

Curved Surface Plugin for CamBam

[Version 2.0.4]

Note: Some terminology in the UI have had some minor changes to clarify the descriptions of the various options.

The three main features added for this version are:

- A capability to save a computed surface model as a file (various formats) for importing back into CamBam for use as a Surface model, or for use in a third party application.
- A new surface type created by extruding arbitrary shapes along a path in the X,Y plane.
- Previously, parameter values in the plugin dialog were automatically saved within a CamBam session only. There are now options for the user to explicitly save these settings (multiple versions if required) to be restored for future use.

Purpose

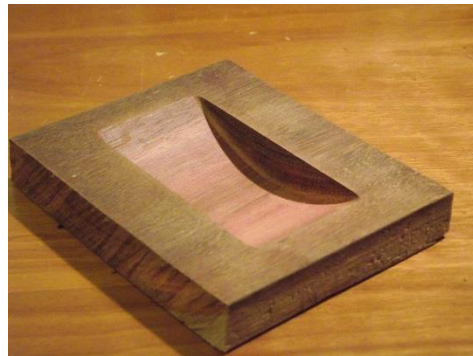
This plugin is intended to assist in the creation of CNC paths for machining of curved and sloped surfaces. Specifically, there are 6 options:

- **Circular Surface** – a half cylindrical surface with the top at $Z=0$.
- **Circular Pocket** – a cylindrical pocket, the full cut is the default but it is possible to select the first or second halves of the cut only.
- **Spherical Surface** – a full or part circle with the top at $Z=0$
- **Spherical Pocket** - a full or part spherical pocket
- **Flat Surface** - a flat sloping surface starting at $Z=0$.
- **Curved Surface** – a surface with arbitrary curvature in the Z-direction, and to extrude this shape along a path in the X,Y plane. (new in v2.0.0)

Note that the naming of these options has changed in V2.0.0.



Circular Surface



Circular Pocket



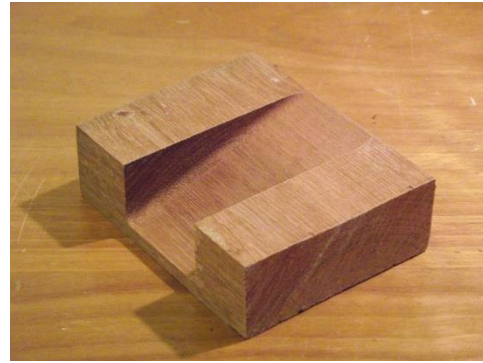
Spherical Surface



Spherical Surface within cleared pocket



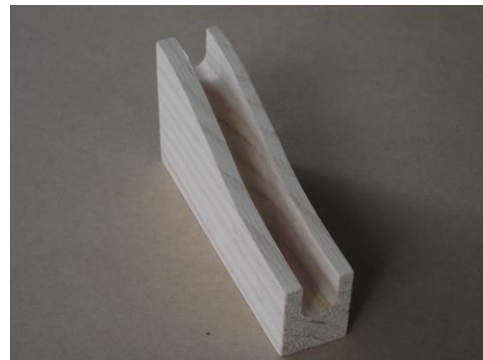
Spherical Pocket



Flat Surface



Curved Surface: ex 1



Curved Surface: ex 2



Curved Surface ex 3



Curved Surface ex 4

The goal is to provide a quality machined finish on the surface by running cuts over/down the surface rather than around/across the surface. Most likely a BALL mill is the appropriate cutting tool, but END and VEE mills might give interesting (or unexpected) surface textures and possibly some “glitches” where the tool shape cannot reasonably follow the required geometry.

The maximum depth of cut is naturally limited to the vertical curve radius, but may be more normally restricted by tool length and machine design. In theory the plugin supports cut shapes up to complete hemi-circles/spheres and up to 45 deg sloping surfaces. Curved surfaces may have short lengths of quite steeply-sides surfaces (but not vertical).

For the Curved Surface option, as shown above, care is required to ensure that the cutter to be used (generally a ball cutter) is sized to suit the curvature of the required surface. If the curvature is high

(like example 1) then a smaller diameter cutter is required to accurately follow the Profile shape. Using a too large cutter will result in cutting artefacts as the cutter fails to follow the required surface. Example 2, above, was cut with a 15 mm diameter ball cutter without problems. In this case the machining was done in two steps: firstly, to cut the top of the stock to produce the required top profile, then secondly a cut (with a width of zero) to cut the channel using the same cutter. Ex 3 shows a case where a vertically oriented profile shape is extruded along a horizontal and curved Path, and Ex 4 a case where the extrusion follows a full circular Path.

Installation

The CurvedSurfacePlugin.dll file needs to be copied into the CamBam Plugins folder, and CamBam restarted. The plugin will then appear in the Plugins menu.

Operation

Normally a surface is created from a geometry seed, i.e.:

Seed Type	Type of Cut	Notes
PointList	Circular Surface Circular Pocket Flat Sloping Pocket	The PointList should contain just two point (the From point and the To point). If it contains more points the first two are selected. The direction of the cut can be changed in the dialog.
Line	Circular Surface Circular Pocket Flat Sloping Pocket	A Line is created by drawing a PolyRectangle, then exploding it. Only one of the edges should be selected. The direction of the cut can be changed in the dialog if required.
Polyline	Circular Surface Circular Pocket Flat Sloping Pocket Curved Surface	The Polyline should have just one line segment. The direction of the cut can be changed in the dialog if required. Multiline Polyline, defining a 3D path, Z = 0 is taken to be the stock top level.
Circle	Spherical Surface Spherical Pocket	The whole circle or some part of it (from angle to angle) can be selected for the cut in the dialog.
Arc	Spherical Surface Spherical Pocket	The whole of the arc is selected for cutting, can be varied in the dialog.
Spline	Curved Surface	Defining a 3D path. Z = 0 is taken to be the stock top level.

If a geometry seed is not selected, then the user can define a geometry base in the user interface dialog, using numerical values for coordinates. The advantage of using a geometry seed it that it is






easy to see where the surface is to be cut relative to the specified geometry. The cut geometry will often include adjustments for tool size and type, and edge clearances, so it may not align to the geometry seed. If a geometry seed is not specified the Curved Surface option is not available. To use the Curved Surface option the geometry seed must be pre-defined and selected.

After creating and selecting the required geometric seed (optional), the <Plugins|Curved Surface Generator> menu option launches the user interface dialog:

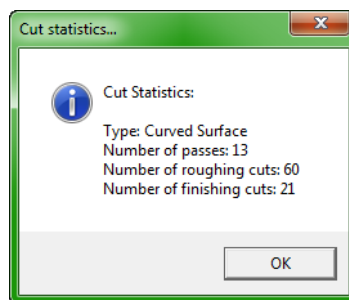
The fields are:

- **Surface Type** radio buttons: used to select the type of surface required. Only those options valid for the selected geometry seed will be available. If no geometry seed is chosen then all options are available, except for Curved Surface. When an option is chosen, those input fields not relevant for this surface type are disabled.
- **Cut Section** radio buttons: used only for **Spherical Pocket** type surfaces to describe whether a full, first half or second half cut of the pocket is made.
 - A full cut starts at Z=0, goes to the target depth then finishes at Z=0.
 - A first half cut starts at Z=0, and ends at the target depth.
 - A second half cuts starts at the target depth and ends at Z=0.

For partial cuts it is assumed that the cut starts, or ends, at the edge of the stock; or where clearance cut has already been made to allow the tool to travel beyond the surface to be cut. Care is therefore required to ensure plunging is safe.

- **Layer Name:** this is used to name the new layer that will be added to the CamBam model to contain the generated geometry. The default name will change with the surface type selection, this can then be edited to suit. In CamBam layer names must be unique and you will be prompted to change the name if required.
- For a Line, PointList, Arc, Spline or Polyline geometry seed; the From Point and To Point fields are filled in from the defined geometry, if selected. The Z values fields are only used for the Curved Surface option. Otherwise, some default values are inserted. These values can be edited as required. The  button will swap the From Point and To Point coordinates, i.e. reverses the direction of the seed line/shape.
- **The Width field** defines the width of the surface; use 0 for a single path. The width is taken to be to the right-hand side of the polyline when looking along the Polyline from beginning to end..
- For a Circle or Arc geometry seed the **Centre Point** and **Radius** fields are filled in from the geometry. For a circle the default **From Angle** and **To Angles** are 0 and 360 degrees (0 degrees is along the X-axis). These can be changed to suit. For an Arc these fields are filled in from the Arc geometry.
- The **Surface Curve Radius** field shows the radius of the circular surface (where appropriate). This can be computed from either the **To Point** fields (for circular surfaces or circular pockets) or from the **Radius** field (for spherical surfaces or spherical pockets) using the  or  buttons as follows:
 - If valid values are present in the **To Point** fields, or **Radius** field (depending on the chosen surface type), then the actual surface curve radius is computed and placed in the **Surface Curve Radius** field by clicking the  button.
 - If a valid value is inserted into the **Surface Curve Radius** field, then values for **To Point**, or **Radius** (depending on the chosen surface type) fields are re-computed when the  button is clicked.
 - Note that to compute a valid value for the **To Fields**, the current line must define a valid direction when taken together with the **From Field** values. (i.e. both fields cannot be zero, or have identical values).
- **The Tool Type** combo has three tool type options: BALL, END and VEE. This selection is used to correct paths for tool shape. A VEE tool provides no correction. END and VEE mills are not really suitable to provide smooth surfaces, but may provide “interesting” surface textures. The VEE option might be used to create surface models (from Vers2).
- **Tool Diameter** sets the tool diameter.
- **Accuracy** field has two different meanings, depending on the type of surface. For circular surfaces it defines the length of the longest straight-line segment used to approximate the surface. A value of 1 mm would normally provide a rather accurate surface. For the Curved Surface option, the Accuracy is taken as the smallest length of a Polyline segment. In this case a typical value would be in the order of 0.5 mm (or 0.02”), though some experimentation might be required, especially if the Profile shape has sharp vertices. Care is required to ensure the appropriate value is set if switching between surface types. (new in Version 2.0.1).
- **Stepover** is the required cut stepover. This determines the smoothness of the surface.
- **Final Stepover** is the stepover to be used on the last one (or two) cuts.

- **Targetdepth** is the max depth of cut (below Z=0). For the Curved Surface option, the value is taken as the depth of cut above the lowest point on the defining surface shape (Spline or Polyline).
- **Depth Increment** is the cut depth. The depth increment is taken as the depth of cut measured radially from the centre of the cut length for curved and spherical pockets
- **Inside Edge** checkbox is used to limit the cut to be inside the shape. Otherwise the edge is taken as the centre line of the first and last cut. This is not perfect for spherical shapes. The first/last cut is a radial line that finishes inside the designated edge (by the radius of the cutting tool) at the perimeter of the cut.
- **Final Cut Only** checkbox, generates only the final cut. This can be used in conjunction with a separate rough cut; or by using some other, and more efficient, cut profile to remove the bulk material.
- **Round Trip Cut** checkbox, generates cut paths that cut in alternate directions (rather than like a raster) to reduce “air” time. In the MOP the Maximum Crossover Distance may need to be set to remove tool withdrawals for the resulting horizontal transitions.
- **Add MOP** checkbox automatically adds an Engrave type MOP with some key parameters set to suit the task. It will still be necessary to check and review the MOP settings to ensure that they are all relevant for the machining task. The MOP is added to the currently active machining part.
- **Create G-Code** checkbox creates the G-code file and prompts for a file name (only used if Add MOP is checked). Probably only useful if the default settings for the MOP are appropriate.
- Once the parameters are set, the **Run** button is used to generate the required geometry. This geometry will be placed in a new layer (as named). In some cases (especially for high accuracy spherical surfaces) it may take some time to complete this task and the progress will be shown in the progress bar.
- **Show Cut Statistics** checkbox: reports a brief summary of the generated cuts paths, if checked:



A “cut” corresponds to a polyline and a “pass” corresponds to each cut depth. Close this dialog with the <OK> button. If the Final Stepover is the same as the Stepover, all cuts are counted as finishing.

- **Save Settings** button: Can be used by the user to save the current settings to a Config file. By default, the file is placed in the user’s current working directory, but its location and name can be changed in the FileDialog to suit to user’s preferences. The filename extension must be “.config”.
- **Load Settings** button: Can be used by the user to restore the saved settings (as above). A File Dialog is provided to select the required Config file.

- The **Path Shape [ID]** is the name of the shape chosen for the extrusion Path (if applicable) and its ID number
- The **File to Save Model** field contains the name of the text file for saving an XYZ, RAW or STL file containing the computed surface model of the final cut.
- The **Save Model** button saves this file after the surface has been computed. It is only useful to save a model if the **Final Cut Only** is enabled, and **Round Trip** disabled.
- Once complete, the main dialog can be closed, and the new geometry will be found in the new layer, and if requested a new MOP under Machining.
- The **Close** button will close the dialog.

Saving Surface Models (new in vers 2.0.0)

Surfaces created by the plugin can be saved as:

- **Point Cloud** files for processing elsewhere, perhaps for converting into other surface models with the help of a third party applications like MeshLab (<http://www.meshlab.net/>) or CloudCompare (<https://www.danielgm.net/cc/>), both are Open Source Projects.
- **RAW** files that can be directly imported back into CamBam.
- **STL** files that can also be directly imported into CamBam, or into other modelling packages for further editing.

The type of file generated depends on the nominated extension in the specified file name:

- Point Cloud: “.txt”, “.dat” or “.xyz”
- RAW: “.raw”
- STL: “.stl”

To create a surface model files the following setting are suggested (perhaps required):

- The **Final Cut** option must be chosen so that only the finished surface profile is created for export (otherwise multiple surfaces will be generated).
- The **Round Trip** option must be disabled so that the generated surface Polylines are correctly ordered to facilitate the construction the triangular surface patches.
- A **VEE** cutter should be selected so that the final cutting path follows the computed surface with no adjustments for cutter shape and size.
- The **Stepover** distance should be small enough to accurately represent the surface.

The Surface model must be generated before saving the file.

Point Cloud models can only be saved if the **Final Cut Only** option is selected. RAW and STL models must be generated with **Round Trip** not selected and **Final Cut Only** selected.

If a Surface Model is correctly generated with the **Round Trip** option **disabled** and with the **Final Cut Only** option **enabled**, then the Layer created for the new model is Tagged with “CSnrt:d”. This Tag string indicates that this Layer could be re-used to create a saved surface model file without having to re-compute it. The “d” part of the Tag is the number of part Polylines in each engrave path. These part Polylines are generated if the cutting path would otherwise go above the stock surface (at Z=0) – see Notes for Curved Surfaces (below). This information is required to re-construct the surface if the Plugin has been closed without immediately saving the surface. In such a case, if the Layer containing the required model is currently **Active**, and it is tagged with “CSnrt:d”, when the plugin is launched, then it is possible to save this model to a file without having to recompute it.

Notes for Curved Surfaces (New in v 2.0)

Curved Surface options have been added in V2.0.0. These are a little more complex to set up compared to the other options, though they share many of the configuration properties and offer some new capabilities. A Curved Surface is typically a surface with varying Z values that can be created by extruding a vertically orientated shape (either an Arc, Polyline or a Spline) horizontally. Or, it can be used to engrave a path following the 3D shape with a possibly varying Z depth.

The required surface can be created in two ways:

- A profile shape, with varying Z-values that is extruded horizontally, either normal to the Z-plane of the shape (if it is planar), or normal to a line joining the beginning and ends of the shape, or to some other user defined direction.
- A profile shape that is extruded along the Path defined by a Polyline, Arc or Circle, in the X,Y plane. The Path shape must have its Tag parameter value set to "Path".

To create a suitable shape it is often useful to create the required shape by drawing in the X,Y plane, then rotating it about one or more axes and possibly followed by translation options in X, Y or Z. A typical setup might be like this:

1. Draw the shape in the X,Y plane so that the X axis (at Y=0) represents what will be the stock surface for the required surface.
2. Remove Arcs in shape with required accuracy.
3. Rotate the shape about the X-axis by an angle of 90 deg, so that it is now vertical.
4. Rotate the shape about the Z axis to the required angle in the X,Y plane (as required).
5. Move the shape to the required position in the X,Y plane (as required).
6. Apply transforms.

There are many ways to define the required Profile shape. The Profile shape can be a Polyline or Spline. Other shapes will need to be converted to Polylines. Generally, constructed shapes would be expected to be Polylines, or will be converted to Polylines in the plugin. The defined shape does not have to be planar

When building shapes to be used for the Curved Surface option care is needed with regard to Transformations. It would appear that the CamBam model may not always be cooperative. It is suggested, therefore that after manipulating a shape into position, then Apply Transformations (Edit->Transforms->Apply Transformations) to ensure that the required shape is correctly orientated, before launching the Plugin. Also, some shapes (e.g. Circles, Arcs and Polylines with bulge segments) may not transform correctly out of the X,Y plane. It seems to be useful to convert such shapes to Polylines and to also remove arcs from these Polylines before imposing transformations.

With a profile shape defined, two types of surfaces can be generated:

- An Engraved path, following the profile shape (in X,Y) and down to the varying Z-depth value. The final form of the cut path will then depend on the cutter used (diameter and shape). This is achieved by setting the cut width to zero.
- A Surface by extruding the profile shape horizontally (in the X,Y plane) in a nominated direction. This direction can be:
 - Normal to the vertical plane of the profile shape. By default this is normal to a line joining the first and last points of the profile, or you can change the **From** and **To** point values (for X and Y) to define another direction. The width of the surface is taken as the **Width** field.

- To follow a predefined Path. This Path is defined by one of the following:
 - A Polyline
 - A Circle
 - An Arc

drawn in the X,Y plane at Z=0.

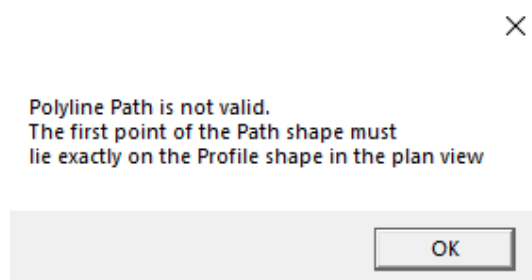
The extrusion is formed by moving the profile shape along the Path. The orientation of the Profile shape along the Path thus changes with the direction of the Path.

For Circle and Arc shaped Paths, the profile is extruded around the Circle/Arc using the nominated centre point of the Path. For Polyline shaped Paths, the Profile shape is set normal to the Path then it is extruded. As a consequence of these differences the results may not always be obvious. Some trial and error is encouraged.

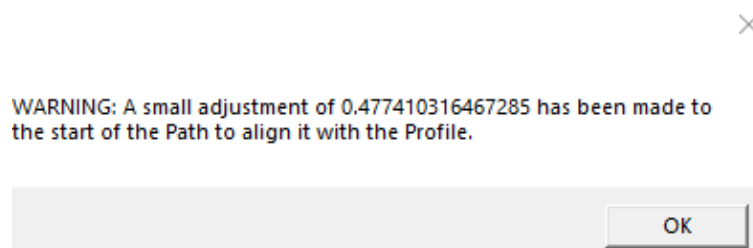
The Path shape is designated by adding a “Path” tag to its properties. Both the Profile shape and the Path shape must be selected before launching the plugin. The width of the surface is defined by the length of the Path.

If the Path shape is a Polyline then the following conditions must apply:

- The profile shape must be planar in the Z-direction, i.e. in the plan view it must appear as a straight line.
- The Path polyline must start at a point that lies (exactly) in the plane of the profile shape. If this condition is not met, then an error message is provided:



If this happens it is necessary to move the starting point of the Path to lie on the Profile (in the plan view), and/or possibly reverse the Path Polyline. If the Path Polyline is close enough (within approx. 0.5 mm) to the Profile shape then the plugin will attempt to adjust it (i.e. move it) to be correctly aligned and provides a warning message like this:



- It is typically not meaningful to extrude a non-planer shape.

Some care is required to define this Path shape as the results may not always be as desired, especially if:

- The curvature of the Path is too small to allow the Profile to be correctly extruded, or if there are sharp corners in the Path. Some artefacts may occur on the inside of the tightly curved sections.
- The location of the Path relative to the Profile will affect the result. A good rule is to place the starting point approximately in the middle of the Profile. The stepover distance is applied along the Path, so there may be excessive stepovers on the outer (convex) edges of a curved extrusion.

The required shape(s) must be first selected before launching the plugin. If there are two shapes then one of them should be tagged as “Path” to define the extrusion Path. The various (relevant) parameters can then be set.

The “Target Depth” parameter has a slightly different interpretation for this surface option. It is taken as the depth of cut measured above the lowest point in the specified profile shape. Cutting paths will be generated from the finished surface upwards at the required “Depth Increment” steps until the “Target Depth” is reached. The default value for the Target Depth is taken as the minimum Z value along the shape.

If a computed cutting path goes above the stock surface (at $Z=0$) then it will be clipped. This means that each cutting path may be broken into a number of parts with rapid movements from the end of one part to the beginning of the next.

It is possible that the top-most cutting path may not reach stock surface (at $Z=0$) if the maximum depth of the surface plus the Target Depth is less than $Z=0$. If this occurs, it is assumed that the stock above this level has been pre-machined to lower it to this level using a preparatory (perhaps a roughing) cut sequence. This is intended to be a feature, so that it is possible to use a prior cut to lower the stock surface.

Cut Accuracy

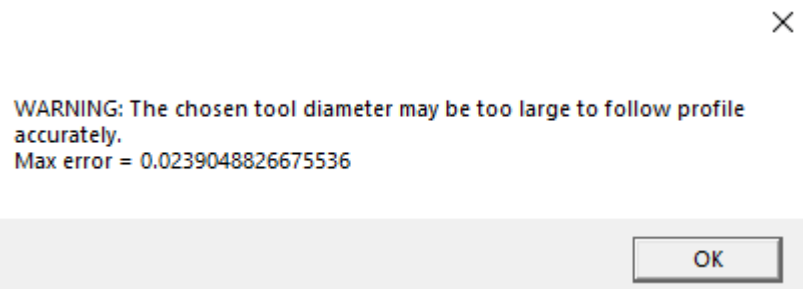
The surfaces constructed by the plugin can only approximate a true curve, they are approximated by a series of straight-line segments. Naturally the shorter these segments are the closer the surface comes to a true curve. There is, therefore, a trade-off to be made between the desired accuracy and the amount of computation required, and also the size of the resulting G-Code file. The best balance will naturally depend on your application.

For any given situation close inspection of the constructed cut geometry will identify these (generally) small errors. For machining tasks that require accuracy better than 0.01 mm (0.004 in) it is advisable to inspect the cut geometry carefully to assess if a more accuracy cut is required by reducing the accuracy value.

For the Curved Surface option, the accuracy is specified by the accuracy of the defined Polyline shape, or how CamBam interpolates values along a Spline (if used). Sometimes the number of computed vertices can be large resulting in some very short line segments. For this option the Cut Accuracy is taken to be the minimum length of these line segments, and any shorter line segments will be filtered out. The cut accuracy may need to be adjusted smaller if the Profile shape has sharp vertices so that the vertex is reasonably represented in the computed cutting paths.

Also, for the Curved Surface option, care is needed to ensure that the cutter diameter is matched to the curvature of the specified surface when it is concave. A check is made, for BALL type cutters only, to measure the possible error involved. If it is estimated that the cutter will deviate more than

the Accuracy/100.0 from the actual surface when trying to cut into a concave profile a warning message is provided. If a possible error is detected then the following dialog is displayed.



The computed cuts are still produced, but should be checked for errors or cutting artefacts (the error value is approximate only).

When using the Curved Surface option to cut a single engraved path (i.e. width = 0.0) with a BALL cutter, and there are tight curves in the X,Y plane relative to the diameter of the cutter, the cutting path can deviate from the set path. In such a case set the cutter diameter to a small value (or choose a VEE cutter) to generate the cutting path, then replace the cutter diameter/type in the MOP as required.

Feedback

Please send any feedback or bug reports to geoff@cadplan.com.au, or post a response on the CamBam Forum.

Curved Surface Plugin Versions

Version	Date	Notes
1.00	3/7/2014	First release (BETA)
1.01	4/7/2014	<ol style="list-style-type: none">1. Error for END mill in pockets corrected2. UI Dialog not closed when a geometry error is detected.3. Units for various UI parameters are converted if the CamBam units are changed.
1.02	4/7/2014	<ol style="list-style-type: none">1. Debug message removed2. To create a curved surface the geometry seed is now correctly the full length of the pocket.
1.0.0.3	7/7/2014	<ol style="list-style-type: none">1. Numerous minor bug fixes.2. Error on tool correction for spherical surface fixed.3. For pockets, a vertical lead-in and lead-out has been added where the cut starts or finishes below the material surface (Z=0).

		<ol style="list-style-type: none"> Errors for END mill in curved pocket fixed – not entirely but the paths now look reasonable given that an END mill is not really appropriate for this task. For pockets the calculated depth of cut has been corrected to give reasonable values for deep cuts, previous estimate did not work well for deep cuts. For curved and spherical surfaces extraneous paths were being generated, now resolved.
1.0.0.4	9/7/2014	An experimental version to remove overcutting when using larger tools in small pockets – for comment.
1.0.0.5	12/7/2014	<ol style="list-style-type: none"> The overcutting issues has been resolved, I think. Some cutting limits increase to allow for more accurate cuts.
1.0.0.6	14/7/2014	<ol style="list-style-type: none"> The selection of a geometry seed is now optional. Multilingual support added (first attempt).
1.0.0.7	16/7/2014	<ol style="list-style-type: none"> The UI is now modal, as it should have been. Minor adjustments to field widths in UI.
1.0.0.8	19/7/2014	<ol style="list-style-type: none"> Some missing labels made translatable. The dialog form now displays at the most recent set position on the screen. Round trip cut paths introduced as an option. If chosen the cut paths “zig-zag” back and forwards rather than in one direction like a raster.
1.0.0.9	20/7/2014	The name of the created MOP is checked for duplication in the currently active machining part, if a duplicate is found a numeric sequence number is added to the name.
1.0.0.10	21/7/2014	<ol style="list-style-type: none"> The tool profile is now exported to the MOP A facility has been added to compute the actual surface curve radius from the defined cut geometry; or to modify the geometry to match a specified surface curve radius.
1.0.0.11	25/7/2014	<ol style="list-style-type: none"> The Unicode characters on the buttons to calculate surface radius have been replaced by bitmap images. These should be more robust across operating systems. When a particular surface type is selected only the relevant fields are enabled for input. An error on surface radius calculation for invalid depths has been corrected. It is now possible to cut half curved pockets by selecting the first half (a cut from the surface to the target depth) or the second half (a cut from the target depth to the surface) of the pocket. Lines and PointLists can now be used as geometry seed. A line is generated when a rectangle shape is exploded

		<p>into 4 lines. One of these can be selected as a seed. The first two points in a PointList can also be used.</p> <p>6. The direction of this line, and one defined from a Polyline, can now be reversed in the UI (i.e. the From and To points are swapped).</p>
1.0.0.12	27/7/2014	<ol style="list-style-type: none"> 1. Extra space for Surface radius label provided. 2. Bug in "Line" types fixed (only worked for English) 3. Bug in selection of Surface Type fixed when previous type is not valid for current seed.
1.0.1.0	1/8/2014	<ol style="list-style-type: none"> 1. First general release, minor changes in text messages.
1.0.2.0	10/7/2019	<ol style="list-style-type: none"> 1. Bug in treatment of Arcs resolved, caused by arc being defined in negative direction. The direction is reversed if detected. 2. Improvement to Layer naming if duplicate layer names are detected. An index number of added to layer name.
2.0.0	20/4/2020	<p>A major update:</p> <ol style="list-style-type: none"> 1. Curved Surface options renamed to Circular Surfaces 2. Options added to create a curved surfaces from Polylines and Splines with the option to extrude along a Path. 3. Saving computed surfaces as Point Clouds, RAW or STL files now possible.
2.0.1	8/5/2020	<p>Some bug corrections:</p> <ol style="list-style-type: none"> 1. The default accuracy was not set correctly for Imperial units – fixed. 2. A bug was found when the Profile shape laid exactly on the Z=0 plane for a part of its length – fixed 3. Updates to translate text items in UI. 4. Various other bugs fixes. <p>New features:</p> <ol style="list-style-type: none"> 5. Parameter settings can now be saved across CamBam sessions.
2.0.2	14/5/2020	<p>Some bug fixes:</p> <ol style="list-style-type: none"> 1. Error on loading settings immediately after save, fixed. 2. Some parameters were not saved – fixed. 3. Some other bugs when initializing some geometric properties (centre points and radius) fixed.
2.0.3	23/5/2020	<p>Some bug fixes:</p> <ol style="list-style-type: none"> 1. Correction to add Translation to some buttons in UI.
2.04	21/7/2020	<p>Some minor bug fixes</p>

		<ul style="list-style-type: none"> • Corrected loss of Depth of Cut for flat surfaces when reloading plugin. • Provide warning messages if a Circle or Arc is chosen as a Profile shape (probably not valid) • Fixed translation issue. • Corrections to this doc.
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