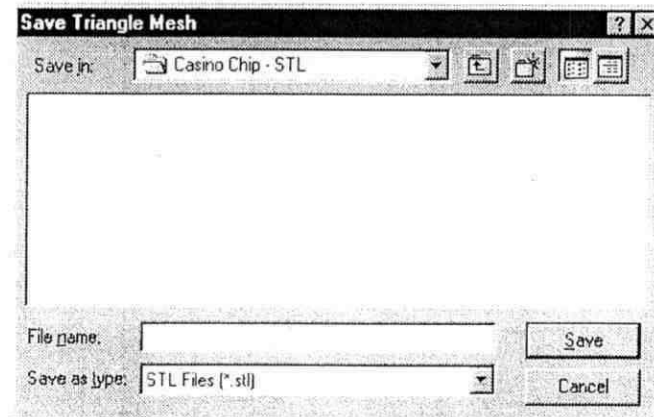
In the **Relief Information** area, notice that the size of the imported relief is identical to that of the current relief. When using a relief as a back face, its size and resolution must match that of the current relief in your model.

6. Click on the **Create Triangles** button.

A progress bar appears beneath the **2D View** window indicating the progress ArtCAM Pro is making in creating the triangle mesh. The back face of the triangle mesh appears in the **3D View** window as follows:



7. Click on the **Save Triangles** button to display the **Save Triangle Mesh** dialog box:



8. Click on the **Save In** list box and select the directory that you want to save the triangle mesh in.
9. Type *Coin Mesh* in the **File name** box, and then click on the **Save** button to save the triangle mesh as a .stl file. This file can now be sent to rapid prototyping machines or other CAD/CAM systems.

Tutorial – ISO-FORM Lettering

Overview

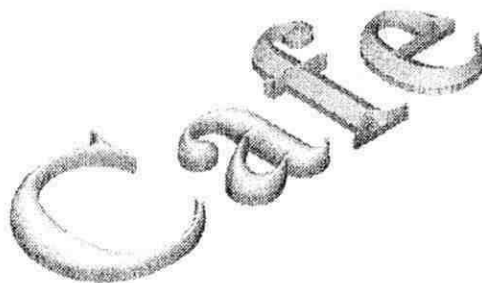
The following tutorial demonstrates how to create ISO-FORM lettering from vector text using the vector based relief creation tools available in ArtCAM Pro.

ISO-Form Letters

The stages that you will cover during the course of this tutorial are:

- Preparing the model.
- Creating the vector text.
- Creating the ISO-FORM letters.

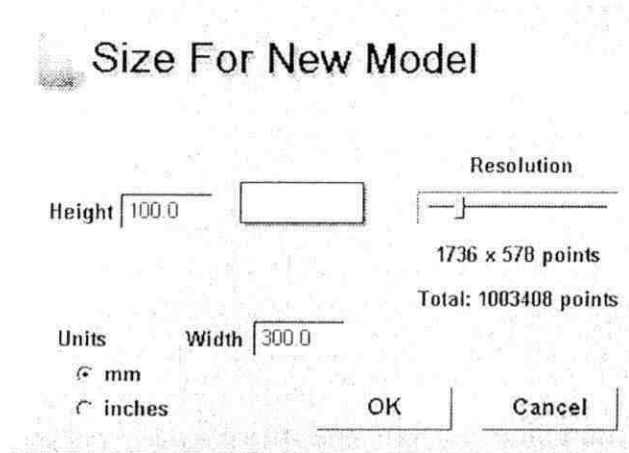
The tutorial will lead you through each of these stages, guiding you through the complete process of creating ISO-FORM letters from vector text, then combining these shapes with the relief to produce the lettering shown below:



Preparing the Model

First, we will set up the model dimensions for this particular job:

1. Click on the **Create New Model** icon in the **Assistant** window to display the **Size For New Model** dialog box:





2. Click on the **Units** option ☒ that you want to use (millimetres or inches).
3. Type *100 mm (3.9")* in the **Height** box and *300 mm (11.8")* in the **Width** box.
4. Click and drag on the **Resolution** slider to set the resolution of the model to *1003408* points.
5. Click on the **OK** button to close the **Size For New Model** dialog box.

A **2D View** window automatically fills the previously empty design window area. This window represents the block of material viewed down the Z-axis.

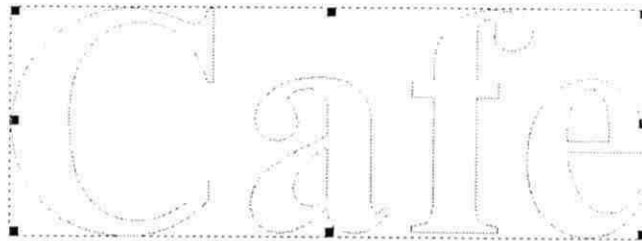
Creating the Vector Text


Now we will create the vector text from which the three-dimensional ISO-FORM letters are to be created.

1. Click on the **Create Vector Text** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Text Tool** page.
2. In the **Style** area, click on the **Bold** button  to type in bold.
3. Click on the **Font** list box, and then click on **Times New Roman** to select it.
4. Make sure that **Western** is selected in the **Script** list box.

5. Click on the **Size** list box, and then click on the appropriate units of measurement.
6. Type 60 mm (2.4") in the **Size** box.
7. In the **Spacing** area, type 8 in the **Character** box.
8. Click anywhere in your model (the white area in the **2D View** window), then type *Cafe*.
9. Click on the **Done** button to create the vector text and return to the **Assistant's** Home page.

The vector text appears, surrounded by a bounding box indicating that it is selected. The vector text is grouped by default.



10. Click on the **Centre In Page** button  in the **Position Size Align Vectors** area of the **Assistant's** Home page to move the vector text to the centre of your model.

Creating the ISO-FORM Letters


We are now ready to create the ISO-Form letters from the vector text you have created.

An ISO-Form letter is essentially made up of two parts, the **Bottom Height** and the **Top Height**. The former describes the vertical height (side-wall) in the base of the letter, while the latter describes the height in the angled or circular cross-section added to its base to complete the letter.

We will create a combination of letters, some with a circular cross-section and others with an angular cross-section.

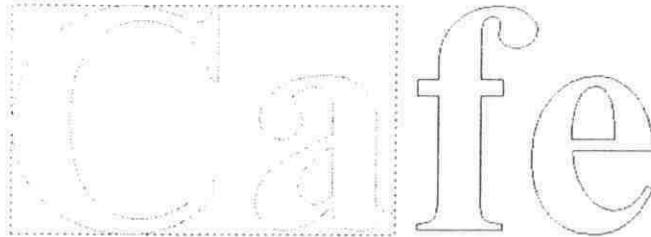
Creating Letters with a Circular Cross-Section

First, we will create the ISO-Form letters with a circular cross-section.

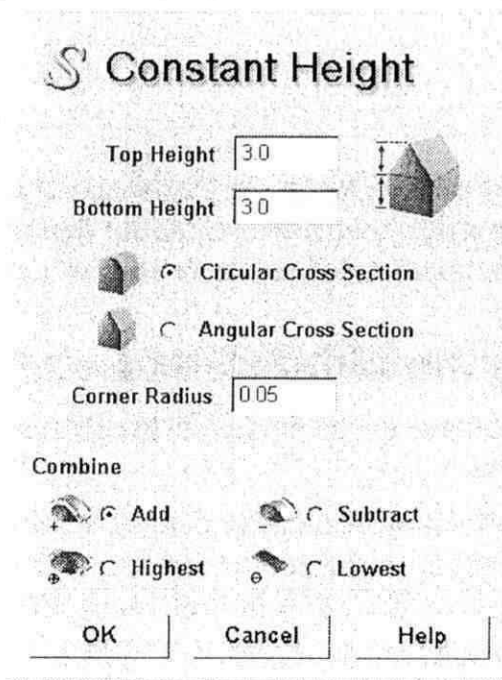
1. Click on the **Ungroup** button  in the **Group Merge Join Vectors** area to ungroup the vector text.


The bounding box surrounding the vector text is removed, indicating that it is no longer selected.


2. Click and drag to form a bounding box around the first two letters in the vector text, then release the mouse button to select them. The selected vector text turns magenta.

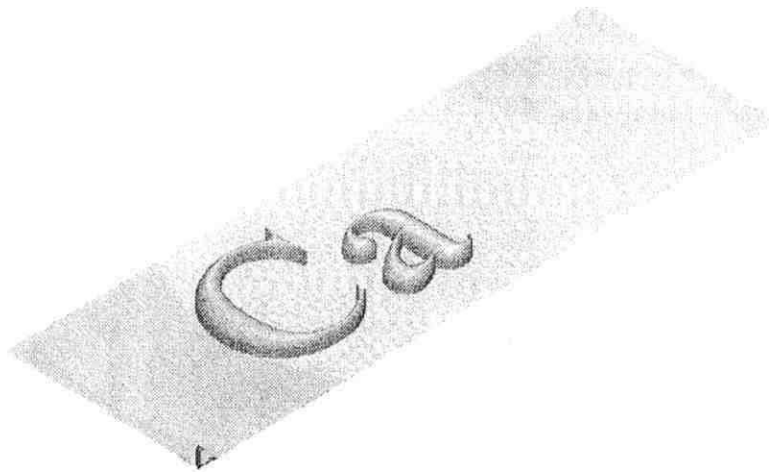


3. Click on the **ISO-FORM Letters** button  in the **Vector Based Relief Creation** area of the **Assistant's** Home page to display the **Constant Height** dialog box:



4. Type 3.0 mm (0.12") in both the **Top Height** and **Bottom Height** boxes. This sets the height of the base and the cross-section in the ISO-Form letters.
5. Make sure that the **Circular Cross Section** option  is selected by clicking on it.
6. Type 0.05 mm (0.002") in the **Corner Radius** box. This option instructs ArtCAM Pro to taper all areas of the constant relief height that have a radius smaller than 0.05 mm (0.002").

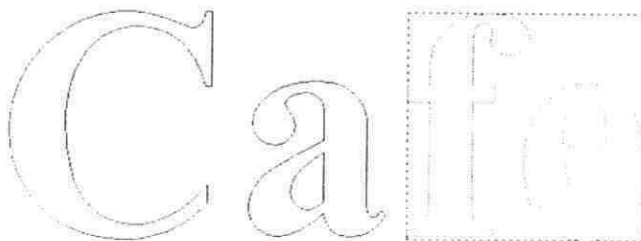
7. In the **Combine** area, make sure that the **Add** option is selected . This option instructs ArtCAM Pro to add the points in the letters to the current relief.
8. Click on the **OK** button to create ISO-FORM letters with a vertical height of 3 mm (0.12") and a curved top profile. The letters have a constant height of 6 mm (0.24") in total.
A progress bar appears beneath the **2D View** window indicating the progress ArtCAM Pro is making in calculating the relief.
9. Press the **F3** key to display the relief in the **3D View** window:






Creating Letters with an Angular Cross-Section

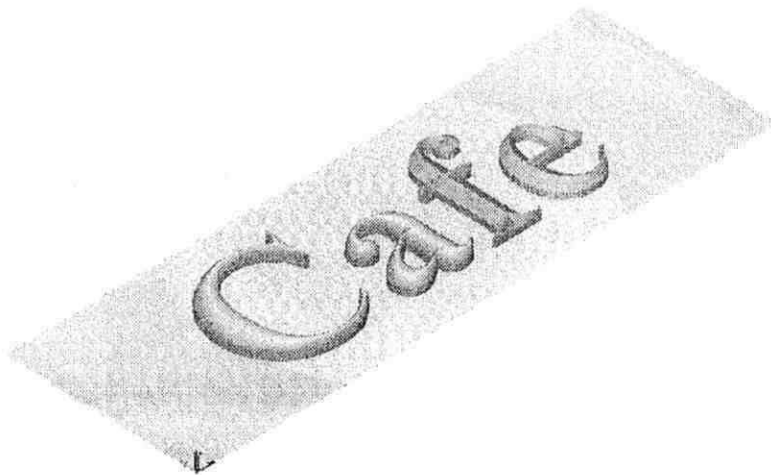
Now we will create the ISO-Form letters with an angular cross-section.

1. Press the **F2** key to display the **2D View** window.
2. Click and drag to form a bounding box around the last two letters in the vector text, then release the mouse button to select them. The selected vector text turns magenta.



3. Click on the **ISO-FORM Letters** button  to display the **Constant Height** dialog box.

4. Type **3.0 mm (0.12")** in both the **Top Height** and **Bottom Height** boxes.
5. Click on the **Angular Cross Section** option  to select it.
6. Type **0.05 mm (0.002")** in the **Corner Radius** box.
7. In the **Combine** area, make sure that the **Add** option is selected .
8. Click on the **OK** button to create ISO-FORM letters with an angular cross-section and a total height of 6 mm (0.24").
A progress bar appears beneath the **2D View** window indicating the progress ArtCAM Pro is making in calculating the relief.
9. Press the **F3** key to display the new relief in the **3D View** window:



You have now finished creating the ISO-FORM letters.

Tutorial – Interactive Sculpting

Overview

The following tutorial demonstrates how to use the Interactive Sculpting tools in ArtCAM Pro to enhance your three-dimensional designs. The Interactive Sculpting tools are particularly useful for editing and modifying scanned data taken from sources such as touch probe and laser scanners.

Teddy Bear


The stages that you will cover during the course of this tutorial are:

- Preparing the model.
- Sculpting the relief.


The tutorial will lead you through each of these stages, guiding you through the complete process of using the Interactive Sculpting tools to edit the appearance of a Teddy Bear relief.

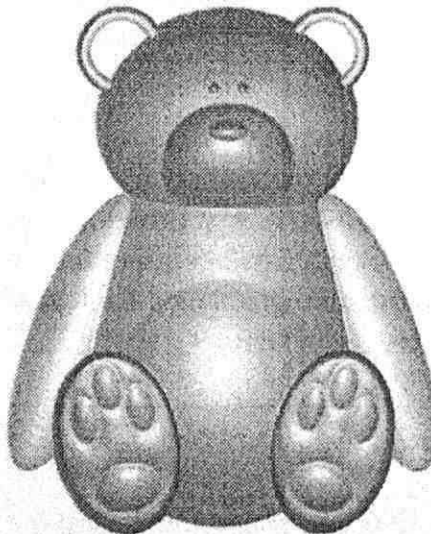
Preparing the Model

First, we will open the ArtCAM model containing the relief that you will edit using the Interactive Sculpting tools:

1. Click on the **Open Existing Model**  icon in the **Assistant** window to display the **Open** dialog box.
2. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples\Ted_bear.
3. Click on the .art file named *Sculpt_Teddy* to select it.

The file name appears in the **File name** box.

4. Click on the **Open** button to open the Teddy Bear model.
A greyscale image of the Teddy Bear relief appears in the **2D View** window.
5. Press the **F3** key to display the relief in the **3D View** window.
6. Click on the **View Along Z** button  in the **3D View** toolbar to display the relief from the Z-axis.




Sculpting the Relief

We are now ready to sculpt the relief using some of the Interactive Sculpting tools in ArtCAM Pro.

Smoothing the Teddy Bear

First, we will use the **Smooth** tool to smooth an area of the relief, as well as remove an area of it altogether.

1. Click on the **Sculpting** button  in the **Relief Editing** area of the **Assistant's** Home page to display the **Interactive Sculpting** page.

The **Smooth** tool is selected by default. This allows you to blend one area of the relief with the next.

2. Click and drag on the **Diameter** slider and set the tool diameter to 10 mm (0.4").


The diameter of the tool determines how much material is blended into the area of the relief affected by the tool.


3. Click and drag on the **Strength** slider and set the strength of the tool to 100%.

The strength of the tool determines the width of the blend as a percentage of the tool width. The image to the left of the slider changes as you move the slider, to reflect the width of the blend.

4. Click and drag on the **Smoothness** slider to set the smoothness of the tool to 50%.

The smoothness of the tool determines how sharp the tip of the tool is.

5. Click on the **Zoom** button  in the **3D View** toolbar, then click and drag to form a bounding box around the teddy bear's right ear. Release the mouse button to zoom in on this area.

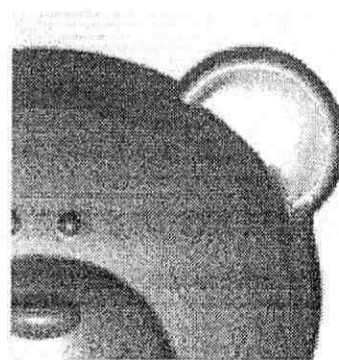
6. Move the  cursor over the inside of the teddy bear's right ear, then click and drag the mouse.

The shape of the ear changes as the cursor passes over it. The teddy bear's ear should look something like this:

Before...







After...



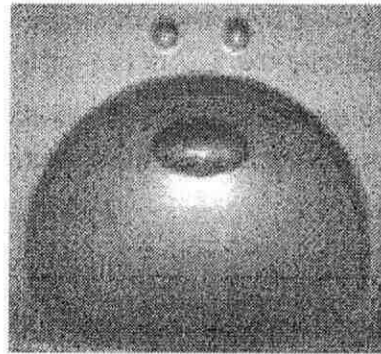
7. Change the diameter, strength and smoothness of the **Smooth** tool and experiment with smoothing other areas of the relief.

If you make a mistake and you want to revert back to how the relief was at the start of this sculpting session, click on the **Revert** button.

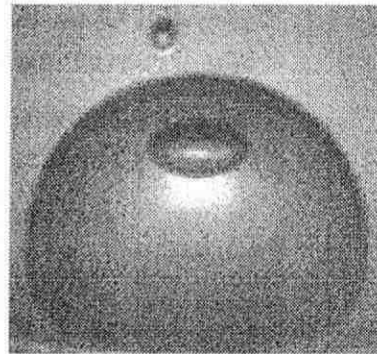
8. When you are happy with your changes, click on the **Apply** button to replace the relief shown in the **3D View** window with a new relief that contains your sculpting changes.
9. Click on the **Scale To Fit** button  in the **3D View** toolbar to view the entire relief.
10. Use the **Zoom** button  to zoom in on the teddy bear's snout.
11. In the **Combine** area, click on the **Lower Only** radio button . This option instructs ArtCAM Pro to lower the highest points under the tool cursor.
12. Move the  cursor over the teddy bear's right eye, then click and drag the mouse.

You can see that the eye is removed without damaging the surrounding area of the relief.

Before...




After...





13. Click on the **Revert** button to restore the teddy bear's eye.

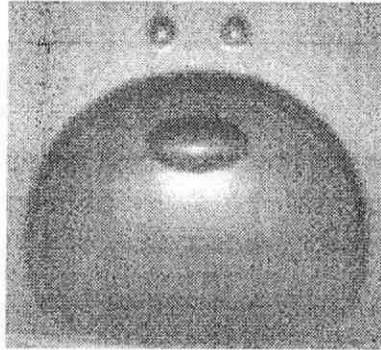
Carving the Teddy Bear

Now we will use the **Carve** tool to remove an area of the relief.

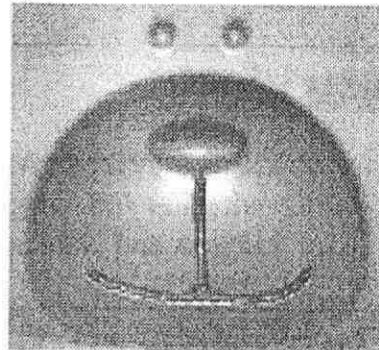
1. Click on the **Carve** icon  to display the tool's settings.
2. Click and drag on the **Diameter** slider and set the tool diameter to 4 mm (0.16").
3. Click and drag on the **Strength** slider and set the strength of the tool to 80%.
4. Click and drag on the **Smoothness** slider to set the smoothness of the tool to 100%.

5. Make sure that the **Add** option is selected  in the **Relief Combine Mode** area of the page. This option allows you to carve material from the relief.
6. Move the  cursor over the teddy bear's nose, then click and drag the mouse downwards to carve the following shape into the relief:

Before...



After...



7. Click on the **Apply** button to save your sculpting changes.
For information on using the other tools and their settings on the Interactive Sculpting page, see the Working with Reliefs chapter in the ArtCAM Pro Reference Manual.
8. Click on the **Finish** button to return to the **Assistant's** Home page.

Tutorial – Scanning

Overview

This tutorial demonstrates how a scanned image can be edited and manipulated using ArtCAM Pro. It also offers general advice for using colour and black and white scanned images in ArtCAM Pro.

Principles of Scanning

You should spend time when creating a good scanned image. It is often best to experiment with the scanning software to get the best possible results and then import that image into ArtCAM Pro.

Consider all of the various image options available to you, such as black and white, colour and photograph, as well as the brightness and colour settings. You should always crop the image to the minimum size required and then edit the image in any way that will improve its quality, such as removing rogue pixels.

You need to find a balance between the need for a high-resolution image and to keep the file size small. The fewer the number of dots per inch (dpi), the smaller the file size, but the more likely it is you will find coarse pixel editing in the artwork and rippled effects when machining. The larger the number of dots per inch (dpi), the less likely you are to find rippled effects when machining, but the larger and more cumbersome the file becomes. The dpi you choose is therefore a compromise between these two requirements.

In ArtCAM Pro, you can load a scan saved as any one of the following types of file:

- Windows Bitmap (*.bmp)
- TIFF image (*.tif)
- PCX image (*.pcx)
- CompuServe image (*.gif)

- JPEG image (*.jpg)

Comparisons of Scans


Now we will look at some examples of the effects of scanning.

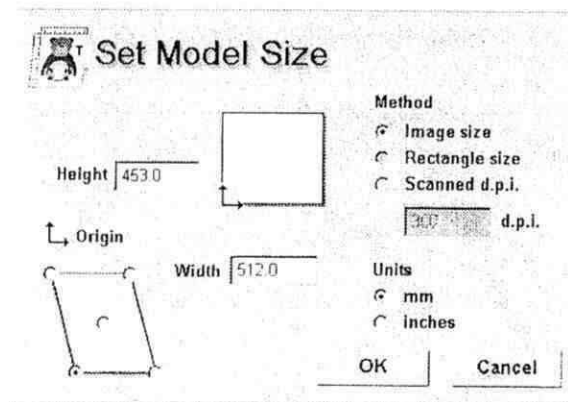
Effects of Changing Resolution

Scanned resolution is normally expressed in dots per inch (dpi). A larger dpi value will usually yield a better scan, but the size of the scanned file increases significantly. We will consider the differences between three scanned files used in ArtCAM Pro.

Scanning at 100 dpi

First, we will look at an image scanned at 100 dpi.

1. Click on the **Open Existing Model** icon  in the **Assistant** window to display the **Open** dialog box.
2. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples\Crest.
3. Click on the **Files of type** list box and then on the **All Files (*.*)** option to select it.
4. Click on the .bmp file named *Crest10* to select it.
5. Click on the **Open** button to display the **Set Model Size** dialog box.



The **Height** of the model is 453.0 mm (17.8") and the **Width** is 512.0 mm (20.2").

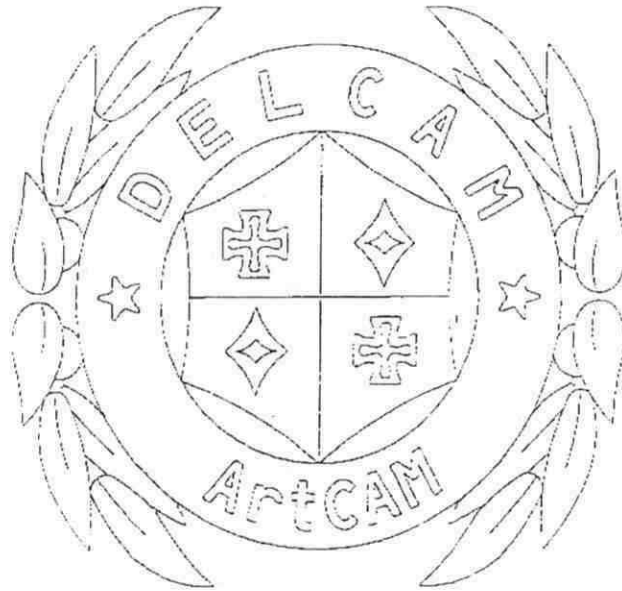
6. Click on the **Scanned d.p.i.** radio button ☐ to select this option, then type *100* in the **d.p.i.** box. The **Height** changes


to 115.062 mm (4.53") and the **Width** changes to 130.048 mm (5.12").

This sets the size of the model according to the dpi at which the image was scanned.

7. Click on the **OK** button to close the **Set Model Size** dialog box. The scanned artwork is displayed in the **Crest10:0** window.

In the **Project Information** area of the **Assistant's** Home page, you can see that the artwork contains 512 x 453 pixels.



8. Click on the **Zoom In** button  in the **Crest10:0** toolbar, click and drag to form a bounding box around the "D" in the text, then release the mouse button to zoom in on it.




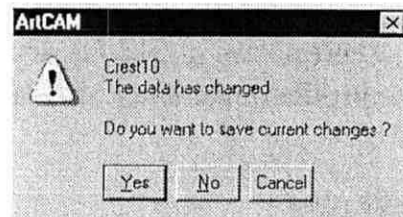
You can see that the pixels are large. Using this scan would produce a rippled surface when machining. There are pixels that need to be added to maintain the profile of the letter.

It would be easy to repair the damaged straight-line segments in this scan using the **Bitmap Editing** tools in ArtCAM Pro, but it would be much harder and more time-consuming to repair the damaged curved segments whilst also trying to maintain the profile of the shape or letter.

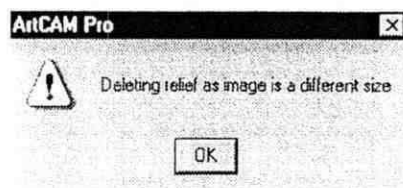
Scanning at 150 dpi

Next we will look at an image scanned at 150 dpi.

1. Click on the **Open File** button  in the **File** area of the **Assistant's** Home page to display the **Open** dialog box.
2. Click on the **Files of type** list box and then on the **All Files (*.*)** option to select it.
3. Click on the .bmp file named *Crest15* to select it.
4. Click on the **Open** button. The following message box appears:



5. Click on the **No** button to close the message box and display the **Set Model Size** dialog box. The **Height** of the model is 707.0 mm (27.8") and the **Width** is 786.0 mm (31.0").
6. Click on the **Scanned d.p.i.** radio button to select this option, then type 150 in the **d.p.i.** box. The **Height** changes to 119.719 mm (4.71") and the **Width** changes to 133.096 mm (5.24").
7. Click on the **OK** button to close the **Set Model Size** dialog box. The following message box appears:



8. Click on the **OK** button to close the message box. The scanned artwork is displayed in the **Crest15:0** window.

In the **Project Information** area, you can see that the artwork contains 786 x 707 pixels.

9. Zoom in on the "D" in the text.



You can already see that by increasing the dpi, the image quality has improved. The pixel size is much smaller, so using this scan would produce a better surface finish when machining. There are no pixels that need to be added to maintain the profile of the letter, reducing the time required for editing.

Scanning at 200 dpi

Now we will look at an image scanned at 200 dpi.

1. Repeat the previous steps, this time selecting the .bmp file named *Crest20* and typing *200* in the **d.p.i.** box.

The **Height** of the model is *114.935 mm (4.52")* and the **Width** is *130.048 mm (5.12")*.


In the **Project Information** area, you can see that the artwork contains 1024 x 905 pixels.



This letter has a clearly defined profile, but the large number of pixels in the artwork means that ArtCAM Pro will run more slowly.

Comparing File Sizes

We will now compare the file sizes of each of the scanned images used in this tutorial so far.

1. Click on the **Open File** button  in the **File** area to display the **Open** dialog box.
2. Right-click on the *Crest10.bmp* file to display the context menu, then click on the **Properties** option to display the **Properties** dialog box.

In the **Size** area, you can see that the file is 29,054 bytes.

3. Click on the **OK** button to close the **Properties** dialog box.
4. Repeat these steps for each of the other *Crest* bitmap files. The *Crest15.bmp* file is 70,762 bytes, while the *Crest20.bmp* file is 115,902 bytes.

You can see that there is a significant increase in file size between the image scanned at 100 dpi and that scanned at 200 dpi. As ArtCAM Pro works slower with larger files, you should find a balance between quality and resolution when scanning images.

Scanning Colour Pictures

So far, we have looked at scanning black and white line drawings. In this section, we will consider scanning colour images.

Scanning at 150 dpi B&W

First, we will look at a black and white image scanned at 150 dpi.

1. Open the *dcam15.bmp* file from the ArtCAM Pro 6.0\Examples\Dcam directory, entering a scanned dpi of 150.

The **Height** of the model is 18.796 mm (0.74") and the **Width** is 86.013 mm (3.4").

In the **Project Information** area, you can see that the artwork contains 505 x 111 pixels.



You can see that this scanned image is of very poor quality.

Scanning at 150 d.p.i. Colour

Now we will look at a colour image, also scanned at 150 dpi.

1. Repeat the previous steps, this time selecting the .bmp file named *dcam15c*.

The **Height** of the model is 19.981 mm (0.79") and the **Width** is 86.013 mm (3.4").

In the **Project Information** area, you can see that the artwork contains 505 x 118 pixels.



You can see that scanning the image in colour is the better option. The number of dpi depends on the size of the model and the quality of finish that you require.

Non-Vertical Lines

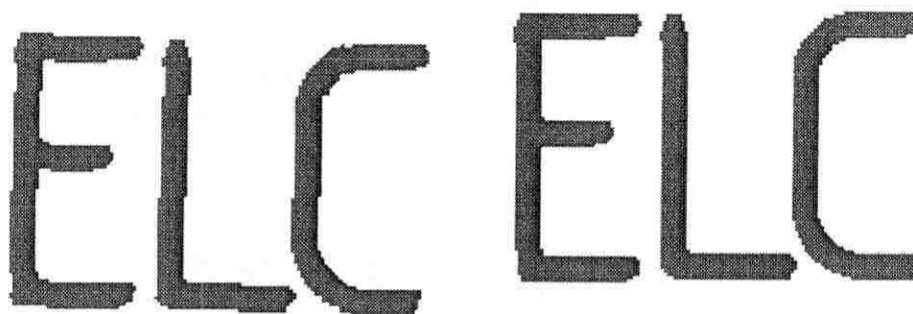
In the previous example, you might have noticed that the vertical and horizontal lines in the letters "A" and "M" of "Delcam" stray from the X and Y axes by 1 pixel. You should aim to minimise this effect in all scanned images, whilst considering if it is worth the time and effort to do so. Your decision will depend on the degree to which horizontal and vertical lines stray from their respective axis and the surface finish

that you require when machining. Editing a scanned image in this way can be very time consuming.

In the previous example, the vertical alignment is acceptable. Now we shall consider how to improve poor alignment between the straight edges in the scanned image and the horizontal and vertical axes of the model.

Before...

After...



You can see a considerable improvement between the above images. The image was rotated anti-clockwise using the **Deskew** tool with an angle of -2° . For more details, see the "Working with Models" chapter in the ArtCAM Pro 6.0 Reference Manual.

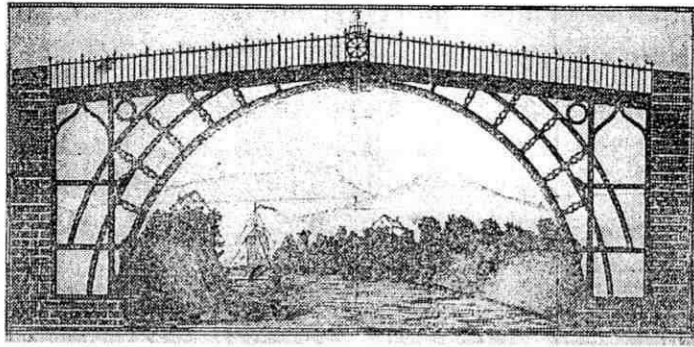
The alternative to deskewing is to manually adjust the vertical and horizontal alignment of the straight edges on the scanner bed, then re-scan the image.

Large Colour Palettes

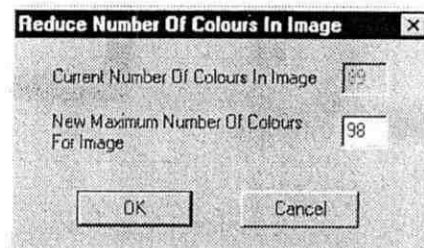
Photographs and transparencies can be difficult to scan as they produce a multitude of colours. Black and white photographs can create several different shades of grey, and colour photographs can produce a similar number of different colours. It is good practice to edit a photograph as much as possible before importing it into ArtCAM Pro.

1. Open the *Bridge1a.bmp* file from the ArtCAM Pro 6.0\Examples\Bridge directory.

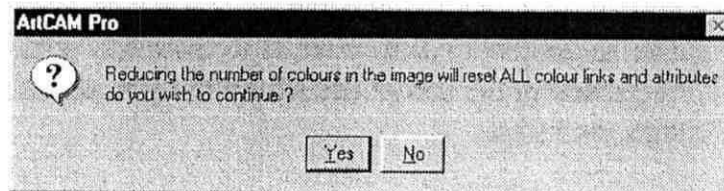
The artwork in the **Bridge1a.bmp:0** window looks as follows:



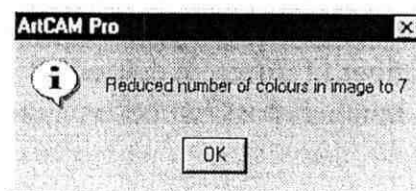
2. Click on the **Reduce Colours** button  in the **Model** area of the **Assistant's** Home page to display the **Reduce Number Of Colours In Image** dialog box:



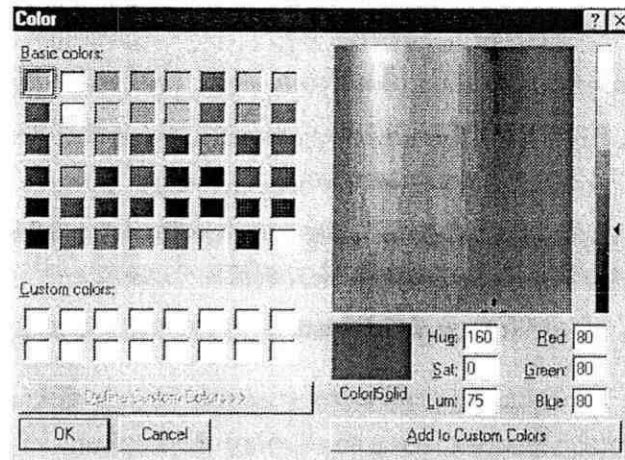
3. Type 7 in the **New Maximum Number Of Colours For Image** box, then click on the **OK** button. The following message box is displayed:



4. Click on the **Yes** button to close the message box and reduce the number of colours in the image. The following message box appears:

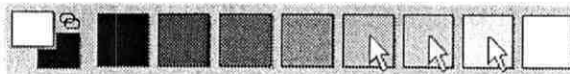


5. Click on the **OK** button to close the message box. You can see that there are now only seven colours in the Colour Palette beneath the **Bridge1a.bmp:0** window.
6. Click on the **Add Colour** button  in the **Bitmap Editing** area to display the **Color** dialog box:

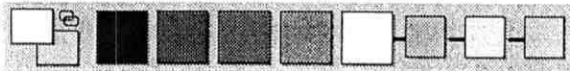


7. Click on the white colour in the **Basic Colors** area, and then click on the **Add To Custom Colours** button.
8. Click on the **OK** button to close the **Color** dialog box and add the white colour to the Colour Palette. This colour is automatically set as the Primary Colour.
9. Double right-click on each of the colours in the Colour Palette shown below to link them to the Primary Colour.

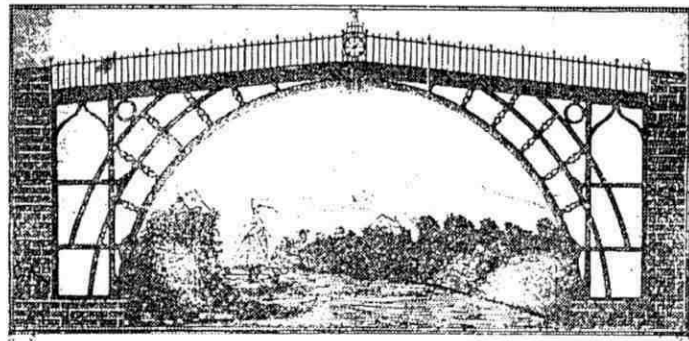
Before...



After...



The image is clarified substantially, as shown below:







Problems Using Flood Fill

When working with scanned data, the **Flood Fill** tool in ArtCAM Pro can produce some interesting results. These are caused by bitmap outlines not being closed, where the colour "leaks" from the area that

you want to fill. In this example, we will create a Colour Palette with which we will add colour to a black and white bitmap image.

1. Open the *Crest01.bmp* file from the ArtCAM Pro 6.0\Examples\Crest directory.

The **Base & Leaves:1**, **Central Base:2**, **Letters:3** and **Diamonds & Crosses:4** windows appear.





2. Click on the **Base & Leaves:1** window to make it active.
3. Click on the **Add Colour** button  in the **Bitmap Editing** area to display the **Color** dialog box.
4. Click on the yellow colour in the second row of the **Basic Colors** area, and then click on the **Add To Custom Colours** button.
5. Repeat the previous step to add the green colour in the third row of the **Basic Colors** area, then click on the **OK** button to close the **Color** dialog box and add both colours to the Colour Palette. The green colour is automatically set as the Primary Colour.
6. Click on the **Flood Fill** button  in the **Bitmap Editing** area.
7. Move the  cursor over each of the leaves in the image, and then click to flood-fill them in the current Primary Colour, green.
8. Click on the yellow in the Colour Palette to select it as the Primary Colour.
9. Move the  cursor in between the two circles in which the text appears, and then click to flood-fill them in yellow.

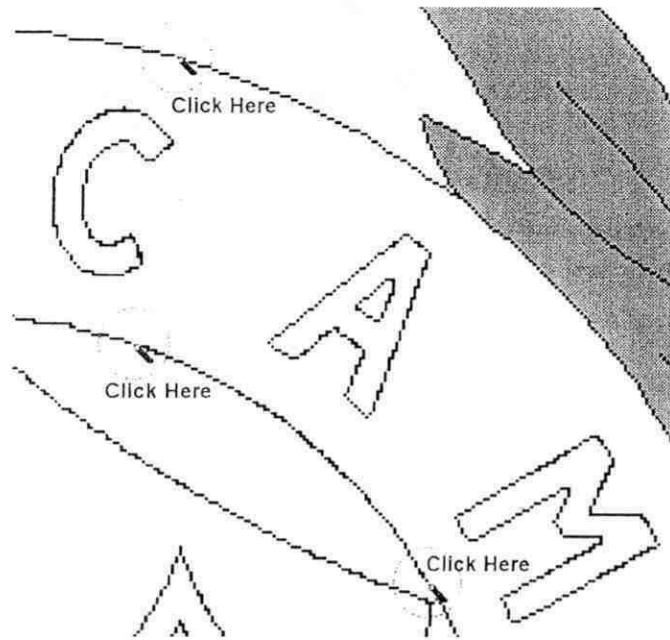
You can see that areas outside of the two circles are also flood-filled in yellow during this process:




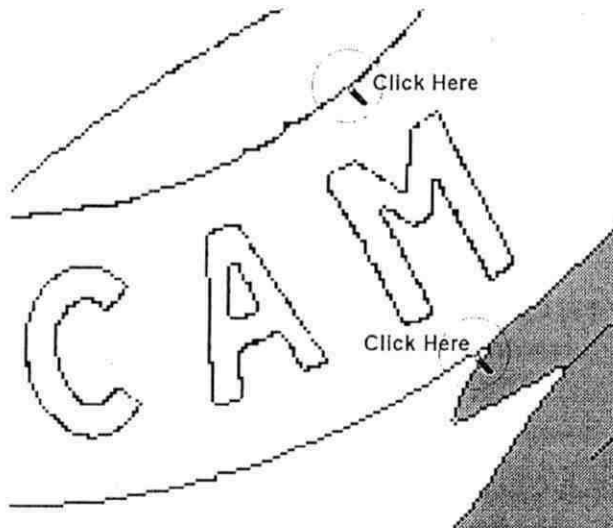
This indicates that the bitmap lines representing the following areas of the image are not closed:



- The "D", "E" and "L" within the "DELCAM" text.
- The star on the left.
- The bottom-right corner of the crest emblem.
- The cavity of the "A" within the "ArtCAM" text.
- The "A", "C", "A" and "M" within the ArtCAM text.

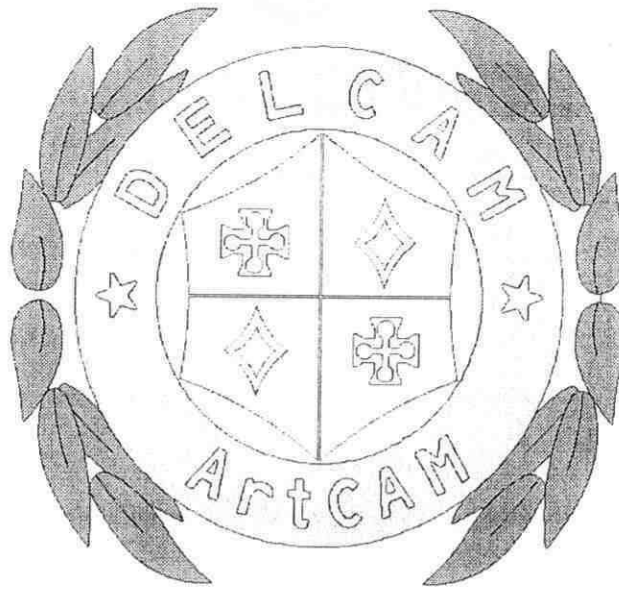
10. Click on the **Undo** button  in the **Base & Leaves:1** toolbar to remove the flood-filled colour.
11. Click on the **Zoom In** button  in the **Base & Leaves:1** toolbar, click and drag to form a bounding box around the "C" in the "DELCAM" text, then release the mouse button to zoom in on it.
12. Click on the black colour in the Colour Palette to select it as the Primary Colour.
13. Click on the **Draw** button  in the **Bitmap Editing** area, then move the  cursor over the areas shown below and click to join the broken bitmap lines together:



14. Click on the **Window Fit** button  in the **Base & Leaves:1** toolbar to view the whole image.
15. Repeat the previous steps for the areas shown below:



16. Click on the yellow colour in the Colour Palette to select it as the Primary Colour.
17. Click on the **Flood Fill** button .
18. Move the  cursor in between the two circles in which the text appears, and then click to flood-fill them in yellow.



19. Repeat these steps, repairing all of broken bitmap lines identified earlier, flood-filling areas in other colours selected from the **Color** dialog box and added to the Colour Palette.

For the **Base & Leaves:1** window, the area between the two circles should be coloured in yellow, as should be the text and the stars within it. The shield in the centre of the crest should be coloured in orange.



Note: You can open an example of the finished colour-filled image, which is saved as **Crest13.art** in the ArtCAM Pro 6.0\Examples\Crest directory.

3D Machining

Overview

The following tutorials demonstrate various aspects of machining three-dimensional models in ArtCAM Pro:

- "Tutorial – Creating and Machining Reliefs" on page 163.
- "Tutorial – Feature Machining" on page 175.

Tutorial – Creating and Machining Reliefs

Overview

The following tutorial demonstrates how to create areas of bitmap colour from vector objects, create three-dimensional shapes from bitmap colours and combine them to create a relief using the relief operations, bitmap editing, vector to bitmap and relief editing tools available in ArtCAM Pro. It also demonstrates how to calculate toolpaths in a batch.

Teddy Bear

The stages that you will cover during the course of this tutorial are:

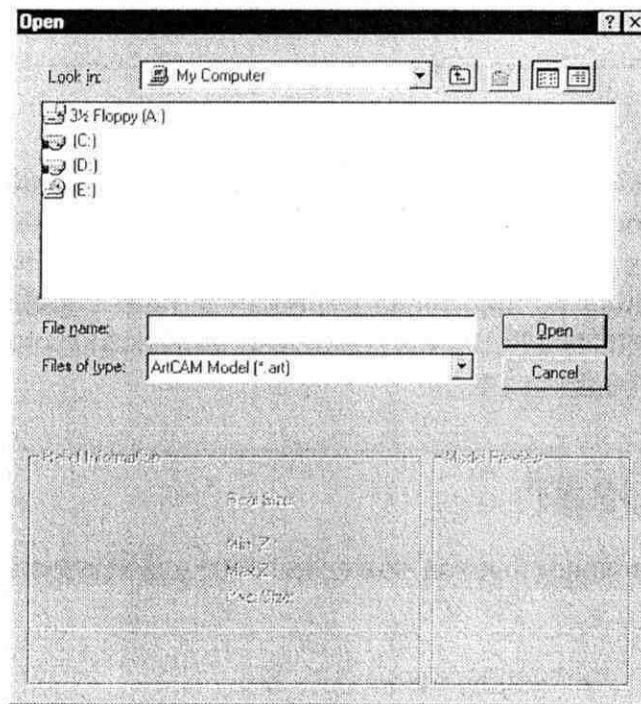
- Setting the model's size.
- Creating an offset vector.
- Machining the model.

The tutorial will lead you through each of these stages

Loading the Model

First, we will open the ArtCAM model containing the artwork that you will use to create the teddy bear relief:


5. Click on the **Open Existing Model** icon in the **Assistant** window to display the **Open** dialog box:

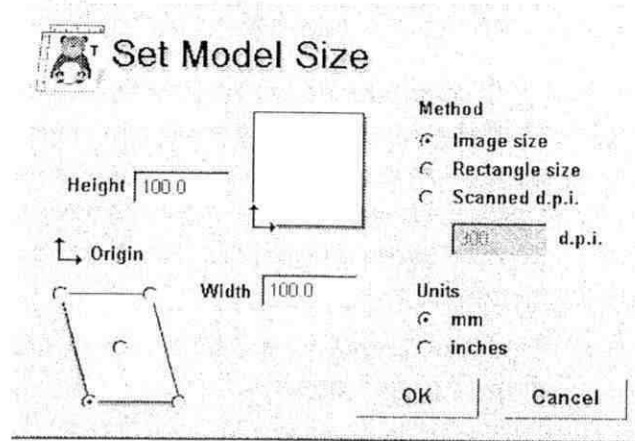



6. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples\NewTeddy.
7. Click on the .art file named *NewTeddy* to select it.
The file name appears in the **File name** box.
8. Click on the **Open** button to open the *NewTeddy* model.

Setting the Model's Size

Before machining the model, we will ensure that the size of the model is correct.

1. Click on the **Set Model Size** button  in the **Model** area of the **Assistant's** Home page to display the **Set Model Size** dialog box:




2. If you are using inches ensure the **Units** section is set to inches.
3. Type *100 mm (4.0")* in both the **Height** and **Width** box.
4. Click on the **OK** button to close the **Set Model Size** dialog box and set the model's size.
5. Click on the **Toolpaths** tab  to display the **Toolpaths** Home page.



Creating an Offset Vector

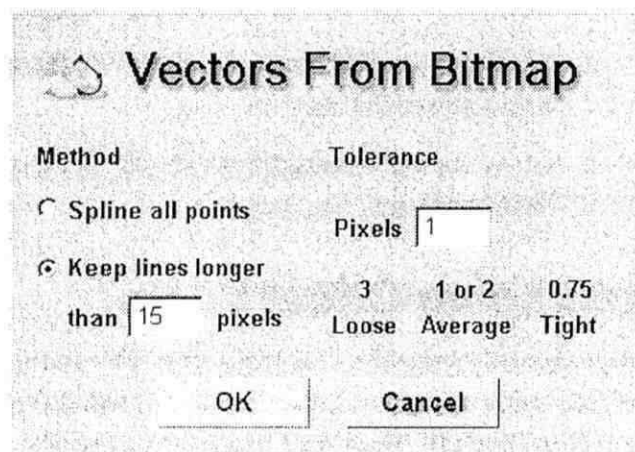
Before we can create the toolpaths that we will use to machine the relief, we must create an offset vector in the shape of the teddy bear to ensure that the Ball Nose tool machines onto the flat plane surrounding the teddy bear, thus giving it a well-defined edge.

We will delete all of the vector objects used to create the teddy bear relief as we no longer need them. We will then create a vector outline of the teddy bear from a greyscale image of the relief. From this vector outline, we will create an offset vector.

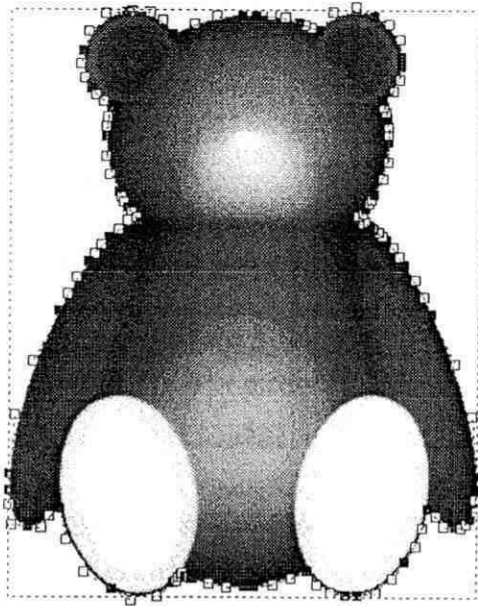
1. Press the **F2** key to display the **2D View** window.
2. Click on the **Assistant** tab  to display the **Assistant's** Home page.
3. In the **2D View** window, click and drag to form a bounding box around all of the vector objects from which the relief was created, then release the mouse to select them. The


vector objects turn magenta and are surrounded by a bounding box.

4. Press the **Delete** key on your keyboard to delete the selected vector objects. The **2D View** window is now empty.
5. Click on the **Grayscale From Relief** button  in the **Model** area of the **Assistant's** Home page to create a greyscale image of the relief in the **2D View** window (the **F10** key is a shortcut for this command). You can see that the area surrounding the teddy bear relief is coloured in yellow by default.
6. Click on the yellow colour in the Colour Palette to select it as the Primary Colour.
7. Click on the **Bitmap to Vector** button  in the **Vector – Bitmap** area to display the **Vectors From Bitmap** dialog box:



8. Click on the **OK** button to create vector objects in the shape of the outline of all areas in the current Primary Colour and close the **Vectors From Bitmap** dialog box.
9. Click on the rectangular vector representing the outline of the material to select it, then press the **Delete** key on your keyboard to delete it. We do not need to use this vector object for anything so it is better to remove it altogether.
10. Click on the vector representing the outline of the teddy bear to select it.





11. Click on the **Offset Vector(s)** button  in the **Vector Editing** area to display the **Offset Vector(s)** page.
12. Type *1.5 mm (0.06")* in the **Offset Distance** box.
 This distance is equal to the radius of the Ball Nose tool that we will use to machine the area of the relief inside the offset vector. Ensure that the **Offset Direction** is set to **Outwards / Right**.
13. Click on the **Delete original vectors** option to turn it on ☒, then click on the **Offset** button. This deletes the original vector outline from which we are creating the offset vector after the offset has been performed.
14. Click on the **Close** button to return to the **Assistant's** Home page.
 The offset vector in the **2D View** window is selected by default.

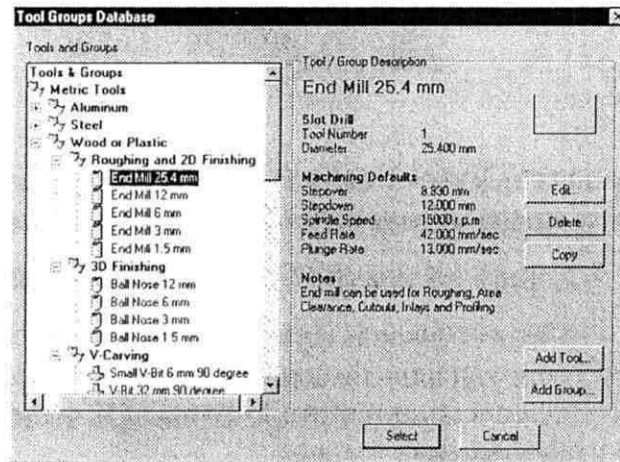
Machining the Model

We are now ready to create the toolpaths that will be used to machine the model.

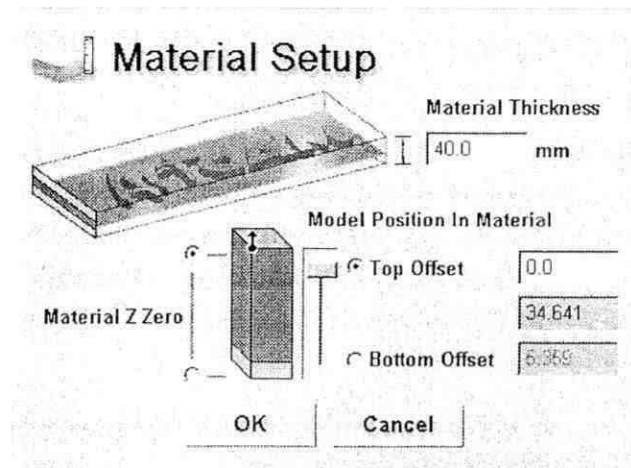
Creating a Roughing Toolpath

The first toolpath that we will create will be used to rough the model. We will also define the thickness of the block of material we will use for this job.

1. Click on the **Toolpaths** tab  to display the **Toolpaths** Home page.
2. Click on the **Z Level Roughing** button  in the **3D Toolpaths** area to display the **Z Level Roughing** page.
3. Click on the **Select** button to display the **Tool Groups Database**:



4. Click on the **End Mill 12 mm** tool (End Mill 1/4 Inch) in the **Wood or Plastic\ Roughing and 2D Finishing** tool group to select it.
5. Click on the **Select** button to close the **Tool Groups Database** and display the selected tool on the **Z Level Roughing** page.
6. Click on the **Add Ramping Moves** option to turn it on ☒. Adding ramping moves, also known as zigzag plunge moves, allows the tool to enter the block of material gradually.
7. Click on the **Setup** button to display the **Material Setup** dialog box:





8. Type 40 mm (1.6") in the **Material Thickness** box.
9. Make sure that the **Material Z Zero** is set to the top of the block, by clicking on the radio button ☒ at the top of the block.
10. Make sure that the **Top Offset** is set to 0.0 mm (0.0").
11. Click on the **OK** button to close the **Material Setup** dialog box.
12. Click on the **Apply** button in the **Z Slices** area of the **Z Level Roughing** page to update the boxes based on the machining parameters of the 12 mm (1/4 Inch) End Mill tool.
13. Click on the **Later** button to save all the parameters we have entered, we will use the batch processing option calculate the Z Roughing toolpath later.
14. Click on the **Close** button to close the **Z Level Roughing** page and return to the **Toolpaths** Home page.

The Z Roughing toolpath you have created is shown on the **Toolpaths** Home page, but it has not yet been calculated.

Creating a Toolpath to Machine the Surface Relief



To show the difference between machining the complete relief and machining a specified area we will create two finishing toolpaths. However, in the real world only one of these toolpaths would be used to machine the final model. First, we will create a toolpath that will be used to machine the entire surface of the relief including the flat plane surrounding the teddy .

1. Click on the **Machine Relief** button  to display the **Machine Relief** page.
2. In the **Area To Machine** area, make sure that the **Whole Model** option  is selected.
3. Click on the **Strategy** list box, and then click on the **Raster In X** option to select it.
4. Click on the **Select** button to display the **Tool Groups Database**.
5. Click on the **Ball Nose 3 mm** tool (Ball Nose 1/8 Inch) in the **Wood or Plastic\3D Finishing** tool group to select it.
6. Click on the **Select** button to close the **Tool Groups Database** and display the selected tool on the **Machine Relief** page.
Note: If you wish to edit the default parameters such as stepover, feedrate etc. for this tool click the down arrow next to the tool description to show the current values and if required edit them.
7. Click on the **Later** button to save the values we have entered so that we can calculate the **Machine Relief** toolpath later.
8. Click on the **Close** button to close **Machine Relief** page and return to the **Toolpaths** Home page.

The Machine Relief toolpath you have created is shown on the **Toolpaths** Home page, but it has not yet been calculated.

Creating a Toolpath to Machine only the Teddy Relief


Next, we will create a toolpath that will be used to machine an area of the relief defined by the vector representing the outline of the teddy bear.

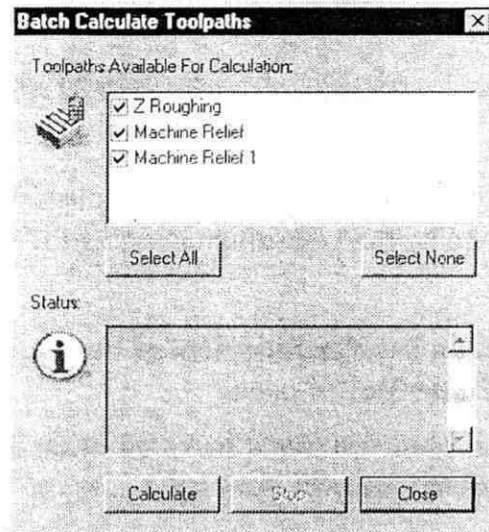
1. Click on the **Machine Relief** button  to display the **Machine Relief** page.
2. In the **Area To Machine** area, make sure that the **Selected Vector** option  is selected.
3. Click on the **Strategy** list box, and then click on the **Raster** option to select it.
4. Click on the **Select** button to display the **Tool Groups Database**.
5. Click on the **Ball Nose 3 mm** tool (Ball Nose 1/8 Inch) in the **Wood or Plastic\3D Finishing** tool group to select it.
6. Click on the **Select** button to close the **Tool Groups Database** and display the selected tool on the **Machine Relief** page.
7. Click on the **Later** button to save the values we have entered so that we can calculate the **Machine Relief** toolpath later.
8. Click on the **Close** button to close **Machine Relief** page and return to the **Toolpaths** Home page.

The Machine Relief toolpath you have created is shown on the **Toolpaths** Home page, but it has not yet been calculated.

Calculating the Toolpaths

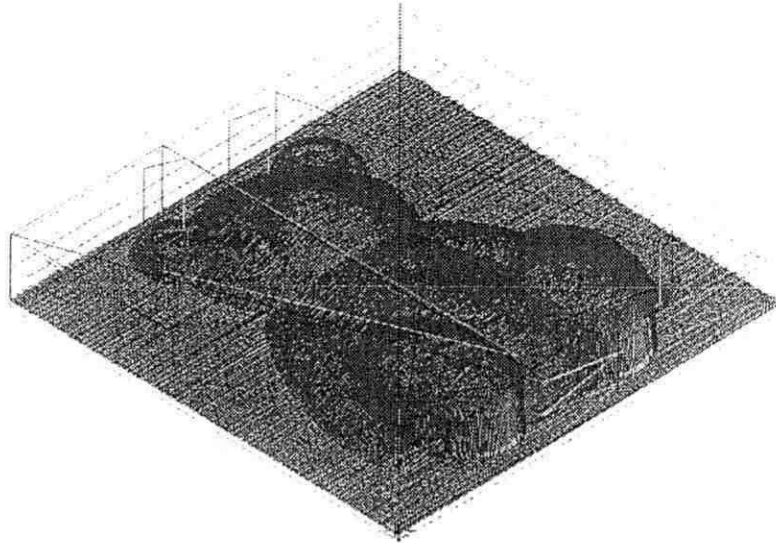
Now that we have created all of the toolpaths needed to machine the relief, we are ready to calculate them.

1. Click on the **Batch Calculate Toolpaths** button  to display the **Batch Calculate Toolpaths** dialog box:



You can automatically calculate all three of the toolpaths in sequence using ArtCAM Pro's batch calculation process. This process gives you the freedom to work continuously on creating a model during the day, and calculate all of its corresponding toolpaths during the night if they were very complex over a very large relief and hence would take a long time to calculate.

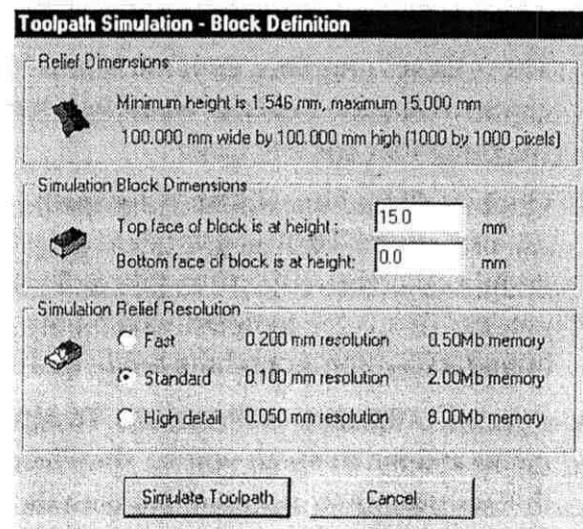
2. Click on the **Calculate** button to calculate the toolpaths. ArtCAM will now calculate each toolpath in turn displaying the time taken for each.
3. When you see the "Completed batch calculation of 3 toolpaths" message in the **Status** window, click on the **Close** button to close the **Batch Calculate Toolpaths** dialog box.
4. Press the **F3** key to display in the **3D View** window a preview of all three of the toolpaths used to machine the model.
5. Clicking the check box next to each toolpaths name on the Toolpaths tag will allow you to switch the visibility on and off for each of the toolpaths



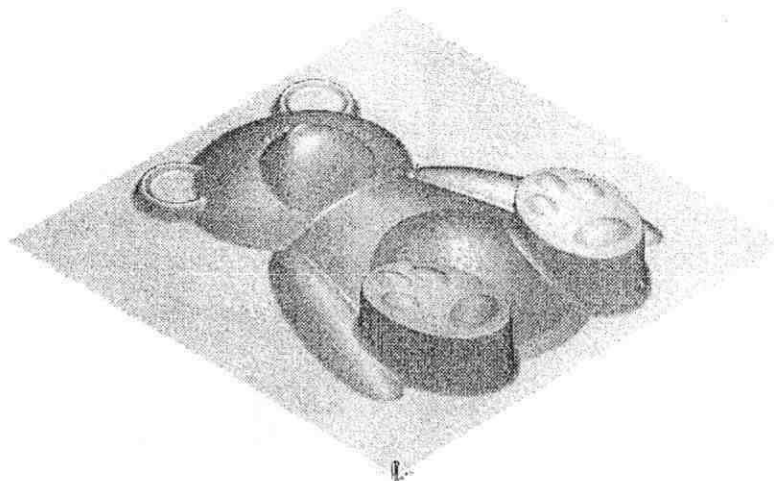
Simulating the Toolpaths

Finally, we are ready to simulate the toolpaths that we have created. We can either simulate all the toolpaths in one go, or simulate each toolpath individually. First, we will simulate them all in one go ...

1. From the Main menu, click on the **Toolpaths** option to display the **Toolpaths** menu, then click on the **Simulate All Toolpaths** option to display the **Toolpath Simulation – Block Definition** dialog box:



2. Click on the **Simulate Toolpath** button to simulate all three of the toolpaths in sequence. The following isometric view of the machined model is displayed in the **3D View** window



To simulate each toolpath individually, do the following ...

1. Delete the simulation using **Toolpaths – Delete Simulation** from the main menu.
2. Click on the [**Z Roughing**] toolpath (the first toolpath in the list) on the **Toolpaths** tab to select it (do **NOT** double click the toolpath as this will take you into editing mode).
3. Select **Toolpaths – Simulate Toolpath** from the main menu and select Simulate Toolpath on the dialog which is displayed.
4. The Z Level roughing toolpath will be simulated and you can see what the material block will look like after the roughing tool has been used.
5. Click on [**Machine Relief 1**] toolpath (the last toolpath in the list) on the **Toolpaths** tab to select it (again, do **NOT** double click the toolpath as this will take you into editing mode). This is the toolpath which only machines within the boundary vector around the teddy outline.
6. Select **Toolpaths – Simulate Toolpath** from the main menu and the toolpath will be simulated. You can see that this toolpath does not machine onto the flat plane and there are areas at the edge of the relief where the large roughing tool has left material on because there was not enough room to get the tool between for example the feet of the teddy and the edge of the block.

Overview

The following tutorial demonstrates how to import vector artwork, create raised and recessed features from vector objects, and then machine a feature using the 3D toolpath strategies available in ArtCAM Pro.

Dragon Badge

The stages that you will cover during the course of this tutorial are:

- Preparing the model.
- Importing the vector text.
- Creating the features.
- Machining the model.

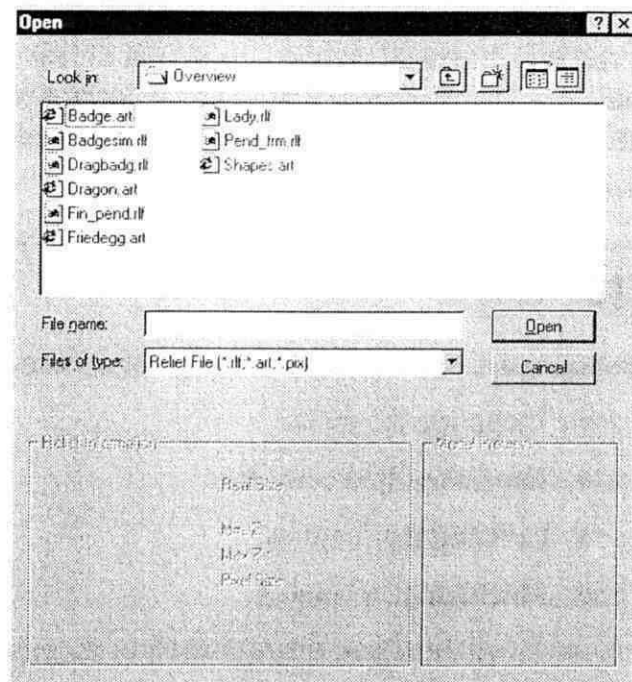
The tutorial will lead you through each of these stages, guiding you through the complete process of creating raised and recessed features from imported vector text, then machining them in the relief to create the text on the following badge.



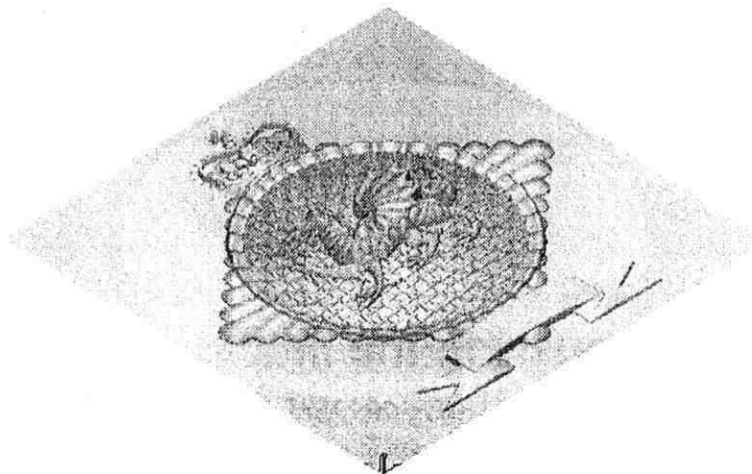
Preparing the Model

First, we will open the ArtCAM relief containing the artwork that you will use to create your model:

1. From the Main menu bar, click on the **Relief** menu, then click on the **Load > Replace** option to display the **Open** dialog box:




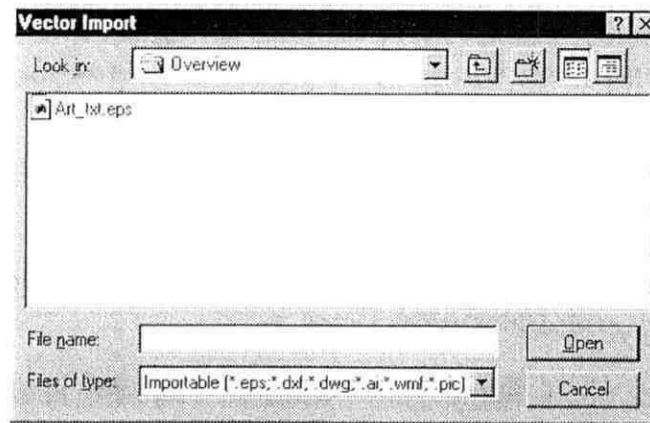
2. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples\Overview.
3. Click on the .rtf file named *Dragbadg* to select it.
The file name appears in the **File name** box.
4. Click on the **Open** button to open the relief.
The following relief appears in the **3D View** window:



Importing the Vector Text




Next, we will import the vector text that will be used to machine the text on the Dragon badge.

1. Click on the **2D View** window to make it active.
2. Click on the **Import Vector Data** button  in the **Model** area of the **Assistant's** Home page to display the **Vector Import** dialog box:



3. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples\Overview.
4. Click on the .eps file named *Art_txt* to select it.
5. Click on the **Open** button to close the **Vector Import** dialog box and import the vector text.




A grouped string of vector text reading as *ArtCAM* appears over the scroll area of the greyscale image of the relief.



6. Click on the **Ungroup** button  in the **Group Merge Join Vectors** area to ungroup the vector text.
7. Click on the **Bitmap On/Off** button  in the **2D View** toolbar to hide the greyscale image of the relief.
8. Click and drag to form a bounding box around the first three letters of the vector text, then release the mouse button to select them.
9. Click on the **Group** button  in the **Group Merge Join Vectors** area to group this text.
10. Click and drag to form a bounding box around the last three letters of the vector text, then release the mouse button to select them.

11. Click on the **Bitmap On/Off** button  to show the greyscale image of the relief.
12. Click on the **Group** button  in the **Group Merge Join Vectors** area to group this text.

Creating the Features

We are now ready to make features out of the two groups of vector text that you have created. The *Art* feature will be engraved into the scroll at the base of the badge. The *CAM* feature will be raised lettering.

1. Click on the *Art* grouped vector text to select it.
The vector text turns magenta.
2. Click on the **Toolpaths** tab  to display the **Toolpaths** Home page.
3. Click on the **Recessed Feature** button  to display the **Recessed Feature** page.
4. Type *1 mm (0.04")* in the **Feature Depth** box to set the depth of the recessed feature.
5. Click on the **Vector at Bottom Edge** radio button  to select this option.

This option places the machining tool in contact with the bottom edge of the *Art* vector text during the machining process.
6. Type *Art* in the **Name** box.
7. Click on the **Create** button, followed by the **Close** button.
The *Art* vector text turns blue, indicating that it is now a feature.
8. Click on the *CAM* grouped vector text to select it.
9. Click on the **Raised Feature** button  to display the **Raised Feature** page.
10. Type *1 mm (0.04")* in the **Feature Height** box to set the height of the raised feature.
11. Type *1 mm (0.04")* in the **Feature Allowance** box.
12. Make sure that the **Clear inner islands** option is turned off .

This option is turned off as the feature allowance we have defined will also apply to the central cavity in the letter 'A' of the *CAM* vector text.



13. Type *CAM* in the **Name** box.
14. Click on the **Create** button, followed by the **Close** button. The *CAM* vector text turns blue, indicating that it is now a feature.

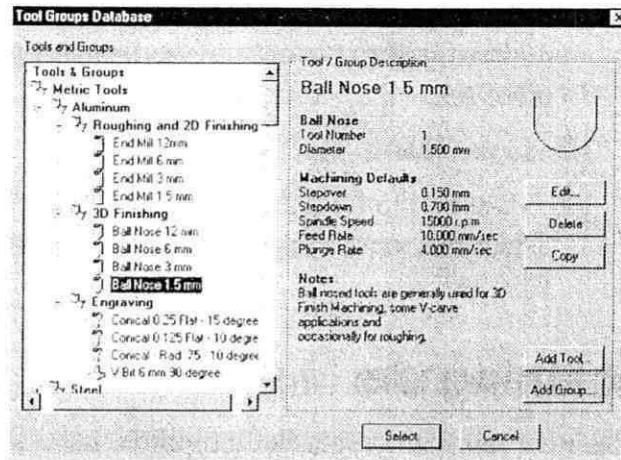
Machining the Model

We are now ready to create the toolpaths that will be used to machine the relief, and the raised and recessed features.

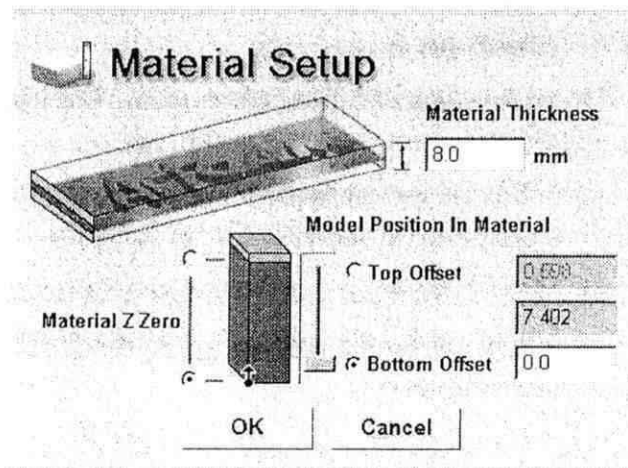
Creating a Toolpath to Machine the Badge Surface

Before we create the toolpath for the features, we must create a toolpath for the badge relief. When calculating the toolpath, ArtCAM automatically leaves sufficient material on the surface to allow for both of the features to be machined. This material is referred to as the feature relief.

1. Press the **F3** key to display the **3D View** window.
2. Click on the **Machine Relief** button  to display the **Machine Relief** page.
3. In the **Area to Machine** area, click on the **Whole Model** radio button  to select this option.
4. Click on the **Strategy** list box to display the list of options, then click on the **Raster in X** option to select it.
5. Type *0.01* mm (*0.0004*") in the **Tolerance** box.
6. Click on the **Select** button to display the **Tool Groups Database**:



7. Click on the **Ball Nose 1.5 mm** tool (Ball Nose 1/16 Inch) in the **Aluminum\3D Finishing** tool group to select it.
8. Click on the **Select** button to close the **Tool Groups Database** and display the selected tool on the **Feature Machining** page.
9. Click on the ▼ arrow in the **Tool** area to display the machining parameters of the Ball Nose tool.
10. Type *0.4 mm (0.016")* in the **Stepover** box.
11. Click on the **Setup** button to display the **Material Setup** dialog box:





The middle box in the **Model Position In Material** area shows that relief height is 7.402 mm (0.29").

12. Type *8.0 mm (0.31")* in the **Material Thickness** box. This is sufficient to machine the relief.
13. Click on the **OK** button to close the **Material Setup** dialog box.

14. Click on the **Later** button to create the Machine Relief toolpath.
15. Click on the **Close** button to return to the **Toolpaths** Home page.

Creating a Toolpath to Machine the Raised Feature

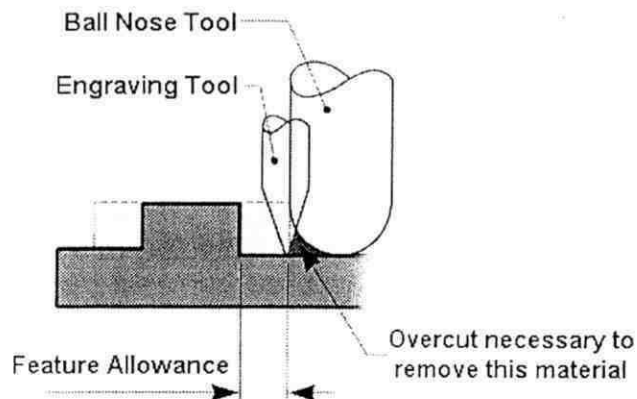
Next we will create the toolpath that will be used to machine the raised *CAM* text.


1. Click on the **Feature Machining** button  to display the **Feature Machining** page.
2. Click on the **Choose Feature** list box to display the list of features available, then click on the *CAM* option to select it.
3. Make sure that the **Area Clear** radio button  is selected by clicking on it.


This strategy allows the machining tool to clear an area of material based on the boundary of the feature, then to make profile passes around it.

4. Type 2.0 mm (0.08") in the **Overcut Distance** box.

The overcut distance allows you to remove the ridge of unwanted material that will appear around the feature during the machining process. This ridge appears because the radius of the Ball Nose tool used to machine the feature relief is greater than that of the engraving tool we will use to machine the features.



5. Click on the **Corner Sharpen** option to turn it on .
6. Click on the **Select** button to display the **Tool Groups Database**.

7. Click on the **Conical 0.125 Flat – 10 degrees** tool (Conical 0.005 Flat – 10 degrees) in the **Aluminum\Engraving** tool group to select it.
8. Click on the **Select** button to close the **Tool Groups Database** and display the selected tool on the **Feature Machining** page.
9. Click on the  arrow in the **Feature Tool** area to display the machining parameters of the Conical tool.
10. Type *0.1 mm (0.004")* in the **Stepover** box.
11. Click on the **Later** button to create the Feature Machine toolpath.

Creating a Toolpath to Machine the Recessed Feature


Now we are ready to create the toolpath that will be used to machine the recessed *Art* text by editing the toolpath created for the raised CAM feature.

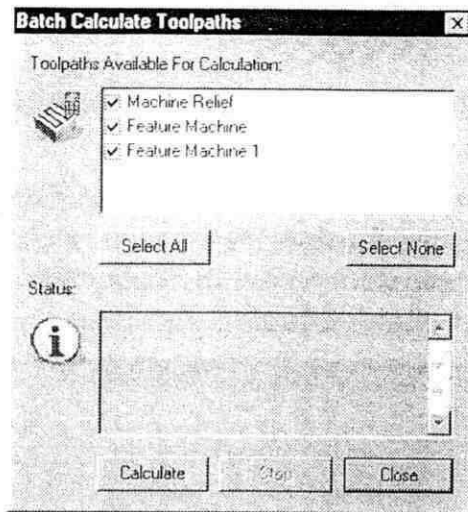
1. Click on the **Choose Feature** list box to display the list of features available, then click on the *Art* option to select it.
2. Type *Feature Machine 1* in the **Name** box.
3. Click on the **Later** button to create the Feature Machine toolpath.
4. Click on the **Close** button to return to the **Toolpaths** Home page.

The toolpaths that you have created are shown on the **Toolpaths** Home page, but they have not yet been calculated.

Calculating the Toolpaths

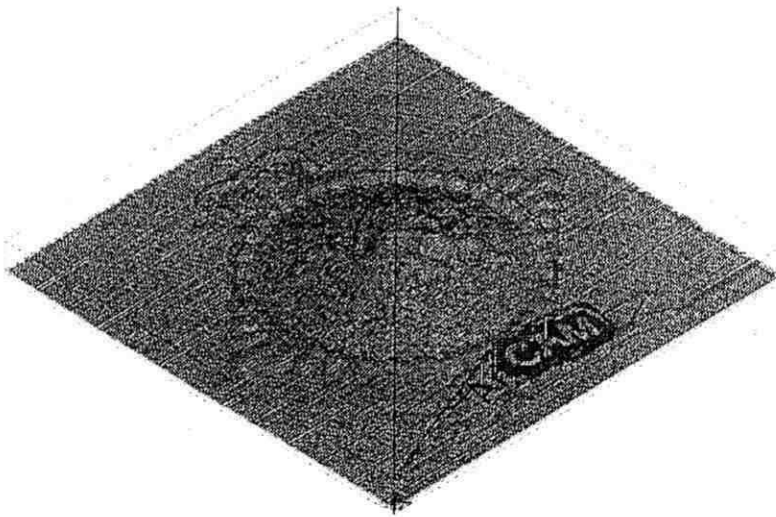
Now that we have created all of the toolpaths needed to machine the main badge relief and the two features created for the text, we are ready to calculate them.

1. Click on the **Batch Calculate Toolpaths** button  to display the **Batch Calculate Toolpaths** dialog box:



You can automatically calculate all three of the toolpaths in sequence using ArtCAM Pro's batch calculation process. This process gives you the freedom to work continuously on creating a model during the day, and calculate all of its corresponding toolpaths during the night.

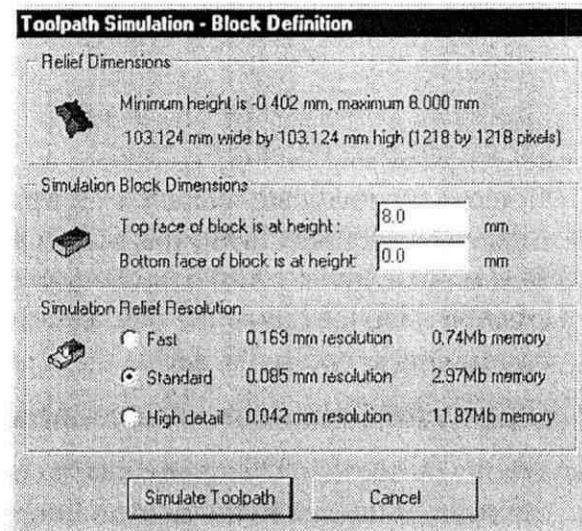
2. Click on the **Calculate** button to calculate the toolpaths.
3. When you see the "Completed batch calculation of 3 toolpaths" message in the **Status** window, click on the **Close** button to close the **Batch Calculate Toolpaths** dialog box.
4. Press the **F3** key to display in the **3D View** window a preview of all three of the toolpaths used to machine the main badge relief and both of the features:



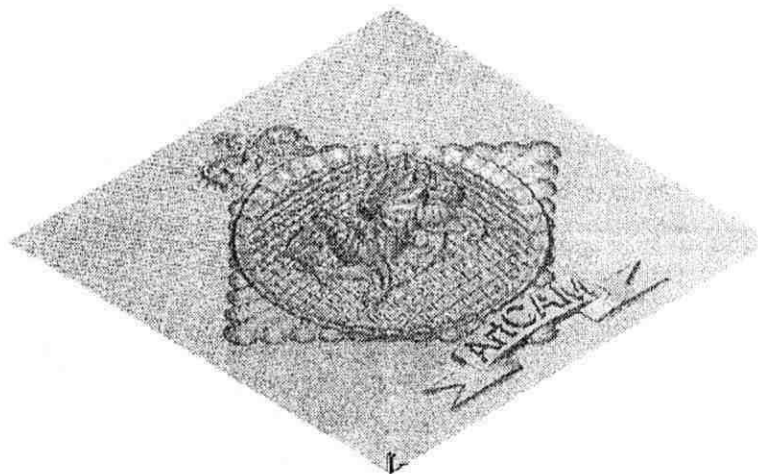
Simulating the Toolpaths

Finally, we are ready to simulate all of the toolpaths that we have created.

1. From the Main menu, click on the **Toolpaths** option to display the **Toolpaths** menu, then click on the **Simulate All Toolpaths** option to display the **Toolpath Simulation – Block Definition** dialog box:



2. Click on the **Simulate Toolpath** button to simulate all three of the toolpaths in sequence. The following isometric view of the machined model is displayed in the **3D View** window:



2D/2½D Modelling

Overview

The following tutorials demonstrate various aspects of two-dimensional modelling in ArtCAM Pro:

- "Tutorial – Aston Martin" on page 186.
- "Tutorial – Smart Engraving" on page 211.
- "Tutorial – Bevelled Carving" on page 218.
- "Tutorial – Nesting Vectors" on page 224.
- "Tutorial - Bridging" on page 231.

Tutorial – Aston Martin

Overview

The following tutorial demonstrates how to create an *Aston Martin* sign from imported vector artwork, using the vector drawing and 2D toolpath tools available in ArtCAM Pro.

The design is courtesy of Holmes & Cottrell Graphic Technologies. Visit their website www.vectorart.com for high quality designs.

Aston Martin

The stages that you will cover in this tutorial are:


- Preparing the model.
- Creating a frame for the sign.
- Importing the vector artwork.
- Creating the vector text.
- Wrapping the vector text.
- Creating an offset vector.
- Machining the vectors.
- Marking the drill holes with circles.
- Creating the drill holes.
- Saving the toolpaths.

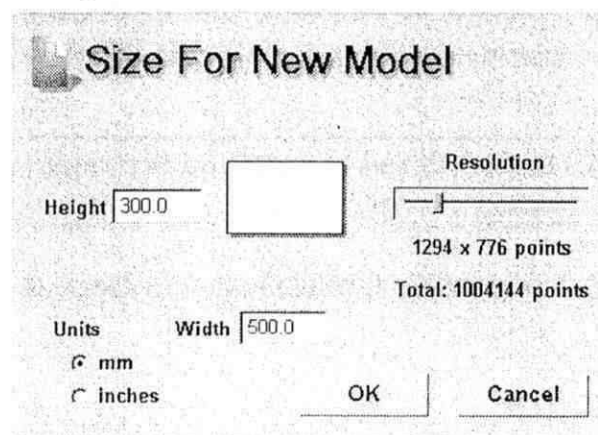
The tutorial will lead you through each of these stages, guiding you through the complete process of creating the *Aston Martin* sign below.



Preparing the Model

First, we will set up the model dimensions needed for this particular job:

1. Click on the **Create New Model**  icon in the **Assistant** window to display the **Size For New Model** dialog box:



2. Click on the **Units** option ☒ that you want to use (millimetres or inches).
3. Type *300 mm (12")* in the **Height** box and *500 mm (20")* in the **Width** box.
4. Click and drag on the **Resolution** slider to set the resolution of the model to *1004144* points.
5. Click on the **OK** button to close the **Size For New Model** dialog box.




A **2D View** window automatically fills the previously empty design window area. This window represents the block of material viewed down the Z-axis.

Creating a Frame for the Sign

Next, we will create the vector objects that represent the sign's frame.

Creating the Outer Rectangle

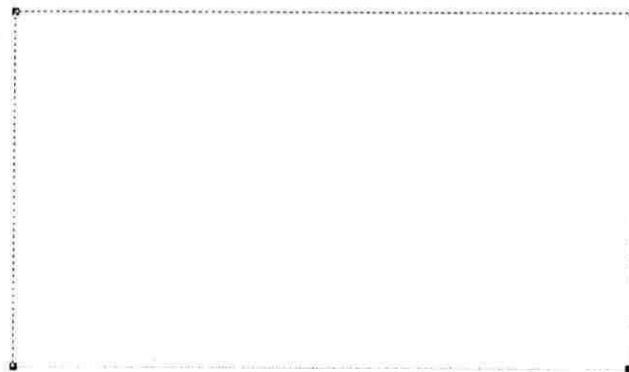
First, we will draw the outer rectangle of the sign's frame:

1. Click on the **Assistant** tab  to display the **Assistant's** Home page, then click on the **Create Rectangle** button  in the **Vector Editing** area to display the **Rectangle Creation** page.
2. Make sure that the **Rectangle** option is selected .
3. Type 250 mm (10") in the **Height** box and 450 mm (18") in the **Width** box.
4. Click on the **Preview** button to view the rectangle. It is centred on the model's origin, which is in the bottom left corner.



Note: All newly created vector objects are centred on the model's origin.

5. Click on the **Create** button to create the rectangle in your model:





6. Click on the **Close** button to return to the **Assistant's** Home page.
7. Make sure that the rectangle is selected by clicking on it. The rectangle should be green and surrounded by a bounding box.

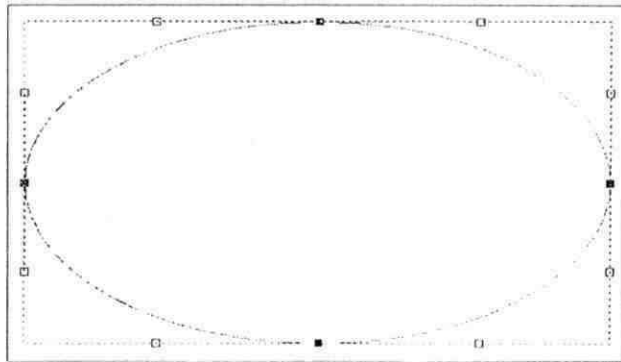
8. Click on the **Centre In Page** button  in the **Position Size Align Vectors** area to move the rectangle to the centre of your model.

This rectangle represents the total area of the sign that you are creating in your model.

Creating the Outer Ellipse

Second, we will draw the outer ellipse of the sign's frame:

10. Click on the **Create Ellipse** button  in the **Vector Editing** area to display the **Ellipse Creation** page.
11. Type 225 mm (9") in the **Height** box and 425 mm (17") in the **Width** box.
12. Make sure that the value in the **Angle** box remains at the default setting of 0°.
13. Click on the **Preview** button to view the ellipse.
14. Click on the **Create** button to create the ellipse, centred on the origin.
15. Click on the **Close** button to return to the **Assistant's** Home page.
16. Make sure that the ellipse is selected.
17. Click on the **Centre In Page** button  to place the ellipse in the centre of your model.

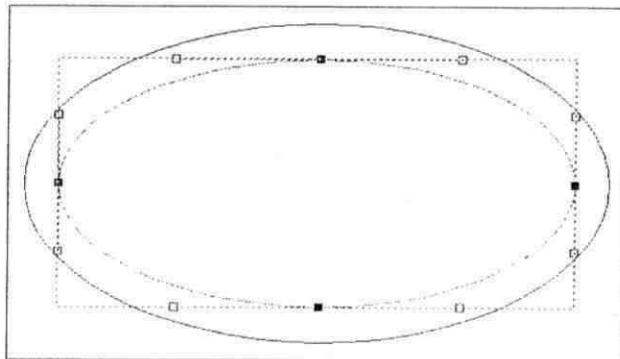


Creating the Inner Ellipse

Now we will draw an inner ellipse to complete the sign's framework:

1. Make sure the ellipse you have just created is selected by clicking on it.

2. Click on the **Copy** button  in the **File** area of the **Assistant's** Home page to create a duplicate of the selected ellipse and place it on the clipboard.
3. Click on the **Paste** button  in the **File** area to place the duplicate ellipse in your model, overlapping the original.
4. Click on the **Transform Vector(s)** button  in the **Position Size Align Vectors** area to display the **Transform Vector(s)** page.
5. In the **Size** area, click on the **Link Width and Height** option to turn it off .
6. Type 375 mm (15") in the **Size's New Width** box.
7. Type 175 mm (7") in the **Size's New Height** box.
8. Click on the **Apply** button to create a preview image of the second, scaled ellipse.
9. Click on the **Close** button to create the second, scaled ellipse in your model and return to the **Assistant's** Home page:

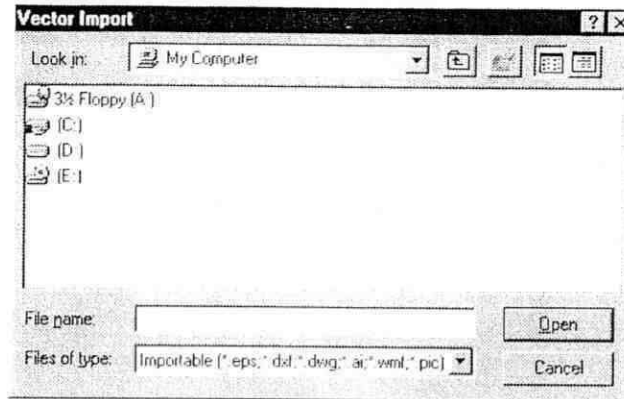


All three of the vector objects that you have drawn, as illustrated above, complete the frame for the *Aston Martin* sign.

Importing the Vector Artwork

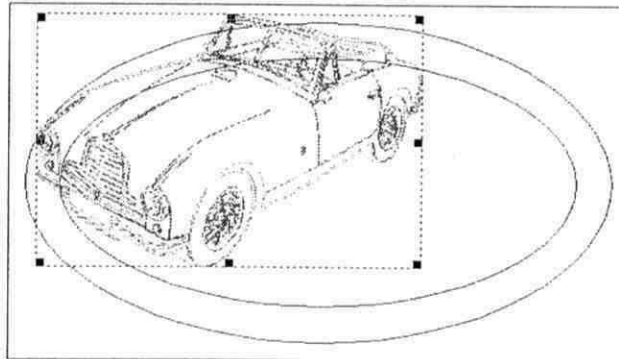
The next stage is to import the Aston Martin vector artwork:

1. Click on the **Import Vector Data** button  in the **File** area to display the **Vector Import** dialog box:




2. Click on the **Look In** list box and select ArtCAM Pro 6.0\Examples.
3. Click on the .eps file named *AstonCar* to select it, then click on the **Open** button to import the vector artwork.

The Aston Martin artwork is magenta, showing that it is a grouped set of vector objects:




4. Make sure that the grouped vector objects that make up the Aston Martin are selected by clicking anywhere on the Aston Martin.

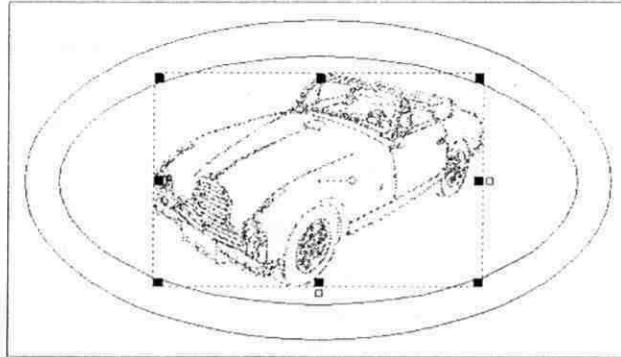
The grouped vector objects are magenta and surrounded by a bounding box.

5. Click on the **Centre In Page** button  to move the Aston Martin to the centre of your model.

As the Aston Martin overlaps the inner ellipse inside the frame, you will now reduce its size so that it fits.

6. Click on the **Transform Vector(s)** button  to display the **Transform Vector(s)** page.
7. Make sure that the **Link Width and Height** option is turned on ☒.

8. Type *150 mm (5.91")* in the **Size's New Height** box.
9. Click on the **Apply** button to create a preview image:




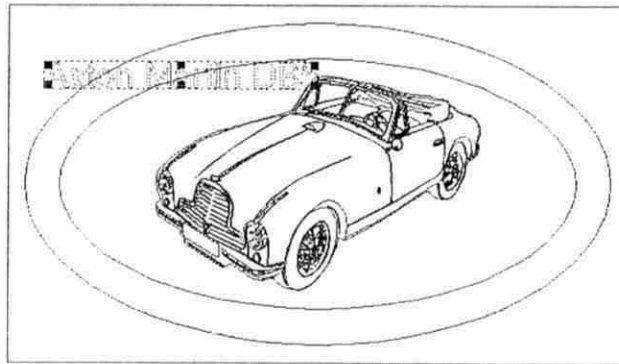
A value of *236.235 mm (9.3112")* automatically appears in the **Size's New Width** box. This is because the **Link Width and Height** option is on ☒.

10. Click on the **Close** button to resize the vector objects and return to the **Assistant's** Home page.

Creating the Vector Text

The next stage is to create vector text for the writing on the sign:

1. Click on the **Create Vector Text** button  in the **Vector Editing** area to display the **Text Tool** page.
2. Click on the **Font** list box, and then click on **Arial** to select it.
3. Click on the **Size** list box, and then click on the appropriate unit of measurement option (millimetres or inches).
4. Type *18 mm (0.71")* in the **Size** box.
5. In the **Spacing** area, type 8 in the **Character** box.
6. Click anywhere in your model (the white area in the **2D View** window), then type *Aston Martin DB5*.
7. Click the **Done** button to create the vector text and return to the **Assistant's** Home page.





Wrapping the Vector Text

Next, we will wrap the vector text around the inner ellipse:

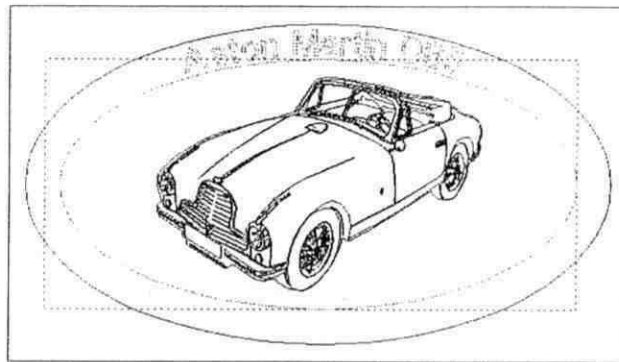
1. Click on the inner ellipse in your model to select it.
2. Hold the **Shift** key on your keyboard, and then click on the vector text to select it.

Both the inner ellipse and the vector text are magenta, showing that both are selected.

3. Click on the **Wrap Text Round A Curve** button  in the **Vector Editing** area to display the **Text On A Curve** page.
4. Click on the **Specify** radio button  to select it.

This option allows you to position the block of vector text around the inner ellipse, using a positive or negative value that you type in the **Specify** box.



5. Type 3 mm (0.12") in the **Specify** box.
6. Click on the **Update** button to offset the vector text from the inside edge of the inner ellipse.
7. Click on the **Text on Other Side** option to turn it on ☒. The vector text is moved to the outside edge of the inner ellipse.
8. Click and drag the vector text approximately into the centre of the frame, as shown below:



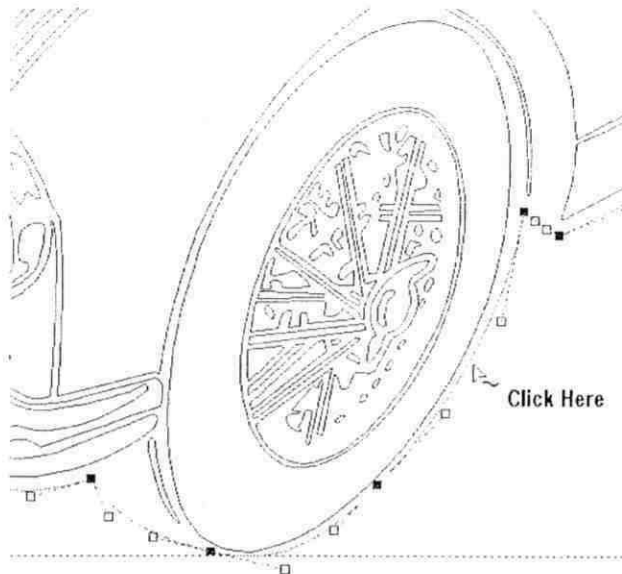
9. Click on the **OK** button to return to the **Assistant's** Home page.


Creating an Offset Vector

Next we will create a vector object, offset from the outline of the Aston Martin. This is referred to as the "offset vector":

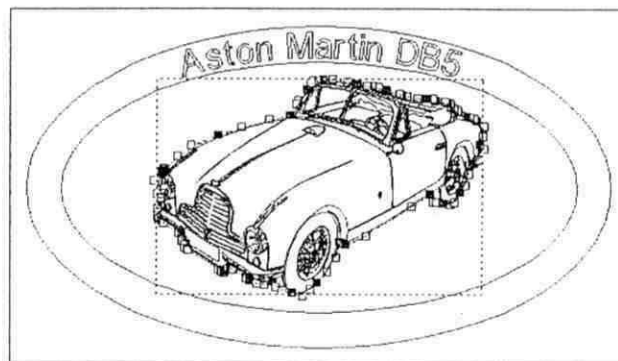
1. Click on the group of vector objects that make up the Aston Martin to select it.
2. Click on the **Ungroup** button  in the **Group Merge Join Vectors** area of the **Assistant's** Home page.
By ungrouping the group of vector objects, you can see that the Aston Martin is made up of a number of separate vector objects.
3. Click on the **Zoom In** button  in the **2D View** toolbar.
4. Click and drag to form a bounding box around the front wheel of the Aston Martin, then release the mouse button to zoom in on it.

5. Click on the outer vector object of the Aston Martin to select it:






6. Click on the **Window Fit** button  in the **2D View** toolbar to view the whole of the model.

You can clearly see the spans, points (nodes) and adjoining control points that make up the selected outer vector:

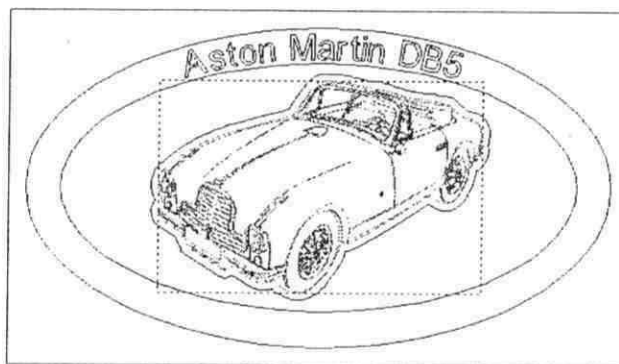



The offset vector you will now create acts as a boundary for the area clearance tool you will use to machine this area of the sign.

7. Click on the **Offset Vector(s)** button  in the **Vector Editing** area to display the **Offset Vector** page.
8. Type 5 mm (0.20") in the **Offset Distance** box.
9. Make sure that the **Outwards/Right** option is selected  for the **Offset Direction**.

10. Make sure that the **Sharp** option is selected  for the **Offset Corners**, and the **Max. Sharp Offset Distance** is set to *100 %*.
 11. Click on the **Offset** button to create the offset vector.
 12. Click on the **Close** button to return to the **Assistant's** Home page.
- You are now ready to regroup the vector objects that make up the Aston Martin car so that they can be machined at the same time.
13. Click and drag around the Aston Martin car and its offset vector to select all of the vector objects.
 14. Hold the **Shift** key on your keyboard, and then click on the offset vector to deselect it.

The offset vector is now black, whilst the vector objects that make up the Aston Martin remain magenta:



15. Click on the **Group** button  in the **Group Merge Join** area to group the vector objects that make up the Aston Martin.

Machining the Vectors

Now that we have positioned and resized the Aston Martin car, you will create the toolpaths that will be used to machine your model, and thus create your sign.

Clearing the Unwanted Material



First, we will create an area clearance toolpath that will remove the unwanted material in your model:

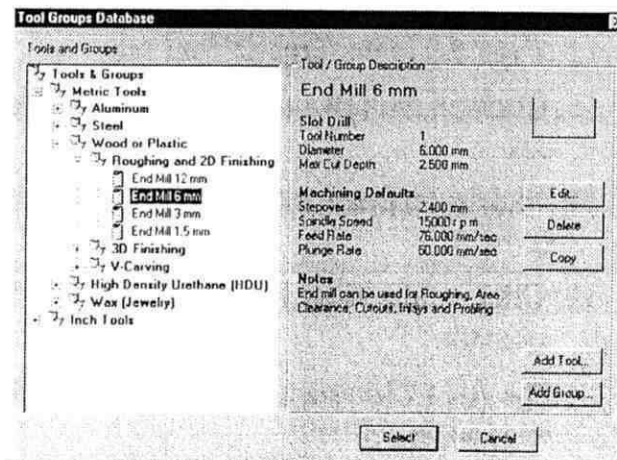
1. Click on the rectangle to select it.

2. Hold the **Shift** key on your keyboard, and then click on each of the ellipses and the offset vector in turn to select them:



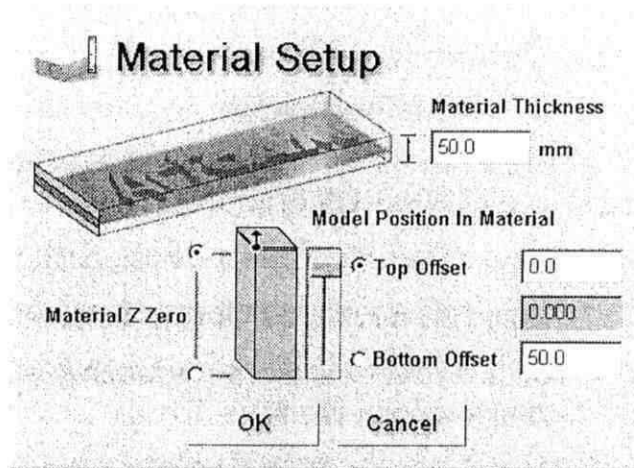
All of the selected vector objects turn magenta.

3. Click on the **Toolpaths** tab to display the **Toolpaths** Home page, then click on the **Area Clearance** button  to display the **2D Area Clearance** page.
4. Type **10 mm (0.39")** in the **Finish Depth** box.
5. Type **0.02 mm (0.001")** in the **Tolerance** box.
6. Click on the  arrow in the **Machine Safe Z** area of the page to display the **Safe Z** box.
7. Type **3 mm (0.12")** in the **Safe Z** box.
8. Click on the **Add** button beneath the **Tool List** window to display the **Tool Groups Database**:



9. Click on the **End Mill 6mm** (End Mill $\frac{1}{4}$ Inch) tool in the **Wood or Plastic\Roughing and 2D Finishing** tool group to select it.

10. Click on the **Select** button to close the **Tool Groups Database** and add the tool to the **Tool List** on the **2D Area Clearance** page.
11. Type 5 mm (0.20") in the **Stepover** box in the **Tool Settings** area.
12. Make sure that the **Raster** option is selected ☒ in the **Tool Clearance Strategy** area.
13. Click on the **Setup** button to display the **Material Setup** dialog box:



14. Make sure that the **Material Z Zero** is set to the top of the block, by clicking on the radio button ☒ at the top of the block.
15. Type 0.0 in the **Top Offset** box.
16. Click on the **OK** button to close the **Material Setup** dialog box
17. Make sure that the **Create 2D Preview** option is checked on ☒.
18. Click on the **Now** button to calculate the Area Clearance toolpath.


The Area Clearance toolpath appears in the **2D View** window as follows:

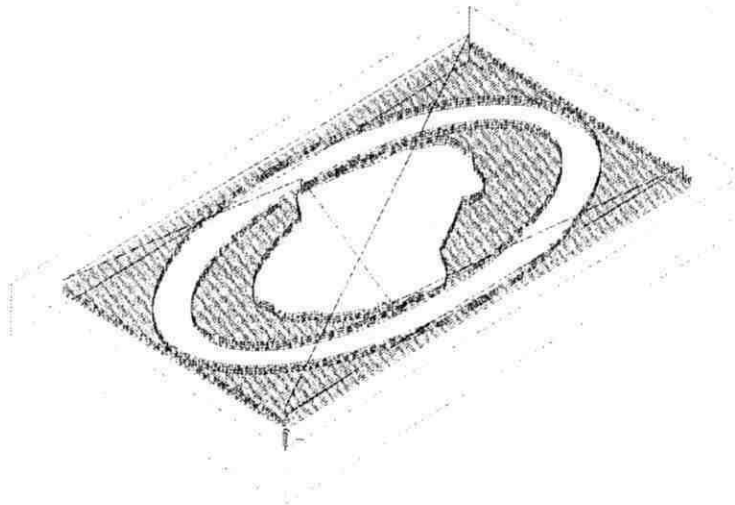


19. Click on the **Close** button to return to the **Assistant's** Home page.

Simulating the Toolpath

Now we can simulate the Area Clearance toolpath. A toolpath simulation allows you to visualise the machining passes used to machine your model.

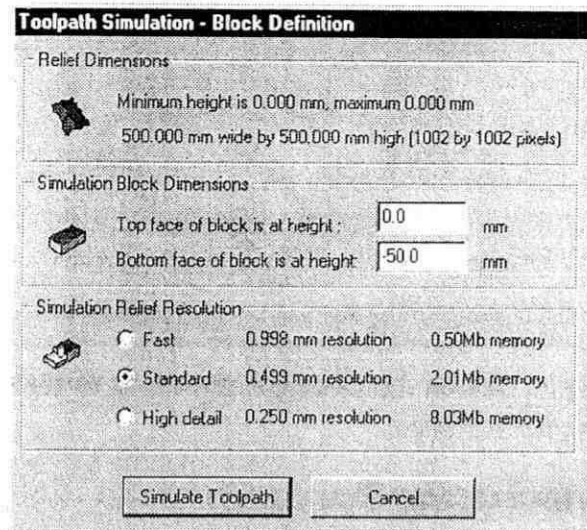
1. Click on the **3D View** button  in the **2D View** toolbar to display an isometric view of the Area Clearance toolpath in the **3D View** window:



2. Click on the **Toolpaths** tab to display the **Toolpaths** Home page.

The **Toolpaths** Home page allows you to edit, simulate and save the toolpaths that you have created.

3. Click on the **Simulate Toolpath** button  to display the **Toolpath Simulation - Block Definition** dialog box:




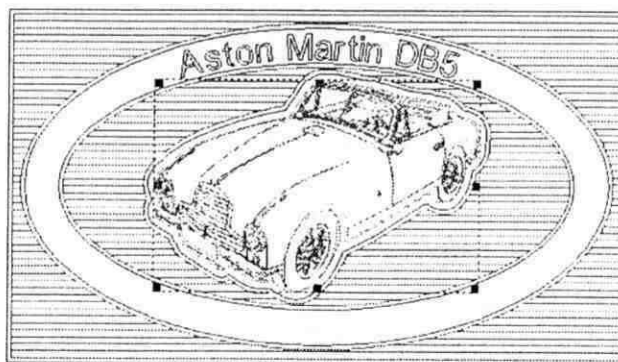
4. Click on the **Simulate Toolpath** button in the dialog box to simulate the Area Clearance toolpath.

As you simulate each individual toolpath, you will see in the **3D View** window what the machined sign would look like afterwards.

Carving the Aston Martin

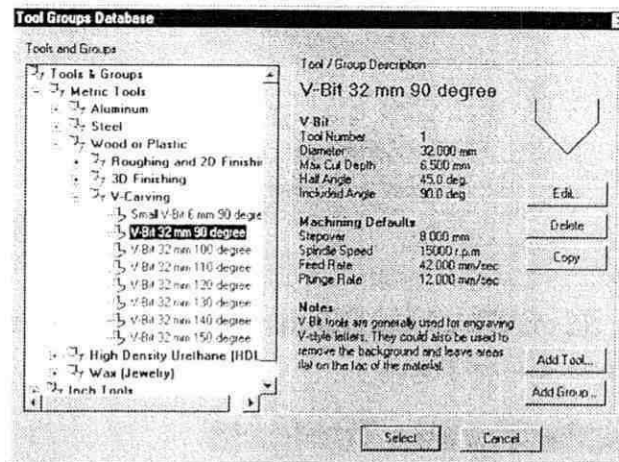
We are now ready to create a V-Bit Carving toolpath that will carve the Aston Martin vector object in your model:


1. Click on the **2D View** button  in the **3D View** toolbar to display the **2D View** window.
2. Click on the Aston Martin vector object to select it:



3. Click on the **Toolpaths** tab to display the **Toolpaths** Home page.
4. Click on the **V-Bit Carving** button  to display the **V-Bit Carving** page.
5. Type 0.02 mm (0.001") in the **Tolerance** box.

- Click on the **Select** button in the **Carving Tool** area to display the **Tool Groups Database**:



- Click on the **V-Bit 32 mm 90 degree** (V-Bit 1.25 Inch 90 degree) tool in the **Wood or Plastic\V-Carving** tool group to select it.
- Click on the **Select** button to close the **Tool Groups Database** and display the selected tool in the **Carving Tool** area of the **V-Bit Carving** page.
- Click on the  arrow to display the machining parameters of the selected tool.
- Click on the **Tool Number** list box, and then click on the number **2** option.

This number should correspond with the position of the tool in your CNC machine's tool changer.

- Click on the **Now** button to calculate the V-Bit Carving toolpath.

The Aston Martin vector object is colour-filled in cyan during the centreline calculation process. A progress bar appears beneath the **2D View** window indicating the progress ArtCAM Pro is making in calculating the centreline.


The V-Bit Carving toolpath appears in the **2D View** window as follows:

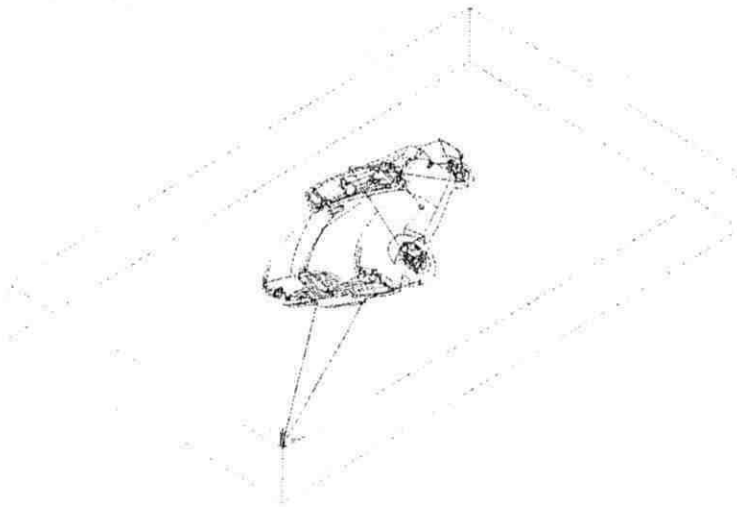



12. Click on the **Close** button to return to the **Assistant's** Home page.

Simulating the Toolpath

Now we can simulate the V-Bit Carving toolpath:


1. Click on the **3D View** button  in the **2D View** toolbar to display an isometric view of the V-Bit Carving toolpath in the **3D View** window:



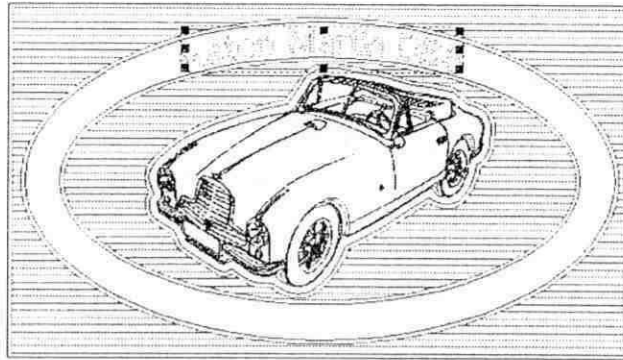
2. Click on the **Toolpath** tab to display the **Toolpaths** Home page.
3. Click on the **Simulate Toolpath** button  to simulate the V-Bit Carving toolpath.


Carving the Text

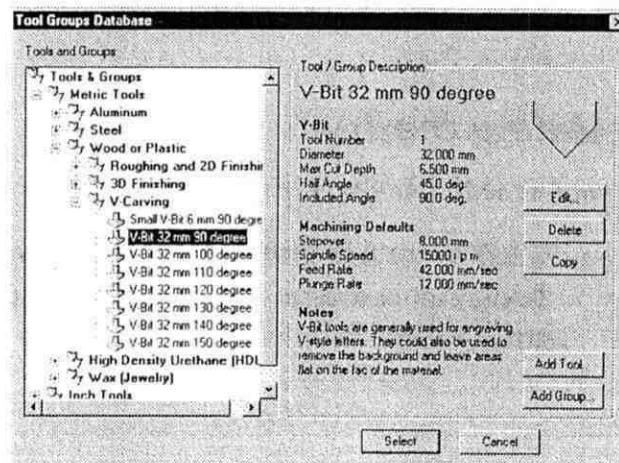
Next, we will create a V-Bit Carving toolpath that will carve the *Aston Martin DB5* vector text in your model:

1. Click on the **2D View** button  in the **3D View** toolbar to display the **2D View** window.

- Click on the *Aston Martin DB5* vector text to select it:




- Click on the **V-Bit Carving** button  to display the **V-Bit Carving** page.
- Type *0.02 mm (0.001")* in the **Tolerance** box.
- Click on the **Select** button in the **Carving Tool** area to display the **Tool Groups Database**:



- Click on the **V-Bit 32 mm 90 degree** (V-Bit 1.25 Inch 90 degree) tool in the **Wood or Plastic V-Carving** tool group to select it.

This tool is the same as that which was used to carve the Aston Martin vector object.

- Click on the **Select** button to close the **Tool Groups Database** and display the selected tool in the **Carving Tool** area of the page.
- Click on the  arrow to display the machining parameters of the selected tool.
- Click on the **Tool Number** list box, and then click on the number **2** option.

10. Click on the **Now** button to calculate the V-Bit Carving toolpath.

The *Aston Martin DB5* vector text is colour-filled in cyan during the centreline calculation process.


The V-Bit Carving toolpath appears in the **2D View** window as follows:

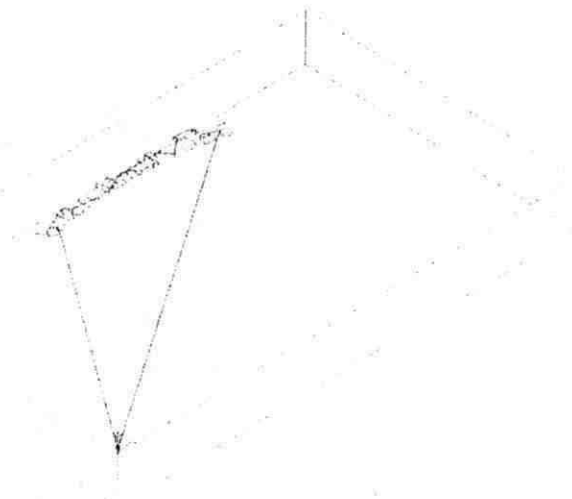



11. Click on the **Close** button to return to the **Assistant's** Home page.

Simulating the Toolpath

Now we can simulate the V-Bit Carving toolpath:



1. Click on the **3D View** button  in the **2D View** toolbar to display an isometric view of the V-Bit Carving toolpath in the **3D View** window:

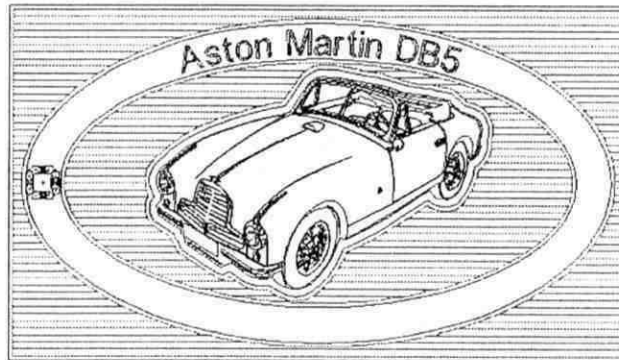


2. Click on the **Toolpaths** tab to display the **Toolpaths** Home page.
3. Click on the **Simulate Toolpath** button  to simulate the V-Bit Carving toolpath.

Marking the Drill Holes with Circles

Now we will mark the position of the drill holes that you want to machine using circles:

1. Click on the **2D View** button  in the **3D View** toolbar to display the **2D View** window.
2. Click on the **Assistant** tab to display the **Assistant's** Home page.
3. Click on the **Create Circles** button  in the **Vector Editing** area to display the **Circle Creation** page.
4. Type *50 mm (2")* in the **Circle Centre's X** box.
5. Type *150 mm (6")* in the **Circle Centre's Y** box.
6. Type *9 mm (0.35")* in the **Circle Radius** box.
7. Click on the **Create** button to create a circle between the middle of the inner and outer ellipse on the left side of the model:



8. Type *450 mm (18")* in the **Circle Centre's X** box.
9. Type *150 mm (6")* in the **Circle Centre's Y** box.
10. Type *9 mm (0.35")* in the **Circle Radius** box.
11. Click on the **Create** button to create a circle between the middle of the inner and outer ellipse on the right side of the model, opposite the first drill hole.
12. Click on the **Close** button to return to the **Assistant's** Home page.




Creating the Drill Holes

In this next stage, we will create drill holes inside the selected circles:

1. Hold the **Shift** key on your keyboard, and then click on both of the circles that you have created to select them.

The circles turn magenta and are surrounded by a bounding box:



2. Click on the **Toolpaths** tab to display the **Toolpaths** Home page.
3. Click on the **Drilling** button  to display the **Drilling** page.
4. Type 50 mm (2") in the **Finish Depth** box.
5. Click on the **Select** button in the **Tool** area of the page to display the **Tool Groups Database**.
6. Click on the **End Mill 12 mm** (End Mill ½ Inch) tool in the **Wood or Plastic\ Roughing and 2D Finishing** tool group to select it.
7. Click on the **Select** button to close the **Tool Groups Database** and display the selected tool in the **Tool** area of the **Drilling** page.
8. Click on the  arrow to display the machining parameters of the selected tool.
9. Click on the **Tool Number** list box, and then click on the number **3** option.
10. Click on the **Circular Vectors** radio button  in the **Drill Centre of...** area of the page to select it.

This option is used because you have selected circles to define the position of the drill holes.
11. Make sure that the **Create 2D Preview** option is checked on ☒.
12. Click on the **Now** button to calculate the Drilling toolpath.


The Drilling toolpath appears in the 2D View window, shown as a cross in the centre of both circles.

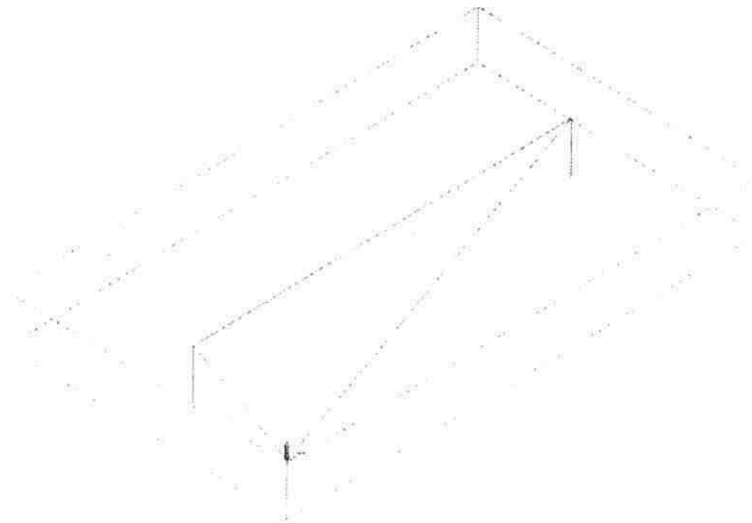
13. Click on the **Close** button to return to the **Assistant's** Home page.
14. Press the **Delete** key on your keyboard to delete the two circles, leaving just the drill holes:




Simulating the Toolpath

Now we can simulate the Drilling toolpath:

1. Click on the **3D View** button  in the **2D View** toolbar to display an isometric view of the Drilling toolpath in the **3D View** window:



2. Click on the **Toolpaths** tab to display the **Toolpaths** Home page.
3. Click on the **Simulate Toolpath** button  to simulate the Drilling toolpath.

You have simulated all of the toolpaths you will use to create the Aston Martin sign. The **3D View** window now gives an impression of what the model will look like after all of the toolpaths have been machined.


Saving the Toolpaths

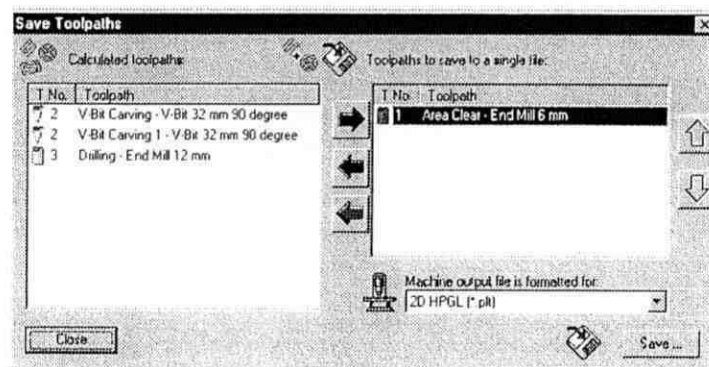
We are now ready to save the toolpaths that you have created to machine the *Aston Martin* sign.


We will save the toolpaths as separate files, grouping together those that use the same tool. Both of the **V-Bit Carving** toolpaths have the same tool number because the **V-Bit 32 mm 90 degree** (V-Bit 1.25 Inch 90 degree) tool is used in each of them.


1. Click on the **Toolpaths** tab to display the **Toolpaths** Home page.
2. Click on the **Area Clear** toolpath to select it.

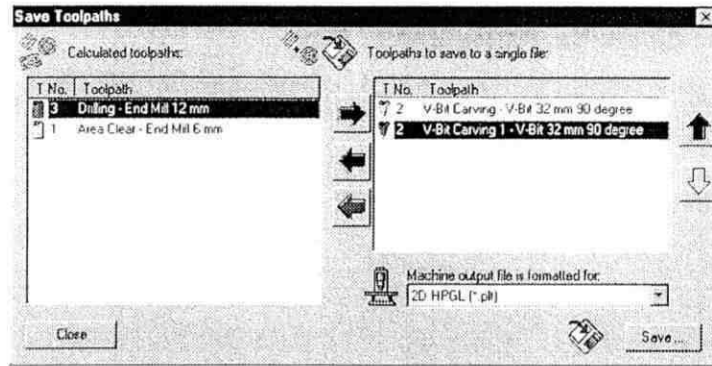
The toolpath name at the top of the page is highlighted in blue.

3. Click on the **Save Toolpaths** button  to display the **Save Toolpaths** dialog box:





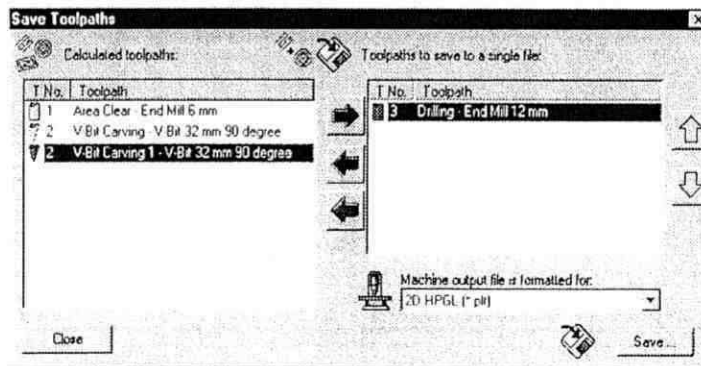
4. Click on the **Machine output file is formatted for** list box and select the format compatible with your machine.
5. Click on the **Save...** button to open the **Save As...** dialog box.
6. Type *Area Clearance* in the **File Name** box.
7. Click on the **Save** button to save the toolpath to the selected directory.
8. Click on the  button to send the **Area Clear** toolpath to the **Calculated Toolpaths** window.

9. Hold the **Shift** key on your keyboard, and then click on both of the **V-Bit Carving** toolpaths in the **Calculated Toolpaths** window to select them.
10. Click on the  arrow to send both of the selected toolpaths to the **Toolpaths to save to a single file** window:



Both of the **V-Bit Carving** toolpaths are saved as a single file because the **V-Bit 32 mm 90 degree** (V-Bit 1.25 Inch 90 degree) tool is used in each of them.

11. Click on the **Save...** button to open the **Save As...** dialog box.
12. Type *V-Bit Carving* in the **File Name** box.
13. Click on the **Save** button to save the toolpath.
14. Click on the  button to send both the **V-Bit Carving** and the **V-Bit Carving 1** toolpath to the **Calculated Toolpaths** window.
15. Click on the **Drilling** toolpath to select it.
16. Click on the  button to send the selected toolpath to the **Toolpaths to save to a single file** window:



17. Click on the **Save...** button to open the **Save As...** dialog box.

18. Type *Drilling* in the **File Name** box.
19. Click on the **Save** button to save the toolpath.
20. Click on the **Close** button to close the **Save Toolpaths** dialog box.

These toolpath files can now be sent to your CNC machine tool to create the *Aston Martin* sign.

Tutorial – Smart Engraving

Overview

The following tutorial demonstrates how to create engraved text using the vector editing and the Smart Engraving toolpath available in ArtCAM Pro.

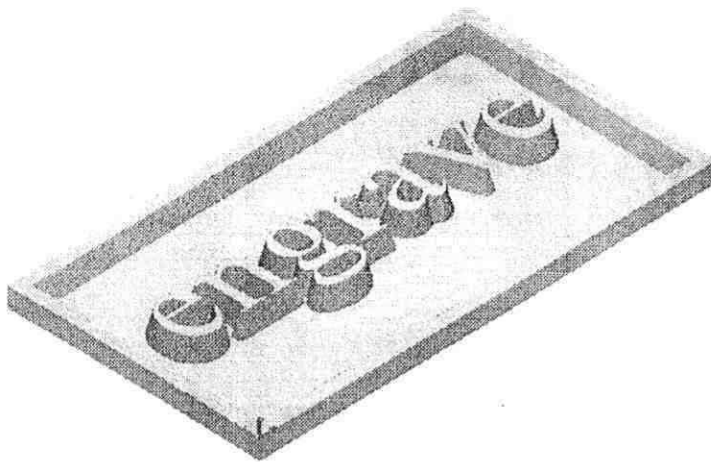
A Smart Engraving toolpath allows you to produce engraved vector text effectively and efficiently.

Engraved Text

The stages that you will cover during the course of this tutorial are:


- Preparing the model.
- Creating the outer-edge of the engraved area.
- Creating the vector text.
- Machining the model.
- Saving the toolpaths.

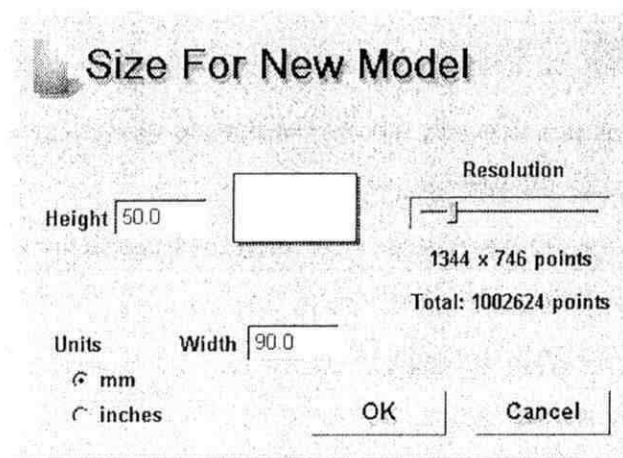
The tutorial will lead you through each of these stages, guiding you through the complete process of creating the engraved text below:



Preparing the Model

First, we will set up the model dimensions needed for this particular job:

1. Click on the **Create New Model**  icon in the **Assistant** window to display the **Size For New Model** dialog box:







2. Click on the **Units** option ☒ that you want to use (millimetres or inches).
3. Type 50 mm (2.0") in the **Height** box and 90 mm (3.5") in the **Width** box.
4. Click and drag on the **Resolution** slider to set the resolution of the model to 1002624 points.
5. Click on the **OK** button to close the **Size For New Model** dialog box.

A **2D View** window automatically fills the previously empty design window area. This window represents the block of material viewed down the Z-axis.

Defining the Outer-Edge of the Engraved Area



In this next stage we will create a rectangle that represents the outer-edge of the area to be engraved:

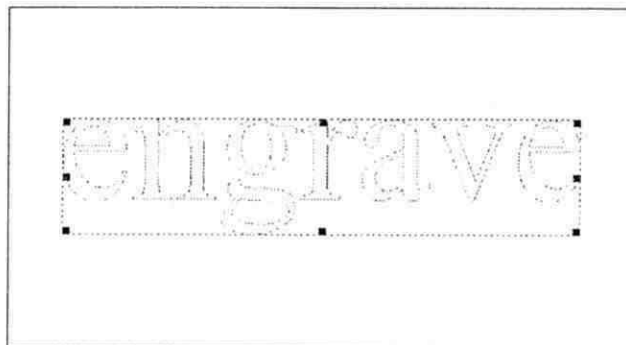
1. Click on the **Assistant** tab  to display the **Assistant's** Home page.
2. Click on the **Create Rectangle** button  in the **Vector Editing** area to display the **Rectangle Creation** page.
3. Make sure that the **Rectangle** option is selected .
4. Type 45 mm (1.8") in the **Height** box and 85 mm (3.3") in the **Width** box.
5. Click on the **Preview** button to view the rectangle. It is centred on the model's origin, which is in the bottom left corner.
6. Click on the **Create** button to create the rectangle in your model.
7. Click on the **Close** button to return to the **Assistant's** Home page.
8. Make sure that the rectangle is selected by clicking on it. The rectangle should be green and surrounded by a bounding box.
9. Click on the **Centre In Page** button  in the **Position Size Align Vectors** area to move the rectangle to the centre of your model.

This rectangle represents the outer-edge of the area to be engraved.

Creating the Vector Text

The next stage is to create the vector text that we will engrave:


1. Click on the **Create Vector Text** button  in the **Vector Editing** area of the **Assistant's** Home page to display the **Text Tool** page.
2. Click on the **Font** list box, and then click on **Times New Roman** to select it.
3. Click on the **Size** list box, and then click on the appropriate units of measurement.
4. Type *15 mm (0.6")* in the **Size** box.
5. In the **Spacing** area, type 8 in the **Character** box.
6. Click anywhere in your model (the white area in the **2D View** window), then type *engrave*.
7. Click the **Done** button on the **Text Tool** page to create the vector text and return to the **Assistant's** Home page.
8. Make sure that the *engrave* vector text is selected by clicking on it. The *engrave* vector text should be magenta and surrounded by a bounding box.
9. Click on the **Centre In Page** button  to move the vector text to the centre of your model:



Machining the Model

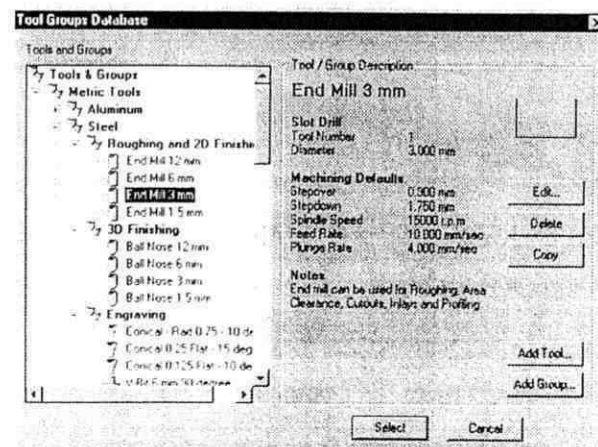
Next, we will create two toolpaths to engrave the design. A 3 mm End Mill (1/8 Inch End Mill) tool will be used to rough the part and a Conical 0.25 mm Flat – 15 degrees (Conical 0.01 Inch Flat – 15 degrees) tool will be used to finish engrave it:


1. Click on the rectangle to select it.
2. Hold the **Shift** key on your keyboard, then click on the *engrave* vector text to select it. Both the vector text and the rectangle turn magenta.

3. Click on the **Toolpaths** tab to display the **Toolpaths** Home page.
4. Click on the **Engraving** button  to display the **Smart Engraving** page.
5. Type 4 mm (0.15") in the **Finish Depth** box and 0.02 mm (0.001") in the **Tolerance** box.
6. Make sure that the **Vectors are on surface** option is turned on ☒.
7. Make sure that the **Offset end mills for engraving tools** option is turned on ☒.

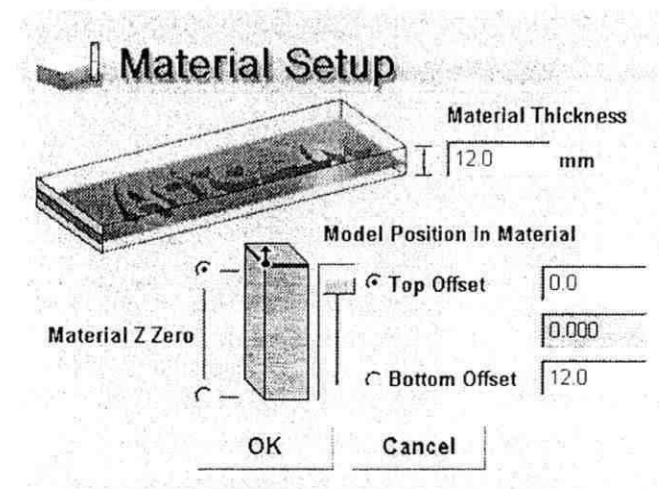
This option will automatically offset the roughing tool in order to leave sufficient material for the angled-edge of the Conical engraving tool to form the side of the engraved feature.



8. Click on the  arrow in the **Machine Safe Z** area of the page to display the **Safe Z** box.
9. Type 3 mm (0.12") in the **Safe Z** box.
10. Click on the **Add** button in the **Tools List** area of the page to display the **Tool Groups Database**:

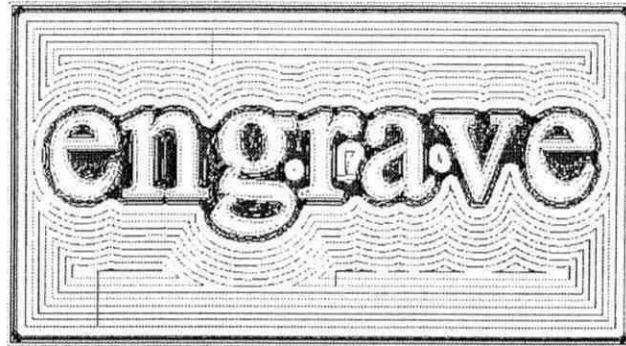


11. Click on the **End Mill 3mm** (End Mill 1/8 Inch) tool in the **Steel\Roughing and 2D Finishing** tool group to select it.
 12. Click on the **Select** button to close the **Tool Groups Database** and display the selected tool in the **Smart Engraving** page.
 13. Click on the **Add** button to display the **Tool Groups Database** again.
 14. Click on the **Conical 0.25 Flat – 15 degrees** (Conical 0.01 Flat – 15 degrees) tool in the **Steel\Engraving** tool group to select it.
 15. Click on the **Select** button to close the **Tool Groups Database** and display this tool under the End Mill tool in the **Smart Engraving** page.
 16. Click on the  arrow to display the machining parameters of the Conical tool.
 17. Click on the **Tool Number** list box, and then click on the number **2** option.

This number should correspond with the position of the Conical tool in your CNC machine's tool changer.
 18. Click on the **Do corner sharpening** option to turn it on ☒.
- The corners of the engraved feature will be sharpened by the Conical engraving tool.
19. Click on the **Setup** button to display the **Material Setup** dialog box:



20. Type *12 mm (0.5")* in the **Material Thickness** box.
21. Make sure that the **Material Z Zero** is set to the top of the block by clicking on the radio button  at the top of the block.
22. Type *0.0* in the **Top Offset** box.
23. Click on the **OK** button to close the **Material Setup** dialog box.
24. Make sure that the **Create 2D Preview** option is checked on .
25. Click on the **Now** button to calculate the Smart Engraving toolpath. The Smart Engraving toolpath appears in the **2D View** window as follows:



26. Click on the **Close** button to return to the **Assistant's** Home page.

Tutorial – Bevelled Carving

Overview

The following tutorial demonstrates how to create bevelled (angle-edged) lettering using the vector text and 2D toolpath tools available in ArtCAM Pro.

Bevelled Letter B


The stages that you will cover during the course of this tutorial are:

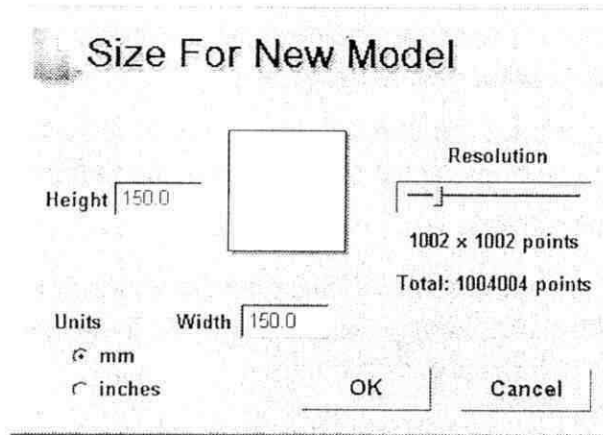
- Preparing the model.
- Creating the vector text.
- Machining the vector text.

The tutorial will lead you through each of these stages, guiding you through the complete process of creating a bevelled letter *B*.

Preparing the Model

First, we will set up the model dimensions needed for this particular job:

1. Click on the **Create New Model**  icon in the **Assistant** window to display the **Size For New Model** dialog box:






2. Click on the **Units** option ☒ that you want to use (millimetres or inches).
3. Type *150 mm (6")* in the **Height** box and *150 mm (6")* in the **Width** box.
4. Click and drag on the **Resolution** slider to set the resolution of the model to *1004004* points.
5. Click on the **OK** button to close the **Size For New Model** dialog box.

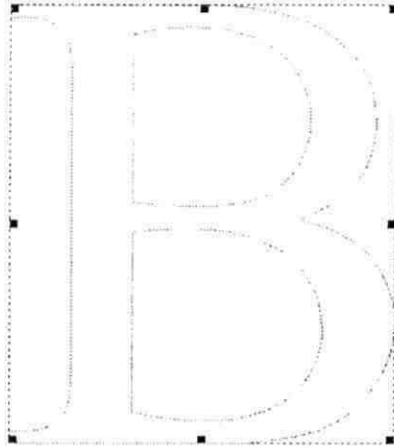
A **2D View** window automatically fills the previously empty design window area. This window represents the block of material viewed down the Z-axis.

Creating the Vector Text

Now we will create the vector text we will use to produce the bevelled letter *B*:



1. Click on the **Assistant** tab  to display the **Assistant's** Home page.
2. Click on the **Create Vector Text** button  in the **Vector Editing** area to display the **Text Tool** page.
3. Click on the **Font** list box, and then click on **Times New Roman** to select it.
4. Click on the **Size** list box, and then click on the appropriate units of measurement.
5. Type *110 mm (4.3")* in the **Size** box.
6. Click anywhere in your model (the white area in the **2D View** window), then hold the **Shift** key on your keyboard and type *B*.

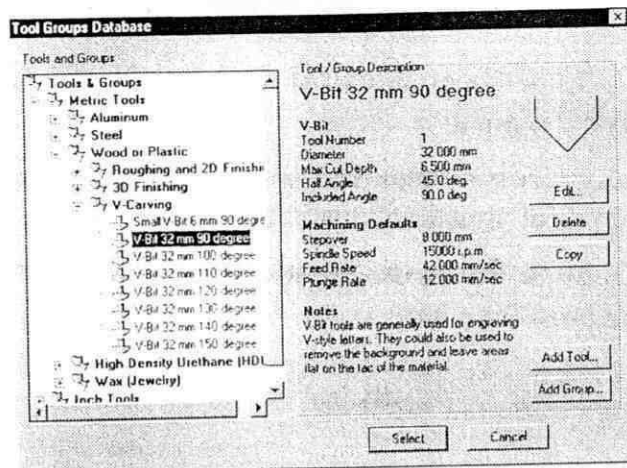
7. Click on the **Done** button to create the vector text and return to the **Assistant's** Home page.
8. Make sure that the *B* vector text is selected by clicking on it. The *B* vector text should be magenta and surrounded by a bounding box.
9. Click on the **Centre In Page** button  in the **Position Size Align Vectors** area to move the *B* vector text to the centre of your model.



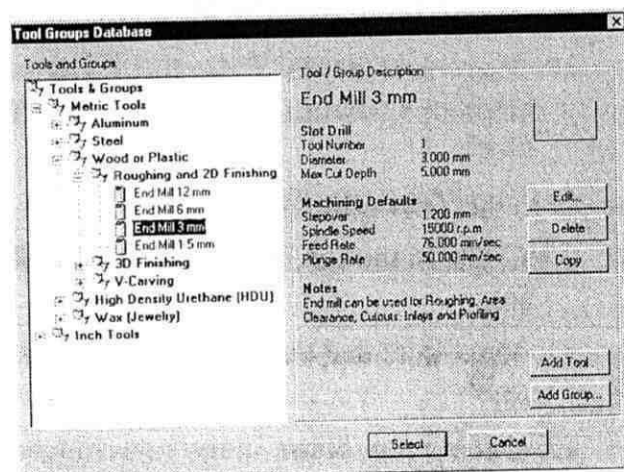
Machining the Vector Text


We are now ready to create the toolpath that will be used to machine the *B* vector text, and thus create the bevelled letter:

1. Click on the **Toolpaths** tab to display the **Toolpaths** Home page.
2. Click on the **Bevel Carving** button  to display the **3D Bevel Carving** page.
3. Type 3 mm (0.15") in the **Wall Height** box.
4. Type 15 mm (0.6") in the **Finish Depth** box.
5. Type 0.02 mm (0.001") in the **Tolerance** box.
6. Click on the  arrow in the **Machine Safe Z** area of the page to display the **Safe Z** box.
7. Type 3 mm (0.12") in the **Safe Z** box.
8. First, select the Carving tool by clicking on the **Select** button in the **Carving Tool** area:



9. In the **Tool Groups Database**, click on the **V-Bit 32 mm 90 degree** (V-Bit 1.25 Inch 90 degree) tool in the **Wood or Plastic\V-Carving** tool group to select it.
10. Click on the **Select** button to close the **Tool Groups Database** and display the selected tool in the **Carving Tool** area of the **3D Bevel Carving** page.
11. Next, we will select the Profiling tool by clicking on the **Select** button in the **Profiling Tool** area:

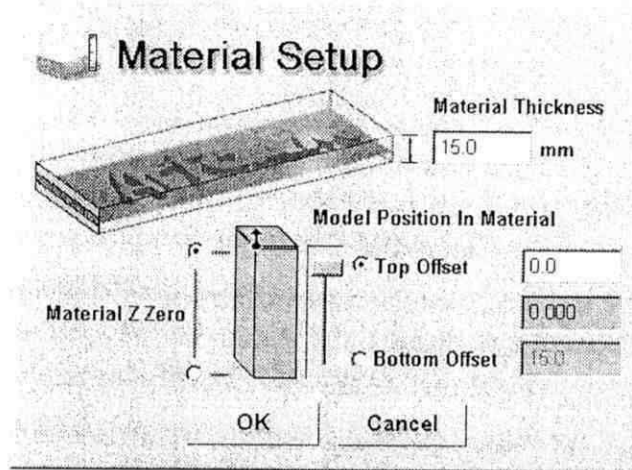


12. In the **Tool Groups Database**, click on the **End Mill 3 mm** (End Mill 1/8 Inch) tool in the **Wood or Plastic\Roughing and 2D Finishing** tool group to select it.
13. Click on the **Select** button to close the **Tool Groups Database** and display the selected tool in the **Profiling Tool** area of the **3D Bevel Carving** page.
14. Click on the  arrow to display the machining parameters of the Profiling tool.

15. Click on the **Tool Number** list box, and then click on the number **2** option.

This number should correspond with the position of the tool in your CNC machine's tool changer.

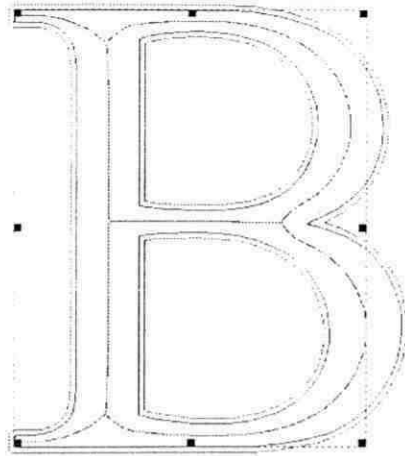
16. Click on the **Setup** button to display the **Material Setup** dialog box:



17. Type *15 mm (0.6")* in the **Material Thickness** box.
18. Make sure that the **Material Z Zero** is set to the top of the block by clicking on the radio button ☒ at the top of the block.
19. Type *0.0* in the **Top Offset** box.
20. Click on the **OK** button to close the **Material Setup** dialog box.
21. Make sure that the **Create 2D Preview** option is checked on ☒.
22. Click on the **Now** button to calculate the Bevelled Carving toolpath.

The *B* vector text is colour-filled in cyan during the centreline calculation process. A progress bar appears beneath the **2D View** window indicating the progress ArtCAM Pro is making in calculating the centreline.

The Bevelled Carving toolpath appears in the **2D View** window as follows:



23. Click on the **Close** button to return to the **Assistant's** Home page.

Tutorial – Nesting Vectors

Overview

The following tutorial demonstrates how the Nesting tool in ArtCAM Pro repositions vector objects in order to minimise material wastage when you are machining.

Nesting Vectors

The stages that you will cover during the course of this tutorial are:

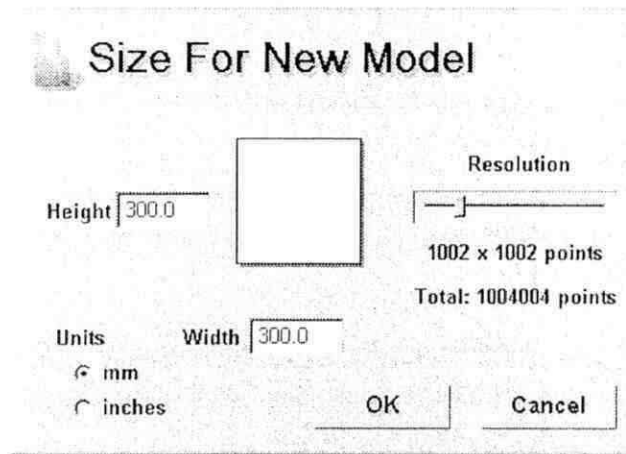
- Preparing the model.
- Defining the material shape.
- Creating the vector text.
- Nesting the vector text.
- Machining the nested vector text.

The tutorial will lead you through each of these stages, guiding you through the complete process of nesting. At the end of this tutorial you will have nested text within an area of material, and created the toolpath with which to machine it.

Preparing the Model

First, we will set up the model dimensions needed for this particular job:

1. Click on the **Create New Model**  icon in the **Assistant** window to display the **Size For New Model** dialog box:






2. Click on the **Units** option ☒ that you want to use (millimetres or inches).
3. Type *300 mm (12")* in both the **Height** and **Width** boxes.
4. Click and drag on the **Resolution** slider to set the resolution of the model to *1004004* points.
5. Click on the **OK** button to close the **Size For New Model** dialog box.

A **2D View** window automatically fills the previously empty design window area. This window represents the block of material viewed down the Z-axis.

Defining the Material Shape

In this next stage, we will create the vector object in which we will nest the vector text:

1. Click on the **Assistant** tab  to display the **Assistant's** Home page.
2. Click on the **Create Rectangle** button  in the **Vector Editing** area to display the **Rectangle Creation** page.
3. Make sure that the **Rectangle** option is selected ☒.
4. Type *75 mm (3")* in the **Height** box.
5. Type *200 mm (8")* in the **Width** box.

6. Click on the **Preview** button to view the rectangle. It is centred on the model's origin, which is in the bottom left hand corner.
7. Click on the **Create** button to create the rectangle in your model.
8. Click on the **Close** button to return to the **Assistant's** Home page.
9. Make sure that the rectangle is selected by clicking on it. The rectangle should be green and surrounded by a bounding box.
10. Click on the **Centre In Page** button  in the **Position Size Align Vectors** area to move the rectangle to the centre of your model.
11. Move the cursor over the right edge of the rectangle, right-click to display the **Vector Editing** menu, then click on the **Convert span to arc** option.

The rectangle now appears as follows:




12. Move the cursor over the left edge of the rectangle, then press the **A** key on your keyboard to convert this span to an arc as well.

This vector object represents the total area of the material you have available in which to machine a block of vector text.

Creating the Vector Text

Now that we have created the vector object, we will create the vector text that shall be nested within it:

1. Click on the **Create Vector Text** button  in the **Vector Editing** area to display the **Text Tool** page.

2. Click on the **Font** list box, and then click on **Arial** to select it.
3. Click on the **Size** list box, and then click on the appropriate units of measurement.
4. Type 35 mm (1.38") in the **Size** box.
5. In the **Spacing** area, type 8 in the **Character** box.
6. Click on the **Bold** button  to type in bold.
7. Click anywhere in your model (the white area in the **2D View** window), then type *ArtCAM Pro*.
8. Click on the **Done** button to create the vector text and return to the **Assistant's** Home page.

The vector text appears, surrounded by a bounding box indicating that it is selected.

Nesting the Vector Text

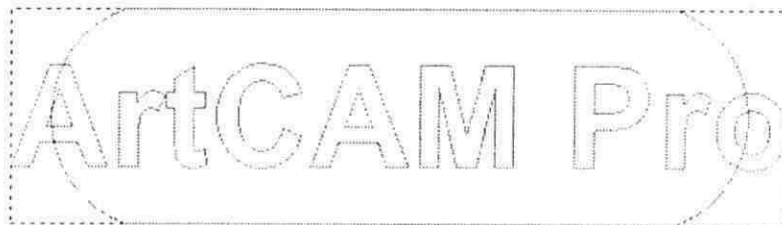
We are now ready to nest the *ArtCAM Pro* vector text within the vector object representing the material:


1. Click on the vector object representing the material in your model to select it.

The vector object changes from black to green.

2. Hold the **Shift** key on your keyboard, and then click on the vector text to select it as well.

Both the vector object and the *ArtCAM Pro* vector text are magenta, and surrounded by a bounding box:



3. Click on the **Nesting** button  in the **Position Size Align Vectors** area to display **Nesting** page.
4. Type 3 mm (0.125") in the **Tool Diameter (D)** box.
5. Click on the **Allow Part Rotation** option to turn it on ☒.
6. Type 45 ° in the **Step Angle (A)** box.

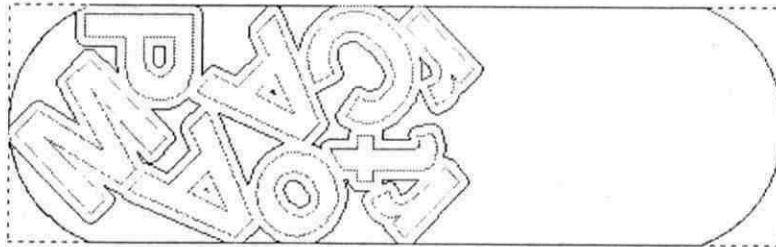
7. Make sure that the **Bottom Left** option is selected in the **Nest From** list box by clicking on it.
8. Type *0.02 mm (0.001")* in the **Curve Tolerance** box.
9. Click on the **Create Leftover Material Vector** option to turn it on ☒.

This option creates a vector object that represents the area of material after the vector text has been machined.

10. Click on the **Nest** button.

A progress bar appears beneath the **2D View** window indicating the progress ArtCAM Pro is making in calculating the position of the nested vector text.

The nested vector text appears in the **2D View** window as follows:



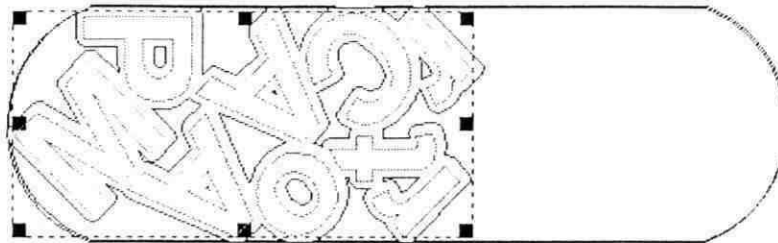
11. Click on the **Close** button to return to the **Assistant's** Home page.
12. Click on the vector object representing the total area of the material to select it.




You can see that the area of the material that surrounds the nested vector text is now a vector object in which you could nest other vector objects into. You could save this vector object for the next time you use this area of material in a job.

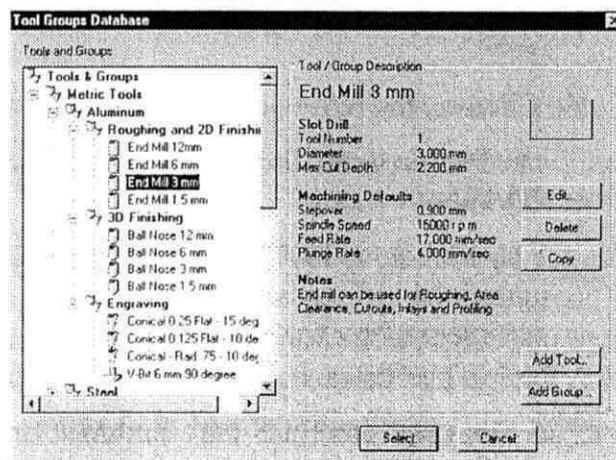
Machining the Nested Vector Text

Now that the *ArtCAM Pro* vector text has been nested, we are ready to create the Profile toolpath that will be used to machine it:

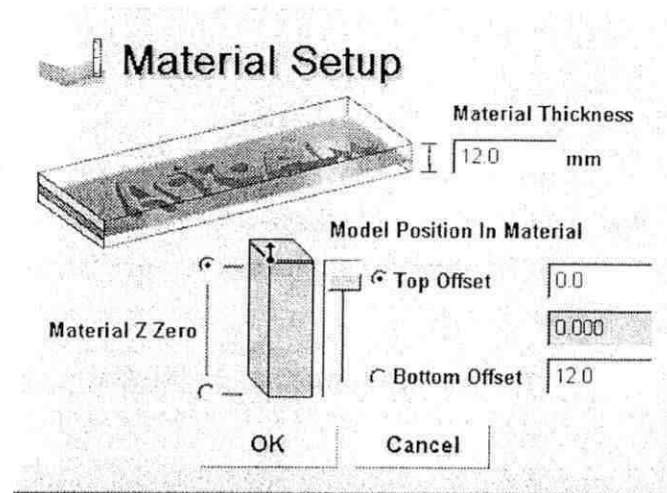
1. Click anywhere in the **2D View** window to deselect the vector objects.
2. Click on the nested vector text to select it.



3. Click on the **Toolpaths** tab to display the **Toolpaths** Home page.
4. Click on the **Profiling** button  to display the **Profiling** page.
5. Make sure that the **Outside** radio button  is selected.
6. Make sure that the **Finish Depth** is set to *12 mm (0.5")*.
7. Type *0.02 mm (0.001")* in the **Tolerance** box.
8. Click on the  arrow in the **Machine Safe Z** area of the page to display the **Safe Z** box.
9. Type *3 mm (0.12")* in the **Safe Z** box.
10. Click on the **Select** button in the **Profiling Tool** area of the page to display the **Tool Groups Database**:



11. Click on the **End Mill 3mm (End Mill 1/8 Inch)** tool in the **Aluminum\Roughing and 2D Finishing** tool group to select it.
12. Click on the **Select** button to close the **Tool Groups Database** and display the selected tool in the **Nesting** page.
13. Click on the **Setup** button to display the **Material Setup** dialog box:



14. Type *12 mm (0.5")* in the **Material Thickness** box.
15. Make sure that the **Material Z Zero** is set to the top of the block by clicking on the radio button ☒ at the top of the block.
16. Type *0.0* in the **Top Offset** box.
17. Click on the **OK** button to close the **Material Setup** dialog box.
18. Make sure that the **Create 2D Preview** option is checked on ☒.
19. Click on the **Now** button to calculate the Profile toolpath.

The Profile toolpath appears around the nested letters in the **2D View** window.

You can see by looking at the toolpath that ArtCAM Pro has nested the individual characters in this way to leave a sufficient offset for the 3mm End Mill (1/8 Inch End Mill) tool to profile each of them without causing gouging.

A 3mm End Mill (1/8 Inch End Mill) tool must be used to machine the nested vector text for each character to be cut from the area of material successfully.

20. Click on the **Close** button to return to the **Assistant's** Home page.

Tutorial - Bridging

Overview

The following tutorial demonstrates how to add bridges, also referred to as tabs, to a Profile toolpath. Bridges are used to hold a part in place during machining.

Bridged Letter B


The stages that you will cover during the course of this tutorial are:

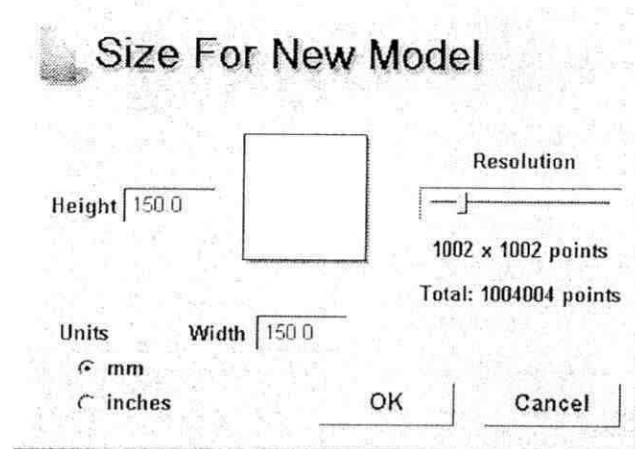
- Preparing the model.
- Creating the vector text.
- Creating the toolpath.
- Adding the bridges.
- Editing the bridges.
- Viewing the toolpath.

The tutorial will lead you through each of these stages, guiding you through the complete process of creating a profiled letter *B* with bridging.

Preparing the Model

First, we will set up the model dimensions needed for this particular job:

1. Click on the **Create New Model**  icon in the **Assistant** window to display the **Size For New Model** dialog box:






2. Click on the **Units** option ☒ that you want to use (millimetres or inches).
3. Type *150 mm (6")* in the **Height** box and *150 mm (6")* in the **Width** box.
4. Click and drag on the **Resolution** slider to set the resolution of the model to *1004004* points.
5. Click on the **OK** button to close the **Size For New Model** dialog box.

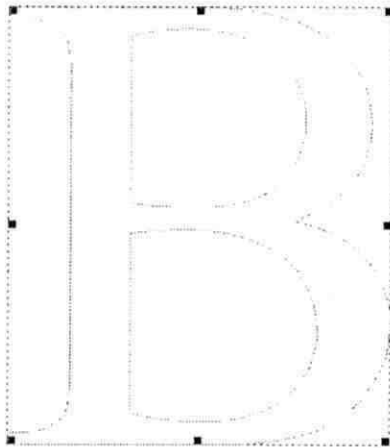
A **2D View** window automatically fills the previously empty design window area. This window represents the block of material viewed down the Z-axis.

Creating the Vector Text

The next stage is to create the vector text to which we will be adding bridging:




1. Click on the **Assistant** tab  to display the **Assistant's** Home page.
2. Click on the **Create Vector Text** button  in the **Vector Editing** area to display the **Text Tool** page.
3. Click on the **Font** list box, and then click on **Times New Roman** to select it.
4. Click on the **Size** list box, and then click on the appropriate units of measurement.
5. Type *110 mm (4.3")* in the **Size** box.

6. Click anywhere in your model (the white area in the **2D View** window), then hold the **Shift** key on your keyboard and type *B*.
7. Click on the **Done** button to create the vector text and return to the **Assistant's** Home page.
8. Make sure that the *B* vector text is selected by clicking on it. The *B* vector text should be magenta and surrounded by a bounding box.
9. Click on the **Centre In Page** button  in the **Position Size Align Vectors** area to place the *B* vector text in the centre of your model:

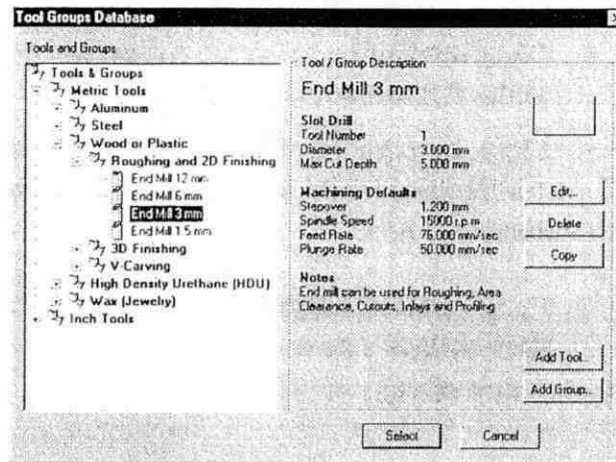


Machining the Vector Text

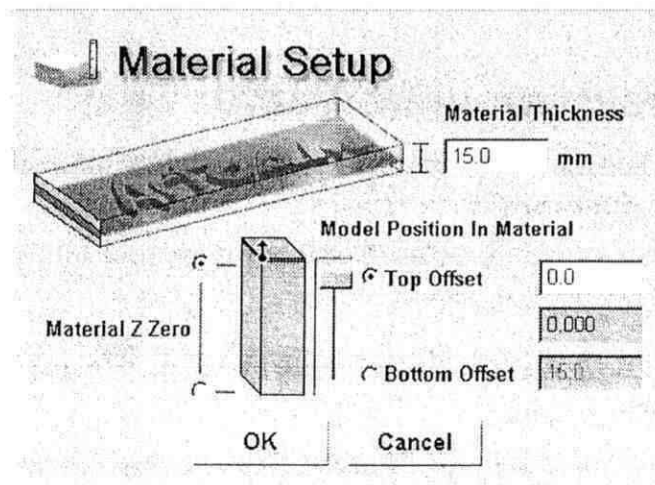
In this next stage, we will create a Profile toolpath that will be used to machine the *B* vector text:

1. Click on the **Toolpaths** tab to display the **Toolpaths** Home page.
2. Click on the **Profiling** button  to display the **Profiling** page.
3. Make sure that the **Outside** radio button  is selected.
4. Make sure that the **Finish Depth** is set to 15 mm (0.6").
5. Type 0.02 mm (0.001") in the **Tolerance** box.
6. Click on the  arrow in the **Machine Safe Z** area of the page to display the **Safe Z** box.
7. Type 3 mm (0.12") in the **Safe Z** box.

8. Click on the **Select** button in the **Profiling Tool** area to display the **Tool Groups Database**:

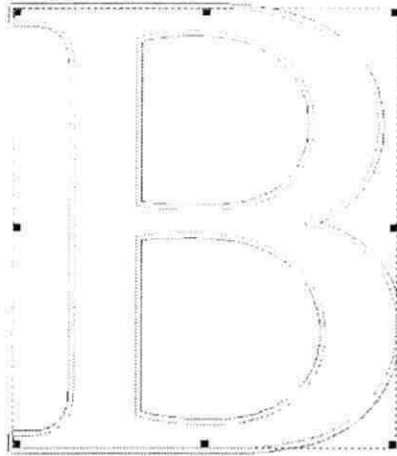


9. Click on the **End Mill 3 mm** (End Mill 1/8 Inch) tool in the **Wood or Plastic\Roughing and 2D Finishing** tool group to select it.
10. Click on the **Select** button to close the **Tool Groups Database** and display the selected tool on the **Profiling** page.
11. Click on the **Setup** button to display the **Material Setup** dialog box:



12. Type *15 mm (0.6")* in the **Material Thickness** box.
13. Make sure that the **Material Z Zero** is set to the top of the block by clicking on the radio button ☒ at the top of the block.
14. Type *0.0* in the **Top Offset** box.



15. Click on the **OK** button to close the **Material Setup** dialog box.
16. Make sure that the **Create 2D Preview** option is checked on ☒.
17. Click on the **Now** button to calculate the Profile toolpath.
The Profile toolpath appears in the **2D View** window as follows:



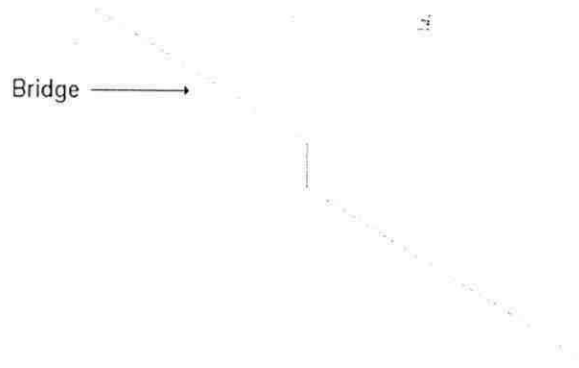
18. Click on the **Close** button to return to the **Assistant's** Home page.


Adding the Bridges

We can now add the bridges to the Profile toolpath that has been created:

1. Click on the dark red Profile toolpath to select it. A bounding box surrounds the Profile toolpath.
2. Click on the **Toolpaths** tab to return to the **Toolpaths** Home page.
3. Click on the **Bridging** button  to display the **Bridging** page.
4. Make sure that the value in the **Bridge Length** box is 3 mm (0.125").
5. Make sure that the value in the **Bridge Thickness** box is 1 mm (0.05").
6. Make sure that the **Constant Number** option is selected  in the **Add Bridges To Profiles** area of the page.

3. Click and drag in the **3D View** window to create a bounding box around one of the bridges. You can now see the bridge on the Profile toolpath clearly:



4. Click on the **Window Fit** button  in the **3D View** toolbar to restore the isometric view of the Profile toolpath shown prior to zooming in.