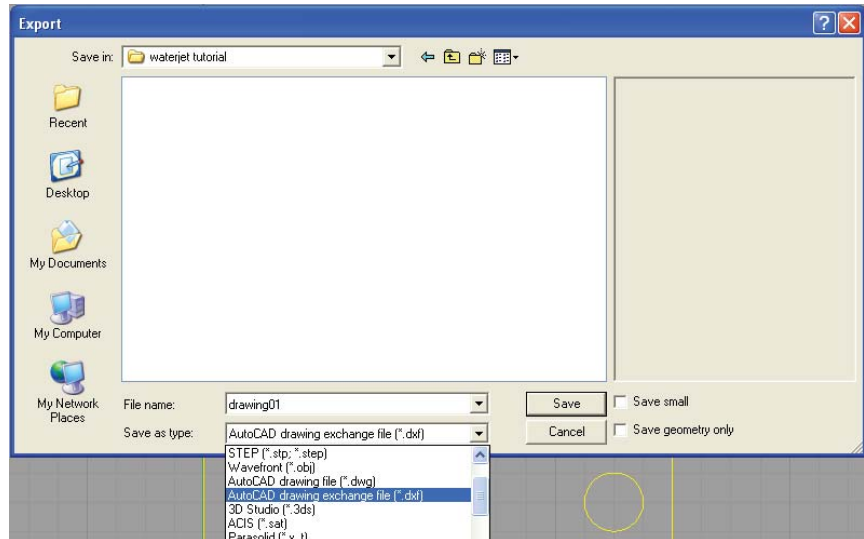
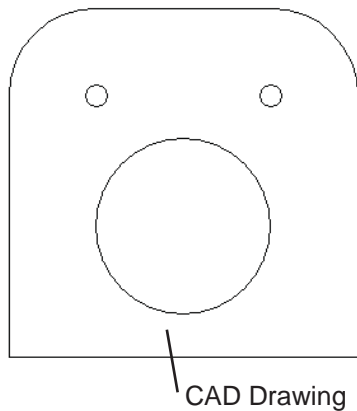


# Using the Waterjet

Digital Media Tutorial  
Written By: John Eberhart

The waterjet shoots water out of a nozzle at 3 times the speed of sound. This combined with abrasive (garnet) allows the waterjet to cut almost any material, and without heat distortion. The process for loading a CAD file setting up the tool path and cutting a part is covered in this tutorial.

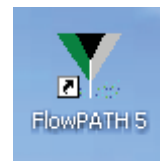
## Step One: Export your CAD drawing as a Release 12 DXF file



AutoCAD: Explode your file before exporting it as a Release 12 .dxf file.

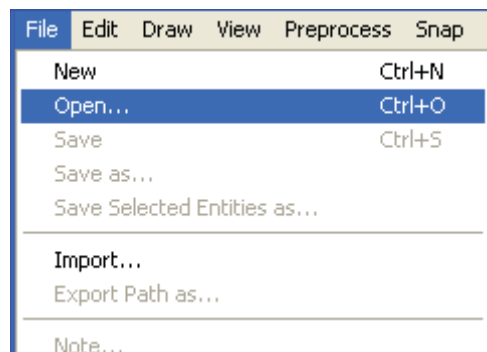
VectorWorks: Decompose your file before exporting it as a Release 12 .dxf file.

## Step Two: Import your DXF file in FlowPATH



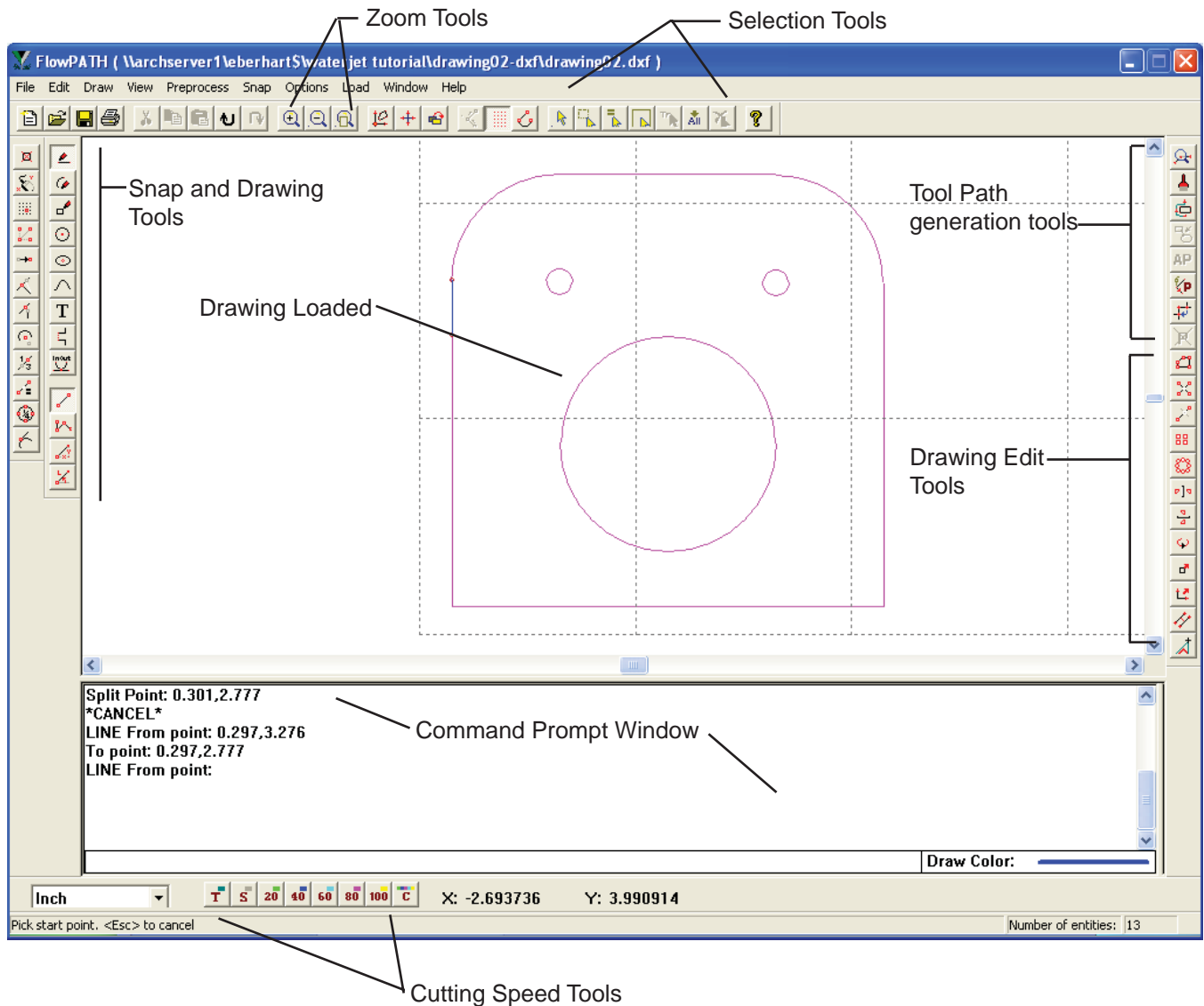
Double click on the Icon on the screen.

In FlowPATH, select File>Import. Select your DXF CAD file, and click OK.



The FlowPATH interface.

The grid represents the cutting area of the water jet (20" x 40"). Each segment of the grid represents 2". Use the grid to ensure your file is scaled correctly.



**Note:** Your file may be located very far from the grid in FlowPATH, and may be too difficult to move to the origin. If this is the case, open your .dxf file in Rhino. Move your file to the origin in Rhino, then export it as a Release 12 .dxf file. Re-import it into FlowPATH, it should be correctly located on the grid.

### Step Three: Scale your file if needed.

Each grid point represents 2 inches on the cutting area. If your file is not set to the correct scale, select the entire file by clicking on the Select All tool. This highlights your file in red.



Select Edit - Scale Model. Enter a factor to scale your file.

## Step Four: Move your file to the origin of the cutting area.

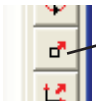
Your file should be placed close to (but not exactly on) the origin of the cutting area (bottom left). It should be in the positive axis of both X and Y.

To move a part around on the cutting area, select all of the cad drawing by clicking on the "Select All" button.

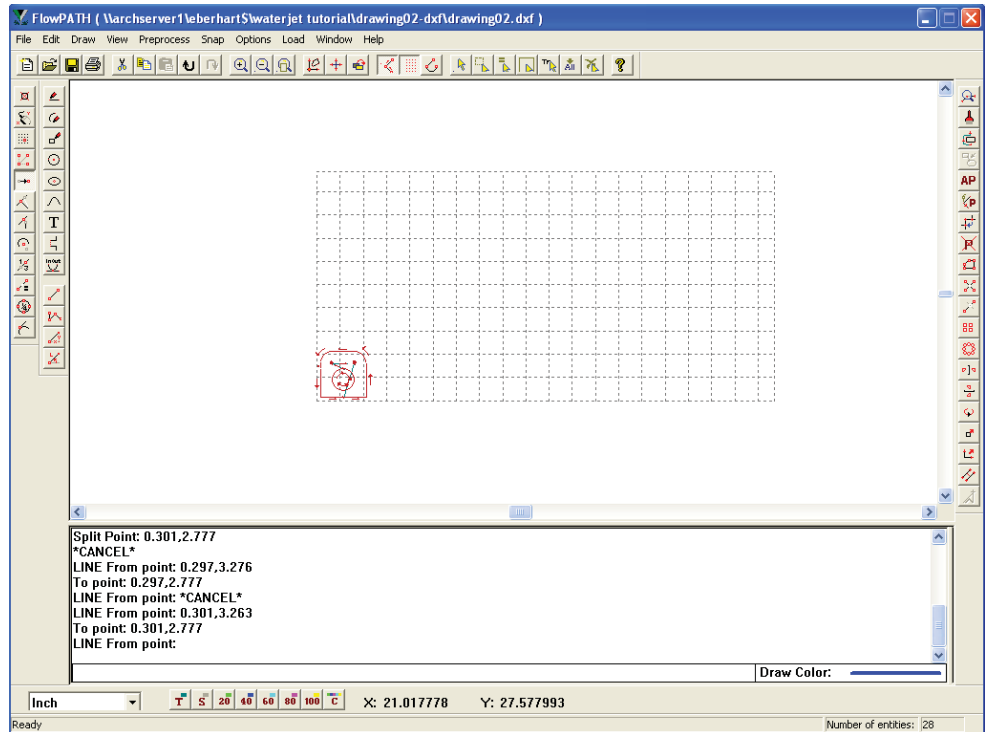


Select All Button

Then click the "Move" tool. Click on the drawing and move it to a new location.



Move Tool



## Step Five: Adjust the cutting speed. *This must be done at this point, do not do it later.*

The water jet cuts at a speed set according to the material and the material thickness selected. This is done in FlowCUT software, which is done at a later point in the tutorial.

The speed associated with the material and thickness is the speed required to separate the material. It will leave a very rough cut, and drag the stream behind. You need to slow the speed settings.

*\*It is recommended to cut at 40% or 60% for best results.*

Select the entire file by selecting the Select All icon.



Select a speed setting.



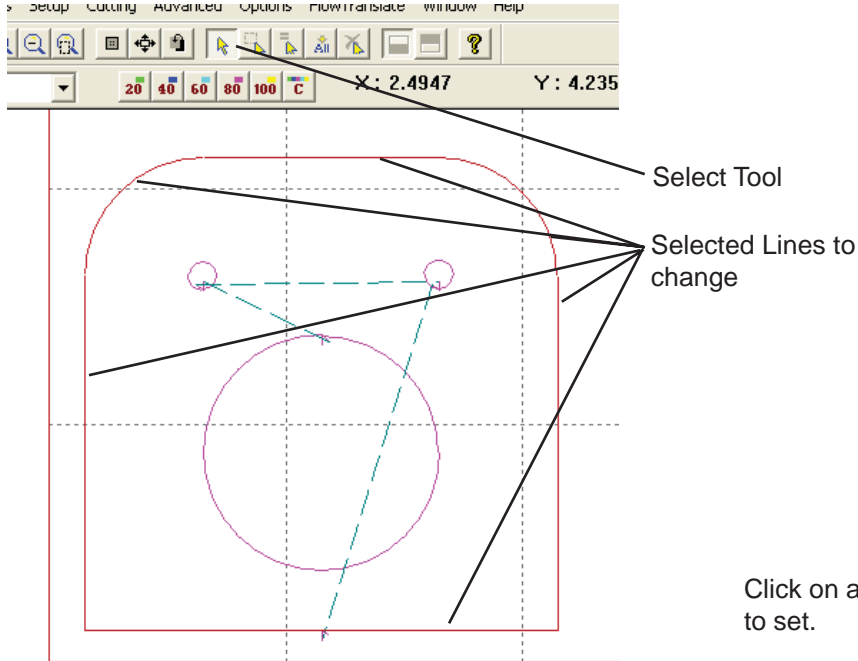
The file should turn to the color of the speed selected.

- This will remedy any dashed lines you may have in your file that import in as traverse lines.
- All lines in your file must be set to one of the colors associated with the speed settings: (green, blue, teal, pink, or yellow). **Any other colors will not cut on the water jet.**

## Step Six: Adjust Cutting Speeds for individual lines in your part

You can adjust the cutting speed of individual lines in your part, so that certain lines are cut at different speeds. *It is not necessary to have different speeds in your file, you can leave all lines at the same speed.*

To change a cutting speed, click on the select tool, and select the lines to change.



After you have selected your lines, then click on a speed button. By default, Flow CUT gives you 5 Speed settings. Each has a color associated with it. 20 is 20% of full speed, 100 is 100% full speed etc. Click on a speed and the selected lines will change color.



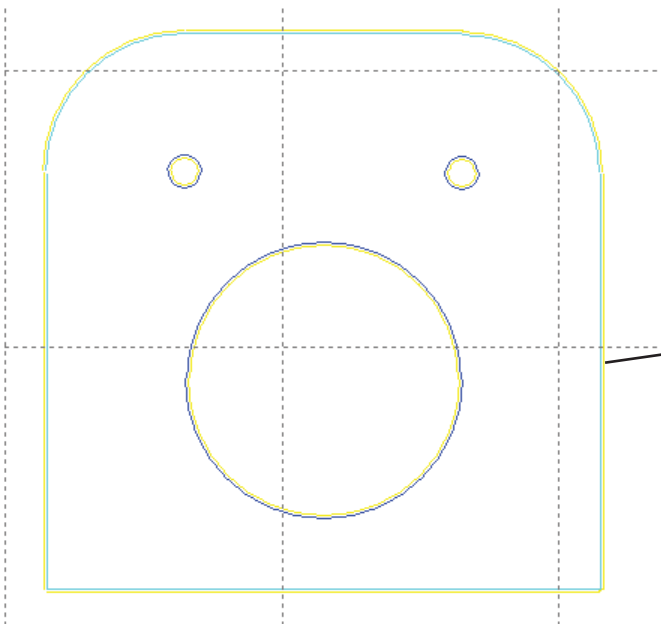
## Step Seven: Examine file for intersecting lines and correct geometries

You need to verify that the drawing is OK, that all lines intersect and that the geometry is correct so that a tool path can be created around the file.

To do this click the select all button. This will select the whole cad file.

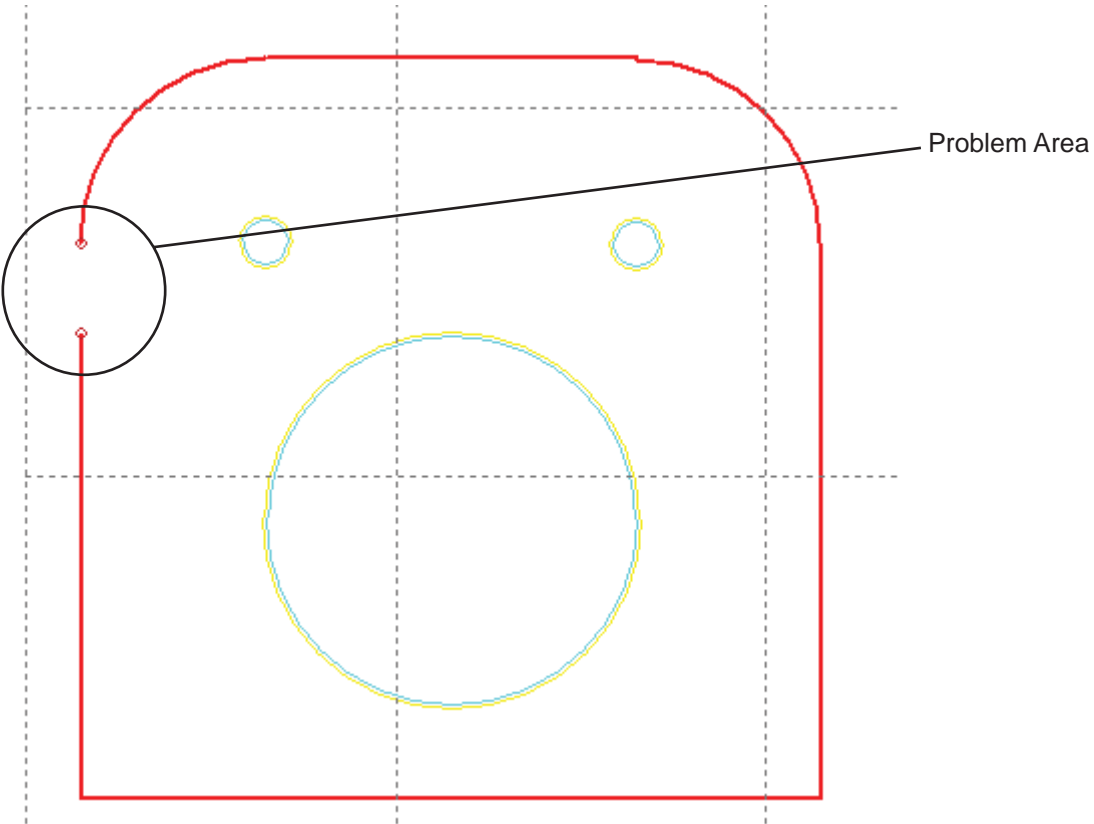


Then click on the "Examine Drawing" button. This will check the geometry.



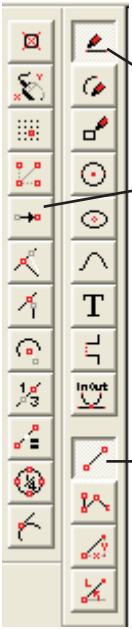
If everything is drawn correctly, you will get a window that looks like the one below. The colored lines indicate the pathway and speed of the cut around the part. Verify that the cut will happen on the correct side of the line.

If you have a gap in a line or incorrect geometry, FlowPATH will highlight the trouble areas in red. In the drawing below, I have a gap in a line, and FlowPATH will have trouble deciding which side of the line to cut on.



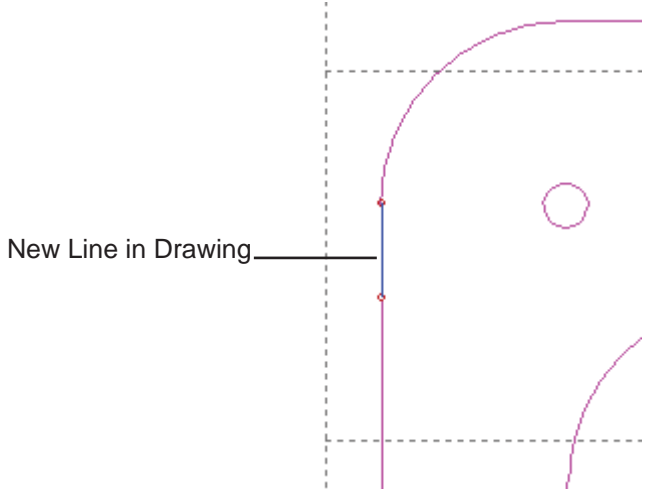
To fix this problem, you can either correct the problem in the original cad program, or you can draw a line in flow path.

**Note: If your lines are purposely open and not closed, the water jet will still cut your file, but it will not know on which side of the line to cut. If this is the case, you can move on to the next step.**



Line Drawing Functions  
End Point Snap  
Draw Line Tool

To draw a line, click on the line tool, and set your snap to endpoint. Then click and draw a line to close the gap in the drawing.



**Step Eight:** Click on the "Examine Drawing" button to deselect.

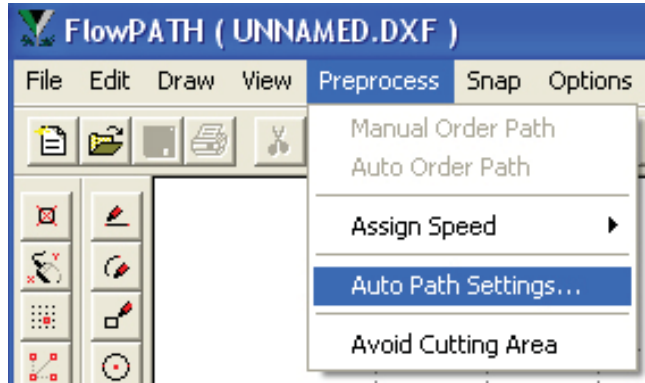


## Step Nine: Autopath your drawing.

FlowPATH can automatically set up a tool path to cut your part.

Verify the Auto Path settings are correct.

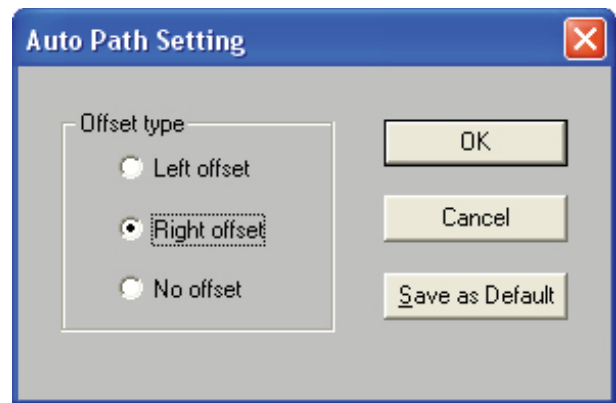
Select Auto Path Settings from the Preprocess menu.



**Right offset** should be selected. This ensures that a correct path will be created to cut inside the negative areas, and outside the positive areas.

*Note: You can change the path settings if you wish to achieve different results:*

*Left offset will cut outside the negative and inside the positive (reverse of the default), and no offset will cut directly on the line.*

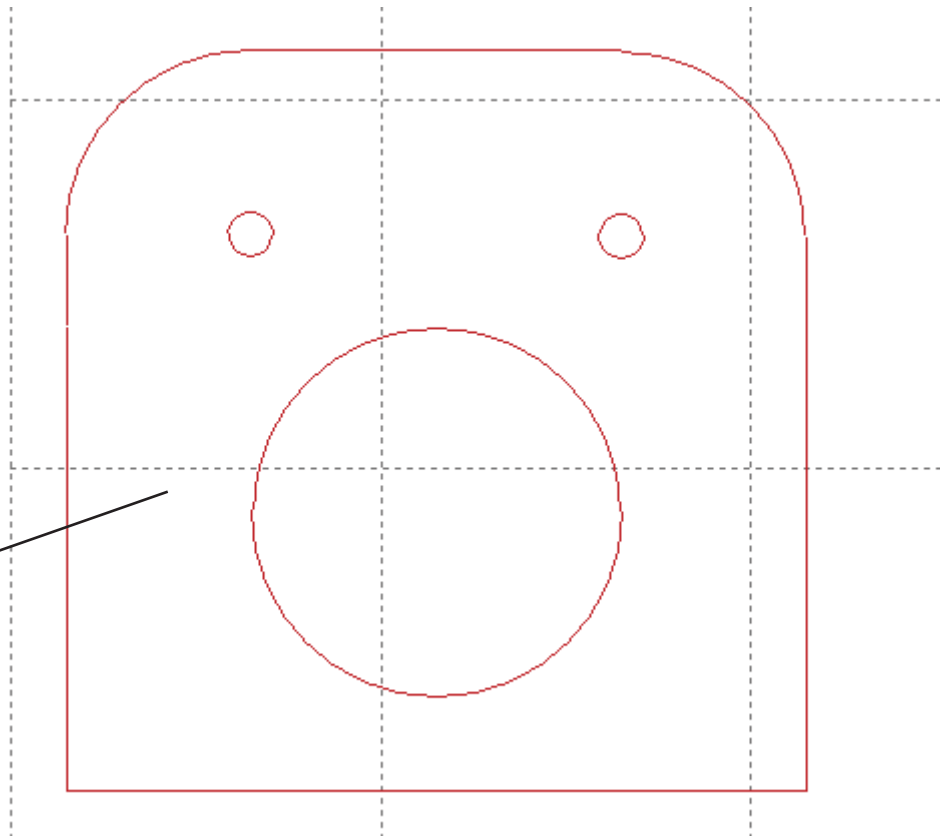


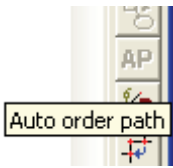
Select all the lines within the drawing.



Click the select all button to select the drawing

The selected drawing





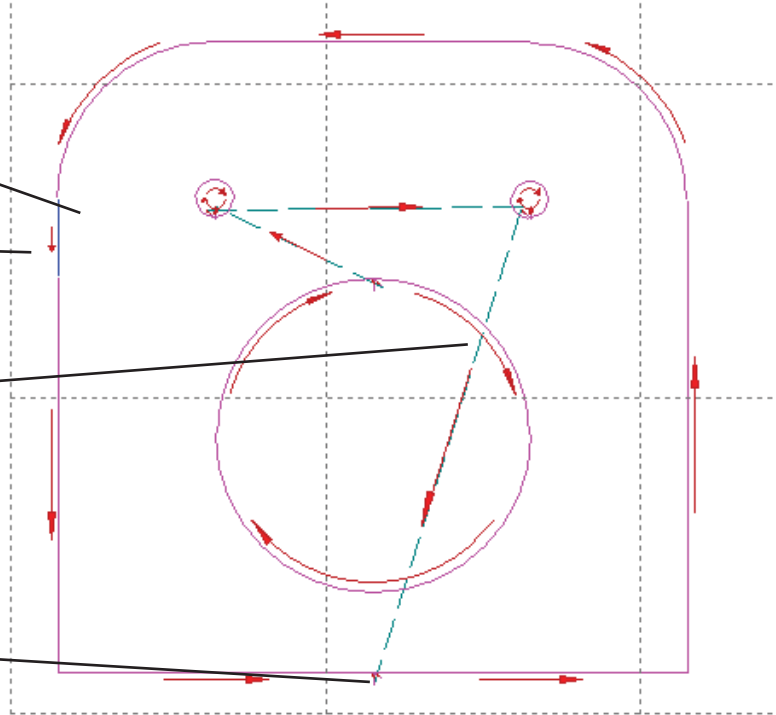
Once the drawing is selected, click on the AP (Autopath) button. The AP button will calculate the tool paths around the part.

Drawing that has been "Auto Pathed"

Arrows indicate direction and side of cut

Dashed Lines indicate areas where the cutting nozzle will transverse the piece.

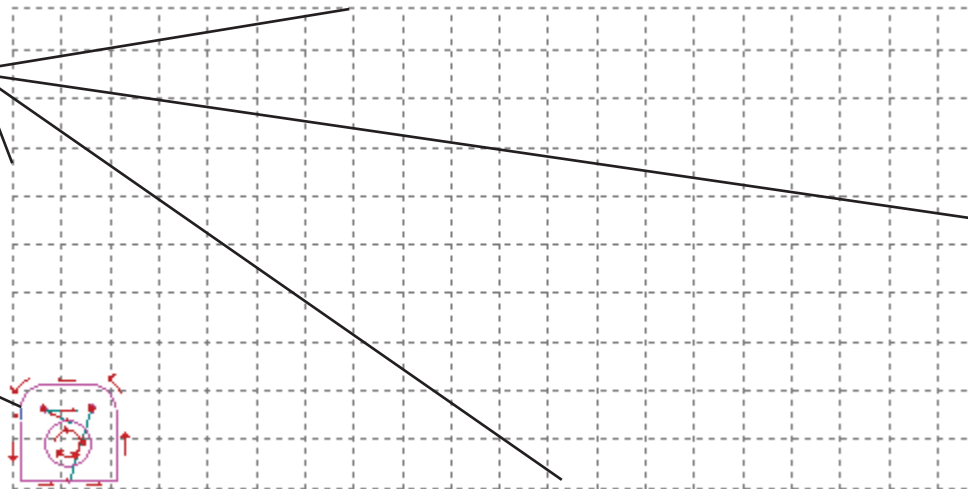
Lead-In and Lead-Out Points



If you zoom out, you will see your part in relation to the overall cutting area of the waterjet

Overall Cutting Area

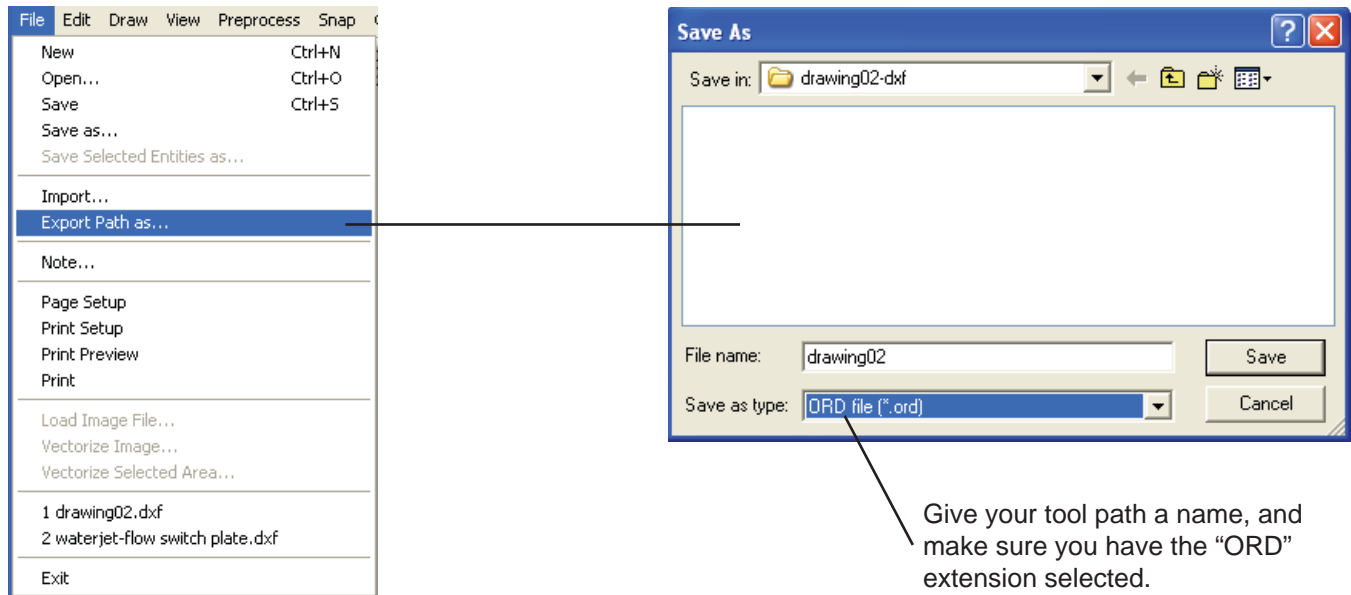
Part to be cut



## Step Ten: Save your Tool path

After you have verified your geometries and created a tool path for your part, you need to save that tool path.

To do this, click on File>Export path as...”



***\*Note: Creating the tool path is the last step before exporting the .ord file. Any changes made after the tool path has been created will corrupt the .ord file. If any changes need to be made, start over from the beginning steps in FlowPath.***

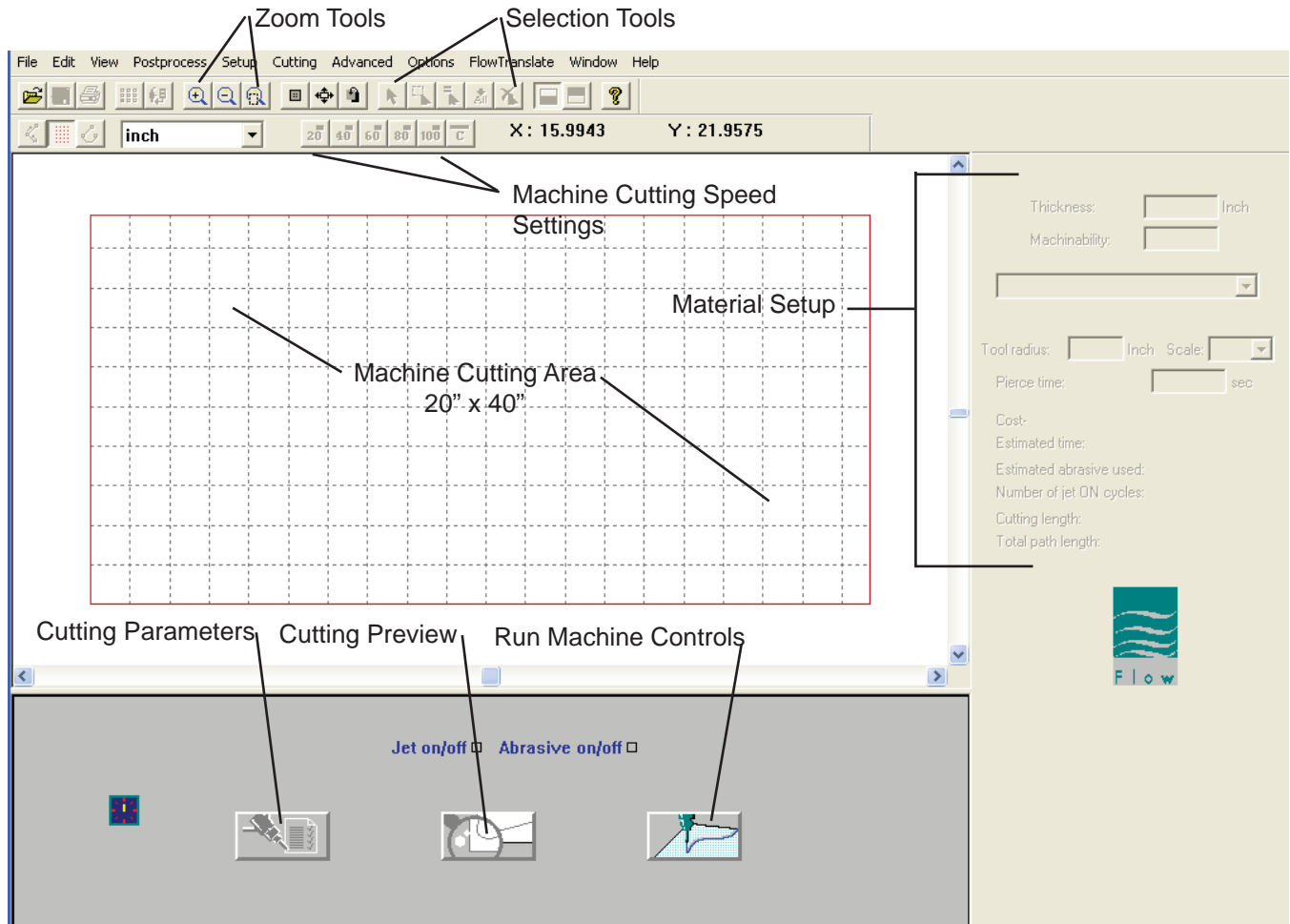


## Step Eleven: Open FlowCUT to cut your part.

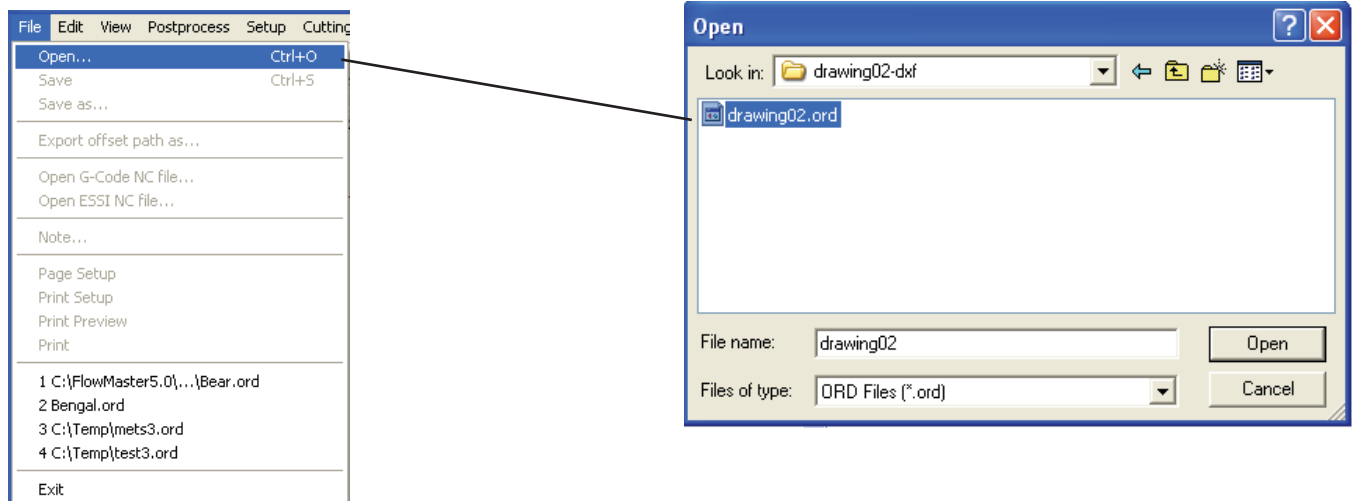
To open FlowCUT, click on the icon on the screen.



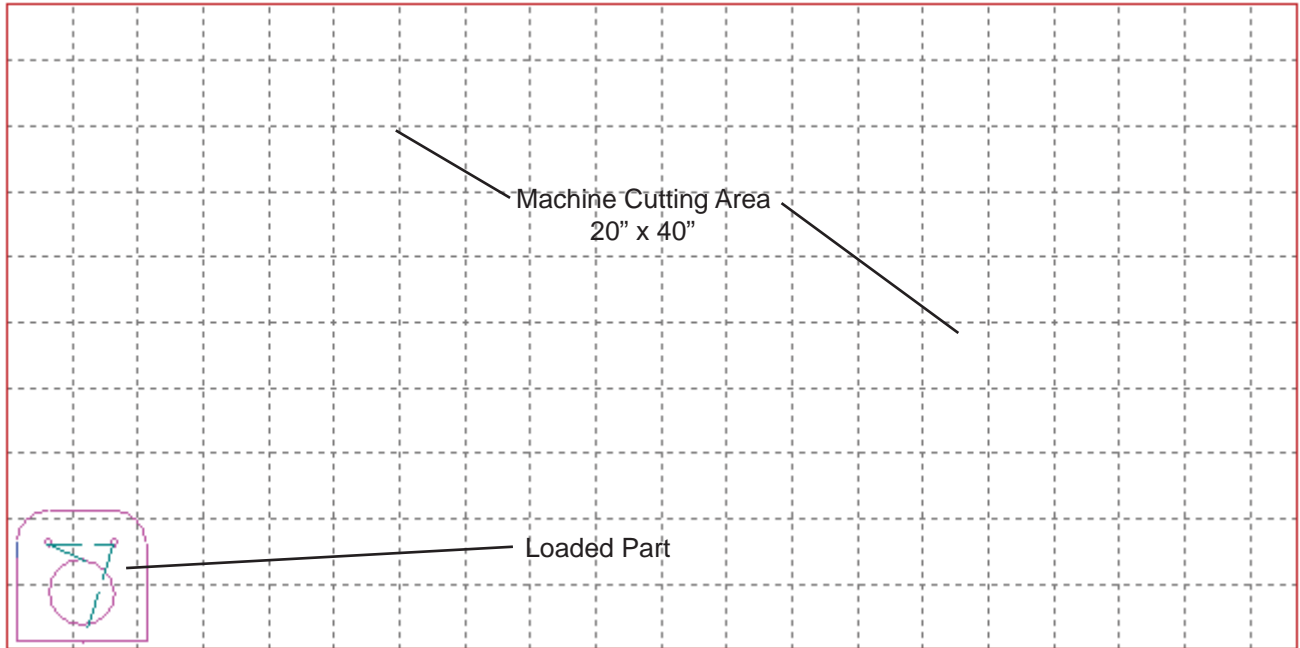
FlowCUT interface:



To open a file in FlowCUT, select File>Open. Select the file you saved from FlowPATH, and select "Open"

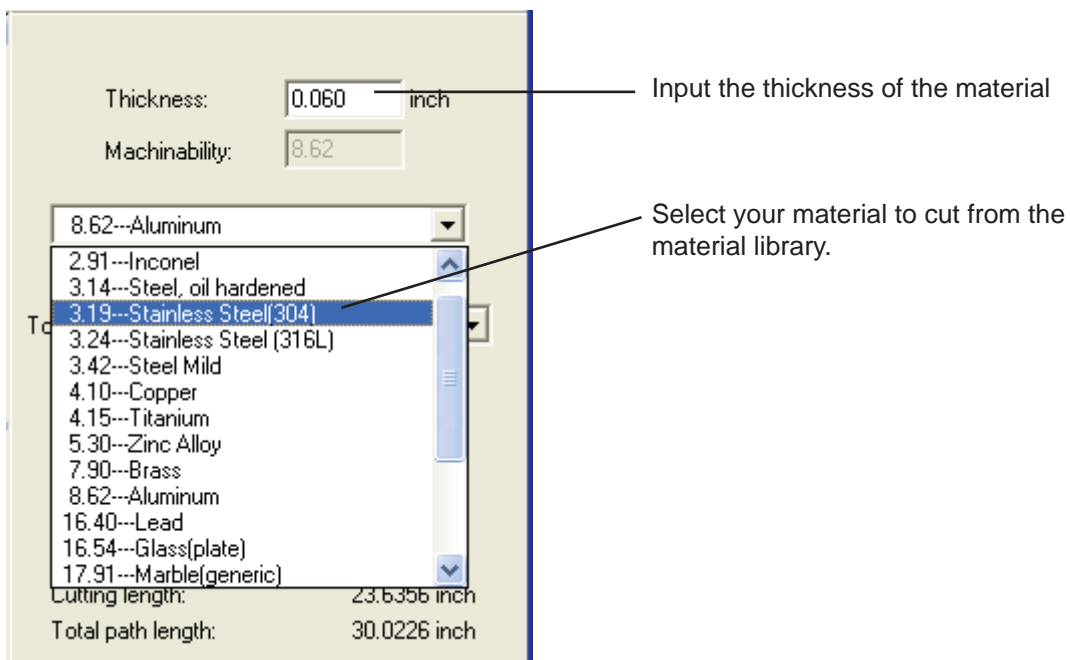


Your part will show up on the Machine Cutting Area.



### Step Twelve: Set your material settings.

In the material settings, input the thickness of your material as well as the material type. If the material type is not indicated, then select a material that is as close in hardness to the material you will cut.



## Step Thirteen: Save your file and load it on the waterjet .

Save your file as an "ORD" file.

Go to the waterjet, and turn it on:

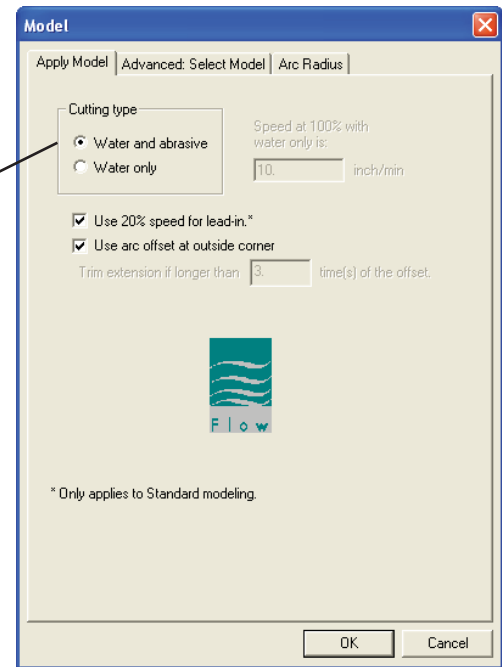
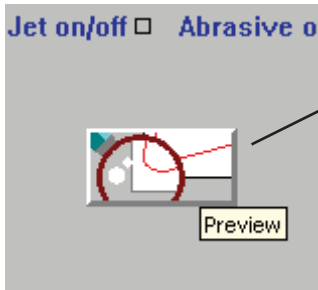
1. Fill the garnet tank to the top with garnet.  
*Garnet must be clean and dry. Do not leave any garnet on the top outside of the tank. Dirty garnet will clog the water jet.*
2. Turn on the Air Valve at the air compressor.
3. Pressurize the Garnet Holding Tank.
4. Turn on the Water Valve.
5. Position your material on the cutting bed.

Once you have turned on the air and water valves, log onto the computer and open FlowCUT. Load your ORD file in flow cut.

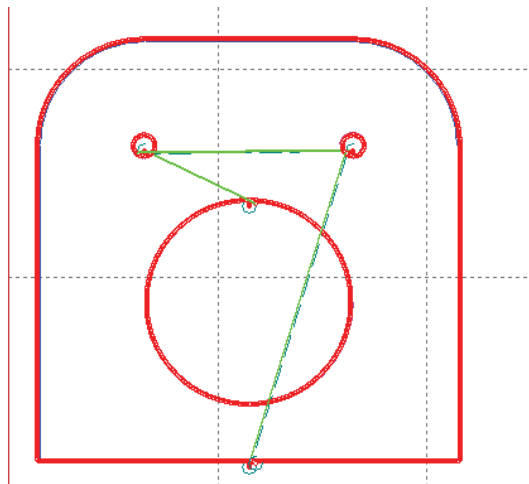
**WARNING:**  
**Starting the water jet pump without turning on the water or the air can severely damage the pump.**

## Step Fourteen: Preview your Cut

Click the preview button to preview your part. At the pop up window, make sure "water and abrasive" are selected.



The previewed part.

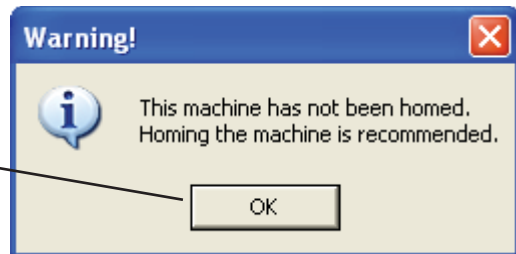
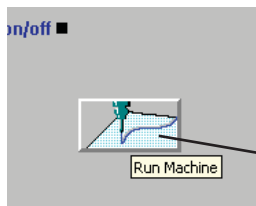


The cutting time is indicated.

Thickness:	<input type="text" value="0.25"/>	inch
Machinability:	<input type="text" value="8.62"/>	
	<input type="text" value="8.62--Aluminum (6061)"/>	
Tool radius:	<input type="text" value="0.022"/>	inch
Scale:	<input type="text" value="1."/>	
Piece time:	<input type="text" value="0.24"/>	sec
Cost-None:	0.00	
Estimated time:	1'26"	
Estimated abrasive used:	0.7921 lb	
Number of jet ON cycles:	1	
Cutting length:	17.0228 inch	
Total path length:	17.0228 inch	

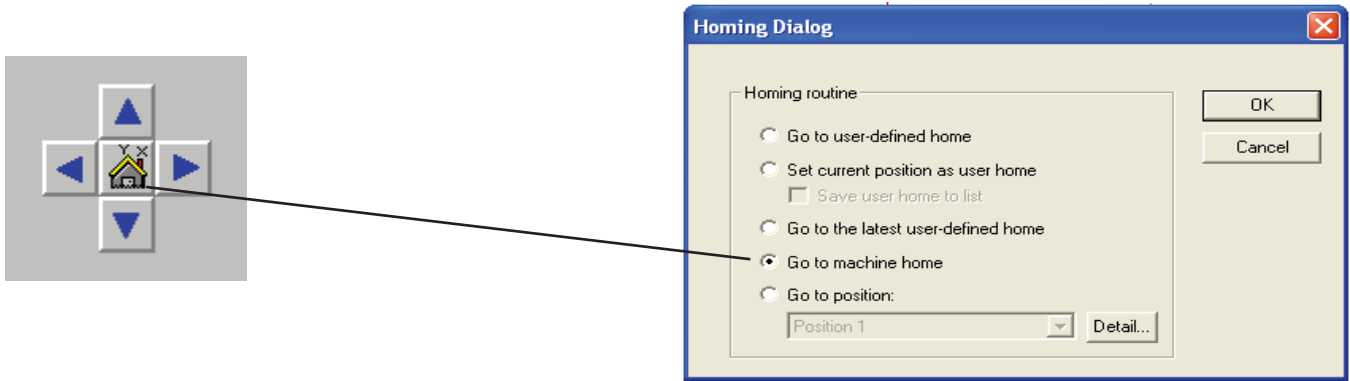
## Step Fifteen: Switch to Machine Control Mode

Click on the "Run Machine" Button to switch to the machine control panel. When you click on the Run Machine button, the waterjet will ask you to Home the machine. Homing the machine allows the waterjet to find its starting position. Click "OK" to home the machine.



The machine will move to its Home Position

To home the machine manually, click on the Home Icon on the control panel. The following dialogue box will appear. Click on "Go to machine home", and click "OK". The machine will re-home itself.

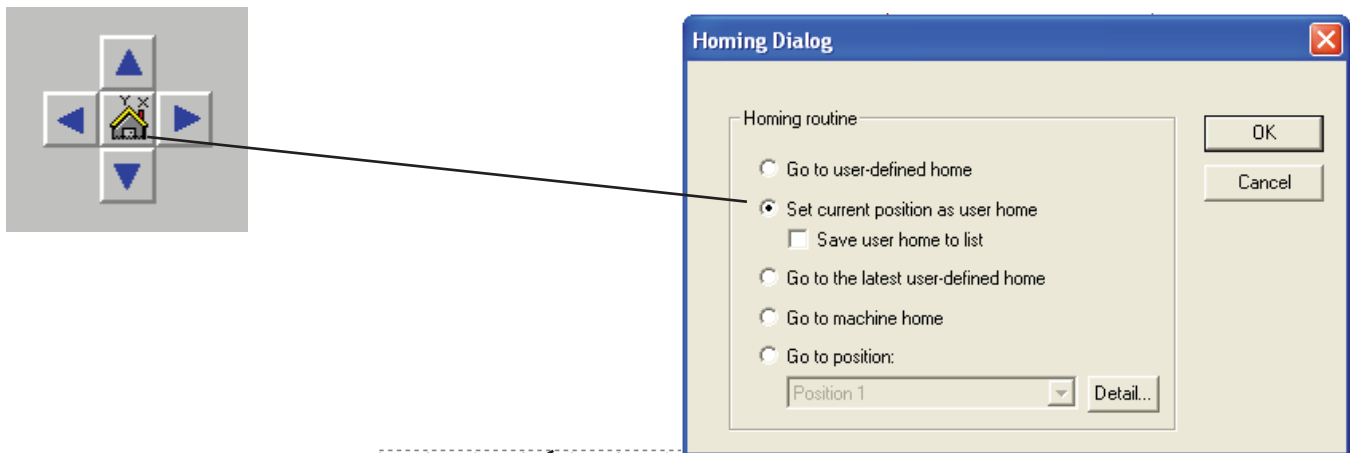


### Step Sixteen: Setting Machine Home to the work piece

After the machine has moved to its home position, use the arrow keys on the keyboard to move the machine to the start of your piece to be cut on the bed.

Note: the lower left corner of the work piece corresponds to the lower left corner of the drawing.

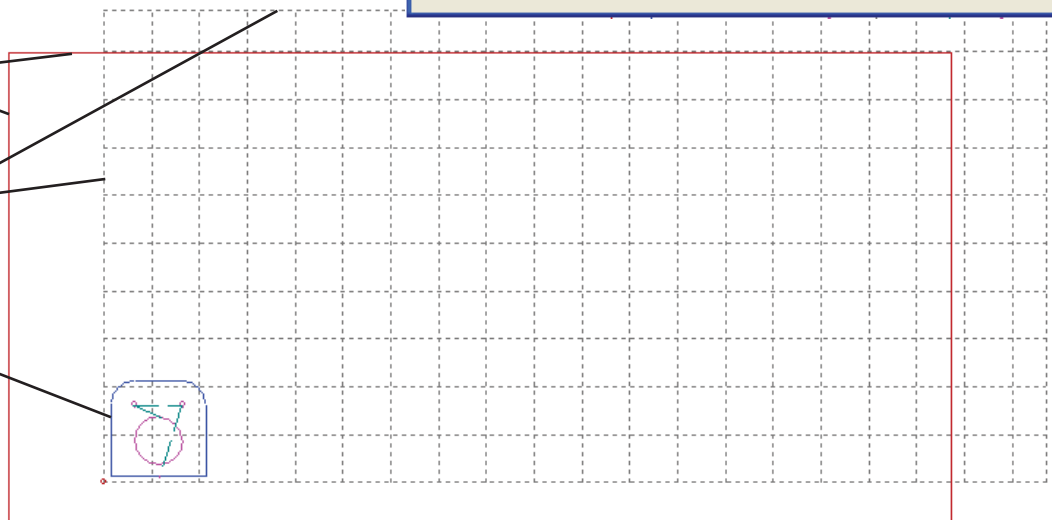
Once you have the cutting nozzle located, click on the home icon on the control panel. At the dialogue box, click on "Set current position as user home". Click OK.



Machine Cutting window

Drawing Window

Drawing moved to User-Defined home position.



### Step Seventeen: Adjust the height of the nozzle to 1/8 - 1/4" above your piece.

Rotate the height adjustment wheel on the waterjet so that the cutting nozzle is 1/8" to 1/4" above your work piece.



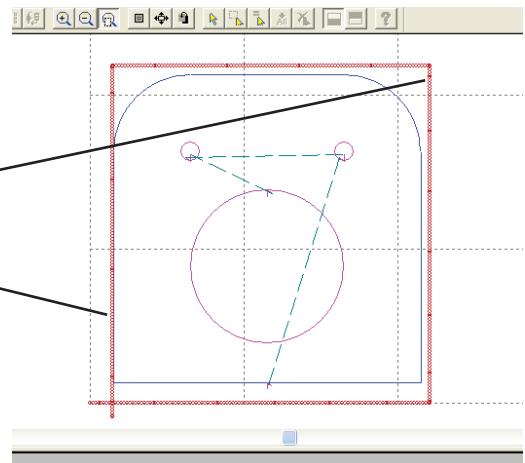
Adjustment Wheel



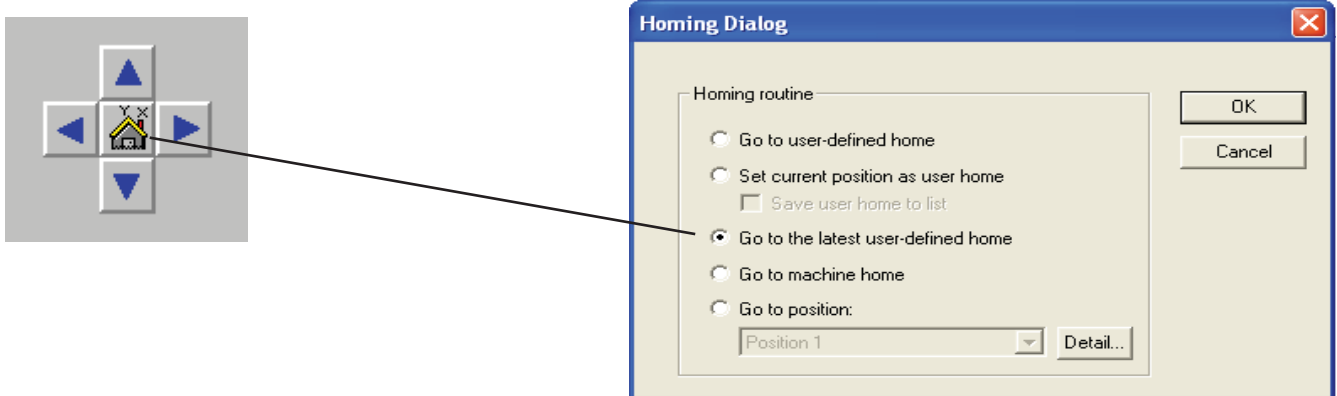
### Step Eighteen: Verify Clearance of nozzle around work piece.

Using the arrow keys on the keyboard, move the nozzle around your work piece making sure that the nozzle does not hit anything. Make sure there is clearance between the nozzle and the work piece all the way around.

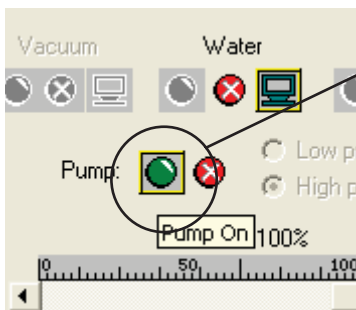
You will see a red line over your drawing as you move the nozzle with the keyboard.



To return to the home position of your work piece, click on the home icon, and at the dialog box, click “Go to the latest user-defined home”. This will send the cutting nozzle back to your starting position.



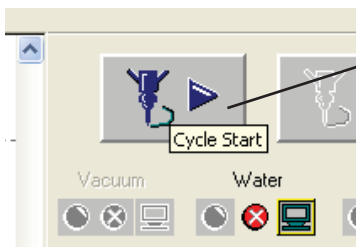
### Step Nineteen: Turn on the Pump and start the cut



Turn on the Pump, by click on the “Pump On Button”

### **WARNING:**

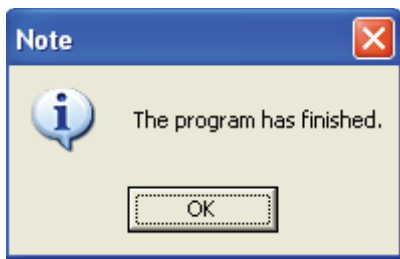
Make sure the water and air is on.  
Turning on the pump on without the water or air on will severely damage the pump.



Click the “Cycle Start” button. This will start your cutting job.

Waterjet Cutting the part





Once the job has finished, the pump will shut off, and the dialog box will appear. Click "OK"

The finished Part.



### **Step Twenty: Shut down the machine.**

When done, log off of the computer.

Push in the emergency stop button on the side of the monitor to shut down the water jet.

Close the waterline valve.

Close the valve to the Air compressor (Do not turn off the Air compressor).