Within this assignment, you will be learning how to properly use the "self-serve" Laser Cutters located in AB 031 of the Architecture Building. If you are new to the fabrication world you may be wondering what a laser cutter is and how it can be used. To put it simply, laser cutters are computer-controlled machines that use a laser beam to cut and engrave material. These machines are used in a vast number of different industries, from electrical engineering to at-home projects. For this module, we will be sticking to the basics in terms of design and will be focusing strongly on getting you comfortable with the workflow of the laser cutters to ensure the safety of the user as well as the machine.

Assignment A1, A2, and A3 Overview

A1. Before you should to even think about operating the laser cutters, you must ensure that you have valid line work. For the best results, you must have Clean, Closed, and properly Colored vectors. Module 2 Assignments 1a, 1b, and 1c provide different options you can choose from when preparing line work (You will only need to complete one of these assignments).

-Clean lines means there are not any double curves where you do not intend on them being and no stray lines that could potentially ruin the clarity of your cut.

- For through cuts, you MUST have closed curves, or else the material you are trying to remove will not come out cleanly.

-The machines use specific print colors to differentiate between types of cuts. For example, if you want to both engrave and through cut you will need at least two different colors. Set up your file so that the different types of cuts are on different layers to make it easier to change the line color as needed.

A2. Once you have valid line work, you can move on to setting up your cut sheets. The laser cutters in the CAP Fab Lab use Illustrator and Rhino so it is recommended that you use one of these software when setting up your cut sheets for the best results. Set up cut sheets for the cutter you choose to use (more info below).

A3. Now that your cut sheets are all nicely laid out and you have triple-checked that your geometry is clean, closed, and properly colored, you are ready to get going on the machines.

-Keep in mind: there are four laser cutters (three 18"x32" and one 18"x24") and each machine has different parameters for how the laser cuts through a certain material. So, even though you may be using the same material on each of the machines, there can be slightly different values that need to be inputted during set-up for each laser cutter. But do not worry! There is a "deck of cards" that is located next to each machine that has all of the approved materials and what values need to be input into them.

For this assignment, you will need to choose to do 1a, 1b, or 1c

Now, if you skipped Module 1 and now have no idea how to make valid vector line work but still want to be able to use the laser cutters, you have come to the right place. We realize not everyone wants to put their time and effort into creating a laser-cut file that they will probably only use once or twice. So it's your lucky day. The CAP Fab Lab is so graciously providing a few options you can pick from that were created by one of our local pros here in the lab. You will still need to complete Assignments 2 and 3. You're not getting out of it that easy.
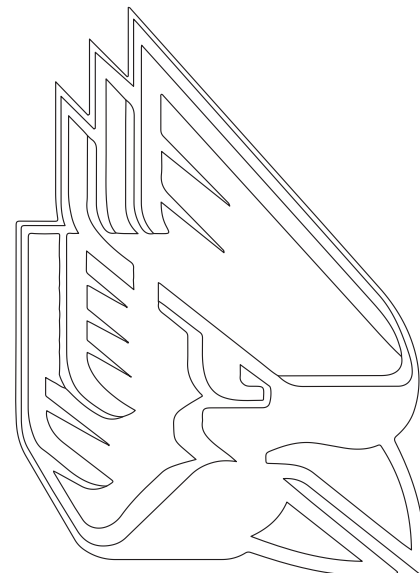
Final Deliverables: One Rhino or Illustrator file with cuts and engraving separated into layers
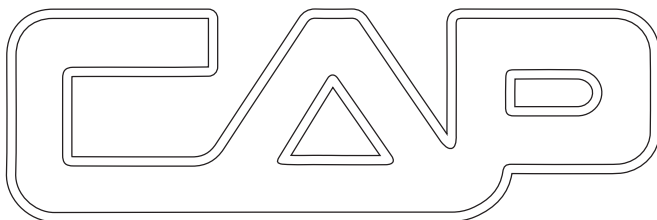

Instructions

1. Download one of the three vector drawings from our website in the Laser Cutter > A1 > attachments.

2. Look over the line work to ensure there are no double or stray lines. You may make changes to the line work as you see fit. Scale the line work to fit in a 6.5"x6.5" box if it is not already to scale.

3. Analyze and determine the positive and negative space in the line work to figure out which spaces need to be cut out and which lines should be engraved into the material. Go ahead and separate these two cut types into two different layers within the software you chose to use as seen in Assignment 2.

4. Proceed to M2A2

Option 1: Beneficence Logo

Option 3: CAP Logo

Option 2: Charlie Cardinal Logo

If you have already completed module 1, you have valid vector line work from the Raster to Vector assignment that you can carry through this module. Only a few changes need to be made before it will be ready to take to the laser cutter. Use this assignment to change anything you noticed you didn't like or anything that didn't work for module 1.

Keep in mind, you still will not be able to use fills for this assignment. We recommend simplifying your design if necessary to make separating your line work into cut sheets a bit easier!
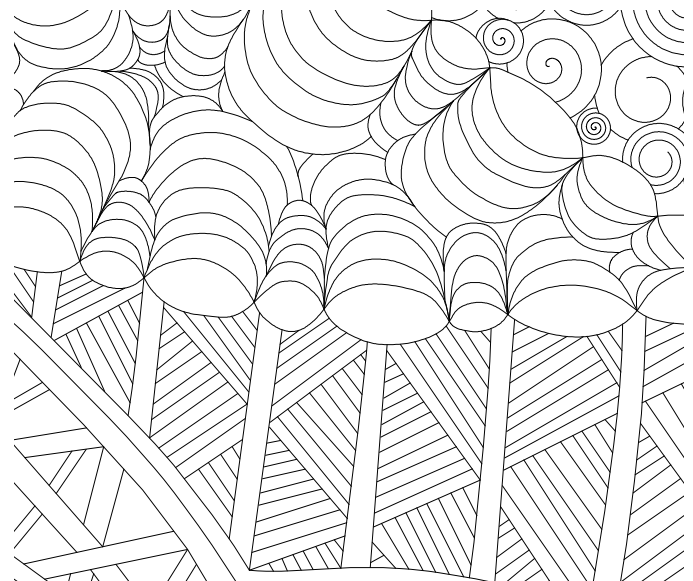
Final Deliverables: One Rhino or Illustrator file with cuts and engraving separated into layers

---

Instructions

1. Open up your vector line work in either Rhino or Illustrator. The laser cutters here at CAP operate through these two programs. Organizing your artwork in one of these two programs will make the next few steps much easier.

2. Look over the line work to ensure there are no double or stray lines. You may make changes to your line work as you see fit. Scale the line work to fit in a 6.5"x6.5" box if it is not already to scale.

3. Analyze and determine the positive and negative spaces in the line work to figure out which spaces need to be cut out and which lines should be engraved into the material. Go ahead and separate these two cut types into two different layers within the software you chose to use as seen in Assignment 2.

4. Proceed to M2A2
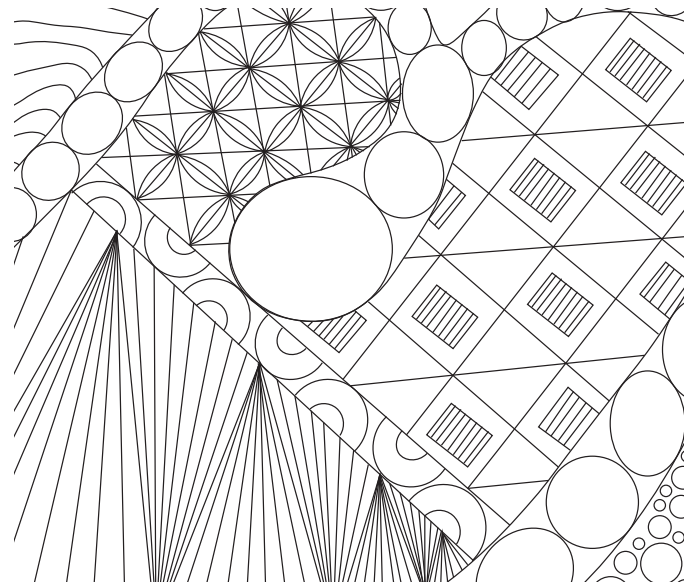
Module 1 Zentangle Vector Example

Module 1 Zentangle Vector Example

On the off chance that you have no interest in doing module 1 and don't want to use one of the pre-made vector options, you can go ahead and hop into any vector software of your choosing and create something completely new. Anything from line work for a project to a logo from your favorite sports team. There are very few limitations to what you can create and then laser cut. You can make your design as complex or as simple as you would like, just be sure that you practice using both the through-cut and engraving functions on the laser cutter.

Final Deliverables: One Rhino or Illustrator file with cuts and engraving separated into layers

Instructions

1. Create vector line work in either Rhino or Illustrator. The laser cutters here at CAP operate through these two programs. Organizing your artwork in one of these two programs will make the next few steps much easier.

-If you do not have access to one of these two programs, you can download Inkscape for free following the links in Module 1 Assignment

2. Look over the line work to ensure there are no double or stray lines. You may make changes to your line work as you see fit. Scale the line work to fit in a 6.5"x6.5" box if it is not already to scale.

3. Analyze and determine the positive and negative space in the line work to figure out which spaces need to be cut out and which lines should be engraved into the material. Go ahead and separate these two cut types into two different layers within the software you chose to use as seen in Assignment 2.

4. Proceed to M2A2
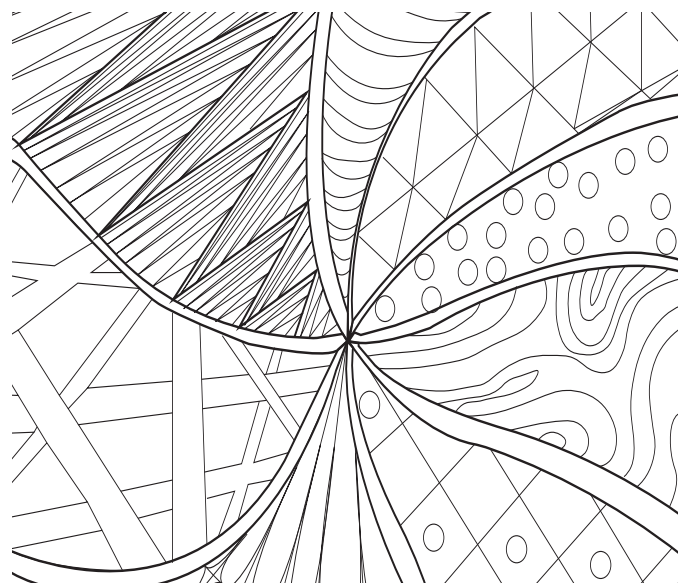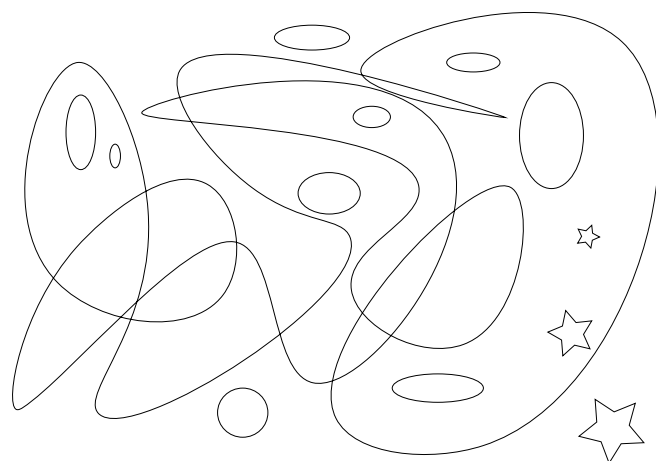
Setting up your cut sheets is one of the most important step towards laser cutting safely and efficiently. Within this assignment you will be separating out your line work into layers by analyzing the positive and negative space of your drawing as well as determining background, middle ground, and foreground of your work. From here you will be able to determine which of your lines will need to be through cuts and which should be engraved. You may have to duplicate your line work in order to ensure you are not missing any piece of the puzzle when you go to assemble after you cut.

Final Deliverables:
One Rhino or Illustrator file with cuts and engraving separated into layers

Instructions

1. Visualize your artwork as a 3D object. This can sometimes be easier said than done. You won't need to create more than two layers unless you are up for the challenge. Make sure your design fits within a 6.5x6.5 bounding box.

2. Determine which software you prefer to use when you will laser cut. You can use either Illustrator or Rhino on the machines here at CAP. Setting up your cut sheets in one of theses two softwares will ensure the results you are expecting.

2. Make multiple copies of the original line work just in case you need to go back to it.

3. Create at least three different layers. One for through cuts, one for engraving, and one for skips. In the example on the right, black represents through cuts, red represents engraving, and blue represents skips. It may be helpful to utilize the engraving function to line up your material for assembly.

5. You can combine multiple cut layers on one cut sheet to save material. The example on the right has three layers.

6. Save your file onto a flash drive or to BSU Onedrive.

7. Proceed to M2A3

Now you finally get to operate the laser cutter. By now you should have valid line work all laid out onto cut sheets and ready to get started on the machines. Keep in mind that this assignment is just a brief rundown of the steps you will need to take to operate the lasers. Please read through the Laser Cutter guide for the software you chose to use (Rhino or Illustrator) before proceeding to cut. If you need any help, please ask an assistant on duty. See M2A3 attachments on our website.
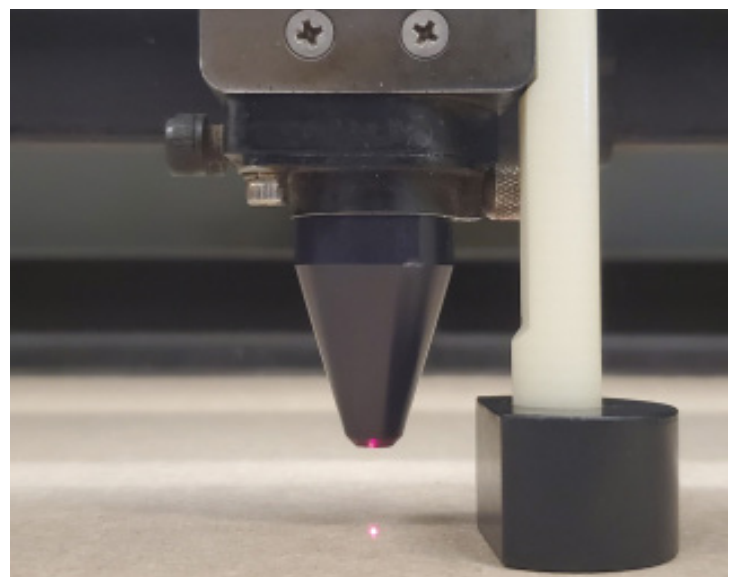
Final Deliverables:
Two images of your laser cut "model." Minimum of two layers thick.

Instructions

1. Use our consultation request form to set up a "first time use" appointment for the laser cutter.

2. When you arrive, log into the computer that is next to the laser cutter you made an appointment to use. Plug in your flash drive and open your file.

3. Make sure you have a 18"x32" or 18"x24" bounding box (depending on which laser cutter you are using) around your linework if using rhino. Or make sure your artboard is set to 18"x32" or 18"x24" bounding box (depending on which laser cutter you are using) if you are using Illustrator.

4. Follow the laser cutter guide to set up your file properly. Keep in mind, each machine requires different values for power, speed, and sometimes dpi even if you are using the same material. Reference the "deck of cards" that is next to each computer when setting up these values for the material you are using.

5. Ensure the laser is focused properly by using the black and white tool that is located in a holder within the machine. Select the "Z" option on the screen and use the arrows until the your laser matches the picture on the right. Do NOT presss down on the material to flatten it during this step.

6. Once your settings and height are checked by an assistant on duty, you are free to cut.
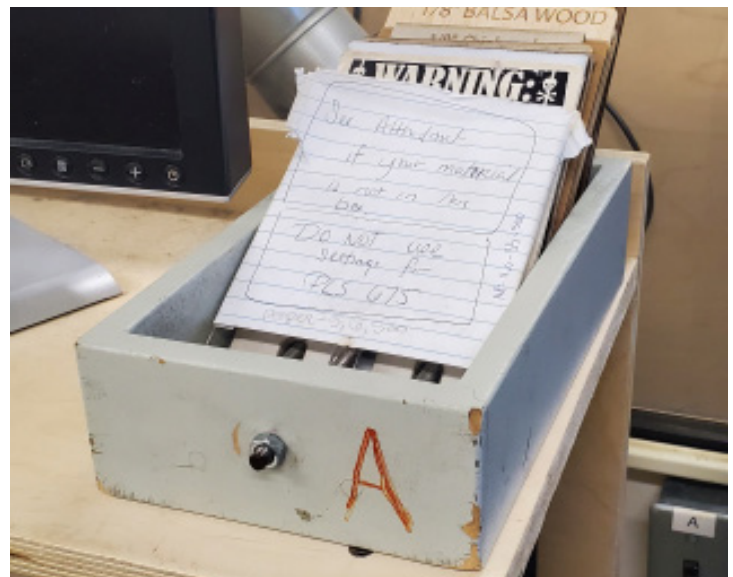
Material "deck of cards"

Proper Laser Height