

Using the Lasercamm

The Lasercamm is a very cool machine that sees a great deal of student use. It can cut geometry from a two-dimensional CAD file into sheets of various wood- and thermoplastic-based materials (not metal). It is an ideal tool for cutting intricate shapes with sharp internal corners. It is also excellent for creating quick prototypes and for building things that can be assembled from 2D components.



Its 100-watt laser can cut through materials up to 1/2" thick, and it can also score the surface of the material without cutting through. The maximum size the Lasercamm can cut is 52" (132 cm) by 25" (63.5 cm). The maximum speed at which it can cut is over 200 inches per minute (508 cm/min), but this varies with material and thickness.

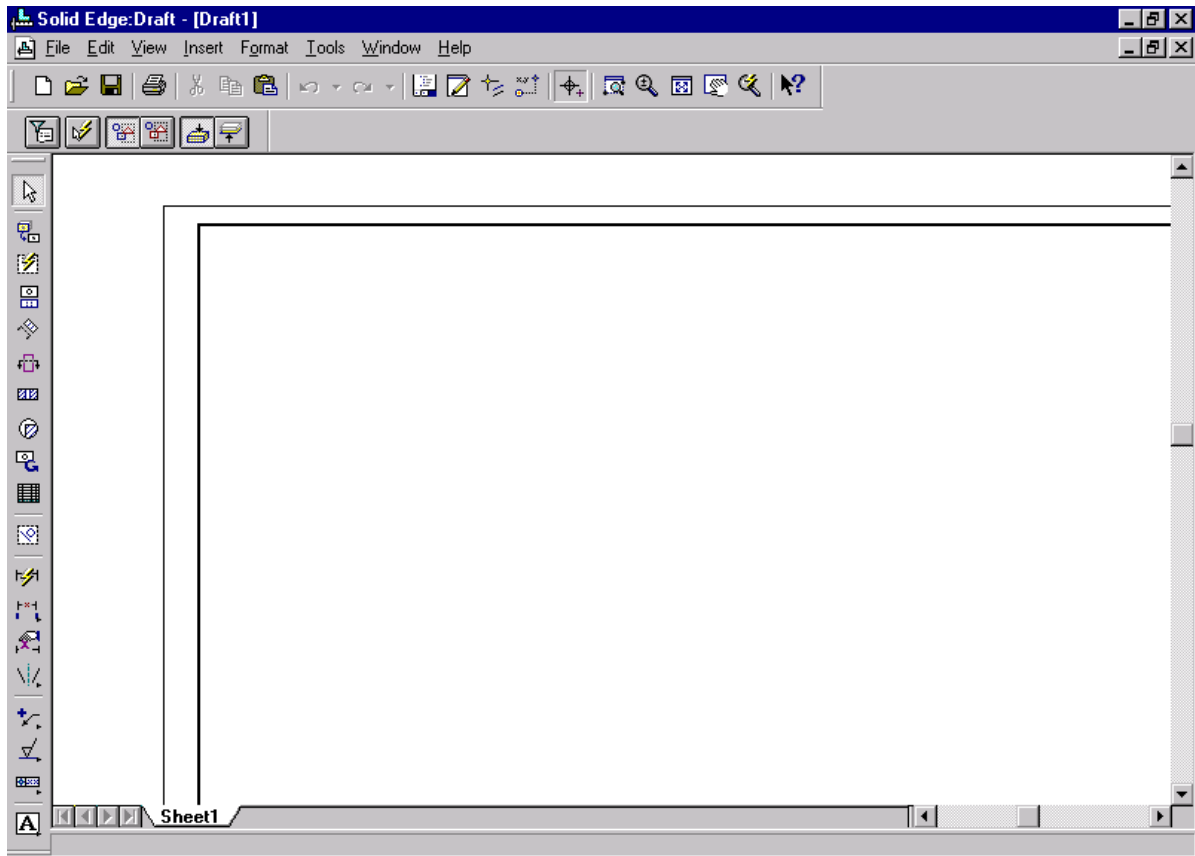
The Lasercamm is connected to a PC that has the Lasercamm software on it; this program takes a DXF file and translates it into a DMC file that the Lasercamm can read and then cut. If a material is not on the current acceptable materials list (this list appears under "material" in the Lasercamm software), you may not cut it on the Lasercamm. Please do not violate this rule - the Lasercamm is very expensive and some materials may damage its optics.

We do not require users to make a Lasercamm license before they use the machine for their own projects, but you should make sure you are familiar with how it works before you use it. Follow steps listed below to create a part on the Lasercamm.

A. Prepare Drawing

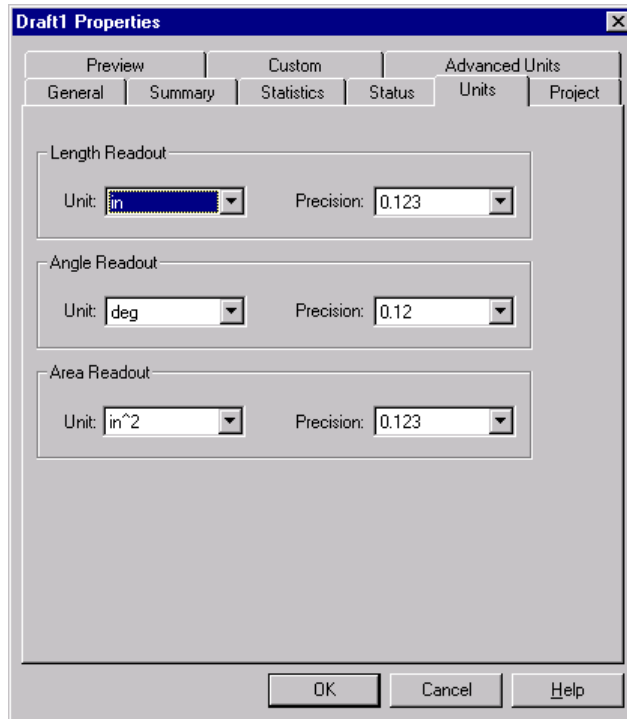
The first step to creating a part on the Lasercamm is to make a CAD drawing of the geometry you want to cut and then save or export it as a DXF. Almost all CAD programs can provide this functionality, but if you were to use *Solid Edge Draft* to do this, you would perform the following steps:

1. **Launch *Solid Edge Draft*:** From a PRL computer or your own machine, launch *Solid Edge Draft*, the 2D drawing component to *Solid Edge*. This program is designed to create part drawings, but it is also very useful for drawing 2D geometry. When the program launches, it will probably look something like this:

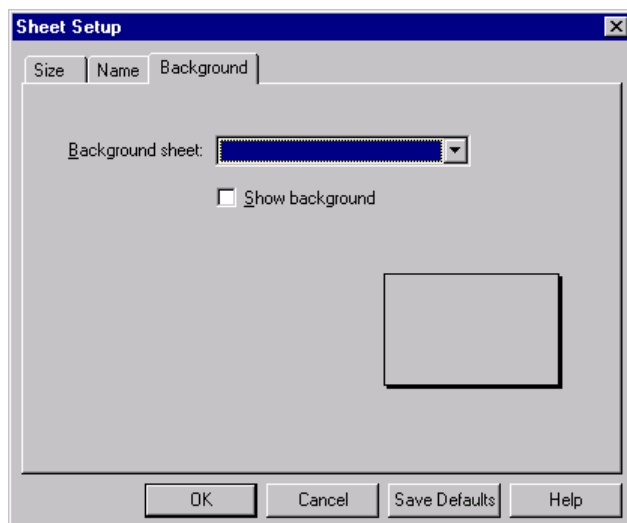


2. **Setup the drawing environment:** you must next configure the program so your file will work correctly and so you have access to the tools you will need.

- a. **Set units to inches:** The Lasercamm interprets all DXF files as though they were in inches regardless of the original units, so it is best to draw in inches. From the “File” menu, select “Properties”, and go to the “Units” tab. Make sure the Length Readout Unit is inches (in), as shown below.




- b. **Remove border:** Your Lasercamm part drawing won't need the default border that *Solid Edge* displays, so you should remove it. From the “File” menu select “Sheet Setup” and go to the “Background” tab. It will probably be set to “D-Sheet”, and you should change this to the blank selection as shown below.



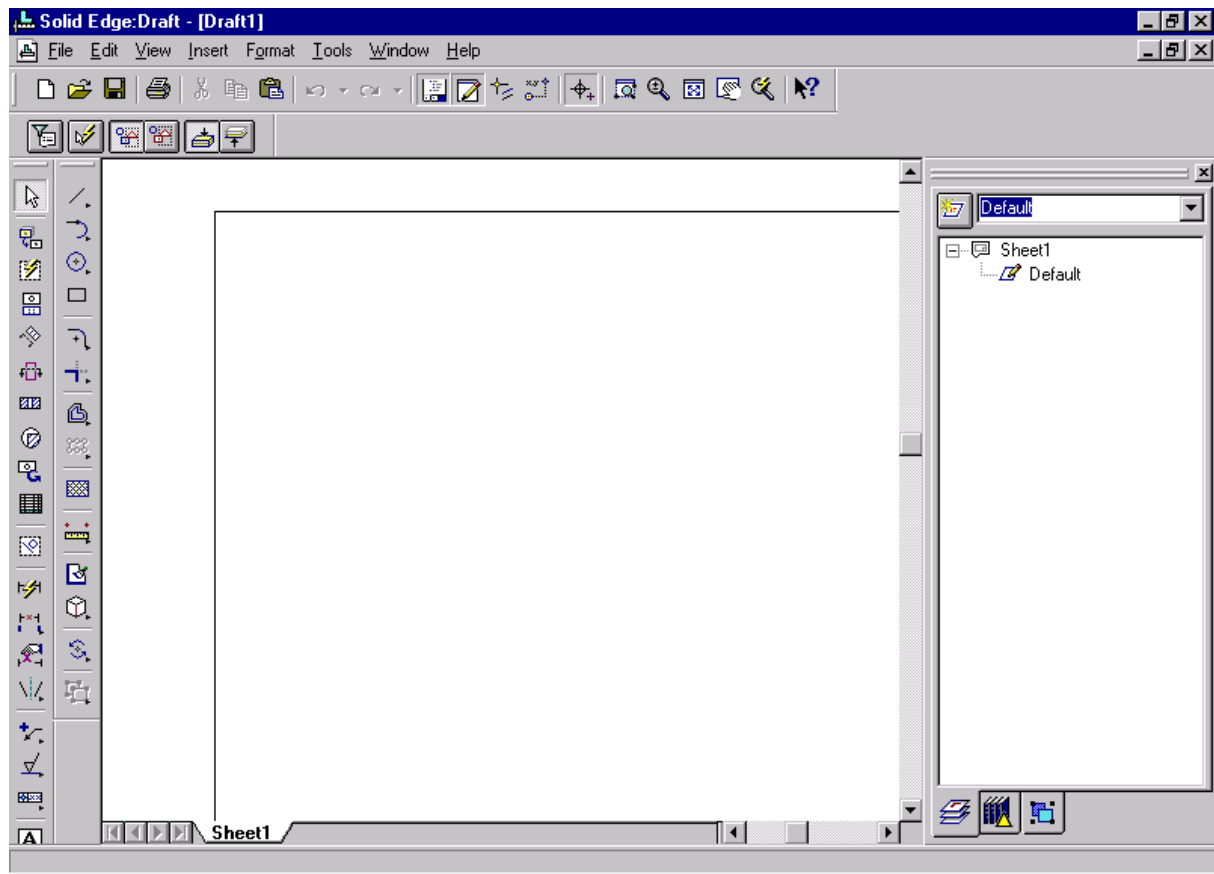
- c. **Turn on drawing toolbar:** You are going to draw geometry, so if your drawing toolbar is not yet active, turn it on by clicking the “Draw” icon



in the top toolbar. The drawing toolbar should appear somewhere on your screen, probably on the left-hand side.

- d. **Turn on EdgeBar:** The EdgeBar will give you control over the layers in your drawing. Turn it on by clicking the “EdgeBar” icon  in the top toolbar.

Once you are done setting up your drawing, it should look something like the following:



3. **Draw:** Now you’re ready to draw your geometry. Use the commands in the drawing toolbar to create your shapes. Hold your left mouse button down over a command to activate its flyout and see other commands in that category. Manage your layers – create, rename, activate, hide, and show – by using commands available in the “Layers” tab of the EdgeBar. You can also try using the Sketchpoint for accurately positioning elements – activate it by pressing the



“SketchPoint” icon in the main toolbar. Refer to *Solid Edge Help* or a TA if you get stuck.

When you are making your drawing, keep the following points in mind:

- All of your geometry must have positive x and y coordinates. In *Solid Edge Draft*, the lower left corner of the drawing is automatically set up to be (0, 0).
- Make sure your parts will fit on the Lasercamm bed (52" in X by 25" in Y) and on your sheet of material.
- Each operation must be on its own layer; for example, a cut profile should be on a separate layer from a score detail. Use the EdgeBar in *Solid Edge Draft* to control which layer your geometry appears on.
- The Lasercamm will cut entities twice if they appear twice, so be sure to clean up your drawing before exporting.
- If you need dimensionally accurate parts, you must compensate in the drawing for the width of the laser beam and the melt/burn back. This kerf varies by material and thickness but is usually between .008" and .010", so offset your part .004" to .005". If you really need dimensionally accurate parts, run a test cut in your intended material and measure the kerf for yourself.
- Text is an independent entity and can only be cut if it is composed of arcs and lines. If you are trying to cut text, you must either create the text yourself in a CAD drawing, or find a software method for converting the fonts to curves.

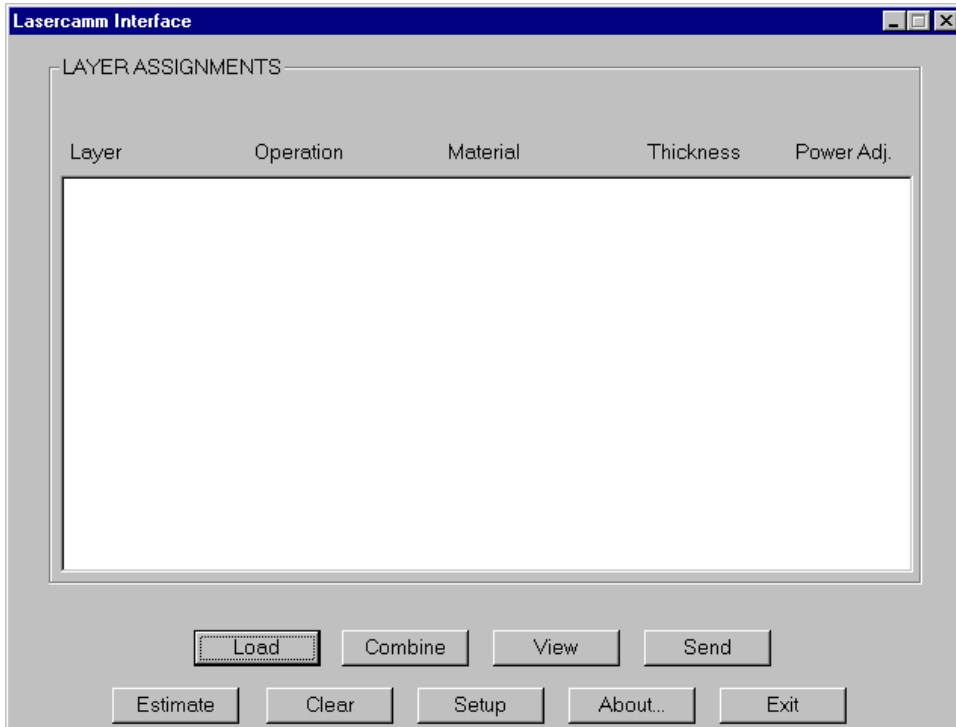
B. Process DXF File to Cut in Paper

The next step to creating a part on the Lasercamm is to process your DXF file so that the Lasercamm can cut it. This processing requires the use of the *Lasercamm* program, which is only available on the Lasercamm computer.

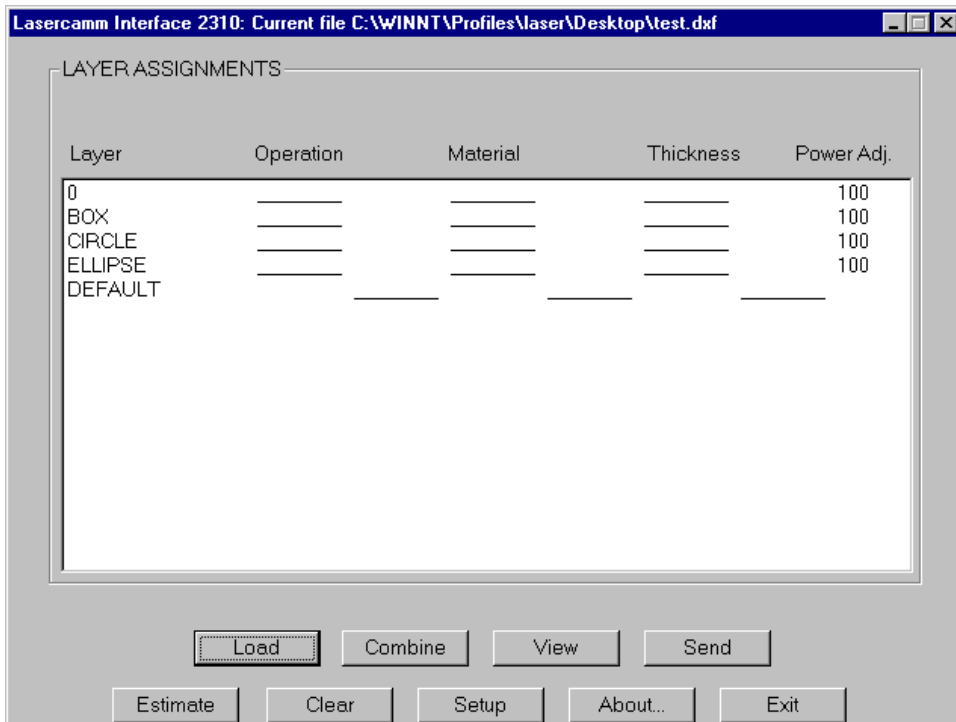
- 1. Transfer file:** The next step is to transfer your DXF file over to the Lasercamm computer. Your first option is to put your file on a floppy disk or CD and walk it over to the Lasercamm computer. Alternatively, you can save your file on the PRL network: Create your own sub-folder in the “Lasercamm_user” folder on the Users drive and place your file there.

Once you can access it from the Lasercamm computer, copy your DXF file to the Lasercamm computer’s desktop.

2. **Launch Lasercamm Program:** Launch the Lasercamm software by clicking on the “Lasercamm” icon on the desktop. The program will look like this:



3. **Load DXF file:** Load your DXF file into the Lasercamm software by clicking on the “Load” button and navigating to your file on the desktop. The program will then display the layers of your drawing as separate text lines in the central white box of its window, as shown in the example below:



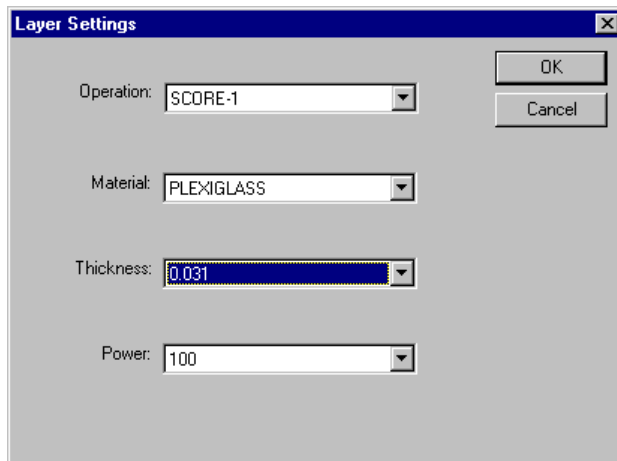
4. **Process layer for paper:** The next step in creating a Lasercamm part is to pick the layer of the loaded drawing you want to work with and specify the operation, material, and thickness for that process. You should always cut your geometry in paper before you cut it in your final material, as described below.

Begin by double clicking on the layer you want to cut. If you did not name your layers, your geometry is probably on Layer 0 or Layer Default, so double-click on one of those to start. This action will bring up the “Layer Settings” window.

- The “Operation” options are Cut, Score-1, Score-2, Score-3, Score-4, Score-5, and Custom. A Cut will fully pierce the material, and Scores only penetrate partway. Score-1 is the lightest score available, and Score-5 is the heaviest. Custom allows you to control the laser beam directly, but we do not have enough experience to set it up correctly with this method.
- The “Material” options probably include Plexiglass, Masonite, Plywood, and Delrin and may include more if the software has been updated since this was published. If a material is not on this materials list, *you may not cut it on the Lasercamm*. Please do not violate this rule - the Lasercamm is very expensive and some materials can damage its optics.
- The “Thickness” options are dependent on the selected material and are displayed in inches. If you have not yet selected a material, no thickness options will be displayed.
- The “Power” options adjust the strength of the laser from 90% to 110% in increments of 5%. We have found that leaving this at 100% produces the most consistent results.

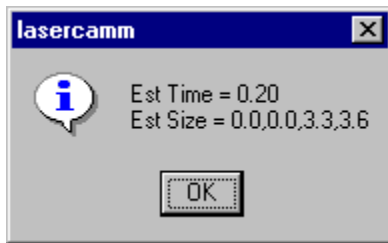
Set the layer up to Score-1 paper:

You should always cut your part in paper before you cut in your intended material in order to make sure everything is setup correctly. Cutting in paper will also show you exactly where you need to put your stock. Thus, you should set this layer up to “Score-1” on Paper (also known as Stratmore) or the thinnest available material in the listing. At the time of publishing, the thinnest setting was Plexiglass 0.031”, as shown below.



When you have set the layer up to score paper, press the “OK” button. The program will then process the layer, create the DMC file that will run the Lasercamm, and save that file in the directory where the DXF resides.

It will also display a small window named “lascamm” that will show you the estimated cut time (in minutes) and estimated size (in inches) from the origin to the farthest points in the geometry.



Take note of the estimated time and make sure you have enough time left in the shop session to cut your part. You should finish before clean-up time begins at twenty minutes to the hour.

Check DMC:

Now that you’ve created your DMC file, you should verify that it contains the geometry you intend to cut. Press the “View” button and navigate to your file. It will be named LAYERNAME.dmc and will be located in the same directory as the DXF you originally opened. Click on it, and hit “Open”.

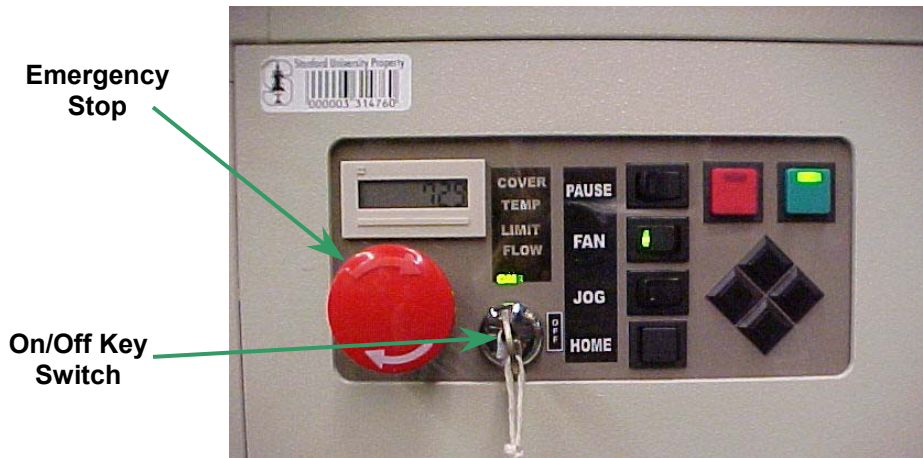
The software will then display the path that the Lasercamm will take to cut your geometry. Dashed lines are rapid moves and solid lines are cuts. Make sure this is the file and layer you want to cut, and then press “Esc” to exit. If nothing appears in the diagram, then there is no geometry on the layer you selected. Go back to the beginning of this step and try another layer or check your DXF.

Note that if you want to cut more than one layer at once, perhaps a cut profile and a score detail, you can process both layers separately and then combine them into one DMC by clicking the “Combine” button.

C. Cut Your Part in Paper

Now that you have finished processing your file to cut in paper, you are ready to setup the Lasercamm machine. Leave the program open on the computer and approach the Lasercamm.

1. **Turn the machine on:** If the Lasercamm is off, obtain the Lasercamm key from the TA (if it's not already in the machine) and insert it into the keyhole switch on the Lasercamm's front control panel. Rotate the big red emergency stop button clockwise to pull it out and turn the key to "ON".



When the Lasercamm first turns on, it goes through an initialization sequence and warms up its various components. Wait until the initialization completes (check status on the four-line LCD screen on the upper surface) before you start working with the machine.

2. **Cover the bed with paper:** The bed of the Lasercamm needs to be covered with thick paper (except for a 2"-wide open slot at one end) before you run a part. Covering the bed helps the Lasercamm's fan achieve a strong suction where the laser cuts through. This suction pulls all the smoke down and away from the optics, which keeps them clean and functional. The small gap at one end will help evacuate any free-floating smoke that may form.

Covering the bed with paper will also show you exactly where you need to put your material when you do your actual part. Having a couple of cuts in the paper beforehand is ok, but it should not have any large holes. Ask the TA where the special Lasercamm paper is kept if you cannot find it.

- 3. Send your DMC file:** Next you need to send your DMC file over to the Lasercamm machine. Back at the Lasercamm computer, click on the “Send” button in the Lasercamm program. Navigate to your file, which will be named LAYERNAME.dmc and will be located in the same directory as the DXF you originally opened, click on it, and hit “Open”.

The computer will then begin sending your file to the Lasercamm machine. You can watch the progress of the download by looking at the four-line LCD screen on the machine.



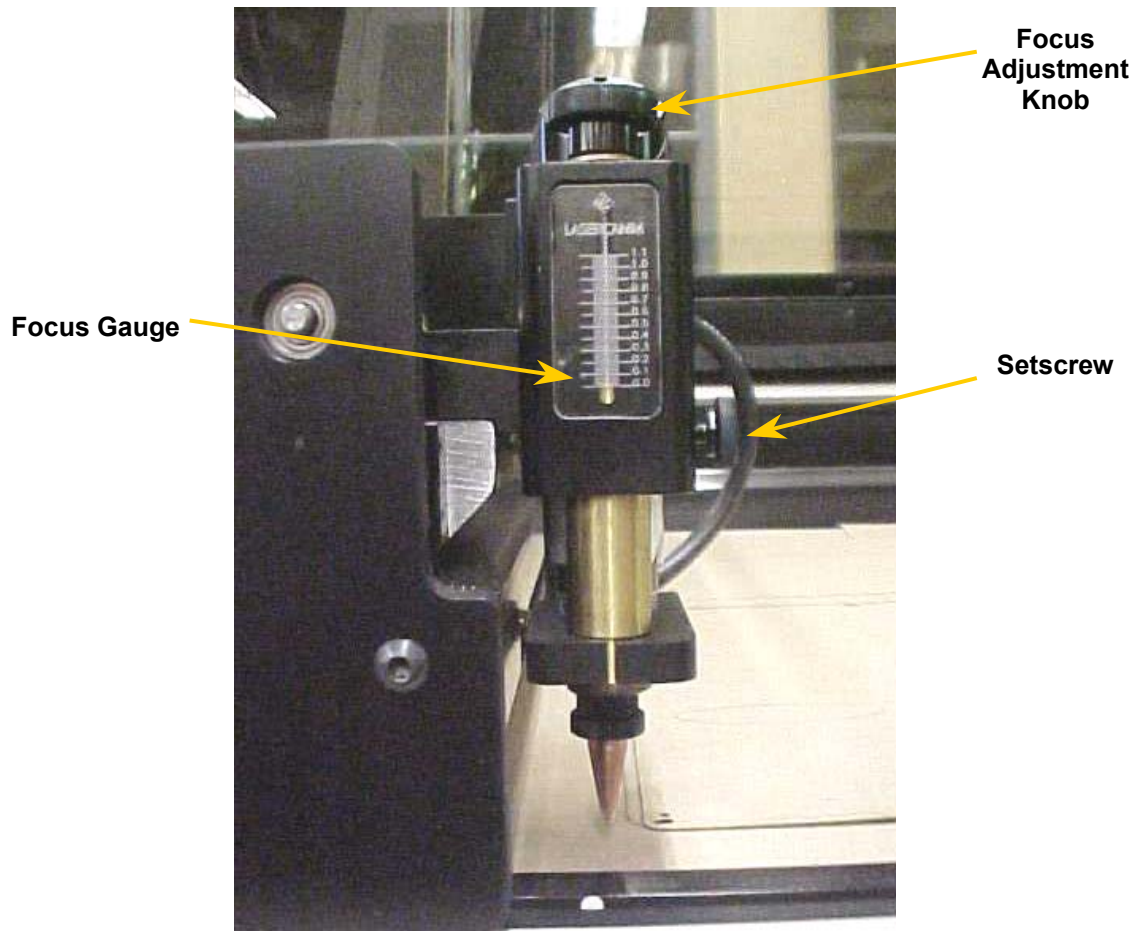
Once your file arrives, the Lasercamm screen will display information about it:



filename		-> LAYERNAME
thickness		MATERIAL
% full power	speed (in/min)	thickness
size		cut time (minutes)

Check to make sure all the settings are correct before proceeding to the next step.

- 4. Set laser focus:** The laser needs to be manually focused for the thickness of material that you are cutting. This setting is independent of material type. Locate the head of the Lasercamm and find the measurement gauge above the laser tip. This gauge reads out part thickness in inches, and you should set it to the thickness of your part. Loosen the setscrew on the right side and rotate the top knob, driving the brass cylinder up or down. Move the brass cylinder so that its top edge is aligned with the correct tick mark and re-tighten the setscrew to hold it in place. For paper, set the thickness to just above zero.



Improper focus can prevent the part from being cut all the way through and can leave a crummy surface finish. Drastically improper focus (e.g. set to 0" for 0.5" material) can also cause the laser to crash laterally into your part. Remember to do this step, and do it properly.

- 5. Set origin:** If you want the origin of your part to be somewhere other than the default lower-left corner of the Lasercamm bed, switch the machine into jog mode by pressing the **Jog** rocker switch on the front control panel so its green light comes on. Then use the four arrow keys to position the head in the location where you want your origin. When you are satisfied, turn off the jog mode. This

stopped position is the (0,0) coordinate of your drawing. There is no provision for more accurate positioning of the head, but often you won't even need to move it from its default position.

6. **Double-check settings:** Check the display on the top of the Lasercamm. Make sure the proper filename, layer, material, and thickness are listed. Then double-check the laser focus to make sure it is set correctly and make sure the entire bed is covered with paper.
7. **Cut your part in paper:** Before you actually cut your file, it is important to know what you should do if something was to go wrong while the Lasercamm was running. The biggest hazard when Lasercamming is that the material inside the Lasercamm can catch fire if the settings are incorrect. Such a fire can do serious damage to the machine and could endanger shop users as well.
 - The first thing you can do to prevent such a scenario is **to make sure you understand how the Lasercamm works**, check to make sure your settings are all correct, only cut approved materials, and ask a TA if you have any questions or concerns whatsoever.
 - The second thing you can do is to **pay full attention to the machine while it is cutting**. Once you do turn it on, you should always be within arm's reach of the machine, and you should be watching it continuously to make sure nothing is going wrong.
 - The third thing you can do is to **act quickly if you see a fire starting. Press the Square Red Stop Button as soon as possible**. Pressing this button will stop the Lasercamm and return it to its home position, *away from the fire*. Pressing the emergency stop is not as good of an option because it kills all power to the machine, leaving the laser right above the fire, which is very bad for its optics and electronics. After you press the **Stop** button, yell for the TA, open up the cover, and remove the fire from the Lasercamm. If you do everything correctly, the material should never catch fire.



Now that you know what to do if something goes wrong, you're ready to cut your part in paper. Press the **Green Square Start Button** to run your file. The Lasercamm will sit still for a few seconds and then go cut your part. It will cut the geometry in a somewhat random order. Watch it throughout the cut time and make sure everything is going correctly.

If you want to pause the machine in the middle of the work, you can press the **Pause** button (top rocker switch) and cutting will stop at the end of the current command. Lifting the Lasercamm cover will also stop the laser from cutting. Be sure to wait at least 1 minute before pressing the **Start** button again. Failure to do so can send the cutting head crashing into the stops and ruin the alignment of the laser beam. It has been found that stopping in the middle of a program can cause the machine to restart improperly. If this happens, press in the big red button, wait one minute and then rotate the big red button out. Wait for the machine to initialize. Your file should still be there ready to cut. If this does not remedy this situation, report the problem to a TA.

Once you have cut your part successfully in paper, you are ready to cut it in your final material.

C. Reprocess Layer for Your Material: The next step is to reprocess the same drawing layer to specify the operation, material, and thickness for your final part.

Back at the Lasercamm program, double click on the layer you want to cut. This action will bring up the “Layer Settings” window.

- The “Operation” options are Cut, Score-1, Score-2, Score-3, Score-4, Score-5, and Custom. A Cut will fully pierce the material, and Scores only penetrate partway. Score-1 is the lightest score available, and Score-5 is the heaviest. Custom allows you to control the laser beam directly, but we do not have enough experience to set it up correctly with this method.
- The “Material” options probably include Plexiglass, Masonite, Plywood, and Delrin and may include more if the software has been updated since this was published. If a material is not on this materials list, *you may not cut it on the Lasercamm*. Please do not violate this rule - the Lasercamm is very expensive and some materials can damage its optics.
- The “Thickness” options are dependent on the selected material and are displayed in inches. If you have not yet selected a material, no thickness options will be displayed.
- The “Power” options adjust the strength of the laser from 90% to 110% in increments of 5%. We have found that leaving this at 100% produces the most consistent results.

Configure the layer to make your part:

Choose the appropriate operation, material, and thickness, and press the “OK” button. The program will then process the layer, create the DMC file that will run the Lasercamm, and save that file in the directory where the DXF resides.

It will also display a small window named “lascamm” that will show you the estimated cut time (in minutes) and estimated size (in inches) from the origin to the farthest points in the geometry.

Take note of the estimated time (which will be longer than it took to run in paper) and make sure you have enough time left in the shop session to cut your part. You should finish before clean-up time begins at twenty minutes to the hour.

D. Cut Your Part

Now that you have finished processing your file to cut in your material, you are ready to setup the Lasercamm machine to cut your part.

- 1. Prepare your material:** Remove any paper or plastic covering that may be on your stock. Coverings can interfere with the laser's ability to penetrate the material and can compromise the quality of the cut.
- 2. Remove paper parts from the Lasercamm bed:** The cut paper acts as a good guide to show you where to put your material, but it should *not* stay underneath your part while it is cutting. Leaving the paper there causes it to burn and smoke and can damage the surface finish on your material.

Hold the outer edges of the paper still and carefully remove the paper cutouts of your parts.

- 3. Position your material:** Place it where the Lasercamm is going to cut your parts. Make sure every cut will be contained by your stock so that the high-power laser beam will never hit the paper.
- 4. Send your DMC file:** Back at the Lasercamm computer, click on the "Send" button in the Lasercamm program. Navigate to your newly processed file, which will be named LAYERNAME.dmc and will be located in the same directory as the DXF you originally opened, click on it, and hit "Open".

The computer will then begin sending your file to the Lasercamm machine. You can watch the progress of the download by looking at the four-line LCD screen on the machine.

Once your file arrives, the Lasercamm screen will display information about it:

filename		-> LAYERNAME
thickness		MATERIAL
% full power	speed (in/min)	thickness
size		cut time (minutes)

Check to make sure all the settings are right, especially material and thickness, before proceeding to the next step.

- 5. Set laser focus:** The laser needs to be manually re-focused for the thickness of material that you are cutting. This setting is independent of material type. Locate the measurement gauge above the laser tip, and set it to the thickness of your part in inches. Loosen the setscrew on the right side and rotate the top knob, driving the brass cylinder up or down. Move the brass cylinder so that its top edge is aligned with the correct tick mark and re-tighten the setscrew to hold it in place.

Improper focus can prevent the part from being cut all the way through and can leave a crummy surface finish. Drastically improper focus (e.g. set to 0" for 0.5" material) can also cause the laser to crash laterally into your part. Remember to do this step, and do it properly.

- 6. Double-check settings:** Check the display on the top of the Lasercamm. Make sure the proper filename, layer, material, and thickness are listed. Then double-check the laser focus to make sure it is set correctly. Make sure your material is positioned in the right spot and the rest of the bed is covered with paper. Also make sure there is enough time left in the session to cut your part.
- 7. Cut your part:** Now you're ready to cut your part. Press the **Green Square Start Button** to run your file. The Lasercamm will sit still for a few seconds and then go cut your part. It will cut the geometry in a somewhat random order. Watch it throughout the cut time and make sure everything is going correctly.

Press the **Red Square Stop Button** if anything goes wrong.



Press the
Red Square
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if you see a
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Press the
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run your file

If you want to pause the machine in the middle of the work, you can press the **Pause** button (top rocker switch) and cutting will stop at the end of the current command. Lifting the Lasercamm cover will also stop the laser from cutting. Be sure to wait at least 1 minute before pressing the **Start** button again. Failure to do so can send the cutting head crashing into the stops and ruin the alignment of the laser beam. It has been found that stopping in the middle of a program can cause the machine to restart improperly. If this happens, press in the big red button, wait one minute and then rotate the big red button out. Wait for the machine to initialize. Your file should still be there ready to cut. If this does not remedy this situation, report the problem to a TA.

E. Clean Up

When your part is done, go through the following steps to clean up the area and prepare the machine for the next user:

- Remove your part from the bed of the Lasercamm.
- If you have excess material that you don't want, please donate it to the shop's Lasercamm scrap pile. Someone else will be very happy to use it. If your scraps are very small, make sure you throw them out.
- Replace the cut-up paper on the bed of the Lasercamm with nice new paper.
- Delete your DXF and DMC files from the desktop of the Lasercamm computer.
- Straighten up the surrounding area and sweep the floor.
- Ask the TA on duty to give you a 5-minute shop job if you're done for the session.

revision history

rev 0-3	5/95	John Wadsworth	original text, revisions
rev 4	5/97	Bryan Cooperrider	revisions and updates
rev 5	11/01	Katherine Kuchenbecker	major revisions for new machine, software