



Carvey CNC Router



Training:

Required

Reservation:

Required

Please check with Library staff to confirm minimum age certification requirements to use this machine with supervision and without supervision as provided on the Equipment Usage Chart.

Certification

To become certified on this piece of equipment you will need to attend a training class that lasts approximately 40 minutes. By the end of the class you will be able to:

- Install and remove router bits
- Securely load material
- Create your toolpath
- Run your toolpath to cut your object

To sign up for a training session please see the training binder (available at the front desk).

Reservation

To reserve this piece of equipment you will need to first be certified on this equipment. After you have attended a training for the equipment you may sign up for a time slot. To see available time slots and sign up for one please see the Reservation Binder (available at the front desk).

Your reservation reserves the equipment for you to use during that time, if you are more than 5 minutes late to your reservation time you will lose your reservation and the machine may be used on a first come-first served basis.

Reference Sheet

Approved Materials:

ABS	Acrylic	HDPE
Hardwood and Softwood	Aluminum	Corian
Delrin	PVC	Foam
Wax	PCB Board	

Maximum Material Size:

12" wide x 8" deep x 2.75" tall

Machine Accessories:

Digital Calipers	Short Aluminum Standoff (Qty 3)	Tall Aluminum Standoff (Qty 3)
Short Plastic Hold-down (Qty 3)	Medium Plastic Hold-down (Qty 3)	Long Plastic Hold-down (Qty 3)
Short Hold-down Screw (Green) (Qty 5)	Medium Hold-down Screw (Blue) (Qty 5)	Long Hold-down Screw (Red) (Qty 5)
Collet Wrench	Spindle Wrench	Assorted Cutting Bits
Extra Long Hold-down Screw (Yellow) (Qty 5)	Super Long Hold-down Screw (Red) (Qty 5)	Super Short Plastic Hold-down (Qty 5)
Aluminum Standoff Booster (Qty 5)		

Workflow:

- Design (<http://easel.inventables.com/>)
- Set Material, Material Dimensions, and Bit
- Machine Setup
 - Clamp material, install bit
- Power Machine on
- Carve
- Vacuum housing
- Remove Items

Software:

- Beginner: Easel <http://easel.inventables.com/>
- Advanced: Fusion 360

Carvey Desktop CNC Router



Materials and Software:

Carvey Desktop CNC Router
11" x 7" x 1/2" Plywood
1/16" Spiral Upcut Bit (Blue Collar)

Computer with internet access
Vacuum with hose
Digital Calipers

Overview

Makers will learn how to operate the Carvey Desktop CNC Router to carve plywood. Lessons learned may be applied to other materials.

Safety

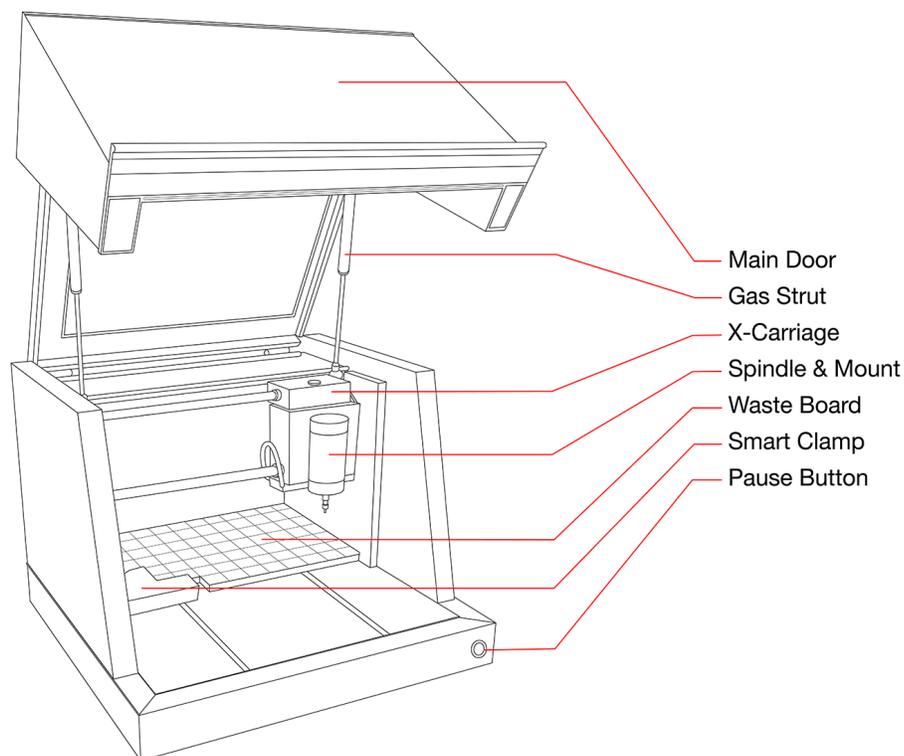
- If the machine is not setup correctly router bits may break.
- Improperly secured material may come loose and damage the machine.

Set Up

Ensure the Carvey is turned off before securing material or changing bits. Download the CNC file in advance, the example CNC file may be found at:

<http://nlc.nebraska.gov/grants/innovationstudios/fake/CNCexample.svg>

Machine layout



Key Concepts

Router

A router is a piece of equipment used to cut through a material. Traditional router materials include woods, plastics, and in some cases metals. A router by itself is a motor with an attachment for holding onto various bits. The style, shape, and size of the bit are highly dependant on the task and material at hand.

CNC (Computer Numerically Controlled)

CNC is the abbreviated term for something that is operated with the control of a computer. A computer turns the tool on, sets the speed, and moves it in space.

Install the Bit

1. Set up the Carvey by first installing the correct bit. Begin by making sure that the Carvey is turned off. Here we'll be using a 1/16" spiral upcut bit with a blue collar (Figure 1). Open the door by lifting up on the handle, the machine has a gas strut that assists opening and closing.
2. Hold the smaller of the two wrenches in your left hand and the larger of the two in your right hand. Using the smaller wrench in your left hand slide it onto the router shaft to prevent the shaft from spinning. Using the larger wrench in your right hand slide it onto the collet nut (Figure 2). Loosen the collet nut by pulling your hands toward you.



Figure 1 - 1/16" Spiral Bit



Figure 2 - Loosening the Collet

3. Insert the router bit until the blue collar is flush with the collet and tighten the collet by holding the wrenches as described in Step 2 and pushing your hands away from you. Check that the router bit is properly installed and snug in the collet (Figure 3). If the collet is not tight enough the router bit may slip out of the collet during the job.



Figure 3 - Installed Bit

Secure your material

1. Before securing material measure the thickness using the digital calipers (Figure 4). Write this number down on a piece of scratch paper. Note that the thickness of your material may vary from the example, use the measurement of your material.



Figure 4 - Measuring Material Thickness

2. Using a tape measure measure your material. Write down the length (longest dimension) and width (next longest dimension), it should be approximately 11.5" x 7.5".
3. Remove the hold-down screws on the smart clamp in the lower left corner and fit your plywood securely against the smart clamp standoffs. Using the three short standoffs, the three medium plastic hold-downs, and the five medium hold down screws (blue) secure the plywood (Figure 5). The plywood should be secure, if you can move it without loosening the standoffs it is not secure enough. The aluminum standoffs and hold downs can not extend past the back of the cutting bed or the machine will not operate. Outside of this training make sure to not place the plastic hold-downs where the CNC will be cutting as the machine will damage the hold-downs. Close the lid.

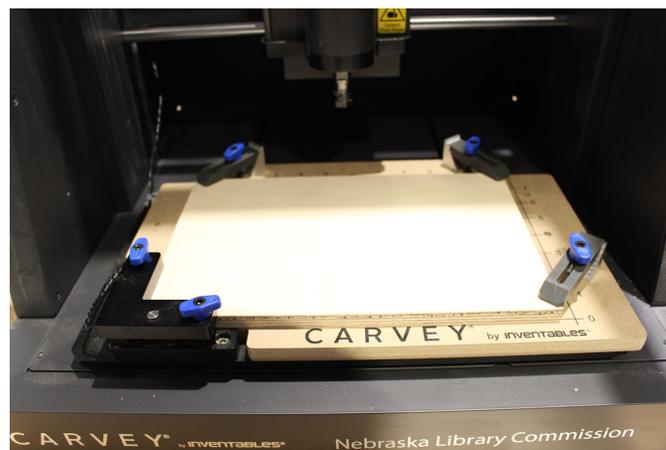


Figure 5 - Properly Secured Plywood

Software Setup

1. On the computer use a browser to go to <https://www.inventables.com/sessions/new> Create an account if you don't have one. Create a new Document. The Easel Design Interface uses a left hand screen for editing designs and a right hand screen for showing a preview of your job (Figure 6)

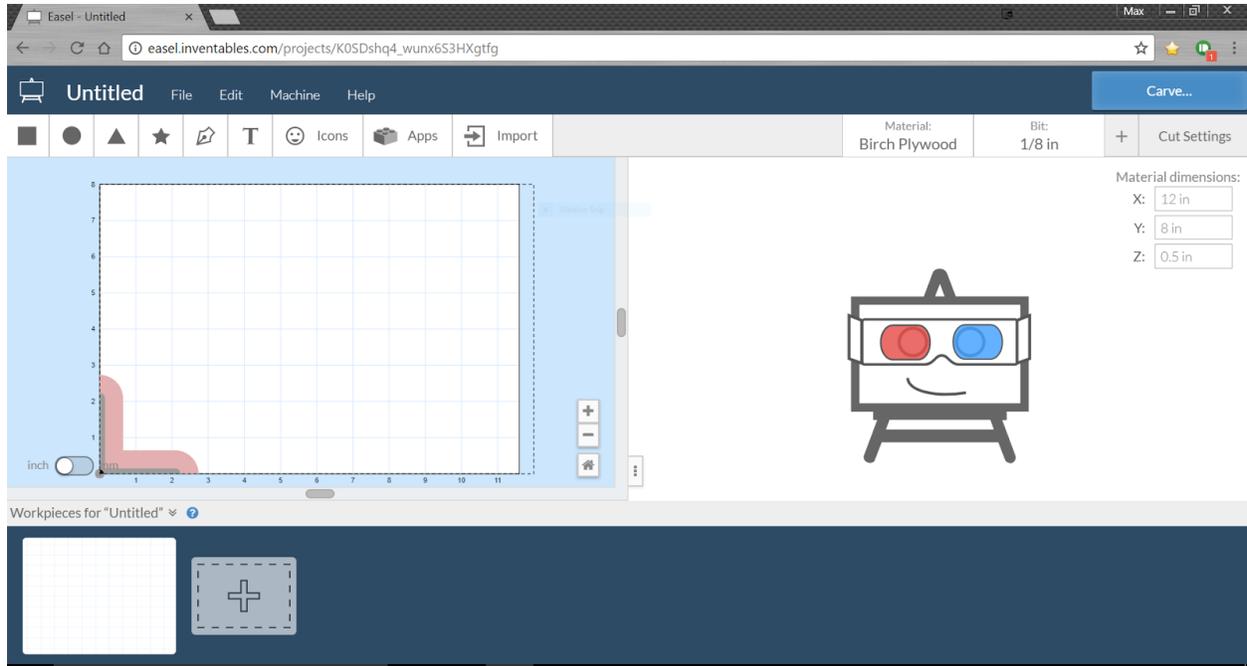


Figure 6 - Easel Interface

2. Set up Easel for the Carvey by clicking on "Machine" in the upper left hand corner and select "Carvey" from the drop down dialog.
3. Set up your piece by editing the Material, Bit, and Material Dimensions in the upper right hand corner to the following:
 - Material: Birch Plywood
 - Bit:
 - Type: Upcut
 - Size: 1/16 in
 - Color: Blue
 - Material Dimensions:
 - X: The Length you Measured (Approximately 11.5")
 - Y: The Width you Measured (Approximately 7.5")
 - Z: The Thickness you Measured (Approximately 0.48")
4. The left hand side of the screen is where you will edit your toolpaths and the right hand side shows a preview of your tool paths and material. Easel comes with several tools to create designs in this interface as well as an "Import" tool which allows you to import designs created in another program.

- Start by placing the example file in the work area by:
Clicking "Import" and selecting "SVG."
Navigate to the example file and select "Open"
- Keep all of the shapes aligned by
combining them into one object.
First, click and drag to highlight
all of the shapes.
Then right click and select
"Combine" (Figure 7).

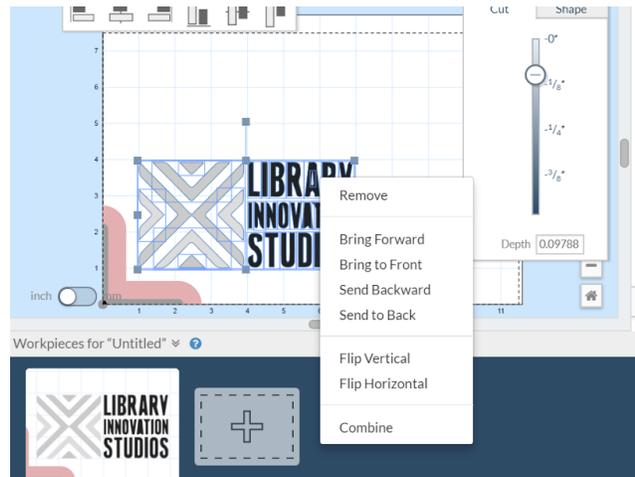


Figure 7 - Combining Objects

- Adjust the cut depth of your object by:
Click and drag the object to the center of the material.
Adjust the depth of the engraving by moving the slider to 1/16" or typing .0625 in the
depth field (Figure 8)

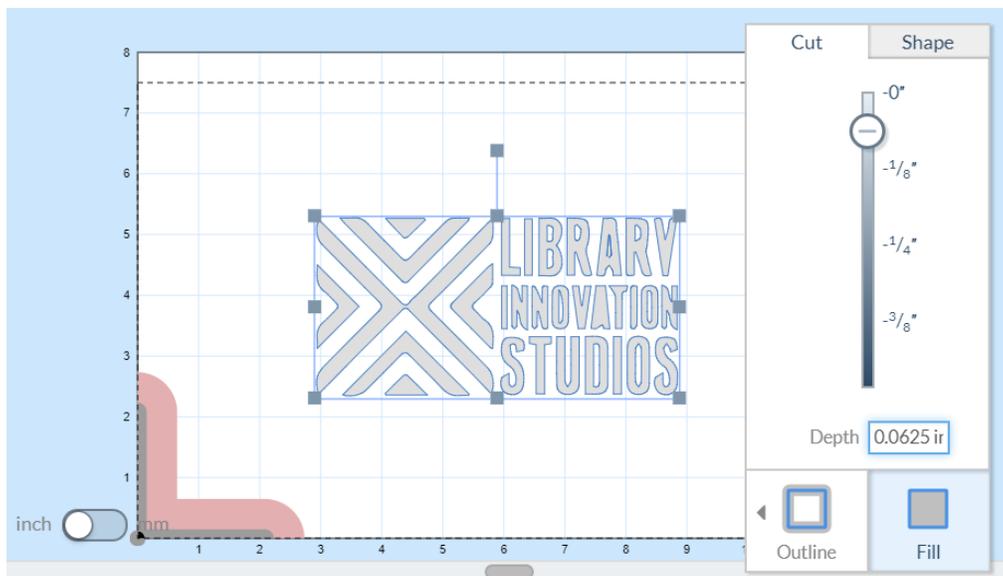


Figure 8 - Setting Cut Depth

- Simulate the cut by clicking "Simulate" in the lower right hand corner of the preview screen.
Note the time estimate in the lower right hand corner. The blue lines are the toolpath when it is
carving the material and the red lines are the toolpath when it is not carving the material.

Carve

1. Power on the Carvey and close the door. In the upper right hand corner of the Easel interface select "Carve."
2. The software will prompt you to verify the material and dimensions of your workpiece.
3. Standby when the CNC begins to cut the material, you may pause the job from the Easel interface by pressing the pause button, or by pressing the "Pause Button" on the front of the machine. Stay near the machine while it is operating in case of an error.
4. When Carvey is done cutting the spindle will turn off and the head will return to its home position, you may now open the door.
5. Use the vacuum to clean up the sawdust from on top of your piece and from the housing of the machine. When you remove the clamps and screws from the build plate return them to the accessories box. Turn the Carvey off.

Additional Resources

Advanced Design and Toolpath Creation - Fusion 360

<https://www.autodesk.com/products/fusion-360/>

Troubleshooting

Problem: The machine will not proceed past initialization during Carve.

Solution: Aluminum standoff or plastic hold-down may be extending past the end of the bed. Rearrange the hold-downs so that they do not hit the back of the housing.

Problem: Easel can't connect to the Carvey CNC Router

Solution: Unplug Carvey's USB cord from the computer, wait a moment and retry the connection.

CorelDRAW Trace Guide

Most equipment with the Library Innovation Studios requires vectors to operate. The CNC router specifically will only cut vector lines. There are two options to convert an image from a raster to a vector. First is manually recreating the design using CorelDRAW's drawing tools. This option can be more accurate to the actual design but it takes a lot of time and expertise. Tracing is a function in CorelDRAW that will automatically convert raster images to vector images based on a few parameters.

Begin by pasting or importing an image into an artboard.

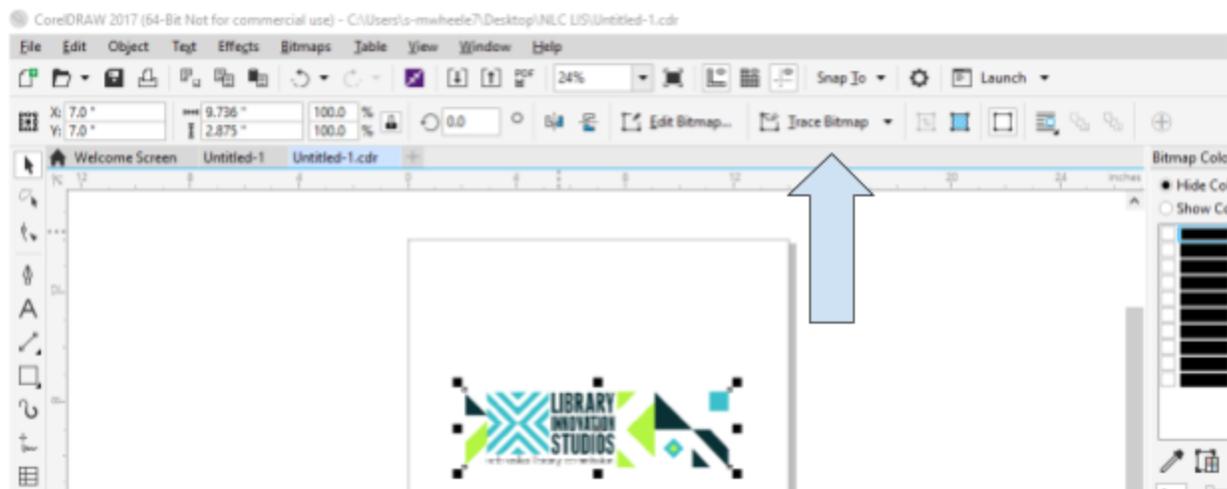
Copy/Paste

Right clicking on an image and selecting "Copy" places the picture on the computer's virtual clipboard, right clicking on the artboard in CorelDRAW and selecting "Paste" will add the image to the artboard. Not all images can be put onto the artboard in this way. If this fails move onto the Import option.

Import

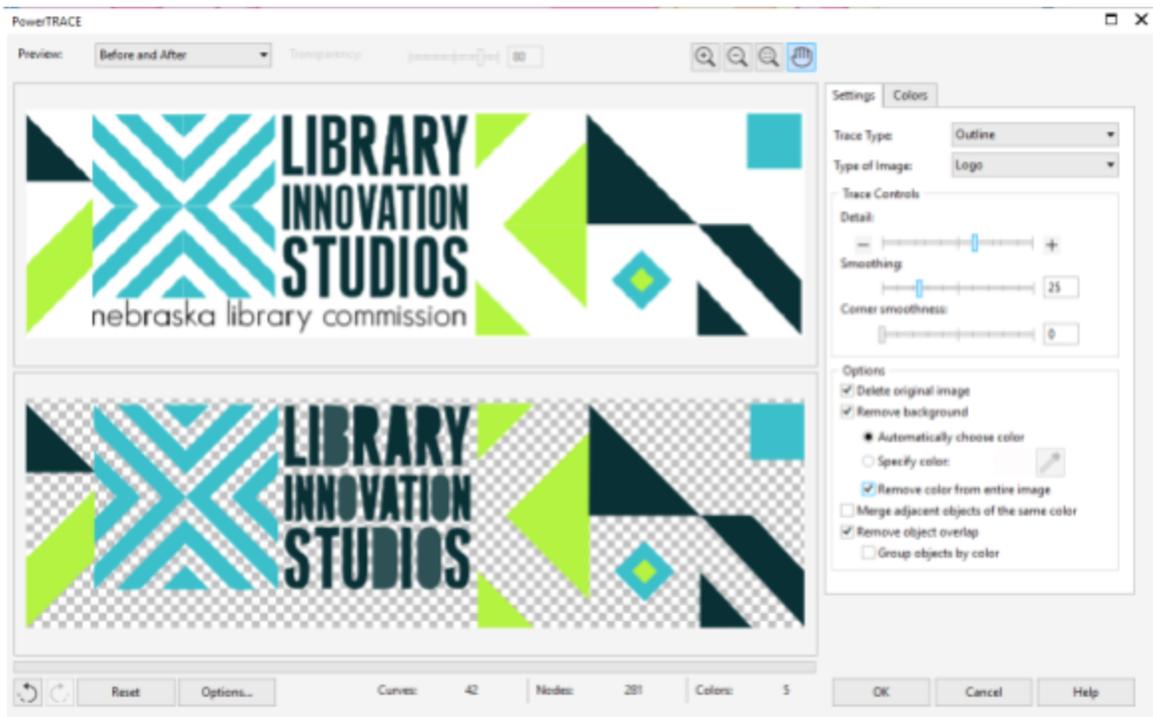
Save the file to the computer (either the desktop or a flashdrive) and then go to your CorelDRAW file. Select "File" and then "Import." Navigate to your file and select "Import." A single left click will place the image on the artboard, or by left clicking and dragging you can specify the size of the object.

With the object now on the artboard and the object selected click "Trace Bitmap" in the upper toolbar. There are different preset Traces depending on what sort of image you're tracing, try experimenting with them to find the one that works best for your image.



Each trace will show the original image and a preview of the Traced image. By adjusting the Detail, Smoothing, and Corner Smoothness you may find more or less accurate results. You will find there are some details that do not trace well. Overly complicated designs or small text will often be ignored by the Trace function.

For best results with the CNC Router make sure not use overly detailed designs. The CNC router has limitations on the smallest piece that it can make and if Easel detects that a design is too small to machine it will just leave that part off the design.



After clicking "OK" the design has now been converted to a vector design and it may be saved as an .svg file and imported into Easel.