**Lab 06: Laser Engraver and Inkscape**

**I. Purpose**

1. Provide an overview of setup for the Laser Engraver
2. Provide experience operating the lab Laser Engraver
3. Provide experience using Inkscape to create images for the lab Laser Engraver

**II. Practice**

For this lab, your team will cooperate to create a set of six key tags. Follow these steps to produce the key tags, and document the process, as necessary, in your engineering notebook.

**Overview of Operations:**

1. Load the Inkscape program on your lab computer. The icon should be located in the lower-right corner of the desktop. It may take several minutes to load, depending on the machine.
2. Observe and take notes as the lab instructor explains the Inkscape and Laser Engraver interfaces
3. In Inkscape, you will perform the following operations:
	1. **Set Up** a new document
	2. **Customize** the template to create your team’s unique key tags
	3. **Save** the document for use on the engraver
4. For the Laser Engraver, you will perform the following operations:
	1. **Turn on** the exhaust fans and engraver
	2. **Fixture selection** and installation
	3. **Production** operations
	4. **Change-Over & 5S** activities

Follow the steps to draft your key tag:

**Before You Begin:**

The lab instructor will have a spreadsheet open. Each student will put their name in one of the six cells in the spreadsheet. This will give a mapping of student to number. In each of the laser engraver “passes”, there is a green comment number in the top-left corner. This number indicates the cell the student is to work inside. ***The number in the corner on each pass is not the same***. You must look and see which rectangle you will work in at each pass, rather than work in the same cell for both passes.

**Set Up:**

1. ***File>New from Template***…
2. select the “**keychain**” template and click the “***Create from Template***” button in the lower-right corner
3. If the **Layers** dialog is not open in the right dock:
	1. ***File > Layers***…
4. Highlight “***First Pass***” in the **Layers** dialog
5. Delete every rectangle which does not contain your number.

**Import an Image for Raster Engraving**

1. Import the School of Mines logo:
	1. At the top menu, select ***File >Import >Desktop >Lab*** folder
	2. Locate the file ***jpg\_MlogoBlack.jpg***
	3. Click ***Open***
	4. Set **Image Rendering Mode** to ***Blocky***
	5. Click ***Ok***
2. Convert the raster image into a vector image that we can control more easily:
	1. Right-click on the imported image
	2. Click ***Trace Bitmap***…
	3. Select ***Brightness Steps***, and set the number of scans to **2**. Click ***Ok***
	4. A vector image is now sitting on top of the imported raster image. With the ***Select*** tool, move the newly-created image to the left on the screen and almost off the raster image
	5. Select the raster image and press the ***Delete*** key
	6. Select the vector image and on the top toolbar, on the left side, click the “***Rotate Selection 90° Clockwise***” button
	7. Holding the ***Ctrl*** key, drag one of the corner arrows to scale the image down, and move it around, until it fits inside your rounded rectangle.
3. To make sure the image is in the correct layer, click on the eyeball icon on the left of “***First Pass***” in the **Layers** dialog window. The image should disappear. If it does not:
	1. Right-click on the image, and click ***Move to Layer***…
	2. Select the “**First Pass**” layer (you may need to expand **Production** to see the “**First Pass**” option)
	3. Click ***Move***

**Create Vector Engraving Text:**

1. Click the ***eyeball*** next to **Second Pass** until the second image appears, and click the ***eyeball*** next to **First Pass** and **Comments** to make them disappear.
2. Select and delete every rectangle that does not contain your number.
3. Select the ***Second Pass*** layer in the **Layer** dialog
4. On the left toolbar, find the “A” button for Create and Edit Text Objects, then click on it.
5. Click inside the rectangle with your number, at a location to place the text for your name:
	1. Type your name
	2. Click the ***Select*** tool from the left toolbar (near the top)
	3. Resize and locate your name to fit inside the rounded rectangle with your number
	4. With the name still selected, go to the top menu and click ***Path > Object to Path*** to convert the text into a path object for printing
	5. Close the **Trace Bitmap Window** (right side)
	6. Open the **Fill** tab in the dialog window on the right side, and:
		1. Click on the small ***X*** next to the rectangle in the dialog, changing the **Fill** tab to **No Paint**
		2. Click on the **Stroke Point** tab:
			1. Click on the shaded box for ***Flat Color***
			2. Set the following color parameters: ***Red*** = **0**, ***Green*** = **0**, ***Blue*** = **255**, ***Alpha*** = **255**
		3. Click on the **Stroke Style** tab
			1. For the **Width** ***units*** box, choose ***px*** (pixels) for the units
			2. Set the ***Width*** value to 0.3, and
			3. Press the ***Enter*** key

**Save Your File:**

1. Click ***File > Save***
2. Navigate to your team’s folder
3. Name your file <First initial><Last name>**.svg**
4. Copy your .svg file to the team jump drive, and take it to the laser engraver

**Laser Engraver Operations:**

**Turn On:**

1. Open the **UCP** software (red square icon on the tray) for the laser engraver machine
2. While that loads, locate the two exhaust fan switches on the west wall, and turn on ***both*** the **Yellow** and **Blue** switches
3. Once the **UCP** is open, click the red ***power*** button on the top-right of the screen. The laser engraver’s compressor should start, and the shuttle should home itself automatically
	1. If, during operation, it becomes necessary to return the engraver to “home”, select the ***Focus View*** button, then click “***Home XY***”. This will cause the engraver to send the shuttle back to the hard home position along the X and Y axes.

**Fixture Selection:**

If a Rotary fixture (for mugs or other roughly cylindrical items) or a honeycomb Cutting Table (for items that will be cut all the way through) are to be used, it is necessary to insert the appropriate fixture and re-focus the engraver:

1. Select the appropriate fixture (Rotary, Cutting Table or None):
	1. For this lab, the Honeycomb Cutting Table is to be used, along with a custom wood positioning fixture.
	2. If the Cutting Table is not in the engraver, it is to be placed underneath the engraver for storage.
	3. If working with flammable materials, such as wood, ensure the small, Air Assist Back Sweep attachment is installed to prevent damage to the engraver optics.
2. Open the panel on the front of the engraver
3. If adding the cutting table, return the bed to its lowest setting by clicking the red ***Home Z*** button on the right side of the UCP window, and click ***Yes***
4. Place the appropriate fixture in the bed of the engraver, and place it in the top, left corner along the cutting table guides
5. Set the zero distance for Z:
	1. Find the **HPDFO** focus length tool in the drawers
	2. Load the workpiece into the fixture
	3. In the UCP window, select the red ***Focus View*** button, then
	4. Select the red ***GO…*** button
		1. Enter **2** in the **X:** box
		2. Enter **2** in the **Y:** box
		3. Click the red ***GO TO*** button at the bottom of the XY group
	5. Load the workpiece into the fixture, and replace it in the table corner
	6. Holding the tool flush against the front of the shuttle, jog the **Z** axis up until the notch on the tool sits flush against the bottom edge of the shuttle
		1. There should be no “wiggle” when the tool sits there, and the tool’s edge should sit flush against the front edge of the shuttle
	7. Switch the UCP software to the **System** tab
	8. Under the **Cutting Table** box, click ***Calibrate***
	9. Click ***Save***, then ***Yes*** to accept the new zero for the Z-axis
	10. Switch back to the **Viewer** tab

**Production:**

1. Open the black **Inkscape** button from the system tray (bottom of the screen)
2. Open your project file from the jump drive:
	1. ***File >Open > Computer > USB20FD (E:) > Lab*** nn
	2. Highlight your .svg file, and click ***Open***
3. Open the **Layers** dialog in the right edge of the screen
	1. Close the eyeball next to the Second Pass and Comments
	2. Open the eyeball next to Production and First Pass
4. Send the image to the engraver:
	1. Select the **Extensions** tab then  **̶ *> Laser Engraver > Send to Laser Engraver***
	2. In the **Materials Database**, select the correct material:
		1. In this lab, select ***Natural > Wood > Medium Wood > Birch***
		2. Set the ***Material Thickness*** to **.135”**
		3. Set the ***Cut Power*** to **+50%** using the sliders
	3. Press the **Ok** button.
		1. At this point, the screen will likely change to something else. If the screen that comes up is *not* the UCP software, hold the ***ALT*** key and press ***Tab*** key until the **UCP** screen appears.
	4. Ensure the print will happen within the fixture:
		1. Ensure the engraver lid is open. This will make a visible red dot appear where the shuttle points.
		2. Click on the red ***Focus View*** button, then in the window, select a point on the bottom-right, top-left, top-right and bottom-left corners of the project, in any order. Ensure that the laser does not land outside the fixture at any of these points.
			1. If the red dot falls outside the fixture window at any of these four points, ***DO NOT BEGIN ENGRAVING*** until you have confirmed with your lab instructor
	5. Once the window is correct, close the lid and all panels on the engraver and press the green ***Play*** button to begin engraving.
	6. Hover your mouse over the ***Pause*** button until all engraving is safely completed
5. Open the lid, remove the material from the fixture, flip it horizontally, and replace the material in the fixture.
6. Return to the Inkscape window
7. Set the eyeball for ***First Pass*** to **closed**, and the eyeball for ***Second Pass*** to **open**
8. Repeat ***Step 4***

**Change-Over/5 S:**

1. Remove all materials and the lab fixture from the engraver, leaving the material and completed parts inside the wooden lab fixture
2. Open the front panel of the engraver, carefully remove the honeycomb cutting table and place it under the engraver
3. Turn the Engraver off by pressing the Power button in the UCP
4. Ensure all lids are closed
5. Turn off both exhaust fans at the wall
6. Holding the fixture over a wastebasket, remove the individual parts and dispose of scrap according to lab instructor directions

*Turn in your tag to your team box for grading. There is no lab report for this work.*