
ArtCAM JewelSmith

User Guide

By Delcam plc



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Introduction

ArtCAM JewelSmith

ArtCAM JewelSmith is based on the tried and tested framework of ArtCAM Pro, a complete computer-aided design and manufacturing solution. As such, it contains all the features and tools within ArtCAM Pro. However, JewelSmith also provides a series of tools tailored specifically for jewellery designers and manufacturers. In particular, it allows you to manage the individual elements that comprise a single jewellery piece, such as the back and front faces of a pendant, or the models forming the head and shank of a ring. To help manage all these elements, JewelSmith introduces the idea of a Project. By working within a Project, JewelSmith simplifies many of the processes involved in designing and combining the related, but independent, ArtCAM models that form a complex 3D object. For more information about Projects, see "The JewelSmith Project Structure" on page 2.

JewelSmith significantly simplifies many of the techniques and processes required when working with rotary axis machining. It also provides real-time rendering of your models in a variety of materials or precious metals, complete with gemstones set in place, throughout the design process. Not only does this aid the designer, it also means that realistic images of the finished design can be taken directly from the relief. JewelSmith can also produce an HTML based viewer for inclusion in a website or email. You can be confident that designs that meet with approval can be put into production immediately.

The ArtCAM Process

ArtCAM differs from most other 3D modelling packages that you are likely to encounter. It has many more features in common with computer paint or drawing packages. Because it is a largely unique process it is perhaps worth outlining the general process of model making using ArtCAM.

The Image

Nearly all ArtCAM models begin as a 2D image. This image can be made up of dots of colour, called pixels. This type of image is known as a bitmap image. This is the sort of image representation used for digital photographs or scans.

An alternative system for representing 2D artwork is known as vector drawing. This is the name given to line drawing elements, or contours, in ArtCAM that are defined in terms of their

geometric shape, e.g. arcs, squares or circles. This type of image is most suited to technical drawings or designs that require precise geometry and sizing.

Both types of artwork have their particular strengths and weaknesses, and ArtCAM can import, create and freely mix both types of artwork within the 2D View. A fuller discussion of these techniques is available in the ArtCAM user guide.

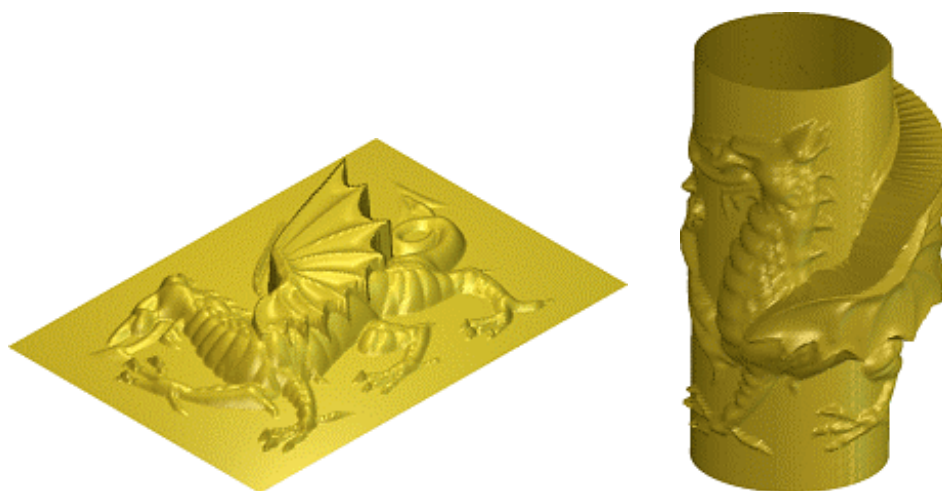
The Relief

Once created, the 2D vector artwork is used to define the 3D shapes in the ArtCAM model. The 3D model within ArtCAM is known as the relief. 3D shapes can be applied to areas of colour, or closed vector shapes. Alternatively the vector artwork can be used more directly to define the desired 3D profile using tools such as the **2-Rail Sweep** or the **3D Blend**. As new shapes are created they can be combined with the relief in different ways, either merging in or adding or subtracting from it. In this way complex 3D relief can be 'built-up' using successive shape creation processes.

Using the same 2D artwork within a single ArtCAM model you can work on two reliefs at any one time. These are known as the Back and Front reliefs as they are generally used to represent the back and front surfaces of a model.

Rings and Cylinders

As well as building 3D models that begin as a flat plane, JewelSmith can 'roll' a relief into a cylinder. Building on a cylinder is an ideal way to create rings.

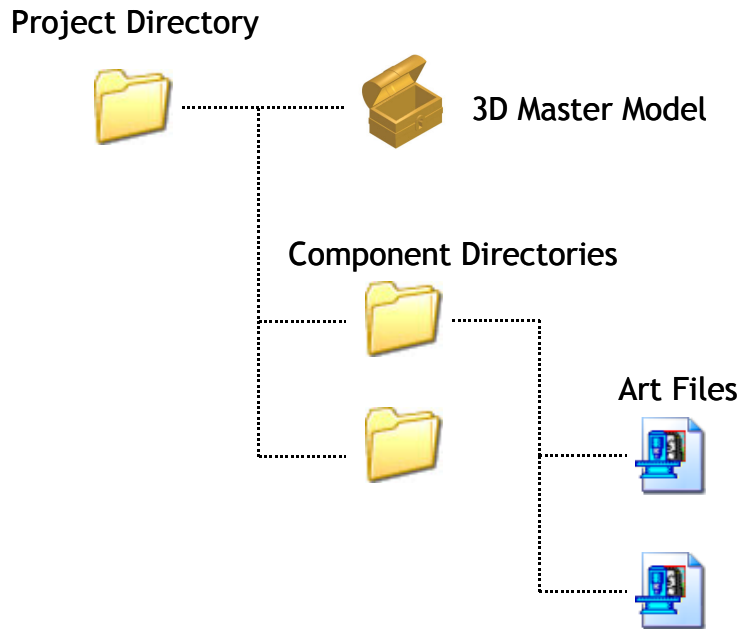



The JewelSmith Project Structure

A single ArtCAM model can only represent 3D shapes based on the single base plane - generally either flat or a cylinder. This is often perfectly suited to many jewellery shapes and designs, particularly if they are to be CNC machined (see below). However, some designs require greater complexity and freedom to work in full 3D space. To create these more complex designs you must begin with a JewelSmith Project, in which all the files associated with the project will be stored during the design process. The first of these files, the 3D Master Model, is also generated automatically when the project is first created. It has the same file name as the Project folder but has the suffix .3DP.


The Project Folder

A JewelSmith Project comprises a conventional windows folder, referred to as the Project Folder. When a Project is created, JewelSmith asks for a project name and then creates the Project Folder with this name automatically. Within the Project Folder, JewelSmith also creates a 3D Master Model file, again this file has the same name as the project, but with the file suffix *3DP*.





The  icon in both Windows Explorer and the Master Model Tree on the Project page identifies the 3D Master Model. The Master Model can be thought of as a repository for finished components of the project. Each component can be freely positioned, combined and manipulated in 3D space. These components are called 3D Assemblies, and are created using triangle mesh replicas of conventional ArtCAM models.

Once you have created a new JewelSmith Project, the usual steps towards creating a component are:

- Use the **Project Components** page on the **JewelSmith** tab to create a new ArtCAM model in the appropriate orientation, or use a component from the available Wizard Libraries.
- Use conventional ArtCAM and JewelSmith specific tools to model the reliefs representing the back and front surfaces of the shape.
- Use the **Add to Master**  button in the **General Tools** area to make a single 3D Assembly of the shape and an associated replica mesh formed from the back and front reliefs, and then add it to the Master Model.
- **Save** and **Close** the ArtCAM Model.
- Position, shade and render the resulting 3D Assembly within the Master Model.

Using this system, you can build a Master Model from as many components, in as many orientations, with any material and shading properties as your design demands. If you need to edit or alter an Assembly component, you use the following steps:

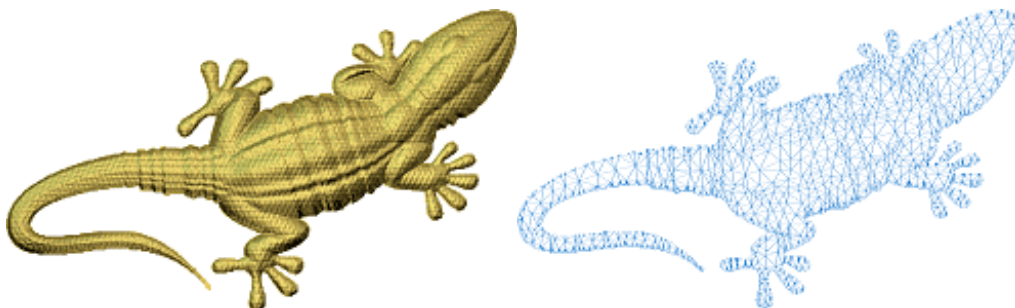
- Click on the 3D Assembly within the Master Model Tree to select it.

- Use the **Edit Associated Model**  button in the **Assembly Manager** area of the **Project** page to automatically find and re-open the ArtCAM model used to create the selected 3D Assembly.
- Alter the model using the ArtCAM modelling tools.
- Use the **Add to Master**  button in the **General Tools** area again to rebuild the 3D Assembly replica of the shape and overwrite the original assembly in the Master Model.
- **Save** and **Close** the ArtCAM Model.

When your design is complete you can either manufacture the components individually from the original ArtCAM Models or 3D Assemblies, or you can manufacture the composite Master Model using STL output, or multi-sided machining.

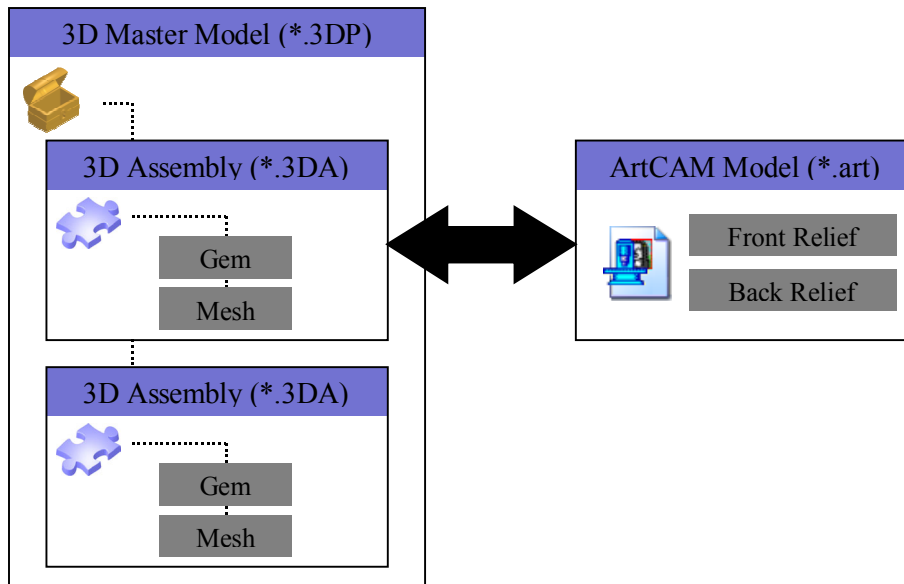
The 3D Master Model

The 3D Master Model file can contain any number of 3D Assemblies. These assemblies hold triangle mesh replicas of ArtCAM models, rendered gemstones, shading and lighting information or other assemblies. In addition they generally hold a link to the ArtCAM Model (*.art) files that were used to create them. The linked ArtCAM Models are stored in sub-folders of the main Project Folder.



Assemblies have a number of uses. Firstly they are very useful for visualisation as they can show both the back and the front surfaces combined into a single model. In addition, they can be replicated, scaled, positioned, rotated and merged with other assemblies or ArtCAM models to form very complex or full 3D forms. The Master Model or any of its sub-assemblies can be exported for Rapid Prototype (RP) manufacture. Using multi-sided machining, these objects can also be manufactured using Computer Numeric Control (CNC) machine tools in their own right.

3D Assemblies can be created in a number of ways. The most common way is to create an ArtCAM model within a project, then design and model the shape as required, and add the result to the project's 3D Master Model (see above). Alternatively, imported 3D files from other software packages can be used to create 3D Assemblies.



When an ArtCAM model is added to the Master Model, an empty assembly is created into which a triangle replica mesh of the back and front reliefs is added. This assembly appears in the Master Model tree as a 'branch'. Although the assembly can be manipulated in 3D space, you cannot edit or alter the shape of the assembly mesh directly. Instead you must open and edit the ArtCAM model that was used to create the existing Assembly and then replace it with a new one based on the altered ArtCAM model.

The Manufacturing Process

The final stage for most ArtCAM projects is to manufacture the 3D relief as a real object. Currently there are two major routes to production: via Computer Numeric Control (CNC) machine tools, or Rapid Prototype (RP) machines. JewelSmith can realise its models using either method.

CNC Machining

CNC machine tools simply move a tool under the control of a computer. The sequence of moves needed to cut a particular shape is known as a toolpath. To use a CNC machine, therefore, you must first create one or more toolpaths in ArtCAM. The exact finish created by your toolpaths can be influenced by a number of factors including tool geometry and toolpath stepovers (the gap between successive passes of the tool over the job). To ensure that you know exactly what the finish will be, ArtCAM allows you to simulate the toolpaths and view a high quality 3D rendering of the 'machined' job.

Once you are happy with the simulation, these toolpaths must then be 'translated' into the specific machining language understood by your machine tool. This process is known as post-processing and it occurs automatically when you select your machine tool from the available list during saving. The post-processed file is then loaded by your CNC software, or sometimes directly into the CNC machine, and the piece can then be cut.

Individual ArtCAM models can always be machined from one direction. The Master Model or 3D Assemblies will sometimes require machining from several directions. This process is known as multi-sided machining and JewelSmith includes a number of tools and wizards to simplify this process.

Rapid Prototyping


Rapid Prototype (RP) machines can work directly from a 3D computer model. However, they usually require a very specific type of 3D model that is created using a large number of small triangles. These triangles form a mesh that defines the surface shape of the model and are very close in form to the 3D Assembly or Master Model representations of the ArtCAM Model. The most common triangle mesh file used in RP is the stereo lithography, or STL, file. To create an RP version of an ArtCAM model you must first convert the associated Assembly by exporting it in the STL format. This file can then be loaded into your RP machine for manufacture. To represent the complex surface of a 3D model faithfully, very small triangles must be used. To represent an ArtCAM model (which are often highly detailed) exactly, the triangles would have to be so small that the sheer number needed to form the mesh would be prohibitive in terms of file size and computing power. To avoid this problem, ArtCAM can create triangle meshes that automatically minimise the number of triangles needed to represent the relief to within a tolerance. In general, the larger the tolerance, the cruder the resulting mesh will be, but the smaller the file size and demands on your computer.

Rendering Models

Another important area for many people is product visualisation. JewelSmith provides a lot of functionality specifically devoted to visually presenting your models, just as they will look as finished pieces. To achieve this JewelSmith uses the Master Model, which comprises a number of 3D Assembly, or 3DA, files. These holds replicas of ArtCAM model data as a triangle mesh, much like an STL file, but with a lot of extra information for displaying the model in a realistic 3D environment. These extras include material colours, lighting, backdrops and gem stones. Crucially, 3DA files can hold multiple components of a model in a hierarchical form so that they can be intuitively manipulated and edited. Again, the number of triangles needed to represent the model is a trade-off between precision, and graphical drawing speed. This trade-off is entirely controllable, so models that you wish to animate dynamically can be reduced in size, while those you will use for a still image can be kept at the highest quality.

Copying A JewelSmith Project

Because a JewelSmith Project comprises a number of files within a fixed file structure, it is very important to copy the *whole* contents of the project folder. To create a duplicate of a Project:

- Copy the Project top folder (the one with the same name as the project) using Windows Explorer.
- Rename the top folder using Windows Explorer.
- Use the **Open JewelSmith Project**  icon on the **JewelSmith Projects** area of the Assistant's **Getting Started** page to open the new project in the usual way. It will now have the name you applied to the top folder.

Resizing

Resizing rings is a complex task that always requires design decisions. Should the different ring sizes have the same metal content? Should they have the same number and/or size of stones? These issues make it difficult to automate the process of resizing a ring design. There are, however, several methods you can use, depending on the production criteria.


End Trimming

If you start with a large ring design it is possible to paste the same model as a piece of clipart into increasing smaller ring projects. ArtCAM will 'trim' away areas of the clipart relief that overlap the edges of the 2D View. This process is analogous to clipping material from the back of the shank and re-joining the shank ends.

It is important to note that, just as in the real process, the ring model is being rolled around an increasingly tighter diameter. This can cause problems if the design has flat planes or specific z-modulation shapes, as these will become distorted.

Coring

An alternative method of resizing a real ring is to thin the whole ring slightly by coring out a larger diameter finger size. The analogous procedure in JewelSmith is to first create a new blank rotary axis model, using a different shank size from the existing Master Model. Then, use the

Combine Master  tool in the **General Tools** area to reproduce the Master Model shape in the current ArtCAM model. If the ArtCAM model has a larger diameter, then the areas of the Master Model inside of this diameter are removed.

Scaling

If your design can be safely scaled (it does not have specifically sized stone settings, for example) then the Master Model of the design can simply be scaled. The scaled model can also be merged back into rotary shank components based on different ring sizes as above.

Getting Started

Overview

This chapter is intended to get straight into creating a simple ring as quickly as possible. We will start by creating a simple JewelSmith Project to hold a single model of a ring shank. The shank will be appropriate for rotary axis CNC or RP production. We will engrave the shank with some text and generate the toolpaths for rotary axis machining. We will also create a rendered image of the ring as it will look in gold, and export an appropriate model for rapid prototype production.

Throughout this chapter, a number of the shortcut keys available for many operations shall be introduced. These functions are always available via other routes, such as menus and buttons. Please refer to the general ArtCAM Pro Reference Manual for details of these alternatives.

Creating the Project


First we will create the JewelSmith Project for the ring we are creating. We will name the project and define the location on our computer in which the project will be stored.


1. Click on the **Create JewelSmith Project**  icon in the **JewelSmith Projects** area of the Assistant's **Getting Started** page to display the **New Project** page.
2. Type *EngravedBand* in the **Project Name** box. This is the name that we want to give the JewelSmith Project. All projects are named *NewProject* by default.

The location in which the JewelSmith Project will be created is shown on the page. If you want to change the location:

3. First, click on the **Change Directory** button to display the **Browse for Folder** dialog box.
4. Next, click to select the directory or folder in which you want to create the JewelSmith Project folder.
5. Finally, click on the **OK** button to confirm your choice and close the **Browse for Folder** dialog box. The new location is shown on the **New Project** page.

If this is the first project you have created, ArtCAM Jewelsmith prompts you to specify the location in which you want to store your project files.

6. Click on the **Accept**  button to create the new JewelSmith Project and display the **Project Components** page.


You can click on the **Back**  button if you want to return to the Assistant's Home page without creating the JewelSmith Project.

ArtCAM JewelSmith has stored all of the information about the project and has created a directory structure to manage any files created as part of it. In the project directory, ArtCAM JewelSmith has also created a 3D Master Model file (*.3DP), which is initially empty. As elements of the ring are created using conventional ArtCAM Models, matching 3D Assemblies can be produced and stored in the Master Model. 3D Assemblies can be copied, scaled, rotated and positioned anywhere in the Master Model. In this way very complex shapes and designs can be created, rendered and manufactured.

In this example we will create a relatively simple model comprising just one ArtCAM Model and one matching 3D Assembly in the Master Model.

To view the files created by ArtCAM JewelSmith, browse to the location specified on the **New Project** page using Windows Explorer, and open the directory named *EngravedBand*. The ArtCAM models and reliefs that will make up this project will be stored in sub-folders within this directory.

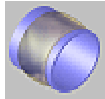
7. Click on the **Project** tab to display the **Project** page in the Assistant window.

The  icon in the Master Model Tree indicates that a JewelSmith Project file named *EngravedBand.3DP* has been created and is currently open, although it is initially empty. As yet, no ArtCAM model file has been created.

Creating a Rotary Axis Shank Component

Next we will create the first component in our JewelSmith Project. This is a rotary-axis shank. We will give this ring component a name and define its size and settings.

1. Click on the **JewelSmith** tab to display the **Project Components** page.

2. Click on the **Rotary Shank**  button in the **Blanks** area to display the **Rotary Shank** page.

In the **Name** box, we can see that the rotary-axis shank is named *RotaryAxisShank* by default. We will use the default name for our shank.


3. Click on the **Standard** list box, followed by the *British* option to define the national standard system for the shank that we are creating. The **Size** list box now contains options for each of the available ring sizes in the selected system.

4. Click on the **Size** list box, followed by the *P* option to define the size of the ring.

In the **Ring Diameter** box, you can see that a British size *P* corresponds to an inner ring diameter of *17.9 mm*. Since we are using a preset sizing system (British), the **Ring Diameter** box is greyed out and cannot be edited directly.

If you wish to define a specific diameter, you must first select *Custom* from the **Standard** list box.

The **Width**, **Border**, **Thickness** and **Resolution** settings are discussed in later tutorials. We will use the default settings on the page for the purpose of this example.

5. Click the **Accept**  button to confirm the component settings and create an ArtCAM model file named according to that which you defined in the **Name** box.

ArtCAM JewelSmith calculates the necessary dimensions of the ArtCAM model automatically, according to the settings defined on the **Rotary Shank** page. It also displays the **Rotary Axis Tools** page on the **JewelSmith** tab. The page is made up of several tools divided into separate areas. Some of these tools will be used to create our rotary-axis shank.

In the 2D View window, you can see the model area (the white area). This corresponds to the 'unrolled' surface of the ring. Below this area is the Reference Silhouette of the shank. This comprises two locked circular vectors that represent the inner diameter and the outer diameter of the ring (according to the **Thickness** setting specified previously). These are used for some design and modelling techniques where the profile of the ring is a more intuitive starting point for laying out shapes.

The model area is also divided by two locked reference guideline vectors; one marking the vertical centreline and the other marking the horizontal centreline.

ArtCAM JewelSmith automatically manages the saving of component files during the creation process. In this case, a folder called *Shanks* is created (if one does not already exist) within the current project folder. Using the filename specified during creation, ArtCAM JewelSmith then saves the newly created ArtCAM Model in this folder (i.e. *Shanks/RotaryAxisShank.art*).

In the 3D View window, ArtCAM Jewelsmith creates a relief that is rolled into a cylinder, again matching the parameters defined during the creation process.

6. Click on the **Project** tab to display the **Project** page.

The Master Model Tree now shows two roots. The project's Master Model and the current ArtCAM Model.

Designing the Band

To create the ring band, we will use the **2-Rail Sweep** tool. This allows us to create a three-dimensional shape by extruding a cross-section vector along a path, the edges of which are defined by vectors (referred to as drive rails). To begin, we will create the drive rails.

Creating the Drive Rails

First we will create the vector artwork that will be used as the drive rails when creating the swept shape.

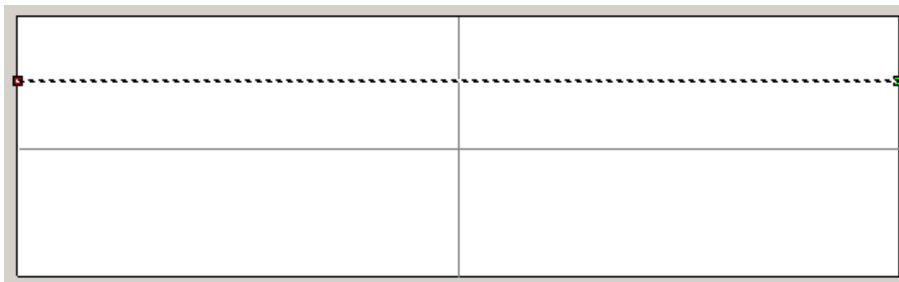
1. Click on the **Assistant** tab to display the Assistant's Home page.
2. In the 2D View window, click to select the central horizontal reference vector drawn in the model area. The reference vector is green and surrounded by a bounding box.

This is a reference guideline that is created as part of the *RotaryAxisShank* ArtCAM model. By default it is locked, which means that it cannot be moved. However, we can create a copy of this guideline for our use.


3. Press the *Ctrl + C* keys on your keyboard to copy the selected guideline to the ArtCAM clipboard.
4. Press the *Ctrl + V* keys on your keyboard to paste a copy of the guideline, overlaying the original. The vector turns magenta and is surrounded by a bounding box, indicating that it is selected.

This vector will be used as the first drive rail when creating our swept shape.

5. Hold down the **↑** key on your keyboard to nudge the selected vector upwards. Release the key when the vector is positioned halfway from the top-edge of the model area:








To create the second drive rail we will mirror the first drive rail about the central horizontal guideline.


6. Click to select the central horizontal guideline. The guideline turns green, indicating that it is selected.
7. Hold down the *Shift* key on your keyboard, and then click to select the first drive rail. The drive rail turns magenta. A bounding box surrounds both the guideline and the drive rail.
8. Click on the **Mirror Vectors**  button in the **Vector Editing** area to display the **Mirror Vectors** page.
9. Hold down the *Ctrl* key on your keyboard, and then click on the **About Line** option to create a new horizontal linear vector below the guideline.
10. Click the **Close** button to return to the Assistant's Home page.

Creating the Cross Section

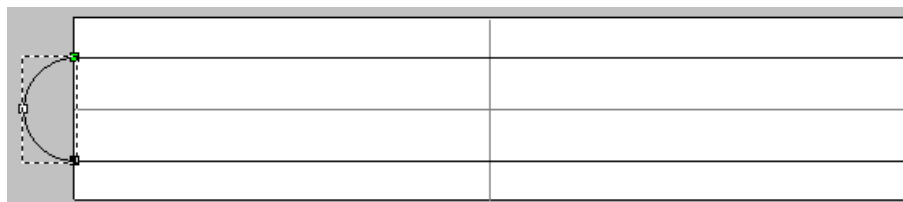
Next we will create a curved vector that we will use as the cross section to be extruded along the two drive rails. The cross section controls the profile of the swept shape.

1. Click on the **Create Polyline**  button in the **Vector Editing** area to display the **Polyline Creation** page.
2. In the 2D View window, move the cursor over the left-hand end of the first drive rail.
3. The cursor changes to  when you are close to the start point (node) within the vector.
4. Click to define the start point in the polyline, and then move the cursor over the left hand edge of the second drive rail. When the cursor changes to  again, click to create a point in the polyline.
5. Click the right mouse button to create the polyline and return to the Assistant's Home page.
6. Click to select the polyline you have created. The polyline turns magenta.
7. Press the *N* key on your keyboard to enter Node Editing mode. The cursor changes to .
8. Move the cursor over the middle of the polyline until it changes to . The cursor indicates that you are pointing at a span.
9. Press the *A* key on your keyboard to convert the span (which is currently linear) to an arc.

By default, the arc will be to the right of the line, if we swept the shape with the profile as it is, we would produce a negative and recessed shape, rather than a raised shape.

10. Click on the white node  that defines the arc and drag it as far as it will go to the left. This will make the arc face left so that it will produce a raised shape when used as a profile.

In the 2D View window, the polyline should now look as shown below:



11. Press the *Esc* key on your keyboard to return to Select Vectors mode.

Two-Rail Sweep

Now we have the vector artwork we need to create the basic shape of the band. We will use this artwork together with the **2-Rail Sweep** tool to create the relief for the ring's shank.

1. Click on the **JewelSmith** tab to display the **Rotary Axis Tools** page.

2. Click on the **2-Rail Sweep**  button in the **Modelling Tools** area to display the **Two Rail Ring Sweep** page.

This is one of the most powerful modelling tools in ArtCAM JewelSmith and may seem a little daunting at first. However, the **Status** area of the page is designed to help you select the minimum number of vectors in the correct order. If you are familiar with ArtCAM Pro, you will also notice that this ring specific version of the **2-Rail Sweep** tool is slightly different from the conventional one. These differences will be discussed later.

3. Click to select the first drive rail vector from the 2D View window. The vector turns magenta.
4. In the **Select Control Vectors** area, click on the Top Drive Rail's **Select** button.

In the **Status** area, you can see that the comment next to *First Drive Rail* changes to *Valid*. A red letter *A* also appears beside the drive rail vector in the 2D View window.

5. Click to select the second drive rail vector. The vector turns magenta.
6. Click on the Bottom Drive Rail's **Select** button.

In the **Status** area, you can see that the comment next to *Second Drive Rail* changes to *Valid*. A red letter *B* also appears beside the drive rail vector in the 2D View window.

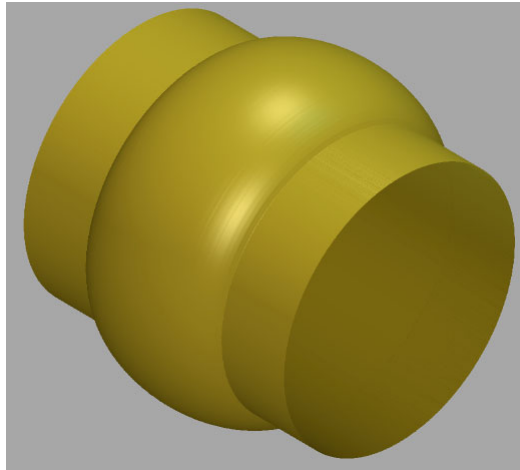
7. Click to select the cross-section vector in the 2D View. The vector turns magenta.
8. Click on the **Add Cross Section** button in the **Status** area.

In the **Status** area, the cross-section vector is listed as *Cross Section 1*. A red number *1* appears to mark its position on the first drive rail, and a blue number *1* appears to mark its position on the second drive rail

9. Click to select the **Scale Final Height** option, and then type *2* in its associated box.
10. Click the **Calculate** button.
11. Click the **Close** button to return to the Assistant's Home page.
12. Press the *F3* key on your keyboard to display the 3D View window.

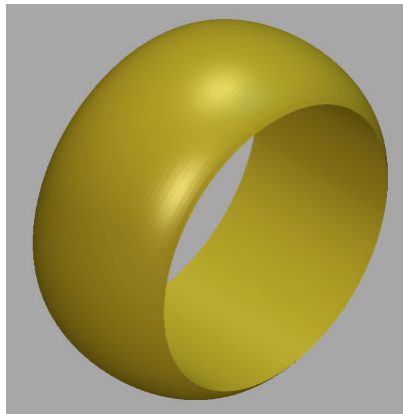
You can see that the cross section has been extruded along the two drive rails to create a rounded shank.

You can also see the base cylinder around which our shank shape has been created. This is referred to as the zero plane.



13. You can click on the **Draw Zero Plane**  button in the 3D View toolbar to hide the zero plane, the area of the relief with zero height. This is generally preferable when viewing components.



The basic ring band appears as shown below:




Depending on the resolution of the ArtCAM model, there may be a small gap in the shank at the point at which the two ends of the wrapped shape meet. If there is a gap, copy and paste an area of the existing relief to close it. For details, see "Copying and Pasting Reliefs" in the Working with Reliefs chapter of the ArtCAM Pro Reference Manual.

Adding Text


We will now add some text to the ring band.

1. Press the *F2* key on your keyboard to display the 2D View window.
2. Click on the **Create Vector Text**  button in the **Vector Editing** area to display the **Text Tool** page.
3. In the **Style** area, click on the **Bold**  button.
4. Click on the **Font** list box, and then on the *Arial* option to select it.
5. Click on the **Script** list box, and then on the *Western* option to select it.
6. Click on the **Size** list box, and then on the *Points* option to select it.


7. Type *11* in the **Size** box.
8. Click anywhere in the model area (the white area in the 2D View window), and then type *JewelSmith*.
9. Click the **Done** button to return to the Assistant's Home page.
10. The vector text is purple and surrounded by a bounding box indicating that it is selected. If it is shown in black, click to select the vector text.
11. Press the *F9* key on your keyboard to move the selected vector text to the centre of the model.
12. Press the *F12* key on your keyboard to display the **Shape Editor**.
13. Click on the **Angled**  button.
14. Using the default settings for this shape, click on the **Subtract** button.
15. Click the **Close** button.
16. Press the *F3* key on your keyboard to display the 3D View window. You can see the *JewelSmith* text in the shank relief.
17. Press the *Ctrl + S* keys to save the current ArtCAM Model.

Adding to the Master Model


We now have a finished ArtCAM Model for the one and only component of this example, the engraved shank. We now want to add a replica mesh of this model into the JewelSmith Project's Master Model Tree. This replica mesh takes the form of a triangle mesh and serves a number of useful purposes. Generally the replica mesh will be slightly less accurate than the originating model (depending on the selected tolerance of the triangulation), but this often makes it better suited for visualisation because of the associated reduction in rendering time. In addition, other visualisation tools, such as gem settings, can be added to an assembly alongside its associated replica mesh. Although in this example we have only created a single rotary component, the Master Model allows lots of assemblies to be combined in 3D space in any orientation. Complex Master Models, comprising many assemblies, can be converted to a single STL file for Rapid Prototype production, or machined from different directions to allow the CNC manufacture of previously impossible shapes.

1. Click on the **JewelSmith** tab to display the **Rotary Axis Tools** page in the Assistant window.
2. Click on the **Add To Master**  button in the **General Tools** area to display the **Add To Master** page.
3. Type *0.002* in the **Tolerance** box.

The tolerance defines how closely the replica mesh preserves the shape of the original relief. The smaller the number, the better the representation. However, the resulting file will be larger and more memory intensive for your computer.




4. Click on the **Next**  button to begin creating the replica mesh at the defined tolerance.

A progress bar appears beneath the 2D View window to indicate the progress ArtCAM JewelSmith is making in creating a replica mesh of the shank relief.

5. Click on the **Accept**  button to add the replica mesh of the shank relief to the current JewelSmith project.

A progress bar appears beneath the 2D View window to indicate the progress ArtCAM JewelSmith is making in creating a replica mesh of the shank relief.

6. Click on the **Close Current File**  button in the **General Tools** area to return to the **Project** page.



In the Master Model Tree, a new assembly has been created represented by the  icon. It is called *RotaryAxisShank*, the name specified when the assembly was created and added to the Master Model. Associated with the assembly are several other elements. The  icon indicates properties of the component, including the size and national standard system of the shank. The  icon indicates the replica mesh representing the shape of the ring component.

Rendering in Gold

To view our ring in a more realistic material, we need to choose a new shading set-up for the shank relief shown in the 3D View window.


1. From the Master Model Tree, click to select the *RotaryAxisShank* assembly. Its name turns bold.

When the assembly is selected, its associated toolset is displayed in the lower half of the **Project** page. At the top of these tool areas is the title of the currently selected object, in this case *RotaryAxisShank*.

2. Click on the **Shading**  button in the **Assembly Manager** area to display the shading settings.
3. Click on the **Shading Set** list box, followed by the *24ct Satin Finish* option.
4. Click on the **Accept**  button to render the flush setting as if it were cast in satin finished gold.

Creating an STL file for Rapid Prototype production

The first method of manufacture we are going to consider is Rapid Prototype (RP) production of the Master Model. The Master Model is already represented in the form of a replica mesh, so we simply need to export it in the STL format required for the RP machine to read.


1. From the Master Model Tree, click to select the *EngravedBand* Master Model. Its name turns bold and its associated tools appear in the lower half of the page under the heading *EngravedBand*.
2. Click on the **Export**  button in the **Edit** area to display the **Save File** dialog box.
3. Type a name for the STL file in the **File name** box.
4. Click on the **Save As Type** list box, and then on the *STL Files (*.stl)* option to select it.
5. Click on the **Save** button to create the triangle model and close the dialog box.

The resulting STL file can be loaded into your RP machine or software supplied with your machine.


Defining a Tool and Creating a Toolpath

In the final section of this chapter we will consider CNC machining of the model. For this example we will create a very basic raster toolpath using a new tool that we will define and add to the database. Within your production process it is likely that you will only use a few tool types. Editing the tool database to include your own tooling options will simplify toolpath generation in the longer term.



The first thing we need to do is select the shank assembly in the Master Model in order to open the associated ArtCAM Model.

1. Click to select the *RotaryAxisShank* assembly in the Master Model Tree to display its associated toolset.
2. Click the **Edit Associated Model**  button in the **Assembly Manager** area to open the ArtCAM Model used to create this assembly.

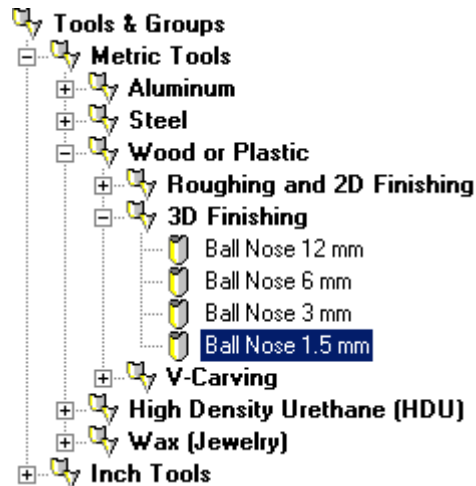
When creating toolpaths it is generally better to view the ring model in an unrolled form, even if the toolpaths will ultimately be post-processed for a rotary axis machine.

3. When the model is open, click on the **Toolpaths** tab to display the **Toolpaths** Home page.
4. In the **3D Toolpaths** area, click on the **Machine Relief**  button to display the **Machine Relief** page.
5. Type *45* in the **Raster Angle** box. By using this angled strategy we reduce the strain on the tool in the initial machining passes, since they each are of a very short length.
6. Click the **Select** button in the **Tool** area to display the **Tool Groups Database**.

The very fine Ball Nose tool that we wish to use is not in the database by default. Instead, we will copy and modify an existing tool in order to add our tool to the database.

To navigate through the database, we can click on the  and  symbols next to each group in the **Tools and Groups** tree view. These symbols expand and hide the groups, respectively. Expand the **Metric Tools**, **Wood or Plastic** and **3D Finishing** groups

7. Click to select the *Ball Nose 1.5 mm* tool.




8. Click the **Copy** button in the **Tool Groups Database**.
9. Click the **Edit** button to display the **Edit Tool** dialog box.
10. Type *Ball Nose 0.5* in the **Description** box.
11. Type *0.5* in the **Diameter (D)** box.
12. Type *1* in the **Stepdown** box.
13. Click **OK**. This adds our new tool to the database and closes the **Edit Tool** dialog box.
14. Click the **Select** button in the **Tool Groups Database** to select our new tool. The **Tool Groups Database** window closes and our selected tool appears in the **Tool** area of the page.
15. Press the *F3* key to display the **3D View** so we can see the toolpath generation process.
16. Click the **Now** button in the **Calculate** area to begin calculating the toolpath.
17. When the calculation is complete, click the **Close** button at the bottom of the page to return to the **Toolpaths** page.

Our new toolpath now appears in the toolpath list at the top of the page.

To see exactly what our toolpath will produce we can simulate the cutting process. This is a very powerful feature of ArtCAM and should allow any problems to be identified before manufacturing begins.



18. Click on the **Simulate Toolpaths**  button in the **Toolpath Simulation** area to display the **Toolpath Simulation - Block Definition** dialog box.

19. Click on the **Simulate Toolpath** button to accept the default settings and display the **Simulation Control** panel.
20. Click on the **Run Simulation at Maximum Speed**  button.

When the simulation process is complete you can view the simulation in exactly the same way as the normal ArtCAM relief. You will notice that there are cusps at the base of each letter.



These cusps you see are a result of the tool geometry that we have specified. These are exactly the sort of finish details you can check using the simulation tool.

21. Click on the **Delete Simulation**  button to delete the toolpath simulation from the 3D View window.
22. Click on the **Save Toolpaths**  button to display the **Save Toolpaths** dialog box.

Since we have only created one toolpath, it automatically appears in the **Toolpaths to save to a single file** window.

23. Click on the **Machine output file is formatted for** list box, followed by the option for your machine tool type, and then on the **Save...** button.

The output file is specific to your machine and can be loaded directly into your machine, or via the CNC software provided by your machine dealer.

Rotary Axis Pixel Distortion

Overview

In this chapter we will look at some of the modelling issues associated with rotary axis machining. In particular we will examine the potential for pixel distortion when shapes created in the 2D View are used to model 3D forms at different heights above the base of the model. We will then discuss the tools available in JewelSmith to minimise and correct any potential distortion.

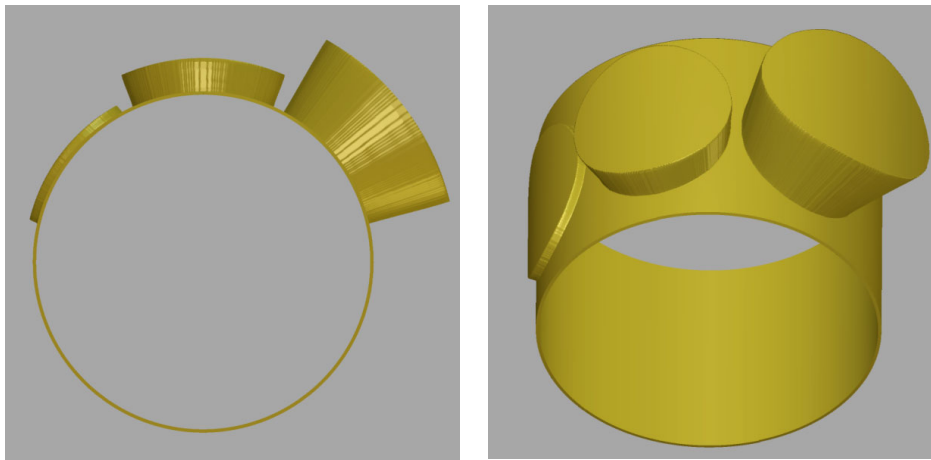
Pixel Expansion

When JewelSmith creates a Rotary Shank model, the circumference of the ring determines the width of the associated 2D View. This is analogous to unrolling a tube of paper. The larger the diameter of the tube, the longer the unrolled piece of paper. However, it is important to note that the piece of paper can only match a single, fixed, diameter tube. Now if we consider a real ring, instead of a wafer thin piece of paper, it has a certain thickness. This means that the inner and the outer circumferences of a ring are different. So which circumference should JewelSmith use to create the 2D View? The answer is that the 2D View matches the *outer* circumference of the ring, which is the circumference given by the radius of the ring *plus* the Rotary Shank's **Thickness** specified during the ring component set-up. To understand why this is the case, and some of its implications, it is important to consider the rotary axis machining process.

When a rotary axis machine tool rotates the wax that it is cutting by a fixed angular step, the actual distance moved by the tip of the tool is dependent on the distance the tool is from the centre of rotation. In ArtCAM terms, the distance represented by a single machining step is therefore bigger, the higher it is above the base of the relief. The relief 'rolling' system used to show the ArtCAM relief as a ring exactly mimics this process. As a result, the rotary axis ArtCAM model gives a faithful representation of the final machined model, but this includes the problem of expanding step sizes above the base plane of the model.

The figure below shows the 3D shapes resulting from the same size circle in the 2D View. When the circle is created at different heights (and therefore different distances from the centre of

rotation) the circle becomes elongated or compressed as the distance represented by a fixed step size varies.



Another way to imagine this is that pixels in the 2D View can only be considered as square at a single height above the base plane. Below this height they will appear compressed and above this height they will appear stretched.

JewelSmith provides tools to compensate for the rotary axis distortion that can occur in this way and we shall consider these below. Often, however, a ring has a fairly constant thickness, and (because the majority of detail is on the surface of the ring) the 2D design represents shapes that will be created at a fairly constant height. Because of this, if the shank's **Thickness** is chosen judiciously, many ring designs can be laid out in the 2D View with little, or no, shape correction. If the design allows it, this is the preferable arrangement.

Correcting a Vector For Height

A useful tool for correcting the distortion of shapes when building on a cylinder above or below the shank's **Thickness** is the **Correct Vector For Height** tool, found in the **Modelling Tools** area of the **Rotary Axis Tool** page. If you are intending to use a vector outline to create a 3D shape using the **Shape Editor** that is not on the shank's **Thickness**, you should first use this tool. It will stretch or compress the vector shape, so as to compensate for any pixel expansion or compression in the subsequent 3D shape.

For example, if you wish to create a plane at a height above the shank's **Thickness**, it will be stretched due to the rotary pixel expansion. By selecting the vector and entering the height into the **Correct Vector For Height** tool first, JewelSmith will slightly compress the vector outline. This compressed oval will produce an expanded 3D shape at the required height that will exactly match the original shape thus perfectly counteracting the expansion problem.

Creating a Flat Plane

When using the simple flat plane option in the **Shape Editor** on a cylinder, the resulting shape is curved just like the underlying base. Sometimes you need to create a genuinely flat plane,

despite building on the base cylinder. This is achieved using the **Create Flat Plane** tool found in the **Modelling Tools** area of the **Rotary Axis Tool** page.

This tool corrects both the initial vector boundary (for pixel distortion, as described above) and creates an underlying 3D shape that produces a flat plane, despite being built on an underlying cylinder. If you were to view this shape in its 'unrolled' form, you would see it is actually curved surface along the X-axis of the model. Because the curve is produced by smoothly changing the Z height, or thickness, of the shape to counter the bending of the model when it is 'rolled' into a cylinder, the pixel distortion associated with the shape also changes accordingly. For this reason the vector correction will not be entirely the same as for a shape whose thickness is constant. Don't be surprised, therefore, if the vector outlines produced by the **Correct Vector For Height** tool and the **Create Flat Plane** tool, do not match.

Three-Stone Ring Tutorial

Overview

The following tutorial demonstrates how to create a relief and a triangle replica mesh of a shank, a flush setting to house a principal gemstone, and two further flush settings to house smaller gemstones on either side. We will use the **Shank Library** and tools available in the **Project Components** page.



Three-Stone Ring

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

- Creating the JewelSmith Project.
- Adding the Shank to the Project.

- Creating the Centre Gem Setting.
- Decorating the Flush Setting.
- Creating the Side Flush Setting.
- Decorating the Side Flush Setting.
- Repositioning the Side Flush Setting.
- Duplicating and Mirroring the Side Flush Setting.
- Editing the Shank.
- Saving the New Shank.
- Presenting the Finished Ring.

Creating the JewelSmith Project

First we will create the JewelSmith Project for the ring we are creating. We will name the project and define the location on our computer in which the project will be stored.


1. Click on the **Create JewelSmith Project**  icon in the **JewelSmith Projects** area of the Assistant's **Getting Started** page to display the **New Project** page.

All projects are named *NewProject* by default. This is the name that we will use for this particular JewelSmith Project.

The location in which the JewelSmith Project will be created is shown on the page. If you want to change the location:


- First, click on the **Change Directory** button to display the **Browse for Folder** dialog box.
- Next, click to select the directory or folder in which you want to create the JewelSmith Project folder.
- Finally, click on the **OK** button to confirm your choice and close the **Browse for Folder** dialog box. The new location is shown on the **New Project** page.

If this is the first project you have created, ArtCAM JewelSmith prompts you to specify the location in which you want to store your project files.

2. Click on the **Accept**  button to create the new JewelSmith Project and display the **Project** page.

ArtCAM JewelSmith has stored all of the information about the project and has created a directory structure to manage any files created as part of it. In the project directory, ArtCAM JewelSmith has already created a 3D Project file (*.3DP), which is needed to link the 3D Assembly (*.3DA) and ArtCAM Model (*.art) files that will be created for the individual components in your design.

To view the files created by ArtCAM JewelSmith, browse to the location specified in the **New Project** page using Windows Explorer, and open the directory named *NewProject*. The ArtCAM models and reliefs that will make up this project will be stored in sub-folders within this directory.


The  icon in the Master Model Tree indicates that a JewelSmith Project file named *NewProject.3DP* has been created and is currently open. As yet, no ArtCAM model file has been created.

Creating the Shank


In this section we will create a standard shank using the Shank Library. During this process, ArtCAM JewelSmith generates the vector artwork needed to produce the shank. We will edit the vector artwork in order to customise the design of our shank.

1. Click on the **JewelSmith** tab to display to the **Project Components** page.


2. Click on the **Shank Library**  button in the **Libraries** area to display the **Shank Library** page.

3. Click on the **Tapered Round**  button in the **Bands** area to display the **Tapered Round** page.
4. Click on the **Standard** list box, followed by the *American* option to set the national standard system for the shank we want to create. The **Size** list box now contains options for each of the available ring sizes in the selected standard.
5. Click on the **Size** list box, followed by the 5 option to set the size of the shank.

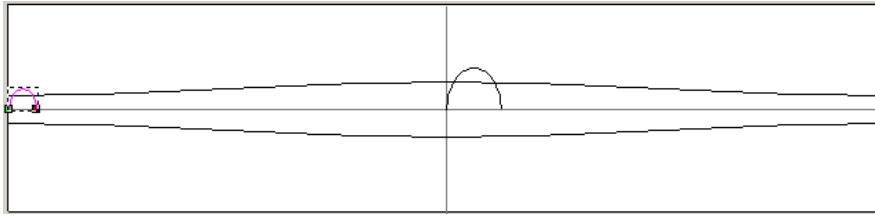
We will use the remaining default settings on the page for our shank.

6. Click on the **Next**  button to display further shank settings allowing you to define its width and thickness. We will use the default settings on the page for our shank.

This means that our shank has a top thickness of *3 mm*, a bottom thickness of *1.5 mm*, a top width of *4 mm* and a bottom width of *2 mm*.

7. Click on the **Next**  button. ArtCAM JewelSmith creates a tapered round shank according to the default settings.

In the 2D View window, we can see that ArtCAM JewelSmith has generated the vector artwork required to produce our tapered round shank:



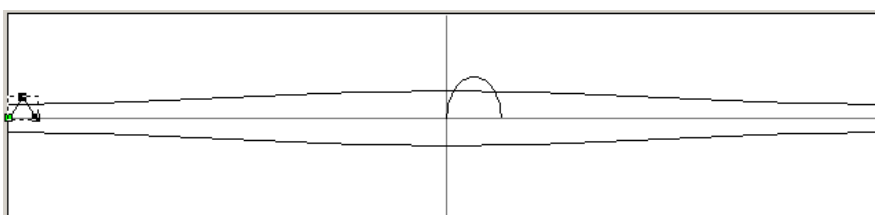
The artwork comprises four vectors: a pair of drive rails and two profiles. The profile on the left is the cross-section of the shank at the back, whilst the profile in the centre is the cross-section of the shank at the front.


8. Press the *F3* key on your keyboard to display the shank relief in the 3D View window:

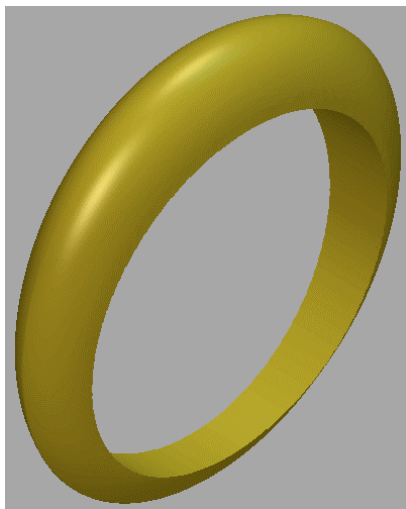


Still using the wizard, you can now make changes to the shank. You can either adjust the parameters on the **Tapered Round** page or edit the artwork shown in the 2D View directly. You cannot add to or delete the existing vector artwork, only alter it. In this example we will use the Node Editing tools to adjust the shape of the shank at the back to a knife-edge, or 'V' cross-section.

9. Press the *F2* key on your keyboard to return to the 2D View window.
10. Make sure that the curved profile vector on the left of the model area is selected by clicking on it. It is magenta and surrounded by a bounding box.
11. Press the *N* key on your keyboard to enter Node Editing mode.
12. Move the cursor over the left bezier span in the curved profile on the left-hand side of the 2D View. You can see the points (nodes) and spans that make up the curved profile vector.
13. Press the *L* key on your keyboard to convert the span from a curve to a line.
14. Repeat the previous step for the bezier span on the right of the curved profile to produce a knife-edge profile.



15. Click on the **Rebuild**  button to regenerate the shank relief using the modified vector artwork.





16. Click on the **Accept**  button.


When a shank is created using an ArtCAM JewelSmith wizard, a folder named *Shank* is automatically created (if it does not already exist) within the current project directory. The ArtCAM Model (*.art) is then saved in this folder using the filename specified in the wizard. In this tutorial, it is named *TaperedRound*.


Adding the Shank to the Project



In this section we will combine the new shank relief with the JewelSmith Project.

1. Click on the **Add To Master**  button in the **General Tools** area to display the **Add to Master** page.
2. Make sure that the tolerance is set as *0.002* in the **Tolerance** box. This tolerance is used to preserve the detail of the shank relief.
3. Click on the **Next**  button to create a replica mesh of the shank.

A progress bar appears beneath the 2D View window to indicate the progress ArtCAM JewelSmith is making in creating a replica mesh of the shank. ArtCAM JewelSmith shows that the shank has a volume of 278.232 mm³ when cast in 9 carat gold and no shrinkage is used. Its overall weight is calculated as 3.283 metric (g). You can set the material in which you would prefer to cast the shank, define the shrinkage and adjust the units of measurement used for the weight.

4. Click on the **Accept**  button to add the replica mesh of the shank to the current JewelSmith project.
5. Click on the **Project** tab to display the **Project** page.

The  icon in the Master Model Tree indicates that an assembly component named *TaperedRound* has now been added to the JewelSmith project.

6. Click on the **JewelSmith** tab to return to the **Rotary Axis Tools** page.
7. Click on the **Close Current File**  button in the **General Tools** area to return to the **Project** page.
8. Click on the **Save**  button in the **Project Tools** area to save the JewelSmith Project.


Creating the Centre Gem Setting


To create the centre gem setting we will also use another wizard-based component. Just as for the shank, however, you can use the wizard to provide a starting point for your design. You are free to edit and add to this initial model to make it unique.


1. Click on the **JewelSmith** tab to display the **Project Components** page.

2. Click on the **Rotary Flush**  button in the **Blanks** area to display the **Rotary Flush** page.

This opens the **Rotary Flush** wizard that guides us through each of the steps we need to define a setting of this type. This process starts by defining the shape and size of the gem.

3. Click on the **Box Radiant**  button to select the shape of gemstone we want to sit in the flush setting, and display the next group of settings.
4. Click on the **Standard** list box, and then on the *Carat* option so that we can define the size according to standard diamond carat weights for this shape of stone.
5. Click on the **Size** list box, and then on the *1.00* option to choose a 1 Carat stone.

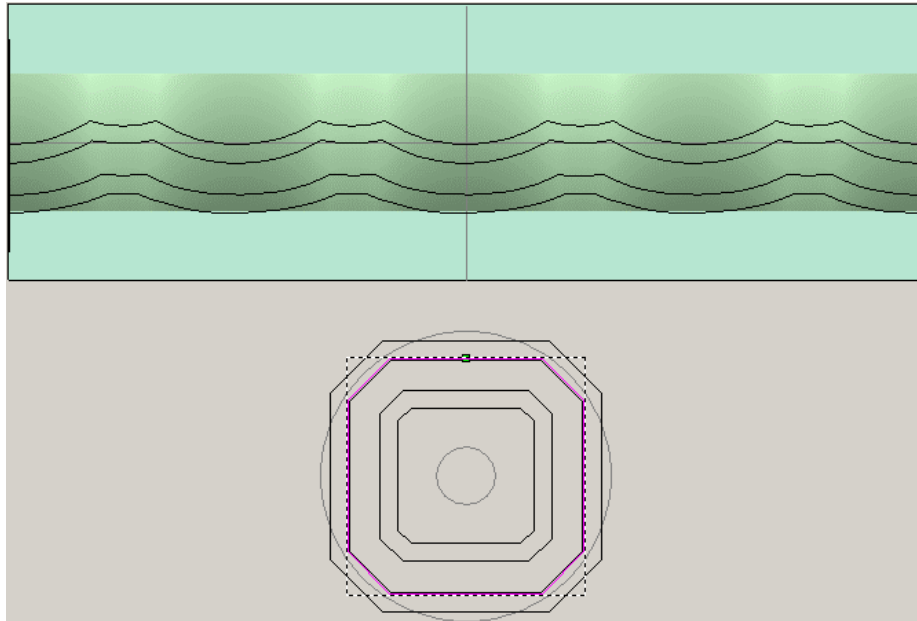
6. Click on the **Next**  button to display the final group of settings.

7. Click on the **Ruby**  button to set the colour of the gemstone that will sit in the flush setting.
8. Type *70* in the **Wall Angle (D)** box to set a slightly shallower wall angle than normal. We will use the remaining default settings on the page for our flush setting.

9. Click on the **Next**  button to create the flush setting.


A progress bar appears beneath the 2D View window to indicate the progress ArtCAM JewelSmith is making in generating the relief for the flush setting.

In the 2D View window, we can see the vector artwork that ArtCAM JewelSmith has generated to produce the flush setting relief.



10. Press the *F3* key on your keyboard to display the 3D View window. You can see the box radiant flush setting relief positioned on the shank relief, shown as follows:




Since we will be decorating the flush setting, do not click on the **Accept** button  at this time.

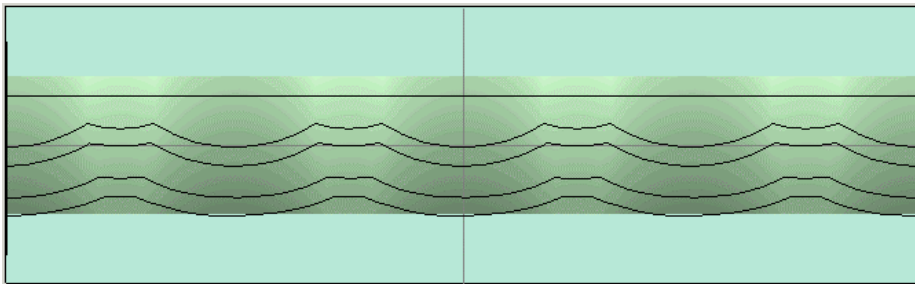
Decorating the Flush Setting


We are now ready to create additional vector artwork in the ArtCAM model file associated with the box radiant flush setting. We will use this vector artwork to create three-dimensional shapes that we will then combine with the existing flush setting relief.

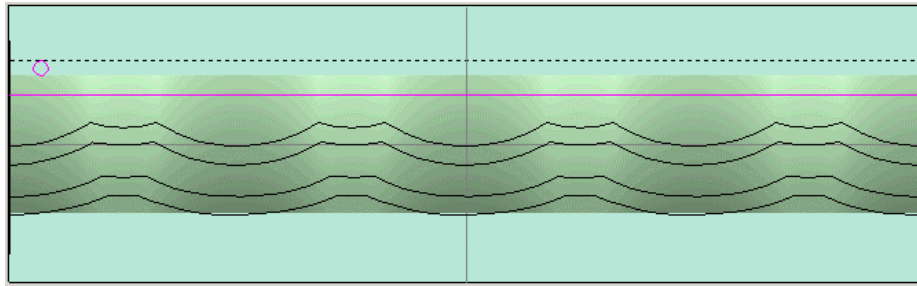
Creating a Millgrain Edge


First, we will create a band of millgrains around the flush setting. This is made up of a strip of small circular domes on a raised plane.

1. Press the *F2* key on your keyboard to return to the 2D View window. You can see the vector artwork that has been used to calculate the rotary flush setting relief.
2. Click on the **Assistant** tab to display the Assistant's home page.
3. Click on the **Create Polyline**  button in the **Vector Editing** area to display the **Poly Line Creation** page.
4. In the **Next Point** area, type *-12.58* in the **X** box, *1.35* in the **Y** box, and then click on the **Add** button.
5. In the **Next Point** area, type *12.58* in the **X** box, *1.35* in the **Y** box, and then click on the **Add** button.
6. Click on the **Close** button to create the polyline and return to the Assistant's Home page.



7. Click on the **Create Circles**  button to display the **Circle Creation** page.
8. In the **Circle Centre** area, type *-11.7* in the **X** box and *2.1* in the **Y** box.
9. In the **Circle Size** area, click to select the **Diameter** radio button and then type *0.4* in the box below.
10. Click on the **Create** button to create the circle.
11. Click on the **Close** button to return to the Assistant's Home page.
12. With the circle selected, hold the *Shift* key down on your keyboard to allow for multiple selections, and then click to select the polyline that you created.

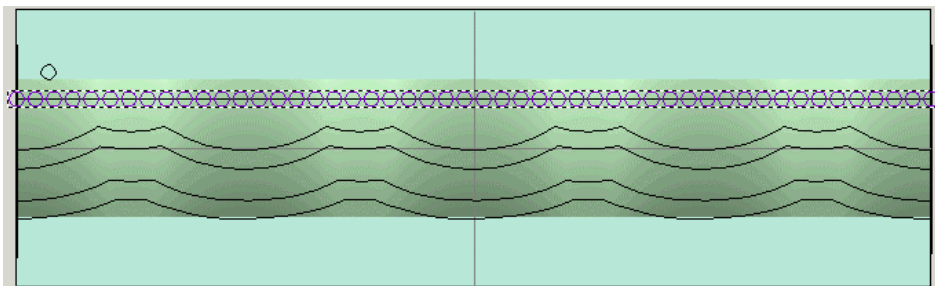



13. Click on the **Paste Along a Curve**  button in the **Vector Editing** area.
14. Type **50** in the **Number of Copies** box, and then click on the **Paste** button to create fifty copies of the circle along the copy of the polyline.
15. Click on the **Close** button to return to the Assistant's Home page.

Adding the Grains

We are now ready to create the series of small dome shapes that make up the millgrains.


1. Click to select any one of the circles created along the polyline. Since the **Paste Along a Curve** tool creates the copies as a single group, all the circles are now selected.



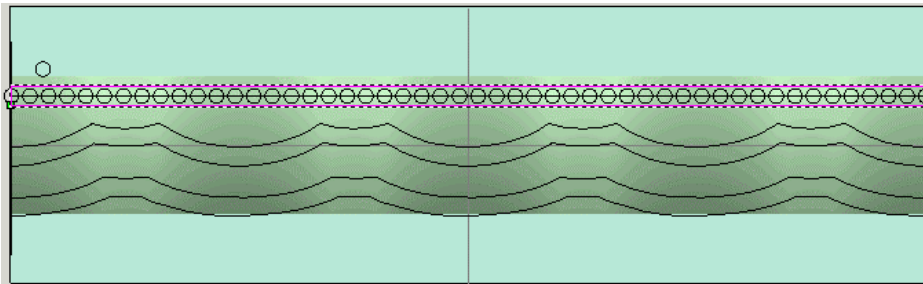
2. Press the *F12* button on your keyboard to display the **Shape Editor**.
3. Click on the **Round**  button.
4. Type **60** in the **Angle** box.
5. Click on the **Add** button to add the round shapes to the relief.
6. Click on the **Close** button to exit the **Shape Editor**.

Creating the Raised Band

We will now create the raised plane base shape on which the band of millgrains shall lie.

1. Click on the **Create Rectangle**  button in the **Vector Editing** area of the Assistant's Home page to display the **Rectangle Creation** page.
2. Type **25.152** in the **Width** box.
3. Type **0.54** in the **Height** box.


4. Type *1.36* in the **Y** box.
5. Click on the **Create** button to create the rectangle, followed by the **Close** button to return to the Assistant's Home page.

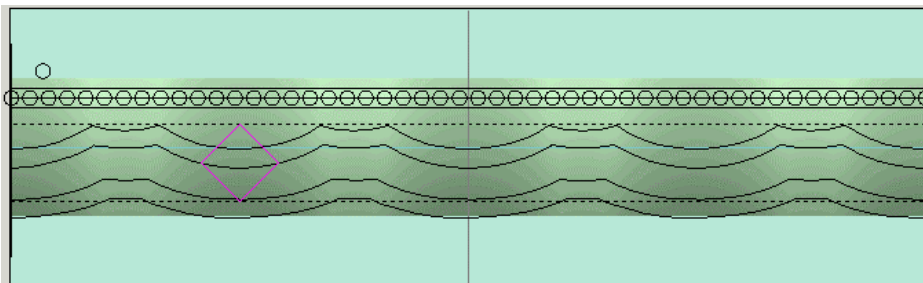



6. Press the *F12* button on your keyboard to display the **Shape Editor**.
7. Type *0.2* in the **Start Height** box. We will use the remaining default settings (a flat plane) to create a raised plane of 0.2 mm under the millgrains.
8. Click on the **Add** button to add the flat shape to the relief.
9. Click on the **Close** button.

Creating the Side Cuts

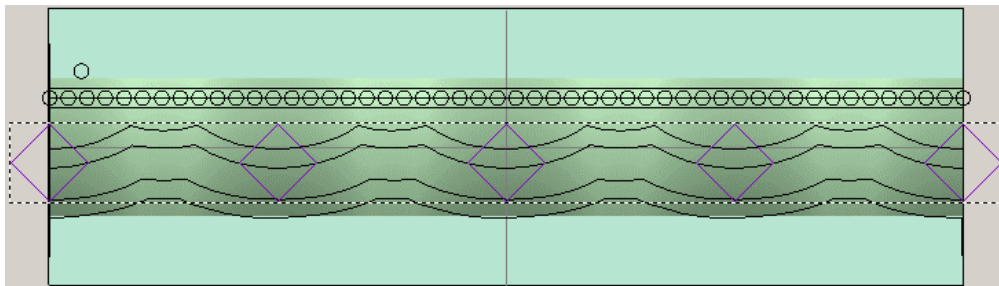
Next, we will create some diamond shaped cuts in the front and back face of the flush setting.

1. Click on the **Create Rectangle**  button in the **Vector Editing** area of the Assistant's Home page to display the **Rectangle Creation** page.
2. Click on the **Square** radio button to select it. The **Width** box is greyed out.
3. Type *1.5* in the **Height** box.
4. In the **Centre Point** area, type *-6.3* in the **X** box.
5. In the **Centre Point** area, type *-0.4* in the **Y** box.
6. Type *45* in the **Angle** box.
7. Click on the **Create** button to create a diamond shape.
8. Click the **Close** button to return to the Assistant's Home page.



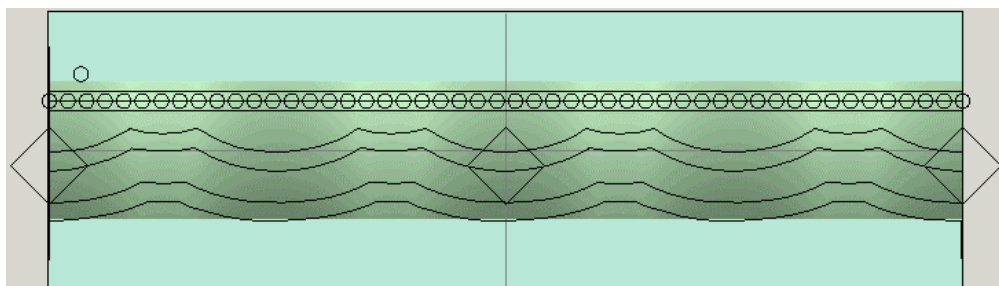
9. With the diamond vector selected, hold the *Shift* key down on your keyboard and then click to select the horizontal guide vector that divides the model area.
10. Click on the **Paste Along a Curve**  button in the **Vector Editing** area to display the **Paste Along a Curve** page.

11. Type 5 in the **Number of Copies** box, and then click on the **Paste** button to create five copies of the diamond shape vector (the first vector in the current selection) along the horizontal guide vector (the second and last vector in the current selection).
12. Click on the **Close** button to return to the Assistant's Home page. Both the horizontal guide vector and the original diamond shape vector remain selected.
13. Press the *Delete* key on your keyboard. A message box appears indicating that one or more of the selected vectors are locked, this being the horizontal guide vector. Click on the **No** button to close the message box and delete only the original diamond shape vector from which the five copies were created.
14. Click to select any of the five new copies of the diamond shape. All of the diamond shape vectors turn purple, indicating that they are grouped together and selected.
15. Press the **↓** key on your keyboard until the grouped diamond shapes are positioned as shown below:

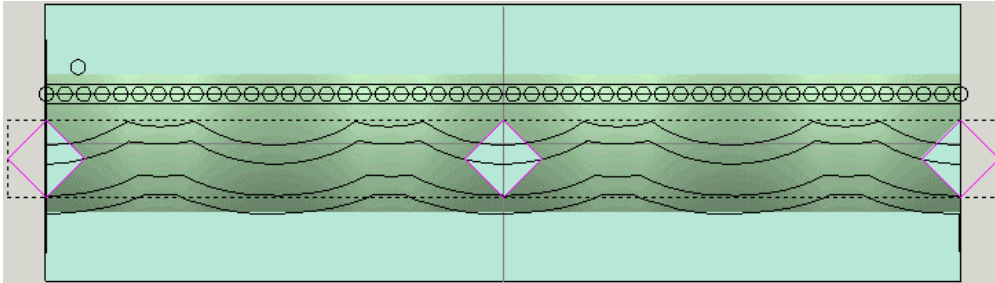



16. Press the *Ctrl + U* keys on your keyboard to ungroup the five diamond shape vectors. The diamond shape vectors turn magenta, indicating that they are now ungrouped.
17. Click anywhere in the grey area of the 2D View to deselect the diamond shape vectors.
18. Click to select the second diamond shape vector from the left-edge of the model area.
19. Press the *Delete* key on your keyboard to delete the diamond shape vector.
20. Click to select the second diamond shape vector from the right-edge of the model area.
21. Press the *Delete* key on your keyboard to delete the diamond shape vector.

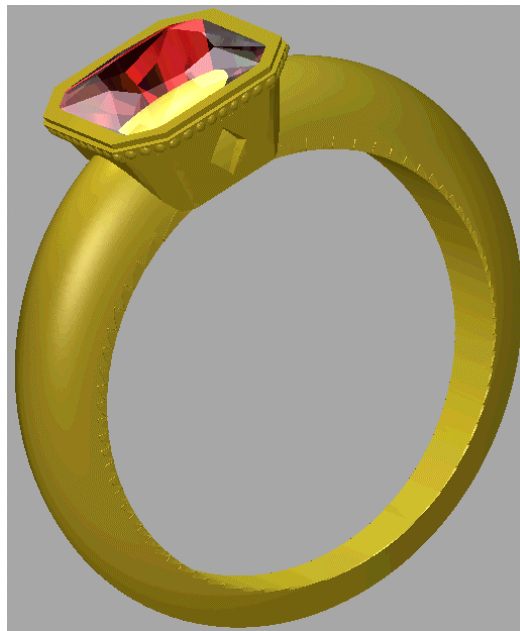
The remaining diamond shape vectors will be used to create cuts in both the front and back face of our setting.




22. Hold down the *Shift* key on your keyboard and then click to select all three of the remaining diamond shape vectors. The vectors turn magenta and are surrounded by a bounding box.
23. Press the *F12* key on your keyboard to display the **Shape Editor**.
24. Click on the **Zero** button to reset the areas of the relief within the area of the three diamond shape vectors to zero.




25. Click on the **Close** button to exit the **Shape Editor**.
26. Click on the **JewelSmith** tab to display the **Rotary Flush** page.
27. Click on the **Rebuild**  button to regenerate the replica mesh of the rotary flush setting relief using the modified relief.
28. Press the *F3* key on your keyboard to display the 3D View window. You can see the new decorative rotary flush setting as shown on the following page:






29. Click on the **Accept**  button to add the replica mesh of the modified rotary flush setting to the current JewelSmith project and save its associated ArtCAM model file.

Since everything is saved, we are free to close this file and return to the Master Model Tree.

30. Click on the **Close Current File**  button in the **General Tools** area to return to the **Project** page.

31. Click on the **Save**  button in the **Project Tools** area to save the JewelSmith Project.


You will see that a new  icon in the Master Model indicates that a second 3D Assembly component named *BoxRadiantFlushSetting* has now been added. This Assembly comprises two elements. The new  icon indicates the replica mesh of the setting shape and the  icon indicates the gemstone that is used simply for visualisation.


Creating the Side Flush Setting


We are now going to create an additional flush setting that we will eventually position on either side of the flush setting that holds the principal gemstone in our ring.


1. Click on the **JewelSmith** tab to display the **Project Components** page.

2. Click on the **Rotary Flush**  button in the **Blanks** area.

3. Click on the **Round**  button on the first page of the **Rotary Flush** wizard to define the shape of gemstone, and display the next group of settings.
4. Click on the **Standard** list box, and then on the *Carat* option so that we can define the size according to the standard diamond carat weights for this shape of stone.
5. Click on the **Size** list box, and then on the *0.30* option to select it.


6. Click on the **Next**  button to display the final group of settings.

7. Click on the **Diamond**  button to set the colour of the gemstone that will sit in the rotary flush setting.

8. Click on the **Next**  button to create the round flush setting.

A progress bar appears beneath the 2D View window to indicate the progress ArtCAM JewelSmith is making in generating the vector artwork and the relief for the rotary flush setting.

9. Press the *F3* key on your keyboard to display the 3D View window.

Since we will be decorating the flush setting, do not click on the **Accept** button  at this time.

Initially the new setting will be obscured by the existing components. In order to view it, we must first hide the *TaperedRound* and the *BoxRadiantFlushSetting* assemblies.

10. Click on the **Project** tab to display the **Project** page.

11. From the Master Model Tree, click to select the *TaperedRound* assembly. Its name appears in bold.
12. Right-click to display its context menu, and then click on the **Hide** option to hide it from view in the 3D View window.
13. Repeat the previous two steps for the *BoxRadiantFlushSetting* assembly in the Master Model Tree. Only the new *RoundFlushSetting* can now be seen in the 3D View window.




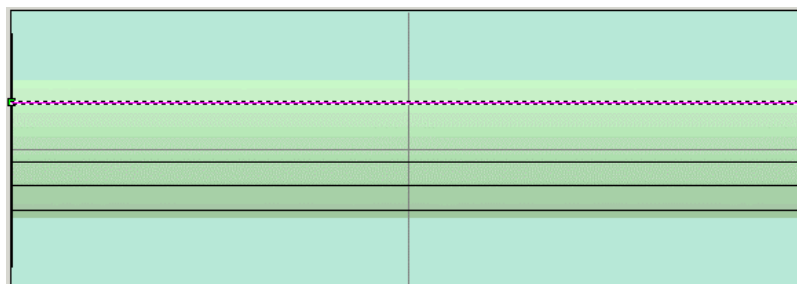
Decorating the Side Flush Setting



As with the centre setting, we are going to decorate the edge of the setting with millgrains.

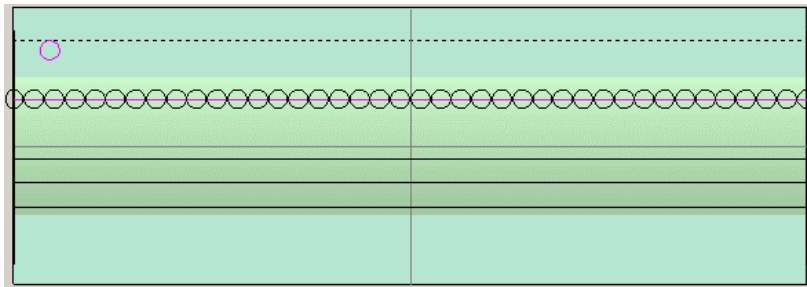
Creating a Band of Grains

First, we will create a band of grains around the flush setting. This is made up of small dome shapes on a slightly raised platform.


1. Press the *F2* key on your keyboard to display the 2D View window.
2. Click on the **Assistant** tab to display the Assistant's Home page.
3. Click on the **Create Polyline**  button in the **Vector Editing** area to display the **Poly Line Creation** page.
4. In the **Next Point** area, type -8.247 in the **X** box, 0.981 in the **Y** box, and then click on the **Add** button.
5. In the **Next Point** area, type 8.247 in the **X** box, 0.981 in the **Y** box, and then click on the **Add** button.
6. Click on the **Close** button to create the polyline and return to the Assistant's Home page.




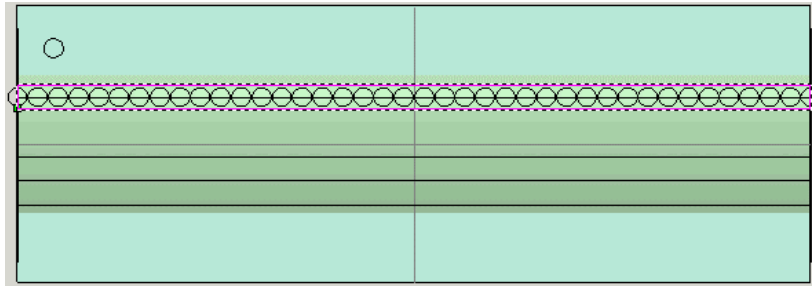
7. Click on the **Create Circles**  button in the **Vector Editing** area of the Assistant's Home page.
8. In the **Circle Creation** page, type -7.5 in the **X** box and 2 in the **Y** box **Circle Centre** area.
9. Click to select the **Diameter** radio button, type 0.4 in the box below, and then click on the **Create** button.
10. Click on the **Close** button to return to the Assistant's Home page.
11. With the circle vector selected, hold down the *Shift* key on your keyboard, and then click to select the copy of the horizontal guide vector.
12. Click on the **Paste Along a Curve**  button in the **Vector Editing** area to display the **Paste Along a Curve** page.
13. Type 40 in the **Number of Copies** box, and then click on the **Paste** button to create forty copies of the circle along the copy of the horizontal guide vector.




14. Click on the **Close** button to return to the Assistant's Home page.
15. Click to select any one of the circles to select the entire group.
16. Press the *F12* key on your keyboard to display the **Shape Editor**.




17. Click on the **Round**  button.
18. Type 60 in the **Angle** box.
19. Click on the **Add** button to add the round shapes to the existing relief.
20. Click on the **Close** button to exit the **Shape Editor**.


21. Click on the **Create Rectangle**  button in the **Vector Editing** area of the Assistant's Home page to display the **Rectangle Creation** page.
22. Type 16.492 in the **Width** box.
23. Type 0.505 in the **Height** box.
24. Type 0.982 in the **Y** box.
25. Click on the **Create** button to create the rectangle around the row of circle vectors, followed by the **Close** button to return to the Assistant's Home page.



26. Press the *F12* button on your keyboard to display the **Shape Editor**.
27. Type *0.2* in the **Start Height** box. We will use the remaining default settings (a flat plane) to create a raised plane of 0.2 mm beneath the millgrains.
28. Click on the **Add** button to add the flat shape to the relief.
29. Click on the **Close** button.
30. Click on the JewelSmith tab to display the **Rotary Flush** page.
31. Click on the **Rebuild**  button to regenerate the replica mesh of the flush setting using the modified relief.
32. Press the *F3* key on your keyboard to display the 3D View window.





33. Click on the **Accept**  button to add the replica mesh of the modified flush setting to the current JewelSmith project and save its associated ArtCAM model file.
34. Click on the **Close Current File**  button in the **General Tools** area to return to the **Project** page.
35. Click on the **Save**  button in the **Project Tools** area to save the JewelSmith Project.


The third  icon in the project tree indicates that the new assembly named *RoundFlushSetting* has been added to the Master Model Tree.

Repositioning the Side Flush Setting

By default the new 3D Assembly of the flush setting has been positioned top-centre on the ring shank and it needs to be repositioned to the right of the *BoxRadiantFlushSetting* that holds the principal gemstone.

1. From the Master Model Tree, click to select the *BoxRadiantFlushSetting* assembly. Its name is shown in bold text.
2. Right-click to display its context menu, and then click on the **Show** option to view the assembly in the 3D View window.
3. From the Master Model Tree, click to select the *RoundFlushSetting* assembly.
4. Click on the **Nudge**  button in the **Positioning** area to display its settings.

Ensure that the origin markers visible in the 3D View window using the **Origin**  button on the 3D View toolbar. You should see that there are two origin markers visible. The model's world centre origin is shown in wireframe only, while the currently selected assembly's component origin is solid. Using the nudge tools we can work relative to either of these origins. In this case, we will work using the world centre origin.


5. In the **Transform Relative To** area, click to select the **World Centre** radio button.
6. Click to select the **X** radio button, and then type *30* in the **Angle** box.
7. Click on the  icon once to rotate the *RoundFlushSetting* assembly anti-clockwise around the X-axis of the world centre by 30 degrees.




8. Click on the **Back**  button to return to the previous page.


Duplicating and Mirroring the Side Flush Setting

Since we want to produce a ring with a setting on either side of the central setting, we can now create a copy of the existing *RoundFlushSetting* and then reposition it on the other side of the shank.



1. Make sure that the *RoundFlushSetting* assembly is selected in the Master Model. The name of the currently selected object is always indicated in the title of the toolset available below the Master Model Tree.
2. Click on the **Copy**  button in the **Edit** area to create a copy of the *RoundFlushSetting* assembly.

3. Click to select the Master Model, named *NewProject.3DP*,  in the Master Model Tree. Its name is now shown in bold text.



If we pasted the object with a sub-assembly selected, it would be added beneath the selected assembly in the tree. By selecting the Master Model before pasting, we ensure that the new assembly will be added to the top level.

4. Click on the **Paste**  button in the **Edit** area and a second *RoundFlushSetting* assembly is created in the Master Model.

To avoid confusion later, we will now change the name of the new setting.

5. Click to select the second and last *RoundFlushSetting* assembly in the Master Model Tree. Its name is now shown in bold text.
6. Click on the **Attributes**  button in the **Assembly Manager** area to display its settings.
7. Type *RoundFlushSetting2* in the **Name** box.
8. Click on the **Accept**  button.

The new assembly has now been renamed as *RoundFlushSetting2* in the Master Model Tree. There are now four assemblies in total. Finally, to complete the three-stone head, we need to position the new flush setting on the other side of the central gem.

9. With *RoundFlushSetting2* selected, click on the **Nudge**  button in the **Positioning** area to display its settings.
10. In the **Transform Relative To** area, click to select the **World Centre** radio button.
11. Click to select the **Z** radio button, and then type *180* in the **Angle** box.
12. Click on the  button once to rotate the *RoundFlush2* assembly anti-clockwise around the Z-axis.
13. In the 3D View, the *RoundFlushSetting2* setting can now be seen to the left of the *BoxRadiantFlushSetting* as follows:





14. Click on the **Back**  button to return to the previous page.

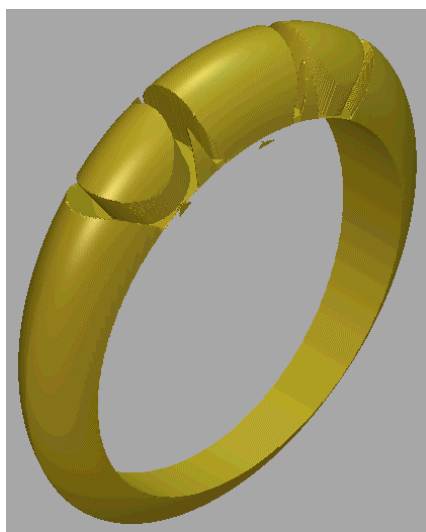
Editing the Shank


We will now edit our existing shank. First, we shall remove the areas of the shank relief that are no longer needed now that the flush settings have been created. This ensures that the minimum amount of materials are used when casting the ring, that it is not unnecessarily heavy and it is as cost effective as possible.


Removing Unwanted Material

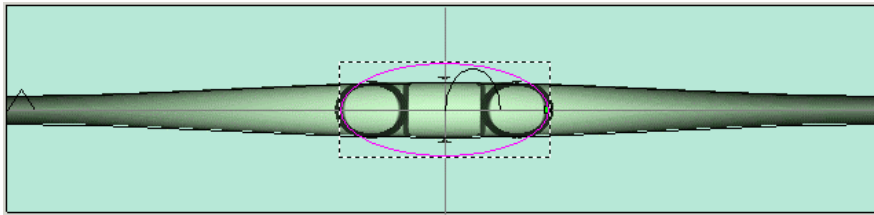
We are now ready to remove the unnecessary areas of the shank. We will do this by subtracting the shape of all three of our flush settings from the shank, and then resetting the area to zero.

1. Make sure that only the *BoxRadiantFlushSetting*, *RoundFlushSetting* and *RoundFlushSetting2* assemblies are currently shown in the 3D View window.
2. Click to select the *TaperedRound* assembly from the Master Model Tree. Its name is now shown in bold text.
3. Click on the **Edit Associated Model**  button in the **Assembly Manager** area to open the ArtCAM model file that was used to create the *TaperedRound* assembly.
4. Click on the **Subtract Master**  button in the **General Tools** area to subtract the shape of the *BoxRadiantFlushSetting*, *RoundFlushSetting* and *RoundFlushSetting2* assemblies from that of the *TaperedRound* assembly.
5. Press the *F3* key on your keyboard to display the 3D View window. You can now see the new shape of the *TaperedRoundShank* relief, as shown below:



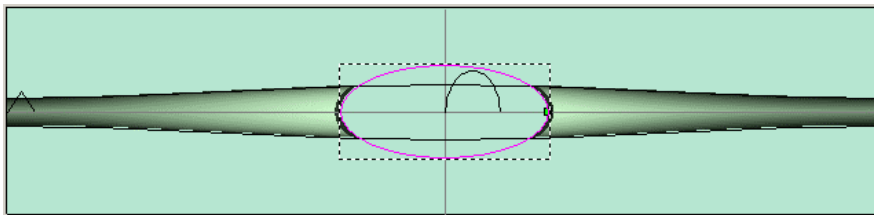
6. Press the *F2* key on your keyboard to display the 2D View window.
7. Click on the **Greyscale**  button in the 2D View toolbar to display a greyscale view of the new unwrapped shank relief in the 2D View window.

8. Click on the **Assistant** tab to display the Assistant's Home page.
9. Click on the **Create Ellipse**  button in the **Vector Editing** area to display the **Ellipse Creation** page.
10. Type *-6.734* in the **Ellipse Height** box.
11. Type *-15.13* in the **Ellipse Width** box.
12. Click on the **Create** button.
13. Click on the **Close** button.
14. Make sure that the ellipse is selected by clicking on it. The ellipse is magenta and surrounded by a bounding box.



15. Press the *F12* key on your keyboard to display the **Shape Editor**.
16. Click on the **Zero** button. This instructs ArtCAM JewelSmith to reset the area of the *TaperedRound* relief within the boundary of the ellipse to zero.

All unwanted areas of the shank relief have now been removed, as shown below:



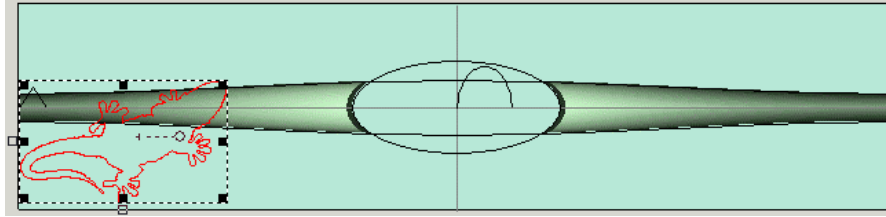
17. Click on the **Close** button to exit the **Shape Editor**.

Adding Detail to the Shank

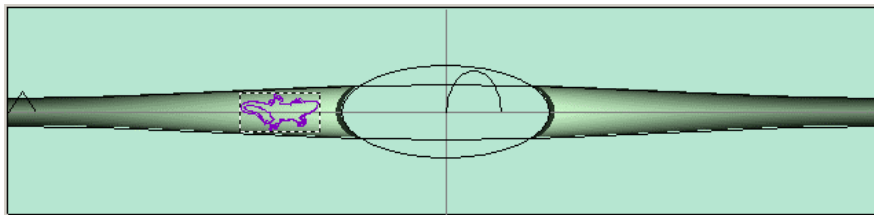
We are now ready to add some detail to the shank relief. We will combine a relief in the shape of a lizard with the left side of the shank, and then mirror the existing relief so that a lizard eventually sits on either side.



1. From the Main menu bar, click on the **Relief** drop-down menu, followed by the **Load** option, and finally the **Paste** option to display the **Open** dialog box.
2. Click on the **Look in** list box, and then browse to the *3dClipArt\CREATURE* folder on your Installation CD.
3. Click to select the *LIZARD.RLF* file. Its name appears in the **File name** box.
4. Click on the **Open** button to display the **3D Clipart** dialog box.

In the 2D View window, a red vector outline indicates the current size and position of the lizard relief in the model:



5. Click on the **Scale** tab to display its settings, and then type **35** in the **New scale %** box.
6. Click on the **Rotate** tab, and then type **20** in the **Rotate by angle** box.
7. Click on the **Move** tab, and then type **10.1** in the **Move Y origin by** box, followed by **12** in the **Move X origin by** box.
8. Click on the **Apply** button. The vector outline turns purple and represents the new size and position of the lizard relief in relation to the shank relief:






9. Click on the **Mode** tab and make sure that the **Add** radio button is selected in the **Paste Mode** area by clicking on it.
10. Click on the **Paste** button to combine the lizard relief with the existing *TaperedRound* relief.
11. Click on the **Close** button.
12. Click on the **JewelSmith** tab to display the **Rotary Axis Tools** page.
13. Click on the **Mirror Relief**  button in the **General Tools** area to display the **Mirror Relief** page.
14. Make sure that the **Left/Right** option is selected in the **Mirror Options** list box. This allows us to mirror the left side of the shank onto the right, thus producing a lizard on both sides of the shank.
15. Click on the **Next**  button to mirror the relief.
16. Press the *F3* key on your keyboard to display the 3D View window.



Saving the New Shank

Since we have finished modifying the shank relief, we are now ready to add its new assembly to the JewelSmith Project. In doing so, we will replace the previous *TaperedRound* assembly and the ArtCAM model file from which it was created.

1. Click on the **Add To Master**  button in the **General Tools** area to display the **Add To Master** page.
2. Click on the **Next**  button to add the modified *TaperedRound* assembly to the JewelSmith Project.
3. Click on the **Accept**  button. A message box appears requesting if you want to replace the existing *TaperedRound* assembly.
4. Click on the **Yes** button to replace the existing assembly. A message box appears requesting if you want to save the current ArtCAM model.
5. Click on the **Yes** button to replace the existing ArtCAM model file used to create the *TaperedRound* assembly.



In the *NewProject* directory, the modified ArtCAM Model file named *TaperedRound* is saved in the *Shank* folder.

6. Click on the **Close Current File**  button in the **General Tools** area to display the **Project** page.



Presenting the Finished Ring

Finally we will shade the different assemblies that make up the JewelSmith Project so that they each appear as if they were cast in 24 carat polished gold. This allows prospective customers to visualise the finished ring prior to manufacture.

1. Make sure that the *NewProject.3DP* project is selected in the Master Model Tree. Its name is now shown in bold text.
2. Click on the **Shading**  button in the **Assembly Manager** area to display the shading settings.
3. Click on the **Shading Set** list box, and then on the *24ct Polished Gold* option to select it.
4. Click on the **Background** list box, and then on the *ArtCAM* option to select it.
5. Click on the **Accept**  button to render the JewelSmith Project as if it were cast in 24 carat polished gold.

The rendered assemblies are now shown as follows in the 3D View window:



6. Click on the **Save** button in the **Project Tools** area to save the JewelSmith Project.



7. Click on the **Close Project** button to return to the Assistant's **Getting Started** page.

Zodiac Signet Ring Tutorial

Overview

In this tutorial, we will create a signet style ring and decorate it using relief clipart on the Installation CD. The important design features of the shank are the flat top, with a square cross section, which blends smoothly into the rounded 'D' shaped shank.



Zodiac Signet Ring

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

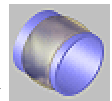

- Creating the JewelSmith Project.
- Creating a Rotary Axis Shank Model.
- Designing the Shank Shape.
- Decorating the Shank Relief.
- Adding the Relief to the Master Model.
- Presenting the Finished Ring.

Creating the JewelSmith Project

As usual, our first step is to create a new JewelSmith Project to manage the component models needed to produce the ring. In this example, there will only be one component; the shank.

1. Click on the **Create JewelSmith Project**  icon in the **JewelSmith Projects** area of the Assistant's **Getting Started** page to display the **New Project** page.
2. Type *ZodiacSignet* in the **Project Name** box.
3. Click on the **Accept**  button to create the JewelSmith Project.

Creating a Rotary Axis Shank Model

1. Click on the **JewelSmith** tab to display the **Project Components** page.
2. Click on the **Rotary Shank**  button in the **Blanks** area of the page to display the **Rotary Shank** page.
3. Click on the **Standard** list box, and then on the *Custom* option to select it.
4. Type *20* in both the **Diameter** and **Width** boxes.
5. Type *5* in the **Border** box, *2* in the **Thickness** box and *30* in the **Resolution** box.
6. Click on the **Accept**  button to create an ArtCAM model file according to these settings. This ArtCAM model file is named *RotaryAxisShank* by default.


When the creation process has finished you will see that the 2D View of the model has some reference geometry already within it. This includes horizontal and vertical guidelines and two concentric circles below the model area. The circles correspond to the inner and outer (as defined by the thickness setting) diameters of the shank. This artwork is known as the Reference Silhouette, and by default the artwork is created on a locked layer. However, you can copy and paste the artwork to provide a starting point for your design. You can also use this area of the 2D View for laying out design features on the shank, in profile form. This can often be a useful addition to the conventional 'unwrapped' view, as this tutorial will demonstrate.

Designing the Shank Shape

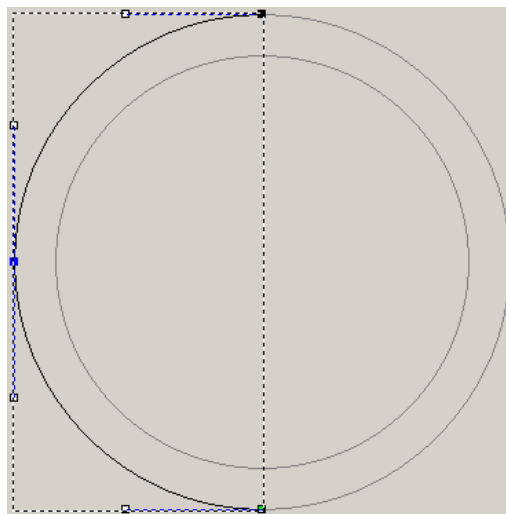
The zodiac signet shank will be created from a two rail swept shape combined with relief clipart on the ArtCAM JewelSmith Installation CD. Before we can create a two rail swept shape we must first create the necessary vector artwork.


Creating the Z Modulation Curve

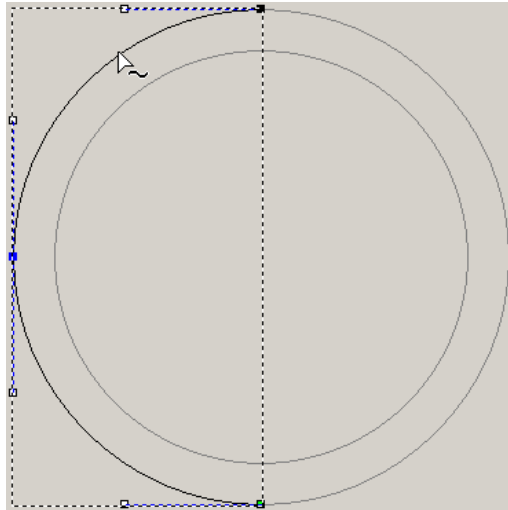
Because JewelSmith provides mirror tools for both vector artwork and the relief, we only need to design a partial section of the ring.


1. Click to select the outer circle of the reference silhouette.
2. Press the *Ctrl + C* keys on your keyboard to create a copy of the reference silhouette on the ArtCAM clipboard.
3. Press the *Ctrl + V* keys to paste a duplicate copy of the reference silhouette overlaying the original.
4. Press the *N* key to enter Node Editing mode.
5. Move the cursor over the top-right segment, or span, of the circle. When the cursor changes to , press the *R* key to remove the span.
6. Repeat this process to remove the bottom-right span of the circle.

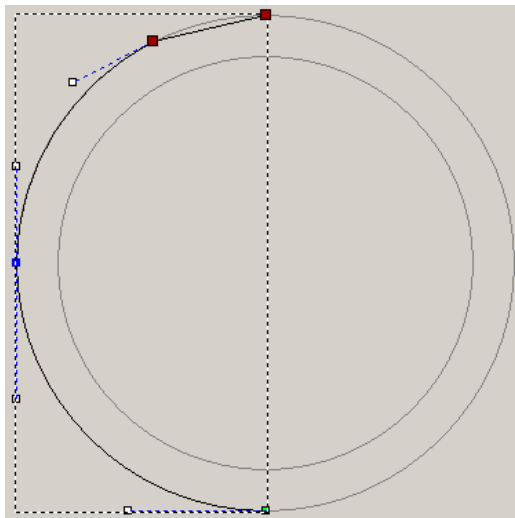
We are now left with a semi-circle, representing the left side of the shank.



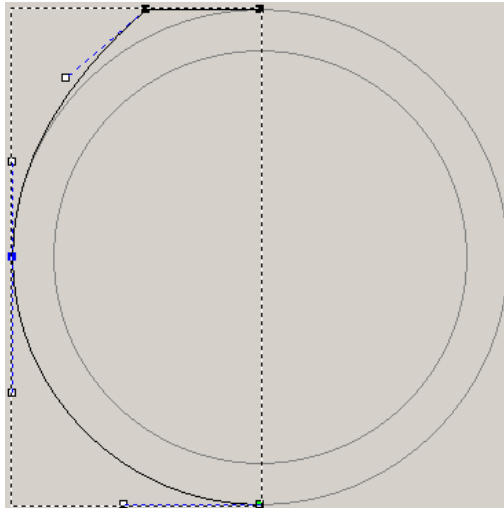
7. Move the  cursor to the point on the semi-circle that is about one third of the way along the first span from the top:



8. Press the *I* key to insert a new node in the span.
9. Move the  cursor to a position over the span between the new node and the top node.
10. Press the *L* key to convert the span to a linear span.
11. Click and drag to create a bounding box around the node that you have just inserted and the top node. Both nodes turn red to indicate that they are now selected.




12. Press the *Y* key to align the two selected nodes in the Y-axis.

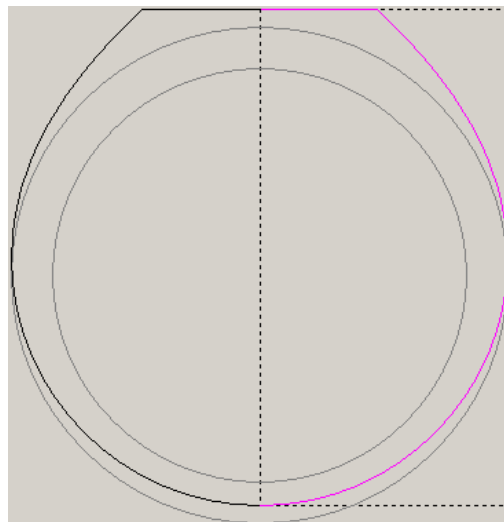


This shortcut allows us to align all nodes currently selected, with the position of the last selected node. As you might expect, the *X* key performs a similar operation along the X-axis. In this example we have aligned the new node with the top node, along the Y-axis.


13. Press the *Esc* key to return to Select Vectors mode.
14. Click on the **Assistant** tab to display the Assistant's Home page.

15. Click on the **Mirror Vectors**  button in the **Vector Editing** area to display the **Mirror Vectors** page.

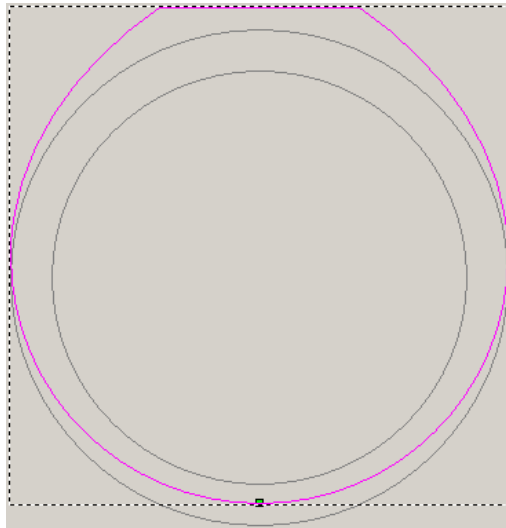
16. Hold down the *Ctrl* key, and then click on the **Right** option to create a mirrored copy of the vector artwork from left to right.



17. Click on the **Close** button to return to the Assistant's Home page.
18. With the vector on the right selected, hold the *Shift* key down and then click to select the vector on the left. Both the original and the mirrored vector should now be selected.

19. Click on the **Join Vectors with a Curve**  button in the **Group Merge Join Trim Vectors** area to create a single curved vector.






20. Press the **↑** key to nudge the selected vector upwards to the exact position shown below. This has the effect of tapering the shank's thickness towards the back of the ring when using the vector to create a swept shape.

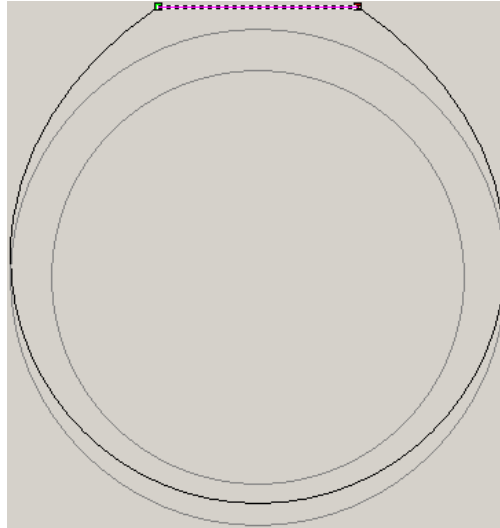



The vector we have created using the Reference Silhouette shall be used to control the overall height of the swept shape that forms the shank relief. This vector is referred to as the Z modulation curve.

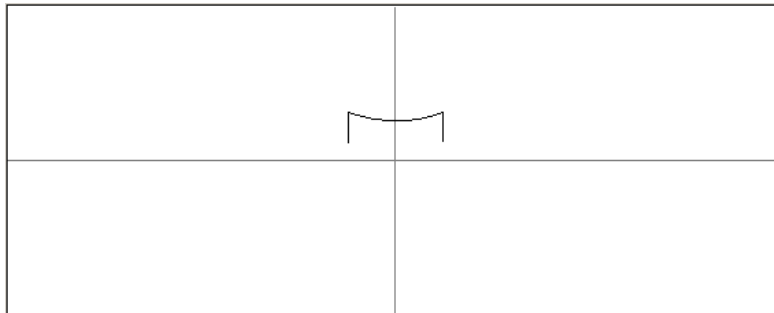
Creating the Drive Rails

Our next step is to produce two drive rails to match the z-modulation curve. We can use the node snapping tools to help in this process.

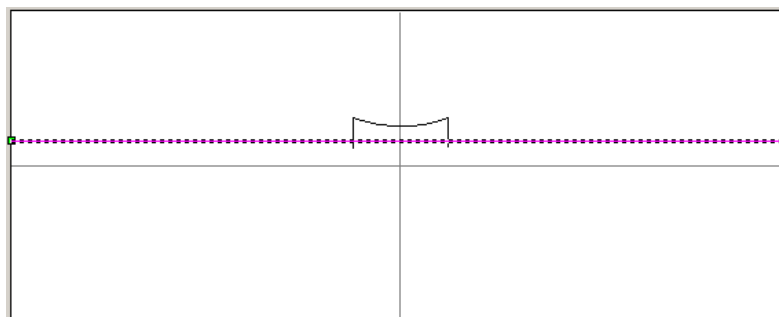
1. Click on the **Create Polyline**  button in the **Vector Editing** area to display the **Polyline Creation** page.
2. Move the  cursor over the top-left corner of the vector. When the cursor changes to , click to create the start point in the polyline.
3. Move the  cursor over the top-right corner of the vector. When the cursor changes to , click to create a point in the polyline. A linear span joins this and the start point.
4. Right-click to close the polyline and return to the Assistant's Home page.
5. Click to select the polyline that you have just created, as shown below:




6. Click on the **JewelSmith** tab to display the **Rotary Axis Tools** page.
7. Click on the **Unwrap Profile**  button to create a vector in the model area.
8. Click to select the unwrapped profile vector in the model area.
9. Press the **↑** key to nudge the selected vector upwards to the exact position shown below:

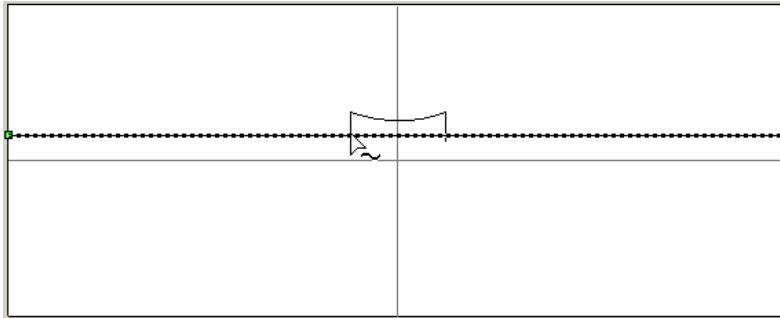


10. Click to select the horizontal guideline.
11. Press the **Ctrl + C** keys to create a copy of the horizontal guideline.
12. Press the **Ctrl + V** keys to paste a copy of the horizontal guideline overlaying the original.




13. Press the **↑** key to nudge the selected vector upwards by approximately 2.5 mm. You can use the ruler on the left-edge of the design window for guidance.
14. Press the **N** key to enter Node Editing mode.

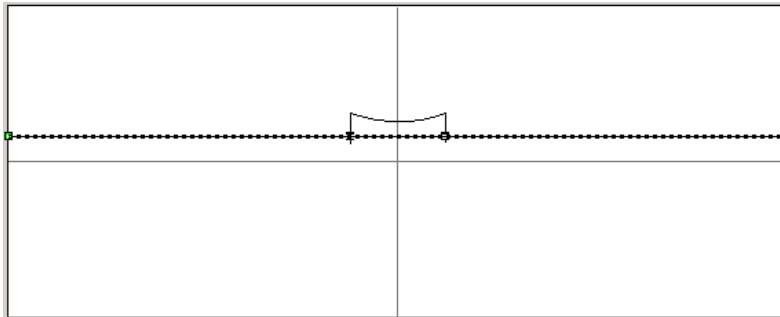
15. Move the  cursor over the position where the left edge of the unwrapped profile vector intersects with the copy of the horizontal guideline.




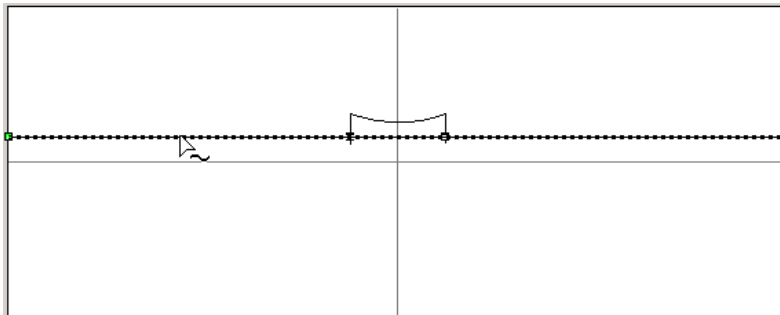
16. Press the *I* key to insert a node at this location.

17. Move the  cursor over the position where the right edge of the unwrapped profile vector intersects with the copy of the horizontal guideline.

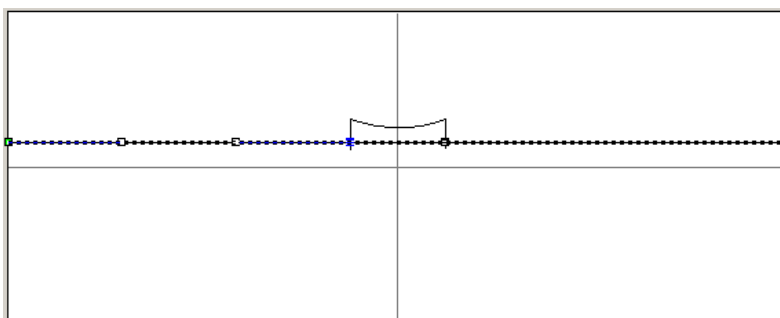
18. Press the *I* key to insert a node at this location.




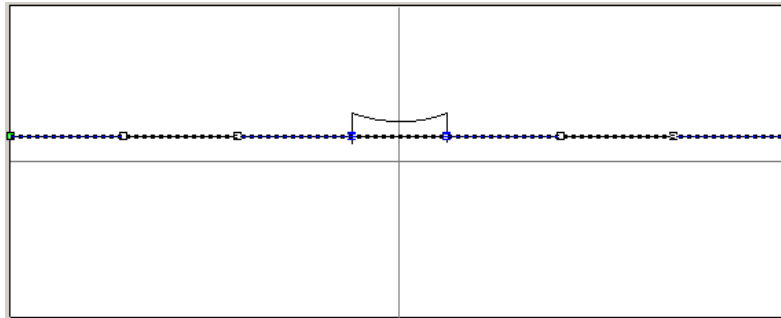
19. Move the  cursor over the span on the left side of the model area, anywhere between the start node and the left node you have just inserted.




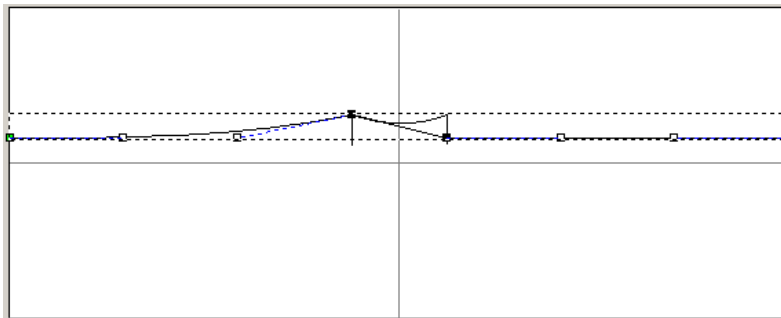
20. Press the *B* key to convert the span to a bezier.




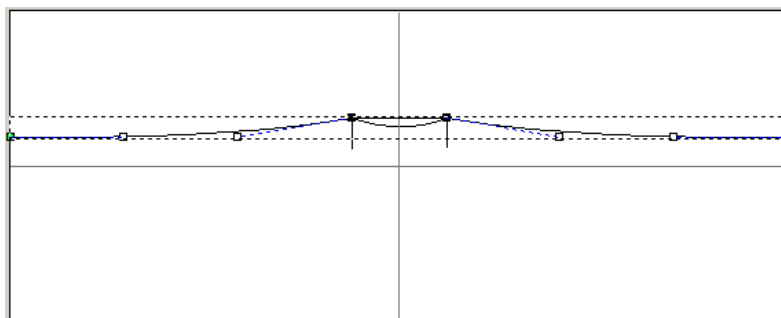
21. Move the  cursor over the span on the right side of the model area, anywhere between the end node and the right node you have just inserted, and then press the *B* key to convert the span to a bezier.




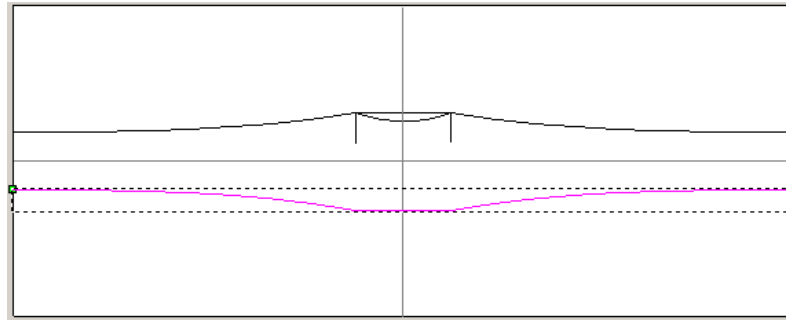
22. Click to select the left node that you recently inserted. The node turns red.
23. Click and drag the node upwards. When the cursor changes to , indicating that it has snapped to the top-left node in the unwrapped profile vector release the mouse button to reposition the node.



24. Click to select the right node that you recently inserted. The node turns red.
25. Click and drag the node upwards. When the cursor changes to , indicating that it has snapped to the top-right node in the unwrapped profile vector release the mouse button to reposition the node.









26. Press the *Esc* key to return to Select Vectors mode.
27. Hold the *Shift* key down, and then click to select the horizontal guideline.
28. Click on the **Assistant** tab to display the Assistant's Home page.
29. Click on the **Mirror Vectors**  button in the **Vector Editing** area to display the **Mirror Vectors** page.
30. Hold the *Ctrl* key down, and then click on the **About Line** option.





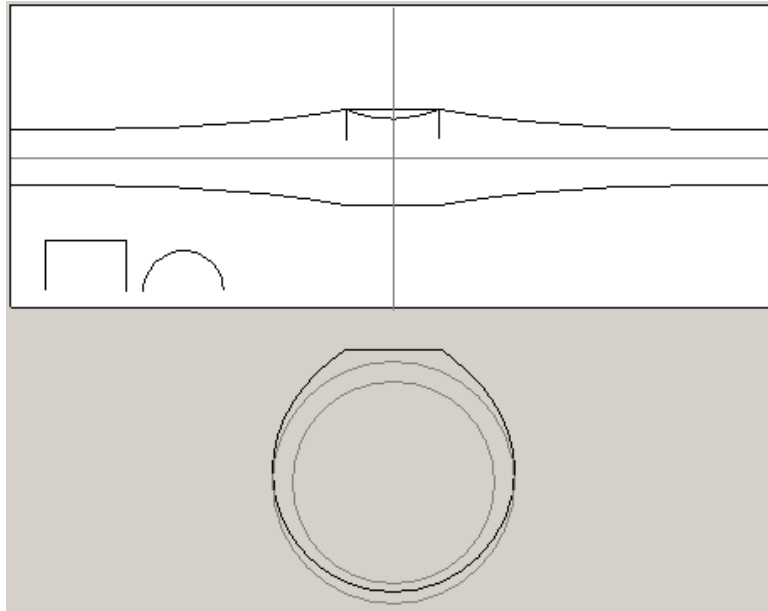
31. Click on the **Close** button to return to the Assistant's Home page.

Creating the Cross Sections

The final parts of the vector artwork that we need to create are the cross-sections. In this tutorial, we want to sweep smoothly from a 'D' shaped shank, up to the square shaped flat plane forming the head of the signet ring.

1. Click on the **Create Circles**  button in the **Vector Editing** area to display the **Circle Creation** page.
2. In the **Circle Centre** area, type -20.5 in the **X** box and -13 in the **Y** box.
3. In the **Circle Size** area, make sure that the **Diameter** option is selected by clicking on its radio button.
4. Type 8 in the **Diameter** box.
5. Make sure that the **Create with arcs** option is selected.
6. Click on the **Create** button.
7. Click on the **Close** button to return to the Assistant's Home page.
8. Press the *N* key to enter Node Editing mode.
9. Move the  cursor over the bottom-right span of the circle. When the cursor changes to , press the *R* key to delete the span.
10. Move the  cursor over the bottom-left span of the circle. When the cursor changes to , press the *R* key to delete the span. Only a semi-circle now remains.
11. Press the *Esc* key to return to Select Vectors mode.
12. Click on the **Create Rectangle**  button in the **Vector Editing** area to display the **Rectangle Creation** page.
13. In the **Square or Rectangle** area, make sure that the **Rectangle** option is selected by clicking on its radio button. This option is selected by default.
14. Type 8 in the **Width** box.
15. Type 5 in the **Height** box.
16. In the **Centre Point** area, type -30.5 in the **X** box and -11 in the **Y** box.
17. Click on the **Create** button.

18. Click on the **Close** button to return to the Assistant's Home page.
19. Press the *N* key to enter Node Editing mode.
20. Move the  cursor over the bottom span in the rectangle. When the cursor changes to , press the *R* key to delete the span.
21. Press the *Esc* key to return to Select Vectors mode.





Creating the Two Rail Swept Shape

Now that we have created all the necessary vector artwork, we can use it to generate the three-dimensional shape needed to form the basis of the shank relief. We will use the **Two Rail Sweep** tool to calculate our swept shape.

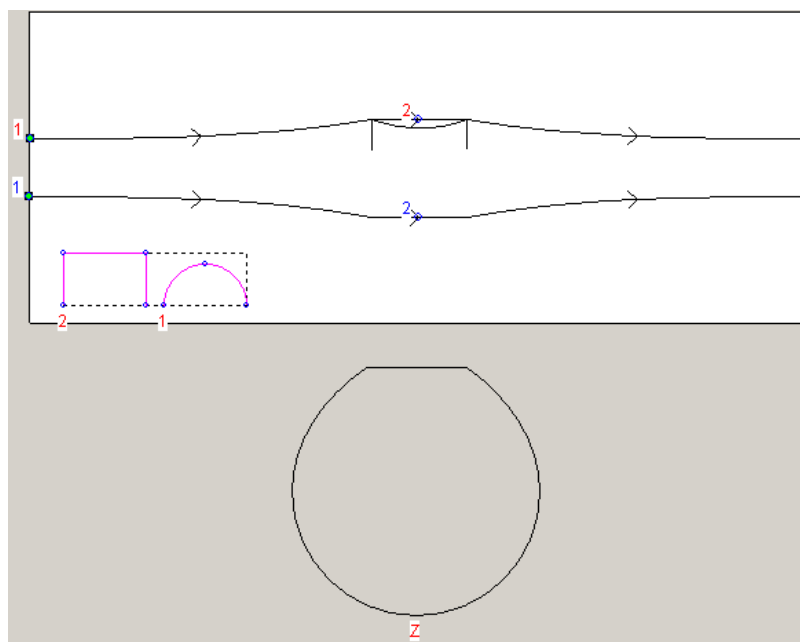
This process uses most of the available **Two-Rail Sweep** settings, so let's take a moment to consider what each of them do.




Firstly we will control our swept shape principally using a z-modulation curve. This is the vector we created using the Reference Silhouette. This means that the two cross-section shapes will be scaled up, and down, in z height during the sweep, so that the resulting profile of our swept shape exactly matches the vector we have drawn relative to the reference silhouette.

Next we will select our vectors so that we sweep between the drive rails, from a round cross-section on the left to a square cross-section on the right. Finally, the highest point of the swept shape in Z at each stage will be determined by the height of the selected z-modulation curve.

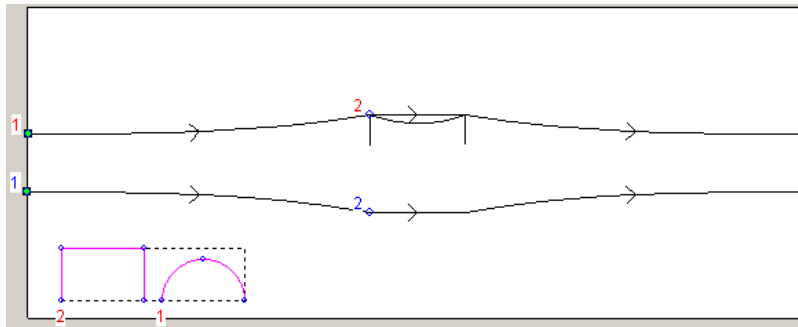
1. Click on the **Layers** tab to display the **Layers** page.
2. Click on the  button beside the *Reference Silhouette* and *Reference Lines* layers to hide these layers. This is because we no longer require these layers.
3. Click on the **JewelSmith** tab to display the **Rotary Axis Tools** page.
4. Click on the **2-Rail Sweep**  button in the **Modelling Tools** area to display the **Two Rail Ring Sweep** page.


5. Click to select the top curved vector in the model area.
6. Click on the **Select** button in the **Top Drive Rail** area to confirm the selected vector as the top drive rail. Direction arrows appear along the selected vector and a red letter *A* appears beside it. In the **Status** area, the First Drive Rail is shown as *Valid*.
7. Click to select the bottom, curved vector.
8. Click on the **Select** button in the **Bottom Drive Rail** area to confirm the selected vector as the bottom drive rail. Direction arrows appear along the selected vector and a red letter *B* appears beside it. In the **Status** area, the Second Drive Rail is shown as *Valid*.
9. Click to select the vector we had drawn using the Reference Silhouette. This is the vector in the grey area of the 2D View window beneath the model area.
10. Click on the **Select** button in the **Ring Silhouette** area. A red letter *Z* appears beside the selected vector. In the **Status** area, the Ring Silhouette is shown as *Valid*.
11. Click to select the semi-circle vector.
12. Hold the *Shift* key down, and then click to select the rectangle vector.
13. Click on the **Add Cross Section** button. A number *1* appears beside the semi-circle, and a number *2* beside the rectangle. You can also see a number *1* and *2* along the drive rails. This indicates the current position of each cross-section relative to each of the drive rails.



14. In the **Cross Section** area, click on the **Smooth Blend**  button to change it to the **Linear Blend**  button.
15. Make sure that the **Ring is symmetrical** option is selected. This option is selected by default.
16. In the **Cross Section** area, click on the **Set Position**  button associated with the second cross-section.

- Click on the top-left corner of the Z modulation vector drawn about the Reference Silhouette. This defines the new position of the second cross-section relative to the first and second drive rails. You can see that the number 2 shown on each of the drive rails has now changed position.




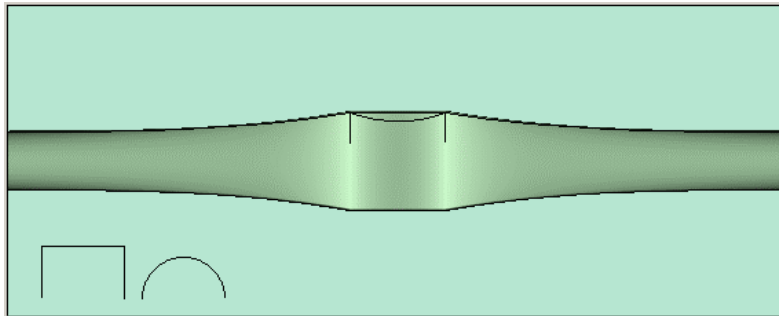
- Make sure that the **Silhouette Vector Controls Z** option is selected. This option is selected by default.
- In the **Combine** area, click to select the **Highest** option.
- Click on the **Calculate** button to create the two rail swept shape.
- Click on the **Close** button to return to the Assistant's Home page.
- Click on the **Smooth Relief**  button in the **Relief Editing** area to display the **Smooth Relief** dialog box.
- Make sure that the **Whole Relief** option is selected by clicking on its radio button.
- Type 3 in the **Smoothing Passes** box, and then click on the **Apply** button to smooth the relief.
- Click on the **Cancel** button to close the dialog box.
- Press the *F3* key to display the blank signet ring relief in the 3D View window, as shown below:




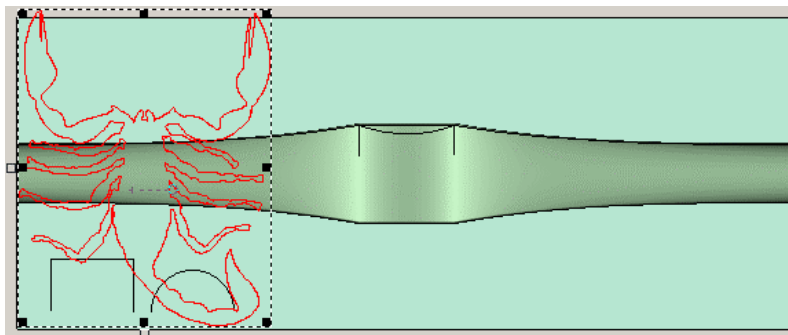
Decorating the Shank Relief

Now that we have created the shape that forms the basis of the shank, we are ready to add some detail in order to produce the finished ring design. We will combine two reliefs with the flat area of the shank to create a Scorpio motif.

1. Press the *F2* key to display the 2D View window.
2. Click on the **Greyscale**  button in the 2D View toolbar to display a greyscale view of the current shank relief in the 2D View window.



3. Click on the **Load Relief**  button in the **Relief Operations** area to display the **Open** dialog box.
4. Click on the **Look in** list box, and then browse to the *3dClipArt\CREATURE* folder on your Installation CD.
5. Click to select the *SCORPION.RLF* file. Its name appears in the **File name** box.
6. Click the **Open** button to display the **Load Relief** dialog box.
7. Select the **Pasting** option by clicking on its radio button.
8. Click the **OK** button to load the clipart relief into the model. A vector outline of the Scorpio relief is shown in red. The **3D Clipart** dialog box is displayed, and a red vector outline of the *Scorpion* relief is shown.

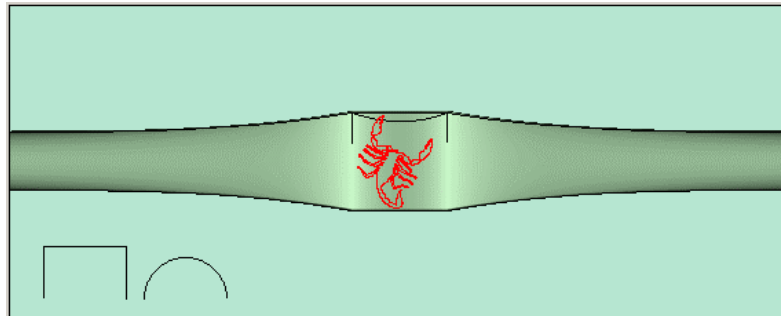


9. Click on the **Rotate** tab to display its settings, and then type *25* in the **Rotate by angle** box.
10. Click on the **Scale** tab to display its settings, and then type *25* in the **New scale %** box.
11. Click on the **Move** tab to display its settings, and then type *24.5* in the **Move Y origin by** box and *-0.75* in the **Move X origin by** box.


12. Click on the **Apply** button to resize and reposition the vector outline of the *Scorpion* relief.
13. Click on the **Wrap** tab, and then select the **Wrap X** option by clicking on its radio button.

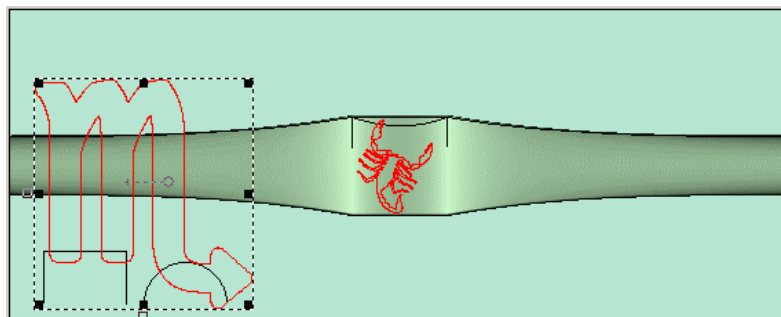
Since the underlying relief that forms the flat face of the ring's shank is actually a curved surface (to compensate for the rotary axis wrapping), this option will stop the clipart from being distorted.

14. Click on the **Paste** button to combine the Scorpion relief with the existing shank relief.



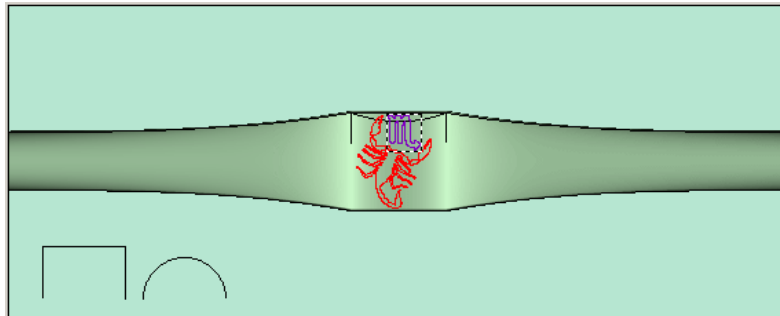
15. Click on the **Close** button.

16. Click on the **Load Relief**  button in the **Relief Operations** area to display the **Open** dialog box.
17. Use the **File Open** window to browse to the *3dClipArt\ZODIAC* folder on your Installation CD.
18. Click to select the *SCORPIO.RLF* file. Its name appears in the **File name** box.
19. Click the **Open** button to display the **Load Relief** dialog box.
20. Select the **Pasting** option by clicking on its radio button.
21. Click the **OK** button to load the clipart relief into the model. A vector outline of the *Scorpio* relief is shown in red. The **3D Clipart** dialog box is displayed, and a red vector outline of the *Scorpio* relief is shown.



22. Click on the **Scale** tab to display its settings, and then type *15* in the **New scale %** box.
23. Click on the **Move** tab to display its settings, and then type *26.3* in the **Move X origin by** box and *5.7* in the **Move Y origin by** box. The *Scorpio* relief is now positioned between the claws of the Scorpion.

24. Click on the **Wrap** tab, and then select the **Wrap X** option by clicking on its radio button.
25. Click on the **Paste** button to combine the *Scorpio* relief with the existing shank relief.







26. Click on the **Close** button.
27. Press the *F3* key to display the finished zodiac signet ring relief in the 3D View window, as shown below:



Adding the Relief to the Master Model






Now that we have created the finished relief for the ring, we are ready to add it to our Master Model as an assembly. During this process a replica mesh of the relief is created.

1. Click on the **JewelSmith** tab to display the **Rotary Axis Tools** page.
2. Click on the **Add to Master**  button in the **General Tools** area to display the **Add to Master** page.
3. Type *ZodiacSignet* in the **Assembly Name** box.
4. Make sure that the **Tolerance** is set as *0.002*.
5. Click on the **Next**  button to create a replica mesh of the finished *ZodiacSignet* ring relief.

6. Click on the **Accept**  button to add the assembly to the Master Model. A message box is displayed requesting if you also want to save the ArtCAM model associated with the assembly.
7. Click on the **Yes** button to save the ArtCAM model file.
8. Click on the **Close Current File**  button in the **General Tools** area to close the *RotaryAxisShank* ArtCAM model file. The Master Model Tree is displayed on the **Project** tab.

Presenting the Finished Ring

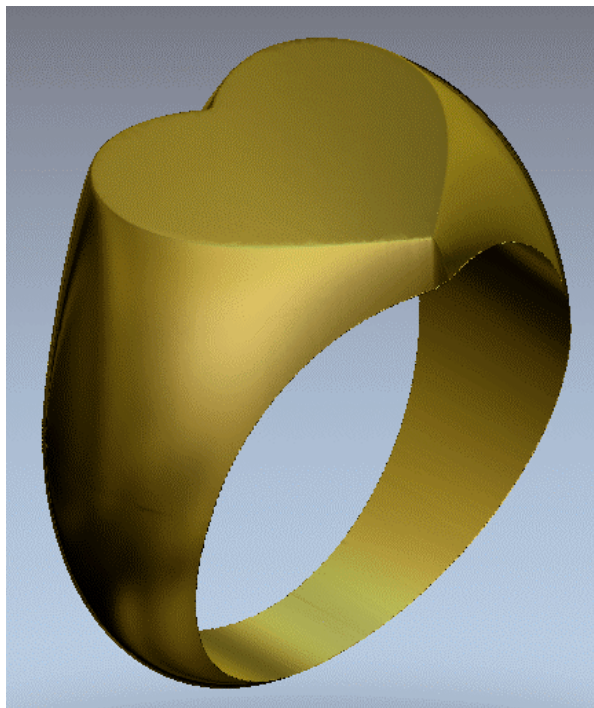
Finally we will shade the assembly so that it appears as though it were cast in 24 carat gold with a satin finish. This allows prospective customers to visualise the finished ring prior to manufacture.

1. Click to select the *ZodiacSignet.3DP* Master Model  listed in the Master Model Tree. Its name turns bold and the tools available for it are shown on the page.
2. Click on the **Shading**  button in the **Assembly Manager** area to display the shading settings.
3. Click on the **Shading Set** list box, and then click on the *24ct Satin Finish* option.
4. Click on the **Background** list box, and then on the *ArtCAM* option.
5. Click on the **Accept**  button to apply the selected shading settings to the assembly. The assembly now appears as if it were cast in 24 carat gold with a satin finish. The background compliments the assembly.
6. Click on the **Save**  button in the **Project Tools** area to save the JewelSmith Project.
7. Click on the **Close Project**  button to close the JewelSmith Project and return to the Assistant's **Getting Started** page.

Heart Signet Ring Tutorial

Overview

In this tutorial, we will create a rotary-axis signet-style ring. Initially we will create the head of the ring using a vertical three-axis approach. In this way we can precisely specify any shape of head that can be blended smoothly into a shank. In this tutorial we will use a heart shaped head and a rounded shank, but the principle is the same for many other shapes, from simple circles and ovals, to more complex stars or shields.



Heart Signet Ring

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

- Creating the JewelSmith Project.
- Creating a 3-Axis Shank Model.
- Creating the Head of the Ring.
- Converting the 3-Axis Shank to a Rotary Shank.
- Editing the Rotary Shank Relief.
- Adding the Relief to the Master Model.
- Presenting the Finished Ring.

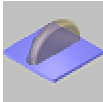

Creating the JewelSmith Project

As usual, our first step is to create a new JewelSmith Project to manage the component models needed to produce the ring. In this example, there will only be one component; the shank.

1. Click on the **Create JewelSmith Project**  icon in the **JewelSmith Projects** area of the Assistant's **Getting Started** page to display the **New Project** page.
2. Type *HeartSignet* in the **Project Name** box.
3. Click on the **Accept**  button to create the JewelSmith Project.

Creating a 3-Axis Shank Model

Our next step is to create a shank model. For this design, it is easier to lay the ring design in a conventional three-axis relief, with the face of the ring pointing up in Z. To do this we will use a vertical three-axis shank model.

1. Click on the **JewelSmith** tab to display the **Project Components** page.
2. Click on the **3-Axis Shank (Vertical)**  button in the **Blanks** area of the page to display the **3-Axis Shank (Vertical)** page.
3. Click on the **Standard** list box, and then on the *Custom* option to select it.
4. Type *20* in both the **Diameter** and **Width** boxes.
5. Type *2* in the **Thickness** box, *5* in the **Border** box and *30* in the **Resolution** box.
6. Click on the **Accept**  button to create an ArtCAM model file according to these settings. This ArtCAM model file is named *ThreeAxisShankV* by default.

The **General Tools** page is now displayed. The 2D View has a Reference Silhouette, similar to Rotary Axis models, but Three Axis models require virtually no specific tools. As a result we


will create most of our model using conventional ArtCAM tools. We are aiming to create the top of the ring oriented with the face of the ring pointing up in Z.

Creating the Head of the Ring

We are now ready to create the vector artwork needed to produce the head of the ring.

Creating the Ellipses

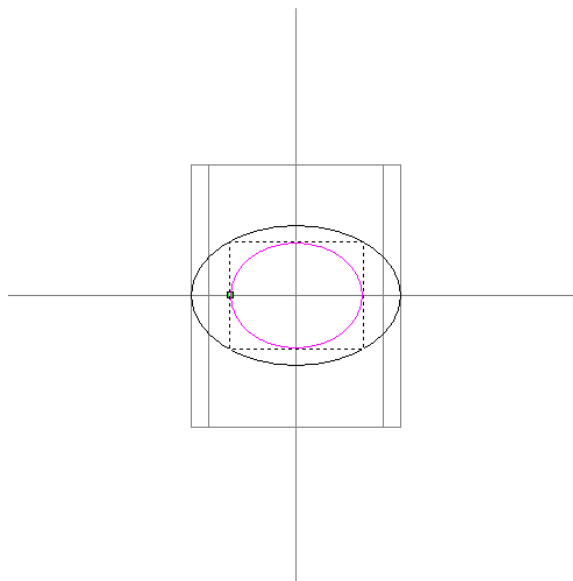
We will begin by creating two ellipses. The first ellipse will be used later when creating the heart shape relief. The second ellipse will be used to create a heart shape vector.

1. Click on the **Assistant** tab to display the Assistant's Home page.
2. Click on the **Create Ellipse**  button in the **Vector Editing** area to display the **Ellipse Creation** page.
3. Type *16* in the **Ellipse Height** and *24* in the **Ellipse Width** box.
4. Click on the **Create** button to create the ellipse.
5. Type *12* in the **Ellipse Height** and *15* in the **Ellipse Width** box.
6. Click on the **Create** button to create a second ellipse positioned inside the first.
7. Click on the **Close** button to return to the Assistant's Home page.

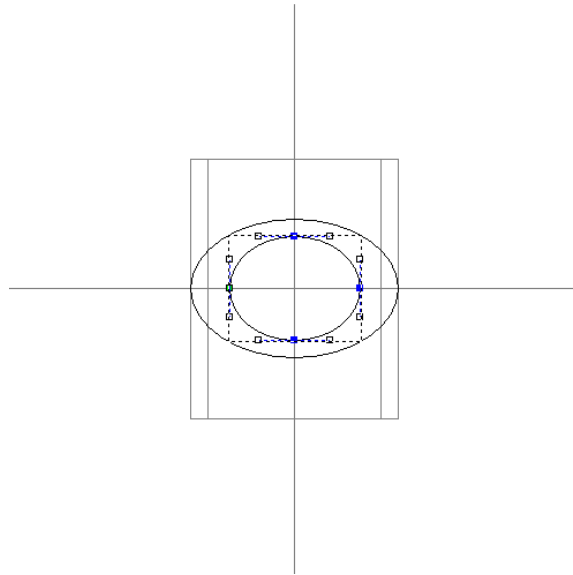
Creating the Heart Shape

Now we will use the Node Editing tools to manipulate the central ellipse to form the required heart shape.

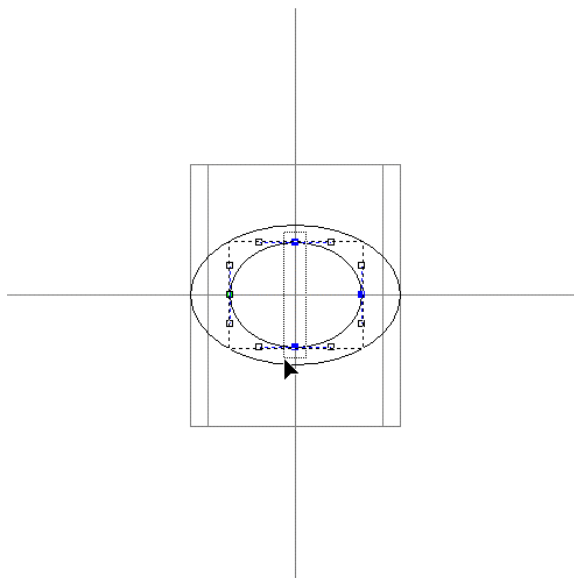
1. In the 2D View window, make sure that the innermost ellipse is selected by clicking on it.



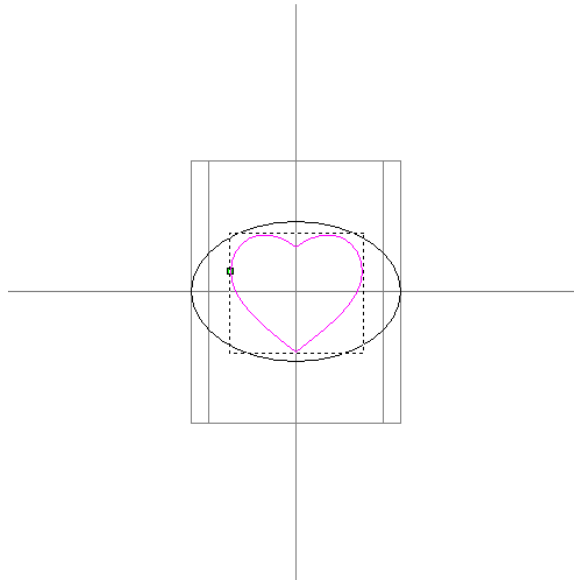
2. Press the *N* key on your keyboard to enter Node Editing mode.



3. Move the cursor so that it is positioned above and to the right of the top node in the central ellipse.
4. Click and hold down the left mouse button, and then drag to form a bounding box that surrounds both the top and bottom nodes in the central ellipse:




5. Release the mouse button. Both nodes turn red, indicating they are selected.
6. Press the \blacktriangledown arrow key to nudge the selected nodes downwards to produce a heart-shaped vector.
7. Press the *Esc* key to return to Select Vectors mode.
8. Press the *F9* key to position the heart-shaped vector in the centre of the model area.

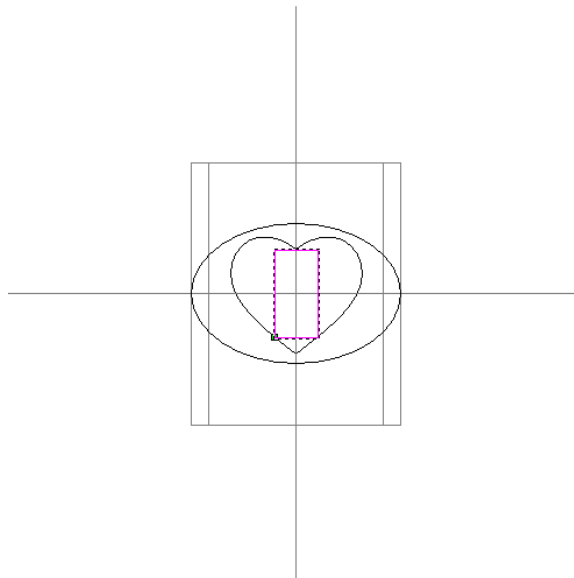


The resulting artwork will be used to define the ring shape as if we were looking down upon it from above the face.






Creating the Blend Cross-Section

The final piece of vector artwork we need to create is the cross-section that will be used to form the head of the ring.

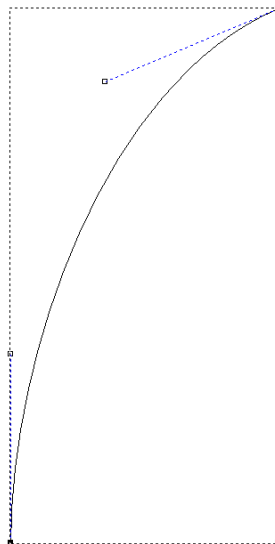
1. Click on the **Create Rectangle**  button to display the **Rectangle Creation** page.
2. Type *5* in the **Width** box and *10* in the **Height** box.
3. Click on the **Create** button to create the rectangle in the model area.
4. Click on the **Close** button to return to the Assistant's Home page.



5. Press the *N* key on your keyboard to enter Node Editing mode.


6. Move the Node Editing cursor  over the node at the top-left corner of the rectangle. When the cursor indicates that it is over the node , press the *D* key to delete it.
7. Move the cursor over the span that connects the remaining top node to the bottom-left node. When the cursor indicates that it is over the span , press the *B* key to convert it to a bezier curve. Two control points appear.
8. Click and drag the lower control point left until it is vertically aligned with the start node .
9. Click and drag the other control point upwards diagonally, until it produces a pleasing curve in the span.
10. Finally, move the cursor over the bottom span in what was the rectangle. When the cursor indicates that it is over the span , press the *R* key to remove it.

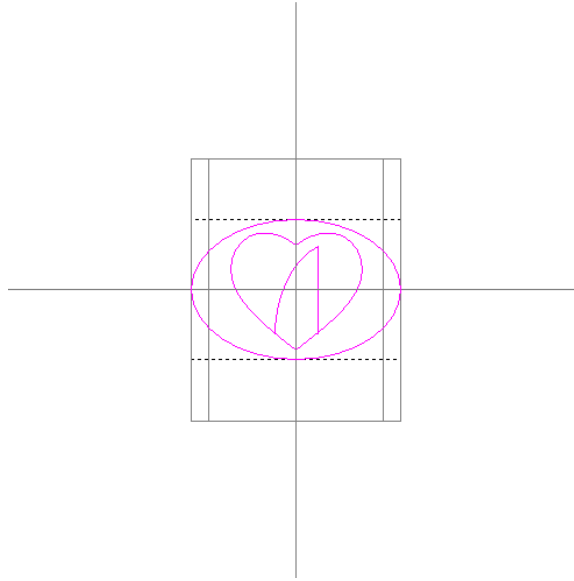
The resulting cross-section should look as follows:



Creating the Heart Relief

Now that we have created all the vector artwork that we require, we can create the heart shape relief using the **3D Blend** tool.

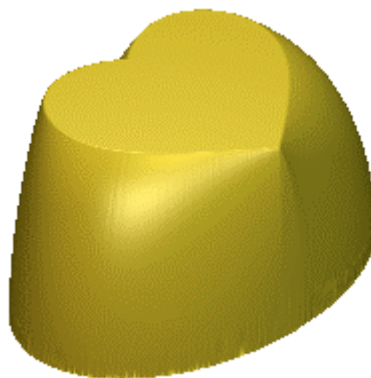
1. Press the *Esc* key to return to Select Vectors mode.
2. Click on the **Create 3D Blend**  button in the **Relief Editing** area of the **Assistant** page to display the **3D Blend** page.
3. Hold down the *Shift* key (to allow for multiple vector selection), and then click on the outer ellipse, the heart, and the cross-section in turn.



4. In the **Profile** area, select the **Selected Vector** option by clicking on its radio button.
5. In the **Heights** area, leave the **Border** set to the default value of 0 and type *12* in the **Inner** box.








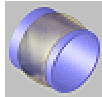

This sets the height of the flat plane under the heart shape (the inner vector in our selection). We have chosen 12 mm because the inner radius of the ring is 10 mm (a diameter of 20 mm) and we require the face of the ring to be 2 mm above this.

6. In the **Blend from Border to** area, select the **Inner Vector Edge** option by clicking on its radio button.
7. Make sure that the **Fill Inner Vector** option is selected and the **Proportion** is set to *100%*.
8. In the **Combine** area, make sure that the **Add** option is selected by clicking on its radio button.
9. Click on the **Create Blend** button.
10. Click on the **Close** button to return to the Assistant's Home page.
11. Press the *F3* key to display the relief in the 3D View window. We can now see the three-dimensional heart shape that will be used in our ring.



Converting the 3-Axis Shank to a Rotary Shank


To achieve the desired shape of the ring's shank we need to reproduce the **3-Axis Shank (Vertical)** heart shape component as a **Rotary Shank** component. First we need to add the **3-Axis Shank (Vertical)** heart shape to the Master Model. We then need to create a new **Rotary Shank** component and combine the heart shape that is now part of the Master Model with it.

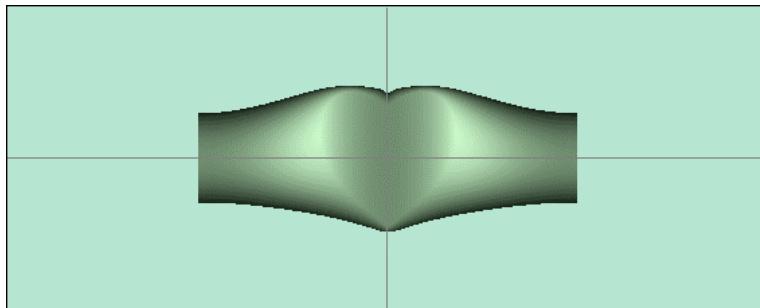
1. Click on the **Add To Master**  button in the **General Tools** area to display the **Add To Master** page.
2. Type *HeartSignet* in the **Assembly Name** box.
3. Type *0.001* in the **Tolerance** box.
4. Click on the **Next**  button to create a replica triangle mesh of the heart-shaped relief.
5. Click on the **Accept**  button to add the heart-shape replica mesh to the Master Model. A message box appears asking if you want to save the ArtCAM model associated with the assembly.
6. Click on the **Yes** button to save the ArtCAM model.
7. Click on the **Project** tab to display the Master Model Tree. You can see that the *HeartSignet* assembly  has been added to the Master Model. If you click on the  icon, you can see that a replica mesh  is associated with this assembly.
9. Click on the **JewelSmith** tab to return to the **General Tools** page.
10. Click on the **Close Current File**  button to close the *ThreeAxisShankV* ArtCAM model file associated with the *HeartSignet* assembly, and return to the Master Model Tree on the **Project** tab.
11. Click on the **JewelSmith** tab to display the **Project Components** page.
12. Click on the **Rotary Shank**  button in the **Blanks** area to display the **Rotary Shank** page.
13. Make sure that the *Custom* option is selected in the **Standard** list box, both the **Diameter** and **Width** are both set as *20*, the **Thickness** is set as *2*, the **Border** as *5* and the **Resolution** as *30*.
14. Click on the **Accept**  button to create the *RotaryAxisShank* ArtCAM model file. The **Rotary Axis Tools** page is displayed on the **JewelSmith** tab.

15. Click on the **Combine Master**  button in the **General Tools** area to combine the replica mesh associated with the *HeartSignet* assembly with the *RotaryAxisShank* ArtCAM model.

Editing the Rotary Shank Relief


We will now edit the relief in the *RotaryAxisShank* model to complete the shank we require for the ring. To give us a starting point for editing, we first need to see the relief we have created in the 2D View.

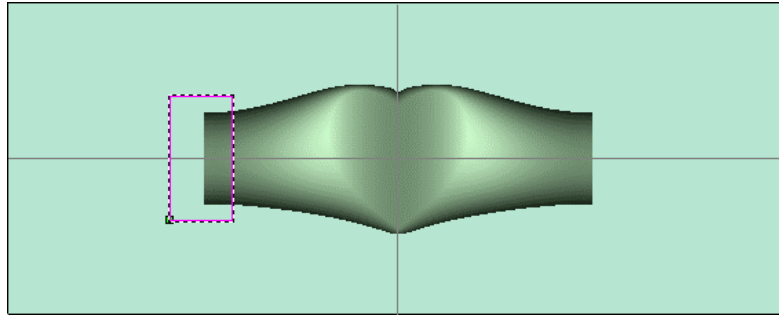
1. Click on the **Greyscale**  button in the 2D View toolbar to display a greyscale image of the relief in the 2D View window.



In this view, the highest points are represented by lighter shades, and the lower points by darker shades. The zero plane is coloured so to provide a high contrast edge to the model in the 2D View window.

At the edges of the relief, you will notice that the sides of the shank are parallel. This is a necessary consequence of the three-axis model used to generate the replica mesh. To complete our ring we need to taper the shank towards the back. To achieve this we first need to identify the area of the relief that we will replace with a new tapered shape.



2. Click on the **Assistant** tab to display the Assistant's Home page.
3. Click on the **Create Rectangle**  button in the **Vector Editing** area to display the **Rectangle Creation** page.
4. Type *6* in the **Width** box, *12* in the **Height** box and *-19* in the **Centre Point's X** box.
5. Click on the **Create** button to create a rectangle over the left-hand side of the shank model area. The rectangle identifies the region in the existing relief where its desired taper is lost.

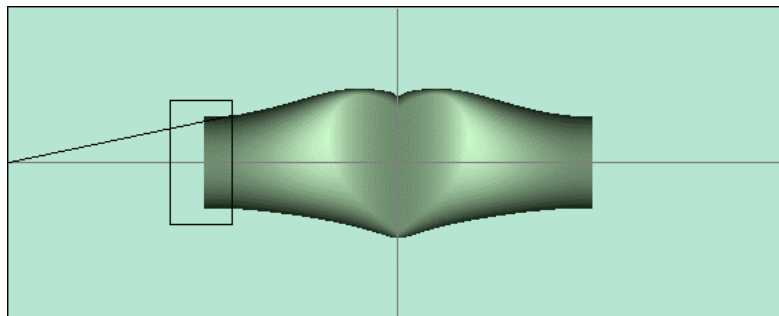





6. Click on the **Close** button to return to the Assistant's Home page.

Creating the Drive Rails

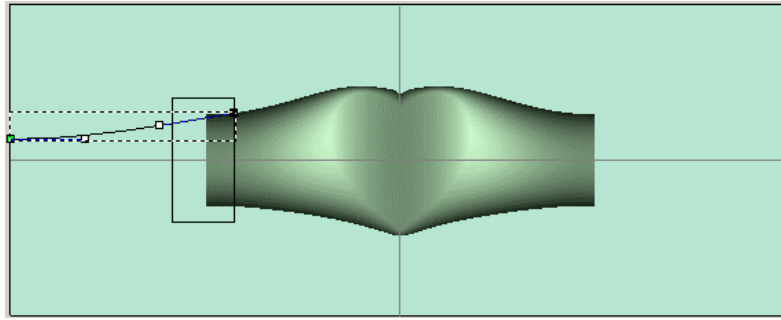
We will now create the vector artwork that will be used as the drive rails when creating the two-rail swept shape needed to complete the ring's shank.


1. Click on the **Create Polyline**  button in the **Vector Editing** area to display the **Polyline Creation** page.
2. Move the cursor over the position where the horizontal reference line meets the left-edge of the model area. When the cursor changes to , left-click to define this position as the start point in our poly line.
3. Move the cursor over the position where the rectangle intersects the edge of the existing shank relief, and then click to create a point. A linear span joins this and the previous point in the poly line.
4. Right-click to finish the poly line and return to the Assistant's Home page.

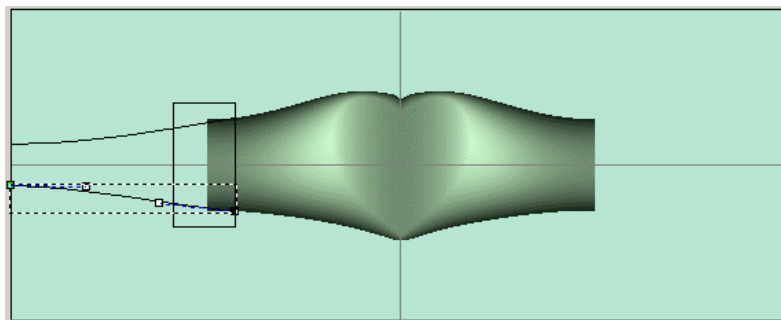


5. Click to select the poly line.
6. Press the *N* key to enter Node Editing mode.
7. Click on the green start point in the poly line. The start point turns red.
8. Press the  key to nudge the point upwards by approximately 2 mm. You can use the ruler on the left-edge of the design window for guidance.
9. Move the cursor over the span. When the cursor changes to , press the *B* key to convert the span to a bezier. Two control points appear.
10. Click and drag the left control point downwards until it is aligned with the poly line's start point. The cursor changes to  to indicate a horizontal alignment.

11. If necessary, adjust the other control point so that the curved vector continues the taper of the existing relief.



12. Press the *Esc* key to return to Select Vectors mode.
13. Click to select the horizontal guideline, and then, holding down the *Shift* key, click to select the curved vector.
14. Click on the **Mirror Vectors**  button in the **Vector Editing** area to display the **Mirror Vectors** page.
15. Hold down the *Ctrl* key and click on the **About Line** option to mirror the curved vector about the horizontal guideline.
16. Click on the **Close** button to return to the Assistant's Home page.
17. Press the *N* key to enter Node Editing mode.
18. Click to select the node on the bottom right. The node turns red.
19. Press the **↑** key nudge the point upwards by approximately 2 mm. You can use the ruler on the left-edge of the design window for guidance.






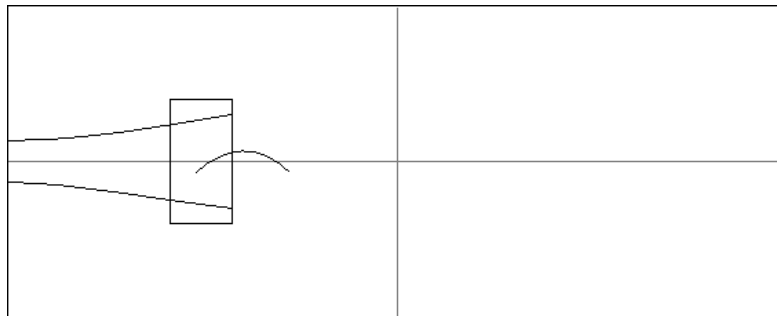
If necessary, adjust the other control point so that curve continues the taper of the current relief in a pleasing fashion.

Creating the Cross-Section using the Relief


In order for our new shape to continue the profile of the existing relief, we will first create a cross-section of the ring shank directly from the relief.

1. Click on the **Create Cross-Section**  button in the **Relief Operations** area to display the **Create Relief Cross Section** page.

2. Click on the **Greyscale**  button in the 2D View toolbar to hide the greyscale image of the relief. This makes it easier to see the vectors we need to use to create the cross section.
3. Move the cursor over the right-hand end of the top vector. When the cursor changes to , click to select this position as the start of the cross section.
4. Move the cursor over the right-hand end of the bottom vector. When the cursor changes to , click to select this position as the end of the cross section.
5. Click on the **Create** button to create the cross section vector, as shown below:



ArtCAM JewelSmith creates a vector that matches the profile of the underlying relief between the right-hand ends of the two curved vectors.

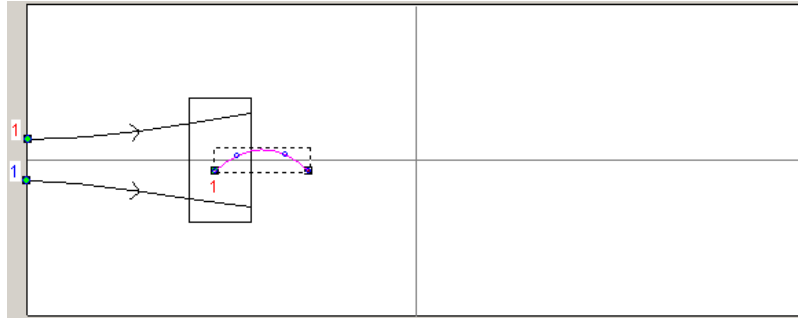
6. Click on the **Close** button to return to the Assistant's Home page.
7. Click to select the cross section vector.
8. Click on the **Arc Fit Vectors**  button in the **Vector Editing** area to display the **Fit Arcs To Vectors** page.
9. Type *0.01* in the **Tolerance** box, and then click on the **Fit Arcs** button to convert the spans that make up the cross section to arcs. This reduces the number of spans in the cross section and adds curvature.
10. Click on the **Close** button to return to the Assistant's Home page.
11. Click to select the rectangle vector.
12. Press the *F12* key to display the **Shape Editor**.
13. Click on the **Zero** button to reset the relief within the area defined by the rectangle to zero, and then click on the **Close** button.

Creating the Two Rail Sweep

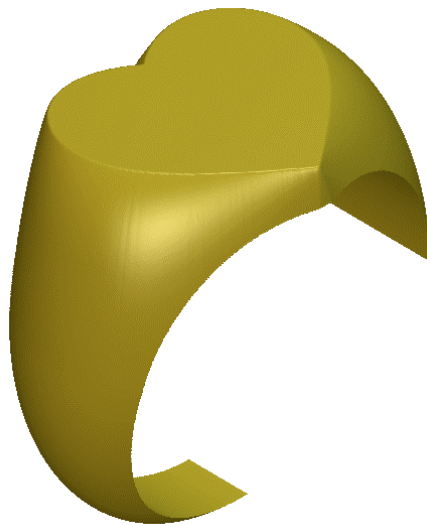
We will now create a three-dimensional shape from the vector artwork that we have drawn in the 2D View. This shape will be combined with the existing relief to form one side of the finished shank.

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

2. Click to select the top curved vector, and then click on the **Top Drive Rail** button to select the vector as the top drive rail.
3. Click to select the bottom curved vector, and then click on the **Bottom Drive Rail** button to select the vector as the bottom drive rail.
4. Click to select the cross section vector, and then on the **Add Cross Section** button to define the vector as the cross section in our two-rail swept shape.





5. Make sure that the **Scale Height and Width** option is selected.
6. In the **Combine** area, select the **Highest** option by clicking on its radio button.
7. Click on the **Calculate** button to create the two-rail swept shape.
8. Click on the **Close** button to return to the Assistant's Home page.
9. Press the *F3* key to display the relief in the 3D View window. We can see that the two rail swept shape has been merged with the existing heart shape relief, but only one side of the shank is now complete.



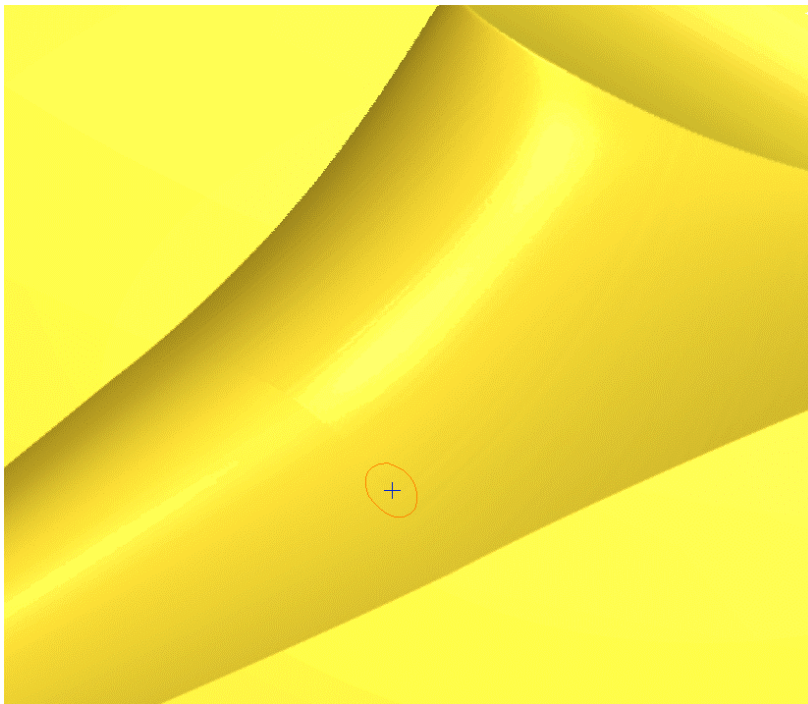
Sculpting the Relief



You will probably detect a slight seam where the new swept shape has been blended into the existing relief. To smooth away this seam we will use the Sculpting tools available in ArtCAM JewelSmith.

1. Press the *F2* key to return to the 2D View window.

2. Click on the **Assistant** tab to display the Assistant's Home page.
3. Click on the **Greyscale From Relief** button  in the **Model** area to display a conventional greyscale image of the relief in the 2D View window.
4. Click on the **Sculpting**  button in the **Relief Editing** area to display the **Interactive Sculpting** page. The shank is displayed in the 3D View in unwrapped form, as this is the best view to use when sculpting a relief.

You can use the **Twiddle Tool** and **Zoom** buttons in the 3D View toolbar to focus on the area of the relief where the seam is situated.





5. Make sure that the **Smooth** tool is selected by pressing the number *1* key.
6. The default settings for the **Smooth** tool are a **Diameter** of 30, a **Strength** of 50% and a **Smoothness** of 100%. Make sure that you are using these exact settings when smoothing the relief.
7. In the **Colour Usage** area, click to select the **Sculpt Excluding Colour** option.
8. Click and drag the light-bulb icon  to anywhere in the 3D View window outside of the shank shape. Release the mouse button to set the colour in the **Colour Usage** box to yellow. This means we now cannot smooth any area of our model marked in this colour, which in this instance identifies the zero plane.
9. Position the  cursor over the seam in the relief, and then click and drag the mouse along the line of the seam to smooth over it.
10. When you are happy that the seam is no longer visible, click on the **Apply** button.

11. Click on the **Finish** button to return to the Assistant's Home page.

Mirroring the Relief

Since the ring is symmetrical, we can finish the piece by mirroring the existing relief onto the right side of the model.


1. Click on the **JewelSmith** tab to display the **Rotary Axis Tools** page.
2. Click on the **Mirror Relief**  button in the **General Tools** area to display the **Mirror Relief** page.
3. Make sure that the **Left/Right** option is selected in the **Mirror Options** list box.
4. Click on the **Next**  button to mirror the existing relief onto the right side of the model, and return to the **Rotary Axis Tools** page.




The finished ring relief is shown below:



Adding the Relief to the Master Model






Now that we have created the finished relief for the ring, we are ready to add it to our Master Model as an assembly. Since we no longer need the original assembly that contains only the heart shape relief, we will replace this with a new assembly of the finished ring. During this process a replica mesh of the relief is created.

1. Click on the **Add to Master**  button in the **General Tools** area to display the **Add to Master** page.
2. Type *HeartSignet* in the **Assembly Name** box.
3. Make sure that the **Tolerance** is set as *0.002*.

4. Click to deselect the **Use Back Relief** option. We do this because the flat back of the model is created as part of the back relief, and we do not require it in this tutorial.
5. Click on the **Next**  button to create a replica mesh of the finished *HeartSignet* ring relief.
6. Click on the **Accept**  button. A message box appears requesting if you want to replace the existing *HeartSignet* assembly.
7. Click on the **Yes** button to add the assembly to the Master Model.
8. Click on the **Close Current File**  button in the **General Tools** area to close the *RotaryAxisShank* ArtCAM model file. The Master Model Tree is displayed on the **Project** tab.

Presenting the Finished Ring

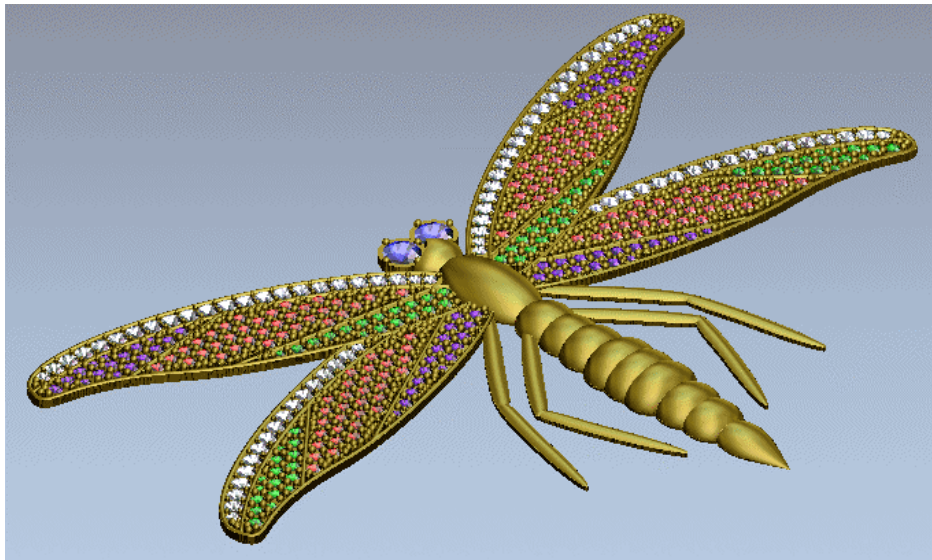
Finally we will shade the assembly so that it appears as though it were cast in 24 carat gold with a satin finish. This allows prospective customers to visualise the finished ring prior to manufacture.

1. Click to select the *HeartSignet.3DP* Master Model  listed in the Master Model Tree. Its name turns bold and the tools available for it are shown on the page.
2. Click on the **Shading**  button in the **Assembly Manager** area to display the shading settings.
3. Click on the **Shading Set** list box, and then click on the *24ct Satin Finish* option.
4. Click on the **Background** list box, and then on the *ArtCAM* option.
5. Click on the **Accept**  button to apply the selected shading settings to the assembly. The assembly now appears as if it were cast in 24 carat gold with a satin finish. The background compliments the assembly.
6. Click on the **Save**  button in the **Project Tools** area to save the JewelSmith Project.
7. Click on the **Close Project**  button. A message box appears requesting if you want to save the JewelSmith Project before closing it.
8. Click on the **Yes** button to save the JewelSmith Project and return to the Assistant's **Getting Started** page.

Dragonfly Brooch Tutorial

Overview

This tutorial uses many of the non-ring specific ArtCAM JewelSmith functions to create a flat 3D brooch item of jewellery. After the brooch relief is built, we will use the **Gem Tools** to add gemstones to this piece for rendering purposes. Finally, we will use conventional ArtCAM tools to create the additional parts required to assemble and present the finished brooch to the customer.



Dragonfly Brooch




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

- Preparing the Model.
- Creating the Relief.

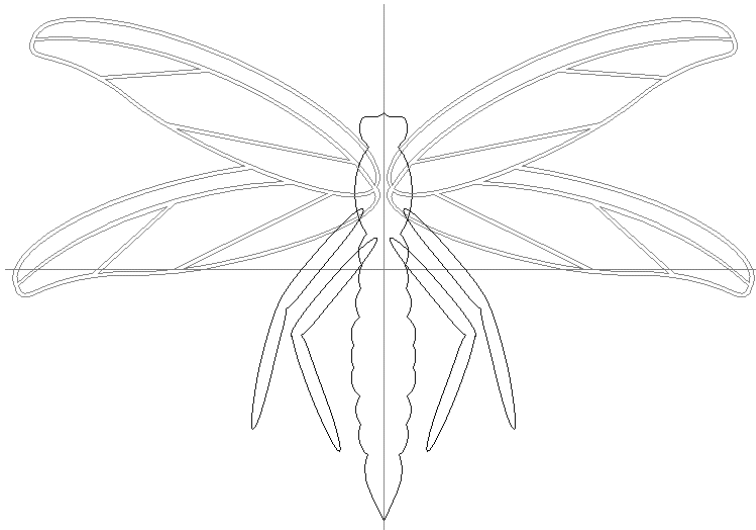
- Creating the Gem Settings.
- Adding the Relief to the Master Model.
- Adding the Gems.
- Creating the Finished Relief.
- Presenting the Master Model.

Preparing the Model

First, we will open the ArtCAM model containing the vector artwork that you will require to build the Dragonfly brooch relief.


1. Click on the **Open JewelSmith Project**  icon in the **JewelSmith Projects** area of the Assistant's **Getting Started** page to display the **Load JewelSmith Master Model** dialog box.
2. Click on the **Look in** list box, and then browse to the *JewelSmithProjects\Dragonfly* folder on your Tutorials CD.
3. Click to select the *Dragonfly.3DP* file. Its name is displayed in the **File Name** box.
4. Click on the **Open** button to open the JewelSmith Project in ArtCAM JewelSmith. The **Project** page is displayed and you can see the Master Model Tree for the *Dragonfly* project.
5. Click on the **Browse Project**  button in the **Project Tools** area of the page to display the **Browse Project Folder** page.
6. Click on the *Dragonfly*  button to open the file named *Dragonfly.art*. This ArtCAM model file was previously created as a Flat 3-Axis component, and is saved in the *Flat* folder within the *Dragonfly* Project directory.

The following vector artwork is shown in the 2D View window:




This vector artwork will be used to create the finished Dragonfly brooch.

Creating the Relief

The vector artwork for the different areas of the Dragonfly design has been created across a number of different layers within this ArtCAM model file. We will deal with each different element of vector artwork in turn, using the **Layers** tab to manage and organise the artwork to create the finished Dragonfly relief. Each layer in this model has been named according to the artwork it contains relative to the overall Dragonfly design. The **Visibility**  toggle button beside each layer name allows us to control whether the vector artwork on a layer is either hidden or visible in the 2D View at any given time. Only the relevant artwork for each modelling stage need be visible. Initially we will only use the *Body*, *Wings* and *Legs* layers.

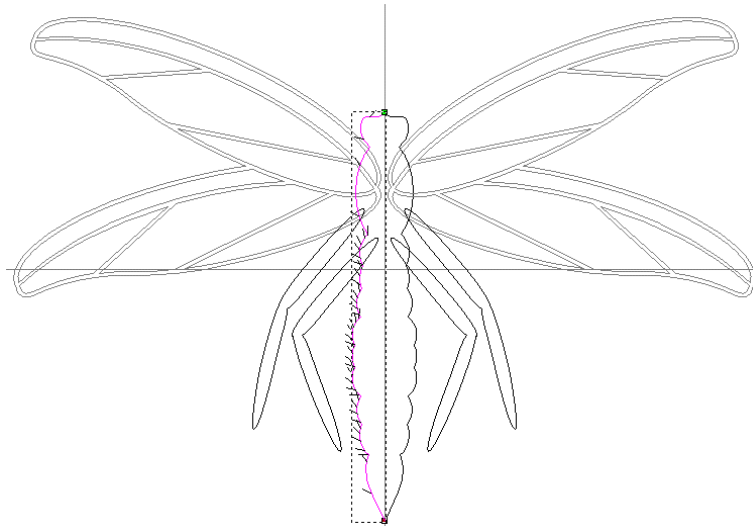
Creating the Body

First we will create the body shape using the **Turn Wizard** and vectors selected from the Dragonfly artwork.

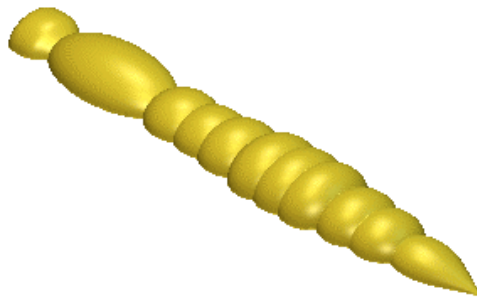
1. Click on the **Turn**  button in the **Vector Based Relief Creation** area of the Assistant's Home page to display the **Turn Wizard**.

The **Turn** button can also be found on the **Relief** tab on the Main toolbar.

2. Click to select the vector representing the left side of the Dragonfly's body shown as follows, and then click on the **Select** button. A bounding box appears around the selected vector, and direction arrows are displayed along its outside edge.



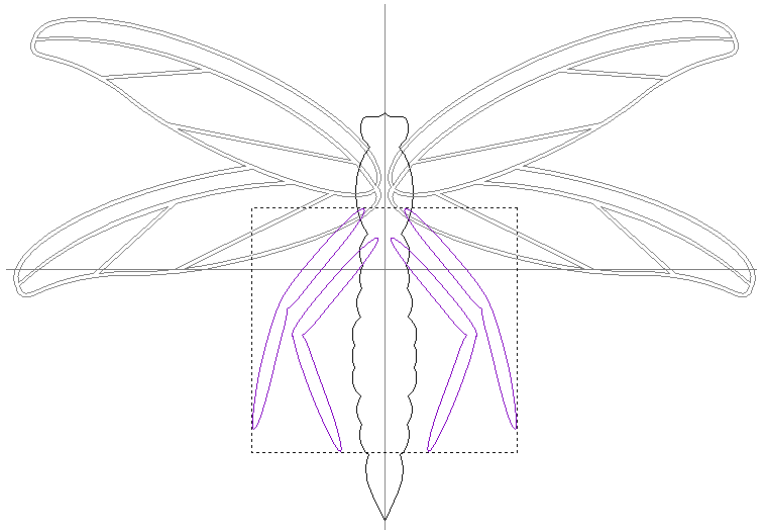
3. Type *0.75* in the **Z Scaling Factor** box, and then click on the **Next** button. The selected vector turns blue.
4. Make sure that the **Add** option is selected by clicking on its radio button.
5. Click on the **Turn** button to create the turned shape.
6. Click on the **Close** button. The previously selected vector is now deselected.
7. Press the *F3* key on your keyboard to display the relief in the 3D View window, shown as follows:



Creating the Legs

Next we will create the legs using the **Shape Editor** and vectors selected from the Dragonfly artwork, and merge them with the body shape.

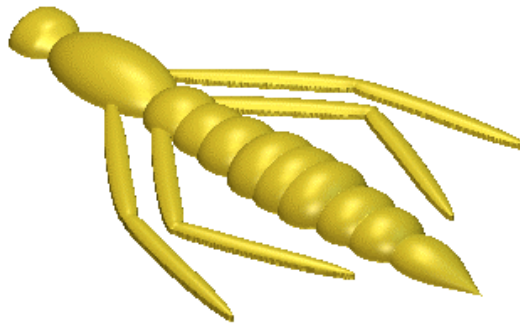
1. Press the *F2* key to return to the 2D View window.
2. Click on a vector representing any of the four legs to select them all. The vectors representing each of the Dragonfly's legs are selected simultaneously as they are grouped together.



3. Press the *F12* key to display the **Shape Editor**.



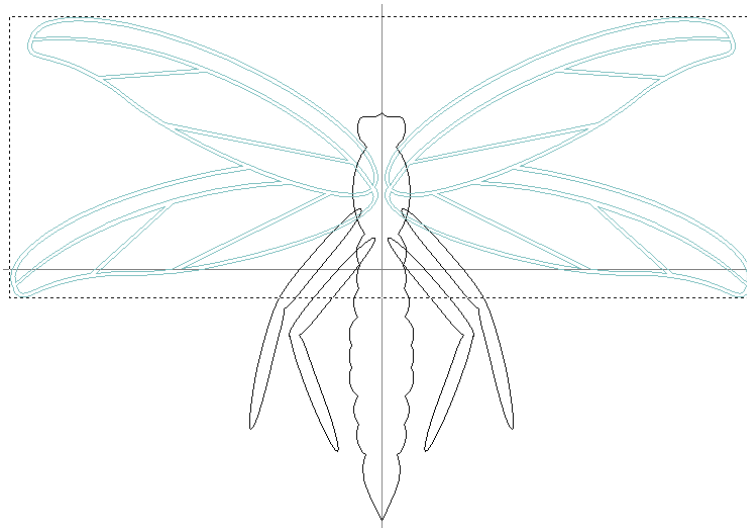
4. Click on the **Round** button. This allows us to create a rounded shape.
5. Type *45* in the **Angle** box, and *0.5* in the **Start Height** box.
6. Click on the **Merge High** button. This instructs ArtCAM JewelSmith to merge the points in the leg shapes with the existing body relief.
7. Click on the **Close** button.
8. Press the *F3* key to display the relief in the 3D View window. The Dragonfly relief currently appears as follows:




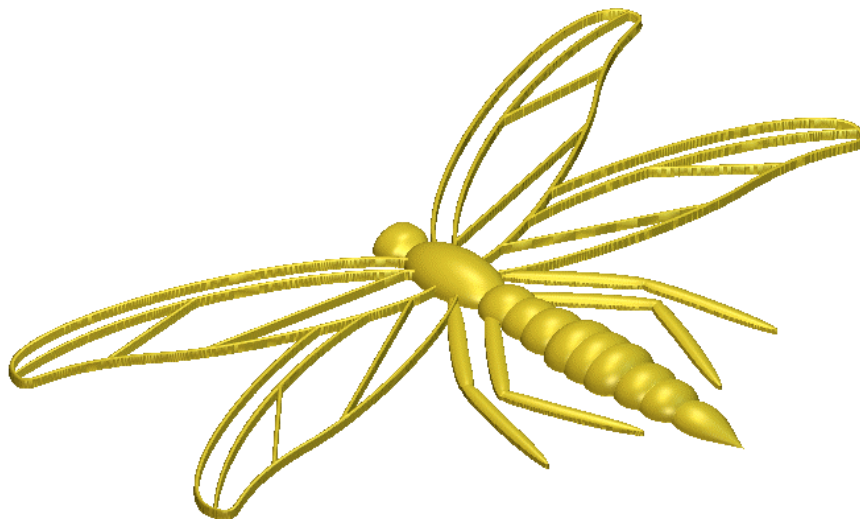
Creating the Wings

Next we will create the wings using the **Shape Editor** and vectors selected from the Dragonfly artwork, and merge them with the body shape.

1. Press the *F2* key to return to the 2D View window.
2. Click on any of the vectors representing the wings to select all of them. The vectors representing each of the Dragonfly's wings are selected simultaneously as they are grouped together.



3. Press the *F12* key to display the **Shape Editor**.
4. Click on the **Round**  button. This allows us to create a rounded shape.
5. Type *40* in the **Angle** box and *1* in the **Start Height** box.
6. Select the **Constant Height (Vectors Only)** option by clicking on its radio button, and then type *0.15* in its associated **Height** box.
7. Click on the **Merge High** button. This instructs ArtCAM JewelSmith to merge the points in the wing shapes with the existing body relief.
8. Click on the **Close** button.
9. Press the *F3* key to display the relief in the 3D View window. The Dragonfly relief currently appears as shown below:



The relief representing the Dragonfly's frame is now complete.

Creating the Gem Settings

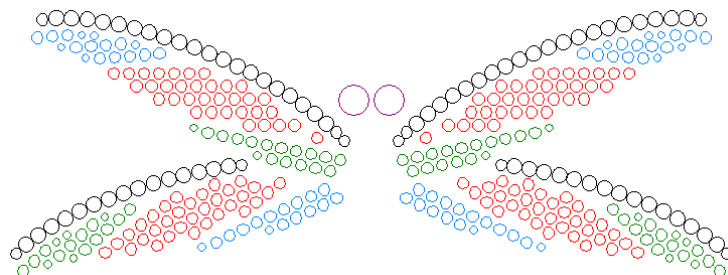
In the finished brooch, the gemstones are set in a pavé style between the veins of the Dragonfly's wings. The gems are a combination of 2 mm and 1.5 mm diameter stones, and so are based on simple circles of equal diameters.

The layout of the stones was originally created using the **Pave Wizard** tool. These simple layouts were then rotated, moved and trimmed manually to produce a pleasing arrangement of stones within specific regions. For the purposes of this tutorial, the settings for each of the required types of gemstones are contained on separate layers. The **Shape Editor** tool in ArtCAM JewelSmith makes it simple to convert these circular vectors into settings for the gemstones.

Creating a Base for the Gemstones

First we will create a shape that will act as a bed for the gemstones, and combine this with the existing relief.

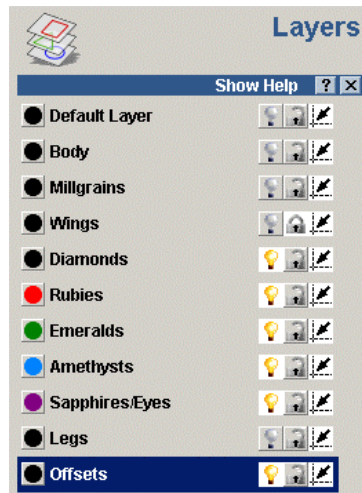
1. Press the *F2* key to return to the 2D View window.
2. Click on the **Layers** tab to display the **Layers** page. Here we can see all of the layers that make up the ArtCAM model.
3. Make sure that all of the layers are hidden, except: *Diamonds*, *Rubies*, *Emeralds*, *Amethyst* and *Sapphires/Eyes*.



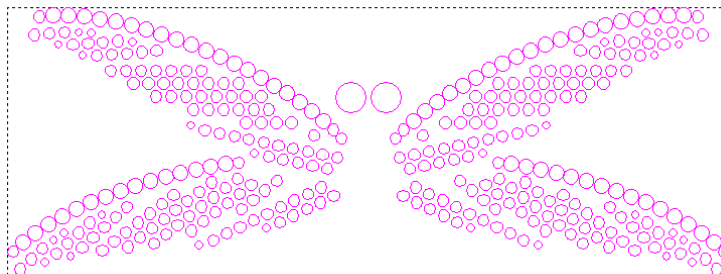
4. Click on the **Create** button to create a new layer. It is named *Layer 11* by default. The layer is also selected by default.




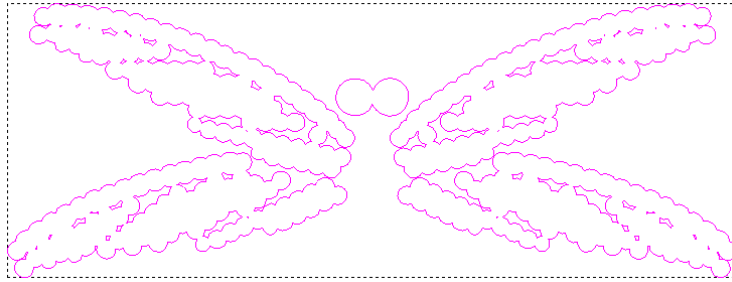
5. Click on the **Rename** button, and then type *Offsets* as the new layer name.
6. Click on the button to apply the new name to the layer.
7. Make sure that the *Offsets* layer is selected. Its name should be highlighted in blue on the **Layers** page. All new vectors are created on the layer currently selected.



8. Press the *Ctrl + A* keys to select all of the vectors shown in the 2D View window.



9. Click on the **Assistant** tab to return to the Assistant's Home page.
10. Click on the **Offset Vector(s)**  button in the **Vector Editing** area to display the **Offset Vector(s)** page.
11. Type *0.5* in the **Offset Distance** box.
12. Make sure that the **Outwards/Right** option is selected in the **Offset Direction** area by clicking on its radio button, that the **Radiused** option is selected in the **Offset Corners** area, and the **Delete Original Vectors** option is deselected.
13. Click on the **Offset** button to create the offset vectors, and then click on the **Close** button.
14. Click on the **Layers** tab to display the **Layers** page.
15. Hide all of the layers, other than the *Offsets* layer. Only the offset vectors we have just created can now be seen in the 2D View window.
16. Click to select the offset vector associated with the Dragonfly's eyes.
17. Press the *F12* key to display the **Shape Editor**.
18. Click on the **Zero** button to reset the area of the relief within the selected offset vector to zero.
19. Press the *Ctrl + A* keys to select all of the vectors shown in the 2D View window.



20. Press the *F12* key again to ensure that the **Shape Editor** is applicable to all of the vectors currently selected.



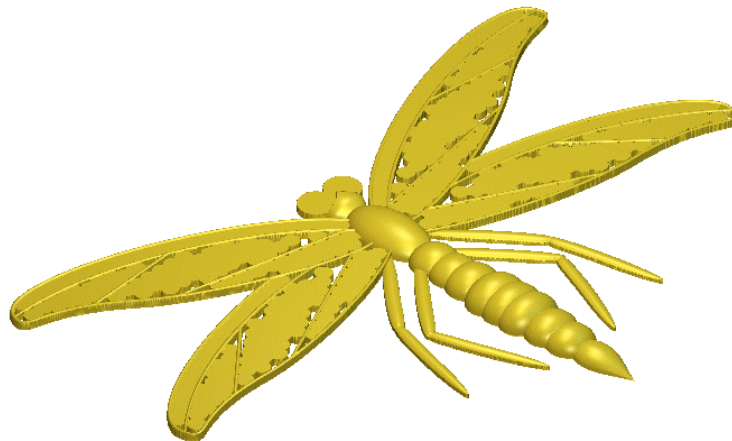
21. Click on the **Plane** button. This allows us to create a flat plane.

22. Type *1* in the **Start Height** box.

23. Click on the **Merge High** button. This instructs ArtCAM JewelSmith to merge a flat plane with the existing body relief.

24. Click on the **Close** button.

25. Press the *F3* key to display the relief in the 3D View window. We can now see the base for the gem settings along with the Dragonfly's frame as follows:



26. Press the *F2* key to return to the 2D View window.

27. On the **Layers** page, make sure that all of the layers are hidden, other than *Diamonds*, *Rubies*, *Emeralds*, *Amethysts* and *Sapphires/Eyes*.

28. Press the *Ctrl + A* keys to select all of the vectors shown in the 2D View window.

29. Press the *F12* key to display the **Shape Editor**.



30. Click on the **Angled** button. This allows us to create an angled shape.

31. Type *-65* in the **Angle** box, and *0* in the **Start Height** box.

32. Click on the **Add** button. This instructs ArtCAM JewelSmith to add the angled shapes to the existing body relief.

We now need to remove the centres of the gem settings. We could create individual circles at the centre of each gem setting and then reset the area of the relief within each of them to zero, however a much faster alternative is available.

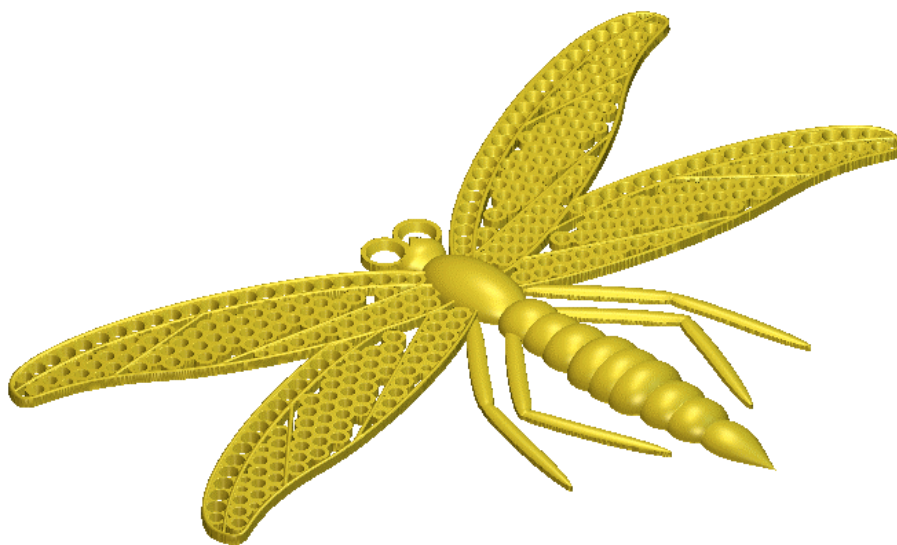
33. Double-click anywhere in the model area (the white area) of the 2D View window to select white as the current Primary Colour. This colour appears in the **Shape Editor**.



34. Make sure that the **Plane** button is selected and its **Start Height** is set as 0.
35. Click on the **Merge High** button. This instructs ArtCAM JewelSmith to merge a flat plane equal to the size of the model with the existing body relief.

Since the white colour covers the whole model area, this process effectively removes all negative areas within the relief. The tips of the cone shapes created for the gemstones (which protrude beneath the zero plane) are therefore removed, thus resulting in azures beneath each of the gem settings.

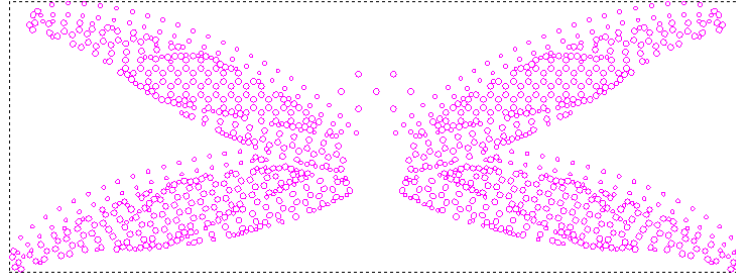
36. Click on the **Close** button.
37. Press the *F3* key to display the relief in the 3D View window. We can now see the gem settings on the Dragonfly's frame as shown below:



Adding Millgrains to the Gem Settings

We will now add millgrains to the gemstone bed. Millgrains are used to help support and secure the gems embedded in the Dragonfly brooch. The **Shape Editor** tool in ArtCAM JewelSmith allows us to quickly build these millgrains. It is easy to add this feature to any item of jewellery.

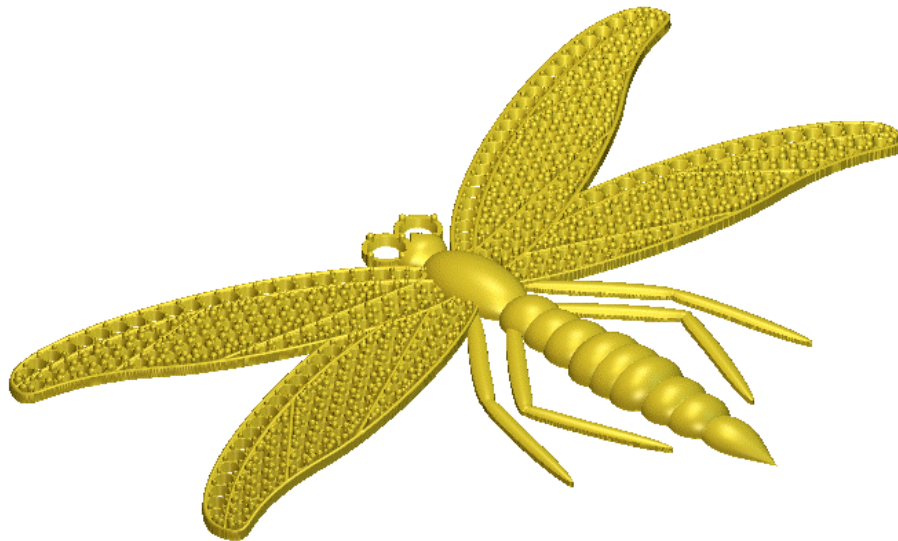
1. Press the *F2* key to return to the 2D View window.
2. On the **Layers** page, make sure that all of the layers are hidden, other than the *Millgrains* layer.
3. Press the *Ctrl + A* keys to select all of the vectors shown in the 2D View window.



4. Press the *F12* key to display the **Shape Editor**.









5. Click on the **Round** button. This allows us to create an angled shape.
6. Type *90* in the **Angle** box and *1.2* in the **Start Height** box.
7. Click on the **Merge High** button. This instructs ArtCAM JewelSmith to merge the rounded shapes with the existing relief.
8. Click on the **Close** button.
9. Press the *F3* key to display the relief in the 3D View window. We can now see the millgrains that have been added to the gem settings to create the Dragonfly brooch relief, as shown below:



Adding the Relief to the Master Model

Now that we have calculated the relief for the Dragonfly brooch, we are ready to add it to our Master Model as an assembly. During this process a replica mesh of the relief is created.

1. Press the *F2* key to return to the 2D View window.
2. Click on the **JewelSmith** tab to display the **General Tools** page.
3. Click on the **Add To Master**  button in the **General Tools** area to display the **Add To Master** page.

4. Make sure that the **Tolerance** is set as *0.002*.
5. Make sure that the **Use Back Relief** option is deselected by clicking on it.
6. Click on the **Next**  button to create a replica mesh of the Dragonfly brooch relief.
7. Click on the **Accept**  button to add the Dragonfly brooch replica mesh to the Master Model. A message box appears asking if you want to save the ArtCAM model associated with the assembly.
8. Click on the **Yes** button to save the ArtCAM model.
9. Click on the **Project** tab to display the Master Model Tree. You can see that the *Dragonfly* assembly  has been added to the Master Model. If you click on the  icon, you can see that a replica mesh  is associated with this assembly.

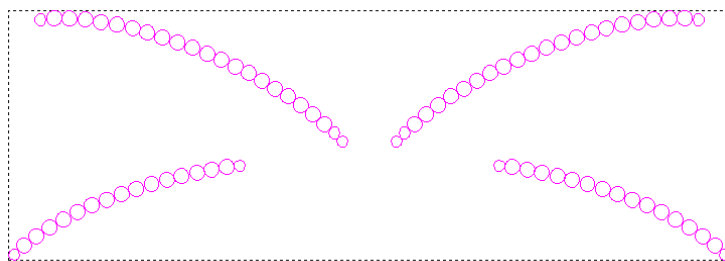
Adding the Gems


At present the relief is already suitable for manufacturing. However, for visualisation and customer presentation purposes, we will add to the relief the gems that resemble those we intend to set in the finished Dragonfly brooch. First we will convert vector artwork representing the layout of the gemstones to gem vectors. When creating the gem vectors, we will define specific properties such as the shape and colour of the gemstones that we want to position within them.

Creating the Gem Vectors


First we will convert the vector artwork representing the layout of the gemstones to gem vectors, defining the properties of the gemstones as we do so.

1. Click on the **Layers** tab to display the **Layers** page.
2. Make sure that all of the layers are hidden, other than the *Diamonds* layer.
3. Press the *Ctrl + A* keys to select all of the vectors shown in the 2D View window.




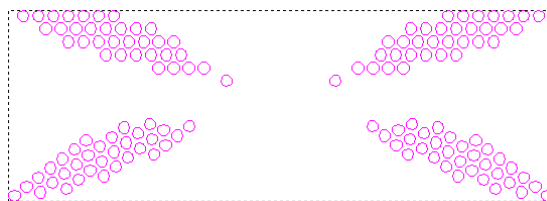
4. Click on the **JewelSmith** tab to display the **General Tools** page.
5. Click on the **Vectors To Gem Vectors**  button to display the **Vectors To Gem Vectors** page.




6. Click on the **Round**  button to display the next page of settings.
7. Make sure that the **Get Gem Sizes from Vectors** option is selected in the **Standard** list box. All remaining options on the page are then greyed-out.
8. Click on the **Next** button to display the colour settings.







9. Click on the **Diamond**  button to set the colour of the gems.
10. Make sure that the **Create New Gem Vectors** and **Remove Original Vectors** options are both selected. This instructs ArtCAM JewelSmith to create gem vectors from the selected vector artwork and then delete the vector artwork, leaving only the gem vectors.
11. Type *Diamonds* in the **Gems Name** box.
12. Click on the **Next** button to create the gems. The gem vectors are created on a new layer named *Gem Vectors*.
13. Click on the **Layers** tab to display the **Layers** page.
14. Press the *Ctrl + A* keys to select all of the gem vectors shown in the 2D View window.
15. On the **Layers** page, click on the **Selected Vectors, move to** list box at the bottom of the page, and then on the *Diamonds* option to send all of the gem vectors on the *Gem Vectors* layer to the *Diamonds* layer. The *Gem Vectors* layer is now empty.
16. Make sure that all of the layers are hidden, other than the *Rubies* and *Gem Vectors* layers.
17. Press the *Ctrl + A* keys to select all of the vectors shown in the 2D View window.



18. Click on the **JewelSmith** tab to display the **General Tools** page.
19. Click on the **Vectors To Gem Vectors**  button in the **Gem Tools** area to display the **Vectors To Gem Vectors** page.





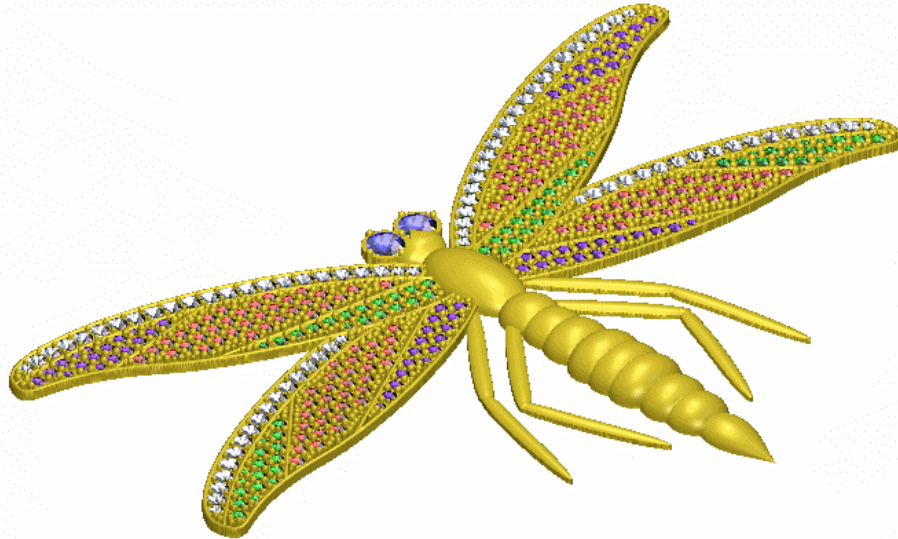
20. Click on the **Round**  button to display the next page of settings.
21. Make sure that the **Get Gem Sizes from Vectors** option is selected in the **Standard** list box. All remaining options on the page are then greyed-out.






22. Click on the **Next**  button to display the colour settings.
23. Click on the **Ruby**  button to set the colour of the gems.
24. Make sure that the **Create New Gem Vectors** and **Remove Original Vectors** options are both selected.
25. Type *Rubies* in the **Gems Name** box.
26. Click on the **Next**  button to create the gems. The gem vectors are created on the *Gem Vectors* layer.
27. Click on the **Layers** tab to display the **Layers** page.
28. Press the *Ctrl + A* keys to select all of the gem vectors shown in the 2D View window.
29. On the **Layers** page, click on the **Selected Vectors, move to** list box, and then on the *Rubies* option to send all of the gem vectors on the *Gem Vectors* layer to the *Rubies* layer. The *Gem Vectors* layer is now empty.
30. Repeat steps 16 to 29 for the vectors on the *Emeralds*, *Amethysts* and *Sapphires/Eyes* layers using the appropriate gem colours.

Creating the Gems

Now that we have converted all of the necessary vector artwork to gem vectors and defined the properties of the gemstones that we want within them, we are now ready to create the gems.

1. On the **Layers** page, make sure that all of the layers are hidden, other than *Diamonds*, *Rubies*, *Emeralds*, *Amethysts* and *Sapphires/Eyes*.
2. Click on the **JewelSmith** tab to display the **General Tools** page.
3. Click on the **Create Gems**  button in the **Gem Tools** area of the page.
4. Click to deselect the **Create Only Selected Gem Vectors** option. This instructs ArtCAM JewelSmith to create gems from all of the gem vectors on all visible layers.
5. Type *DragonflyGems* in the **Gem Set Name** box. This is the name that will be given to the assembly containing the gems once they have been added to the Master Model.
6. Type *I* in the **Start Height** box.
7. Make sure that the **Lay on relief** option is selected and the **Position Around Ring** option is deselected.
8. Click on the **Next**  button to create the gems.
9. Press the *F3* key to display the relief in the 3D View window. We can now see that the gems have been added to the relief as follows:



10. Press the *F2* key to return to the 2D View window.
11. Click on the **Accept**  button to add the gems to the Master Model.
12. Click on the **Project** tab to display the Master Model Tree. You can see that a *DragonflyGems* assembly  has been added to the Master Model . If you click on the  icon, you can see all of the gems  associated with this assembly.

Creating the Finished Relief


If we were to manufacture the Dragonfly brooch relief in its current state, we would produce a solid item of jewellery. We can, however, design the back of the brooch to produce a more practical and cost-effective piece. We will complete the Dragonfly brooch by hollowing out the existing relief to a defined wall thickness. This will reduce the overall weight of the finished piece, and ultimately production costs.

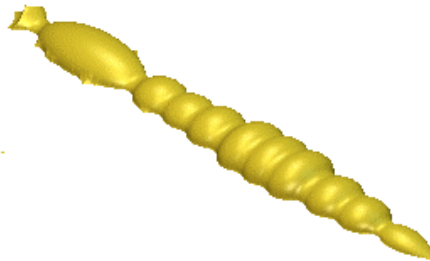
We can generate the back relief from the existing Dragonfly brooch relief using the **Back Relief** tools. Once we have created our back relief, this then co-exists with the previous brooch relief in the same ArtCAM model file. You can easily toggle between the reliefs using the **Back Relief** tools. These two reliefs will be added to our Master Model as a single assembly, replacing the existing *Dragonfly* assembly that currently contains only the original brooch relief. During this process, ArtCAM JewelSmith creates a replica mesh of the finished Dragonfly brooch from both of the reliefs.

Creating the Back Relief

First we will create the back relief directly from the existing Dragonfly brooch relief.

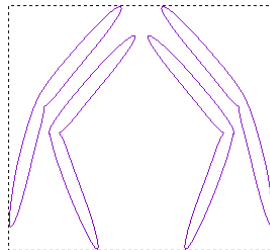
1. Click on the **JewelSmith** tab to display the **General Tools** page.
2. Click on the **Offset Front To Back**  button in the **Back Relief** area to display the **Offset Front To Back** page.

3. Type *1* in the **Offset** box.
4. Click on the **Next**  button to create the offset relief.
5. Press the *F3* key to display the offset relief in the 3D View window as shown below:




To complete the back relief we will rebuild the Dragonfly's legs to give them a fuller 3D shape and thus strengthen the finished brooch.

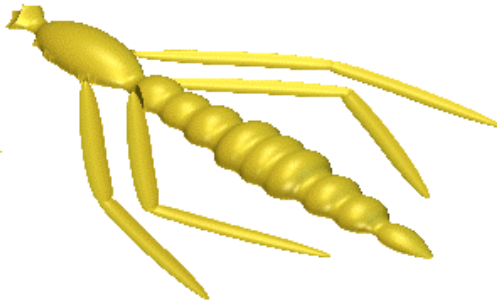
6. Press the *F2* key to return to the 2D View window.
7. Click on the **Layers** tab to display the **Layers** page.
8. Make sure that all of the layers are hidden, other than the *Legs* layer.
9. Click on a vector representing any of the four legs to select them all. The vectors representing each of the Dragonfly's legs are selected simultaneously as they are grouped together.



10. Press the *F12* key to display the **Shape Editor**.








10. Click on the **Round**  button. This allows us to create a rounded shape.
11. Type *-45* in the **Angle** box and *0* in the **Start Height** box.
12. Click on the **Merge Low** button.
13. Click on the **Close** button.
14. Press the *F3* key to display the finished back relief in the 3D View window as follows:




Adding the New Relief to the Master Model

Now that we have created the back relief for the Dragonfly brooch, we are ready to save the two reliefs that co-exist in our model as an assembly. During this process, ArtCAM JewelSmith creates a single replica mesh from both of the reliefs.






1. Press the *F2* key to return to the 2D View window.
2. Click on the **JewelSmith** tab to display the **General Tools** page.
3. Click on the **Add To Master**  button in the **General Tools** area to display the **Add To Master** page.
4. Make sure that the **Use Back Relief** option is selected, and that the **Tolerance** is set as *0.002*.
5. Click on the **Next**  button to create a replica mesh of the complete Dragonfly brooch relief. This replica mesh is created using both the previous brooch relief and the new back relief we have just created.
6. Click on the **Accept**  button. A message box requesting if you want to replace the existing assembly appears.
7. Click on the **Yes** button. A second message box requesting if you want to save the ArtCAM model appears.
8. Click on the **Yes** button to save the modified *Dragonfly* assembly in the Master Model along with its associated *Dragonfly* ArtCAM model file.

You can see that the *Dragonfly* assembly  has moved to the bottom of the Master Model Tree. This is because its associated replica mesh  has been modified since the original assembly was added to the Master Model.

9. Click on the **Close Current File**  button in the **General Tools** area to close the *Dragonfly* ArtCAM model file. The Master Model Tree is displayed on the **Project** tab.

Presenting the Master Model

Finally we will shade the assembly so that it appears as though it were cast in 24 carat gold with a satin finish. This allows prospective customers to visualise the finished ring prior to manufacture.

1. Click to select the *Dragonfly.3DP* Master Model  listed in the Master Model Tree. Its name turns bold and the tools available for it are shown on the page.
2. Click on the **Shading**  button in the **Assembly Manager** area to display the shading settings.
3. Click on the **Shading Set** list box, and then click on the *24ct Satin Finish* option.
4. Click on the **Background** list box, and then on the *ArtCAM* option.
5. Click on the **Accept**  button to apply the selected shading settings to the assembly. The assembly now appears as if it were cast in 24 carat gold with a satin finish. The background compliments the assembly.
6. Click on the **Save**  button in the **Project Tools** area to save the JewelSmith Project.
7. Click on the **Close Project**  button to close the JewelSmith Project and return to the Assistant's **Getting Started** page.

JewelSmith Tools Reference


Getting Started

When you start ArtCAM JewelSmith, there are two buttons on the Assistant's **Getting Started** page in addition to those normally found in ArtCAM Pro. These two buttons enable you to create a new, or open an existing, JewelSmith Project. JewelSmith can still be used to create conventional ArtCAM models. However, if you want to make use of many of the additional features available for managing related files, combining 3D Assemblies, or working on back and front reliefs within a single model, you should start by creating a JewelSmith Project.

Creating a New Project

You can create a JewelSmith Project in two ways. You can create an entirely new project from nothing, or you can create a project from an existing 3D model.

To create a new JewelSmith Project:


1. Click on the **Create JewelSmith Project**  icon in the **JewelSmith Projects** area of the Assistant's **Getting Started** page to display the **New Project** page.
2. Type the name that you want to give to the project in the **Project Name** box. All projects are named *NewProject* by default.
3. Make sure that the path shown in the **Location** area of the page reflects where you want to save the project on your computer.


If you want to change the location:

- First, click on the **Change Directory** button to display the **Browse for Folder** dialog box.
- Next, click to select the directory or folder in which you want to create the JewelSmith Project folder.

- Finally, click on the **OK** button to confirm your choice and close the **Browse for Folder** dialog box. The new location is shown on the **New Project** page.

If this is the first project you have created, ArtCAM JewelSmith prompts you to specify the location in which you want to store your project files.

4. Click on the **Accept**  button to create the JewelSmith Project and display the **Project** page.

You can click on the **Back**  button if you want to return to the Assistant's Home page without creating the JewelSmith Project.

To create a JewelSmith Project from a 3D model saved as a *.3DS or *.STL file:

1. Make sure that the 3D model in the file is orientated with the head of the ring pointing upwards in the Z direction and with the Y-axis 'through the finger'.
2. Click on the **Import 3D Model** button to display the **Import 3D Model File** dialog box.
3. Click on the **Look in** list box and select the directory in which the 3D model that you want to open is stored.
4. Once you have found the 3D model file, click on its file name. Its name appears in the **File name** box.
5. Click on the **Open** button to open the 3D model and display the **Project** page. The name of the 3D model file is given to the JewelSmith Project.

ArtCAM JewelSmith has stored all of the information about the project and has created a directory structure to manage any files created as part of it.

To view the files created by ArtCAM JewelSmith, browse to the location specified on the **New Project** page using Windows Explorer, and open the directory. The ArtCAM models and reliefs that will make up this project will be stored in sub-folders within this directory.

Opening an Existing Project

To open an existing JewelSmith Project, you begin by opening the project's Master Model file (*.3DP), contained within a project folder. The Master Model contains links to the other files contained within the project folder, so to copy or move a JewelSmith Project, you should always select the whole Project folder, not just the Master Model file contained within it.

To open an existing JewelSmith Project:

1. Click on the **Open JewelSmith Project**  icon in the **JewelSmith Projects** area of the Assistant's **Getting Started** page to display the **Load JewelSmith Master Model** dialog box.

If you have Ring Projects from previous versions of ArtCAM JewelSmith (version 6 or earlier) then you can also open 3D Assembly files (*.3DA) or the Ring Information (Ring.info) files associated with the original project. Use the **Files of type** list box in the **Load JewelSmith Master Model** dialog box to select the appropriate file type. You should be aware that older

JewelSmith files might not contain all of the information required to utilise some of the new tools (such as **Edit Associated Model**).

2. Click on the **Files of type** list box, and then click on the file type of the project that you want to open.
3. Click on the **Look in** list box and select the directory in which the project that you want to open is stored.
4. Once you have found the project file, click on its file name. Its name appears in the **File name** box.
5. Click on the **Open** button to open the project and display the **Project** page.

The **Project** page contains the Master Model Tree and a range of tools that can be used to manage the Master Model.

Closing a Project

To close the JewelSmith Project that you are currently working on:

1. Click on the **Close Project**  button in the **Project Tools** area of the Master Model **Project** page.

If you click on the **Close Project** button before saving a new project, or any changes that you may have made to an existing project, a message box appears requesting if you want to save the project or not.

If you want to save the project:

- Click on the **Yes** button to save the project and return to the Assistant's **Getting Started** page.

If you do not want to save the project

- Click on the **No** button to close the message box and return to the Assistant's **Getting Started** page.


Saving a Project


To save the JewelSmith Project that you are currently working on:


1. Click on the **Save Project**  button in the **Project Tools** area of the Master Model **Project** page.


Using the Master Model Tree

You can use the Master Model Tree to manage your JewelSmith Project.

The  icon indicates the 3D Project file you have created, commonly referred to as the Master Model.

The  icon indicates each of the 3D Assembly files that you have created as components within your project.

The  icon indicates that a replica triangle mesh has been created as part of the assembly.

The  icon indicates that a gem setting has been created as part of the assembly.

The  icon indicates the size and national standard system used for the assembly.



Working with Assemblies

You can work directly from the Master Model Tree to build and edit the assemblies that make up your complete jewellery design.

Creating an Empty Assembly



You can add an empty assembly to the Master Model Tree. No associated ArtCAM model file is created along with the empty assembly, although you can make a new component from it.

To create an empty assembly in the Master Model Tree:


1. Click to select the Master Model . Its name is now shown in bold text, and its options are displayed on the page.
2. Click on the **Add Empty Assembly**  button in the **Assembly Manager** area to add the new assembly to the Master Model Tree. It is named *New Assembly* by default. To change its name, see "Viewing the Attributes of an Assembly" on page 106 for details.

You can now create a component from the empty assembly. See "Creating a Component from an Empty Assembly" on page 104 for details.

Creating a Component from an Empty Assembly

You can create a component from an empty assembly already added to the Master Model Tree. An empty assembly has no associated ArtCAM model file, replica mesh or gem setting. An empty assembly is easily identified in the Master Model Tree as having no  or  icon beside it.

To create a component from an empty assembly:

1. Click on the blank assembly  from which you want to create a component. Its name is now shown in bold text, and its options are displayed on the page.

A blank assembly is named *NewAssembly* by default, although you may have already changed its name. See "Viewing the Attributes of an Assembly" on page 106 for details.



2. Click on the **Add New Component**  button in the **Project Tools** area to display the **Project Components** page.




You can now use the tools in the **Blanks** or **Libraries** area to create a component from the empty assembly. For details, see "Using the Blanks" on page 116 for details.

Exporting an Assembly

You can export an assembly as a 3D Assembly (*.3DA), STL model (*.STL) or ASCII STL (*.STL) file.

To export an assembly:

1. Click to select the assembly  that you want to export. Its name is now shown in bold text, and its options are displayed on the page.
2. Click on the **Export**  button in the **Edit** area to display the **Save File** dialog box.
3. Click on the **Save in** list box and select the directory in which you want to save the assembly.
4. Define a name for the assembly in the **File name** box.
5. Click on the **Files of type** list box, and then on the file type in which you want to save the assembly.

You can export an assembly as a 3D Assembly (*.3DA) , STL model (*.STL)  or ASCII STL (*.STL)  file only.



6. Click on the **Save** button to save the assembly file.

The assembly file can then be imported into any Master Model. For further details, see "Importing an Assembly" on page 108.

Editing an Assembly Design

You can edit the design of an assembly, and in turn reconstruct its associated replica mesh and gem settings.

To edit an existing assembly:

1. Click to select the assembly  that you want to reconstruct. Its name is now shown in bold text, and its options are displayed on the page.
2. Click on the **Edit Associated Model**  button in the **Assembly Manager** area to open the ArtCAM model associated with the assembly.



A page of tools is displayed on the **JewelSmith** tab relating to the assembly when it was first created. For example, if you are editing a Rotary Flush setting, the **Rotary Axis Tools** page is displayed. You can use the available tools to reconstruct the assembly.

If you attempt to edit an empty assembly, a message box appears warning you that there is no associated ArtCAM model for the assembly. Click on the **OK** button to close the message box.

Adding a Gem to an Assembly

You can add a gem to an existing assembly.



To add a gem to an assembly:

1. Click to select the assembly  in which you want to add a gem setting. Its name is now shown in bold text, and its options are displayed on the page.
2. Click on the **Add Gem**  button in the **Assembly Manager** area to display options for each available shape of gemstone.
3. Define the shape of the gemstone you want to add to the assembly by clicking on the appropriate button.
4. Click on the **Standard** list box, and then on the standard that you want to use.

Hexagon, Triangle and **Trillion** shapes do not have a **Standard** size setting. You must define the **Length, Width** and **Depth** for each of these particular gemstones.

If you select the **Custom** option, the **Size** list box is greyed-out. You must define the **Length, Width** and **Depth** of the gemstone using the boxes on the page.


If you select the **Carat** option, the **Length, Width** and **Depth** boxes are updated according to the size of the gemstone you define using the **Size** list box.

5. Click on the **Next**  button to display the colour options available for the gemstone.
6. Set the colour of the gemstone you want to add to the assembly by clicking on the appropriate button.
7. Type a name for the gem in the **Gem name** box.
8. Click on the **Next**  button to add the gem to the assembly.

Viewing the Attributes of an Assembly

You can view details about an assembly including its name, visibility, associated ArtCAM model files, ring properties, volume, material and weight. You can also edit many of these attributes.

To display the attributes of an assembly:

1. Click to select the assembly  for which you want to view its attributes. Its name is now shown in bold text, and its options are displayed on the page.
2. Click on the **Attributes** button in the **Assembly Manager** area to display its current attributes. All of the attributes shown on the page can be edited, except for the following:
 - The units of measurement used of the volume of the assembly, as shown in mm³.
 - The location of the ArtCAM model file (*.art) within the JewelSmith Project folder, from which the assembly was created. For further information, see "Creating a New Project" on page 101.
 - The ring properties of the assembly. If the assembly is not a ring, this will be shown as *None*.

3. The current name of the assembly is shown in the **Name** box. If you want to change its name, type the new name in this box.
4. If you want to hide the assembly from view, click to deselect the **Visible** option. Each assembly is visible by default. If you want to restore the hidden assembly, click to select the **Visible** option again.
5. The given weight of the assembly is controlled by the material and units of measurement currently selected. This value is updated if either the material or units of measurement are changed. If you want to change the material used for the assembly:


- Click on the **Material** list box, followed by the material in which it will eventually be cast. **Silver (Sterling)** is selected by default.

If you want to calculate the volume of the assembly whilst compensating for any shrinkage that you would expect to occur during the casting process:

- Define the percentage of the assembly's original volume by which you expect it to reduce during the casting process in the **Shrinkage** box. No shrinkage value is applied by default.

If you want to change the units of measurement in which the assembly is weighed:





- Click on the **Weight** list box, followed by the unit of measurement that you want to use. **Metric (g)** is selected by default.

6. Click on the **Accept**  button to apply any changes that you have made to the attributes.

Creating a Duplicate Assembly

You can create a duplicate copy of an existing assembly in the Master Model Tree.

To create a duplicate assembly:



1. Click to select the assembly  that you want to copy. Its name is now shown in bold text, and its options are displayed on the page.
2. Click on the **Copy**  button in the **Edit** area to place a copy of the assembly on the ArtCAM JewelSmith clipboard.
3. Click to select the Master Model . Its name is now shown in bold text, and its options are displayed on the page.
4. Click on the **Paste**  button in the **Edit** area to create a duplicate copy of the assembly as part of the Master Model. The copy shares the name of the original assembly from which it was copied.

You might want to change the name of the copy so that it can easily be distinguished from the original. For further details, see "Viewing the Attributes of an Assembly" on page 106.

Deleting an Assembly

You can delete an existing assembly from the Master Model Tree.

To delete an assembly:



1. Click to select the assembly  that you want to delete. Its name is now shown in bold text, and its options are displayed on the page.
2. Click on the **Delete**  button in the **Edit** area. The assembly is deleted from the Master Model Tree.

The ArtCAM model file and any replica mesh  or gem setting  associated with the assembly is deleted from the Master Model Tree along with it.

Importing an Assembly

You can import a 3D Assembly file (*.3DA) into the Master Model Tree.

To import an assembly:

1. Click to select the Master Model . Its name is now shown in bold text, and its options are displayed on the page.
2. Click on the **Import**  button in the **Edit** area to display the **Select File** dialog box.
3. Click on the **Look in** list box and select the directory in which the assembly that you want to import is stored.
4. Click on the name of the assembly that you want to import. Its name appears in the **File name** box.
5. Click on the **Open** button to import the assembly into the Master Model Tree.

Transforming an Assembly

You can move, rotate and scale an existing assembly. For details, see "Using the Nudge Tool" on page 111 and "Using the Scale Tool" on page 112.






Working with Gem Settings

You can change the size, position and colour of the gem settings associated with an assembly directly from the Master Model Tree.

Editing a Gem's Size and Colour

You can change the dimensions and colour of an existing gem.




To edit the size and/or colour of a gem:

1. Click to select the  icon beside the assembly  associated with the gem setting that you want to edit. The gem settings  associated with the assembly are now shown in the Master Model Tree.
2. Click to select the name of the gem  that you want to edit. Its name is now shown in bold text, and its options are displayed on the page.
3. Click on the **Gem Properties**  button to display its setting options on the page.
4. If you want to adjust the size of the gem, click on the **Standard** list box, and then on the standard that you want to use:
 - If you select the **Custom** option, the **Size** list box is greyed-out. You must define the **Length**, **Width** and **Depth** of the gem using the boxes on the page.
 - If you select the **Carat** option, the **Length**, **Width** and **Depth** boxes are updated according to the size of the gem you define using the **Size** list box.
5. If you want to change the colour of the gem, click on the **Edit Colour** button to display its colour options, and then click on the button for the new colour that you want to use.

Deleting a Gem

You can delete an existing gem from the Master Model Tree.

To delete a gem:

1. Click to select the name of the gem  that you want to delete. Its name is now shown in bold text, and its options are displayed on the page.
2. Click on the **Delete Gem**  button. The gem  is deleted from the Master Model Tree.

Transforming a Gem

You can move, rotate and scale an existing gem. For details, see "Using the Nudge Tool" on page 111 and "Using the Scale Tool" on page 112.






Working with Replica Meshes



You can export a replica mesh in the Master Model Tree as a 3D Assembly (*.3DA) or STL model file (*.STL), reverse the direction of its triangles or delete it.

Exporting a Replica Mesh

You can export a replica mesh as a 3D Assembly (*.3DA) or STL model file (*.STL).

To export a replica mesh:

1. Click to select the  icon beside the assembly  associated with the replica mesh that you want to export. The replica mesh  associated with the assembly is now shown in the Master Model Tree.
2. Click to select the name of the replica mesh  that you want to export. Its name is now shown in bold text, and its options are displayed on the page.
3. Click on the **Export Mesh**  button to display the **Export Mesh** dialog box.
4. Click on the **Save in** list box and select the directory in which you want to save the replica mesh.
5. Define a name for the replica mesh in the **File name** box.
6. Click on the **Files of type** list box, and then on the file type in which you want to save the replica mesh.




You can export a replica mesh as an Assembly file (*.3DA)  or STL file (*.STL)  only.

7. Click on the **Save** button to save the replica mesh.

Deleting a Replica Mesh

You can delete an existing replica mesh from the Master Model Tree.



To delete a replica mesh:

1. Click to select the name of the replica mesh  that you want to delete. Its name is now shown in bold text, and its options are displayed on the page.
2. Click on the **Delete Mesh**  button. The replica mesh  is deleted from the Master Model Tree.

Reversing a Replica Mesh

You can reverse the direction of the triangles within an existing replica mesh in the Master Model Tree.

To reverse the direction of the triangles within a replica mesh:

1. Click to select the name of the replica mesh  that you want to reverse. Its name is now shown in bold text, and its options are displayed on the page.
2. Click on the **Reverse Mesh**  button.

Transforming a Replica Mesh


You can move, rotate and scale an existing replica mesh. For details, see "Using the Nudge Tool" on page 111 and "Using the Scale Tool" on page 112.

Using the Nudge Tool

You can adjust the position and angle of any Master Model, assembly, replica mesh or gem setting currently in the Master Model Tree. You can either move the item along any of the three axes, or rotate the item around a defined origin.

To reposition an item:







1. Click to select the item in the Master Model Tree that you want to reposition. Its name is now shown in bold text, and its options are displayed on the page.

2. Click on the **Nudge**  button in the **Positioning** area to display its settings.

3. In the **Transform Relative To** area, select the origin you want to use when repositioning the item:

- If you want to transform the item relative to the origin of the Master Model, select the **World Centre** option by clicking on its radio button. This method is selected by default.
- If you want to transform the item relative to the origin of the item itself, select the **Component Centre** by clicking on its radio button.




4. Type the distance by which you want to move the item in the **Step** box.
5. Use the arrows on the diagram to move the item around the specified origin along any of the three axes:

- Each click on the  arrow moves the item up along the Z- axis by the increment specified in the **Step** box.
- Each click on the  arrow moves the item down along the Z- axis by the increment specified in the **Step** box.
- Each click on the  arrow moves the item up along the Y- axis by the increment specified in the **Step** box.
- Each click on the  arrow moves the item down along the Y-axis by the increment specified in the **Step** box.
- Each click on the  arrow moves the item left along the X- axis by the increment specified in the **Step** box.
- Each click on the  arrow moves the item right along the X- axis by the increment specified in the **Step** box.

You can see that the arrows are colour co-ordinated with the origin displayed in the view. This makes it easy to visualise exactly how you want to move the item.

6. Select the **X**, **Y** or **Z** option by clicking on its radio button to define the axis around which you want to rotate the item.


You can see that the **X**, **Y** and **Z** options are colour co-ordinated with the origin displayed in the view. This makes it easy to visualise exactly how you want to rotate the item.

7. Type the angle by which you want to rotate the item in the **Angle** box.
8. Use either of the arrows to rotate the item around the specified origin:
 - Each click on the  arrow rotates the item clockwise by the increment specified in the **Angle** box.
 - Each click on the  arrow rotates the item anti-clockwise by the increment specified in the **Angle** box.
9. Now that you have repositioned the item for machining, you can apply or cancel its new position using the following methods in the **Advanced** area:
 - If you want to save the current position of the item as its machining position, click on the **Set Machining Position** button.
 - If you want to reset the item to its previous machining position, click on the **Return To Machining Position** button. The default machining position is set equal to the World Centre origin.
10. Click on the **Back**  button to return to the Master Model **Project** page.

Using the Scale Tool

You can adjust the size of any assembly, replica mesh or gem setting currently in the Master Model Tree. You can either scale the item in any of the three axes individually, or in all three axes at once.



To scale an item:

1. Click to select the item in the Master Model Tree that you want to scale. Its name is now shown in bold text, and its options are displayed on the page.
2. Click on the **Scale**  button in the **Positioning** area to display its settings.
3. If you want to scale the item in only the X, Y or Z axis, you can do so using either of the following methods:
 - Define the new size of the item; or
 - Define the percentage by which you want to scale the item.

For example, to increase the size of an item by twenty per cent in the Y-axis only, type *120* in the **%** box beside the green letter **Y**.

4. If you want to scale the item in all three axes at once, type the percentage by which you want to scale the item in the **All** box.



You can see that the X, Y and Z options are colour co-ordinated with the origin displayed in the view. This makes it easy to visualise exactly how you want to scale the item.

5. Click on the **Accept**  button to scale the item in the selected axes.
6. Click on the **Back**  button to return to the Master Model **Project** page.

Creating a Movie

You can capture a sequence of images of the finished jewellery design. Prospective customers prior to manufacture can either view these images individually or as a movie.

To create a movie:

1. Click on the **Movie**  button in the **Project Tools** area to display its settings on the page.
2. Type the name you want to give to the movie in the **Name** box.
3. If you do not want to compress the size of the image files that make up the movie, click to deselect the **Compress Images** option. This option is selected by default.
4. Select how you want to use the captured images of your jewellery design. If you want to be able to present the images in sequence:
 - First, click on the **Viewer** radio button to display its settings.
 - Next, define the number of images of the design that you want to capture on each of the three axes in the **Frames** box. The total number of images is shown below.
5. If you want to view the images in sequence after they have been captured, select the **Display Once Created** option by clicking on its radio button. This option is deselected by default.
6. If you want to capture a sequence of images only:
 - First, click to select the **Images Only** radio button to display its settings.
 - Next, define the number of images of the design that you want to capture on an axis in the **Frames** box.
7. Click to select or deselect the option for each of the three axes you want to capture images from. Only the **Z-axis** option is selected by default.
8. Make sure that nothing is obstructing the 3D View window; otherwise unwanted objects will appear in your movie. The size of the captured frames is equal to the current size of the 3D View window, so adjust its size accordingly before moving to the next step.
9. Click on the **Accept**  button to capture the images.





A folder named *Movie* is created in the JewelSmith Project directory. The *Movie* folder contains another folder named according to that which you have given your movie. In this folder is yet another folder named *Images*. This contains a sequence of jpeg image files numbered sequentially. For example, *NewProject_0.jpg* and so on.

Using the Object Viewer

If you have selected the **Viewer** option when creating a movie, an HTML file is created in the folder named according to that which you have given the movie. The HTML file also assumes the name that you have given the movie.

Double-clicking on this HTML file displays the **ArtCAM JewelSmith Object Viewer** window, which allows you to view the jpeg image files located within the *Images* folder either individually or in sequence.

You can use the arrow diagram at the bottom of the page to view your design at specific positions:

- Each click on the  arrow moves the design up along the Y-axis by 45 degrees.
- Each click on the  arrow moves the design down along the Y-axis by 45 degrees.
- Each click on the  arrow moves the design left along the X-axis by 45 degrees.
- Each click on the  arrow moves the design right along the X-axis by 45 degrees.

If you want to view all of the captured images of your design in sequence, click on the **Spin** button.

If you want to cancel the sequence at any time, click on the **Stop** button.

You can compress the HTML file and its associated jpeg image files that make up your movie into a single file, so that it is ready to be sent to a prospective customer via e-mail:

1. Click on the **File > Save As** option to display the **Save Web Page** dialog box.
2. Click on the **Save in** list box and then select the location in which you want to save the compressed movie.
3. If you want to change the name given to the compressed movie, type its new name in the **File name** box.
4. Click on the **Save as type** list box, and then on the **Web Archive, single file (*.mht)** option.
5. Click on the **Save** button to save the compressed movie and close the dialog box.


The compressed movie is saved as an *.mht* file, and this is the single file that should be sent to the prospective customer via e-mail.

Using the Shading Tool

You can shade a Master Model or an individual assembly. When shading the Master Model, you can render the model in the material in which you intend for it to be cast, apply a background

image to the 3D View window, and adjust the light settings. When shading an assembly, you can adopt the shading settings applied to the Master Model or choose to render it in a different material altogether. However, you cannot adjust the background or light settings.

To shade a Master Model or an assembly:

1. Click to select the item in the Master Model Tree that you want to shade. Its name is now shown in bold text, and its options are displayed on the page.
2. Click on the **Shading**  button in the **Assembly Manager** area to display its settings.
3. Click on the **Shading Set** list box, and then on the option for the material in which you intend to cast your design.
4. If you are shading an assembly and want to use the same settings currently applied to the Master Model, click to select the **From Parent** option.
5. Click on the **Background** list box, and then on the option for the background image that you want to apply to the 3D View window.

If you are shading an assembly, this setting is not displayed on the page.

6. If you want to adjust the level of ambient light applied to the model view, you can either:
 - Click and drag on the slider. Drag to the left to reduce the light, and drag to the right to increase the light; or
 - Define the strength in the box to the right of the slider.


If you are shading an assembly, this setting is not displayed on the page.

7. Click on the **Accept**  button to apply the new shading settings.

Opening Existing Components

You can open any component as part of the current Master Model, so long as an associated ArtCAM model file has been previously created as part of a component and it is within the current JewelSmith Project folder. A button is created for each of the ArtCAM model files associated with the various components, so that you can open them quickly.

To open an existing component:

1. Use one of following two methods to display the **Browse Project Folder** page. You can:
 - First, click on the **JewelSmith** tab to display the **Project Components** page.
 - Next, click on the **Browse Project**  button in the **Existing Components** area to display the **Browse Project Folder** page.

Alternatively, you can:

- First, click on the **Project** tab to display the **Project** page.



- Next, click on the **Browse Project** button in the **Project Tools** area to display the **Browse Project Folder** page.

All of the ArtCAM model files associated with the different components in the *Head* and *Shank* directories within the JewelSmith Project folder are shown on the page.



An icon represents each of the ArtCAM model files within the current JewelSmith Project.

2. Click on the button representing the component that you want to open. The ArtCAM model file is opened in ArtCAM JewelSmith.

Details of the chosen component are added to the Master Model Tree.

Displaying the Master Model Tree

You can display the Master Model Tree using any of the following methods:



- Click on the **Master Model Tree** button in the **Project Manager** area of the **Project Components** page.
- Click on the **Project** tab.
- Press the *F4* key on your keyboard to toggle between the **Project** and **JewelSmith** tabs.

Using the Blanks


When creating a blank, otherwise known as an empty component, an ArtCAM model file is created according to the settings you define. This ArtCAM model does not contain any vector artwork, other than a reference silhouette and reference guidelines.

1. Click on the **JewelSmith** tab to display the **Project Components** page.
2. Click on the button in the **Blanks** area for the empty component that you want to create to display its settings.
3. Type the name you want to give the empty component in the **Name** box.
4. Click on the **Standard** list box, and then on the national standard system that you want to use for the empty component.

The **Rotary Setting**, **Rotary Flush** and **Flat 3-Axis** blanks cannot be created according to a national standard system.

5. Click on the **Size** list box, and then on the size of the empty component that you want to create. If you have selected the **Custom** option in the previous step, this option is greyed-out.

Since you cannot create a **Rotary Setting**, **Rotary Flush** or **Flat 3-Axis** blank according to a national standard system, this option is not available.

6. If you have selected the **Custom** option as the national standard or are creating a **Rotary Setting** or **Flat 3-Axis** blank, define its diameter in the **Diameter** box.
7. Define the width of the empty component in the **Width** box.
8. Define the border of the empty component in the **Border** box.
9. Define the thickness of the empty component in the **Thickness** box.
10. Define the number of pixels in the empty component in the **Resolution** box.
11. Click on the **Accept**  button to create the ArtCAM model for the empty component.

If you create a **3-Axis Shank**, **Flat 3-Axis** or **3-Axis Shank (Vertical)** blank, then the **General Tools** page is displayed. If you create a **Rotary Shank**, **Rotary Setting** or **Rotary Flush** blank, then the **Rotary Axis Tools** page is displayed.

Using the Gem Tools


The tools in the **Gem Tools** area are displayed when you create any of the 3-Axis or Rotary Axis blanks or use any of the components in the **Shank Library**.




The tools can be used to create gem vectors, convert existing vectors into gem vectors, assign specific gem properties to gem vectors, create pave gem settings and create gems in a design.

Creating a Gem Vector

A gem vector must be used to add gems to your item. You can create a gem vector with or without an existing vector. When creating a gem vector without using an existing vector, it is created in the origin of the model area according to defined gem properties. When creating a gem vector using a selected vector, the gem vector adopts the size, shape and position of the vector as its gem properties.

To create a gem vector:



1. Click on the **Create Gem Vector**  button in the **Gem Tools** area to display the **Create Gem Vector** page.
2. Click on the button representing the shape of the gem you want to associate with the gem vector to display its settings.
3. Click on the **Standard** list box, and then on the standard that you want to use for the gemstone. If you select the **Custom** option, the **Size** list box is greyed-out. If you select the **Carat** option, the **Size** list box is active. In this instance, click on the **Size** list box, followed by the size of the gemstone that you want to associate with the gem vector.
4. If you have selected a gemstone of a specific **Carat** size, its **Length**, **Width** and **Depth** is already defined. If you have selected the **Custom** option, you must now define the **Length**, **Width** and **Depth** of the gemstone that you want to associate with the gem vector using the three boxes.


5. Click on the **Next**  button to display the colour options for the gem that are associated with the gem vector.
6. Click on the button representing the colour of the gem you want to create.
7. Click on the **Next**  button to display the name settings for the gem setting.
8. Type the name for the gem setting in the **Gem Name** box.
9. Click on the **Next**  button to create the gem vector. You are now able to create a gem from this vector. For details, see "Creating Gems" on page 119.

Converting Vectors to Gem Vectors

You can create a vector representing the size and shape of a custom gem using the tools in the **Vector Editing** area of the Assistant's Home page, and then convert it to a gem vector.

To convert a vector to a gem vector:





1. Draw the vector representing the size and shape of the custom gem. For details, see the Working with Vectors chapter of the ArtCAM Pro Reference Manual.
2. Click to select the vector representing the custom gem. It turns magenta and is surrounded by a bounding box.
3. Click on the **Vectors to Gem Vectors**  button in the **Gem Tools** area to display the **Vectors to Gem Vectors** page.
4. Click on the button representing the shape of the gem you want to associate with the gem vector to display its settings.
5. If you select the **Get Gem sizes from vectors** option, all of the settings on the page are greyed-out.
6. Click on the **Next**  button to display the colour option for the gem that is associated with the gem vector.
7. Click on the button representing the colour of the gem that is associated with the gem vector.
8. If you do not want to create the gem vectors on a new layer, click to deselect the **Create New Gem Vectors** option. This option is selected by default.
9. If you do not want to delete the original vectors from which the gem vectors are being created, click to deselect the **Remove original vectors** option. This option is selected by default.
10. Type the name that you want to give to the gem in the **Gems Name** box.

11. Click on the **Next**  button to convert the selected vector into a gem vector and create the gem setting within it. The gem vector is shown in red when deselected.

Creating Gems

You can create a gem setting providing that you have already created gem vectors for each of the gemstones you want to create.

To create a gem setting:

1. Click to select the gem vector for which you want to create a gem setting. For details, see "Creating a Gem Vector" on page 117. The selected gem vector turns magenta and is surrounded by a bounding box.
2. Click on the **Create Gems**  button in the **Gem Tools** area to display the **Create Gems** page.
3. Type a name for the gem setting in the **Gem Set Name** box.
4. Define the height at which you want to create the gem setting in the **Start Height** box.
5. If you do not want to wrap the gem setting around the relief, click to deselect the **Position Around Ring** option. This option is selected by default.
6. If you want to orientate the gem setting equal to the underlying relief, click to select the **Lay On Relief** option. This option is deselected by default.
7. Click on the **Next**  button to create the gem setting.
8. If you want to adjust any of the settings, define the new settings and then click on the **Rebuild**  button.
9. Click on the **Accept**  button to create the gem setting.
10. Press the *F3* key on your keyboard to view the gem setting in the 3D View window.

Editing Gem Vector Properties


You can edit the dimensions and the colour of the gemstones associated with a gem vector.

You cannot edit both the dimensions and the colour of the gem associated with a gem vector at once.

If you edit the properties of a gem vector for which its associated gem has already been created, you must recreate the gem after you have finished editing the gem vector's properties. For details, see "Creating Gems" on page 119.

If you want to edit the overall shape of a gem vector, see the Working with Vectors chapter of the ArtCAM Pro Reference Manual.

To edit the properties of a gem vector:


1. Click to select the gem vector for which you want to edit its properties. It turns magenta and is surrounded by a bounding box.
2. Click on the **Gem Vector Properties**  button in the **Gem Tools** area to display the **Gem Vector Properties** page. You can either adjust the dimensions or the colour of the gem associated with the selected gem vector.
3. If you want to change the dimensions of the gem associated with the selected gem vector:

- First, click on the **Standard** list box, followed by the option that you want to use to decide the dimensions of the gem associated with the gem vector.

If you select the **Carat** option, click on the **Size** list box followed by the carat size that you want to use. Its associated **Length**, **Width** and **Depth** values are displayed in the appropriate boxes.

If you select the **Custom** option, define the new **Length**, **Width** and **Depth** of the gem vector in the appropriate boxes.

If you select the **Get Gem sizes from vectors** option, the dimensions of the gem shall equal those of the selected gem vector. All of the settings on the page are greyed-out.


- Finally, click on the **Next**  button to apply the new gem dimensions and close the **Gem Vector Properties** page.
4. If you want to change the colour of the gem associated with the selected gem vector:
 - First, click on the **Edit Colour** button to display the colour options.
 - Next, click on the button representing your chosen gem colour to apply the new colour and close the **Gem Vector Properties** page.

Using the Pave Wizard

A Pave gem setting is made up of beads and gemstones in a grid format. ArtCAM JewelSmith generates the vector artwork needed to add the gems and create the beads in a Pave setting design.

You can control the layout, the number of gems and beads and their respective dimensions, and the overall area of the Pave setting.

To create a Pave setting:

1. Click on the **Pave Wizard**  button in the **Gem Tools** area to display the **Pave Wizard** page.
2. In the **Pave Type** area, click to select the style of Pave gem setting that you want to create:

- If you want to create a linear block pattern of gems, click on the **Linear** radio button.
 - If you want to create a honeycomb matrix pattern of gems, click on the **Honeycomb** radio button.
3. In the **Spacing** area, define the dimensions of the gems and the beads:
 - First, type the diameter of each gem in the **Stone Diameter** box.
 - Next, set the size of the beads using either of the following methods:

Click to select the **Bead Diameter** radio button, and then define their diameter in the adjacent box; or

Click to select the **Gap Between Stones** radio button, and then define the distance you want to set between each gem in the adjacent box.
 4. In the **Pave Area** area, set the overall size of the Pave setting. If you want to use an existing vector to define its area:
 - First, click to select the **Selected Vector** radio button.
 - Next, click to select the vector that you want to use to define the area of the Pave setting. It turns magenta, and is surrounded by a bounding box.

If you want to specify an exact number of gems:

 - First, click on the **Number of rows** radio button.
 - Next, define the number of rows and columns of gems in the boxes.
 - Finally, click on the **Create** button to create the vector artwork representing the Pave setting.
 5. If you want to delete the vector artwork created for the Pave setting outside of the selected vector, click on the **Trim** button.

This option is only available if you used the **Selected Vector** option when creating the vector artwork.

6. If you want to delete the Pave setting, click on the **Delete** button.
7. In the **Select Vectors** area, you can control which of the vectors that make up the Pave setting artwork are selected:
 - If you want to select only the circular vectors representing each of the gems in the Pave setting, click on the **Stones** button. They turn magenta, and are surrounded by a bounding box.
 - If you want to select only the circular vectors representing each of the beads in the Pave setting, click on the **Beads** button. They turn magenta, and are surrounded by a bounding box.
 - If you want to select all of the vectors that make up the Pave setting, click on the **All** button. They turn magenta, and are surrounded by a bounding box.

At this stage, you might want to transform the shape of the vectors representing the gems to match that of a custom gem. For details, see "Transforming Vectors" in the Working with Vectors chapter of the ArtCAM Pro Reference Manual.

You might also want to apply a specific shape to the vectors representing the beads and then combine them with the existing relief. For details, see "Shape Editor" in the Working with Reliefs chapter of the ArtCAM Pro Reference Manual.

8. Click on the **Accept**  button to create the Pave gem setting.

The circular vectors representing each of the gems in the Pave setting turn red, indicating that they are now gem vectors. You are now able to create gems from these vectors. For details, see "Creating Gems" on page 119.

The default colour of **Diamond** is applied to all gem vectors that make up a Pave setting. To change their colour, see "Editing Gem Vector Properties" on page 119.

Using the General Tools

The tools in the **General Tools** area are displayed when you create any of the 3-Axis or Rotary Axis blanks or use any of the components in the **Shank Library**.

The tools can be used to combine the Master Model with the existing relief or subtract it from the existing relief, add an assembly of the existing relief to the Master Model, mirror the existing relief, show or hide the Master Model and close the model you are currently working on.

Merging the Master Model with the Relief

You can merge a replica mesh of the Master Model with the existing relief within the current ArtCAM model. The top of the replica mesh is merged with the existing front relief, whilst the bottom of the replica mesh is merged with the existing back relief.

To combine the Master Model with the relief:

1. Click on the **Combine Master**  button in the **General Tools** area to merge the replica mesh of the Master Model with the existing relief.

Subtracting the Master Model from the Relief


You can subtract a replica mesh of the Master Model from the existing relief within the current ArtCAM model. The top of the replica mesh is subtracted from the existing front relief.

To subtract the Master Model from the relief:

1. Click on the **Subtract Master**  button in the **General Tools** area to subtract a replica mesh of the Master Model from the existing front relief.

Adding an Assembly to the Master Model



To add an assembly of the existing relief to the Master Model:

1. Click on the **Add To Master**  button in the **General Tools** area to add an assembly of the existing relief within the current ArtCAM model to the Master Model. A replica mesh of the relief is associated with the assembly.

Mirroring a Relief



If your item of jewellery is symmetrical, you can take an existing half relief on either side or either half of the model area (the white area) shown in the 2D View window, and then mirror it to create a complete relief. The existing half relief can either be mirrored about the vertical or horizontal guideline shown in the model area by default.

To mirror the existing relief:

1. Click on the **Greyscale**  button in the 3D View toolbar to show a greyscale view of the existing relief in the 2D View window. This makes it easy for you to visualise how the relief should be mirrored.
2. Click on the **Mirror Relief**  button in the **General Tools** area to display the **Mirror Relief** page.
3. Click on the **Mirror Options** list box, and then on the direction in which you want to mirror the existing relief:
 - If you want to mirror the relief to the left of the vertical guideline onto the right, click to select the **Left/Right** option.
 - If you want to mirror the relief to the right of the vertical guideline onto the left, click to select the **Right/Left** option.
 - If you want to mirror the relief above the horizontal guideline below it, click to select the **Top/Bottom** option.
 - If you want to mirror the relief below the horizontal guideline above it, click to select the **Bottom/Top** option.

Viewing the Master Model

You can show or hide the Master Model from view in the 3D View window using either of the following methods:

- Right-click on the name of the Master Model  in the Master Model Tree shown on the **Project** page to display its context menu, and then click on the **Show** or **Hide** option depending on whether it is currently visible or not; or
- Click on the **Toggle Master Visibility**  button in the **General Tools** area.

Closing the Current Model

To close the ArtCAM model file associated with the assembly that you are currently working on:


1. Click on the **Close Current File**  button in the **General Tools** area to close the component model.

The **Project** page is displayed, where you can see the assembly in the Master Model Tree.

Creating an Assembly Silhouette

You can create a vector outline of all assemblies currently visible in the 3D View window. This vector outline, referred to as an Assembly Silhouette, is drawn in the model area (the white area) and around the Reference Silhouette. This Assembly Silhouette can be used to create a shank relief that meets gem settings exactly.

To create an Assembly Silhouette:

1. Make sure that all of the assemblies around which you want to create a vector outline are shown in the 3D View window.
2. Click on the **Create Assembly Silhouette**  button in the **General Tools** area to create a vector outline of the visible assemblies.

Using the Back Relief Tools

The tools in the **Back Relief** area are displayed when you create any of the 3-Axis or Rotary Axis blanks or use any of the components in the **Shank Library**.

The tools within the **Back Relief** area can be used to create and control the relief representing the back face of your jewellery design.

Making the Front Relief Current

You can either work on modelling the front or back relief in an ArtCAM model file associated with an assembly. The default relief in an ArtCAM model file is the front relief.

1. Click on the **Make Front Current**  button in the **Back Relief** area to display the front relief in the 3D View window.

Making the Back Relief Current


You can either work on modelling the front or back relief in an ArtCAM model file associated with an assembly. The back relief in an ArtCAM model file is hidden by default.

1. Click on the **Make Back Current**  button in the **Back Relief** area to display the back relief in the 3D View window.

Merging the Master Model with the Back Relief

You can combine a replica mesh of the Master Model with the existing back relief within the current ArtCAM model. The top of the replica mesh is merged with the existing back relief, which has the effect of pushing the back relief upwards and outwards.

To combine the Master Model with the back relief:

1. Click on the **Merge Master**  button in the **Back Relief** area to merge the replica mesh of the Master Model with the existing back relief.

Inverting the Front Relief to a Back Relief

You can invert the front relief to create a back relief. The front relief must be displayed in the 3D View window.

1. Click on the **Invert Front to Back**  button in the **Back Relief** area to invert the front relief onto the back relief.

Offsetting the Front Relief to a Back Relief

You can offset the front relief to create a back relief. The front relief must be displayed in the 3D View window.

1. Click on the **Offset Front to Back**  button in the **Back Relief** area to offset the front relief to create a back relief.

Toggling the Back Relief

You can toggle the back relief. The back relief must be displayed in the 3D View window.

1. Click on the **Toggle Back for Machining**  button in the **Back Relief** area to toggle the back relief.

Using the Modelling Tools

The tools in the **Modelling Tools** area are only displayed when you create a **Rotary Shank**, a **Rotary Setting** or use a shank from the **Shank Library**.


The tools can be used to combine additional shapes with the existing relief and manipulate the vector artwork that you will use to create the design details and gem settings in your finished piece.

Creating a Two-Rail Swept Ring Shape

You can create a two-rail swept ring shape using multiple vector objects. The first two vector objects define the lines along which the shape is extruded. They are referred to as the drive rails.

You can use any number of vectors as cross-sections in the shape. Each of the vectors that you select as cross-sections can be associated to a specific position along each of the drive rails (the vectors along which the swept ring shape is extruded). You can also use a vector created around the reference silhouette to determine the height of the shape in the Z direction.

To create a two-rail swept ring shape:

1. Click on the **2-Rail Sweep**  button in the **Modelling Tools** area to display the **Two Rail Ring Sweep** page.
2. Click to select the first vector along which you want the cross-section to be swept, and then click on the **Select** button for the **Top Drive Rail** in the **Select Control Vectors** area. The selected vector is referred as the first drive rail.

In the **Status** area, the *First Drive Rail* status changes from *Not Selected* to *Valid*. A red letter *A* also appears beside the first drive rail in the 2D View window.

3. Click to select the second vector along which you want the cross-section to be swept, and then click on the **Select** button for the **Bottom Drive Rail** in the **Select Control Vectors** area. The selected vector is referred to as the second drive rail.

In the **Status** area, the *Second Drive Rail* status changes from *Not Selected* to *Valid*. A red letter *B* also appears beside the second drive rail in the 2D View window.

Arrows appear on the two vectors selected as the drive rails to indicate their direction.

4. Click to select the open, ungrouped vector that you want to use as the cross-section in the swept ring shape, and then click on the **Add Cross Section** button in the **Status** area.

In the **Status** area, *Cross Section 1* is now listed with its status as *Valid*. The number of spans that make up the cross-section are also shown. A red number *1* also appears beside the cross-section in the 2D View window.

If you have selected a closed or grouped vector as a cross-section, a message box appears indicating that you have selected an invalid vector and instructs you to select a single ungrouped vector. Click on the **OK** button to close the message box, and then repeat this step using an open and ungrouped vector.




If you want to use multiple cross-sections in the swept ring shape, hold the *Shift* key down on your keyboard, click to select each of the open, ungrouped vectors that you want to use, and then click on the **Add Cross Section** button. In the **Cross Section** area, each of the selected cross-sections is numbered sequentially and its status is shown as *Valid*. Each of the cross-sections selected in the 2D View window is also numbered sequentially in red.



When selecting two or more cross-sections, each of the selected open vectors you use should ideally contain the same number of spans. This will make for a smooth transition in the shape between each cross-section.


A red number marks the position of each cross section along the first drive rail in the 2D View window. The position of each cross section along the first drive rail is numbered sequentially.

A blue number marks the position of each cross section along the second drive rail in the 2D View window. The position of each cross-section along the second drive rail is numbered sequentially.

If you want to adjust the position of any of the cross-sections along either of the drive rails, for each of them:

- Click on the **Set Position**  button. The **Set Position** button changes to  and the **Position** label changes to **1st Rail**.
- Click on the position along the first drive rail that you want to use for the cross-section. The **1st Rail** label changes to **2nd Rail**.
- Click on the position along the second drive rail that you want to use for the cross-section. The **Set Position** button changes to  and the **2nd Rail** label changes to **Position**.

By default, ArtCAM JewelSmith creates a smooth blended shape between each cross-section made up of an equal number of spans. If you would rather a linear blended shape is used, click on the **Smooth Blend**  button. The **Linear Blend**  button is displayed in its place.

If you want to cancel the use of any of the selected cross-sections, click on the **Delete** button  for each of the cross-sections that you do not want to use.

If all of the vectors selected as cross-sections contain the same number of spans, the **Sweep between spans** option is activated and selected by default. This instructs ArtCAM JewelSmith to sweep between matching spans.

If you do not want to sweep between matching spans, click to deselect the **Sweep between spans** option.

If you do not want to duplicate the selected cross-sections on the opposite side of the swept ring shape, click to deselect the **Ring is symmetrical** option. This option is selected by default.

5. You are now ready to decide how you want to scale the swept ring shape. If you want to scale the two-rail swept profile in the Z-axis along its length:
 - Click to select the closed vector that you want to use to control the Z height of the swept ring shape, and then click on the **Select** button for the **Ring Silhouette** in the **Select Control Vectors** area. The selected vector is typically that which is drawn using the reference silhouette. The selected vector is referred to as the ring silhouette.

In the **Status** area, the *Ring Silhouette* status changes from *Not Selected* to *Valid*. A red letter Z also appears beside the ring silhouette in the 2D View window.

- Next, make sure that the **Silhouette Vector Controls Z** option is selected. This option is selected by default whenever a ring silhouette vector is selected. The **Scale Height with Width** and **Scale Final Height** options are greyed-out.

If you do not want to use the ring silhouette to determine the height of the swept ring shape, you can select an alternative scaling option:

- First, click to deselect the **Silhouette Vector Controls Z** option. The **Scale Height with Width** and **Scale Final Height** options are activated, and the red letter Z beside the ring silhouette disappears.

- To scale the height of the cross-section across the two drive rails in proportion with its width, make sure that the **Scale Height with Width** option is selected.

If you want the height of the cross-section across the two drive rails to remain constant, click to deselect the **Scale Height with Width** option.

Narrow sections in the swept shape appear low, while wide sections appear high when the **Scale Height with Width** option is selected.

- To define the final height of the swept ring shape before it is combined with any existing relief, click to select the **Scale Final Height** option, and then define its height in the adjacent box.

If you have selected the **Silhouette Vector Controls Z** option, then the **Scale Height with Width** and **Scale Final Height** options are greyed-out.

6. In the **Combine** area, select the relief combination method that you want to use:
 - Click on the **Add** radio button if you want to add the two-rail swept ring shape to the existing relief.
 - Click on the **Subtract** radio button if you want to subtract the two-rail swept ring shape from the existing relief.
 - Click on the **Highest** radio button if you want to merge the two-rail swept ring shape with the existing relief, so that only the highest points of the two show.
 - Click on the **Lowest** radio button if you want to merge the two-rail swept ring shape with the existing relief, so that only the lowest points of the two show.
7. Click on the **Calculate** button to combine the two-rail swept ring shape with the existing relief.
8. Click on the **Close** button to return to the Assistant's Home page.


Creating a Simple Swept Shape

You can create a simple swept shape and combine this with the existing relief. The swept shape is extruded along two curved vectors, referred to as drive rails. A third vector, referred to as a cross-section, controls the profile of the swept shape. The shape is merged with the existing relief.

This process is similar to that used when creating a two-rail swept shape, although here you cannot use multiple cross sections or the Reference Silhouette to control the profile and height of the resulting shape. For details, see "Creating a Two-Rail Swept Ring Shape" on page 125.


To create a simple swept shape:

1. Click to select the first vector along which you want the cross-section to be swept. The selected vector is referred to as the first drive rail.
2. Hold the *Shift* key down, and then click to select the second vector along which you want the cross-section to be swept. The selected vector is referred to as the second drive rail.

3. Still holding down the *Shift* key, click to select the open, ungrouped vector that you want to use as the cross-section in the swept shape.
4. Click on the **Sweep Profile**  button in the **Modelling Tools** area to create the swept shape.

Unwrapping a Profile Vector



You can unwrap a selected vector. Typically, you would unwrap a vector drawn about the Reference Silhouette. The resulting unwrapped vector is most often used as a drive rail when creating a two-rail swept shape. For details, see "Creating a Two-Rail Swept Ring Shape" on page 125.

1. Select the vector that you want to unwrap.
2. Click on the **Unwrap Profile**  button in the **Modelling Tools** area to unwrap the selected vector. A new unwrapped form of the selected vector is created in the model area.

Creating a Flat Plane

You can create a flat plane at a specified height in the existing relief. You can control the height at which the plane is created and decide whether it has vertical or tapered sides. A flat plane is often used in the construction of Class rings.



To create a flat plane in the existing relief:

1. Click on the **Create Flat Plane**  button in the **Modelling Tools** area to display the **Create Flat Plane** page.
2. Define the height at which you want to create the centre of the flat plane within the existing relief in the **Height** box.
3. If you want to create the flat plane from the edge of the relief, click to select the **From Edge** option.
4. If you want to create a flat plane with vertical, rather than tapered, edges, click to select the **Vertical Sides** option.
5. If you want to merge the lowest points in the plane with the relief rather than high, click to select the **Cut Out** option. This has the effect of removing a plane area from the existing relief.
6. Click on the **Accept**  button to create the flat plane.

Correcting a Vector for Height

You can correct the shape of vectors drawn above and below the defined thickness of the model, so that they maintain their integrity in the finished item.


To correct a vector for height:

1. Click to select the vector that you want to correct for height. It turns magenta and is surrounded by a bounding box.
2. Click on the **Correct Vector For Height**  button in the **Modelling Tools** area to display the **Correct Vector For Height** page.
3. Define the height at which you want to position the vector relative to the existing relief in the **Height** box.
4. If you want to define the height at which you want to position the selected vector from its centre point relative to the existing relief, click to select the **Get Height From Relief** option. This option is deselected by default.
5. If you want to keep a copy of the original vector, click to select the **Preserve Original Vectors** option. This option is deselected by default.
6. Click on the **Accept**  button to modify the shape of the selected vector so that its original shape is preserved in the finished item.

Positioning Selected Vectors

You can produce the vector artwork representing the gem settings or design details in the model area, according to its exact layout on the finished piece from vectors drawn about the Reference Silhouette. Vectors drawn about the Reference Silhouette initially make it easier to visualise the exact position of design details and gem settings in the finished piece.


To position a selection of vectors:

1. Select the vector objects drawn about the Reference Silhouette that you want to recreate in the model area.
2. Hold the *Shift* key down, and then click to select the horizontal guideline in the model area or the vector representing the top edge of the shank.
3. Click on the **Position Selection**  button in the **Modelling Tools** area to position the selected vectors. The selected vectors around the Reference Silhouette are drawn in the model area according to their exact position on the Reference Silhouette.

Closing the Ends of a Shank Relief

You can quickly close any gap that exists between the two ends of a shank relief when the relief is wrapped.

To close the gap between the ends of a shank relief:

1. Click on the **Close Ends**  button in the **Modelling Tools** area to add relief between each end of the shank relief, joining them together.

Multi-Sided Machining

Introduction

ArtCAM JewelSmith is able to output the Master Model from a project for Rapid Prototype (RP) production by simply exporting it as an STL file. For details, see "Exporting a Replica Mesh" in the JewelSmith Tools Reference chapter. However, since RP production may not be available or appropriate for many designs, the same Master Model can also be used to produce the toolpaths required to cut the model on a CNC machine.

This approach also allows you to machine stereolithography (*.STL) files or 3D Studio Max (*.3DS) models produced in other modelling packages or downloaded from the Internet.

The complexity of this machining process is entirely dependent upon the capabilities of your CNC machine and the actual shape of your Master Model. In this chapter we will discuss the steps needed to machine a model containing design detail that is inaccessible from a single machining direction. We will then use the **Multi-Sided Machining** Wizard to automate the process for you.

The Process of Multi-Sided Machining

Although ArtCAM JewelSmith provides the **Multi-Sided Machining** Wizard to automatically perform all the steps needed to machine the majority of models you are likely to make, it is important to understand the process it uses. The Wizard simply automates a series of operations that are available to you manually, but it has been optimised for the general case. On occasions you may wish to make changes to the ArtCAM reliefs or toolpaths generated by the Wizard to produce advanced effects, or to improve either machining efficiency or quality. By understanding the overall process, you will be free to work in this way.

The Problem

Essentially the problem that is often encountered in CNC machining is that some parts of the model are inaccessible to the cutting tool. However, by re-positioning the model and re-machining the area from a different direction, it is possible to overcome this limitation quite easily. We call this process Multi-Sided Machining. However, although the theory is simple, to put it into practice we must overcome three principal problems. We must be able to:

- Generate compatible toolpaths from different directions, and to preserve as much of the detail on the model as possible.
- Reposition the model precisely between toolpaths, so as not to introduce any positioning errors.
- Support the model while it is being machined, so that it does not move or break.

In general, most jewellery designs also fall into two categories: flat work (pendants, brooches, earrings etc) and rings. We will now look at each of the above issues, in the context of these two classes of design.

Flat Work

Toolpath Orientations

For the vast majority of these models we need to represent detail from two directions: the back and the front. By now you should be familiar with the fact that ArtCAM JewelSmith holds two reliefs within each model. For details, see "The Relief" in the Introduction chapter. These two reliefs are used to represent the back and front faces of the design. When these reliefs are added to the Master Model, the two faces are combined to produce a single 3D Assembly (*.3DA).

It is possible to produce toolpaths for each of these reliefs using the **Toolpath** tools available in ArtCAM JewelSmith. However, when we consider the manufacturing process it soon becomes apparent that some additional steps are required before the correctly orientated toolpaths can be calculated.

In order to cut both sides of a flat model, we must first cut the top surface, turn the material and then finally reposition it precisely so that the bottom surface can be cut in exact registration with the top.

Currently ArtCAM JewelSmith supports two approaches to this problem: manual indexing (or 'turning') and automatic rotary indexing. These methods are discussed in more detail below.

Before looking at the physical indexing process, we must first consider how the back relief should be orientated for indexed machining. By convention, the back and front reliefs in ArtCAM JewelSmith are positioned ready to stitch into a single replica triangle mesh. This is not appropriate for indexed machining since the material block needs to be turned halfway during the machining process. Therefore we must duplicate this change in the back relief before calculating the back toolpath. This is achieved using the **Toggle Back for Machining** tool located in the **Back Relief** area of the page of settings shown on the **JewelSmith** tab. This tool inverts the back relief in Z only, and mirrors it vertically, thus positioning it appropriately for calculating the toolpath on the back of the indexed material.

When calculating toolpaths for indexing, it is often better that you leave the **Material** area of the page relating to your selected toolpath strategy as 'undefined'. However, you must ensure that both your **Safe Z** and **Home** positions are defined appropriately for the material block that you are using.

Manual Indexing

To achieve registration manually the recommended approach is that you pre-drill your material block with two alignment holes corresponding to position of the dowels or pins on the base of your machining bed.

The back and front toolpaths must also share a common origin, even after the material block has been turned. To achieve this we conventionally set the model origin to the centre. Also by convention, we always assume the material will be turned around its horizontal axis. Therefore, the back of the model must be mirrored vertically before calculating the back toolpath so that it appropriately orientated.

Now we can output the two toolpaths using a standard, non-indexing, post processor. The first toolpath cuts the top of the block, and then the material is turned and remounted using the alignment holes. The second toolpath can then be run to cut the back of the model.

Automatic Indexing

If your CNC machine has a rotary axis with a four-jaw chuck, it is possible to let the machine turn the model for you. This system has two main advantages over the manual process. Firstly, the machine will keep the material in alignment without the need for holes or pegs. Secondly, ArtCAM JewelSmith can output a single toolpath containing both the front and back toolpaths together. The back toolpath is preceded by a rotary move that turns the material into position before cutting.

To use automatic indexing you must create rotated toolpaths (using the **A Axis Angle** option in the **Parameters** settings on the **Toolpaths** Home page) and output the toolpaths together using a post processor that supports indexing. For example, the Model Master Indexer.

Bridges


The final thing to consider in multi-sided machining is how to hold the piece firmly in place whilst it is being cut. For this we need some supports, or bridges, which will remain in place during the machining process and can be removed afterwards, much like a sprue.

Bridges are very simple to produce manually as they are simply modelled conventionally and merged into either the front or the back relief before calculating the toolpath. Their exact shape is not too important provided that they extend from the model's edge to a point outside of the machining boundary.

Summary

In summary, the initial steps towards manually producing a model machined on both the back and front are as follows:

1. Model the back and front reliefs of the piece as usual, perhaps creating a replica mesh to preview the finished piece or to calculate volumes and weights. For details, see "Adding an Assembly to the Master Model" in the JewelSmith Tools Reference chapter.

2. Click on the **Toggle Back for Machining**  button in the **Back Relief** area of the page of settings shown on the **JewelSmith** tab to effectively 'turn' the back relief over. For details, see "Toggling the Back Relief" in the JewelSmith Tools Reference chapter.
3. Merge some simple bridges around the edge of the model in the back and front reliefs to bridge the gap between the model edge and the machining boundary.
4. Ensure that the front relief is current, and then create and calculate your first toolpath as normal. See "Making the Front Current" in the JewelSmith Tools Reference chapter for details.
5. Make the back relief current, and then create and calculate the second toolpath. See "Making the Back Current" in the JewelSmith Tools Reference chapter for details.
6. After the second (back) toolpath has been calculated, click to select the name of the actual tool used in the toolpath, as listed beneath its toolpath name on the **Toolpaths** Home page.
7. Click the **Edit Parameters** button at the bottom of the **Toolpaths** Home page to display the **Parameters** options.
8. Type *180* in the **A-Axis Angle** box, and then click on the **Apply** button.

Two calculated toolpaths are listed on the **Toolpaths** Home page, one for the front relief and another for the back. The back toolpath has been rotated in the 3D View window to reflect the 180-degree rotation. You can now check that the two toolpaths align in the 3D View window as expected.

9. Click on the **Save Toolpaths**  button in the **Toolpath Operations** area to display the **Save Toolpaths** dialog box.

In the **Save Toolpaths** dialog box, you can see that the front and back toolpaths are listed across separate windows. Their names have been prefixed with the specified A-axis rotation that precedes the toolpath: *{000}* and *{180}* for the front and back respectively.

10. Make sure that both of the calculated toolpaths are listed within the **Toolpaths to save to a single file** window. For details, see "Saving Toolpaths" in the Machining Models chapter of the ArtCAM Pro Reference Manual.

The order of the toolpaths is not critical, as the indicated A-axis rotary moves before each toolpath are specified in absolute rather than relative terms.

11. Click on the **Machine output file is formatted for** list box, followed by an appropriate post processor that is suitable for your CNC machine and that also supports indexing.
12. Click on the **Save** button to save the toolpath file and close the dialog box.

Machine Set-up

For automatic indexing you will need a suitably equipped CNC machine. The key features include a true 4-axis controller. This means that it is able to control all four axes simultaneously, and does not require the exchange of one of the conventional axes in order to work in rotary

'mode'. The rotary chuck must also be able to hold a flat material block centrally around the axis of rotation. Generally this means that a four, not three, jaw chuck is required. Finally, the CNC machine must have an index-enabled post processor available in ArtCAM JewelSmith to produce the required output file format.

Before machining it is vital to set up the machining origin accurately.

A Origin

The A origin ($A=0$) is set to the position in which the material block is held exactly flat in the rotary chuck with reference to the machine bed. Finding when the material is exactly flat is difficult; so one way to achieve this is indirectly. First, find the position when the material is held exactly perpendicular (e.g. vertical) with reference to the machine bed. This can be found using precisely flat material block in the rotary chuck, and using a setsquare set against the machine bed and the block. Once the block is exactly vertical, you can set the A origin to 90-degrees, rather than 0.

Z Origin

You need to set the machining Z origin to the centre of rotation of the A-axis and again this is not always easy to find directly. A simple alternative is to grip a piece of material of an exact thickness (say 5 mm) horizontally in the rotary chuck. Next, bring the tool tip down onto the surface of the material, and then set the Z origin value equal to half of the material thickness (i.e. we tell the machine that this position is 2.5 mm above Z_0 , the centre of rotation).

Y Origin

ArtCAM JewelSmith generally assumes that the axis of rotation lies along the Y axis of the machine (this arrangement is conventionally referred to as an A axis of rotation). The Y origin (e.g. $Y=0$) must be set exactly to the centre of the axis of rotation. It is possible to find this origin in a similar way to Z. Hold the reference material vertically in the rotary chuck and bring the tool shank alongside the material face. The Y position at this point can now be set to the radius of the tool shank, plus half the thickness of the reference material.

X Origin

For flat work, the X origin will often vary between jobs. Remember that if the ArtCAM model had its origin set to the centre when the toolpaths were calculated (a common set-up in ArtCAM JewelSmith), then you must allow for the tool to move negatively in X (e.g. towards the rotary chuck) when it cuts areas to the left of the model origin. Therefore, it is necessary to ensure that X_0 is set to a distance away from the rotary chuck equal to more than half of the model's width to avoid any problems.

Advanced Flat Work

In the preceding discussion, we assumed that the model to be machined was held in a single ArtCAM model file and comprised a front and a back relief. Using the Master Model in ArtCAM JewelSmith, however, it is possible to create or import new models that do not originate from, or

cannot be well represented by, a single ArtCAM model file (*.art). To machine these models manually, we must generate several ArtCAM model files, each containing copies of the same model at different orientations.

To generate toolpaths from a Master Model, we can first add a new, blank, **Flat 3-Axis** component to our project. We can then use the **Combine Master** tool to create a back and front relief in our new component directly from the surfaces of the existing Master Model. By rotating the Master Model and the resulting toolpaths appropriately, it is possible to generate as many rotated toolpaths as required. You are not limited to simple 180-degree indexing as described above. For example, in some designs, four incremental 90-degree indexes may be more appropriate.



Rings

All of the points discussed previously apply to machining rings.

Using the Multi-Sided Machining Wizard

Prior to using the **Multi-Sided Machining** Wizard, you must first create the toolpaths you want to use to machine your piece, and then save each of them as a toolpath template. For details, see "Creating a Toolpath Template" in the Machining Models chapter of the ArtCAM Pro Reference Manual.

To use the **Multi-Sided Machining** Wizard:

1. Open the JewelSmith Project that you want to machine. For details, see "Opening an Existing Project" in the JewelSmith Tools Reference chapter.
2. Click on the **Project** tab to display the **Project** page.
3. From the Master Model Tree, click to select the Master Model  (*.3DP) that you want to machine. Its name is now shown in bold text, and its options are displayed on the page.
4. Click on the **Multi-Sided Machining**  button in the **Project Tools** area of the page to display the **Multi-Sided Machining** Wizard.

You can see details of the model dimensions, toolpath template and post-processor that will currently be used, as well as both the number and dimensions of the bridges used to hold the piece in position, during the machining process. Six bridges, each with a thickness of 0.5 mm and a width of 2 mm, are used by default.

Whether the **Flat Model** or **Ring Model** settings page is displayed depends on if this is your first time using the **Multi-Sided Machining** Wizard, or, if not, the type of model that was previously defined when it was used last.

If this is your first time using the **Multi-Sided Machining** Wizard, a Flat model type, the *2D HPGL (*.plt)* post-processor and the *MMBlue.tpl* toolpath template, based on the use of a 10 degree Conical tool, are selected as the default machining settings.

If you have used the **Multi-Sided Machining** Wizard before, ArtCAM JewelSmith recalls the specific machining settings that were defined for your previous Flat or Ring Model job, including your chosen post-processor(s) and toolpath template file(s).



You can either accept or modify the settings shown on the first page of the **Multi-Sided Machining** Wizard.

5. If you do not want to modify the machining settings shown on the page, go straight to the next step.

If you want to edit the machining settings currently shown on the page, click on the **Edit Settings** button to display the **Model Type** page.

Flat Models

If you are machining a flat item of jewellery, follow these instructions:

- First, click to select the **Flat** radio button.
- Next, click on the **Next**  button to display the **Model Size** page.
- Define the relief dimensions you want to use in the **Width** and **Height** boxes. Setting the size of the model does not physically alter the size of the Master Model you want to machine; it only adjusts the area of the base relief in which it is contained.
- Define the resolution of the model in the **Resolution** box. A resolution of 30 pix/mm is used by default.
- Click on the **Next**  button to display the **Templates & Supports** page.

The *MMBlue.tpl* toolpath template is selected by default. To select an alternative toolpath template:

- Click on the **Select** button to display the **Select Toolpath Template** dialog box.
- Click on the **Look in** list box and then select the directory in which the toolpath template file (*.tpl) that you want to use is stored.
- Once you have found the appropriate template file, click on its file name. Its name appears in the **File name** box.
- Click on the **Open** button to import the template file and close the dialog box.

The *2D HPGL (*.plt)* post-processor is selected by default. To select an alternative post-processor:

- Click on the **Post Processor** list box, followed by the type of post-processor that you want to use for your CNC machine.




To use supports during the machining process:

- In the **Bridges** area, define the number of bridges that you want to create to hold the piece in position during the machining process in the **Number**

box, and then define the dimensions of each bridge in the **Width** and **Thickness** boxes.

Ring Models

If you are machining a ring, follow these instructions:

- First, click to select the **Ring** radio button.
- Next, click on the **Next**  button to display the **Model Size** settings page.
- Define the diameter of the ring in the **Diameter** box and the resolution of the model in the **Resolution** box. A default resolution of 30 pix/mm is used, and this is suitable for almost any ring design.
- Click on the **Next**  button to display the **Machining Orientations** settings page.
- Click to select the machining orientation option(s) that you want to use when machining the ring: **Three Axis**, **Rotary Axis** and/or **Inside**.
- Click on the **Next**  button to display the **Templates & Supports** settings page. The settings shown on the page depend on the machining orientation(s) that you have chosen.

If you are using a **Rotary Axis Template**:

- Define the diameter of the jig you are using in the **Jig Diameter** box to prevent the tool from colliding with the machining jig.

The *Boss.3da* boss file is selected by default. This file is located in the *Custom\HTML\Machining\Supports* folder within your install directory.

If you want to change the boss file used during the machining process:

- Click on the **Select** button in the **Boss File** area to display the **Select Boss Assembly** dialog box.
- Click on the **Look in** list box and select the directory in which the boss file (*.3da) that you want to use is stored.
- Once you have found the boss file, click on its file name. Its name appears in the **File name** box.
- Click on the **Open** button to import the boss file and close the dialog box.

If you are using a **Three Axis Template**:

- Click to deselect the **Remove Negative Points** option if you do not want ArtCAM JewelSmith to remove the negative points contained in the relief. This option is selected by default.

Whether you choose **Three Axis**, **Rotary Axis** and/or **Inside** machining orientation(s), for each selected orientation you must assign a toolpath template. Typically, both a Three Axis and Rotary Axis orientation are used to machine a ring.

The *MMBlue.tpl* toolpath template is selected by default if you are using a Three-Axis orientation for the first time.

The *MMBlue-Pockets.tpl* toolpath template is selected by default if you are using a Rotary Axis orientation for the first time.

The *Internal.tpl* toolpath template is selected by default if you are using an Inside orientation for the first time.

The default toolpath template files are located in the *Custom\HTML\Machining\Templates* folder within your install directory.

To associate a different toolpath template with a particular machining orientation:

- Click on the **Select** button to display the **Select Toolpath Template** dialog box.
- Once you have found the template file, click on its file name. Its name appears in the **File name** box.
- Click on the **Open** button to import the template file and close the dialog box.


The *2D HPGL (*.plt)* post-processor is selected by default for each orientation.

To select an alternative post-processor for a particular machining orientation:

- Click on the **Post Processor** list box, followed by the type of post-processor that you want to use for your CNC machine.

To use supports during the machining process:

- In the **Bridges** area, define the number of bridges in the **Number** box that you want to create to hold the piece in position during the machining process, and then define the dimensions of each bridge in the **Width** and **Thickness** boxes.

6. Click on the **Accept**  button to calculate the machining toolpaths using the settings shown on the page.

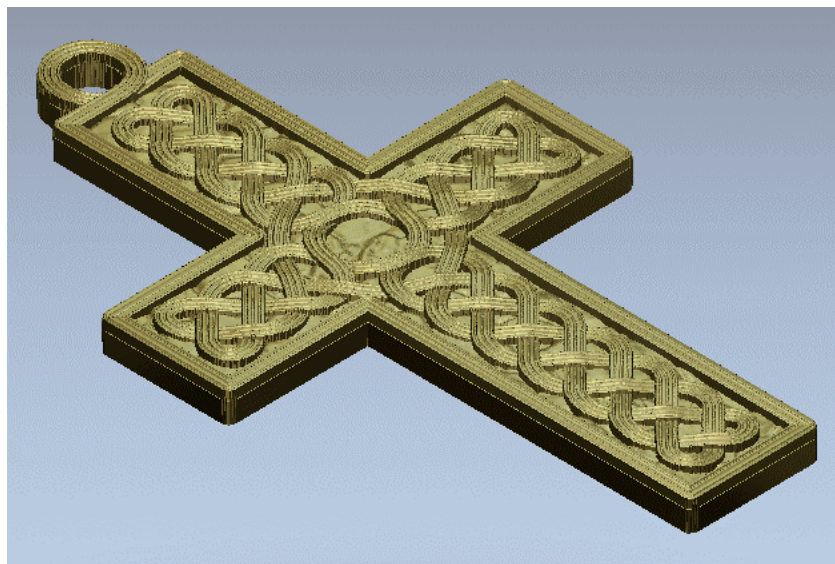
Once the toolpaths have been calculated, a message box appears advising you that a new folder named *Machining* has been created in the JewelSmith Project directory. In this *Machining* folder, ArtCAM model files containing your calculated toolpaths are saved alongside post-processed toolpath files that are ready to be sent directly to your CNC machine.

Click on the **OK** button to close the message box and return to the **Browse Project Folder** page. Listed on the page are all of the new ArtCAM model files that have been created by the **Multi-Sided Machining** Wizard during the toolpath calculation process. If you want to open any of these model files, see "Opening Existing Components" in the JewelSmith Tools Reference chapter.

Celtic Cross Pendant Tutorial

Overview

In this tutorial we will calculate the toolpaths that can be used to manufacture a Celtic Cross pendant on a CNC machine tool that supports indexing. Initially we will create toolpaths containing both roughing and finishing passes. We will save these toolpaths as a single toolpath template. We will then open a previously created JewelSmith Project containing a model of a Celtic Cross pendant. We shall use the Multi-Sided Machining Wizard alongside our toolpath template to calculate the toolpaths required to machine the pendant.



Celtic Cross Pendant

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

- Creating a Toolpath Template.
- Opening the JewelSmith Project.



- Calculating the Toolpaths.
- Understanding the Toolpath Calculation Process.

Creating a Toolpath Template

We shall now create the toolpath template that we will use during the multi-sided machining process. Our toolpath template shall consist of two toolpaths; a roughing and a finishing pass. The toolpaths shall be based on a selected vector. Each of these toolpaths will be created separately, but saved as a single toolpath template.


Preparing the Model

We shall begin by creating an ArtCAM model file in which we shall create a vector that can be used as the basis for our toolpath template.

1. Click on the **Create New Model**  icon in the **Art Files** area of the Assistant's **Getting Started** page to display the **Size For New Model** dialog box.
2. When creating a model solely for the purposes of creating a toolpath template, its dimensions are not important but you must use metric measurements. Therefore, click on the **OK** button to create the ArtCAM model according to the settings currently shown in the dialog box.
3. Click on the **Create Circles**  button in the **Vector Editing** area of the Assistant's Home page to display the **Circle Creation** page.
4. Click and drag anywhere in the model area to draw a circle, and then right-click to create the circle and return to the Assistant's Home page. The size and shape of our vector is not important. We can use any vector whatsoever to create our toolpath template.

Creating the Roughing Toolpath

Next, let us create the roughing toolpath that we shall save as part of our toolpath template.

1. Make sure that the circle you have drawn is selected by clicking on it. It appears as magenta and is surrounded by a bounding box.
2. Click on the **Toolpaths** tab to display the **Toolpaths** Home page.
3. Click on the **Machine Relief**  button in the **3D Toolpaths** area to display the **Machine Relief** page.
4. In the **Area To Machine** area, select the **Selected Vector** option by clicking on its radio button.
5. Make sure that the **Strategy** list box is set to the default **Raster** strategy, and that the **Raster Angle** is set to 0 .


6. Type *0.2* in the **Allowance** box.
7. Make sure that the **Tolerance** is set to *0.01*.
8. Make sure that the **Machine Safe Z** position is set as *12* mm. Of course, this position should reflect the size of the material block you are using and the retraction space available in your CNC machining set-up. For the purposes of this tutorial, we shall assume that we are using a wax block 10 mm thick.
9. Click on the **Select** button in the **Tool** area to display the **Tool Groups Database**.
10. Double-click on the **Ball Nose 1 mm (Roughing)** tool from the **Alcami** group located within the **Wax** tool group. ArtCAM JewelSmith closes the **Tool Groups Database** and displays the selected tool's description in the **Tool** area.
11. Click to select the **Do Multiple Z Passes** option and then type *3* in the **Z Height of First Pass** box.

Do not adjust the **Material** set-up in toolpaths that you intend to use to machine a JewelSmith Project, particularly if you are creating a ring or shank where a specific thickness is defined. Adjusting the **Material** set-up will interfere with the settings needed to successfully machine your item of jewellery.

12. Type *Roughing* in the **Name** box, and then click on the **Later** button. This is because we do not want to calculate the toolpath at this time.
13. Click on the **Close** button to return to the **Toolpaths** Home page. We can see the *[Roughing] Ball Nose 1 mm (Roughing)* toolpath listed at the top of the page.

Creating the Finishing Toolpath


We are now ready to create the finishing toolpath that we need to complete the basis of our toolpath template.

1. Make sure that the circle drawn in the model area remains selected by clicking on it. It appears as magenta and is surrounded by a bounding box.
2. Click on the **Machine Relief**  button in the **3D Toolpaths** area to display the **Machine Relief** page.
3. In the **Area To Machine** area, select the **Selected Vector** option by clicking on its radio button.
4. Click on the **Select** button in the **Tool** area to display the **Tool Groups Database**.
5. Double-click on the **Ball Nose 0.5 mm** tool from the **Alcami** group located within the **Wax** tool group. ArtCAM JewelSmith closes the **Tool Groups Database** and displays the selected tool's description in the **Tool** area. We shall use the remaining default settings on the page for this toolpath.
6. Type *Finishing* in the **Name** box, and then click on the **Later** button. This is because we do not want to calculate the toolpath at this time.

7. Click on the **Close** button to return to the **Toolpaths** Home page. We can see the *[Finishing] Ball Nose 0.5 mm* toolpath listed beneath the previous toolpath we created.


Saving the Toolpath Template

Now that we have created our toolpaths, we are ready to save them as a single toolpath template.

1. Click on the **Save Toolpath as Template**  button in the **Toolpath Operations** area to display the **Save Toolpath Template** dialog box.
2. Click on the **Save in** list box, and then navigate to the location on your computer in which you want to save your toolpath template file.
3. Type *SimpleRoughFinish* in the **File name** box.
4. Click on the **Save** button to save the *[Roughing] Ball Nose 1 mm (Roughing)* and *[Finishing] Ball Nose 0.5 mm* toolpaths as a single toolpath template.
5. Click on the **File > Close** option from the Main menu bar to close the model. A message box appears requesting if you want to save the model.
6. Since we no longer require this ArtCAM model file, click on the **No** button to close the message box and return to the Assistant's **Getting Started** page.


Opening the JewelSmith Project





Our next step is to open the JewelSmith Project containing the Master Model that we want to machine. In this instance, our Master Model is a Celtic Cross pendant.

1. Click on the **Open JewelSmith Project**  icon in the **JewelSmith Projects** area of the Assistant's **Getting Started** page to display the **Load JewelSmith Master Model** dialog box.
2. Click on the **Look in** list box, and then browse to the *JewelSmithProjects\CelticCross* folder on your Tutorials CD.
3. Click to select the *Cross.3DP* project file. Its name appears in the **File name** box.
4. Click on the **Open** button to open the project in ArtCAM JewelSmith. The **Project** page is displayed, on which you can see the Master Model Tree.

Calculating the Toolpaths

Now that we have opened the JewelSmith Project containing the Master Model that we want to manufacture, we are ready to begin calculating the toolpaths required to machine the piece.

1. Click to select the *Cross.3DP* Master Model  in the Master Model Tree. Its name turns bold and its associated tools are shown on the page.

2. Click on the **Multi-Sided Machining**  button in the **Project Tools** area to display the first page of settings in the Multi-Sided Machining Wizard.
3. Click on the **Edit Settings** button to display the **Model Type** page of settings.
4. Make sure that the **Flat** option is selected by clicking on its radio button. This option is selected by default.
5. Click on the **Next**  button to display the **Model Size** page of settings. The **Width** of the model is *21.16* mm and its **Height** is *36.41* mm. We do not need to adjust these dimensions.
6. Make sure that the **Resolution** is set as *30* pix/mm. This is a suitable resolution for machining items of jewellery.
7. Click on the **Next**  button to display the **Templates & Supports** page of settings.
8. In the **Flat Template** area, click on the **Select** button to display the **Select Toolpath Template** dialog box.
9. Click on the **Look in** list box, and then select the location in which you had previously saved your toolpath template file.
10. Click to select the toolpath template file, named *SimpleRoughFinish.tpl*.
11. Click on the **Open** button to import the toolpath template into the Multi-Sided Machining Wizard. Its name is displayed on the page.
12. Click on the post-processor list box, followed by the *Model Master Indexer (*.mmg)* option.
13. Click on the **Accept**  button to calculate the toolpaths.

ArtCAM JewelSmith begins by creating a new folder in the Project directory named *Machining*. In this folder, an ArtCAM model file named *ThreeAxisFlat.art* is subsequently created. This model file contains a copy of both the front and back faces of the Celtic Cross pendant relief. We can see a greyscale image of the front of the Celtic Cross pendant relief in the model area of the 2D View window.

ArtCAM JewelSmith draws a vector boundary around the area of each relief for each of the chosen tools within the toolpath template. In our toolpath template, two separate tools were chosen. The first, a 1 mm Ball Nose tool, was selected for roughing, and the second, a 0.5 mm Ball Nose tool, for finishing. Therefore, in order to calculate the toolpath required to machine the front of the relief, two vector boundaries are drawn. The same method applies to the back relief. Each of these vector boundaries is drawn on their own layer. This means that a total of four new layers are created prior to the toolpath calculation process.

Next, the toolpath settings within the selected toolpath template file are applied to each of the four vector boundaries. The **Machine Relief** page is displayed on the **Toolpaths** tab. This reveals the toolpath strategy defined within our selected toolpath template. We can now see the toolpath settings that shall be used to calculate the toolpaths required to machine the complete Celtic Cross pendant. The reason that the toolpath settings are applied to the vector boundaries is

that the **Selected Vector** option was chosen in our template as the area in which to machine. Four separate toolpaths are calculated in all.



A message box appears confirming that a new folder named *Machining* has been created in the JewelSmith Project directory. In this *Machining* folder, the ArtCAM model file named *ThreeAxisFlat.art*, containing the front and back reliefs of the Celtic Cross pendant alongside their associated calculated toolpaths, is saved.

Two toolpath files are also created in the *Machining* folder, named *ThreeAxisFlatRoughing.mmg* and *ThreeAxisFlatFinishing.mmg* respectively. You may notice that the Model Master Indexer post-processor has been applied to these toolpath files from the suffix used (*.mmg). These files are ready to be sent to the CNC machine in order to cut the complete Celtic Cross pendant.

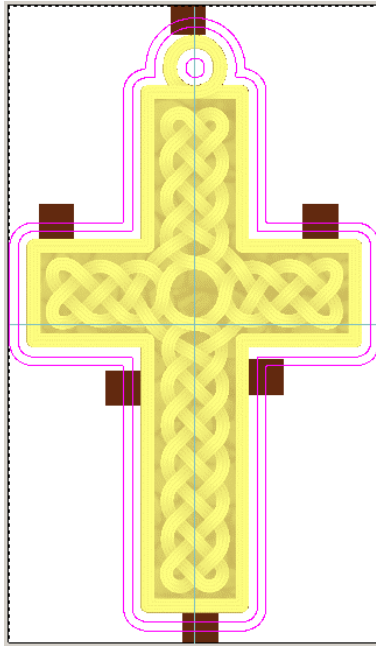
Before sending these post-processed toolpath files to the CNC machine, it is important to understand the process behind their making.




Understanding the Toolpath Calculation Process

Before sending the toolpath files to our CNC machine to manufacture the Celtic Cross pendant, it is important to understand exactly what has been done as a result of the toolpath calculation process. In order to do so, we need to look at the content within the *ThreeAxisFlat.art* file.

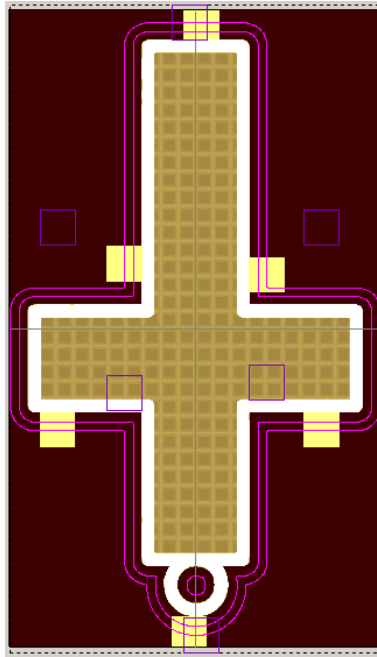
1. Click on the **OK** button to close the message box and display the **Browse Project Folder** page.
2. Click on the *ThreeAxisFlat* icon  in the **Machining** area of the page to open the ArtCAM model file. The **General Tools** page is displayed on the **JewelSmith** tab. The 2D View shows a greyscale image of the front relief and the bridges used to hold it in position during the machining process. We can also see the vector boundaries that were drawn around the front and back reliefs during the toolpath calculation process.
3. Click on the **Layers** tab to display the **Layers** page. Apart from the standard *Default Layer* and *Reference Lines* layers, we can see the four new layers that have been created in the model. Both the front and back reliefs have their own *Roughing* and *Finishing* vector artwork. All of these layers are shown by default.
4. Click on the  icon beside the *RoughingBack - Bottom Boundary* and *FinishingBack - Bottom Boundary* layers to hide them. Only the *Default Layer*, *Reference Lines*, *RoughingFront - Top Boundary* and *FinishingFront - Top Boundary* layers are now visible.




In the 2D View window, we can see the vector boundaries that were drawn around the front relief during the toolpath calculation process. We can also see the position of the bridges that will be used to hold the piece in place during the machining process, as shown below:



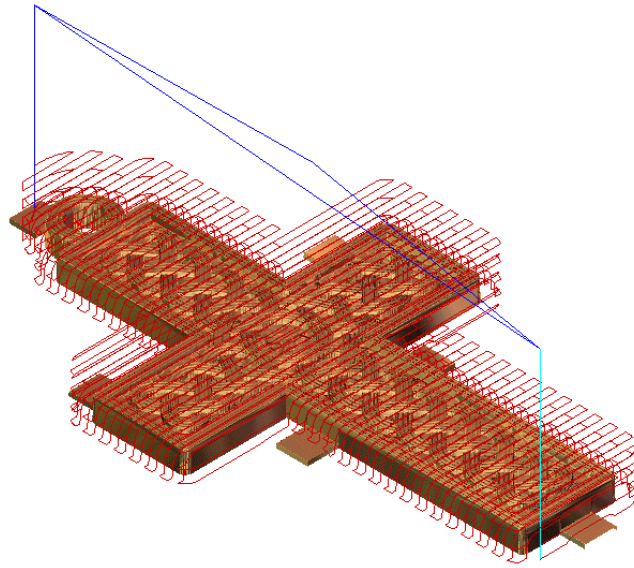
5. Click on the **JewelSmith** tab to display the **General Tools** page.
6. Click on the **Make Back Current**  button in the **Back Relief** area to display the back relief.
7. Click on the **Layers** tab to display the **Layers** page.
8. Click on the  icon beside the *RoughingFront - Top Boundary* and *FinishingFront - Top Boundary* layers to hide them.
9. Click on the  icon beside *RoughingBack - Bottom Boundary* and *FinishingBack - Bottom Boundary* layers to show them.
10. Click and drag to create a selection rectangle around the whole model area and then release the mouse button to select the vector artwork within.

In the 2D View window we can see the vector boundaries that were drawn around the back relief during the toolpath calculation process. The square vectors shown identify the position of the bridges on the front relief, shown as follows:

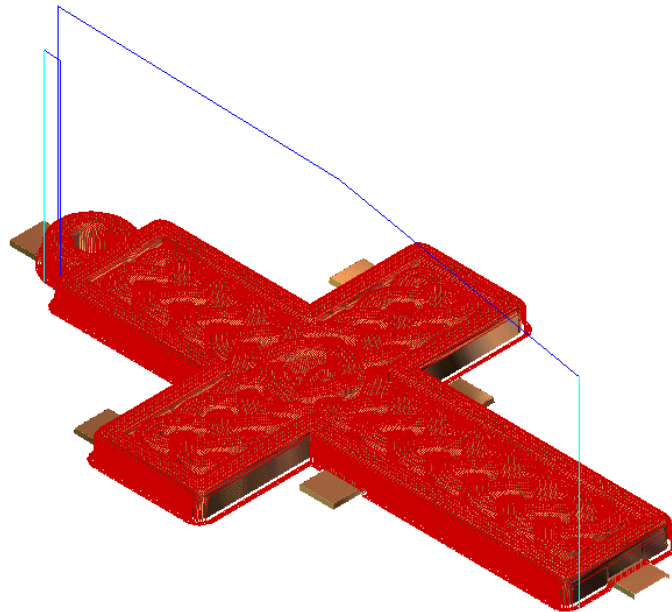


11. Click on the  icon beside the *RoughingBack - Bottom Boundary* and *FinishingBack - Bottom Boundary* layers. All of the vector boundary artwork is now hidden.
12. Click on the **JewelSmith** tab to display the **General Tools** page.
13. Click on the **Make Front Current**  button in the **Back Relief** area to restore the front relief.
14. Click on the **Toolpaths** tab to display the **Toolpaths** Home page. We can see four calculated toolpaths listed at the top of the page. These are: *[Roughing Front] Ball Nose 1 mm (Roughing)*, *[Finishing Front] Ball Nose 0.5 mm*, *{180}[Roughing Back] Ball Nose 1 mm (Roughing)* and *{180}[Finishing Back] Ball Nose 0.5 mm*. The *{180}* prefix applied to the two back toolpath names indicates that a 180 degree rotation of the wax block occurs prior to running each of these two toolpaths.
15. Click on the **3D View**  button in the 2D View toolbar to display the simulated toolpaths in the 3D View window. All four of the calculated toolpaths are shown at once by default. This is somewhat congested. You can use the **Show In 3D** option to control what toolpaths can be seen at any one time.

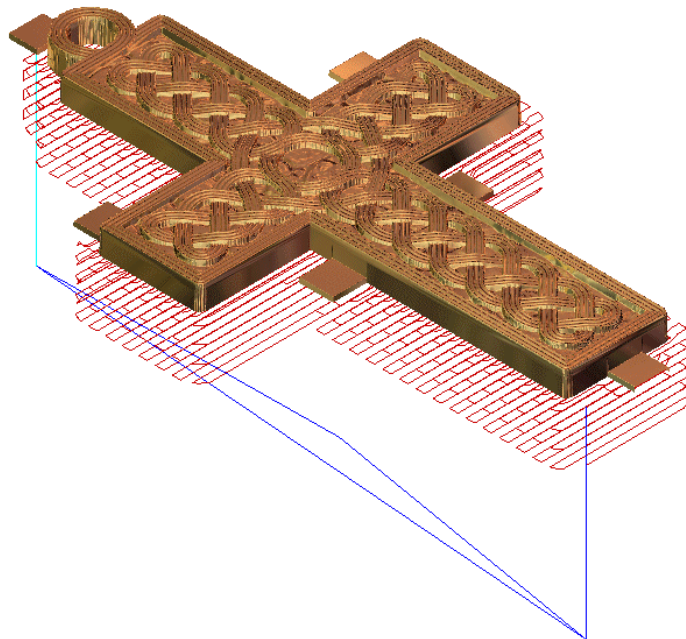
The *[Roughing Front] Ball Nose 1 mm (Roughing)* toolpath is shown below:



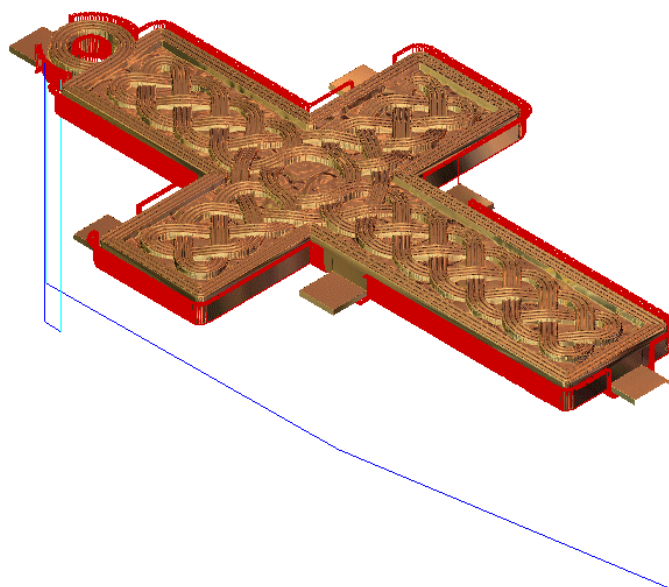
The *[Finishing Front] Ball Nose 0.5 mm* toolpath is shown below:







The *[Roughing Back] Ball Nose 1 mm (Roughing)* toolpath is shown below:






The *[Finishing Back] Ball Nose 0.5 mm* toolpath is shown below:



16. Click on the **Project** tab to display the **Project** page.

You can see that a *Machining* item  is associated with the *ThreeAxisFlat* model Project tree. Beneath this *Machining* item, you can see four associated toolpath items . If you expand each of these items by clicking on the  icon, you can see that each toolpath item also has its own associated tool item .

17. Click on the **JewelSmith** tab to display the **General Tools** page.

18. Click on the **Close Current File**  button in the **General Tools** area to close the *ThreeAxisFlat* ArtCAM model file. The Master Model Tree is displayed on the **Project** tab.
19. Click on the **Save**  button in the **Project Tools** area to save the JewelSmith Project.
20. Click on the **Close Project**  button to close the JewelSmith Project and return to the Assistant's **Getting Started** page.

