

Make

PROGRAMME GUIDE

MakeIT with Laser Crafting Starter Session



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REQUIRED MATERIALS

Content**1 - The Hook**

15 minutes

2 - The Activity

100 minutes + 10 minutes break

3 - Extensions

25 minutes

1. Introduction to Digital Cutters**1. How Does a Laser Cutter Work?**

How a laser cutter works and the components

2. Safety Considerations for Laser Cutting

Safety features of laser cutters and how to safely operate Lionsforge Craftslaser

3. Designing Laser Cut Parts

Use Tinkercad to make a keychain, prepare cut file using Inkscape, and cut on laser cutter

1. Frequently Asked Questions

Materials

What You Need

1. Tinkercad Account - www.tinkercad.com

2. Inkscape - www.inkscape.org

Inkscape also needs a laser cutting plugin, such as J Tech Photonics plugin for Inkscape
https://jtechphotonics.com/?page_id=2012

What You Don't Need

1. Laser Cutter -

MakeIT provides access to the Lionsforge Craftlaser, which may be booked for up to 2.5 hours.

MakeIT will also provide **one** A3-sized sheet of 3mm clear acrylic, MDF, or bamboo plywood for cutting per booking.

REQUIRED MATERIALS

Learner's Profile - Confidence Card**Need Help**

Need help
understanding
content

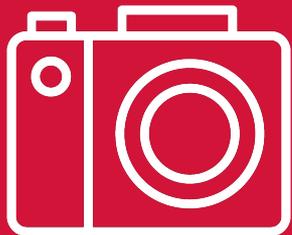
Understand

Content is paced
well and is
understandable

If you need help during the programme, feel free to ask. Our team is happy to pace this content to your needs.

Feel free to also help others! If you notice somebody struggling, offer your support.

A Maker values curiosity, exploration, and openness.



MakeIT

Smile!

**You might be our
next star maker!**

Please be reminded that photos and/or videos of this programme and its participants may be taken.

Introduction to Digital Cutters

How do we cut things?

That depends on what we need to cut.



Paper



Scissors



Wood



Saw



Steel



Angle Grinder



Leather



Rotary Cutter

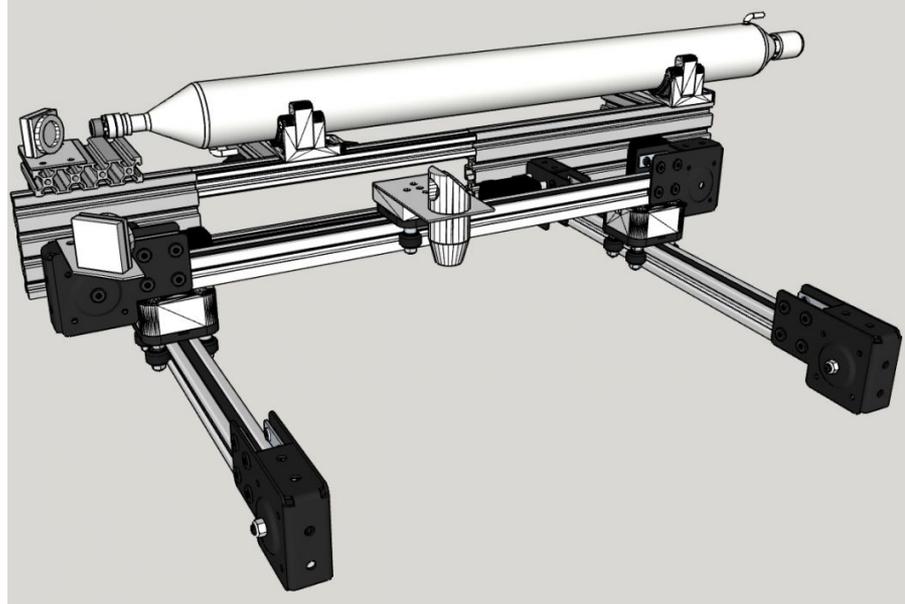


THE HOOK | SECTION 1.1 | 15 MINUTES

Introduction to Digital Cutters

Manually cutting objects can be tedious for the following reasons:

1. You don't have the appropriate tool available to do the job
2. You don't have the strength or dexterity to cut the workpiece yourself
3. You don't have enough time to cut your object
4. You don't want to waste excess material



Digital, or automatic, cutters, use mechanisms to direct a cutting head across a workpiece. There are many kinds of digital cutters available, each designed to work with specific materials.

Introduction to Digital Cutters

Die Cutting



A die is created that presses into the cut material, making the part.

Vinyl Cutting



A bladed cutting head presses into cutting material, controlled by a computer.

Laser Cutting



A laser beam fires into cutting material, controlled by a computer.

Introduction to Digital Cutters



A **digital cutting** machine enables cutting of precise designs done on a computer otherwise known as **Computer Aided Design** or **CAD** for short.

What used to be an industrial service is now made accessible by the introduction of desktop digital cutters at a **fraction of the cost**.

Introduction to Digital Cutters



This video describes the features of laser cutters, how a laser cutter works, and the three types of laser cutters available.

THE HOOK | SECTION 1.1 | 15 MINUTES

Introduction to Digital Cutters

Laser cutters cut or etch planar (flat) materials, which can be assembled together afterward. There are many applications, including the following:

1. Making **mechanical parts**, such as gears, plates, pinions, and precision parts
2. Creating **structural parts** for enclosures, puzzles, or cabinetry
3. **Engraving** and **cutting** logos
4. Making **stencils** for painting, lithography, and decorations



Lionsforge created the Little Hands, Big Hearts initiative, which connected designers with children to build toys for the holiday season. 130 toys were built in 2020.

Introduction to Digital Cutters

Laser cutters are among the most accurate tools to use for making objects, allowing for very precise measurements to be incorporated into designs.

Learning how to design and create objects using a laser cutter can transfer over to other digital cutting machines. Many of the file types and work processes are similar!



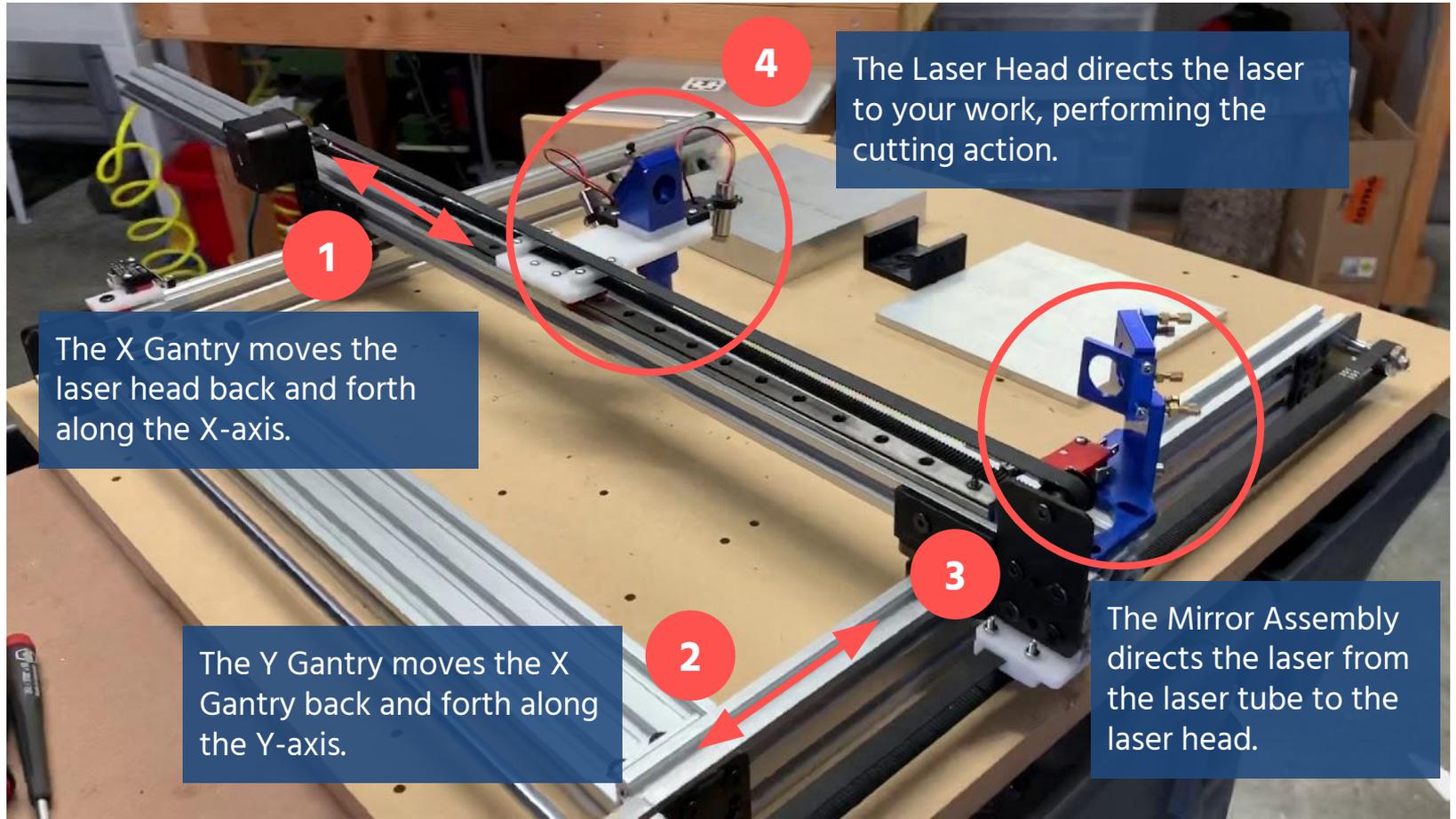
Every cutting tool creates a cutting pathway, called a kerf. The width of the kerf of a laser cutter is typically 0.2mm, or the width of a human hair. We can incorporate this into our designs to get very accurate parts.

HOW DOES A LASER CUTTER WORK?

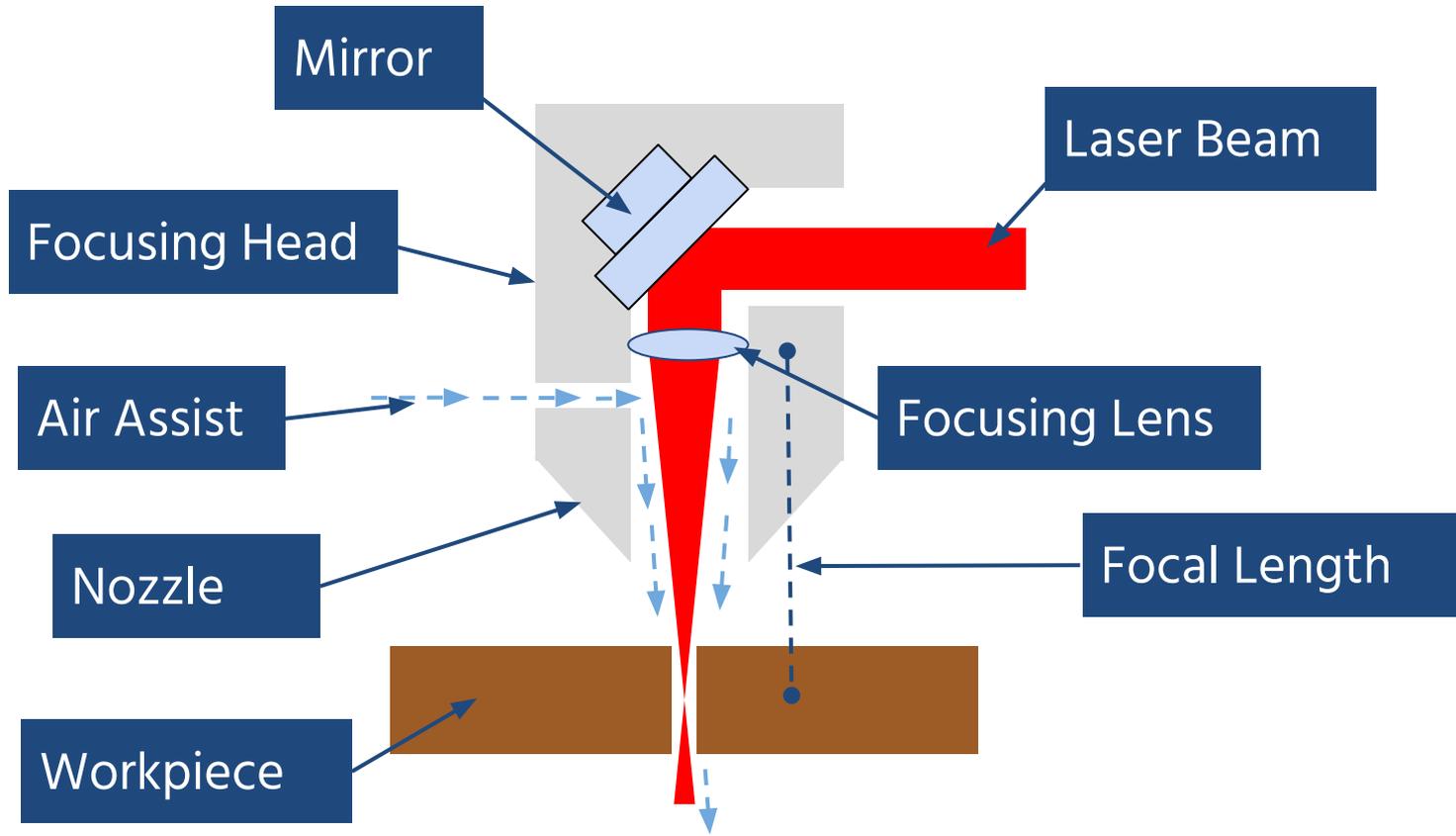
Make



How does a Laser Cutter work?



How does a Laser Cutter work?



PARTS OF THE LASER CUTTER

Make

A large, semi-transparent watermark of the 'Make' logo is centered on the page. The logo consists of the word 'Make' in a sans-serif font, followed by a square icon containing a stylized 'M' shape.

How does a Laser Cutter work?

Control Knob

All settings and file selection can be done using this knob.

LED Indicator lights

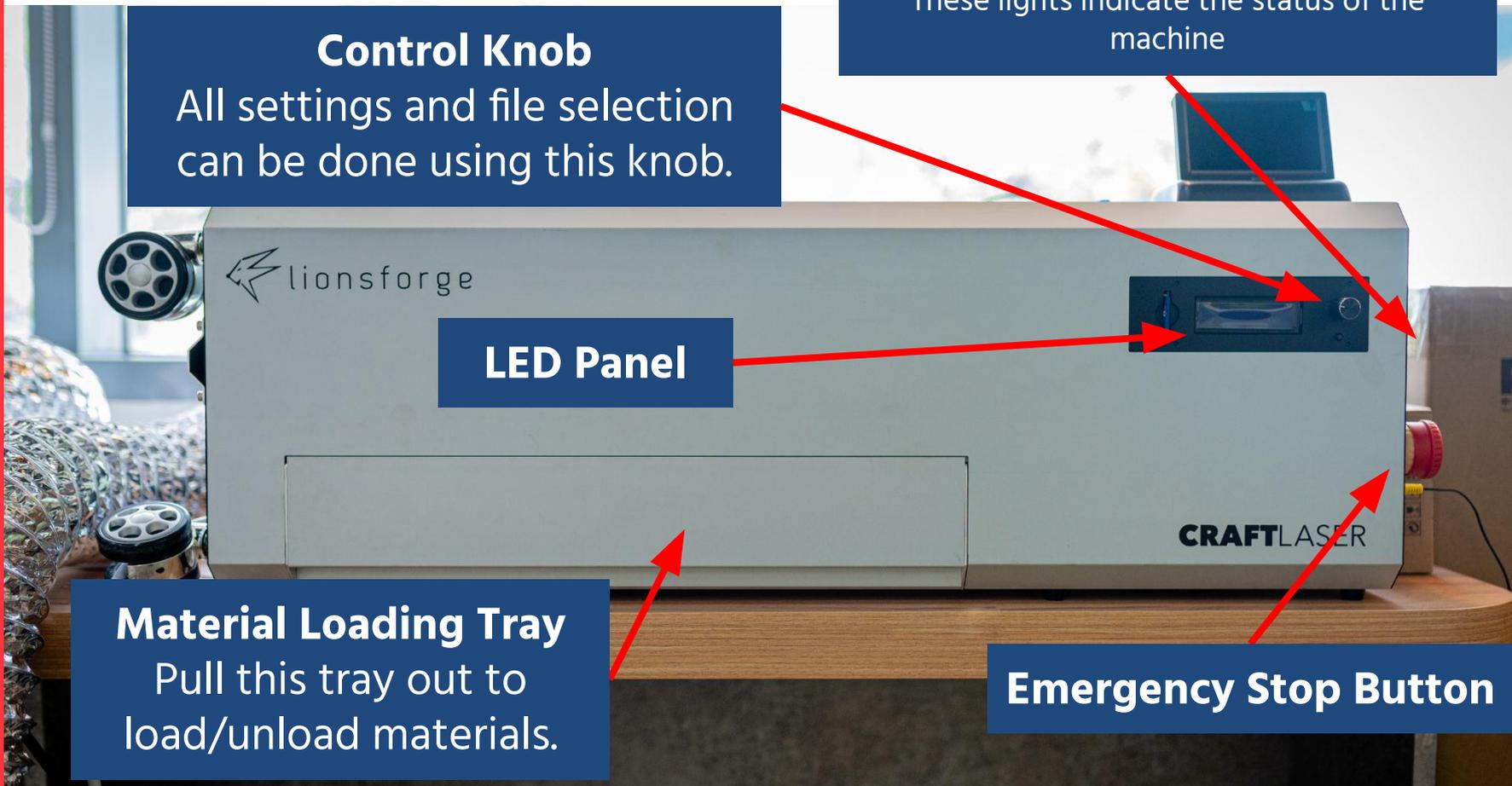
These lights indicate the status of the machine

LED Panel

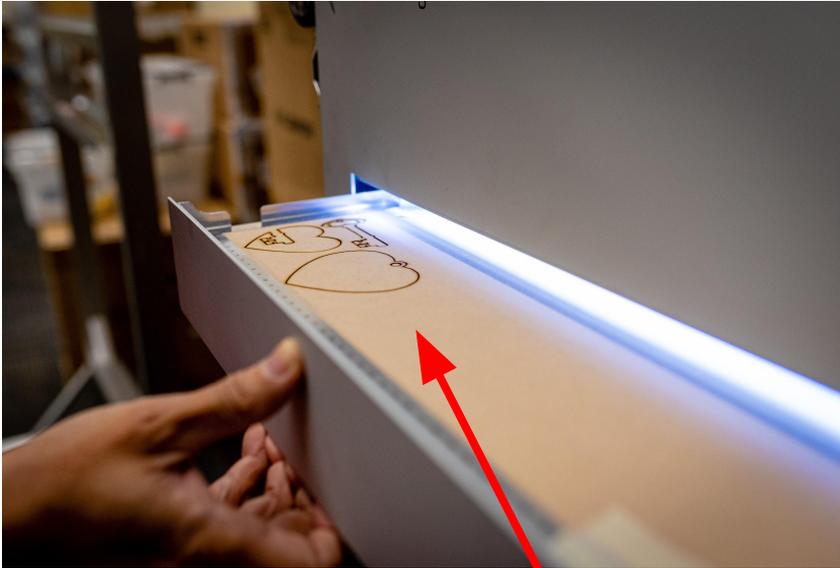
Material Loading Tray

Pull this tray out to load/unload materials.

Emergency Stop Button



How does a Laser Cutter work?



Material Loading Tray

Pull this tray out to **load** and **unload** materials. To secure your material in the tray, you might need to tape the material down. We will demonstrate how this is done later in the class.

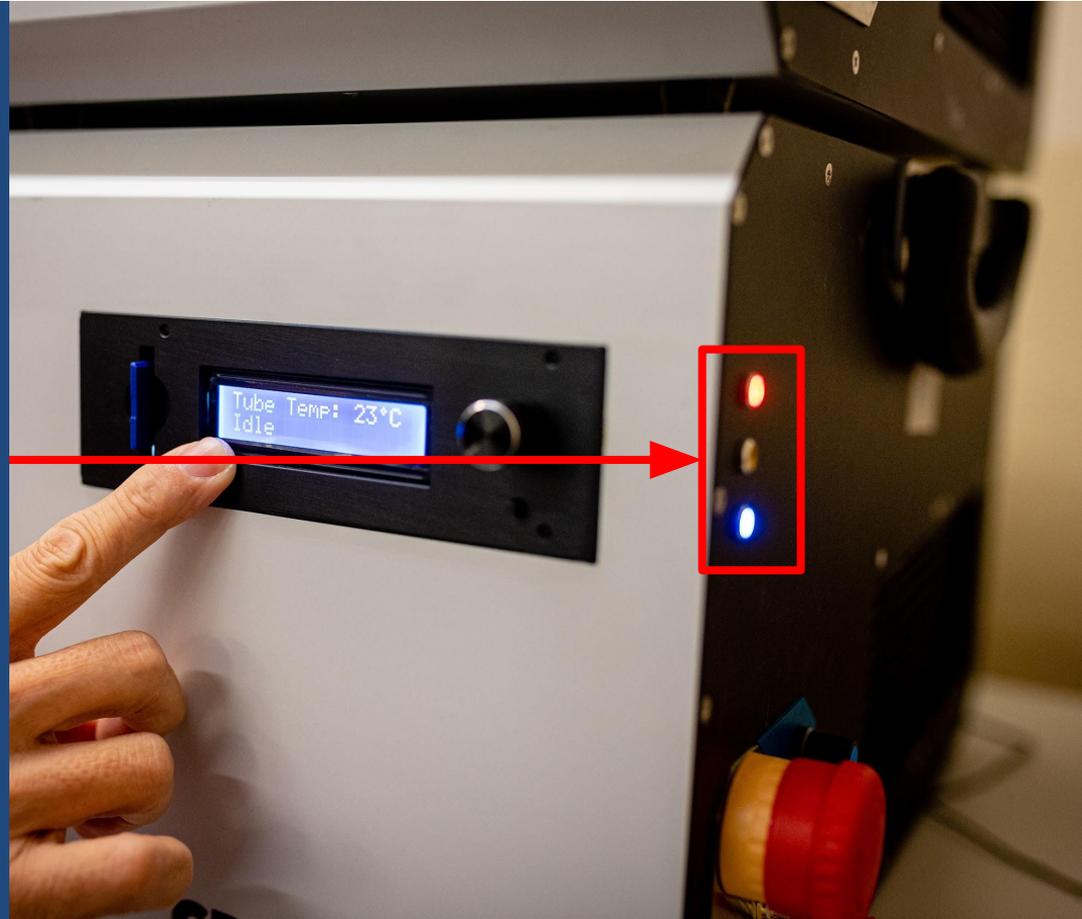
How does a Laser Cutter work?

LED Indicator Lights

Top Light (Tray Status) -
Red Light on indicates the materials tray is closed

Middle Light (Laser Status) -
Yellow Light on indicates the laser is firing

Bottom Light (Water Status) -
Blue Light on indicates the cooling system is functioning



How does a Laser Cutter work?

LED Indicator Lights

Check the status of the lights before using the laser cutter.

The **red and blue lights should be on** when you're ready to start a cut.

If they are not and your material is in the tray, notify MakeIT staff.



THE ACTIVITY | SECTION 2.1 | 20 MINUTES

How does a Laser Cutter work?

SD Card Reader

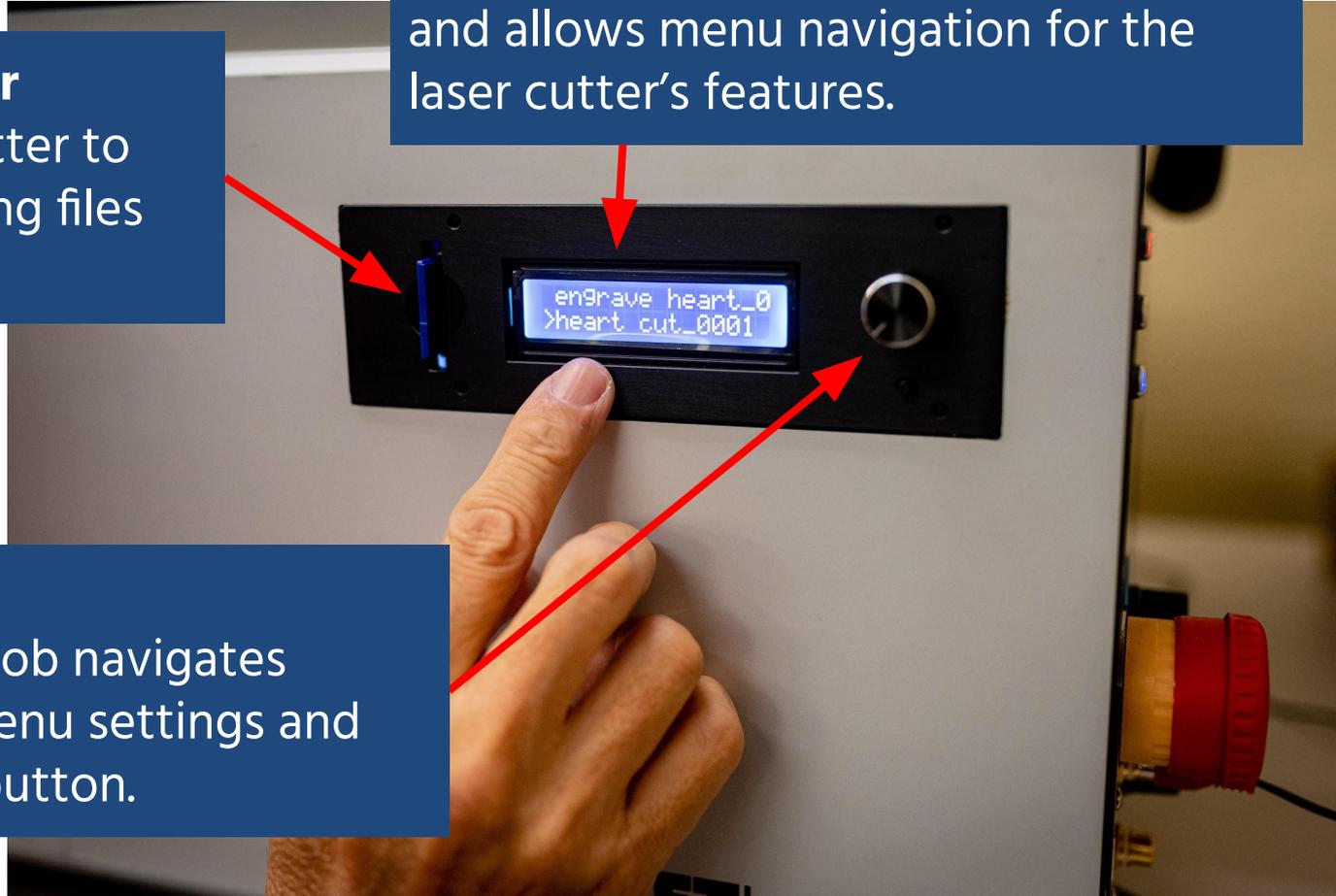
Allows laser cutter to read laser cutting files for cutting.

LED Panel Display

The LED Panel displays key information and allows menu navigation for the laser cutter's features.

Control Knob

The Control Knob navigates through the menu settings and also acts as a button.



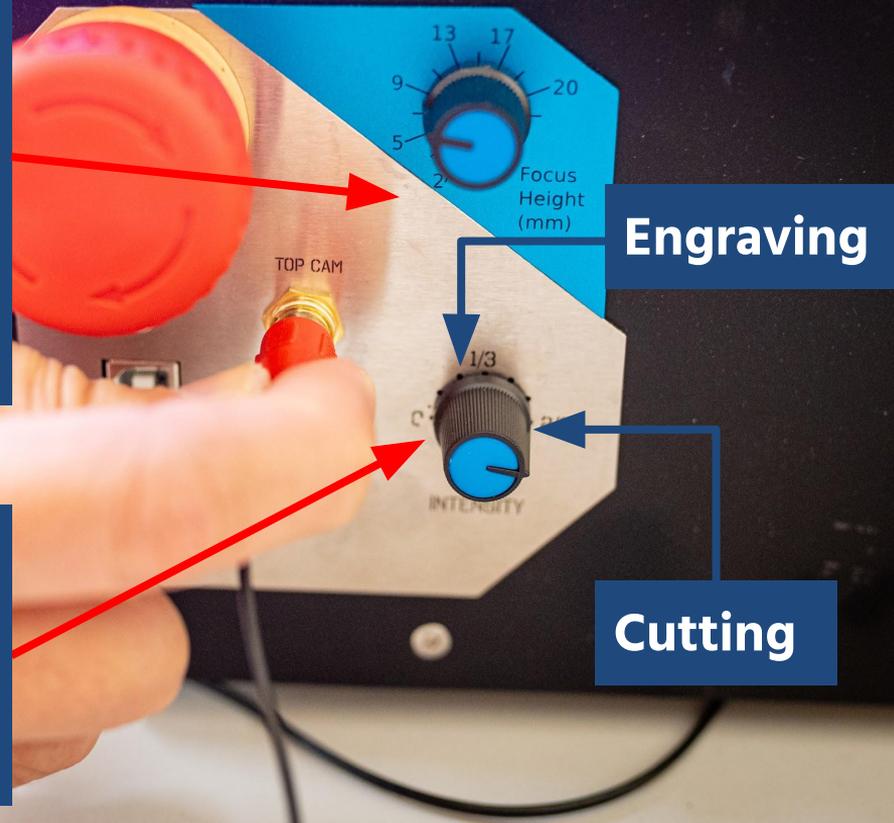
How does a Laser Cutter work?

Laser Height Adjustment Knob

This knob allows you to adjust the height of the lens in relation to the material to focus the laser beam. Please ask MakeIT staff if you are unsure of how to make this adjustment.

Laser Power Control Knob

This knob controls the laser power. The setting depends on whether you are cutting or engraving.



SAFETY WHEN USING THE LASER CUTTER

Make 

Safety Considerations for Laser Cutting

Lasers concentrate light into a precise beam, allowing for energy to be directed to specific places. This can produce a lot of heat, which can be useful for work such as cutting, as well as being very bright.

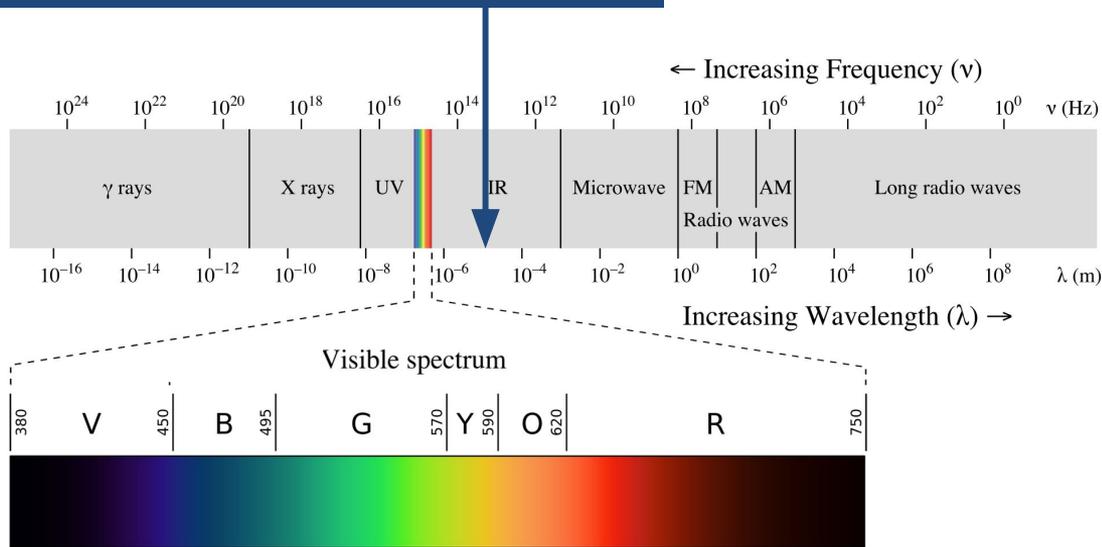
Our eyes can only detect a small spectrum of the electromagnetic spectrum, and many lasers that are used produce light that we cannot see with our eyes but can still pose a hazard.



Any laser can pose a potential hazard while being used. Always understand the risks and hazards possible when using a laser-based product.

Safety Considerations for Laser Cutting

CO2 Laser - 9.6 and 10.6 μm



Laser beams that we cannot see can still damage our eyes.

The laser used melts material, and can set a variety of materials aflame. Always be present when cutting materials.

Safety Considerations for Laser Cutting

All laser appliances are classified into one of four classes. All laser appliances will have a label showing its class.

Check out the following URL for hazard levels for each class of laser product:
<https://www.lasersafetyfacts.com/laserclasses.html>

Class 1 CD/DVD Player, Laptop or Personal Computer

Class 2 Presentation laser pointer, barcode reader

Class 3R Measuring/ Targeting Devices, Higher powered laser pointers

Class 3B Higher powered laser products intended for professional applications

Class 4 Medical lasers, Industrial cutting/welding, Scientific Applications and **most** Laser Light Show equipment.

Safety Considerations for Laser Cutting

The Craftlaser is a Class 1 laser because it is fully enclosed. Under normal conditions, using the machine poses no risk as an eye hazard.



Safety Considerations for Laser Cutting

Monitor

There are two cameras installed in the Craftlaser to allow you to view your job.

Monitor your cutting for fire and flames, and notify MakeIT staff **immediately** if you observe any flames while cutting.



THE ACTIVITY | SECTION 2.2 | 20 MINUTES

Safety Considerations for Laser Cutting

IN CASE OF EMERGENCY ONLY

In the event of fire or emergency, press the emergency stop button to turn off the laser cutter.

Under normal circumstances, turn off the laser cutter using the switch at the back of the device

REMINDER

Do not open the material loading tray when machine is in operation.



Safety Considerations for Laser Cutting

Fume Extractor

As the laser vaporizes the materials, fumes are created. Different materials create different fumes, some of which are hazardous to humans.

Each laser cutter is attached to a fume extractor to filter and clean the air around the laser cutter.

Make sure the fume extractor is turned on before using the laser cutter and notify MakeIT staff if it is not working.



Safety Considerations for Laser Cutting

Air quality is monitored on a daily basis at MakeIT. During the laser cutting process, detecting odours is common and can be cause for concern.

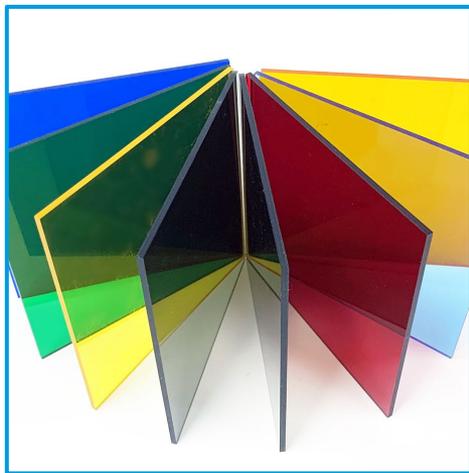
If particulate matter (PM2.5, PM10, VOCs) exceed safe thresholds, MakeIT staff will stop usage of laser cutting equipment to protect anyone inside MakeIT.



WHAT CAN YOU CUT ON THE LASER CUTTER?

Make 

Designing Laser Cut Parts



Acrylic



Plywood



MDF

The Laser Cutter machine has a cutting and engraving area of 420 mm by 297 mm (A3). The following materials will be pre-cut for you that fit those dimensions in 3mm thickness. Each has different uses.

Never Cut the Following Materials with a Laser Cutter

Material	Type of Danger	Consequence
PVC (Polyvinyl Chloride), vinyl, pleather, artificial leather	Emits Chlorine Gas when cut	Cutting PVC will damage the machine and harm the environment.
Polycarbonate, Lexan	Cuts poorly and can catch fire	Polycarbonate cuts very poorly, and while strong
ABS	Emits cyanide gas and melts when cut	ABS cuts and engraves poorly, and can melt, damaging the cutting grid.
HDPE (milk bottle plastic)	Catches fire and melts	Like ABS, cuts and engraves poorly.
PolyStyrene Foam	Catches fire	Catches fire and melts easily
PolyPropylene Foam	Catches fire	Catches fire and melts easily
Fiberglass	Emits fumes	Glass can't be cut, and resin will generate fumes
Carbon Fiber	Emits noxious fumes	Carbon fiber is difficult to cut

THE ACTIVITY | SECTION 2.3 | 80 MINUTES

Never Cut the Following Materials

Identifying materials can be challenging, especially without proper markings.

Please use only the materials provided at MakeIT to cut your projects.

It is common to mistake one material type for another, even if you think you are provided materials from reliable sources.

Never cut or engrave materials unless you are 100% certain what that material is.

MakeIT reserves the rights to revoke your laser cutting privileges if you misuse the laser cutter.



Testing plastics can be unreliable, but to find out more information about home tests to do, check out:

<https://makezine.com/article/science/identifying-unknown-plastics/>

Designing Laser Cut Parts



Medium-Density Fibreboard (MDF) is easy to use and is durable for laser cutting projects. It is made by combining wood fibres together with a binding agent, then is pressurized. The boards can be different thicknesses and colours, and can be used to make furniture, panelling, and DIY projects.

Designing Laser Cut Parts

MDF

- + Easy to work with and cut
- + Consistent shape and thickness
- Not durable or waterproof
- Holds wood screws poorly



Designing Laser Cut Parts



Acrylic sheets are also easy to use, rigid and with consistent thicknesses throughout the material. You can find acrylic sheets in multiple colors and thicknesses. **However, not all sheets labelled as “Acrylic” is Acrylic.**

Designing Laser Cut Parts

Acrylic

- + Can be transparent or any colour
- + Consistent shape and thickness
- Rigidity makes it unforgiving for fitment
- Brittle and susceptible to breaking



Designing Laser Cut Parts



Bamboo plywood is an engineering wood, like MDF, but consists of strips of bamboo wood that are pressed and bound together. Bamboo plywood looks like wood, but is significantly cheaper.

Designing Laser Cut Parts

Bamboo Plywood

- + Aesthetically pleasing look
- + Stronger than MDF and less prone to breaking than Acrylic
- Prone to warping, making cutting more difficult

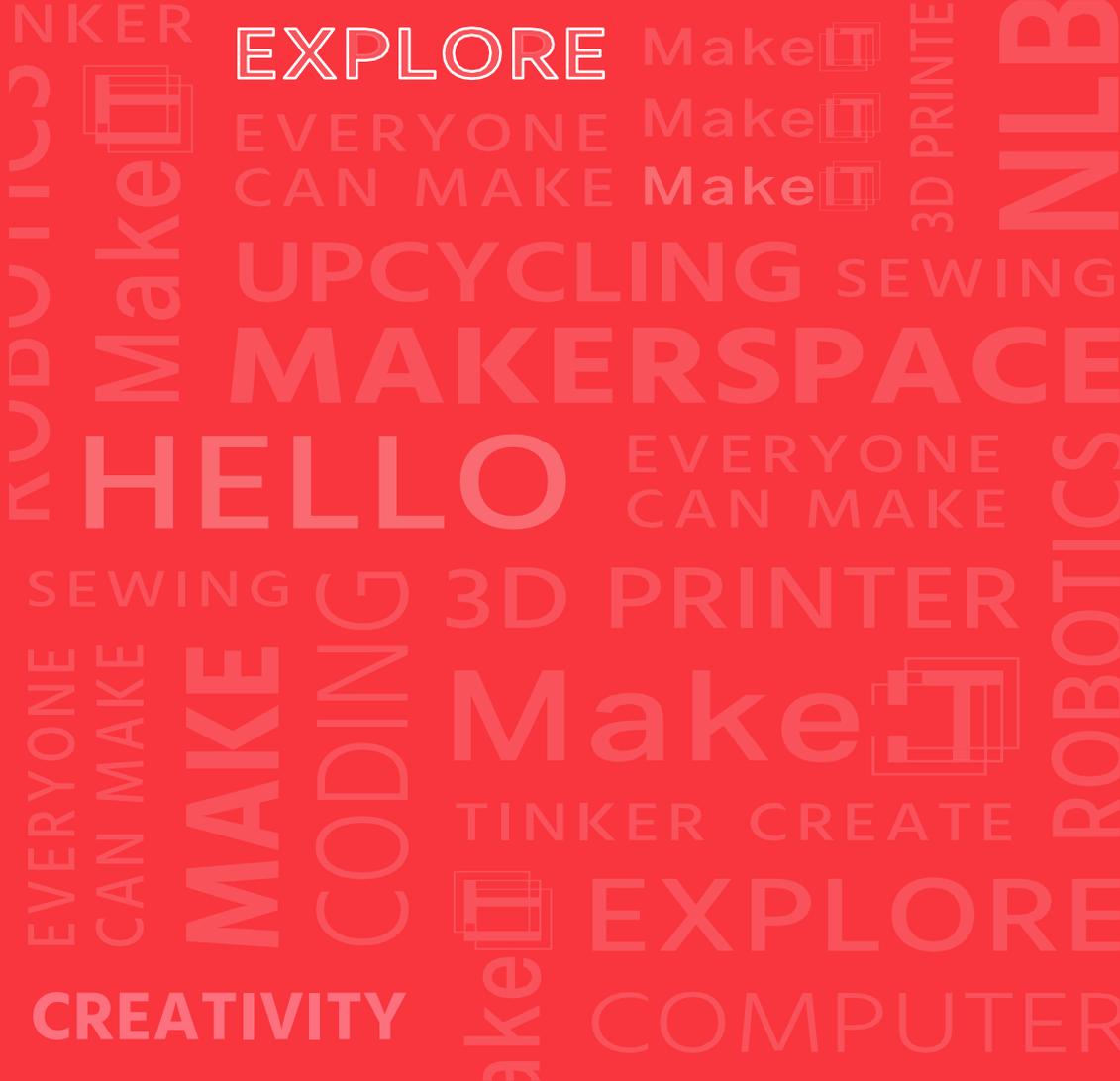


BREAK



<https://go.gov.sg/makeit-onsite-loi>

Please follow the link above to provide feedback for this workshop. We'll use this information to continue to develop your learning journey within MakeIT.



MAKING A DESIGN FROM SCRATCH



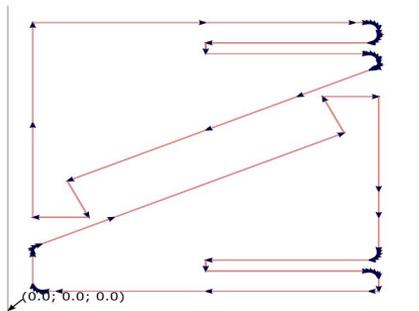
Designing Laser Cut Parts

Digital cutting is a four step process. Here's what you need to know.



Design

Turn your idea into a Tinkercad design and export as an SVG file.



SVG/GCode

Convert your design into a set of instructions that your laser cutter can follow.



Cut

Use a laser cutter to cut chosen material.



Finish

Sanding, priming, painting, and other techniques to make sure your project is the way you want it.

Designing Laser Cut Parts

TASK

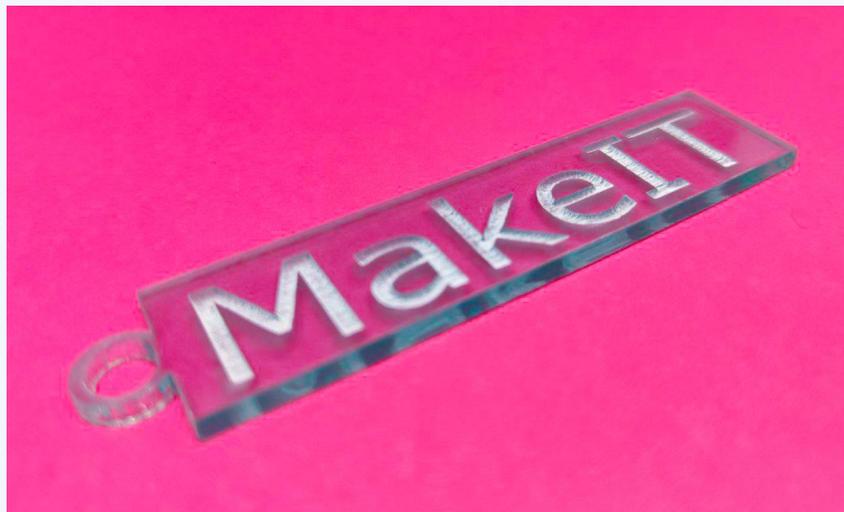
Design a name tag using Tinkercad and Inkscape and cut your project

TIME

50 minutes

MATERIALS

Laptop, SD card, SD card reader
Small acrylic piece



Designing Laser Cut Parts

Tinkercad is a free, cloud-based Computer Aided Design (CAD) Platform designed to simplify the process of creating 3D objects.

www.tinkercad.com

Don't let its simplicity fool you; we consider it to be one of the fundamental building blocks for a new 3D designer.



From mind to design in minutes

Tinkercad is a free, easy-to-use web app that equips the next generation of designers and engineers with the foundational skills for innovation: 3D design, electronics, and coding!



Start Tinkering

Join your class

Make a 3D Key Ring. Launch the Lesson! < || >



Community of 35 million

Join



Fast, free, easy to use

Learn



Loved by educators worldwide

Teach

Safeguarding your privacy is fundamental to our mission. Learn how we protect student data in our [Privacy and Security Statement](#)

Unleash your imagination with these easy steps

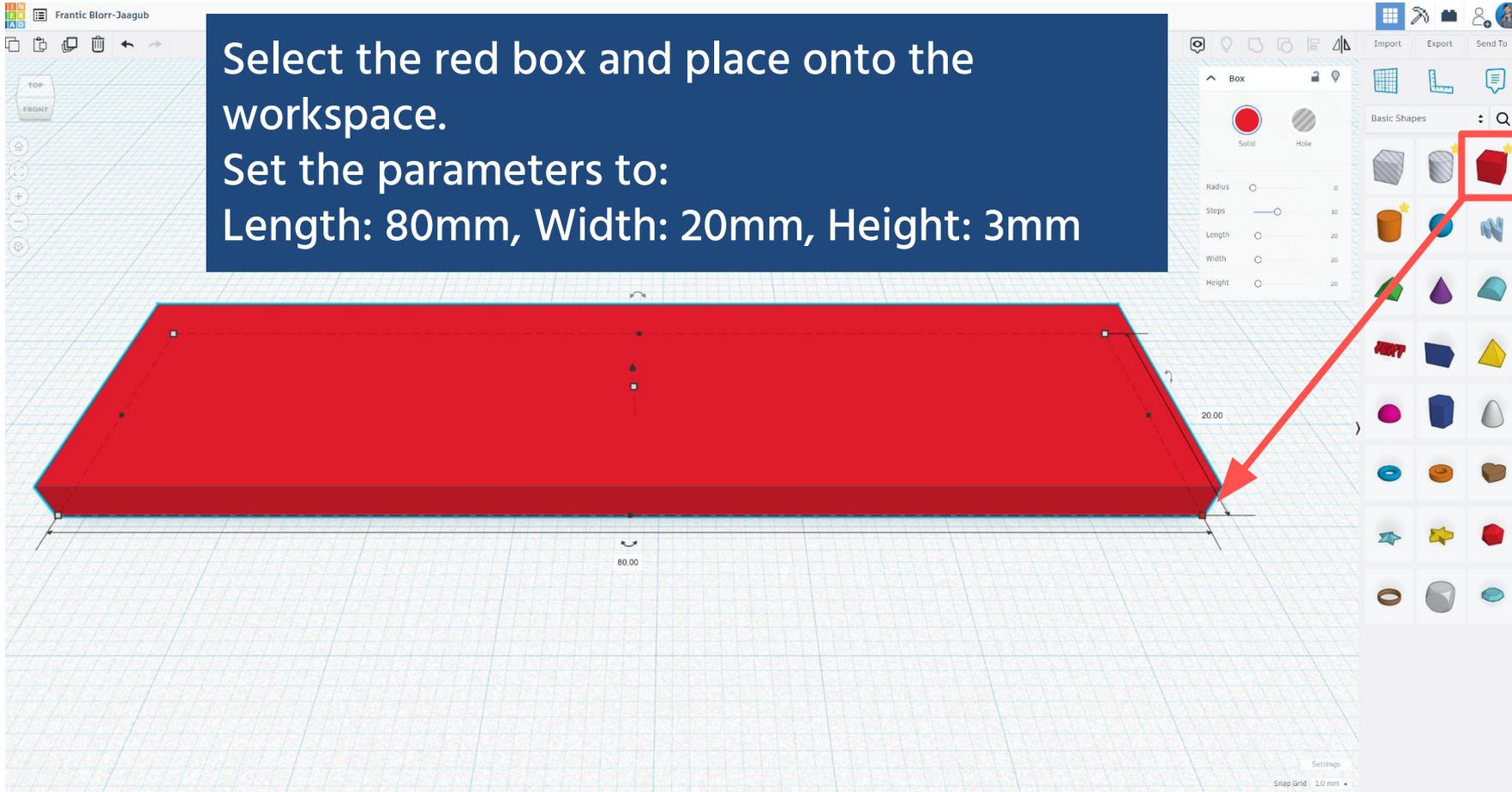


1. Place

Place a shape on the workplane to add or remove material. Use pre-existing shapes or import your own. Shapes are the building blocks of Tinkercad.

Designing Laser Cut Parts

1. Design Tag in Tinkercad



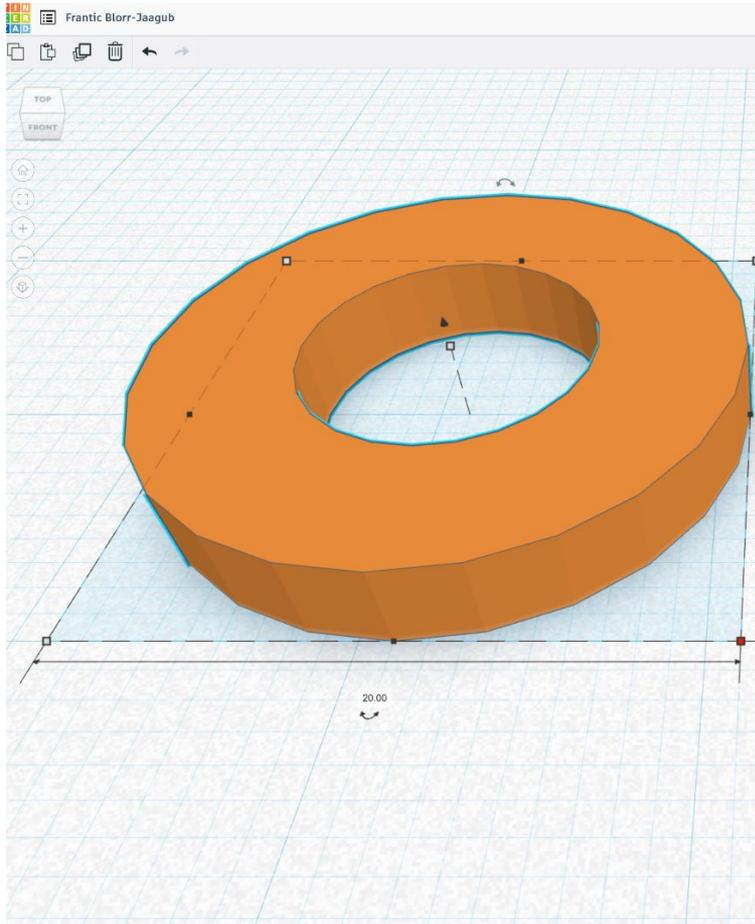
Select the red box and place onto the workspace.

Set the parameters to:
Length: 80mm, Width: 20mm, Height: 3mm

The image shows a screenshot of the Tinkercad software interface. A red rectangular box is placed on a blue grid workspace. The box's dimensions are indicated as 80.00 mm in length and 20.00 mm in width. A dark blue text box with white text provides instructions on how to create the box. The right sidebar shows the 'Basic Shapes' panel with a red box highlighted. The top of the interface shows the 'Frantic Blorr-Jaagub' workspace name and various tool icons.

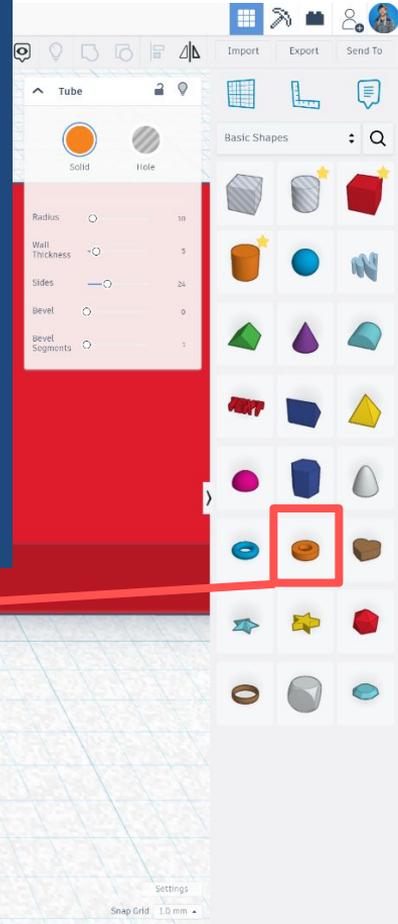
Designing Laser Cut Parts

1. Design Tag in Tinkercad



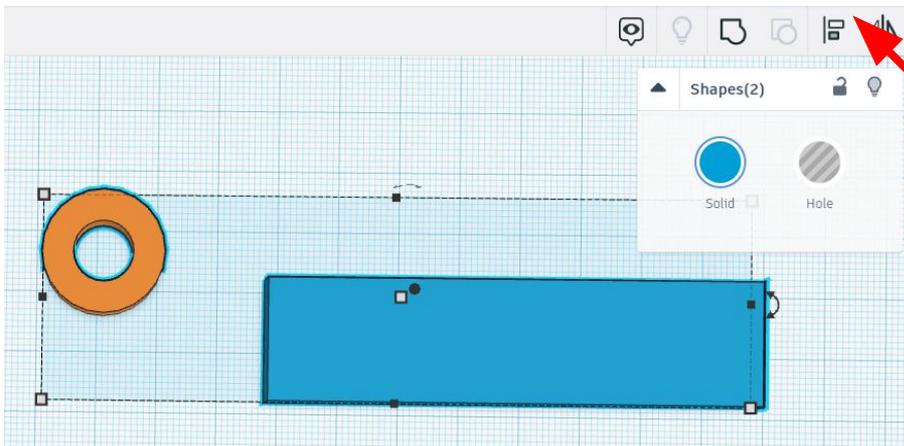
Select the orange ring and place onto the workspace.

Set the parameters to:
Length: 20mm,
Width: 20mm,
Height: 3mm,
Wall Thickness: 5mm

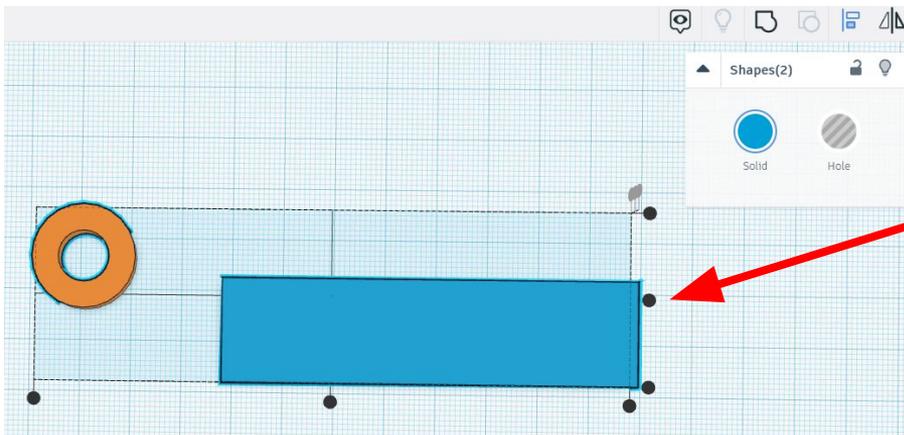


Designing Laser Cut Parts

1. Design Tag in Tinkercad



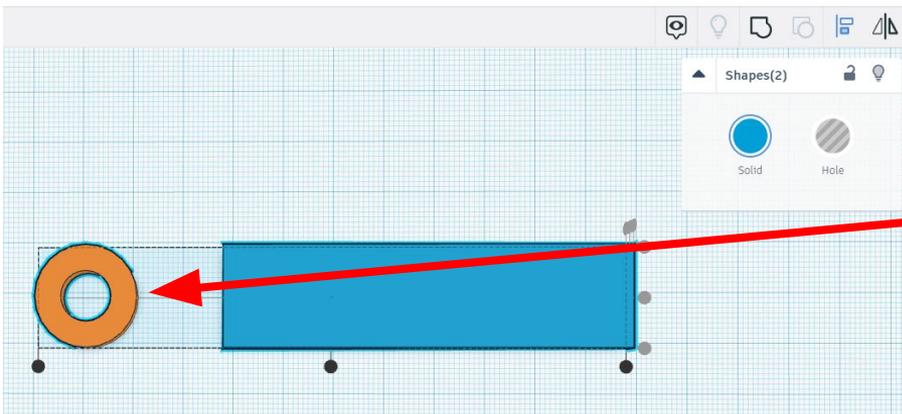
Select both objects by left-clicking and dragging a box around them, then click on the “Align” tool, or press ‘L’ on your keyboard.



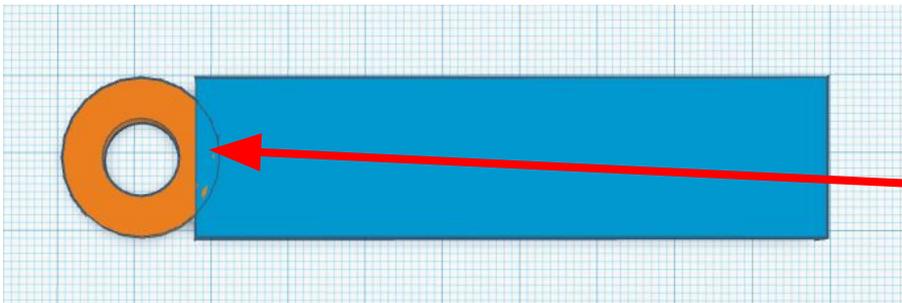
You should see 3 sets of three black dots. Align the shapes along the middle of the long side by pressing the circle that terminates at the end of the long black line in the middle.

Designing Laser Cut Parts

1. Design Tag in Tinkercad



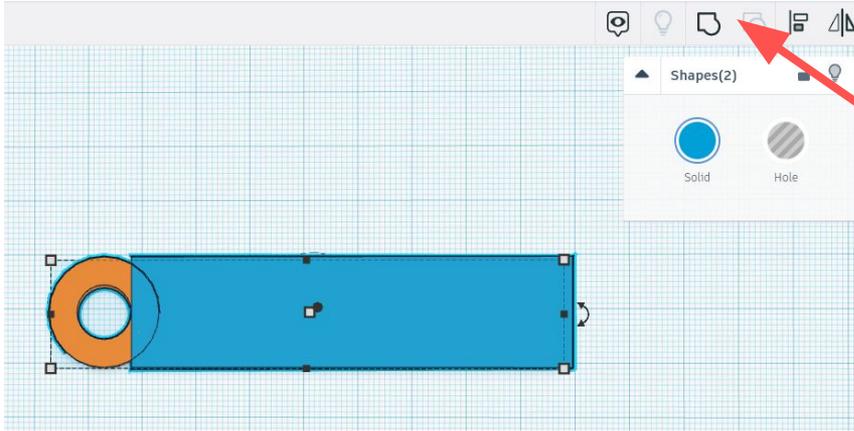
Both objects will align in the middle, indicated by the circle tools greying out. Now, select just the circle by left-clicking off the shapes, then left-clicking on the circle.



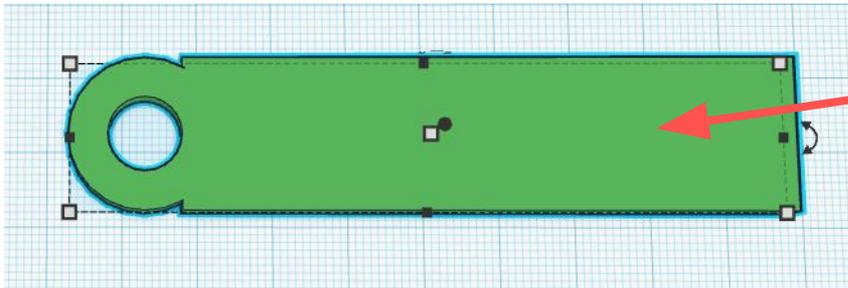
Use the directional buttons (left and right) on your keyboard to move it closer to the block. Make sure both objects overlap.

Designing Laser Cut Parts

1. Design Tag in Tinkercad



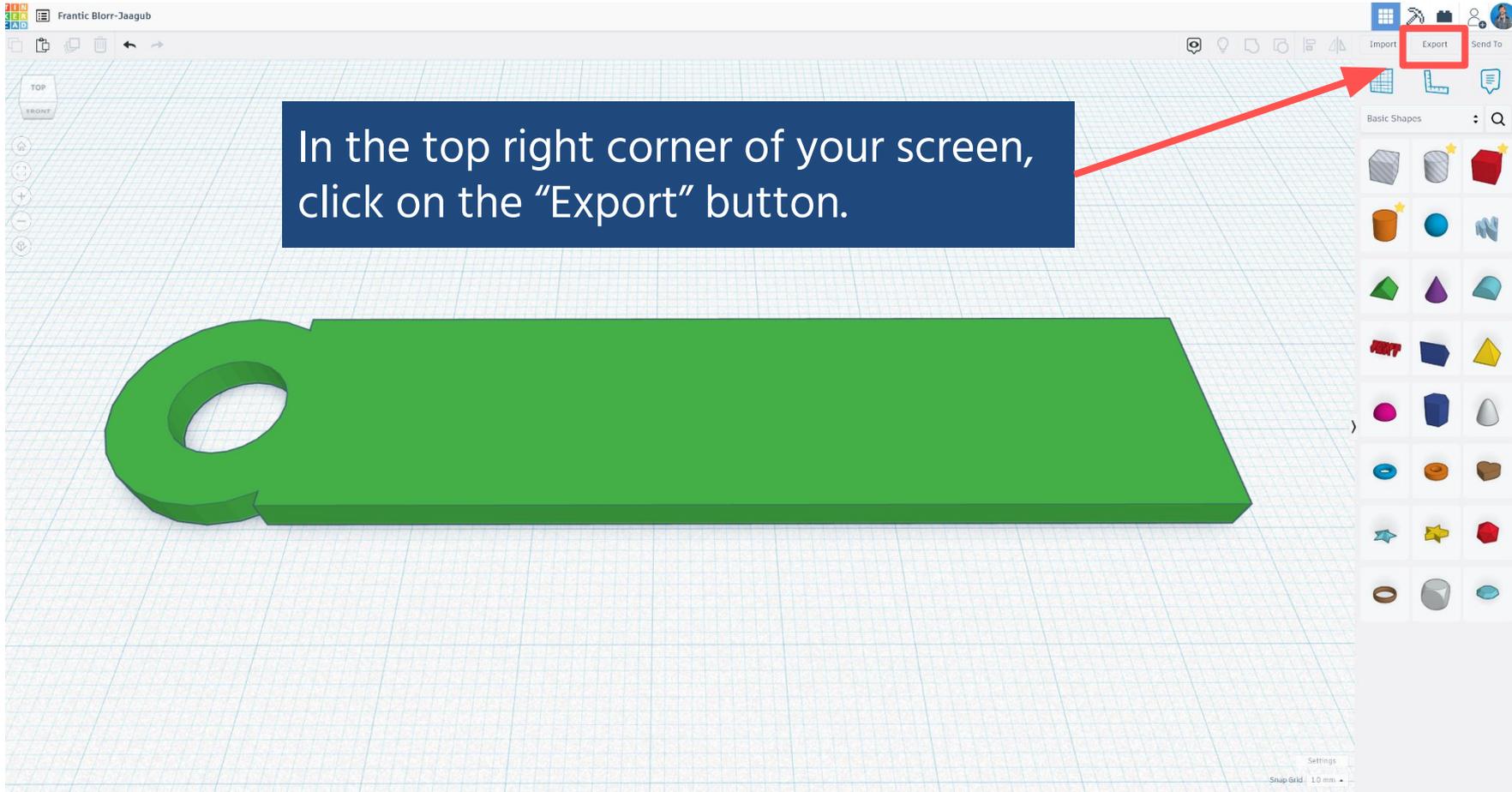
Once the objects have overlapped, select both objects and click on the “Group” tool, or press ‘CTRL + G’ on your keyboard.



Your final object should be connected together with a fully round hole.

Designing Laser Cut Parts

1. Design Tag in Tinkercad

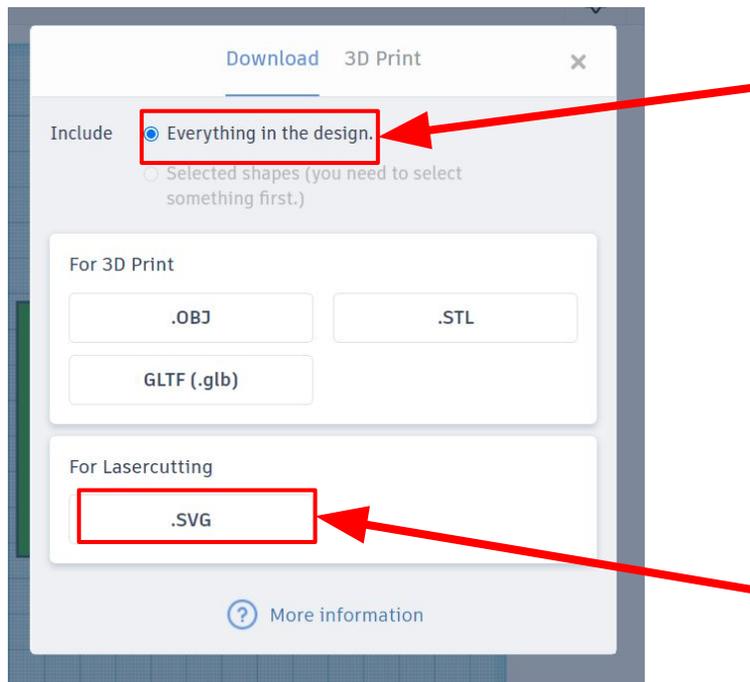


In the top right corner of your screen, click on the "Export" button.

The screenshot shows the Tinkercad interface with a green key design on a grid. The 'Export' button in the top right toolbar is highlighted with a red box, and a red arrow points from a text box to it. The 'Basic Shapes' panel is visible on the right side of the screen.

Designing Laser Cut Parts

1. Design Tag in Tinkercad



If the tag is the only object that you have created, you may select the “Everything in the design”. If there are other designs, select the final object you wish to export and click “Selected shapes”.

Click on the “.SVG” button to export the file as a SVG file format. SVG stands for Scalable Vector Graphic. This file format can be recognized by the laser cutting software later.

MAKING THE FILE CUTTABLE



THE ACTIVITY | SECTION 2.3 | 80 MINUTES

Designing Laser Cut Parts

With our keychain design ready, we can then cut it. At MakeIT, we use Inkscape as our laser Gcode generating tool, but we can also use it to edit objects.

<https://inkscape.org/>

INKSCAPE
Draw Freely.

Search website

ABOUT | DOWNLOAD | NEWS | COMMUNITY | LEARN | CONTRIBUTE | DEVELOP | SUPPORT US

INKSCAPE 1.2.1
Draw Freely.

New Discoveries Award by Chris Hildenbrand

Download Now!
Get the professional vector graphics editor!

Explore Features
Find out what Inkscape is capable of

Community Gallery
Showcase of creations from the community

Learning Resources
HowTos, Videos, Tutorials and more...

Users
A powerful, free design tool
Whether you are an illustrator, designer, web designer or just someone who needs to create some vector imagery, Inkscape is for you!

- ✓ Flexible drawing tools
- ✓ Broad file format compatibility
- ✓ Powerful text tool
- ✓ Bezier and spiro curves

 Want to find out more about how Inkscape can help you? Look at the full set of [Features](#) or [try it!](#)
 We are social!
 Follow us on:

Contributors
Join our thriving community
We can always use help from more people. If you can write code, you may be able to [involve in development](#); if you can't, there are still lots of things we can use help with. For more information, take a look at our [Contribute](#) section.
Sponsors

Recent News
A look back in celebration of Inkscape contributors & milestones in 2021
July 19, 2022
 Without our volunteer contributors, Inkscape simply would not exist!
[Read more...](#)
Important Release of Inkscape version 1.2.1 fixes data loss and crash issues
July 14, 2022
 If you're currently using Inkscape 1.2 then this is an important update to install on your device.
[Read more...](#)
Meet Chris Hildenbrand, the artist behind the winning Inkscape 1.2 About Screen
June 21, 2022
 We recently caught up with Chris Hildenbrand to learn more about the artist and his use of Inkscape.
[Read more...](#)

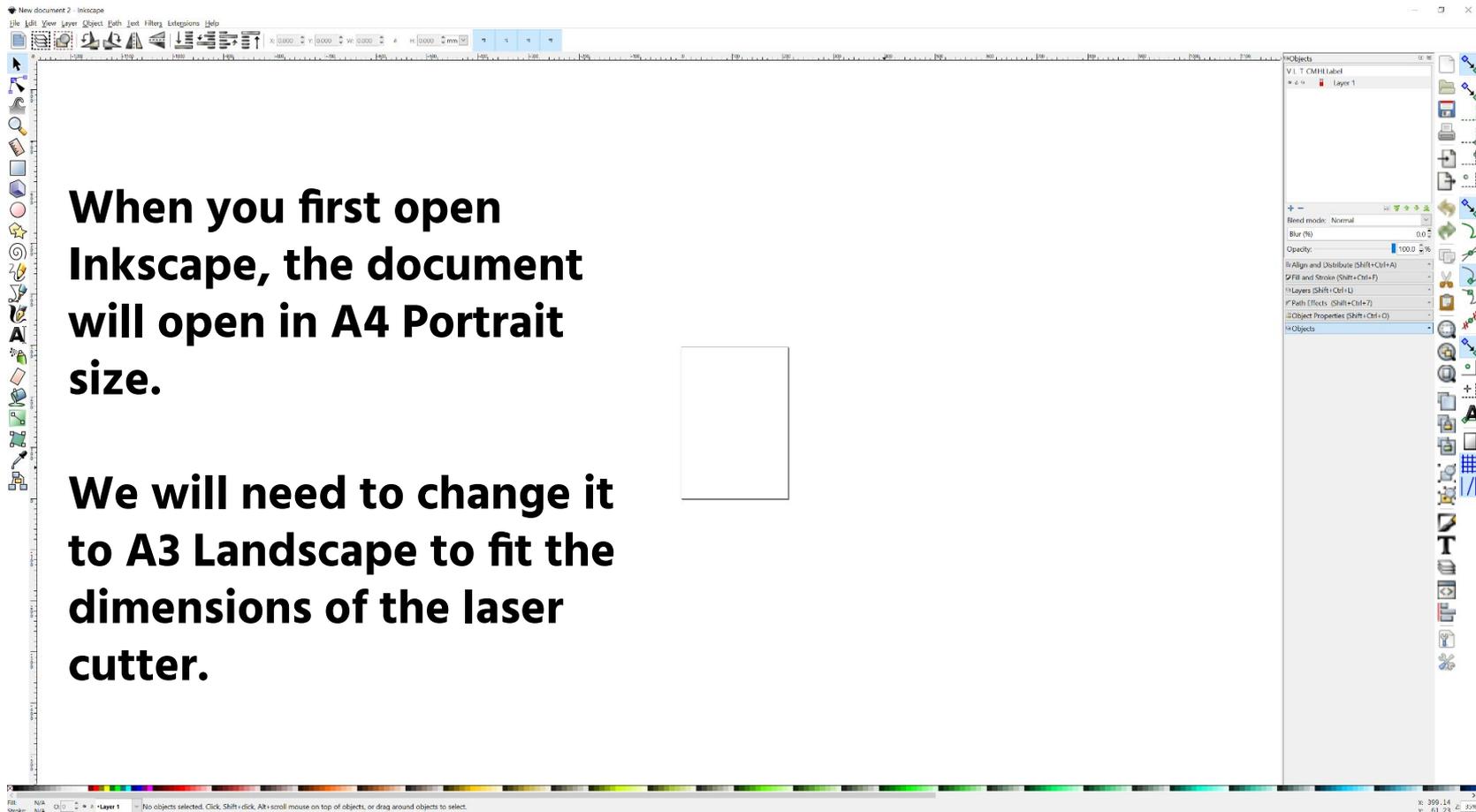
Inkscape is Free and Open Source Software licensed under the GPL.

Designing Laser Cut Parts

2. Use Inkscape to Prepare Work

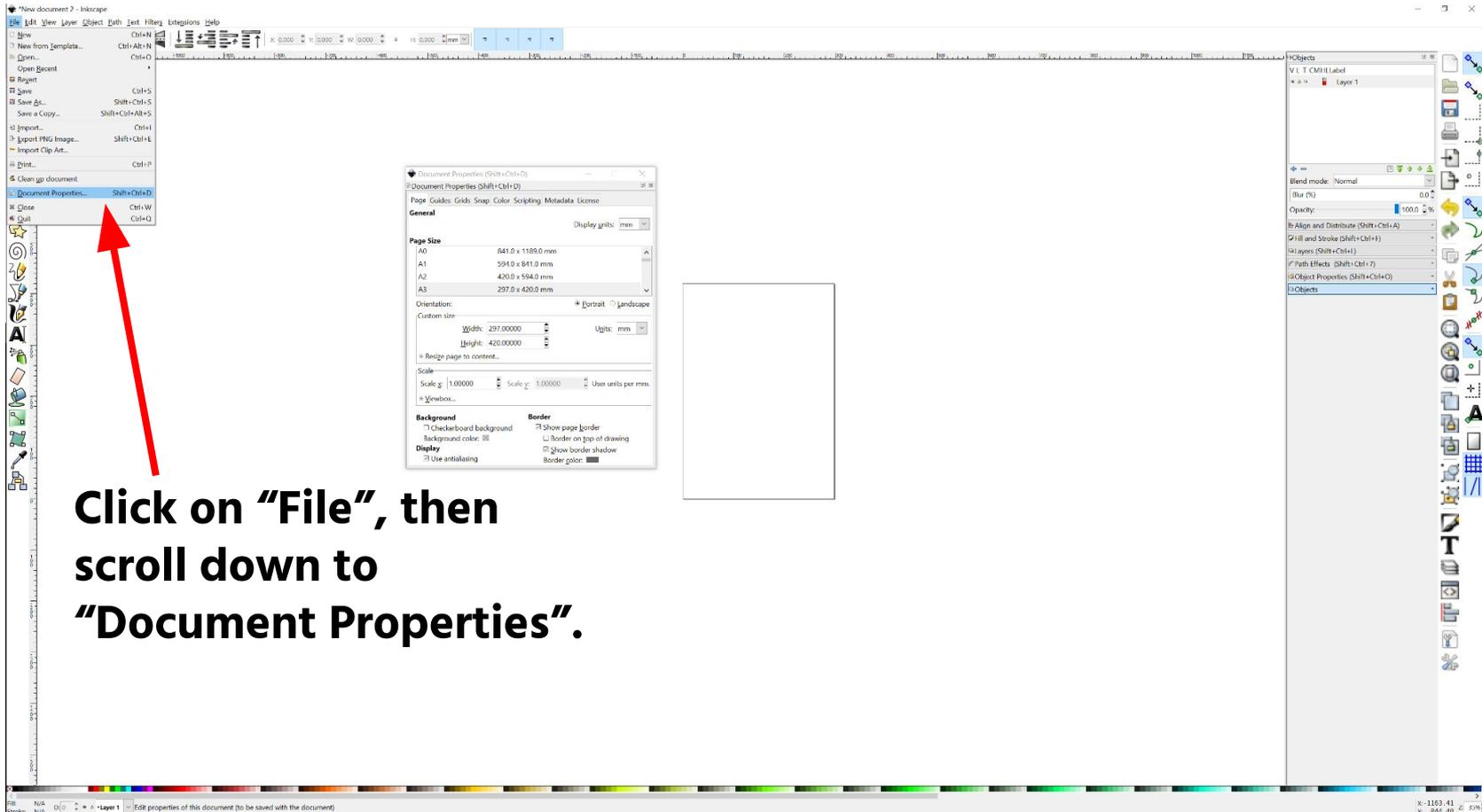
When you first open Inkscape, the document will open in A4 Portrait size.

We will need to change it to A3 Landscape to fit the dimensions of the laser cutter.



Designing Laser Cut Parts

2. Use Inkscape to Prepare Work

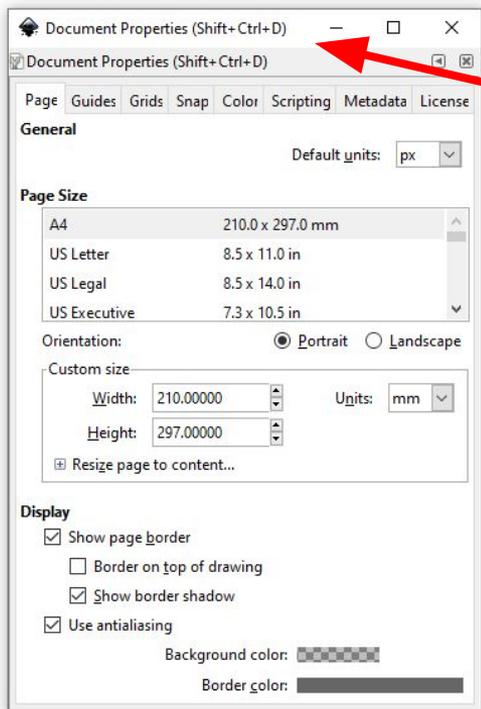


The screenshot shows the Inkscape application window. The 'File' menu is open, and a red arrow points to the 'Document Properties...' option. The 'Document Properties' dialog box is open, displaying various settings for the document, including page size, orientation, and background options. A white rectangle is visible on the canvas.

Click on "File", then scroll down to "Document Properties".

Designing Laser Cut Parts

2. Use Inkscape to Prepare Work



1

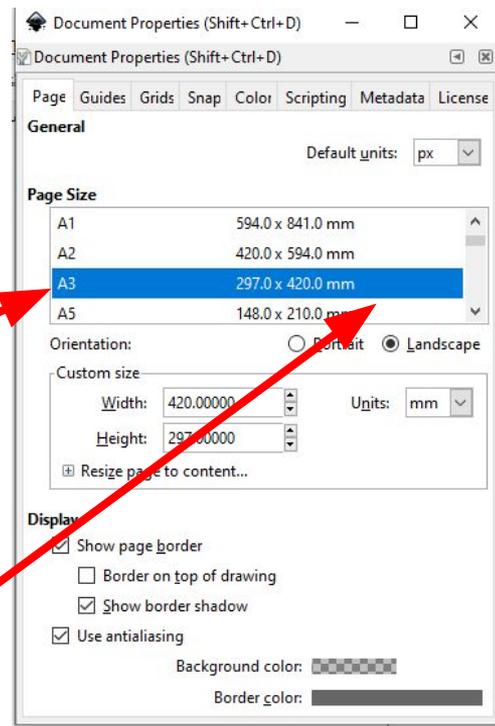
A small window should appear like this.

2

Scroll down to A3.

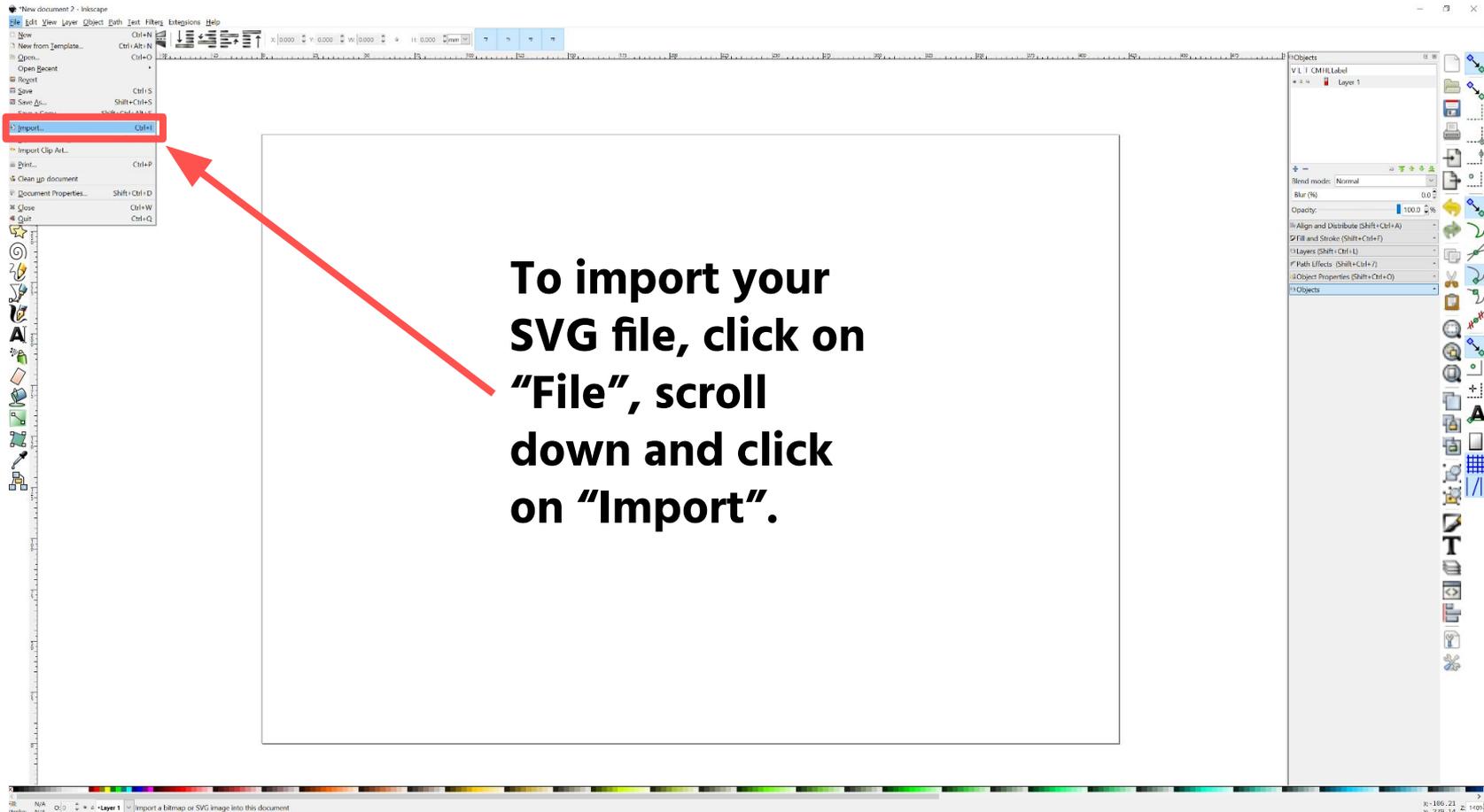
3

Select the "Landscape" option to rotate your canvas sideways.



Designing Laser Cut Parts

2. Use Inkscape to Prepare Work

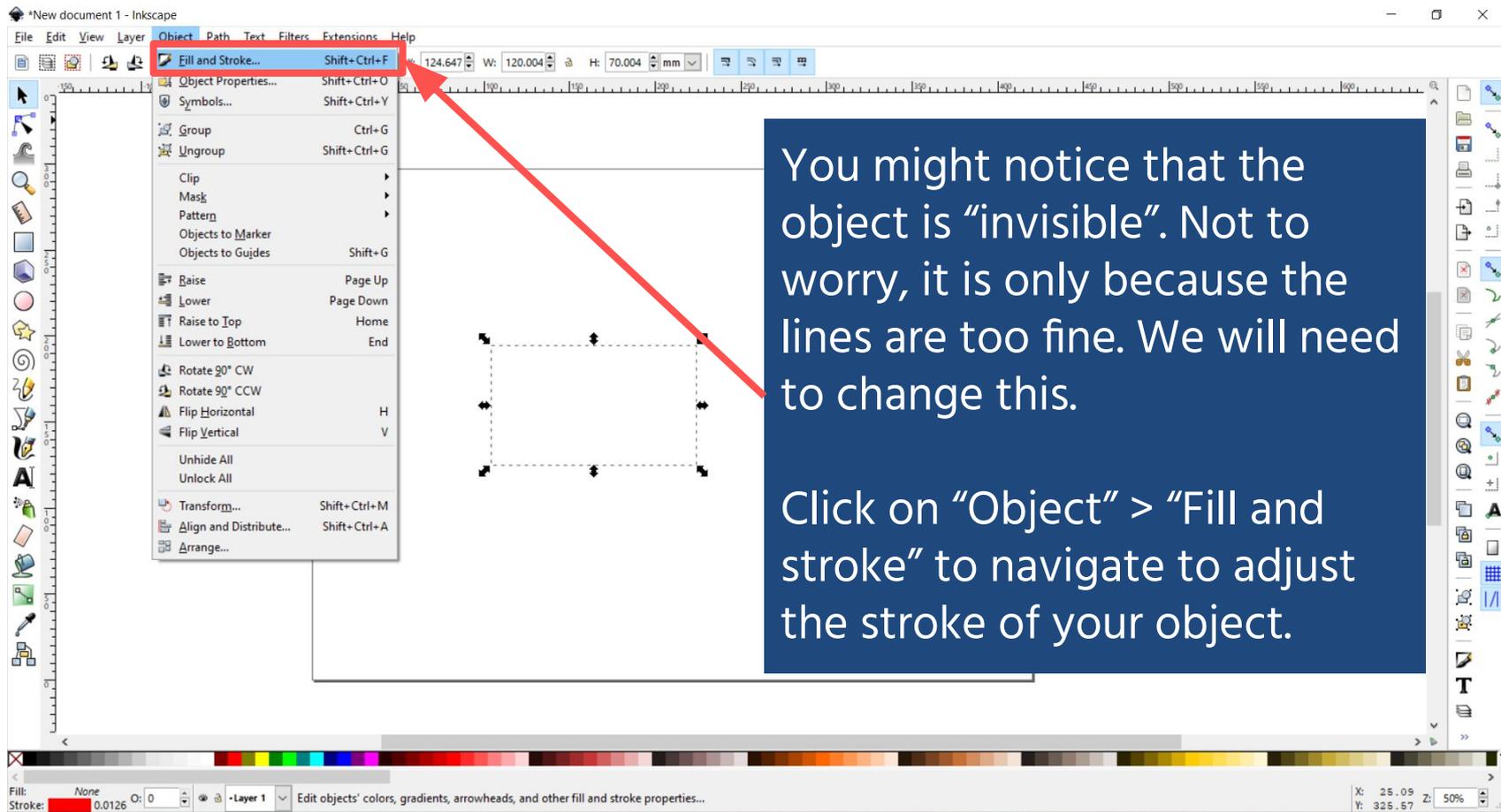


The screenshot shows the Inkscape application window. The 'File' menu is open, and the 'Import...' option is highlighted with a red box. A red arrow points from the text below to this option. The main workspace is empty, and the right-hand side shows the 'Objects' panel with 'Layer 1' selected.

To import your SVG file, click on "File", scroll down and click on "Import".

Designing Laser Cut Parts

2. Use Inkscape to Prepare Work



The screenshot shows the Inkscape interface with the 'Object' menu open. The 'Fill and Stroke...' option is highlighted in red. A red arrow points from this menu item to a blue text box on the right. The text box contains the following text:

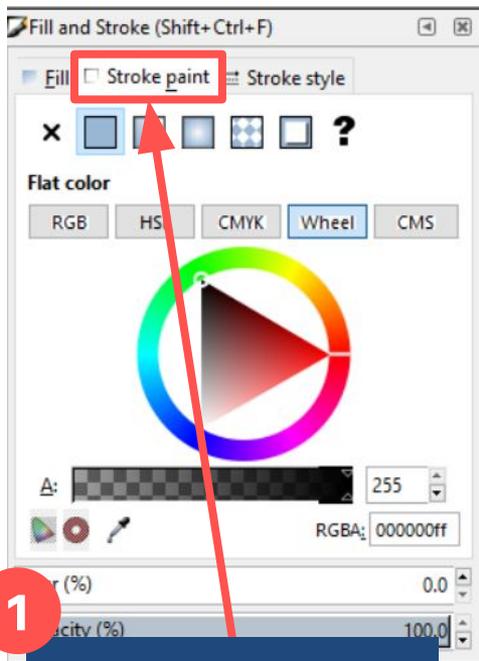
You might notice that the object is "invisible". Not to worry, it is only because the lines are too fine. We will need to change this.

Click on "Object" > "Fill and stroke" to navigate to adjust the stroke of your object.

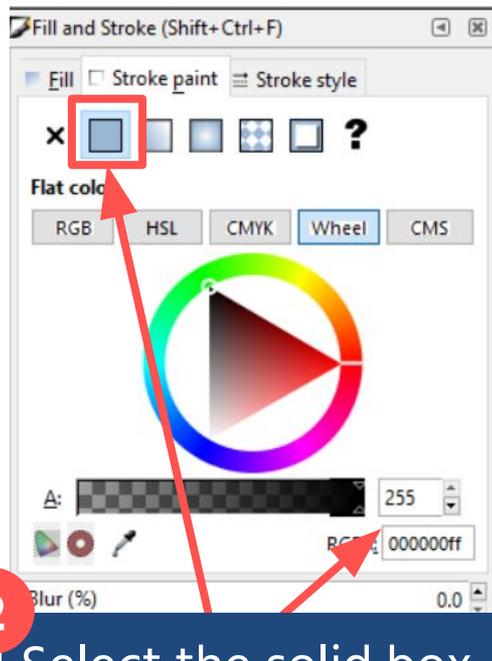
The background shows a dashed rectangular object on the canvas, which is the subject of the text box's explanation. The status bar at the bottom indicates the fill is 'None' and the stroke is '0.0126'.

Designing Laser Cut Parts

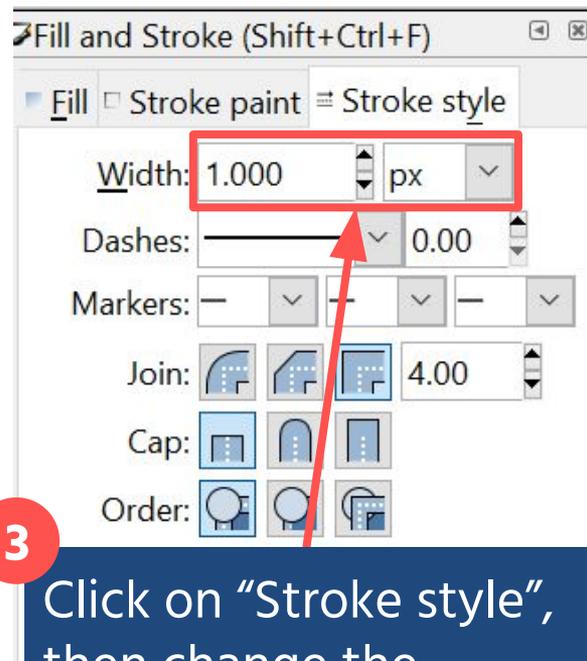
2. Use Inkscape to Prepare Work



1 Click on "Stroke paint".



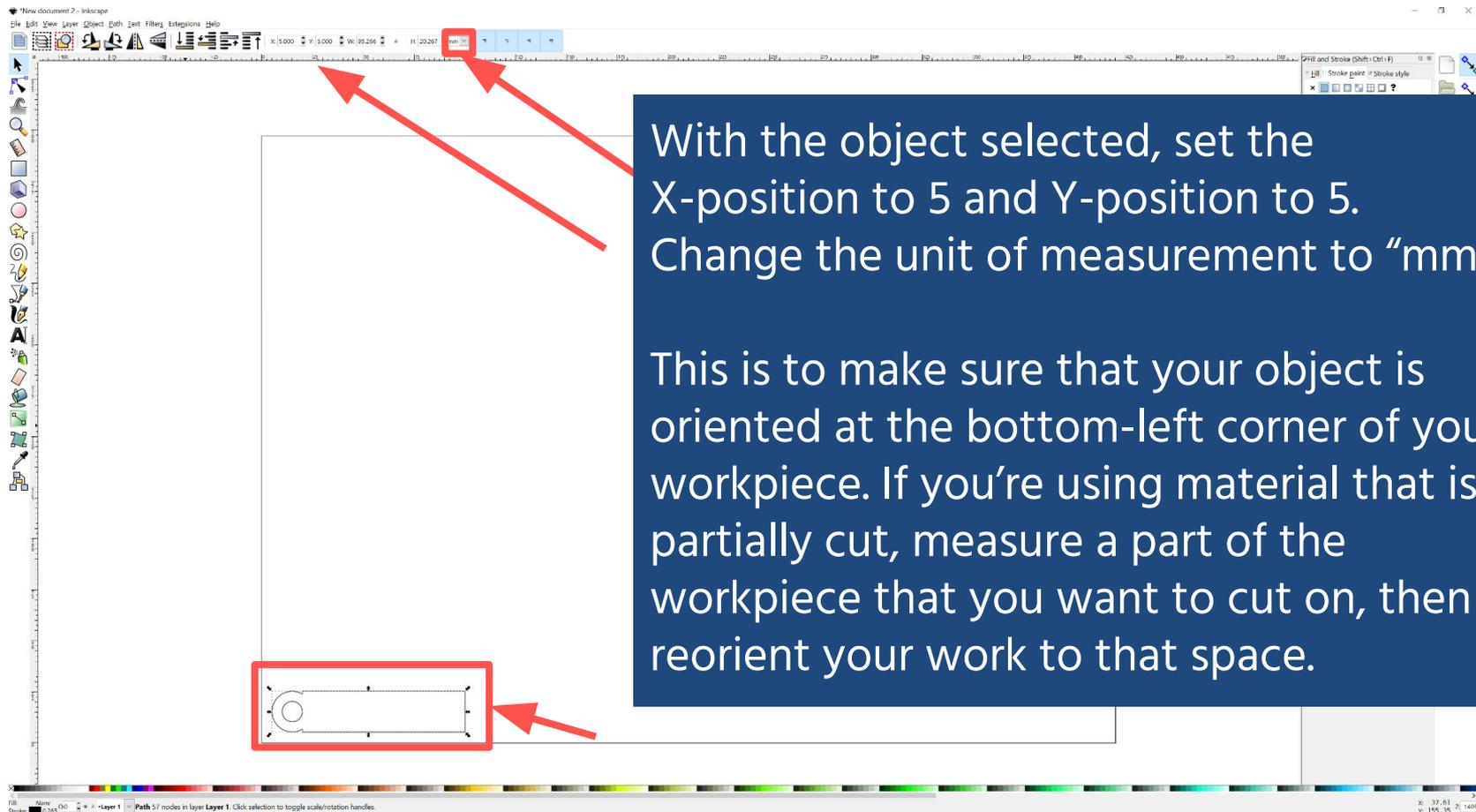
2 Select the solid box for flat colour and change the color to black.



3 Click on "Stroke style", then change the "Width" to 1.000 and the unit to "px", or pixel.

Designing Laser Cut Parts

2. Use Inkscape to Prepare Work



With the object selected, set the X-position to 5 and Y-position to 5. Change the unit of measurement to “mm”.

This is to make sure that your object is oriented at the bottom-left corner of your workpiece. If you're using material that is partially cut, measure a part of the workpiece that you want to cut on, then reorient your work to that space.

Designing Laser Cut Parts

Cutting and engraving are separate operations for our laser cutter. We need to prepare the files separately, making sure we don't move our workpiece between jobs.

Always engrave before cutting, as cutting can move your workpiece.

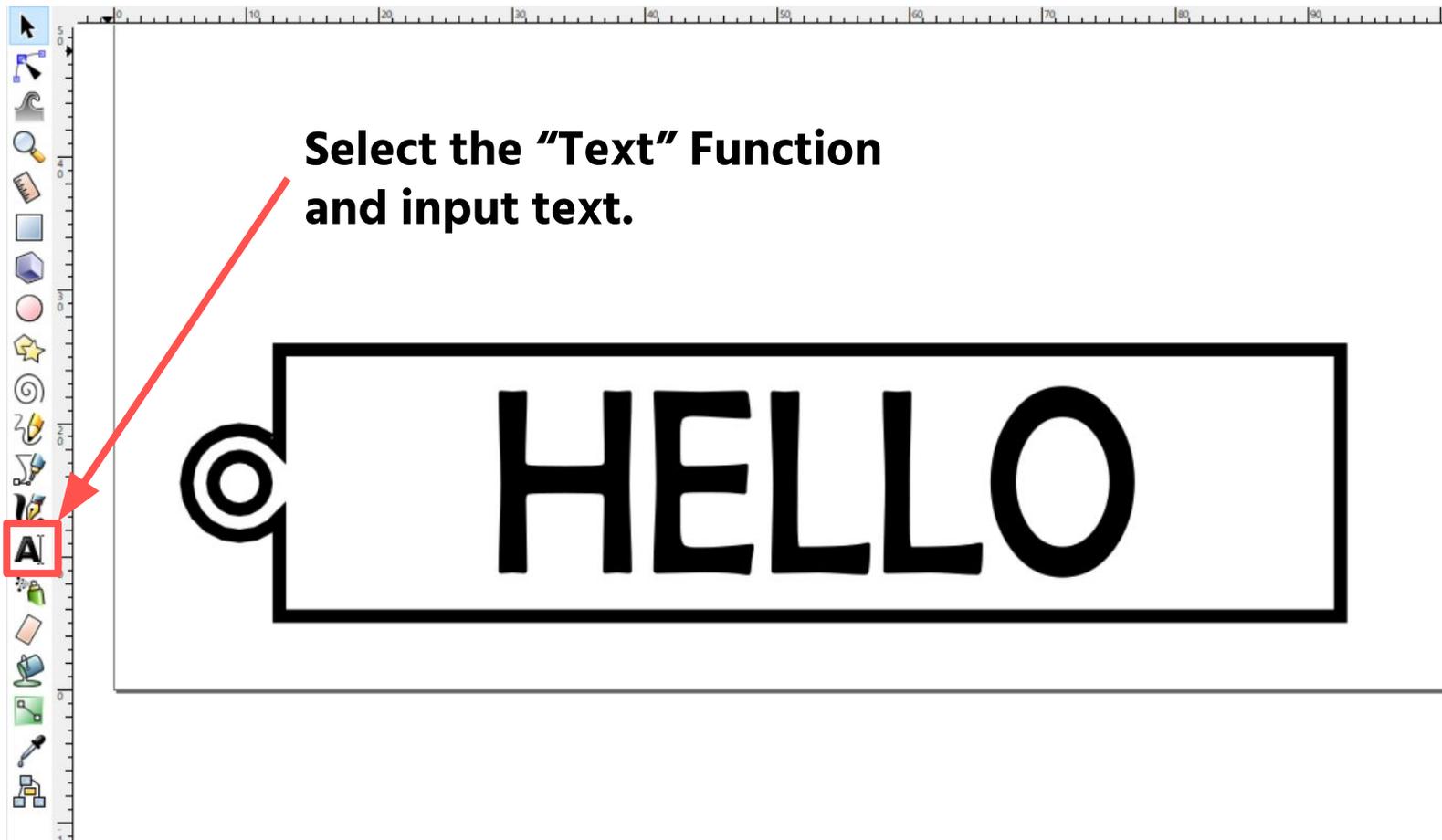
2. Use Inkscape to Prepare Work



Engraving changes an image into a feature where just the top layer is burned off. The thickness of the engraving depends on your speed and power settings.

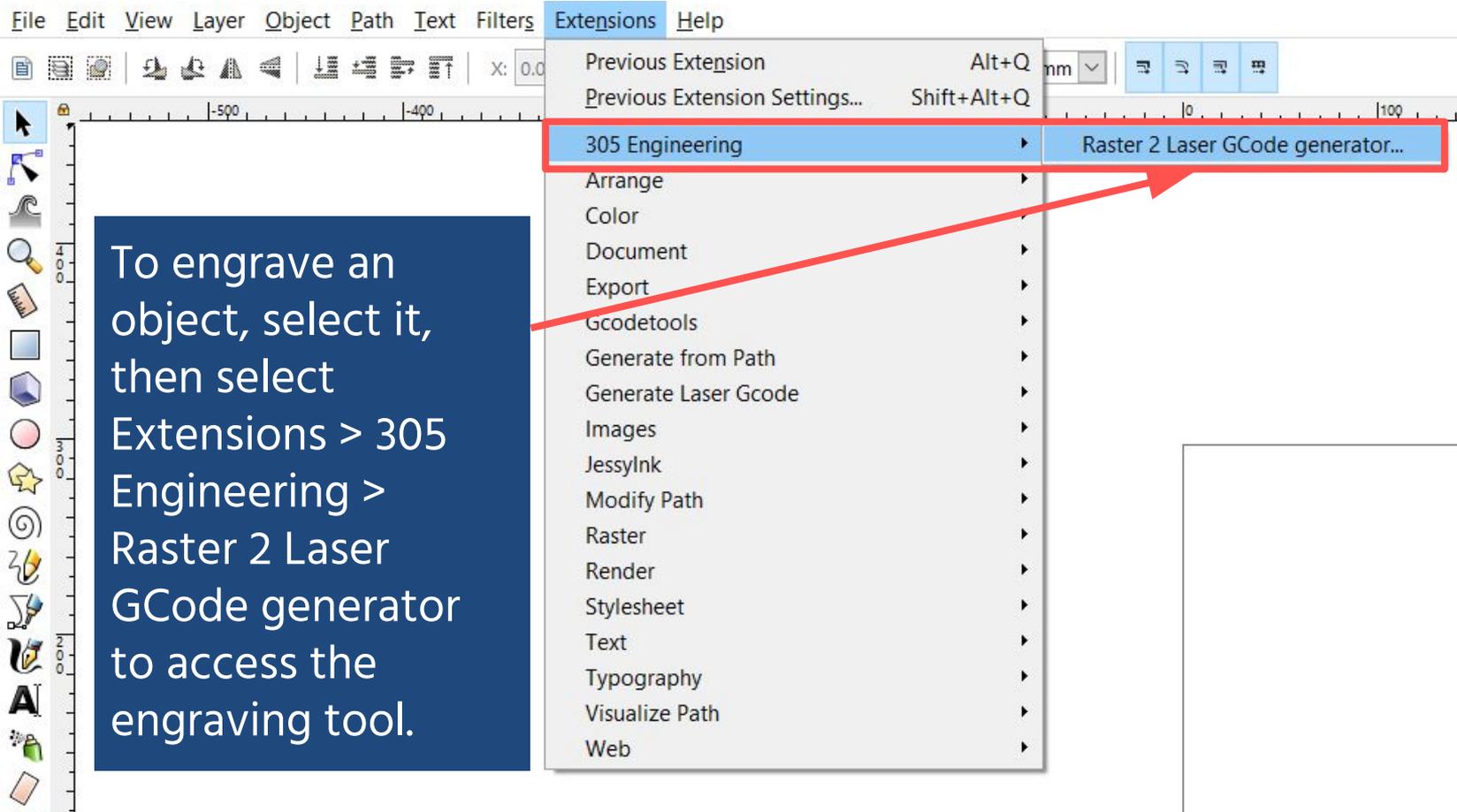
Designing Laser Cut Parts

3. Use Inkscape to Engrave Object



Designing Laser Cut Parts

3. Use Inkscape to Engrave Object



The screenshot shows the Inkscape application window. The 'Extensions' menu is open, and the path '305 Engineering > Raster 2 Laser GCode generator...' is highlighted with a red box. A red arrow points from a blue text box on the left to this menu item. The interface includes a menu bar (File, Edit, View, Layer, Object, Path, Text, Filters, Extensions, Help), a toolbar with various icons, and a canvas area with a coordinate grid.

File Edit View Layer Object Path Text Filters Extensions Help

Previous Extension Alt+Q
Previous Extension Settings... Shift+Alt+Q

305 Engineering Raster 2 Laser GCode generator...

Arrange
Color
Document
Export
Gcodetools
Generate from Path
Generate Laser Gcode
Images
JessyInk
Modify Path
Raster
Render
Stylesheet
Text
Typography
Visualize Path
Web

To engrave an object, select it, then select Extensions > 305 Engineering > Raster 2 Laser GCode generator to access the engraving tool.

Designing Laser Cut Parts

3. Use Inkscape to Engrave Object

Engraving Settings

Raster 2 Laser GCode generator
created by 305 Engineering

Export directory

File Name

Add numeric suffix to filename

Replace transparency with

Resolution

Color to Grayscale conversion

B/W conversion algorithm

B/W threshold

Grayscale resolution

Engraving speed

Flip Y

Homing ?

Laser ON Command

Laser OFF Command

Preview only

If "Preview only" is true the gcode file will not be generated.

1. Note your output directory and change the file name.

2. Set Resolution to 10 pixel/mm. Higher resolution creates higher quality engraving.

3. Set Engraving speed to 4000.

4. Select "Apply".

Designing Laser Cut Parts

3. Use Inkscape to Engrave Object

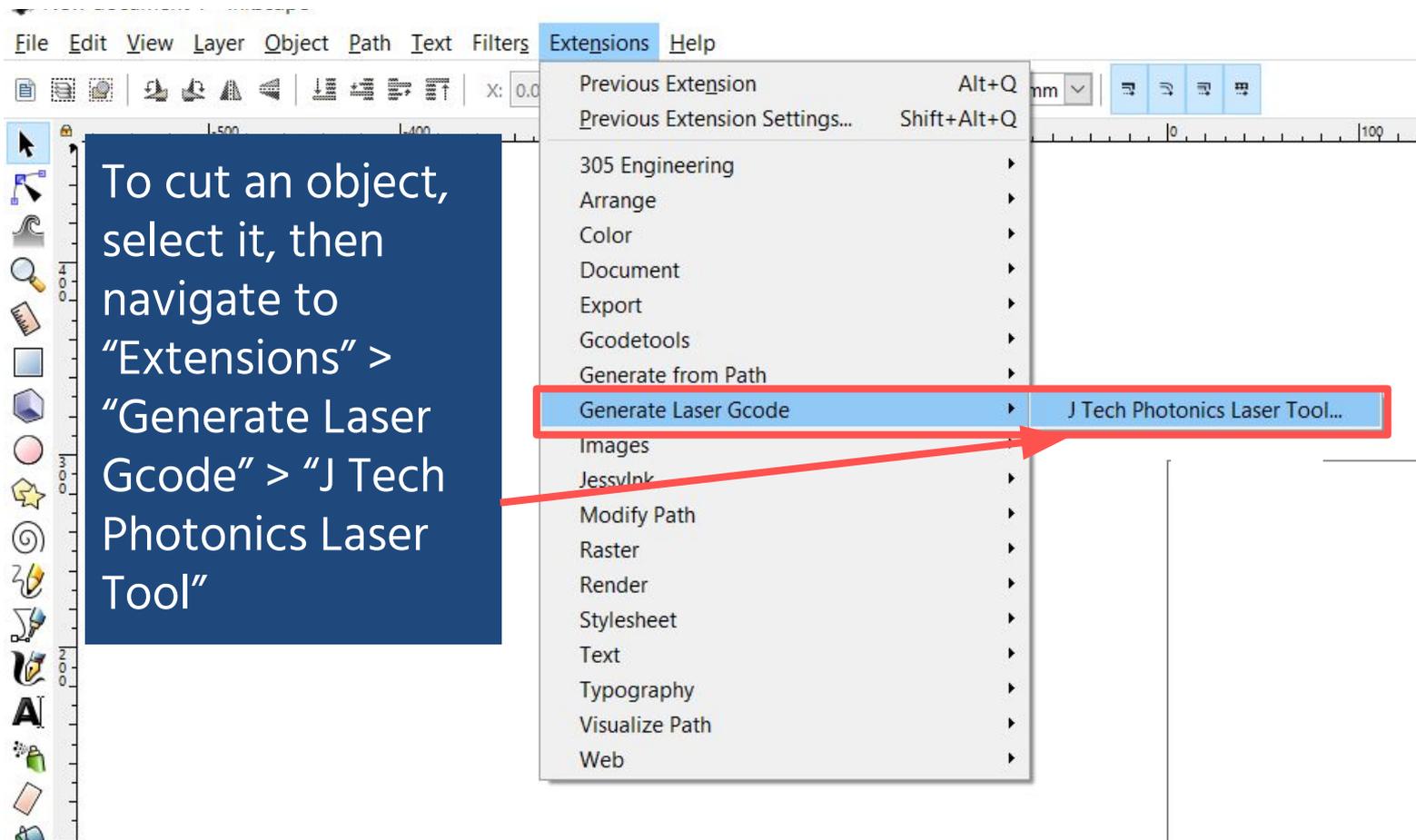
 Name Tag_0001	12/28/2021 5:00 PM	PNG File	1 KB
 Name Tag_0001_BWfix_128_preview	12/28/2021 5:00 PM	PNG File	1 KB
 Name Tag_0001_BWfix_128_gcode	12/28/2021 5:00 PM	Text Document	1 KB

Once settings are applied, the file should be saved in your computer. Transfer only the gcode file to an SD Card. The other files are images and only for preview purposes.

You may also name the file with the term “engrave”.

Designing Laser Cut Parts

4. Use Inkscape to Cut Object



To cut an object, select it, then navigate to "Extensions" > "Generate Laser Gcode" > "J Tech Photonics Laser Tool"

Designing Laser Cut Parts

4. Use Inkscape to Cut Object

J Tech Photonics Laser Tool

Laser ON Command: M03

Laser OFF Command: M05

Travel Speed (mm/min or in/min): 3000

Laser Speed (mm/min or in/min): 300

Laser Power S# (0-255 or 0-12000): 100

Power-On Delay (ms or s): 0.0

Passes: 1

Pass Depth (mm or in): 1.0

Directory: ers\info\OneDrive\Desktop\MakeIT Laser

Filename: Name Tag.gcode

Add numeric suffix to filename

All Units (mm or in): mm

Live preview

Close Apply

1. Change the settings to the values shown to the left.

2. Paste the file directory that was previously copied.

3. Select "Apply".

Designing Laser Cut Parts

4. Use Inkscape to Cut Object

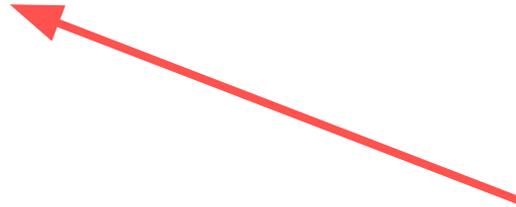
Once settings are applied, there should be arrow markings on your drawing with the axis parameter at the bottom. Inkscape lets you preview your job before you sent it to be cut. Check it to make sure the path aligns with your object.



Designing Laser Cut Parts

4. Use Inkscape to Cut Object

 Name Tag_0001.gcode	12/28/2021 5:01 PM	GCODE File	1 KB
---	--------------------	------------	------



Once settings are applied, the file should be saved in your computer. Transfer the gcode file to an SD Card.

You may also name the file with the term “cut” to distinguish it from an engraving file.

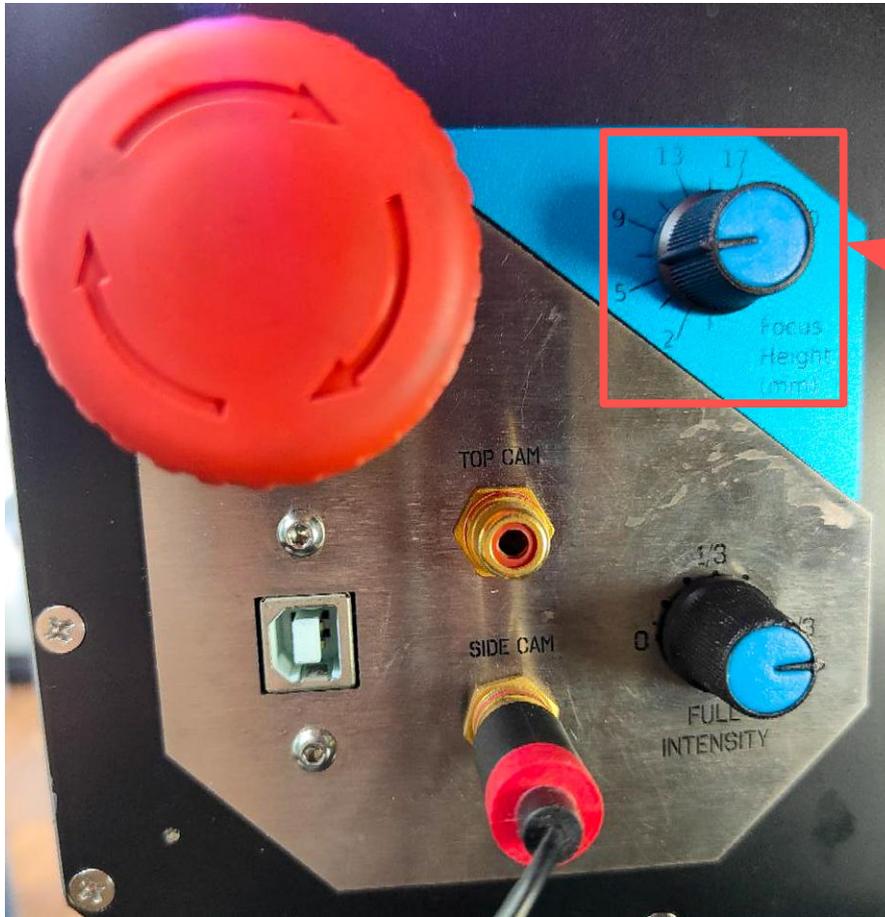
OPERATING THE CRAFTLASER



THE ACTIVITY | SECTION 2.3 | 80 MINUTES

Designing Laser Cut Parts

5. Operating the Laser Cutter



Adjust Focus Height to 4mm above material. The easiest method to roughly gauge this 4mm height is to use a 3mm piece of acrylic on top of your material to be cut. Place both pieces and lower the laser cutting head slightly above the acrylic piece.

Turn the knob anti-clockwise or to the left to lower the laser cutting head to the desired height.

THE ACTIVITY I SECTION 2.3 | 80 MINUTES

Designing Laser Cut Parts

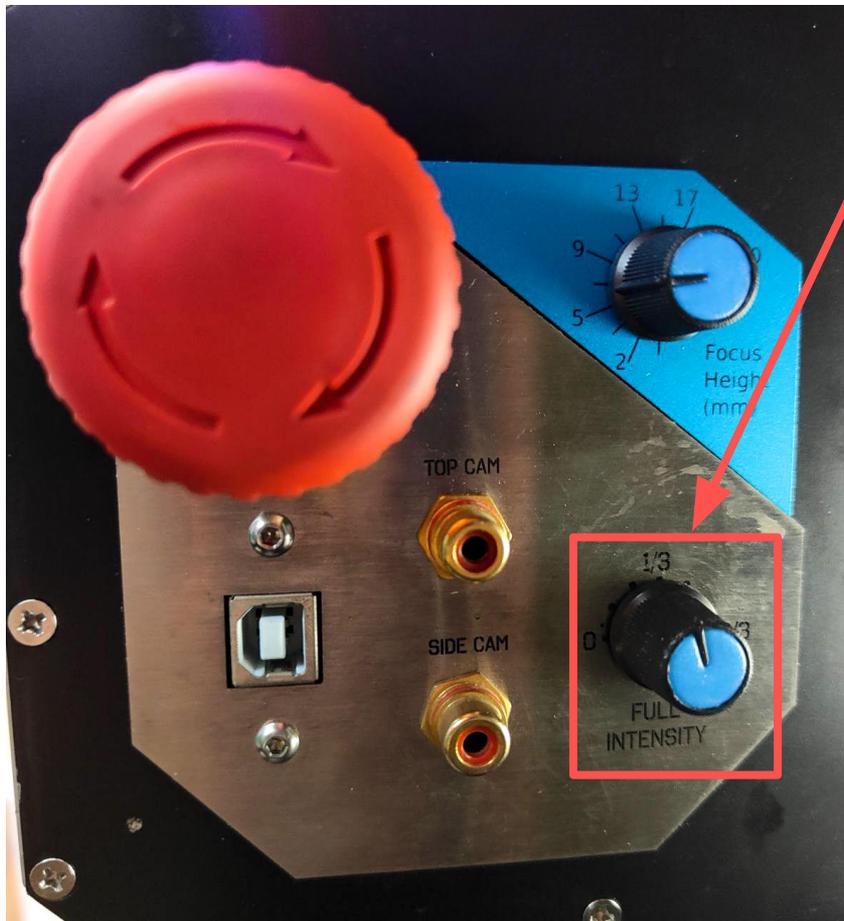
5. Operating the Laser Cutter

For engraving, adjust the laser intensity knob to 2/9 power (11 O'Clock).

REMINDER

Do not exceed this power setting. Exceeding this setting might result in your material getting burnt.

Once you are done cutting, remember to reset the laser intensity knob back to the '0' position.



Designing Laser Cut Parts

5. Operating the Laser Cutter



Open the material loading tray when the display reads “Idle”. This is to ensure that the machine is done cutting/rastering. Check on the monitor and display to confirm the machine is done cutting before opening the tray.

REMINDER

Do not cut other materials other than what is specified.

Monitor the ‘Tube Temp’ and make sure it does not exceed 35 °C. If it does stop the machine and let it cool down for at least 10 mins.

Designing Laser Cut Parts

5. Operating the Laser Cutter

Align your material to the bottom-left corner of the materials tray.

Apply tape to the sides to prevent the workpiece from moving.



Designing Laser Cut Parts

5. Operating the Laser Cutter

Try to make sure your job does not go over the tape.

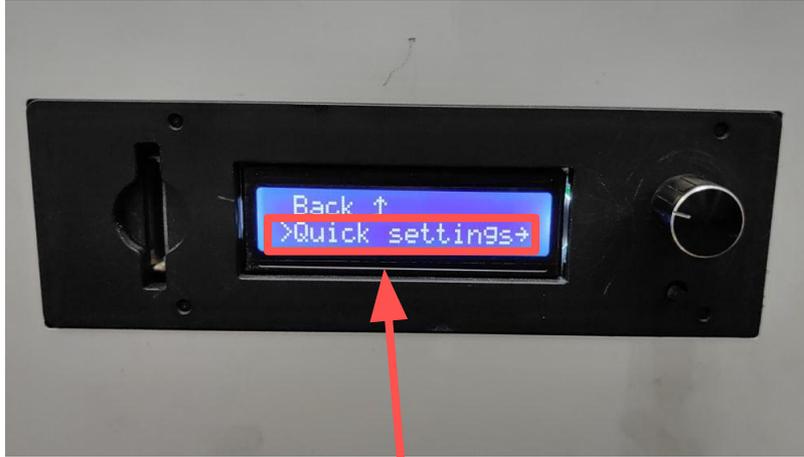
Position the tape strategically to avoid any potential mistakes.



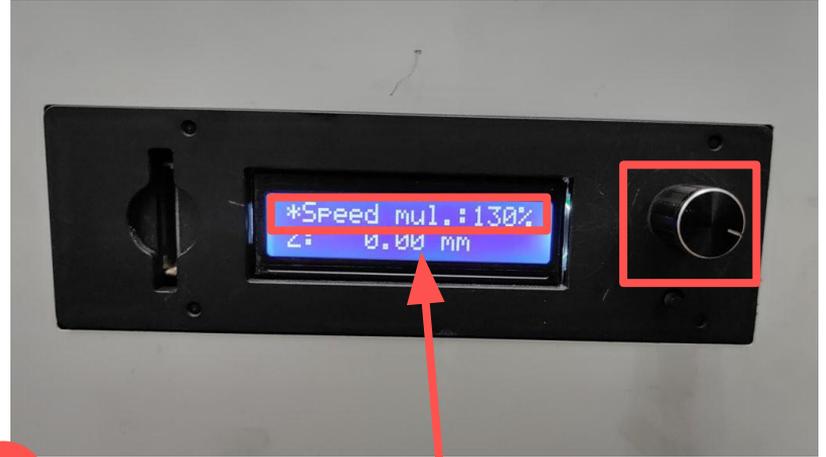
Designing Laser Cut Parts

5. Operating the Laser Cutter

Laser Cutter Settings for Engraving

**1**

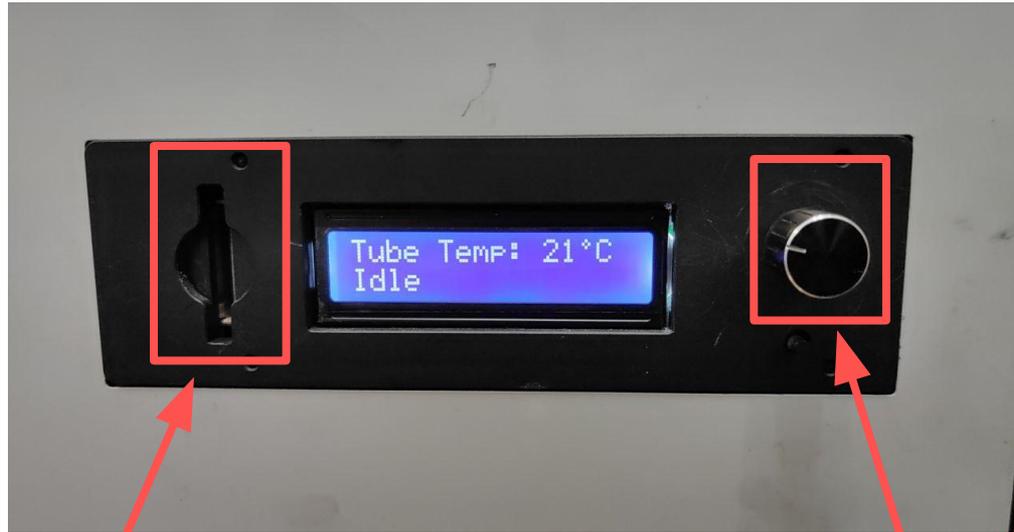
Select "Quick Settings".

**2**

Set "Speed mul." to 200% by rotating the knob clockwise and pressing the knob to select.

Designing Laser Cut Parts

5. Operating the Laser Cutter

**1****Insert SD Card.****2****Select file to print by rotating the knob and pressing the knob to select file.**

Designing Laser Cut Parts

5. Operating the Laser Cutter

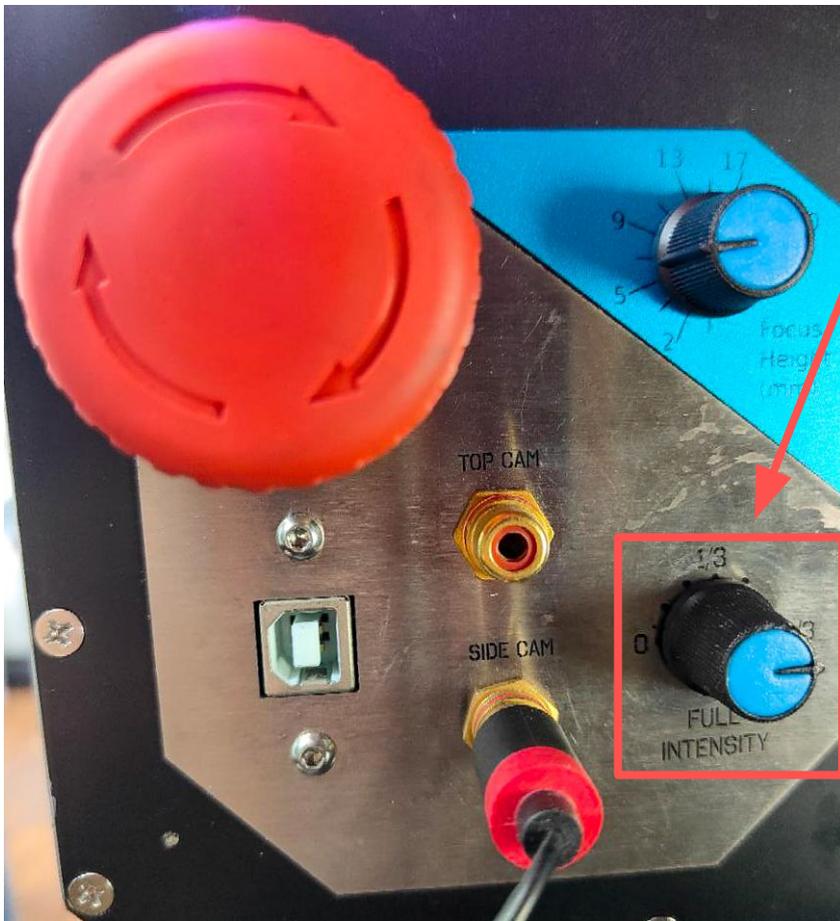
Insert your SD card after you've adjusted the cutter settings.

The menu will automatically navigate to the files on the card, making it difficult to adjust settings after.



THE ACTIVITY I SECTION 2.3 | 80 MINUTES

Designing Laser Cut Parts



5. Operating the Laser Cutter

For cutting, adjust the laser intensity knob to 2/3 power (3 O'Clock).

REMINDER

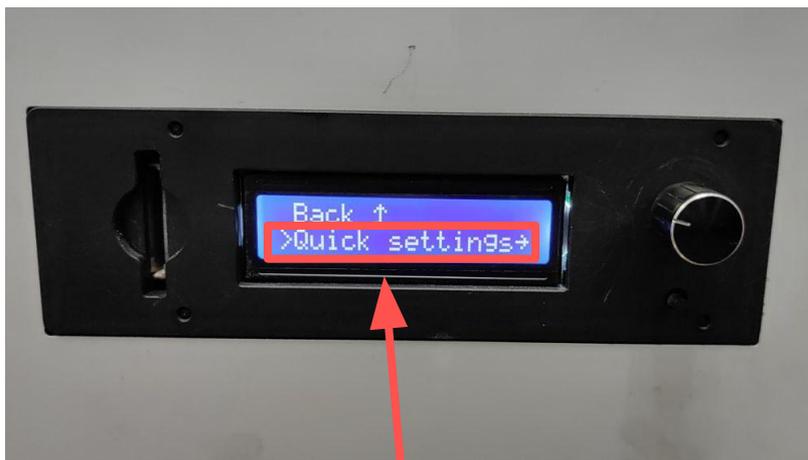
Do not exceed this power setting. Exceeding this setting might result in your material getting burnt.

Once you are done cutting, remember to reset the laser intensity knob back to the '0' position.

Designing Laser Cut Parts

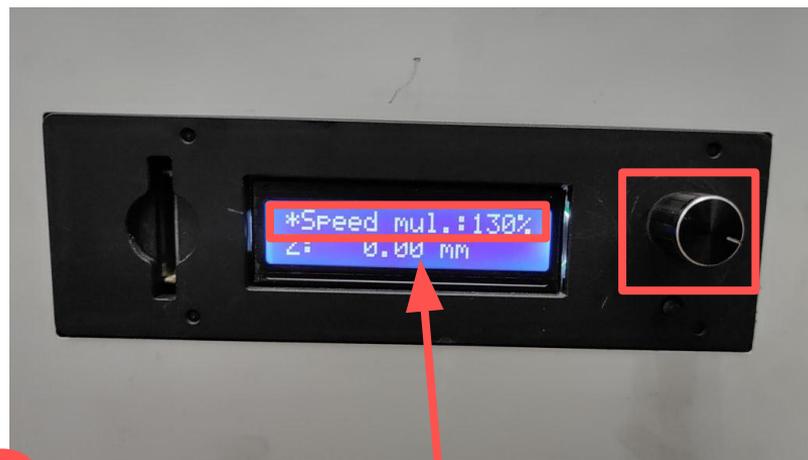
5. Operating the Laser Cutter

Laser Cutter Settings for Cutting



1

Select "Quick Settings".



2

Set "Speed mul." to 130% by rotating the knob clockwise and pressing the knob to select.

Designing Laser Cut Parts

5. Operating the Laser Cutter

Remove your work when you're done both engraving and cutting.

Keep the machine on and close the materials tray to ensure fumes are directed to the extractor.

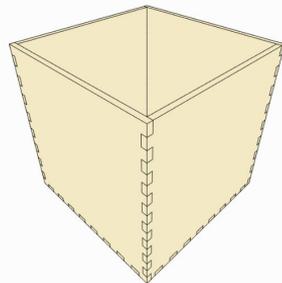


EXTENSIONS | SECTION 3 | 25 MINUTES
3D Shapes and Boxes

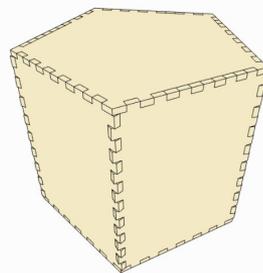
EXTENSIONS

Potential Projects

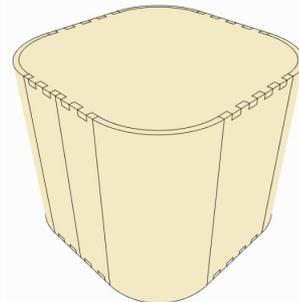
There are lots of projects to create with a laser box, but a powerful and flexible option is to make boxes. Boxes can be used for other projects, hold cherished objects, or for other creative purposes.



Basic Box
Simple boxes



Polygon Box
Polygon boxes with 3 or more sides



Kerf Bent Box
Boxes with round corners



<https://en.makercase.com/>

There are many free box generators available online, speeding up the process. Makercase is showcased because of how easy it is to use.

Potential Projects

Set units to
Millimeters

Set width, height,
depth of box

Material Thickness

Joint Type

MakerCase

Units
 Inches Millimeters

Width mm

Height mm

Depth mm

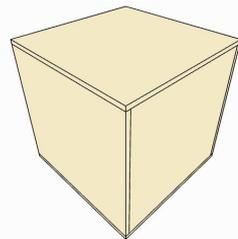
Are these inside or outside dimensions?
 Inside Outside

Material Thickness

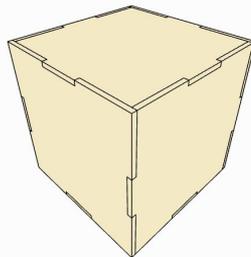
Open or closed box?
 Open Closed

Edge Joints
 Flat Finger T-Slot

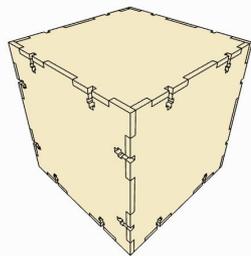
6. Design a 3D Box with MakerCase



Flat Joint

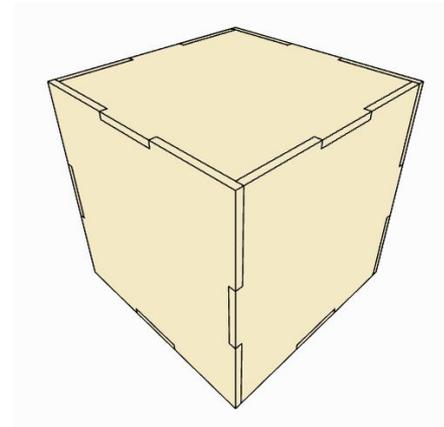
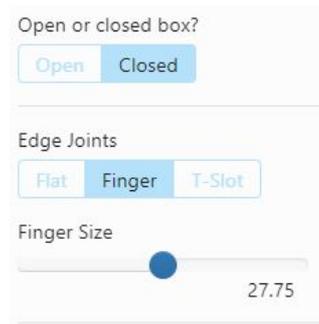
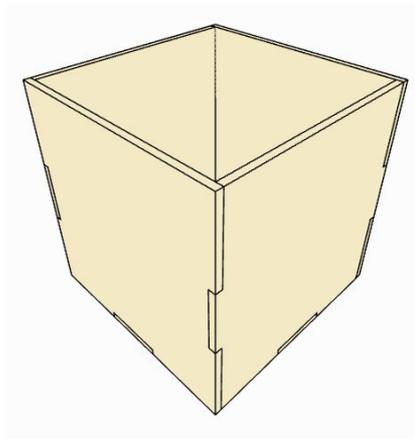


Finger Joint



T-Slot Joint

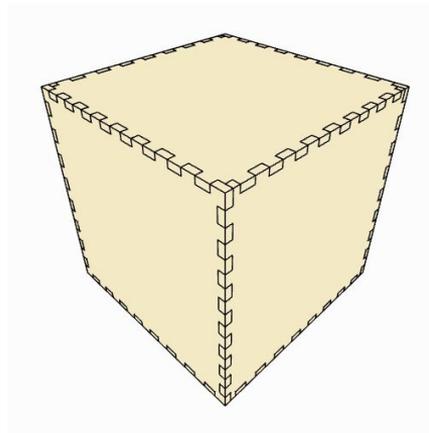
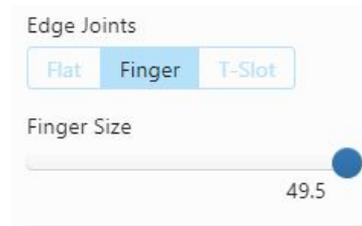
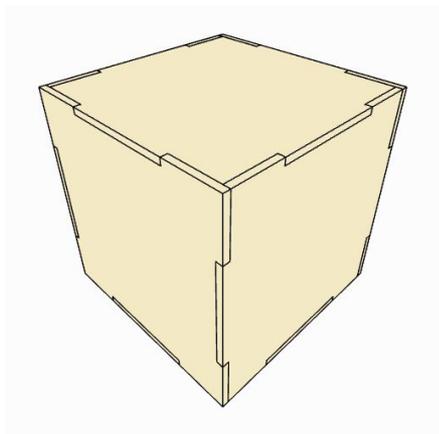
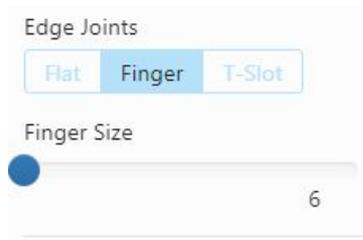
Potential Projects



6. Design a 3D Box with Makercase

Potential Projects

6. Design a 3D Box with Makercase



Potential Projects

6. Design a 3D Box with MakerCase

MakerCase - T Slot Joint

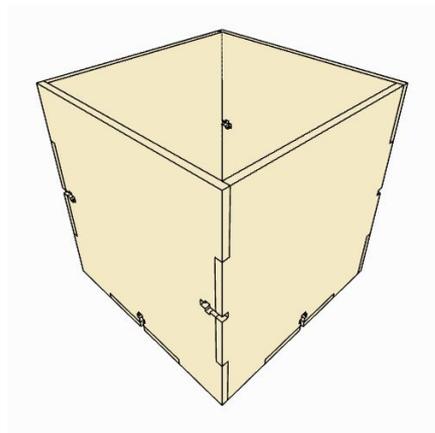
Open or closed box?

Edge Joints

Number of Bolts
 1

Bolt Diameter

Bolt Length



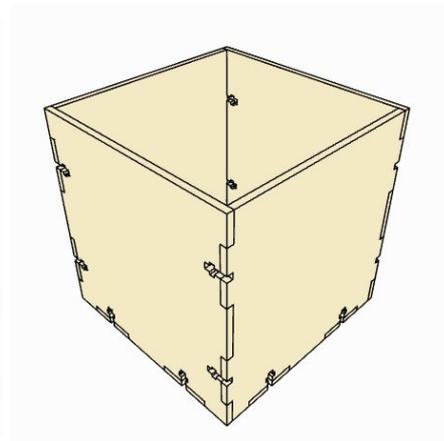
Open or closed box?

Edge Joints

Number of Bolts
 2

Bolt Diameter

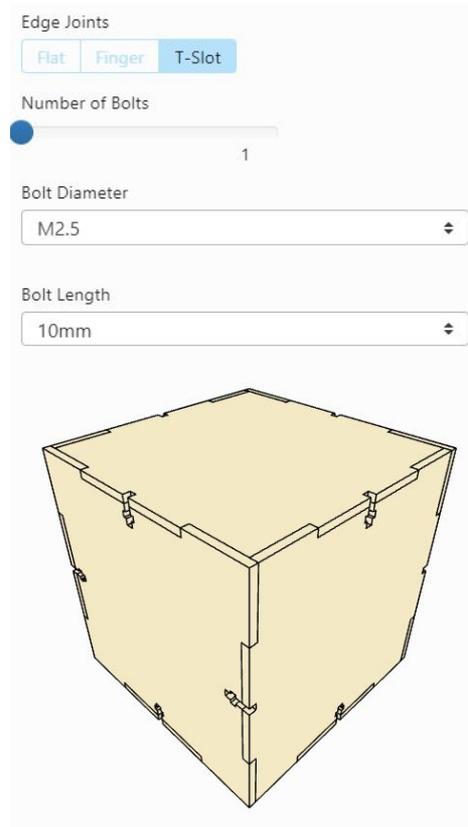
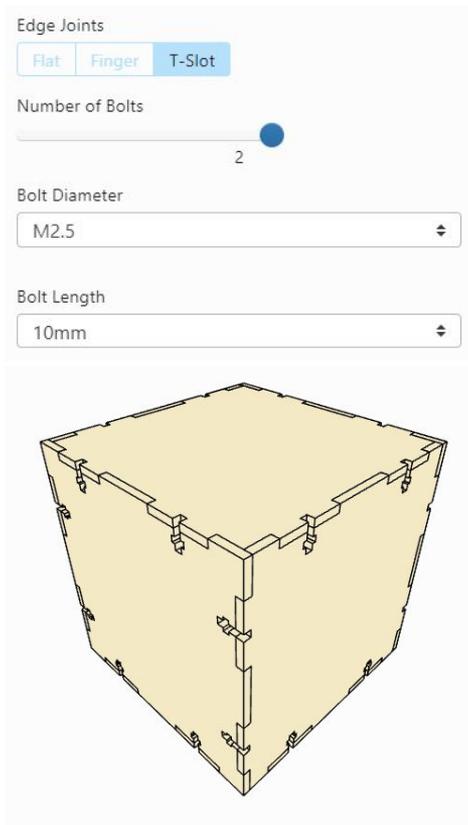
Bolt Length



Potential Projects

6. Design a 3D Box with MakerCase

MakerCase - T Slot Joint



Potential Projects

6. Design a 3D Box with Makercase

Units
 Inch Millimeters

Width
 mm

Height
 mm

Depth
 mm

Are these inside or outside dimensions?
 Inside Outside

Material Thickness

Open or closed box?
 Open Closed

Edge Joints
 Flat Finger T-Slot

Finger Size

Download Box

Labels and Spacing | Line Formatting | Kerf and Corner Compensation

Panel Labels: Enabled Disabled

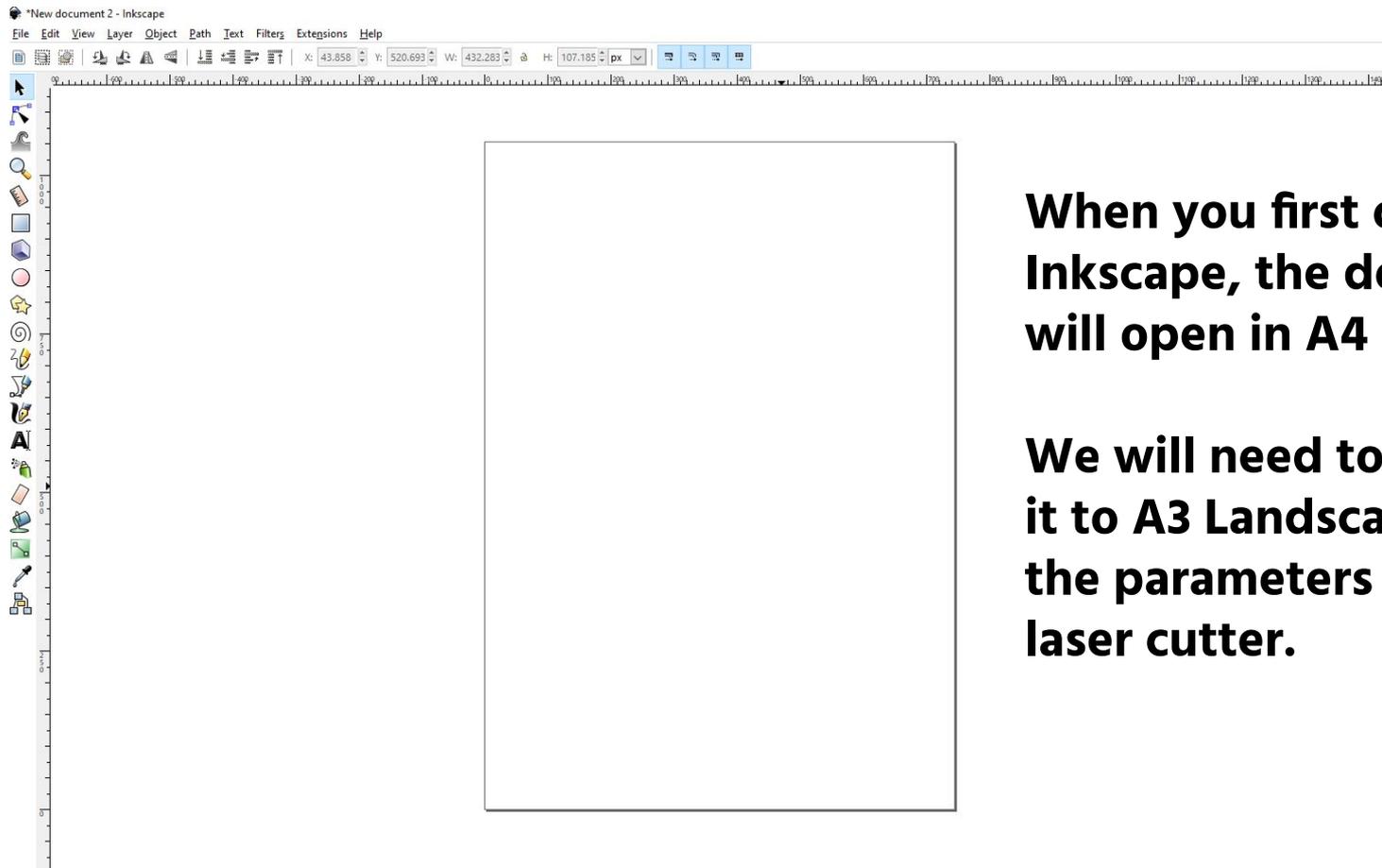
Panel Labels Color:

Panel Layout: Separate Combine

Download in
SVG format

Potential Projects

6. Design a 3D Box with Makercase

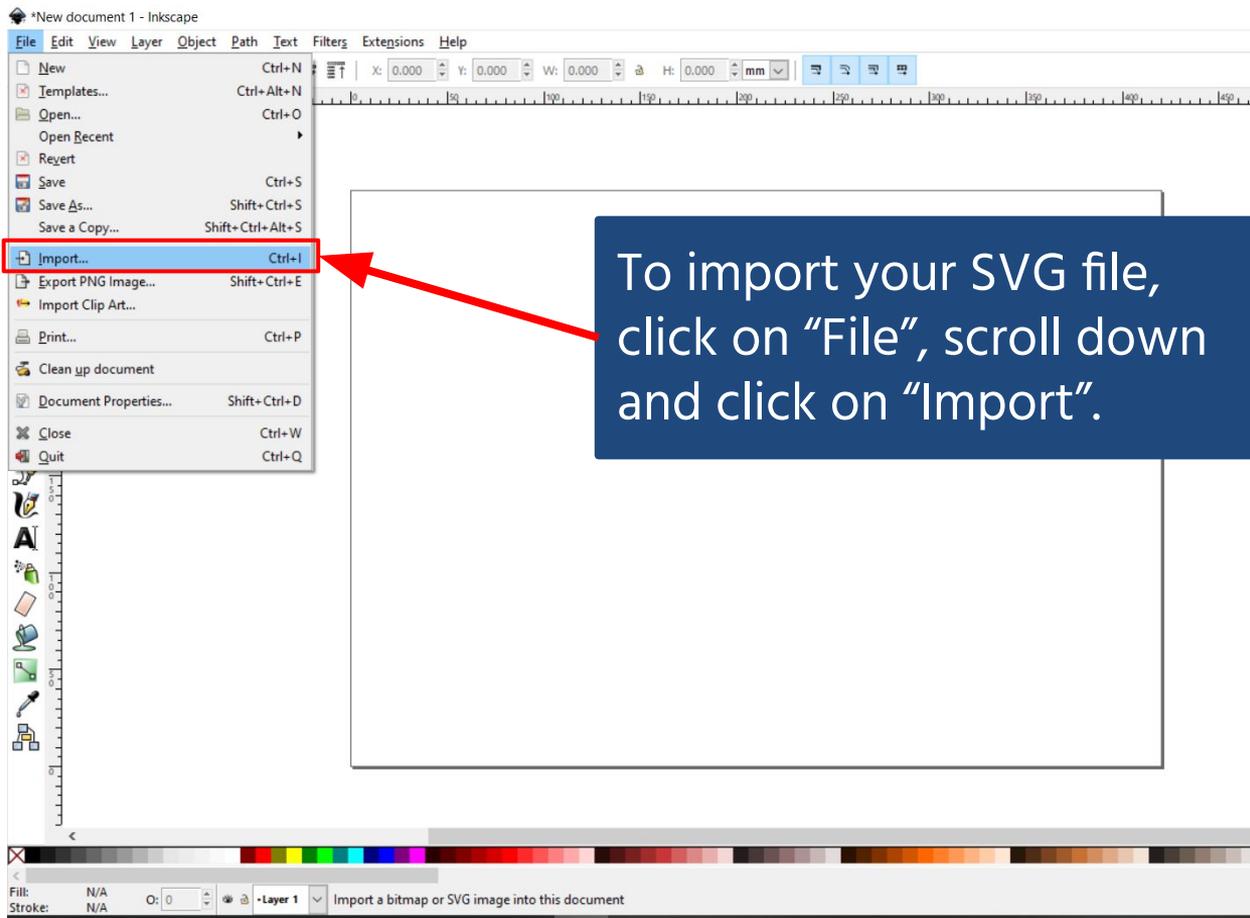


When you first open Inkscape, the document will open in A4 Portrait.

We will need to change it to A3 Landscape to fit the parameters of the laser cutter.

Potential Projects

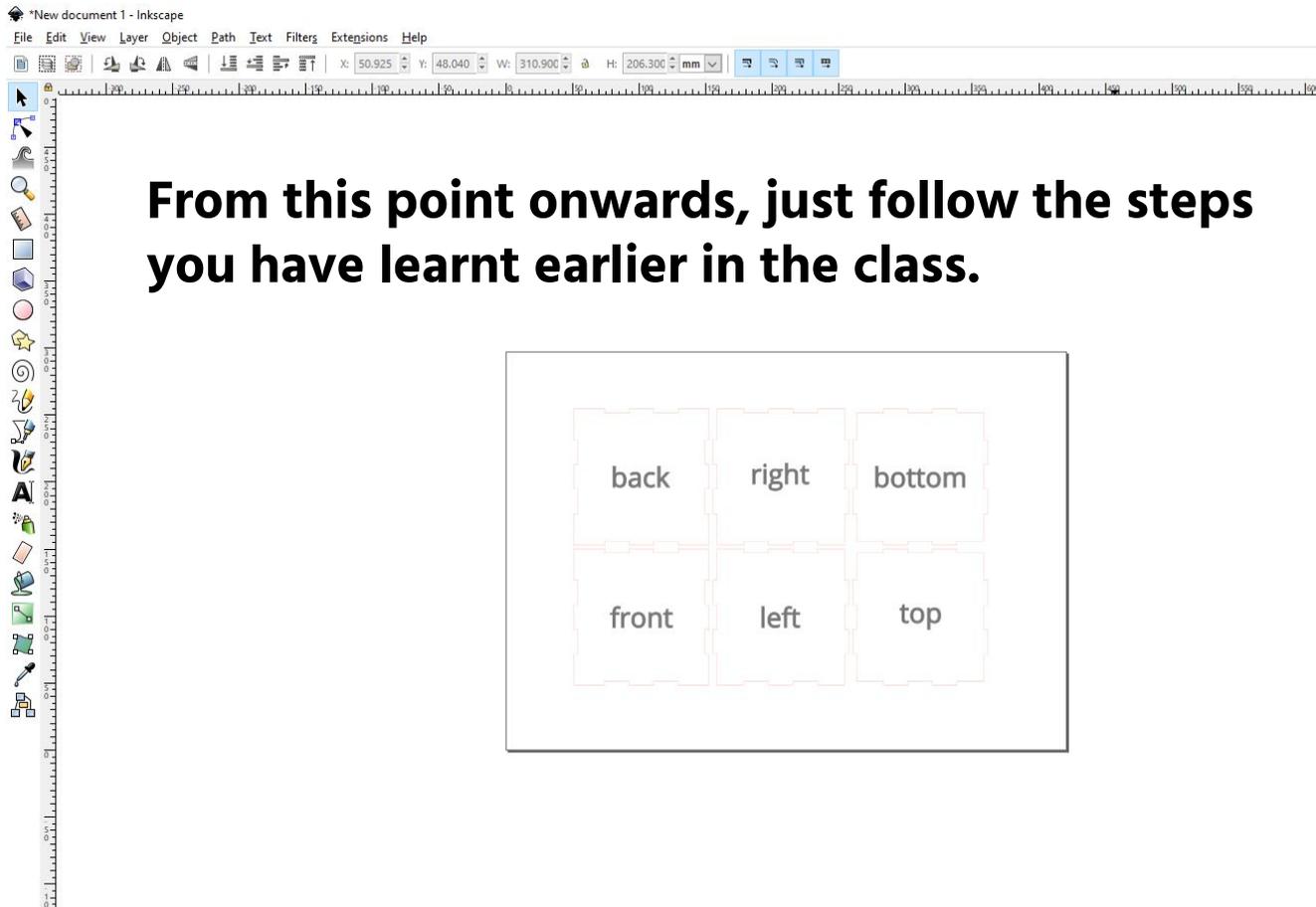
6. Design a 3D Box with Makercase



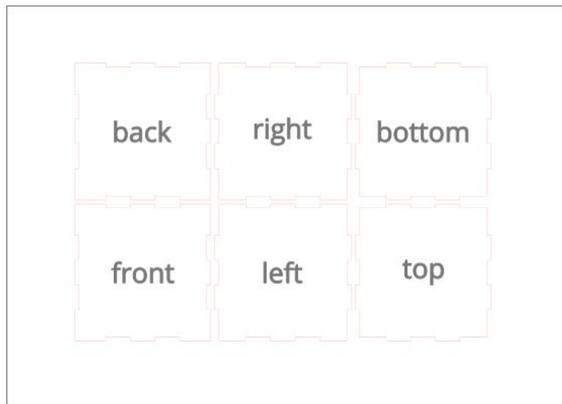
To import your SVG file, click on "File", scroll down and click on "Import".

Potential Projects

6. Design a 3D Box with Makercase

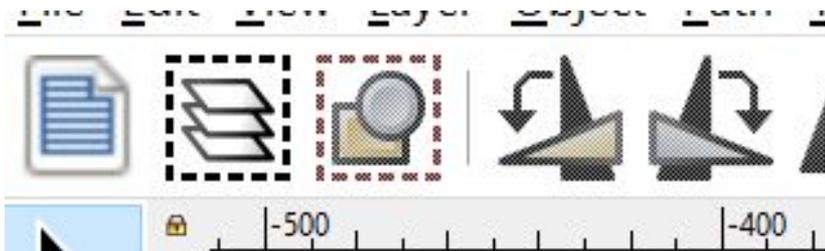


From this point onwards, just follow the steps you have learnt earlier in the class.



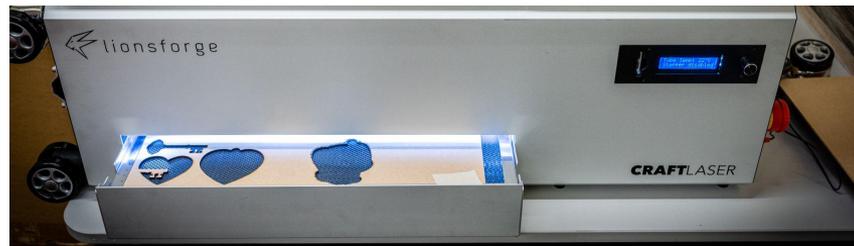
HOW CAN I APPLY WHAT I'VE LEARNED?

Applying Knowledge



Vector Design

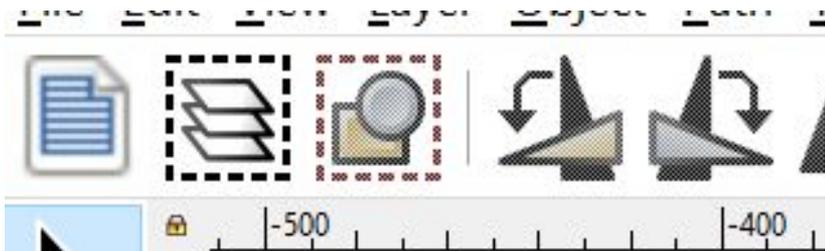
1. Seek learning resources for Inkscape (either from online sources or through NLB OneSearch)
2. Participate in Inkscape challenges to build out your skills



Laser Cutting

1. Find interesting laser cutting projects on Thingiverse or instructables
2. Make simple projects with different materials
3. Share your designs in the MakeIT Facebook group

Applying Knowledge



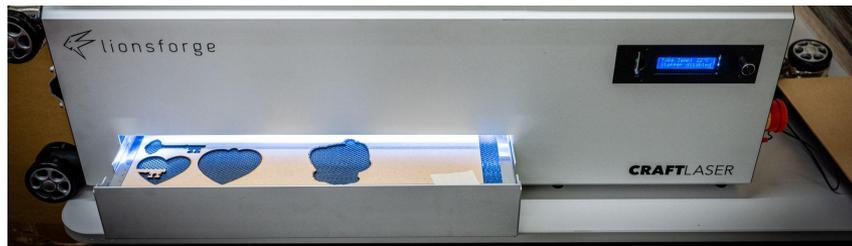
Vector Design - Youtubers to Follow

Logos By Nick:

<https://www.youtube.com/@LogosByNick>

TinkerTips (Playlist):

<https://tinyurl.com/TinkerTips>



Laser Cutting - Youtubers to Follow

Make or Break Shop:

<https://www.youtube.com/@makeorbreakshop>

CraftLaser Full Walkthrough (Video):

<https://tinyurl.com/craftlaser>

EXTENSIONS | SECTION 3 | 25 MINUTES
Frequently Asked Questions

TINKERING AT MAKEIT AT LIBRARIES

EXTENSIONS | SECTION 3.1 | 25 MINUTES

MakeIT at Libraries - Making a Booking

Creating myLibrary ID

1. Go to

<https://account.nlb.gov.sg/>

2. Create a myLibrary account using your Singpass or NRIC / FIN

3. Create a myLibrary ID (username) that you can remember



Account Services

Use this e-Service to

- create an online User ID
- retrieve your online User ID
- reset your password
- sign up for library membership (available with Singpass login)

I have a Singpass account

[Use Singpass](#)

I do not have a Singpass account

[Use NRIC / FIN](#)

EXTENSIONS | SECTION 3.1 | 25 MINUTES

MakeIT at Libraries - Making a Booking

Simplybook

Equipment bookings are handed through Simplybook. Talk to our Centre Manager to register for an account, then visit <https://makeitsg.simplybook.asia/v2/> to book equipment.



MakeIT at Libraries

[Book Tinkering Equipment](#)

Opening Hours

MON	Closed
TUE	Closed
WED	12:00 - 19:00
THU	12:00 - 19:00
FRI	12:00 - 19:00
SAT	12:00 - 19:00
SUN	12:00 - 19:00

MakeIT at Libraries

Get creative at NLB's MakeIT at Libraries, where you can create, tinker, and make with the power of tech! Try 3D printing, robotics, coding, and other crafting tools of the future, with hands-on activities, workshops, and co-making spaces that are free-to-use for all library members in Singapore.

Besides **3D printers** and **3D pens**, there are new equipment available for use during tinkering. Certification is required and will be enabled after completing the starter session. Sign up for the starters at <https://go.gov.sg/nlb-makeit-events> (no expertise or experience is required).

Please note the following:

- For safety, equipment certification and tinkering are recommended for ages **15 and up**.
- MakeIT will be closed between 3 to 4pm for sanitisation, cleaning & equipment upkeep.
- One booking can be made up to three weeks in advance per certification (slot availability subject to changes). Please complete the current booking before creating more bookings.

COVID-19 SMM's in 2022

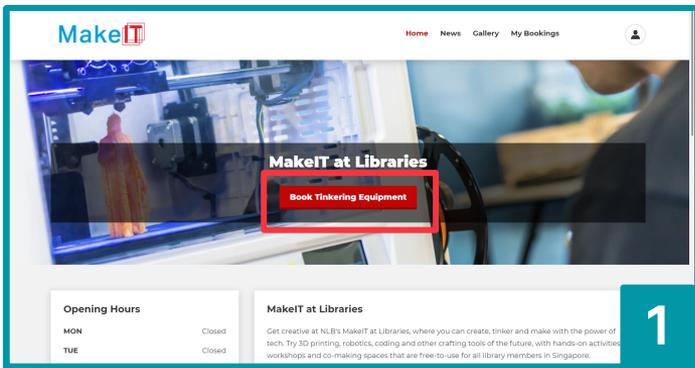
[Recommendations](#)

We recommend those feeling unwell to avoid visiting MakeIT, attending tinkering and starter sessions.

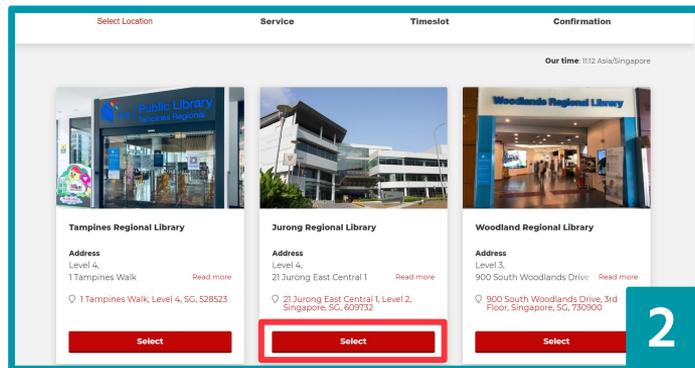
MakeIT at Libraries is an initiative by NLB.

[Book Tinkering Equipment](#)

MakeIT at Libraries - Making a Booking

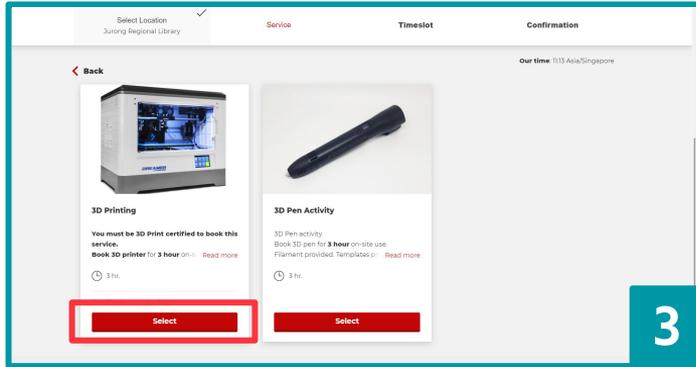


Once you have logged in, click on “Book Tinkering Equipment”.

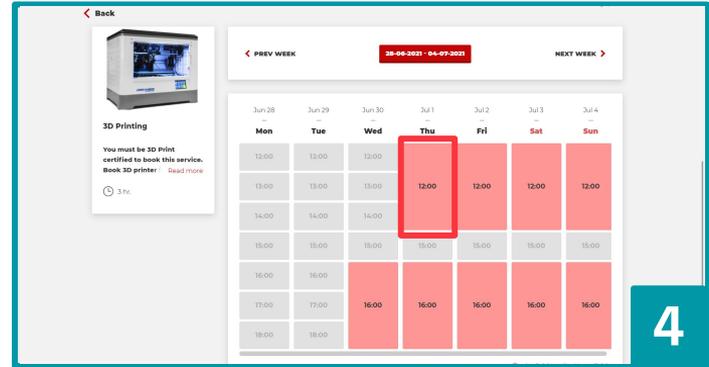


You will be redirected to a page that allows you to choose which MakeIT branch you will like to visit. Select one of the branches by clicking the respective branch “Select” button.

MakeIT at Libraries - Making a Booking



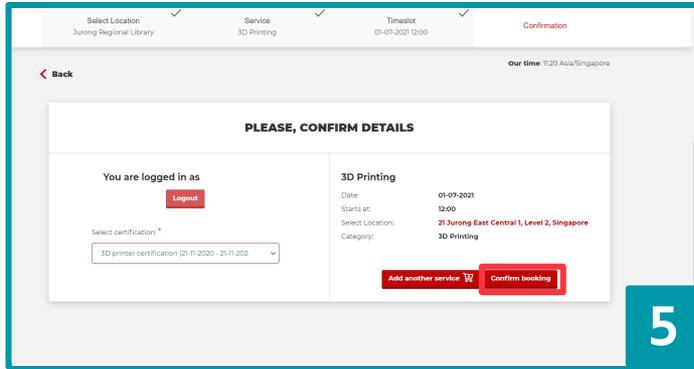
Click the “Select” button respective to the equipment that you will like to use. Note: Bookings for most equipment can only be placed once you have gone for the required training.



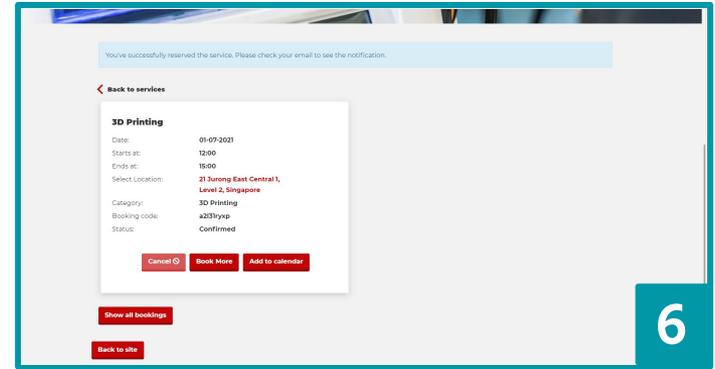
Slots available for booking will be displayed, click on the slot that you will like to book.

Red - Available for booking
Grey - Unavailable

MakeIT at Libraries - Making a Booking

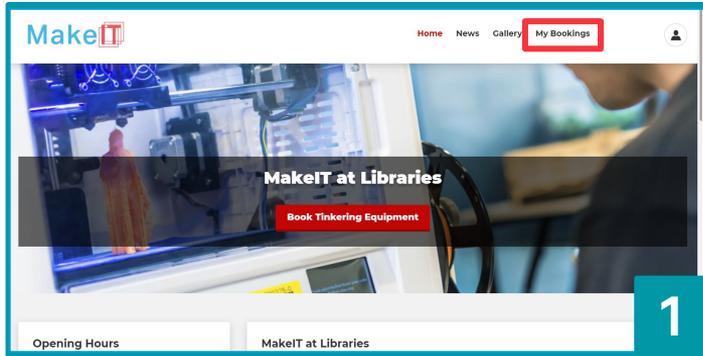


Ensure that you have selected the correct slot and click on “Confirm booking”.

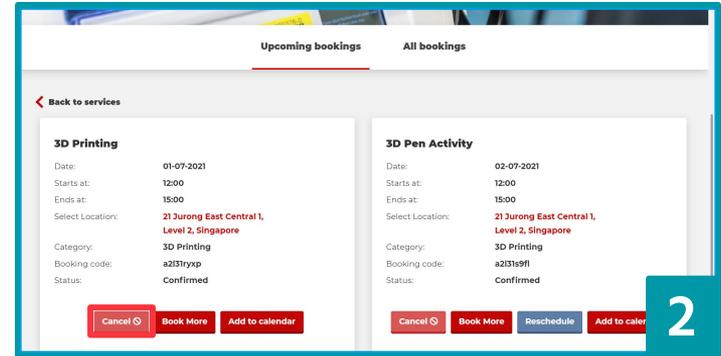


You will be redirected to a confirmation page with your booking details. Should you need to cancel your booking, you may click “Cancel”.

MakeIT at Libraries - Cancelling your Booking

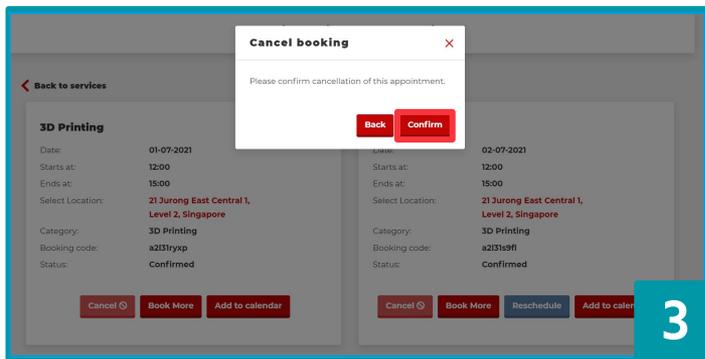


Once you have logged in, click “My Bookings”.

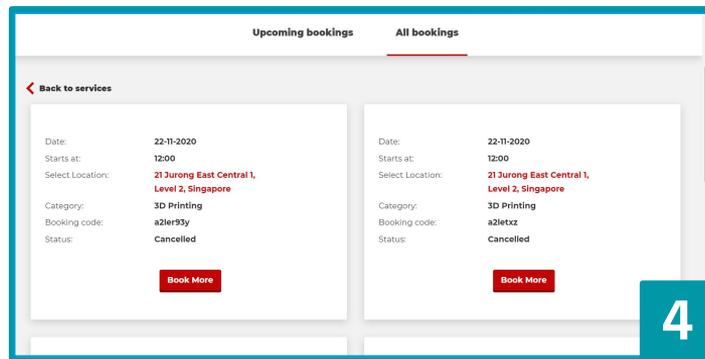


Your upcoming bookings will be displayed as shown above. To cancel your booking, click “Cancel”.

MakeIT at Libraries - Cancelling your Booking



Click “Confirm” to cancel the booking.



To see all past and future bookings, click on “All bookings”.

Frequently Asked Questions

1. How do I book a Laser Cutter?

Register as a user for MakeIT's Simplybook booking system, and book an available time slot for the Laser Cutter.

2. How long can I use the Laser Cutter per booking?

Bookings are limited to 3 hours.

3. How many Laser Cutters can I book? Can I book multiple Laser Cutters?

You may only book 1 Laser Cutter at a time within MakeIT.

4. Can I choose which Laser Cutter to use?

Laser Cutters are booked on a first-come, first-served basis. Arrive at your allocated time on time to begin using one of the available Digital Cutters.

5. What can I cut? Can I bring my own materials for cutting?

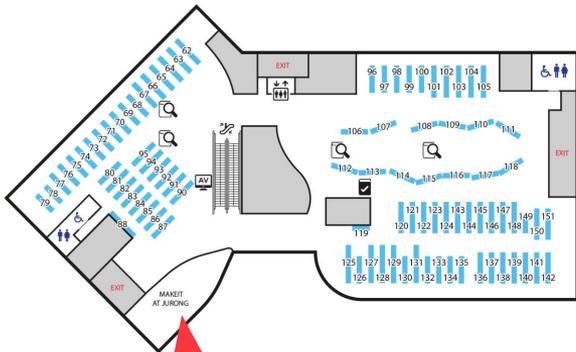
You may choose one sheet of plywood, MDF, or acrylic per booking slot for cutting. In addition, you may test cut using the scrap materials provided at MakeIT. You may not bring your own materials for cutting at MakeIT.

MakeIT at Jurong

JURONG REGIONAL LIBRARY • LEVEL 2

MAP DIRECTORY

62 – 87	Adults' Collection
88, 119	Fiction
90 – 95	Accompanying Items
96 – 98	Audiobooks & Audiovisuals
98 – 100	Travel
101, 102	Health
103 – 105	Recreation
106 – 111	Cookery
112 – 118	Arts
120 – 124	Business
125 – 127	Computer
127 – 151	Comics
	General Non-Fiction



- CATALOGUE
- BORROWING STATION
- AV TESTING
- LIFT
- ESCALATOR
- TOILET

Location	Jurong Regional Library, 2nd Floor
Address	21 Jurong East Central 1 Singapore 609732
Closest MRT Station	NS1 EW24 JE5 Jurong East
Opening Hours	Wednesday - Sunday, 12 - 8PM

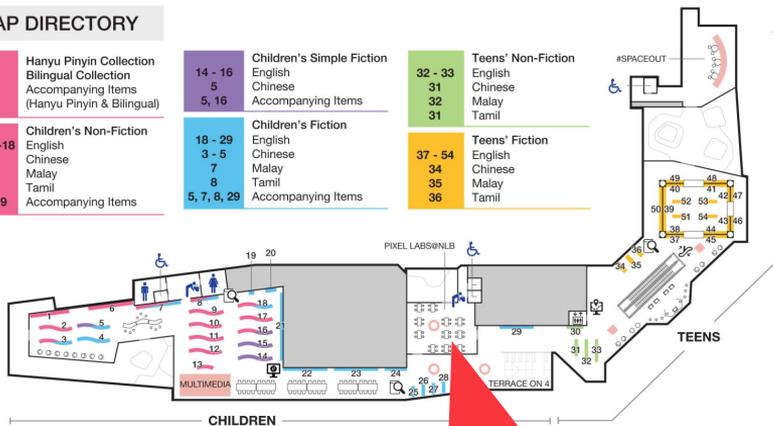
EXTENSIONS | SECTION 3.1 | 25 MINUTES

MakeIT at Tampines

TAMPINES REGIONAL LIBRARY • LEVEL 4

MAP DIRECTORY

1 & 6 2 1, 2	Hanyu Pinyin Collection Bilingual Collection Accompanying Items (Hanyu Pinyin & Bilingual)	14 - 16 5 5, 16	Children's Simple Fiction English Chinese Accompanying Items	32 - 33 31 32 31	Teens' Non-Fiction English Chinese Malay Tamil
9-13, 16-18 2 - 3 7 8 3, 7, 8, 9	Children's Non-Fiction English Chinese Malay Tamil Accompanying Items	18 - 29 3 - 5 7 8 5, 7, 8, 29	Children's Fiction English Chinese Malay Tamil Accompanying Items	37 - 54 34 35 36	Teens' Fiction English Chinese Malay Tamil



- 📖 CATALOGUE
- 📖 DIRECTORY
- 💻 EBOOKS
- 🚶 LIFT
- 🌐 4 LANGUAGES
- 🚪 ESCALATORS
- ♂ MALE TOILET
- ♀ FEMALE TOILET
- ♿ HANDICAP TOILET
- 🏠 NURSING ROOM
- 💧 WATER DISPENSER

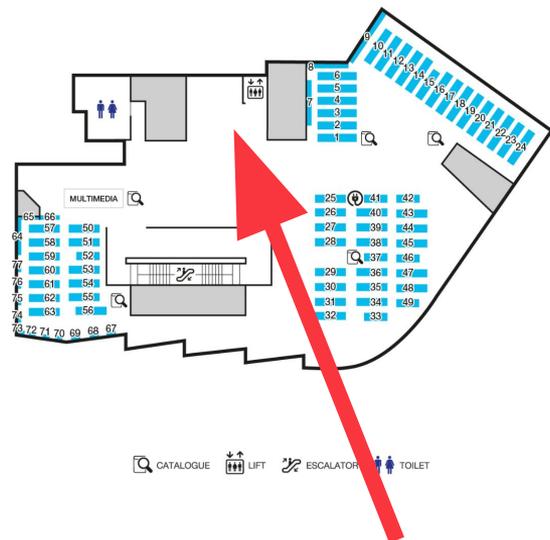
Location	Tampines Regional Library, 4th Floor
Address	1 Tampines Walk, #02-01 Our Tampines Hub, Singapore 528523
Closest MRT Station	EW2 — DT32 Tampines
Opening Hours	Wednesday - Sunday, 12 - 8PM

MakeIT at Woodlands

WOODLANDS REGIONAL LIBRARY • LEVEL 3

MAP DIRECTORY

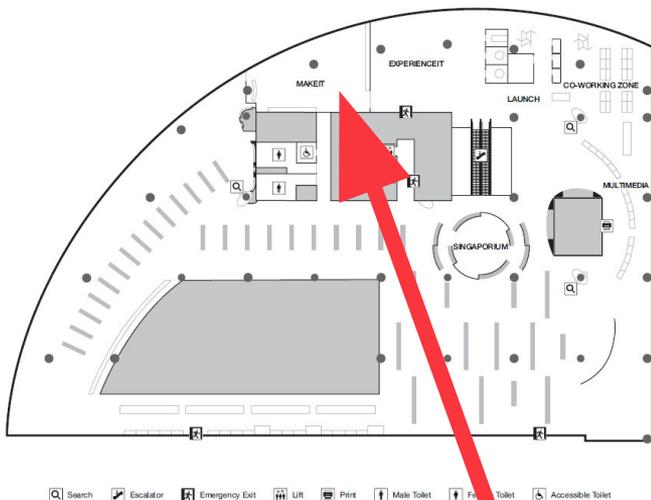
- 1 – 6** Adults' Collection
- 7 – 24** Singapore Collection
- 25** General Non-Fiction
- 26 – 28** Comics
- 29 – 34** Computers
- 35 – 37** Business
- 38** Health
- 39 – 43** Recreation
- 44 – 46** Arts
- 47 – 49** Cookery
- 50 – 66** Travel
- 67 – 77** English Fiction
- English Fiction (Large Print)



Location	Woodlands Regional Library, 3rd Floor
Address	900 South Woodlands Drive #01-03. Singapore 730900
Closest MRT Station	NS9 TE2 Woodlands
Opening Hours	Wednesday - Sunday, 12 - 8PM

MakeIT at Punggol

PUNGGOL REGIONAL LIBRARY • LEVEL 4



Location

Punggol Regional Library,
4th Floor

Address

1 Punggol Drive
One, #01-12,
Singapore 828629

Closest MRT Station

NE17 PTC
Punggol

Opening Hours

Wednesday -
Sunday, 12 - 8PM

MAKE TOGETHER WITH US



Contribute your user creations with MakeIT at Libraries!

(Ongoing)

- Whether you've fabricated something physical like a 3D print or designed a digital creation, we would love to feature them at MakeIT!
- Simply leave your physical works and/or source files with our Maker Coaches at any of our makerspaces.



SHARE YOUR CREATIONS WITH MAKEIT!

Submit us your works

And have them possibly showcased at our exhibition at MakeIT!



From Nov 2023

Submissions can be contributed during MakeIT hours



Any MakeITs

Jurong Regional Library
Punggol Regional Library
Tampines Regional Library
Woodlands Regional Library

Hey there, talented users of MakeIT at Libraries!

We've seen some amazing stuff being created here in our makerspaces, and we're creating a collection of items to display and share them with others!

Whether you've fabricated something physical like a 3D print or designed a digital creation, we would love to feature them at MakeIT!

Sign up now!



Scan the QR code to join MakeIT via our Starter Sessions!

GETTING STARTED

- Contributor must be a registered user of MakeIT at Libraries. Not a member? Sign up with us in one of our Starter Sessions!
- Feel free to leave your physical works and/or source files with our Maker Coaches at any of our makerspaces.
- Your works will be part of MakeIT's open source library, which will be freely shared to other users for their own projects.
- For safety reasons, MakeIT at Libraries are recommended for ages 15 and above.

MakeIT

AT LIBRARIES

go.gov.sg/makeit



NLB | National Library Board
Singapore

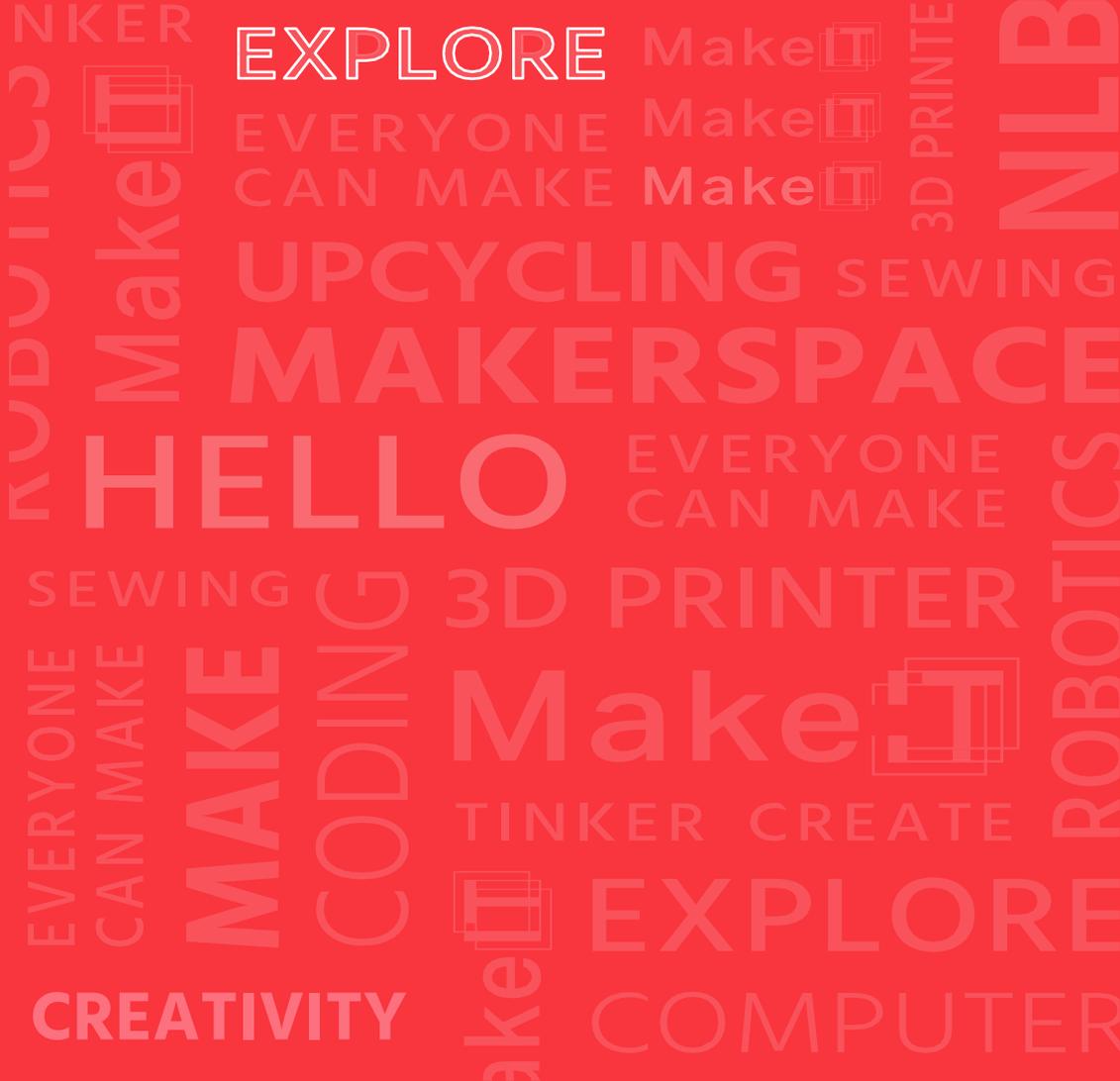


THANK YOU!

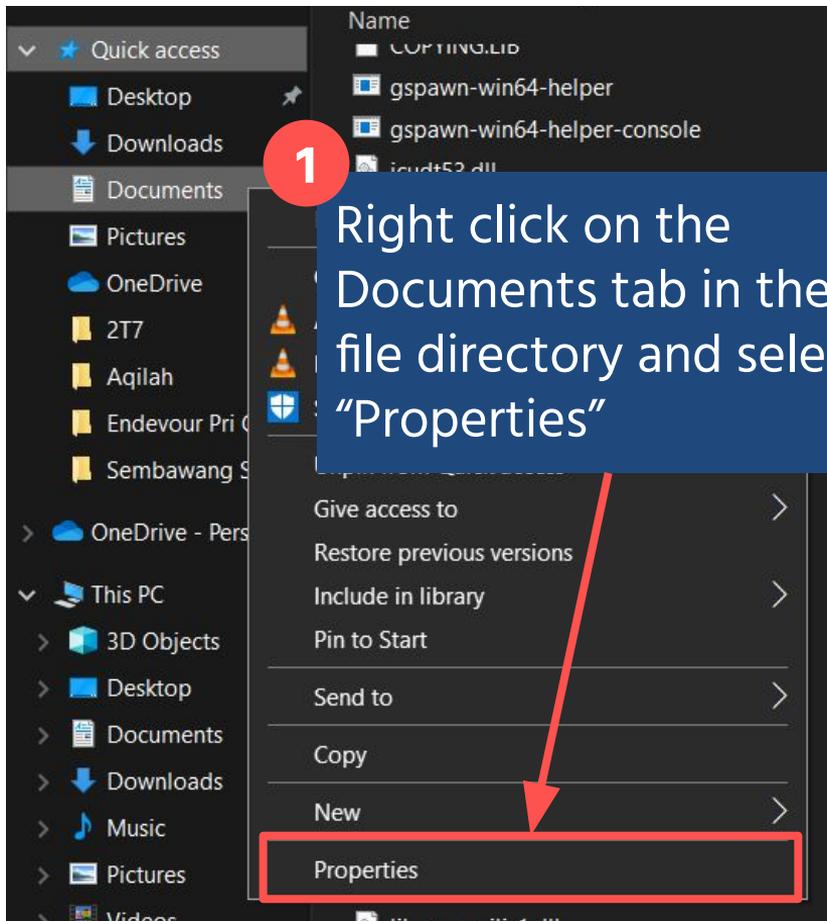


<https://go.gov.sg/makeit-onsite-loi>

Please follow the link above to provide feedback for this workshop. We'll use this information to continue to develop your learning journey within MakeIT.



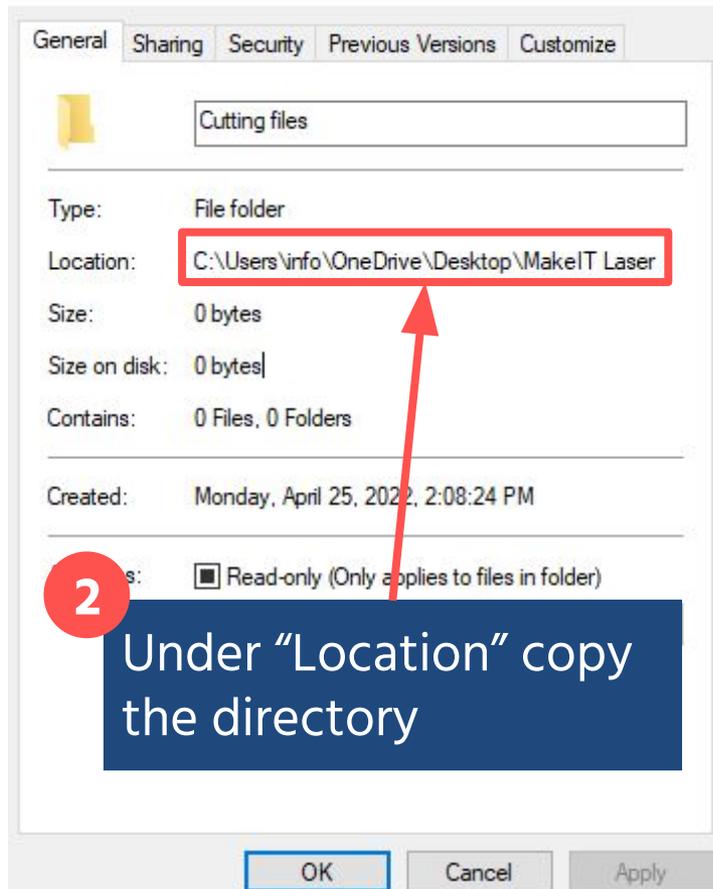
Designing Laser Cut Parts



1

Right click on the Documents tab in the file directory and select "Properties"

3. Use Inkscape to Engrave Object



2

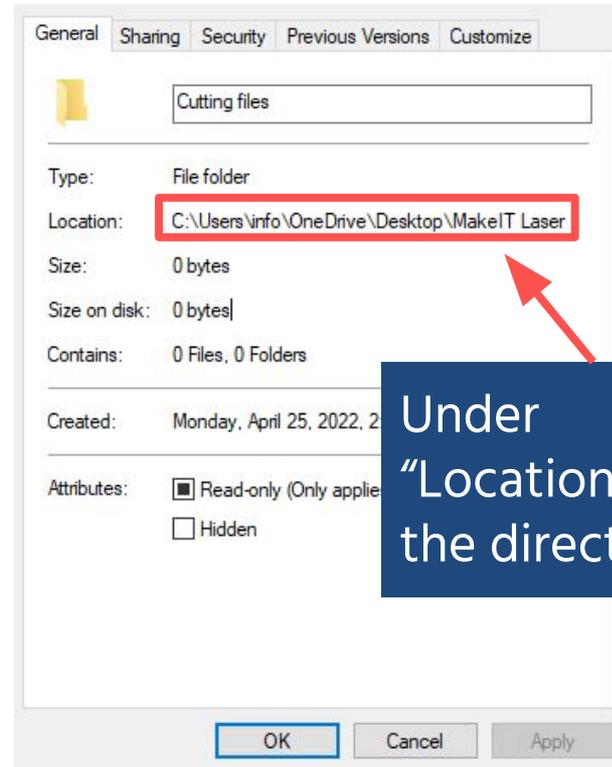
Under "Location" copy the directory

This slide is meant as notes for presenter

Right click any folder on the Desktop and select “Properties”.

In case the output location is not set within Inkscape, copy and paste the file path into the plugin pop-up window.

4. Use Inkscape to Cut Object



Under
“Location” copy
the directory

Applying Knowledge

Udemy

Users with a valid myLibrary ID can access Udemy Business with their library account to access thousands of courses online for free.

Udemy has courses ranging from technology topics to traditional crafting, all available to enroll from: <https://www.udemy.com/>

Home / By Type

Browse By Type

[eBooks](#) [eDatabases](#) [eJournals](#) [eLearning](#) [eMagazines](#) [eNewspapers](#)

Showing 1 - 2 of 2

- ### 1. Udemy Business

Udemy Business is an online learning platform that offers thousands of courses on key soft skills and technical topics such as Software Development, Leadership, Marketing, Sales, Programming, IT, and more.

For login instructions, refer to our [Step-by-Step Guide](#) and [FAQs](#).

Accessibility features for Udemy Business include independent volume control, headings and other stylised content that are rendered as text instead of images, navigation tools, labelled form fields and headings for screen reader support and subtitles. For more information on Accessibility, [click here](#).

Available at all libraries and home, for NLB patrons' personal use only. You will be leaving the National Library Board's site if you choose to use the Services under Udemy Business. Please note that you must be at least 13 years of age to use the Services.
- ### 2. Video Learning Portal (VLP)

Description of eResource.VLP is a one-stop site with video contents curated by our own NLB staffs. This is our very own YouTube portal where we can host videos for training and learning and share them securely within ourselves as well as our patrons.

Available at all libraries and from home.

« ‹ › »

Navigate here to get started:

<https://eresources.nlb.gov.sg/elearn>



Applying Knowledge

Udemy - Laser Cutting

Designer and Artist Ben Gatien created a course focusing on introductory laser cutting design with Inkscape. The techniques used can apply to your projects.

<https://www.udemy.com/course/introduction-to-laser-cutting/>

Design > Other Design > Inkscape

Introduction to Laser-Cutting

Learn to create designs for laser-cutters in less than a day

Bestseller 4.7 ★★★★★ (181 ratings) 858 students

Created by Ben Gatien

Last updated 2/2021 English English [Auto]



Preview this course

\$19.98 ~~\$56.99~~ 46% off

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Training 5 or more people?

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[Try Udemy Business](#)
What you'll learn

- ✓ How to create designs with Inkscape that can be cut with any laser-cutters.
- ✓ How to prepare those designs for cutting.
- ✓ How to make simple one-piece projects (coasters)
- ✓ How to make designs with multiple layered pieces and add words to them, (picture frames)
- ✓ How to make designs with interlocking pieces and engrave images on them, (phone stands)
- ✓ How to make slot joints and finger joints to make boxes (pencil holder)
- ✓ How to add words and use outlines to make nice designs with text (studio sign)

Course content

8 sections • 29 lectures • 3h 9m total length

[Expand all sections](#)

^ Introduction	1 lecture • 2min
☑ Introduction and my Credentials	Preview 02:10
^ First Steps with Inkscape	4 lectures • 9min
^ Making Shapes in Inkscape	7 lectures • 41min
^ First Projects - Flat Coaster Designs	7 lectures • 47min
^ 2nd Project, Multi Layered Flat Designs - Picture Frames	2 lectures • 16min
^ 3rd Project - Tab and Slots - Phone Stand	2 lectures • 17min
^ 4th Project - Slot and Finger Joints - Pencil Box	4 lectures • 42min
^ Final Project - Studio Sign	2 lectures • 15min

Learner's Profile - Confidence Card

Beginner



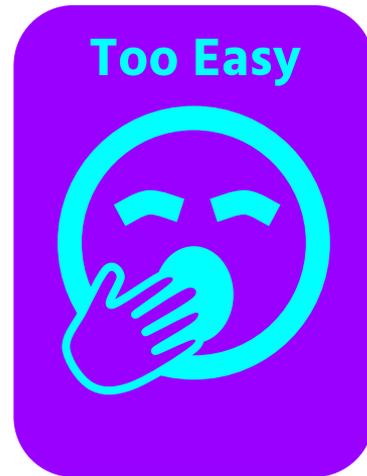
Need help
understanding
content

Intermediate



Content is paced
well and is
understandable

Advanced



Content is too
simple; need a
bigger challenge