

MakeIT

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

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

3 - Extensions

25 minutes

1. Frequently Asked Questions

REQUIRED MATERIALS

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
understanding
content

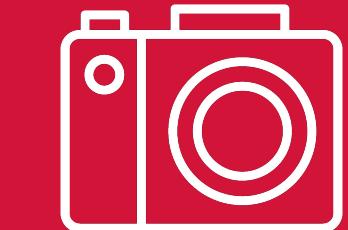


Content is paced
well and is
understandable

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.
-
-

THE HOOK I SECTION 1.1 | 15 MINUTES

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

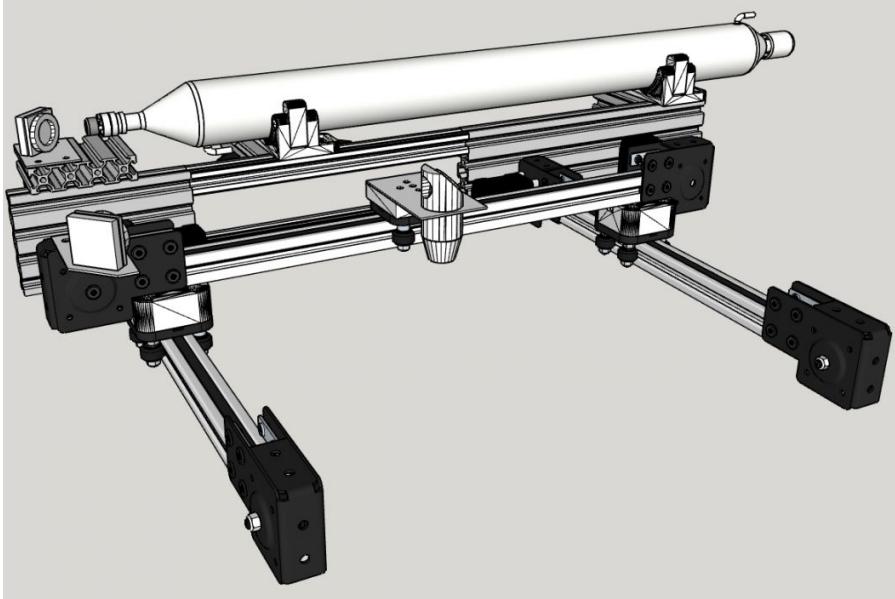


THE HOOK I SECTION 1.1 | 15 MINUTES

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**.

THE HOOK | SECTION 1.1 | 15 MINUTES

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.

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.

THE HOOK I SECTION 1.1 | 15 MINUTES

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.

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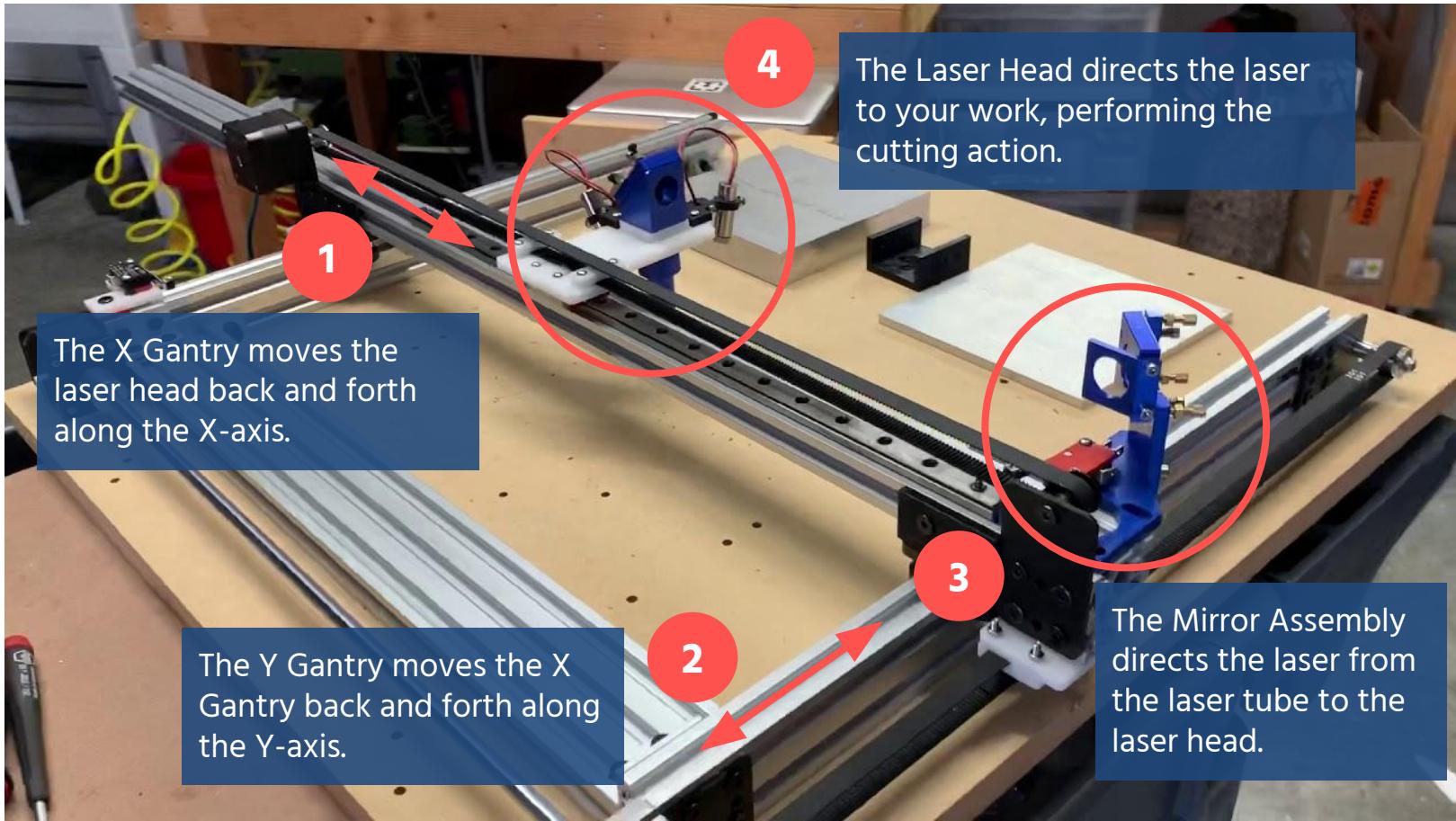
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HOW DOES A LASER CUTTER WORK?

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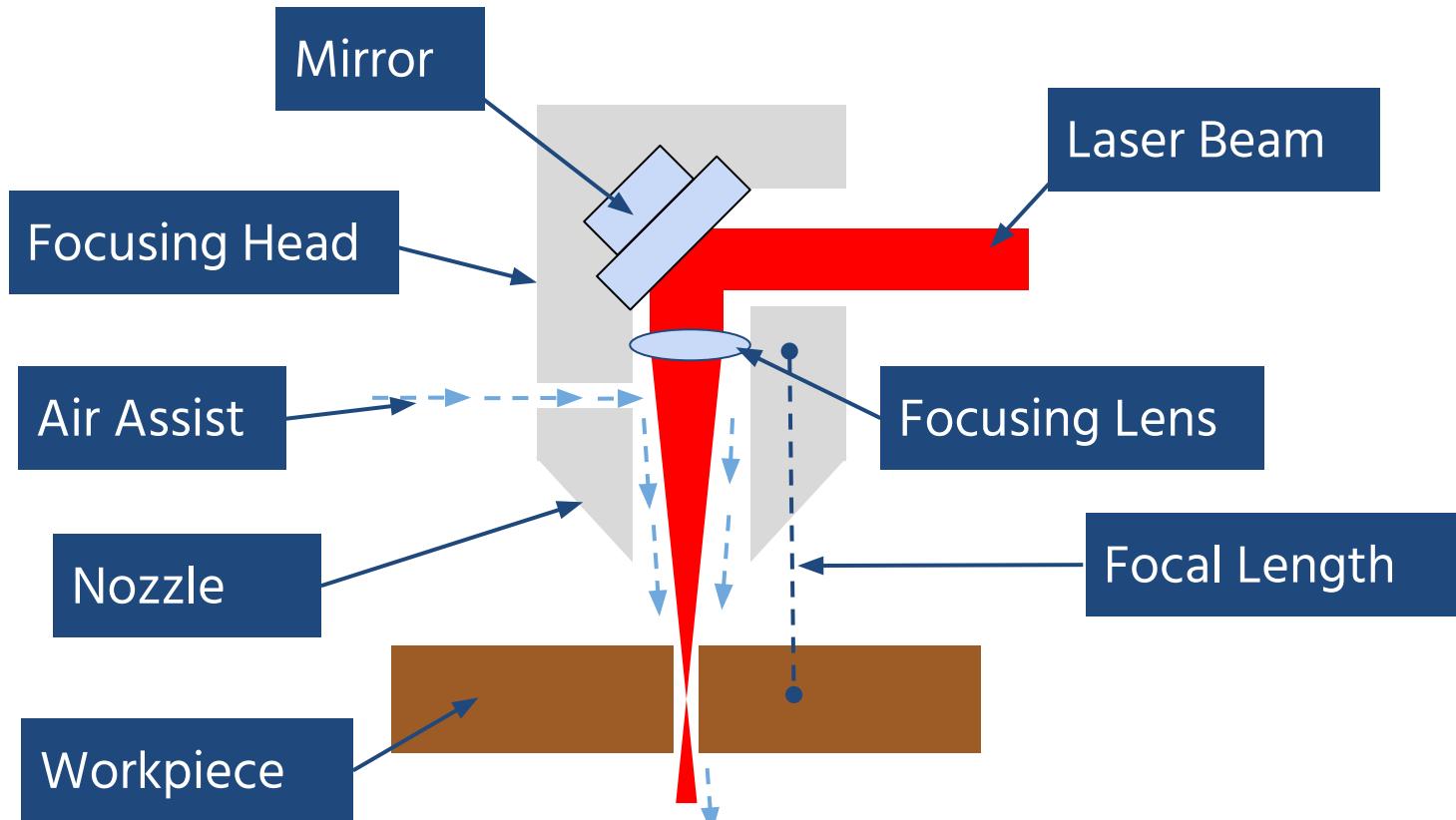
THE ACTIVITY | SECTION 2.1 | 20 MINUTES

How does a Laser Cutter work?



THE ACTIVITY | SECTION 2.1 | 20 MINUTES

How does a Laser Cutter work?

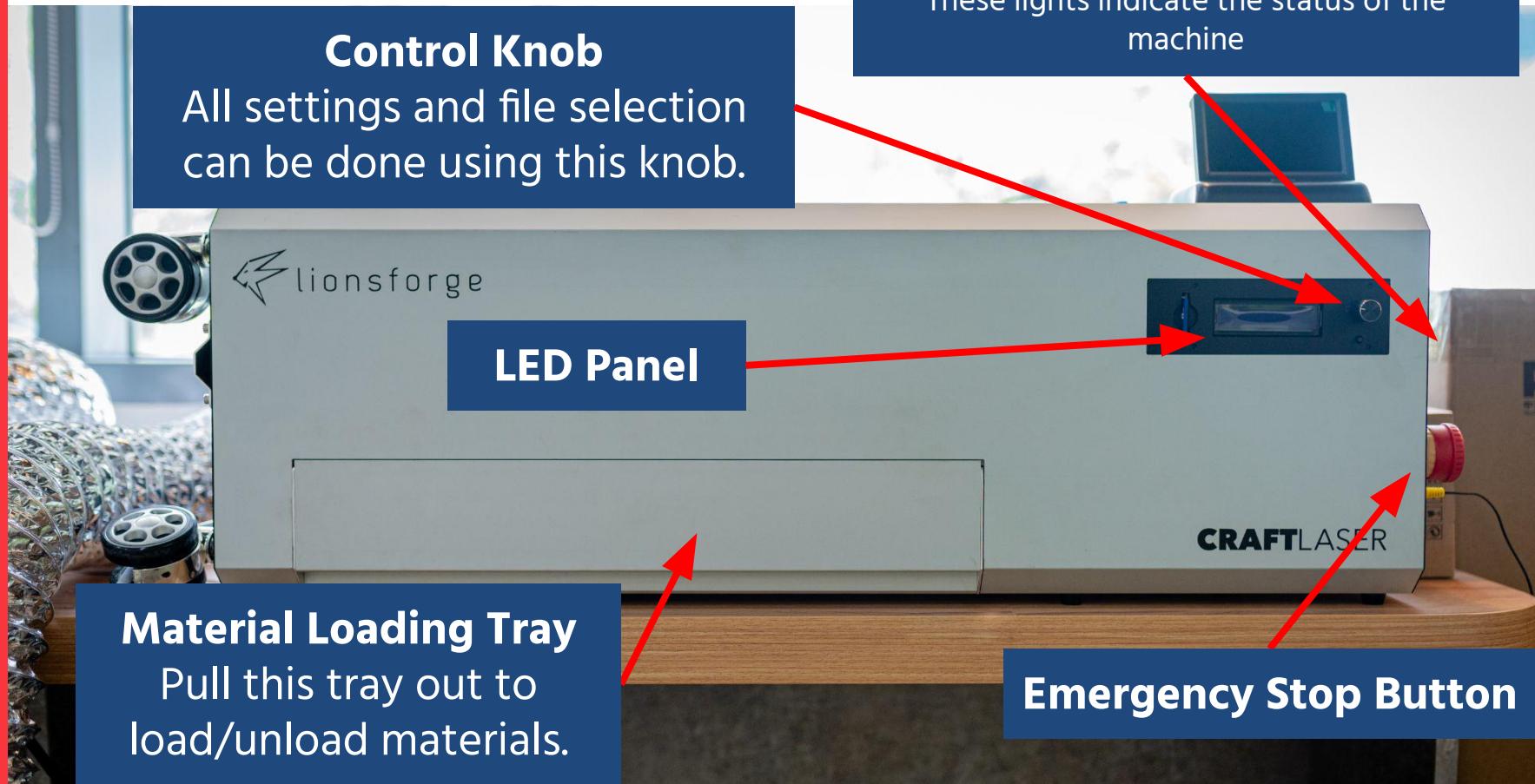


PARTS OF THE LASER CUTTER

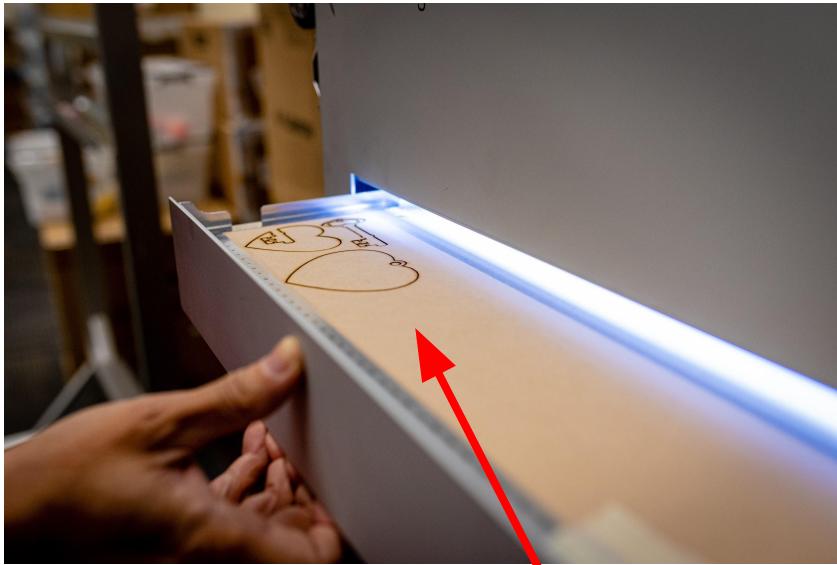
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THE ACTIVITY | SECTION 2.1 | 20 MINUTES

How does a Laser Cutter work?



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.

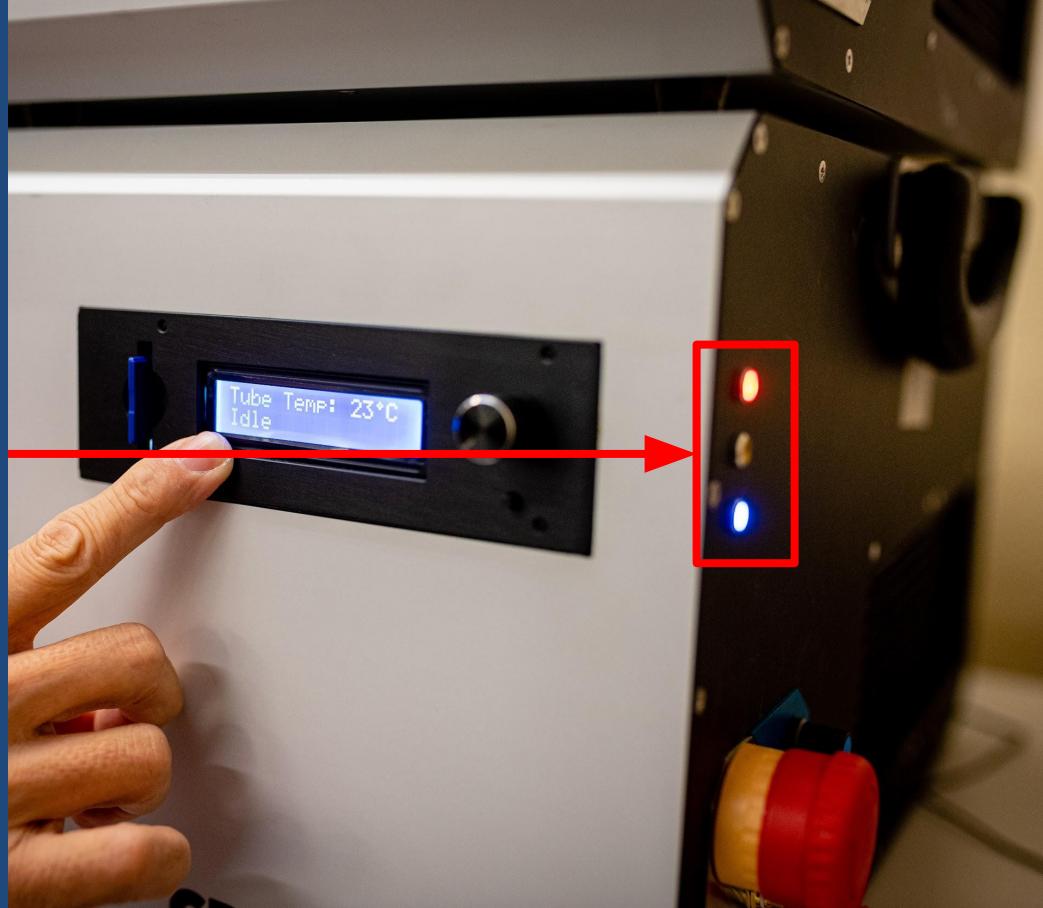
How does a Laser Cutter work?

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 MaketI 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.

Control Knob

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

LED Panel Display

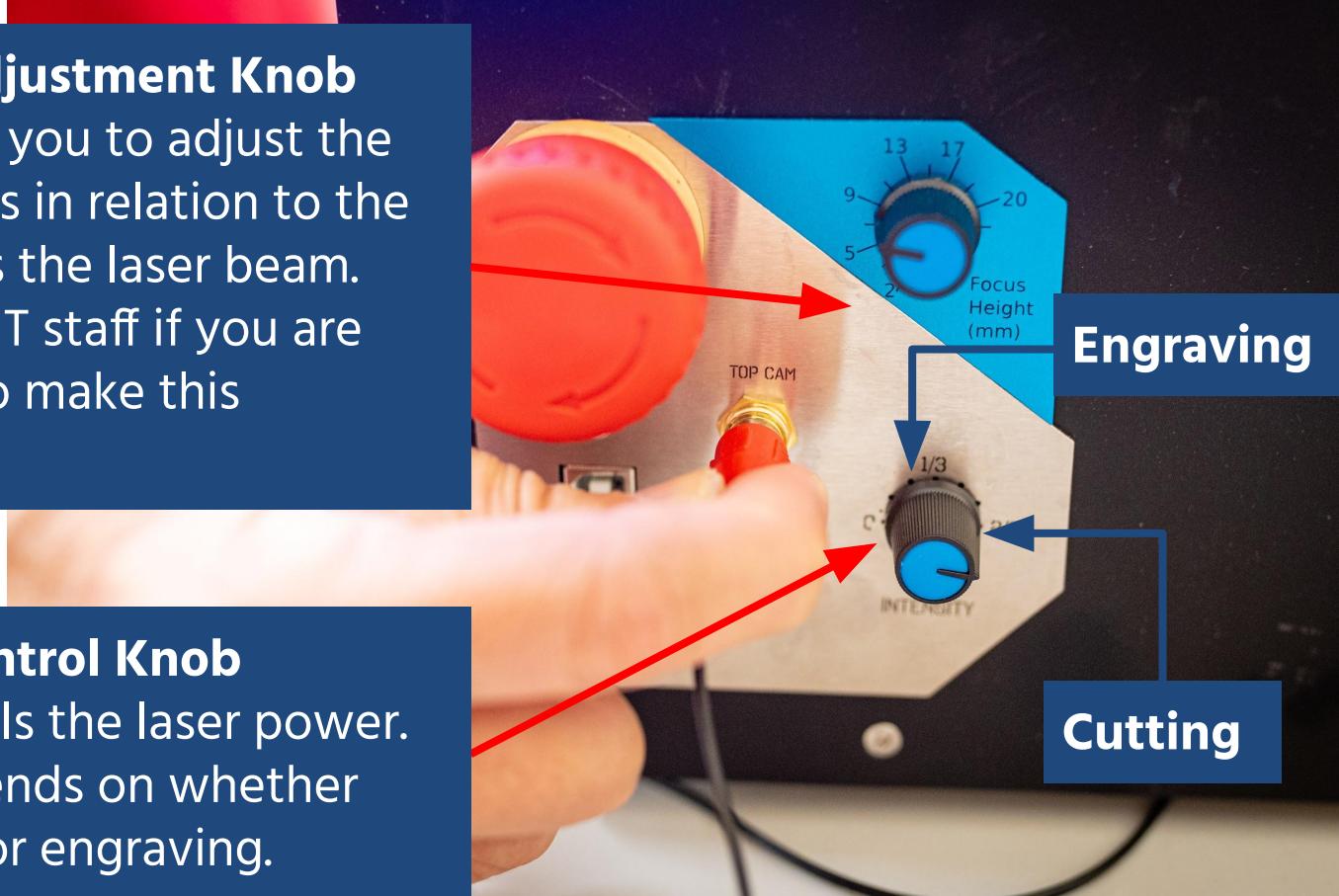
The LED Panel displays key information and allows menu navigation for the laser cutter's features.



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

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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.

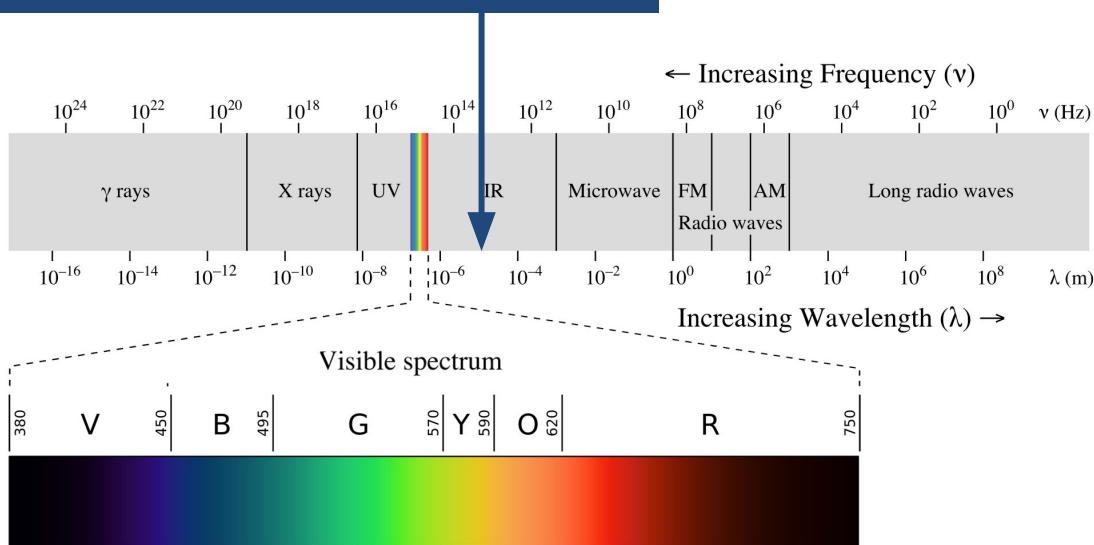


Any laser can pose a potential hazard while being used. Always understand the risks and hazards possible when using a laser-based product.

THE ACTIVITY | SECTION 2.2 | 20 MINUTES

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.



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.



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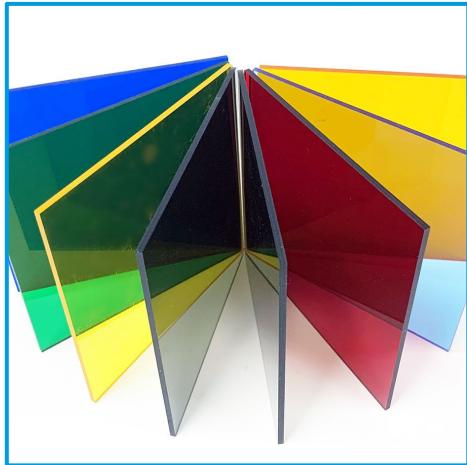
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WHAT CAN YOU CUT ON THE LASER CUTTER?

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THE ACTIVITY | SECTION 2.3 | 80 MINUTES

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 precut 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.

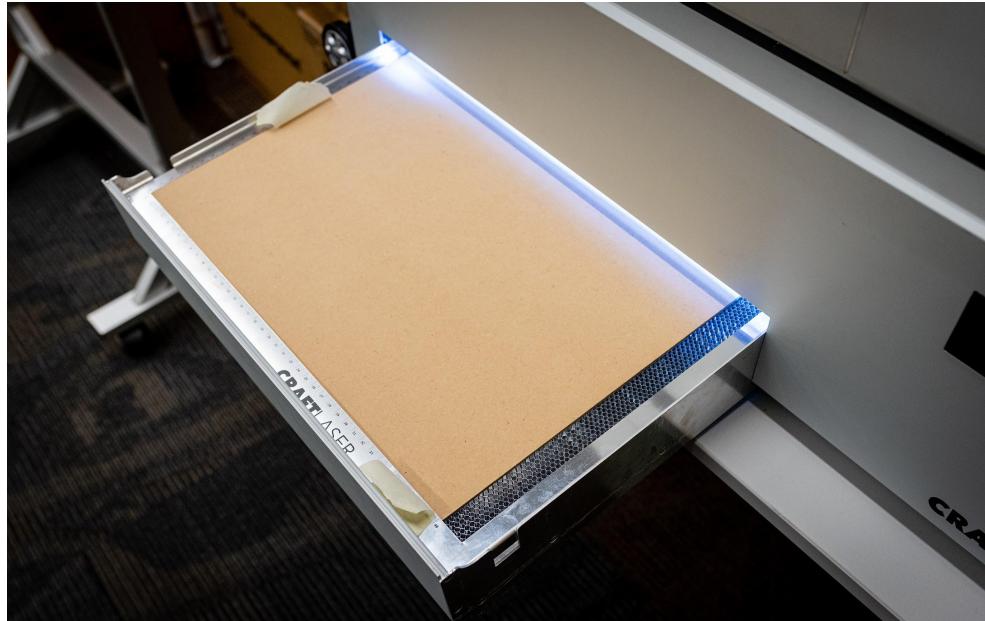
MakeIT reserves the rights to revoke your laser cutting privileges if you misuse the laser cutter.



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



THE ACTIVITY | SECTION 2.3 | 80 MINUTES

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.

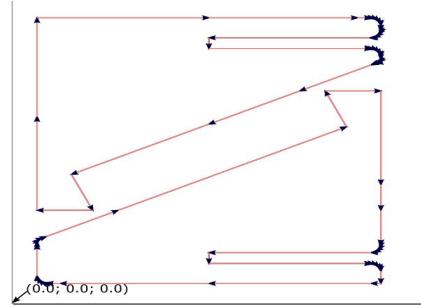
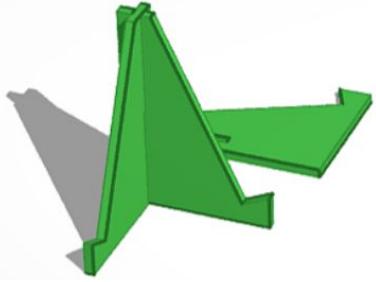
• MakeIT
EVERYONE CAN MAKE
MAKERSPACE
EVERYONE CAN MAKE
SEWING 3D PRINTER
ROBOTICS
MAKE CODING
CREATIVITY
TINKER CREATE
EXPLORE COMPUTER

MAKING A DESIGN FROM SCRATCH

MakeIT

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.

THE ACTIVITY | SECTION 2.3 | 80 MINUTES

Designing Laser Cut Parts

TASK

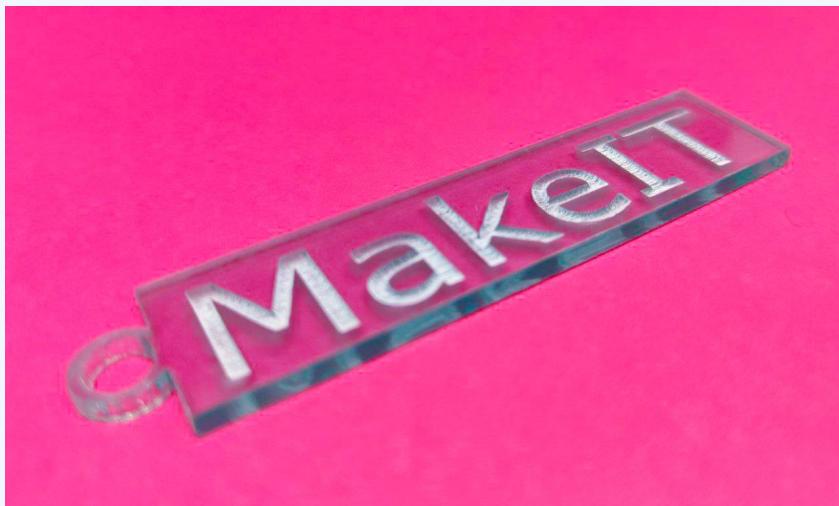
Design a name tag using Tinkercad and Inkscape and cut your project

TIME

50 minutes

MATERIALS

Laptop, SD card, SD card reader
Small acrylic piece



THE ACTIVITY | SECTION 2.3 | 80 MINUTES

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.

The screenshot shows the Tinkercad homepage. At the top right is the Autodesk Tinkercad logo. Below it is the tagline "From mind to design in minutes". A brief description follows: "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!" Two buttons are present: "Start Tinkering" (blue) and "Join your class" (green). To the right, there's a preview of a 3D model titled "ON A MATH KEYRING" with various shapes like letters and stars. Below this, three icons represent community, speed, and education: "Community of 35 million" (Join button), "Fast, free, easy to use" (Learn button), and "Loved by educators worldwide" (Teach button). A blue banner at the bottom states: "Safeguarding your privacy is fundamental to our mission. Learn how we protect student data in our [Privacy and Security Statement](#)". A large call-to-action at the bottom says "Unleash your imagination with these easy steps" with a numbered step 1: "Place" showing a cube being added to a workplane.

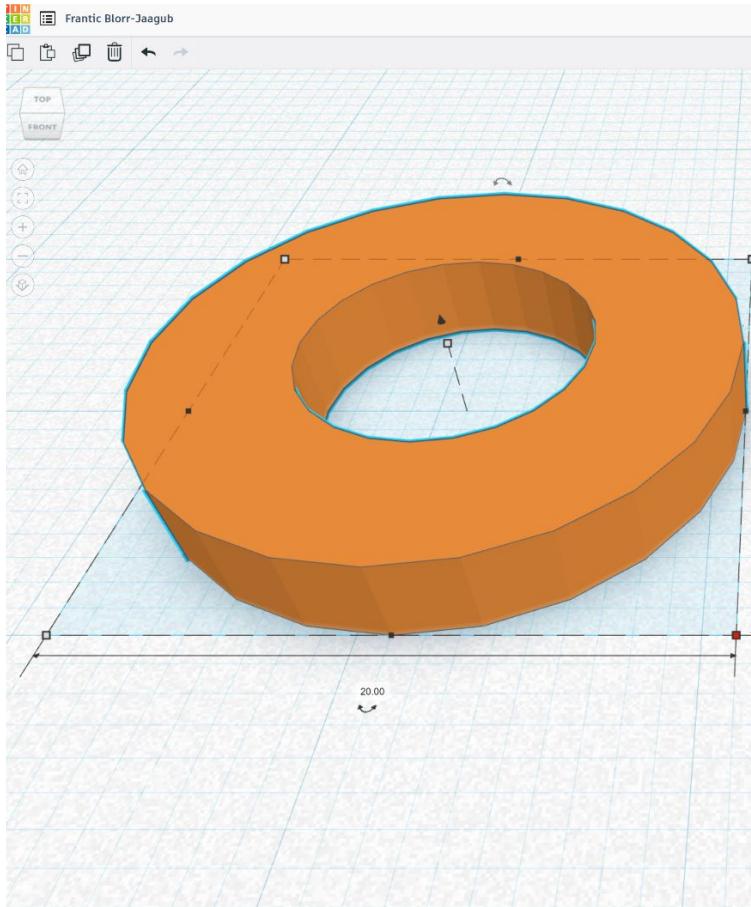
Designing Laser Cut Parts

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 3D rendering of a rectangular block in Tinkercad. The block is colored red and has dimensions labeled: Length 80.00, Width 20.00, and Height 3.00. The Tinkercad interface includes a top-down view, a front view, and a side view. On the right side, there is a library of basic shapes, and a red arrow points from the text instructions to the 'Box' icon in this library. The top-left corner of the slide features the 'INTERACT' logo.

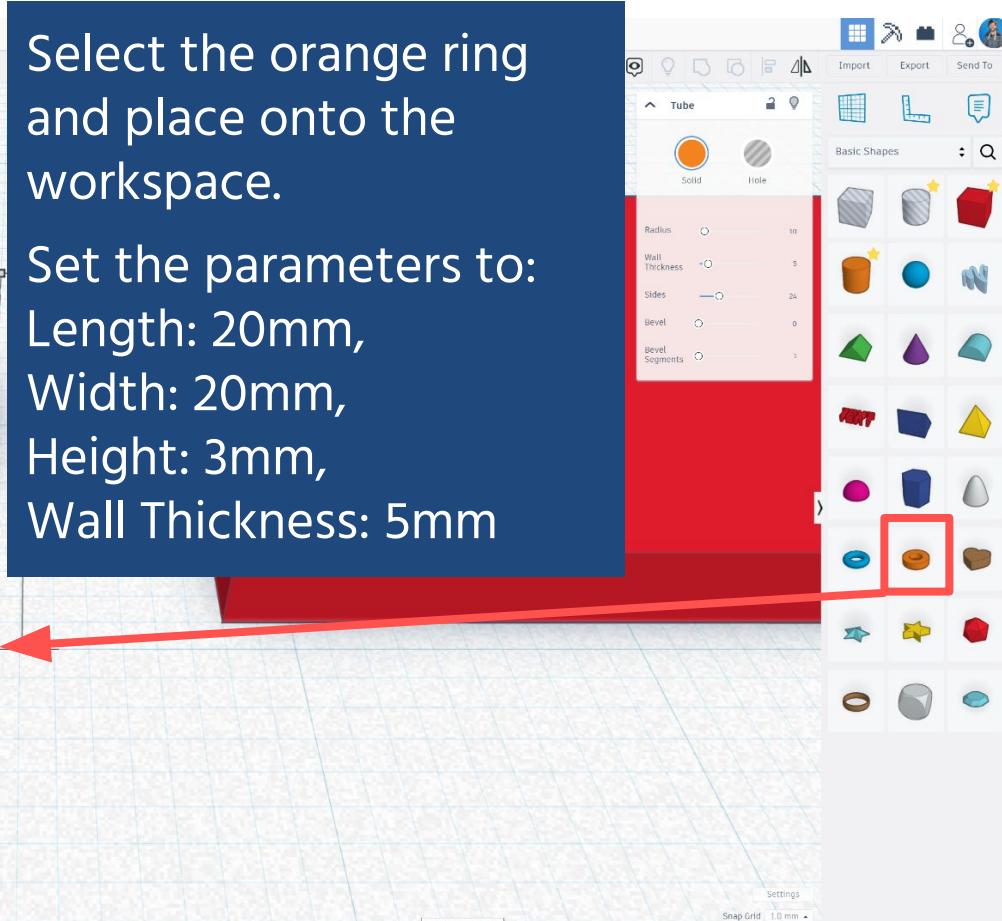
Designing Laser Cut Parts



1. Design Tag in Tinkercad

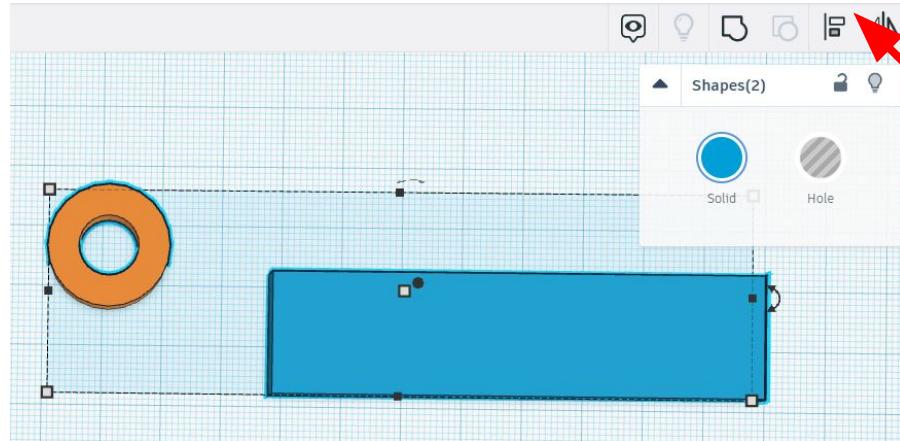
Select the orange ring and place onto the workspace.

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

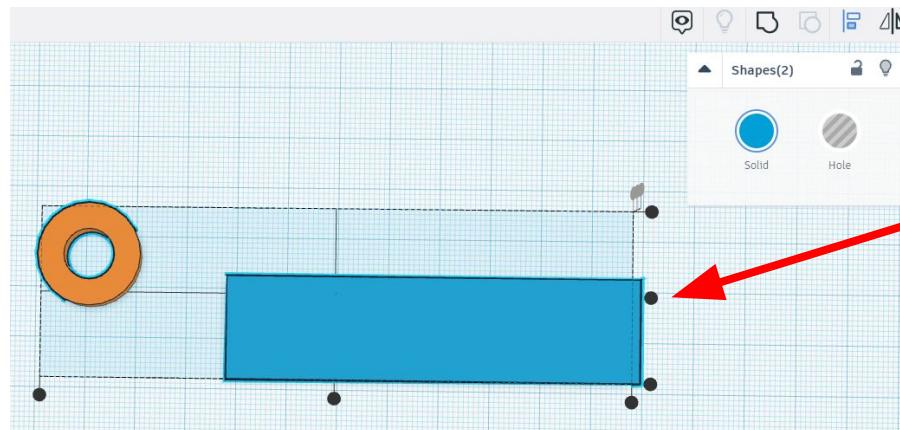


Designing Laser Cut Parts

1. Design Tag in Tinkercad



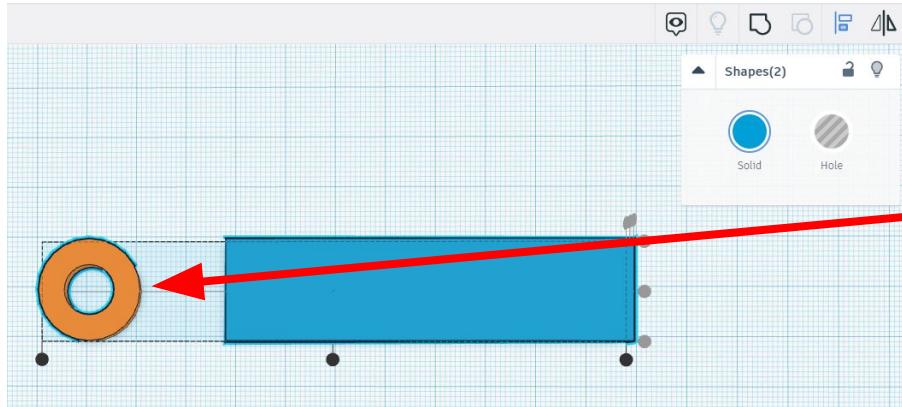
Select both objects by left-clicking and dragging a box around them, then click on the “Align” tool, or press ‘L’ on your keyboard.



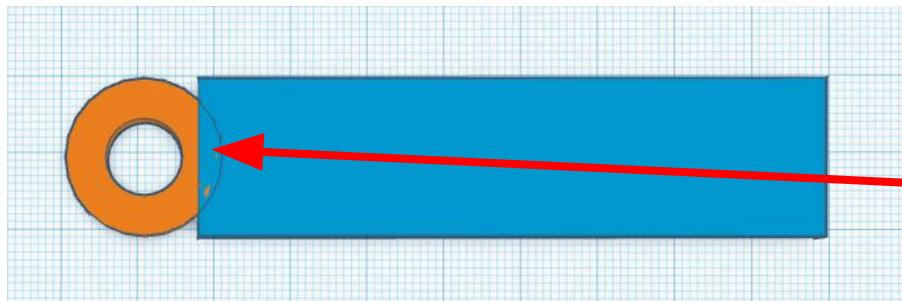
You should see 3 sets of three black dots. Align the shapes along the middle of the long side by pressing the circle that terminates at the end of the long black line in the middle.

Designing Laser Cut Parts

1. Design Tag in Tinkercad



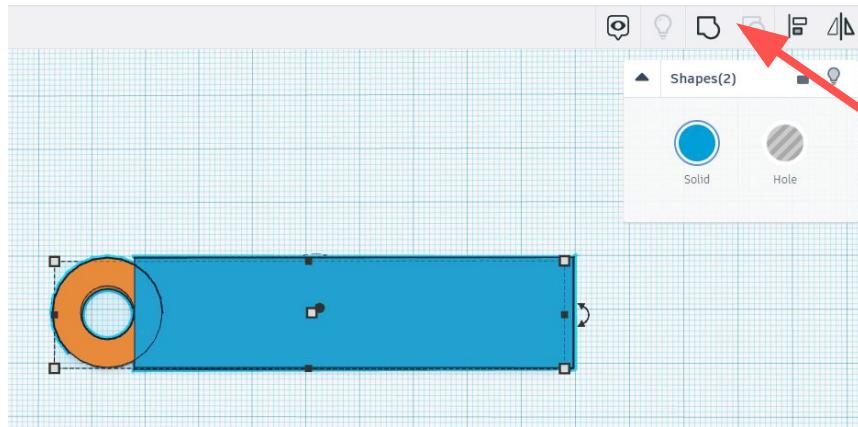
Both objects will align in the middle, indicated by the circle tools greying out. Now, select just the circle by left-clicking off the shapes, then left-clicking on the circle.



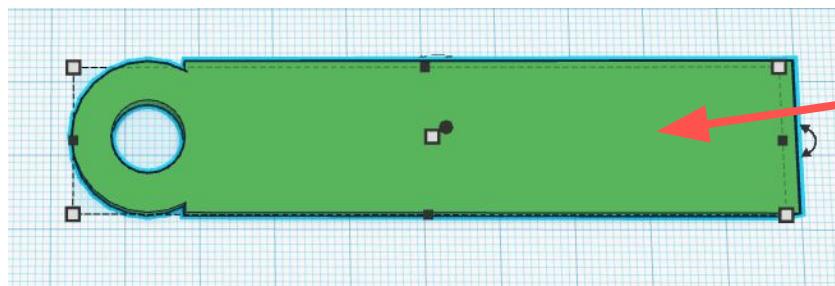
Use the directional buttons (left and right) on your keyboard to move it closer to the block. Make sure both objects overlap.

Designing Laser Cut Parts

1. Design Tag in Tinkercad



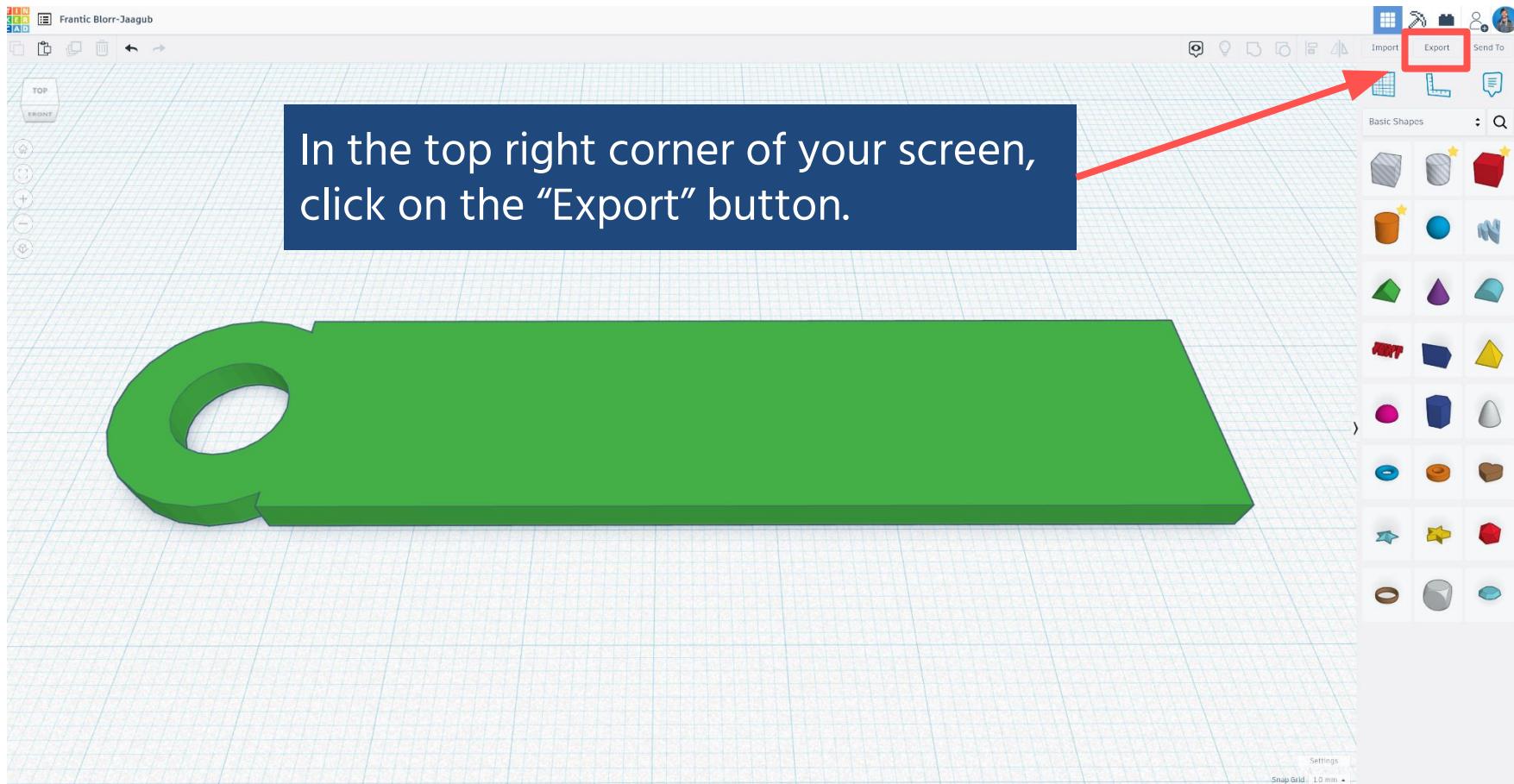
Once the objects have overlapped, select both objects and click on the “Group” tool, or press ‘CTRL + G’ on your keyboard.



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

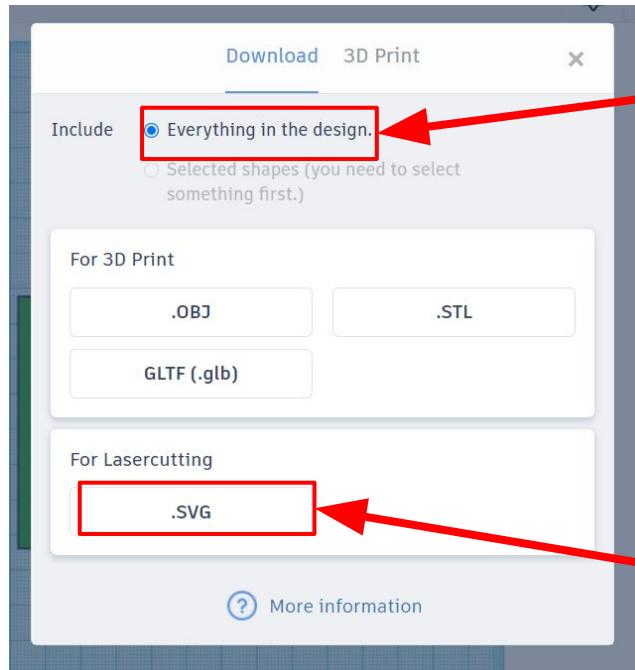
Designing Laser Cut Parts

1. Design Tag in Tinkercad



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

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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.

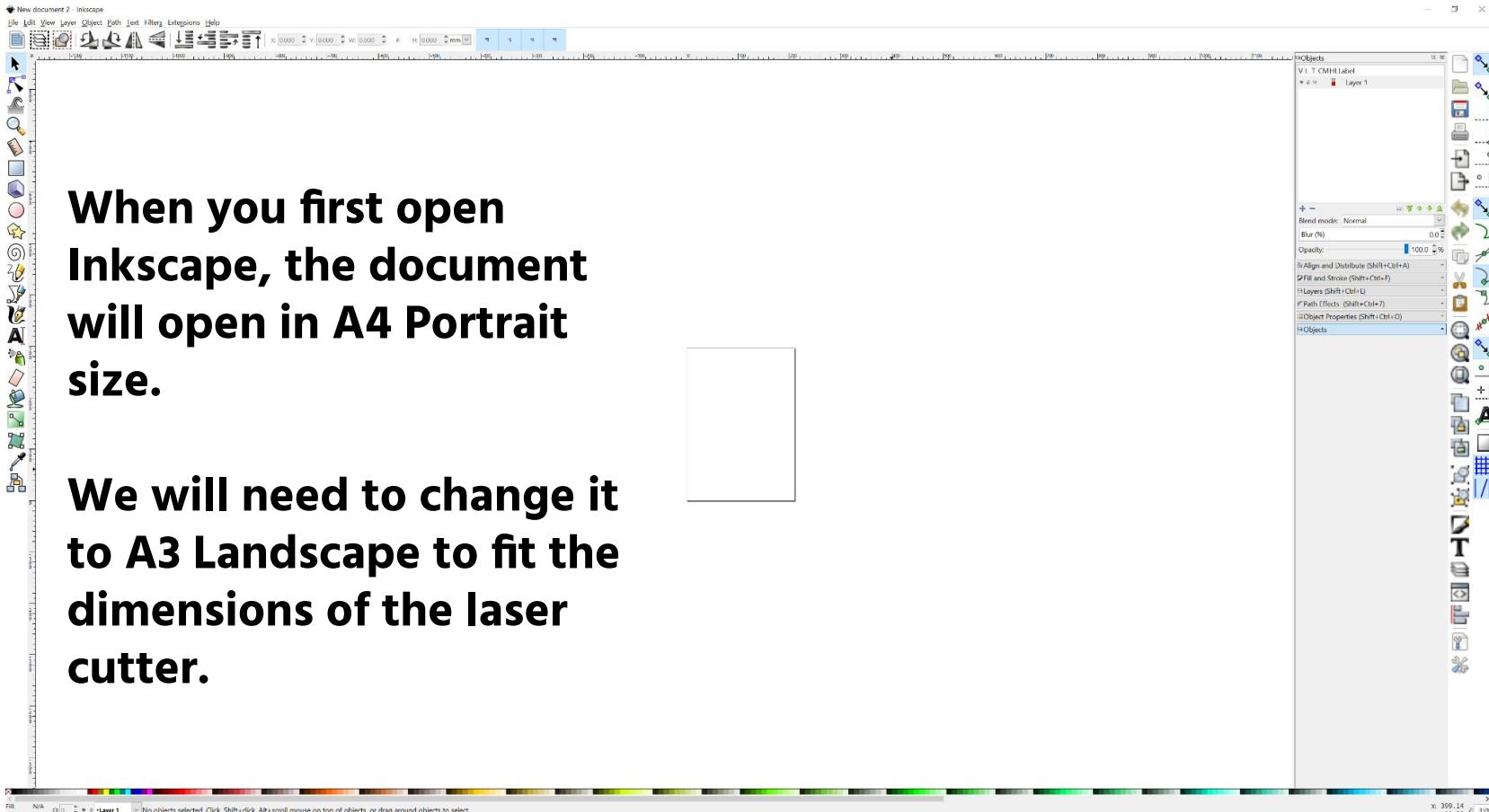
<https://inkscape.org/>



The screenshot shows the official Inkscape website. At the top, there's a navigation bar with links for About, Download, News, Community, Learn, Contribute, Develop, and Support Us. A search bar is located in the top right corner. The main header features the Inkscape logo and the tagline "Draw Freely". Below the header is a colorful illustration of a tropical island scene with various characters and objects related to Inkscape. The page is divided into several sections: "Download Now!", "Explore Features", "Community Gallery", and "Learning Resources". Below these are three main columns: "Users", "Contributors", and "Recent News". The "Users" column highlights "A powerful, free design tool" and lists features like flexible drawing tools, broad file format compatibility, and powerful text tool. It also encourages users to "involve in development". The "Contributors" column features a "Join our thriving community" section and a "Sponsors" section featuring the Red Hat logo. The "Recent News" column has entries for "A look back in celebration of Inkscape contributors & milestones in 2021", "Important Release of Inkscape version 1.2.1 fixes data loss and crash issues", and "Meet Chris Hildenbrand, the artist behind the winning Inkscape 1.2 About Screen". A footer at the bottom states "Inkscape is Free and Open Source Software licensed under the GPL".

Designing Laser Cut Parts

2. Use Inkscape to Prepare Work



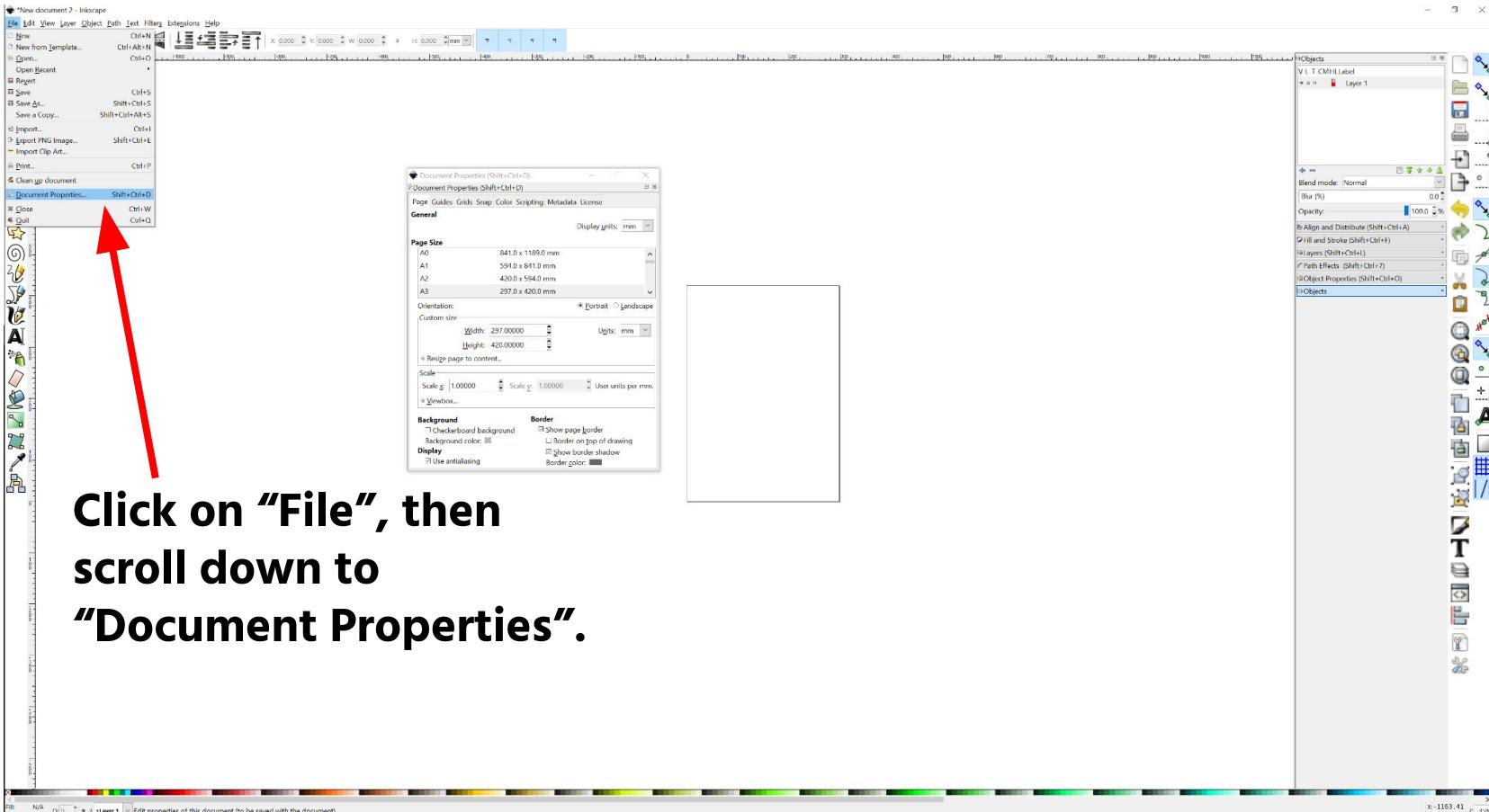
The screenshot shows the Inkscape application window. The title bar reads "New document 2 - Inkscape". The menu bar includes File, Edit, View, Layer, Object, Path, Text, Filters, Extensions, and Help. The toolbar on the left contains various tools like selection, text, shapes, and effects. The main canvas is currently empty. The right-hand sidebar contains the Objects panel, which lists a single object named "VLT CMHLLabel" assigned to "Layer 1". The status bar at the bottom shows file paths and zoom levels.

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.

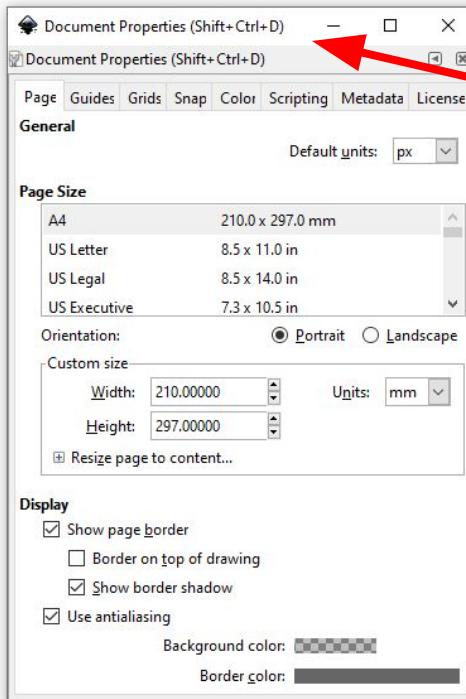
Designing Laser Cut Parts

2. Use Inkscape to Prepare Work



Designing Laser Cut Parts

2. Use Inkscape to Prepare Work



1

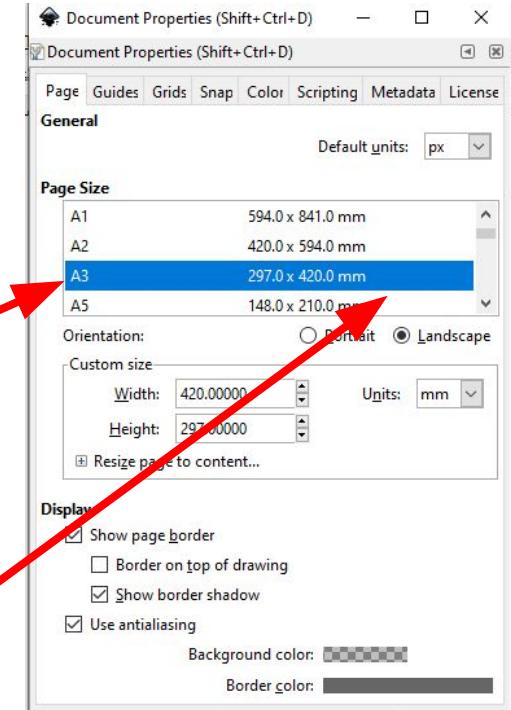
A small window should appear like this.

2

Scroll down to A3.

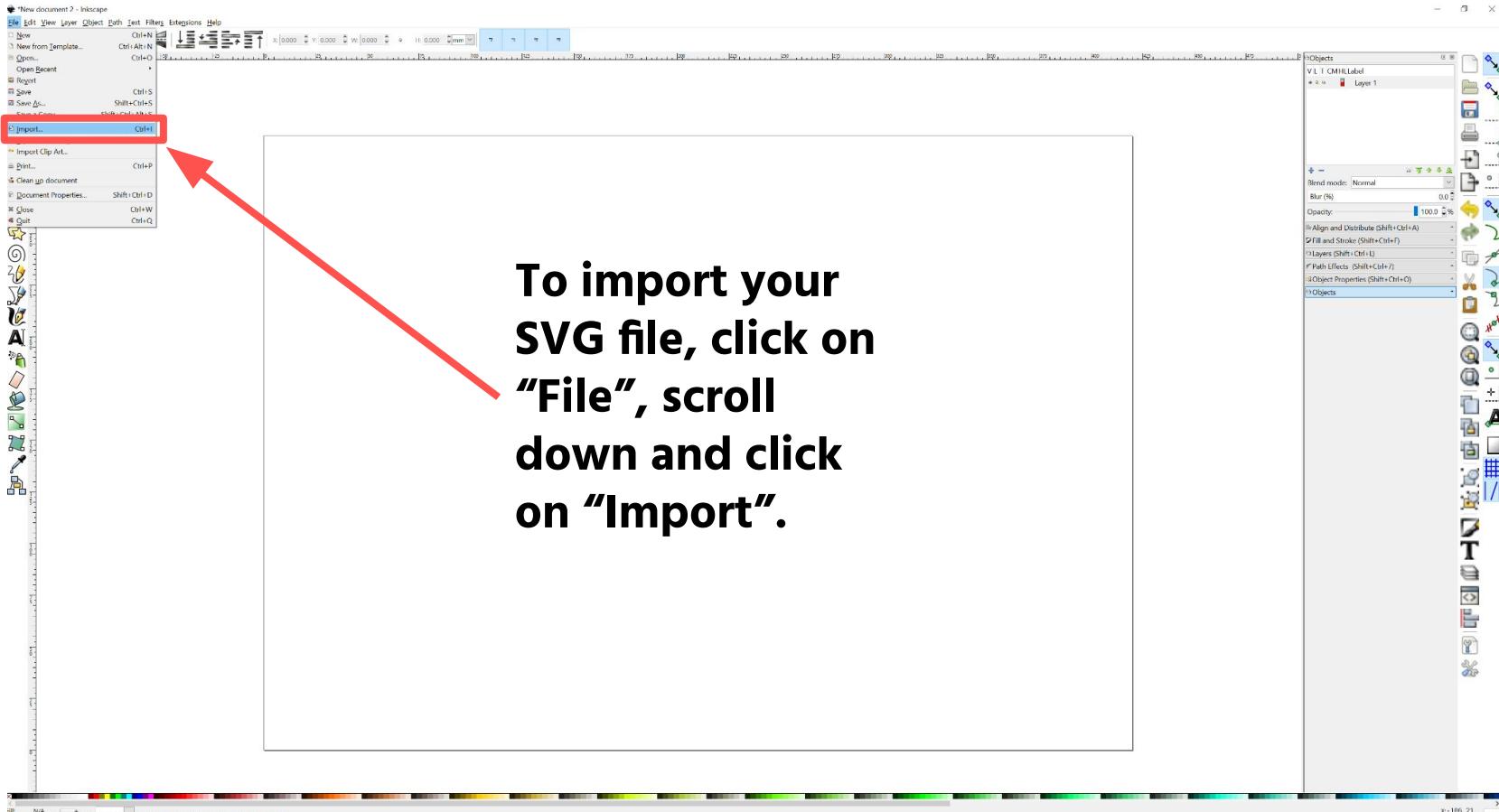
3

Select the “Landscape” option to rotate your canvas sideways.



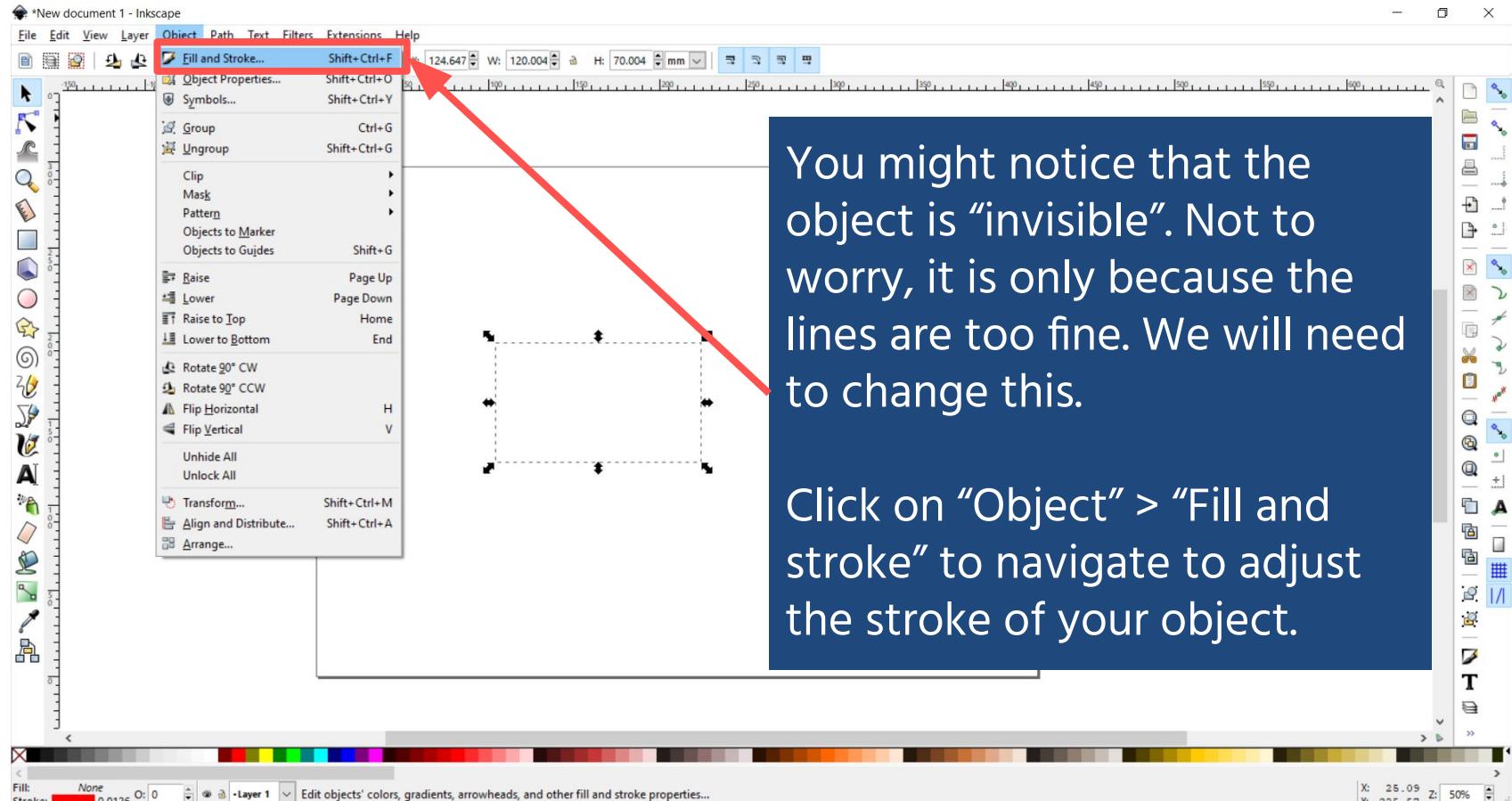
Designing Laser Cut Parts

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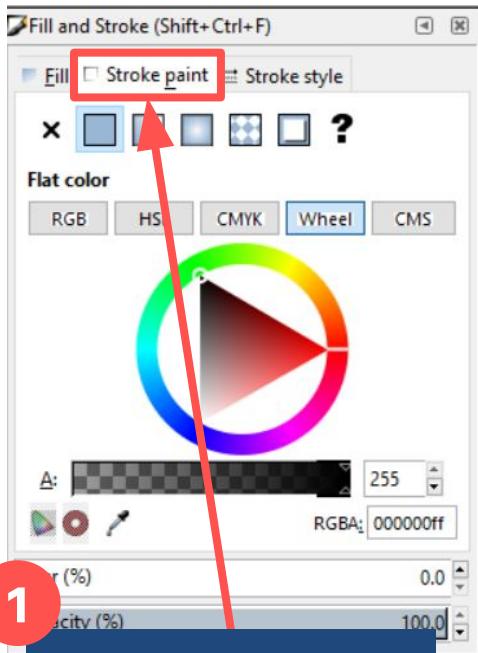
Designing Laser Cut Parts

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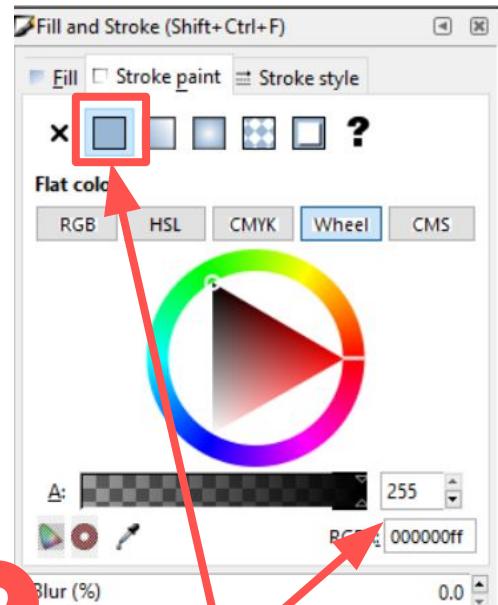
Designing Laser Cut Parts

2. Use Inkscape to Prepare Work



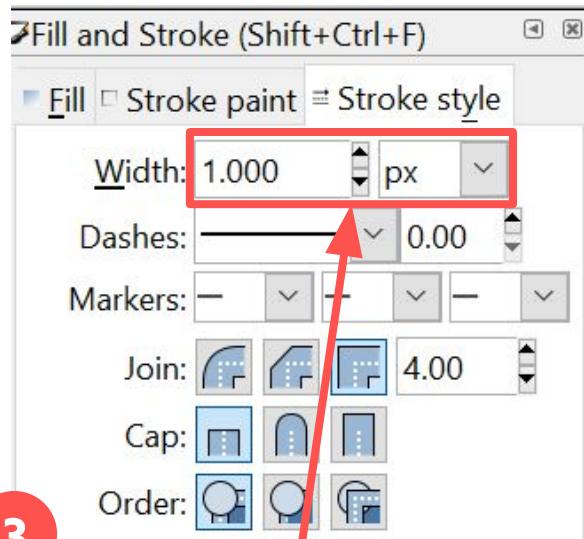
1

Click on “Stroke paint”.



2

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

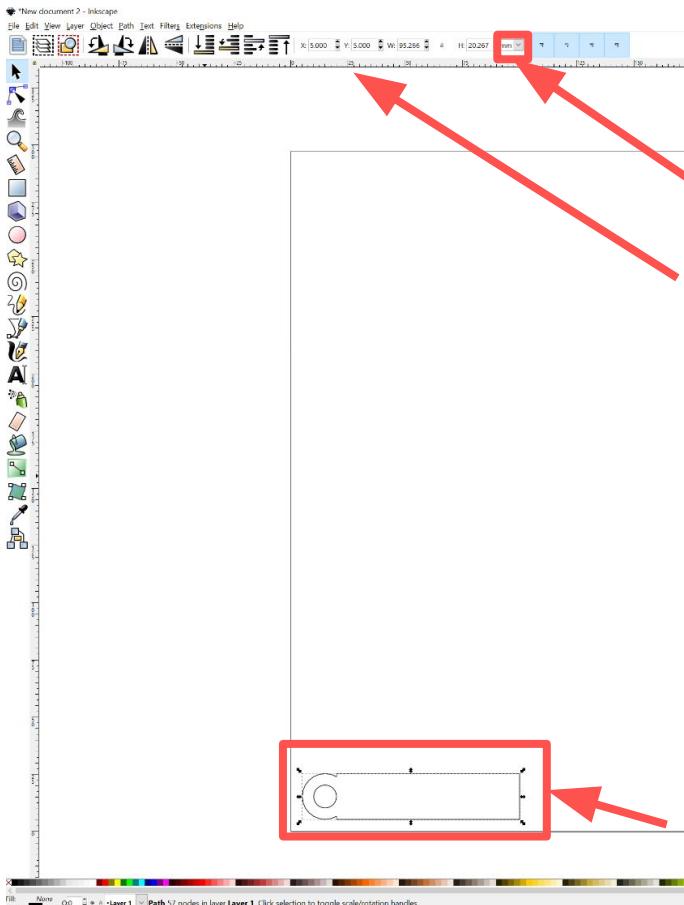


3

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

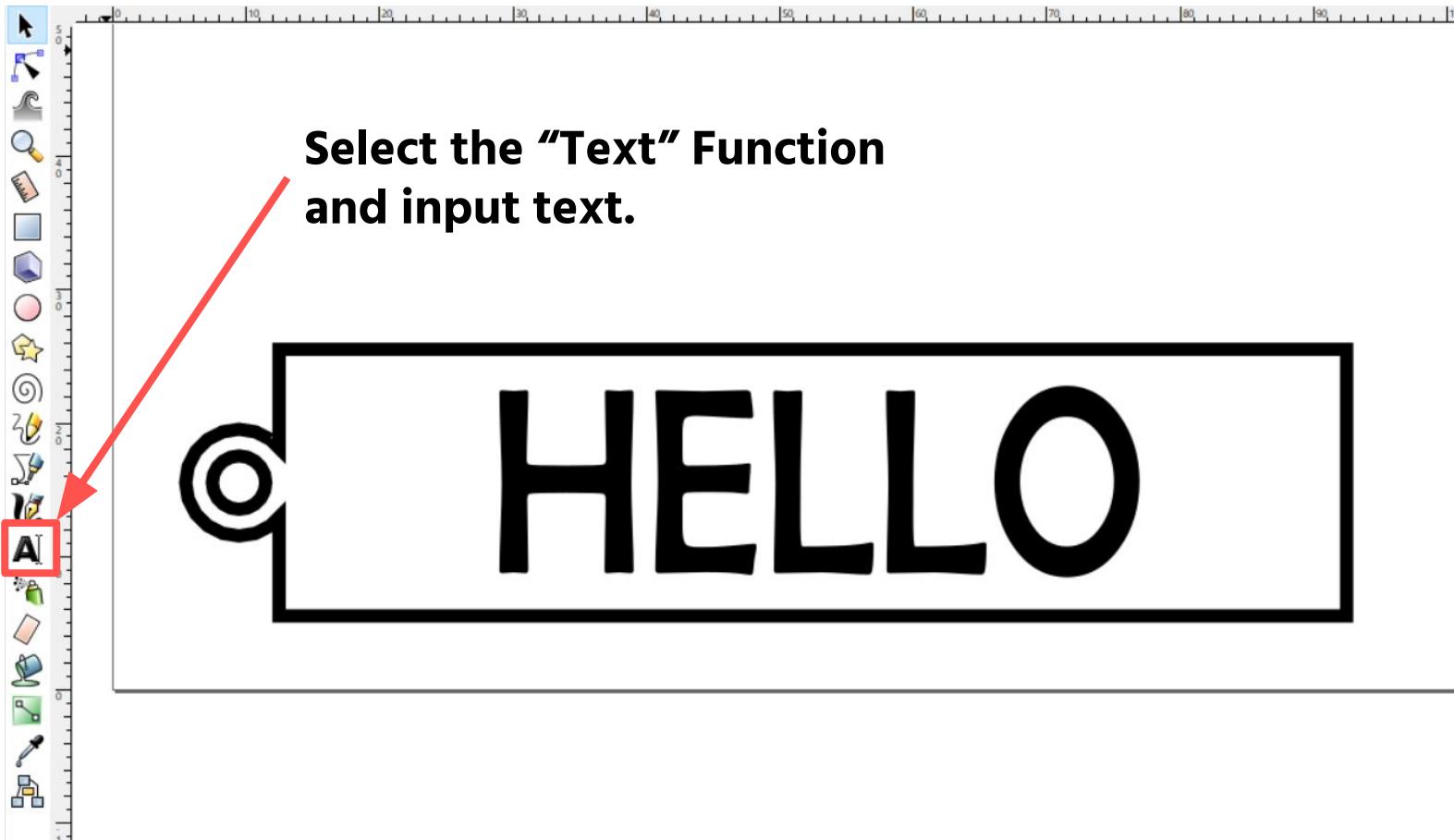


Engraving changes an image into a feature where just the top layer is burned off. The thickness of the engraving depends on your speed and power settings.

THE ACTIVITY | SECTION 2.3 | 80 MINUTES

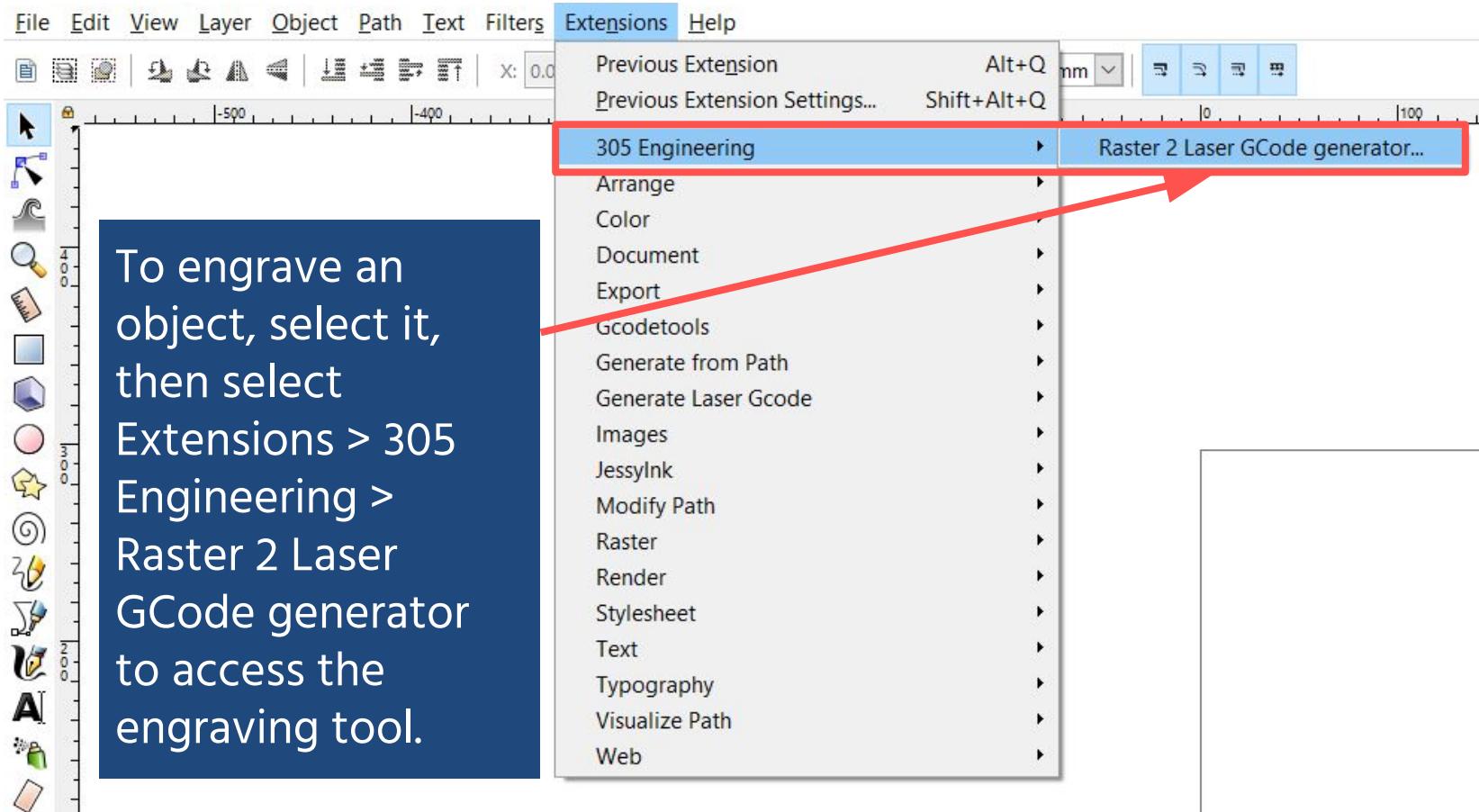
Designing Laser Cut Parts

3. Use Inkscape to Engrave Object

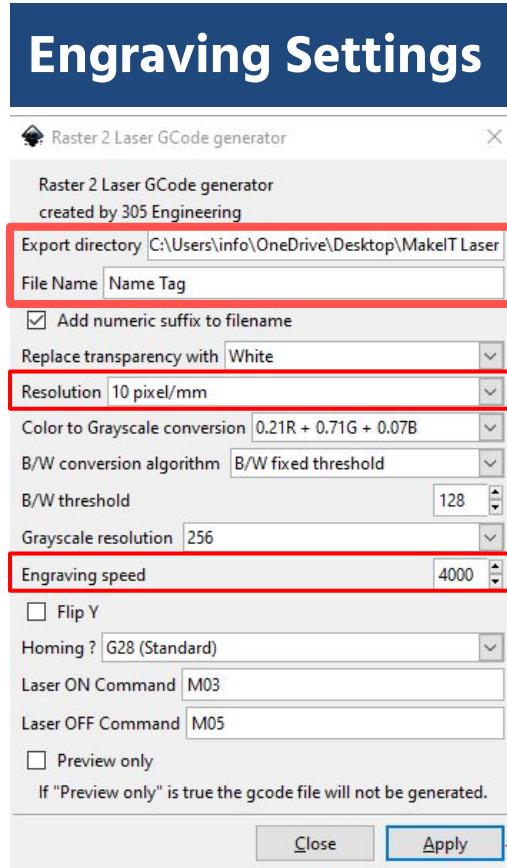


Designing Laser Cut Parts

3. Use Inkscape to Engrave Object



Designing Laser Cut Parts



3. Use Inkscape to Engrave Object

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

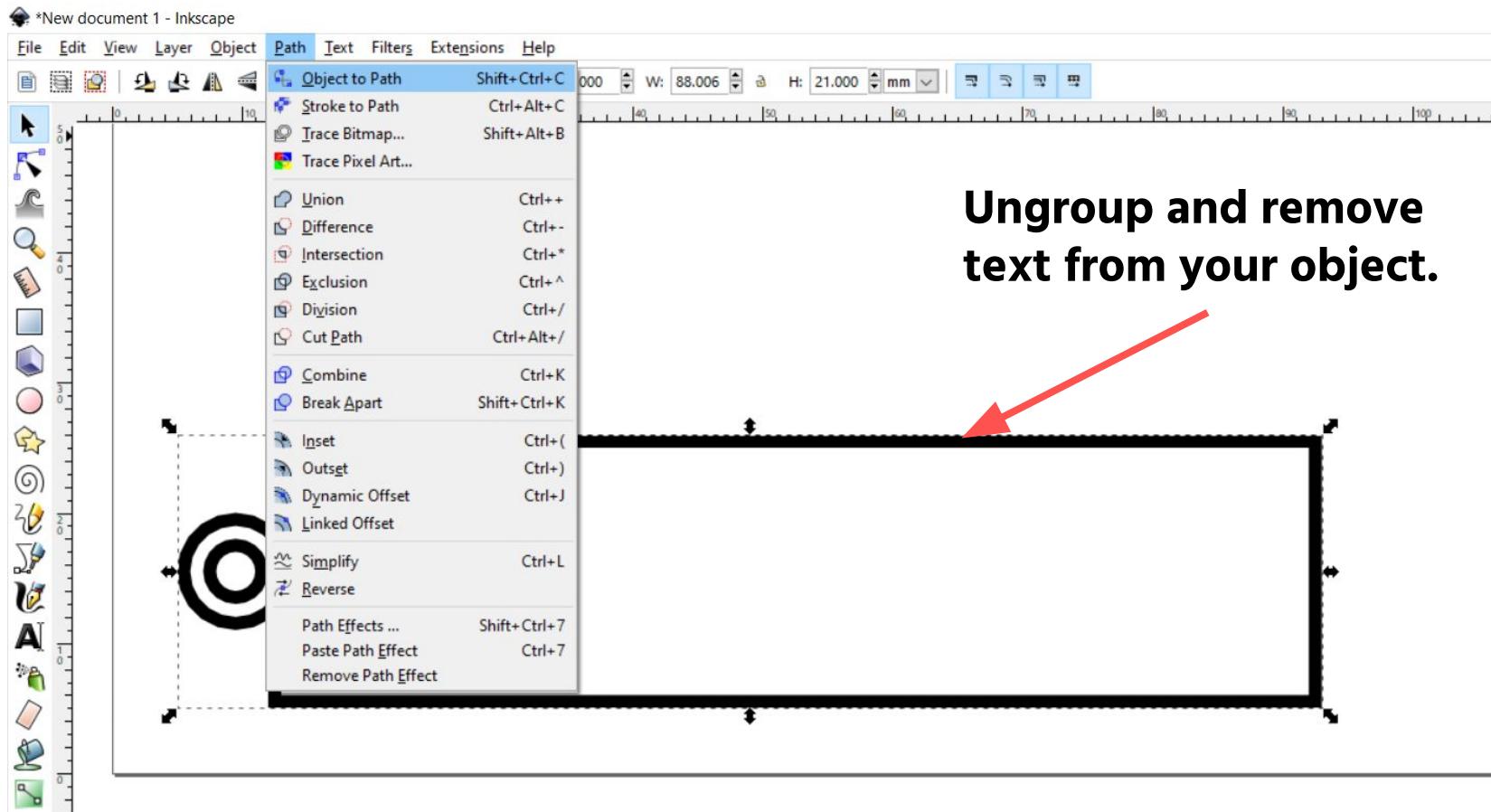


Once settings are applied, the file should be saved in your computer. Transfer only the gcode file to an SD Card. The other files are images and only for preview purposes.

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

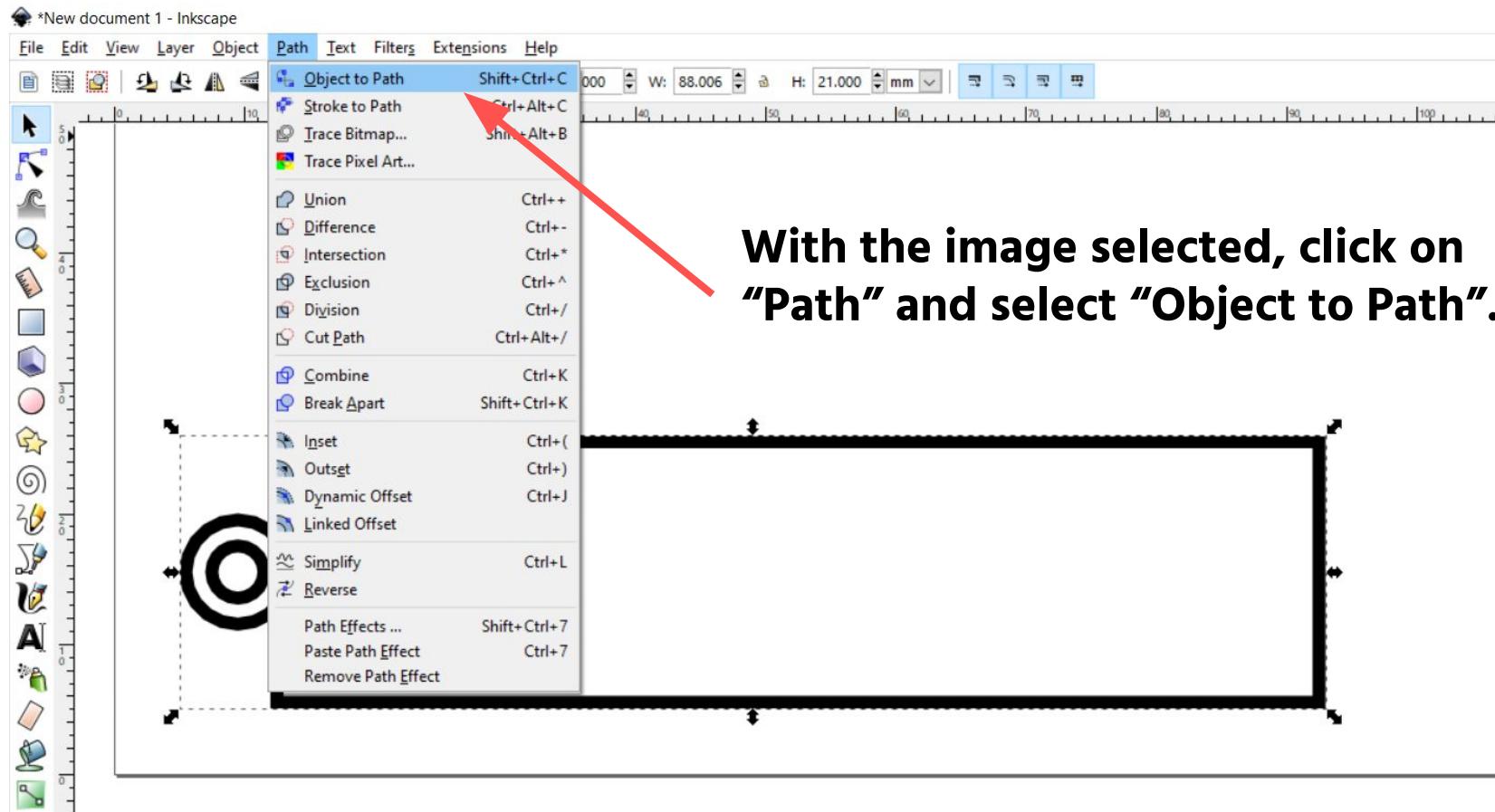
Designing Laser Cut Parts

4. Use Inkscape to Cut Object



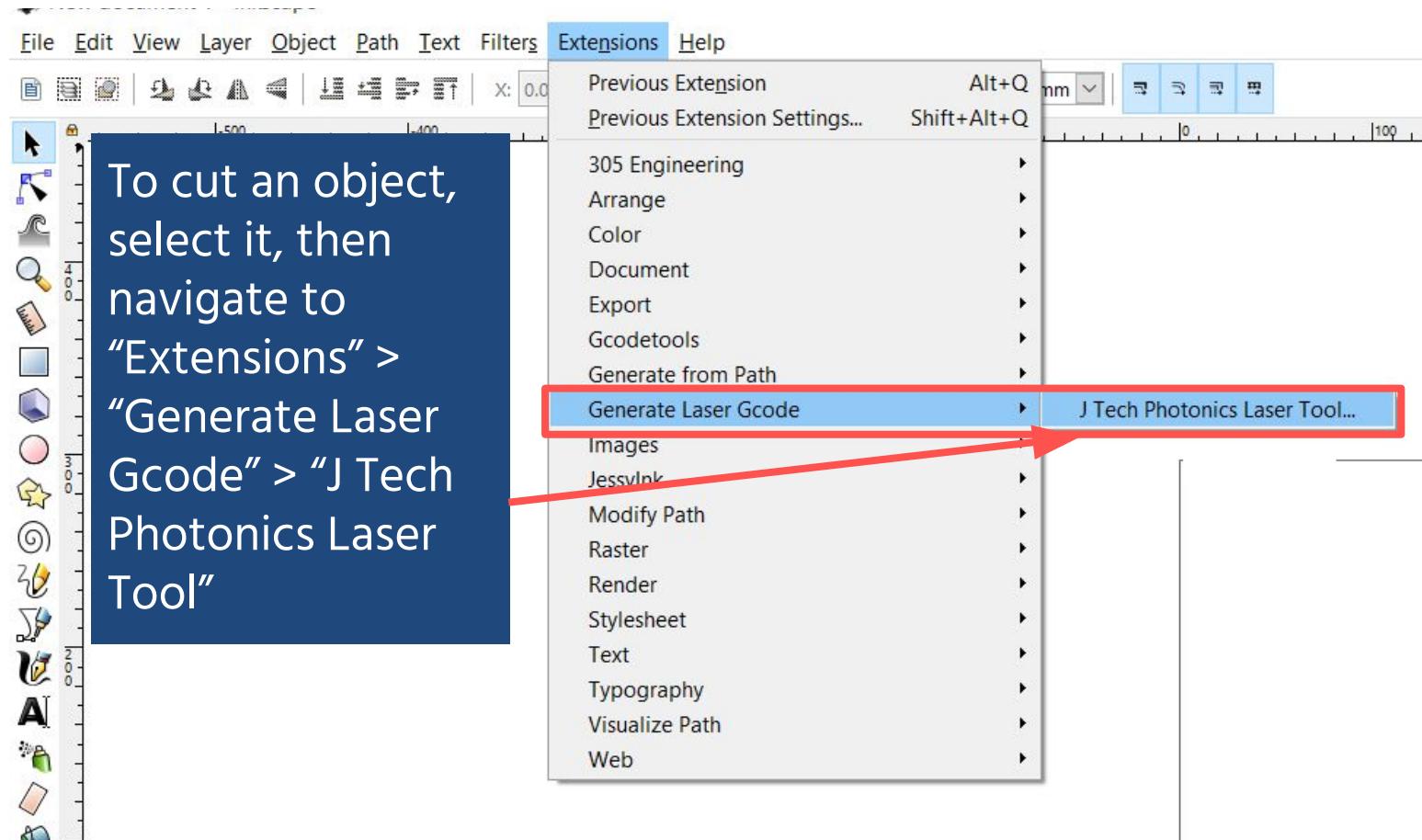
Designing Laser Cut Parts

4. Use Inkscape to Cut Object



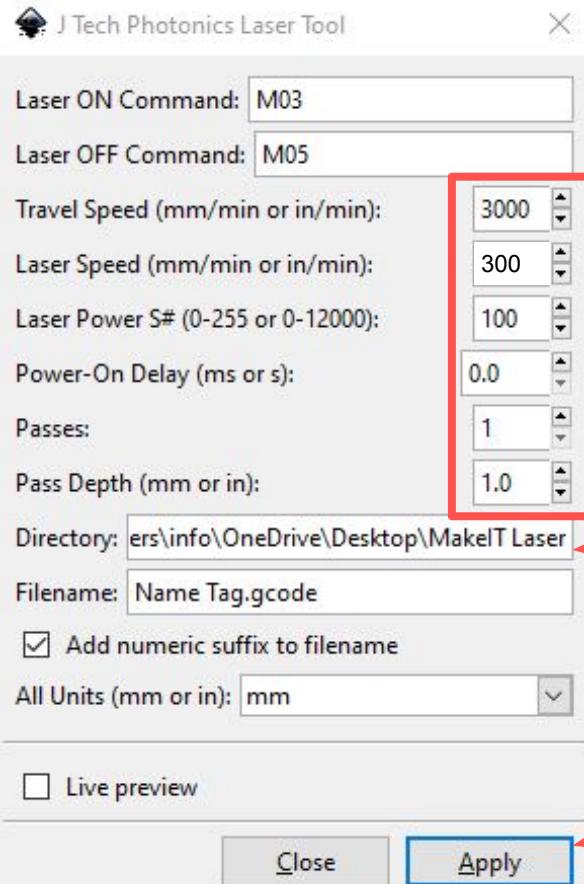
Designing Laser Cut Parts

4. Use Inkscape to Cut Object



Designing Laser Cut Parts

4. Use Inkscape to Cut Object



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.



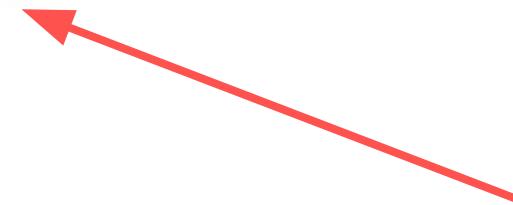
Designing Laser Cut Parts

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.

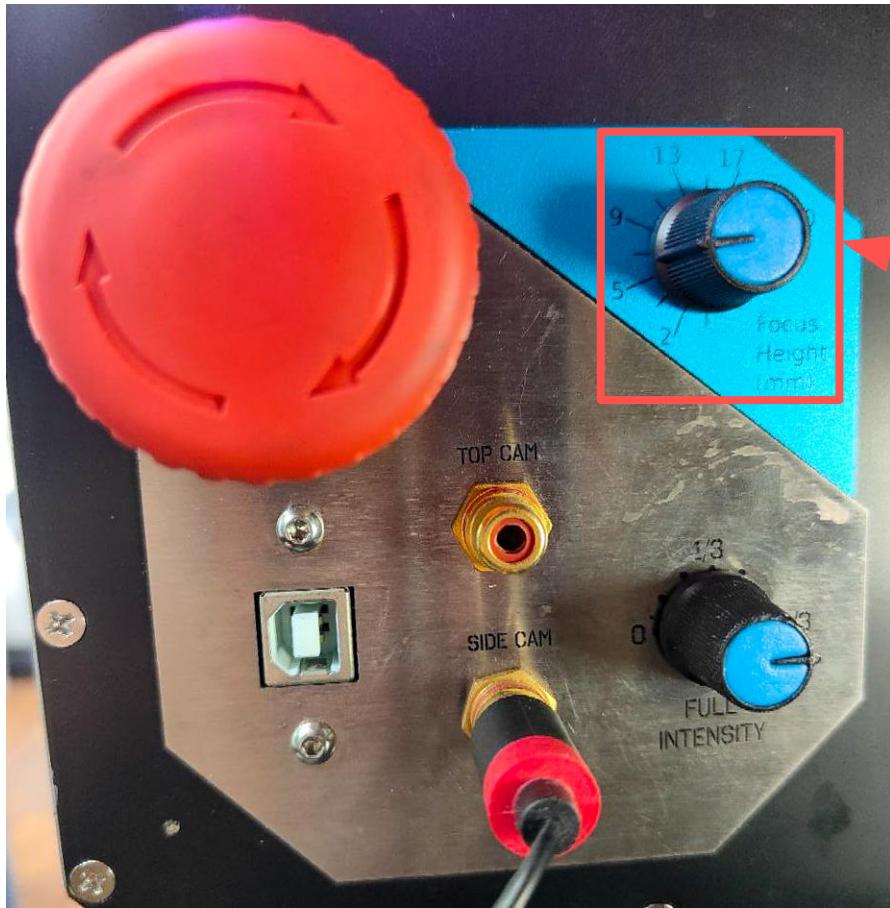
You may also name the file with the term “cut” to distinguish it from an engraving file.

OPERATING THE CRAFTLASER

MakeIT

Designing Laser Cut Parts

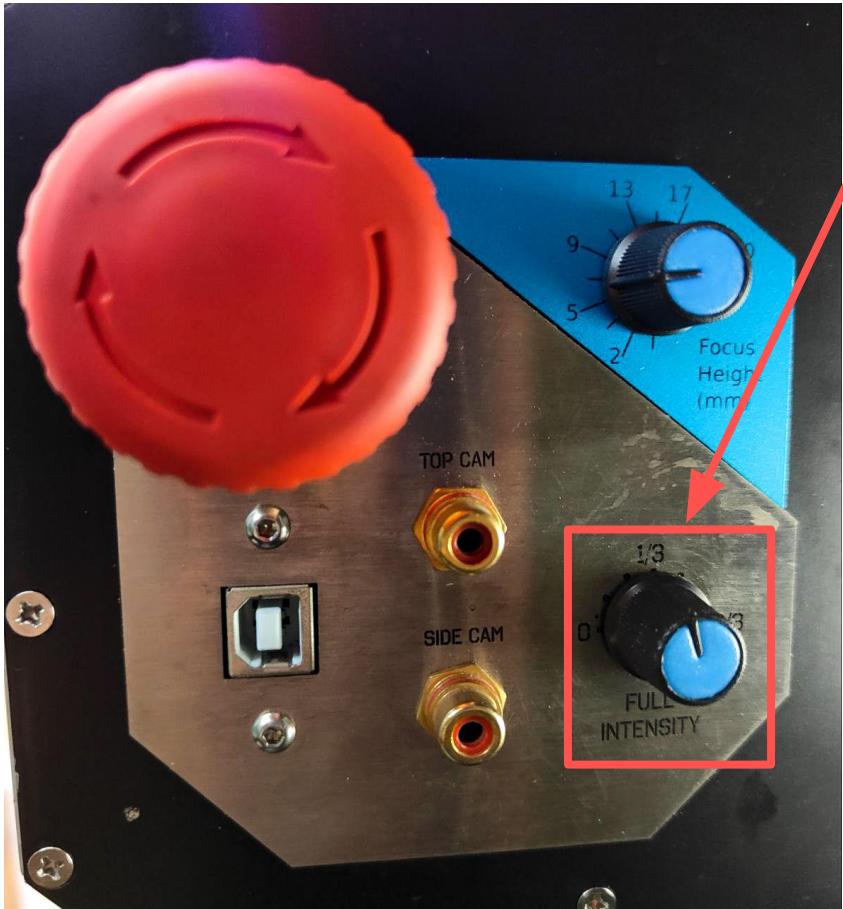
5. Operating the Laser Cutter



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.

Designing Laser Cut Parts



5. Operating the Laser Cutter

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

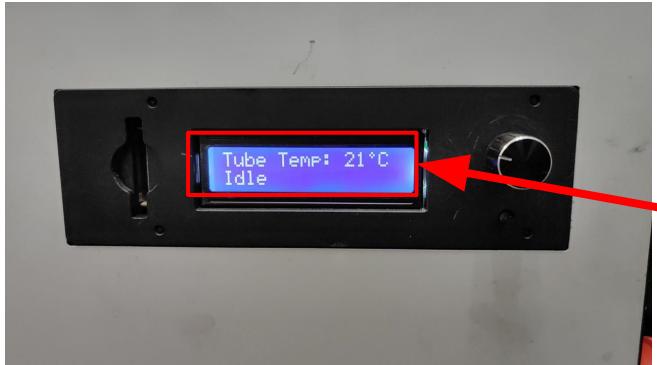
REMINDER

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.

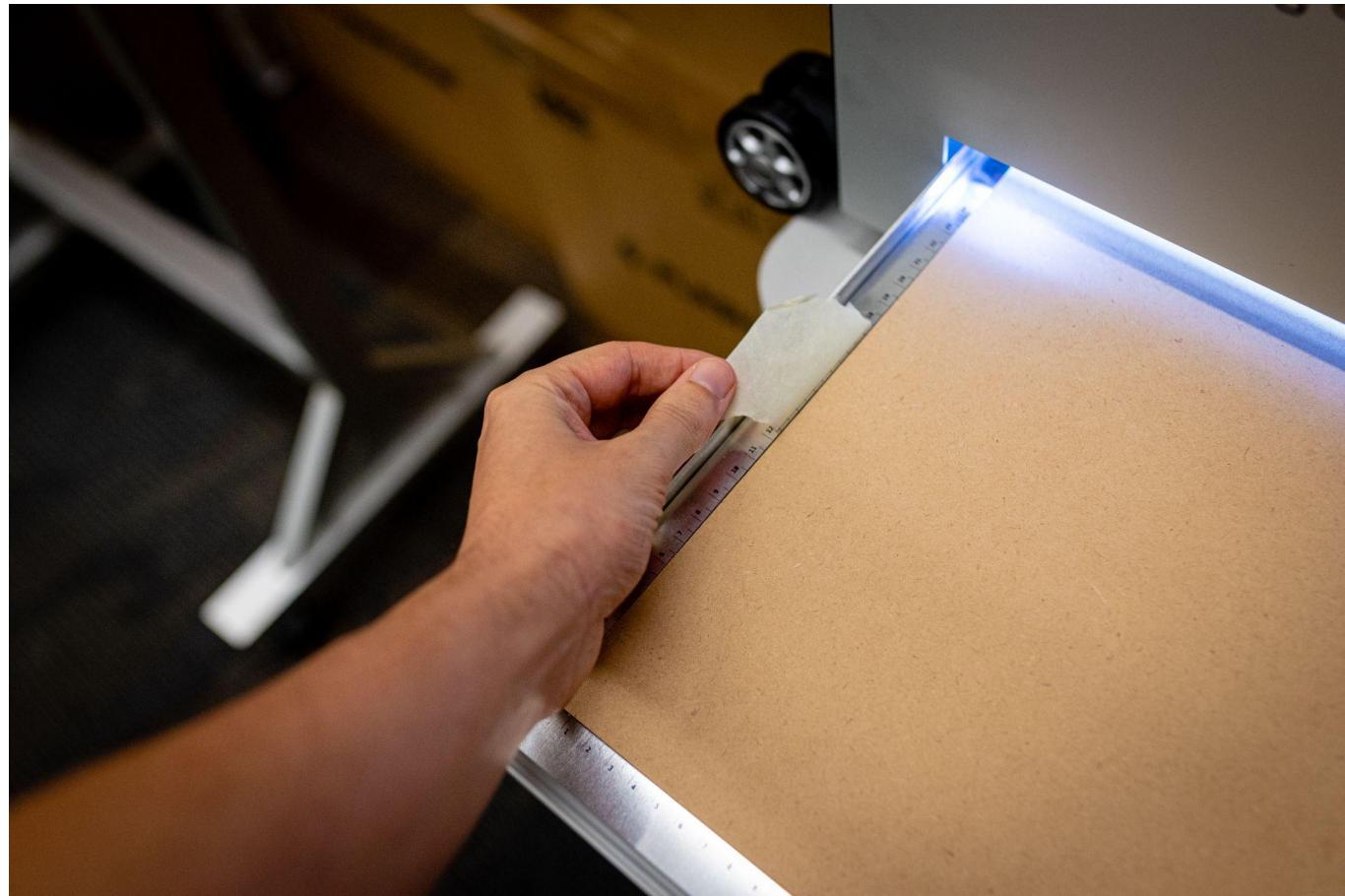
Monitor the ‘Tube Temp’ and make sure it does not exceed 35 °C. If it does stop the machine and let it cool down for at least 10 mins.

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.

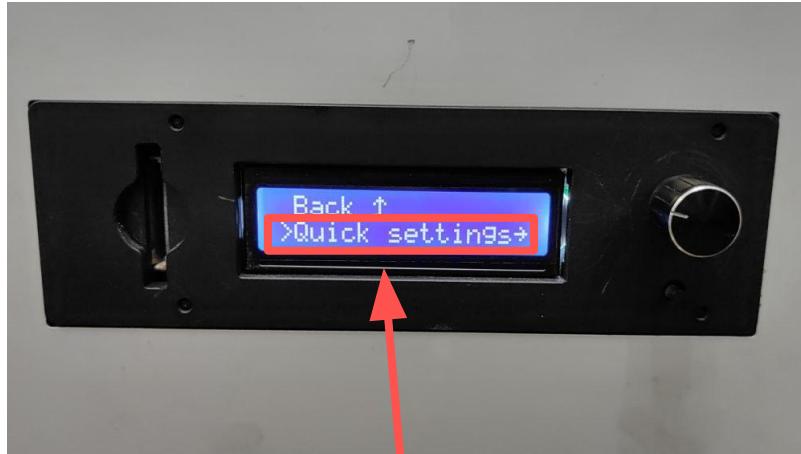
Position the tape strategically to avoid any potential mistakes.



Designing Laser Cut Parts

5. Operating the Laser Cutter

Laser Cutter Settings for Engraving



1

Select “Quick Settings”.

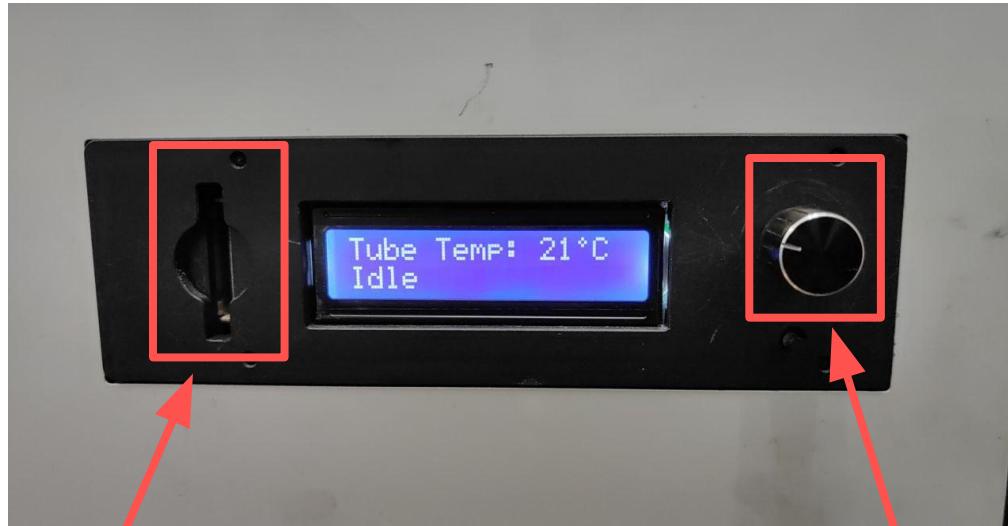


2

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.



Designing Laser Cut Parts



5. Operating the Laser Cutter

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

REMINDER

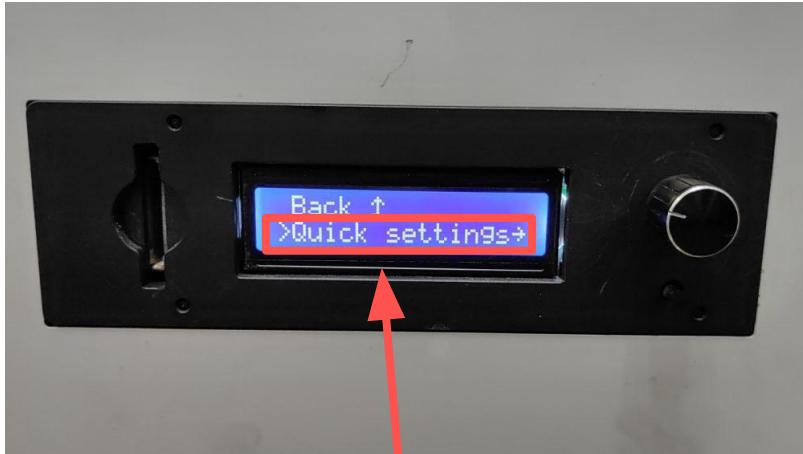
Do not exceed this power setting. Exceeding this setting might result in your material getting burnt.

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.



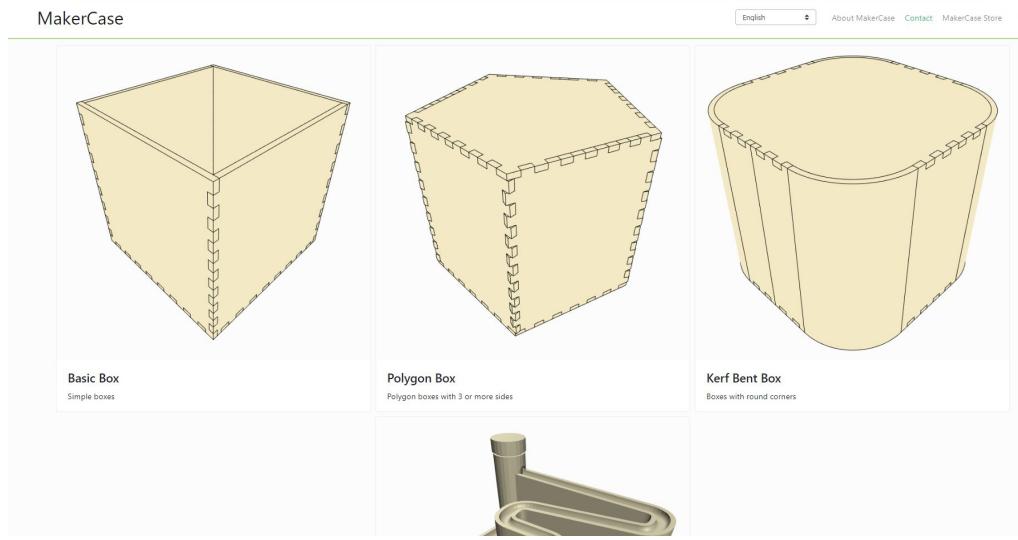
EXTENSIONS | SECTION 3 | 25 MINUTES

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.



<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

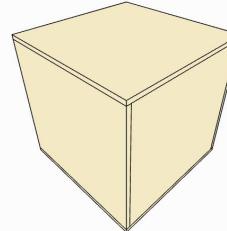
Material Thickness

Joint Type

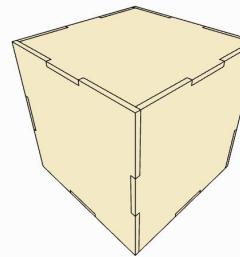
MakerCase

The screenshot shows the 'Units' section with 'Millimeters' selected. Below it are fields for 'Width' (101.6 mm), 'Height' (101.6 mm), and 'Depth' (101.6 mm). A radio button group for 'Are these inside or outside dimensions?' has 'Inside' selected. The 'Material Thickness' dropdown is set to '3mm'. Under 'Open or closed box?', 'Closed' is selected. In the 'Edge Joints' section, 'Flat' is the active tab, while 'Finger' and 'T-Slot' are shown as options. At the bottom is a green 'Download Box Plans' button.

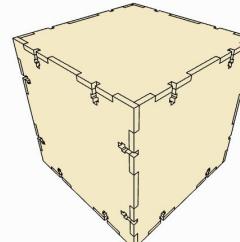
6. Design a 3D Box with Makercase



Flat Joint



Finger Joint



T-Slot Joint

Potential Projects

6. Design a 3D Box with Makercase

Open or closed box?

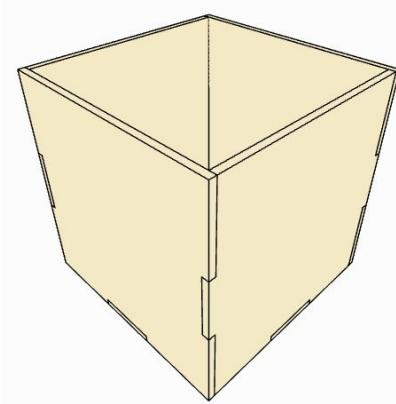
Open Closed

Edge Joints

Flat Finger T-Slot

Finger Size

27.75



Open or closed box?

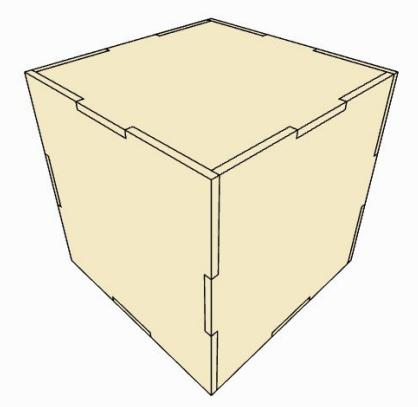
Open Closed

Edge Joints

Flat Finger T-Slot

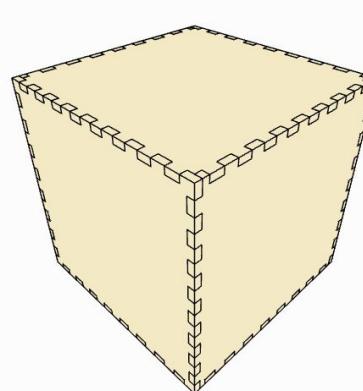
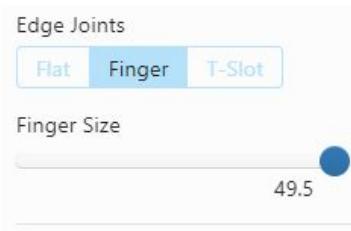
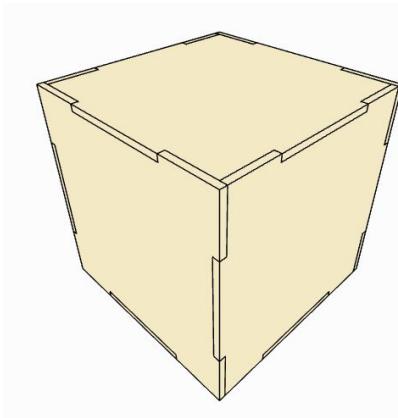
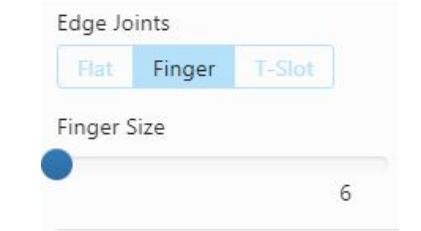
Finger Size

27.75



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?

Open Closed

Edge Joints

Flat Finger T-Slot

Number of Bolts

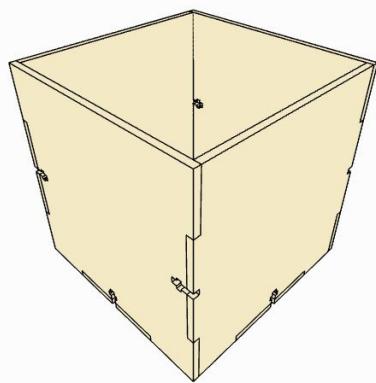
1

Bolt Diameter

M2.5

Bolt Length

10mm



Open or closed box?

Open Closed

Edge Joints

Flat Finger T-Slot

Number of Bolts

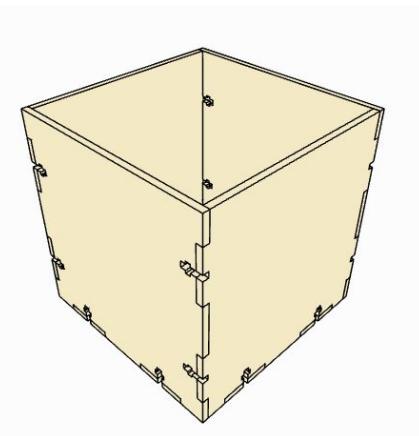
2

Bolt Diameter

M2.5

Bolt Length

10mm



Potential Projects

6. Design a 3D Box with Makercase

MakerCase - T Slot Joint

Edge Joints

Flat Finger T-Slot

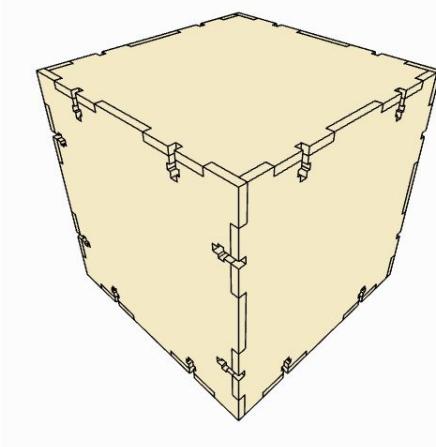
Number of Bolts

Bolt Diameter

M2.5

Bolt Length

10mm



Edge Joints

Flat Finger T-Slot

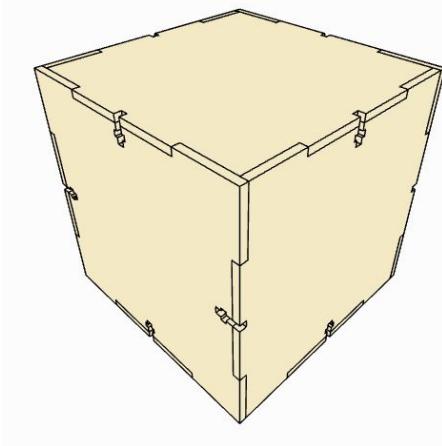
Number of Bolts

Bolt Diameter

M2.5

Bolt Length

10mm



Potential Projects

6. Design a 3D Box with Makercase

Units

Inch Millimeters

Width
101.6 mm

Height
101.6 mm

Depth
101.6 mm

Are these inside or outside dimensions?

Inside Outside

Material Thickness
3mm

Custom Thickness

Open or closed box?

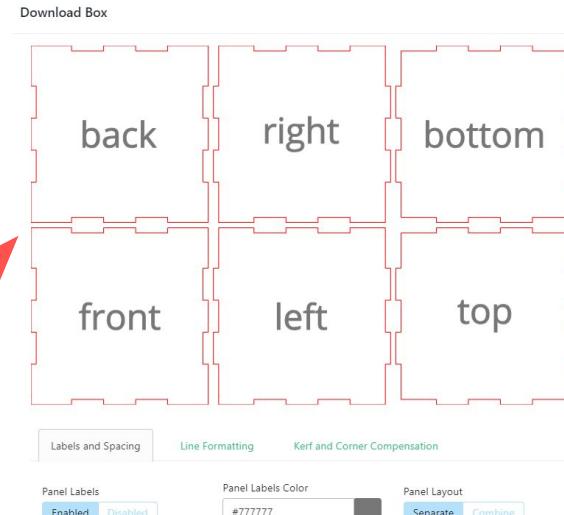
Open Closed

Edge Joints

Flat Finger T-Slot

Finger Size
18.375

Download Box Plans

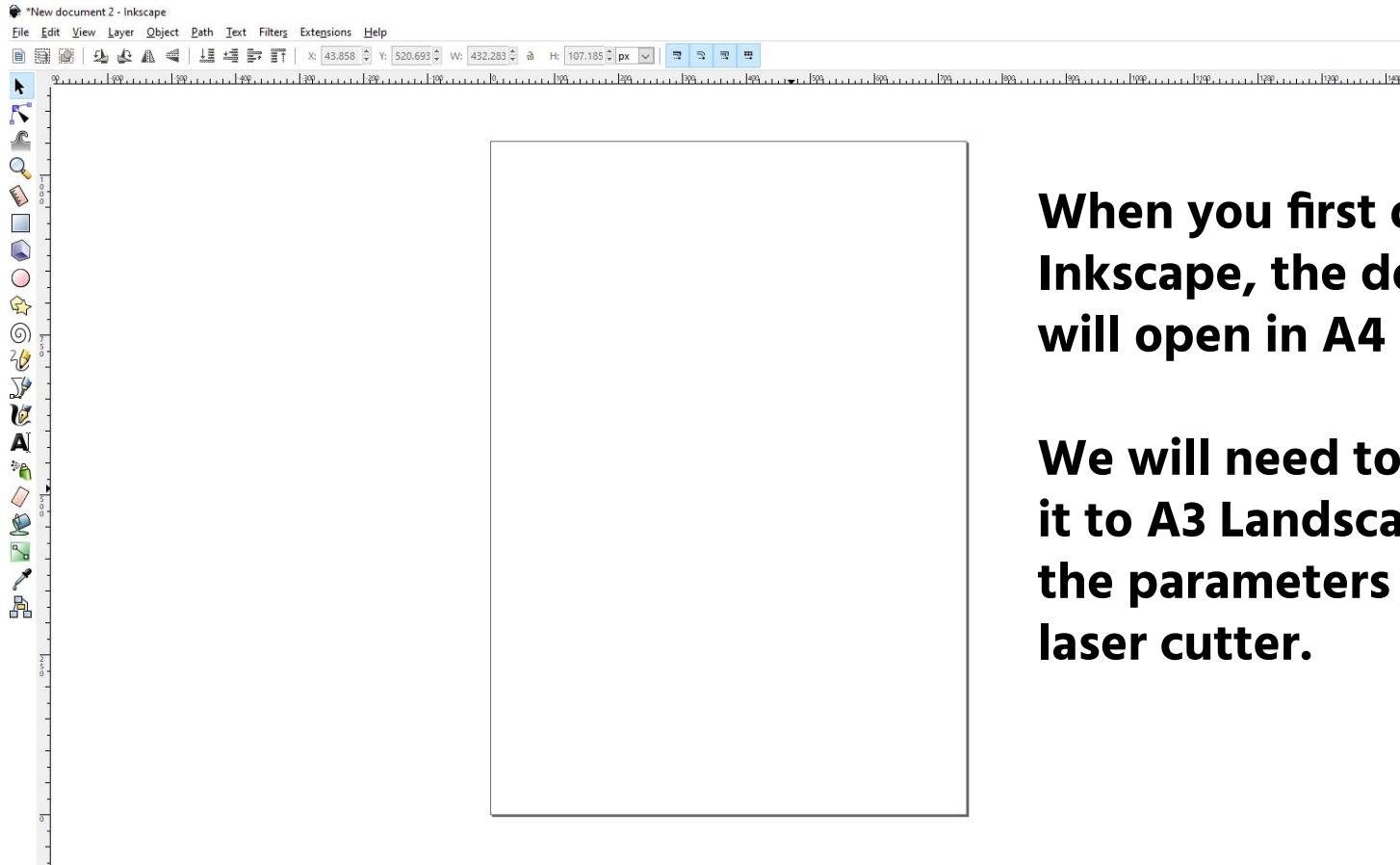


Download SVG **Download DXF** **Single File** **Cancel**

Download in
SVG format

Potential Projects

6. Design a 3D Box with Makercase

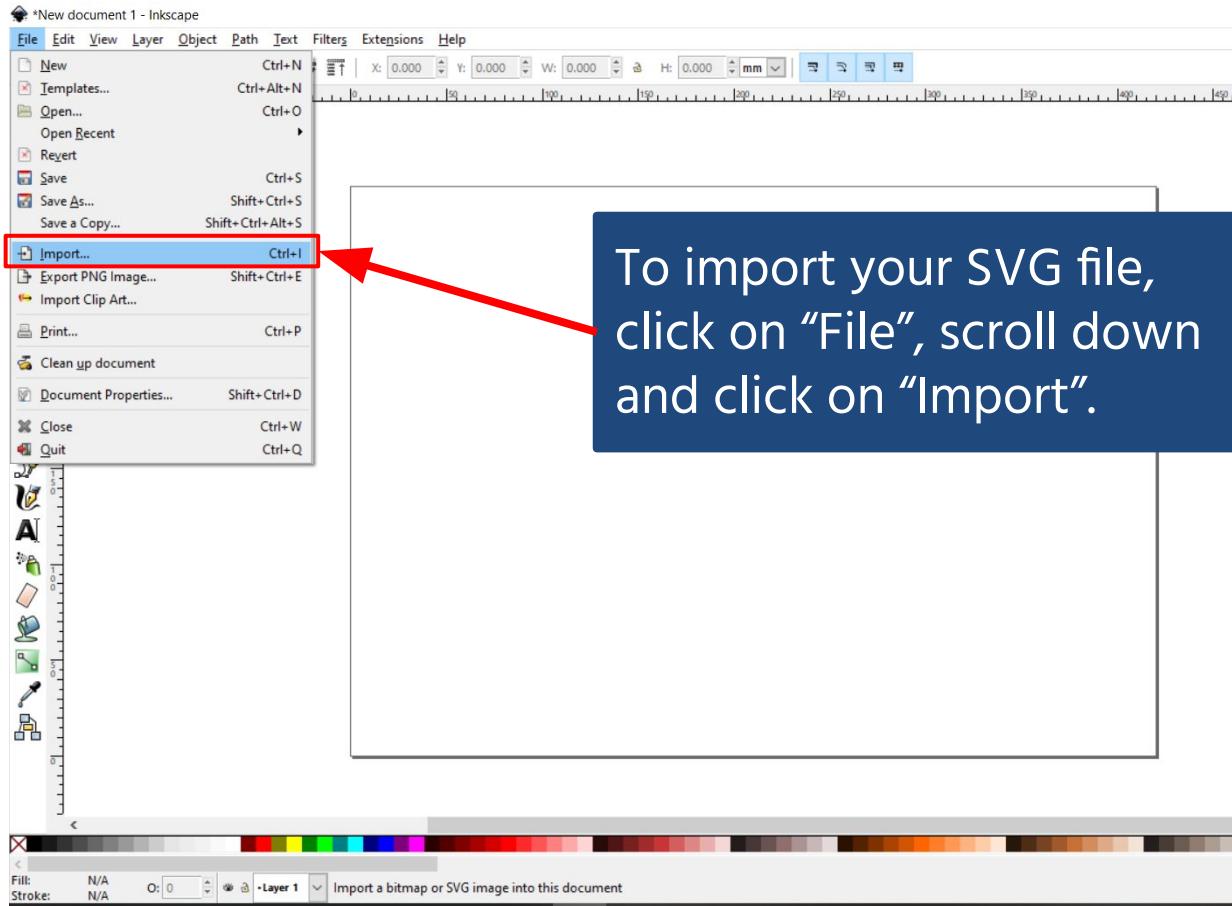


When you first open Inkscape, the document will open in A4 Portrait.

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

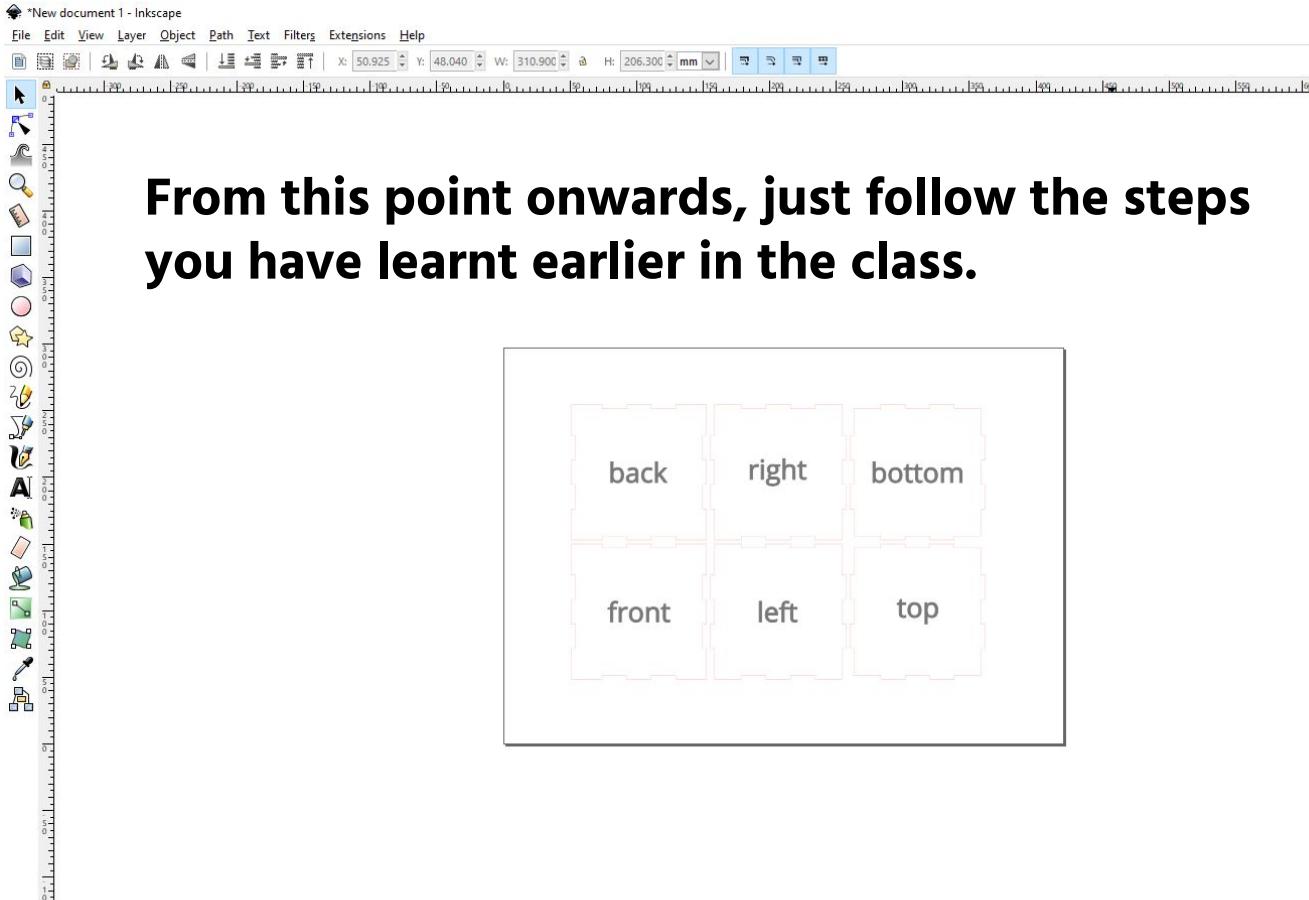
Potential Projects

6. Design a 3D Box with Makercase



Potential Projects

6. Design a 3D Box with Makercase

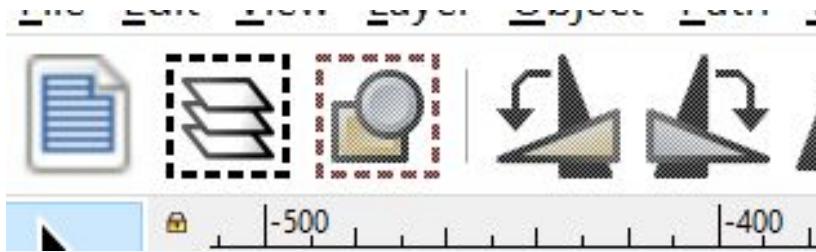


EXTENSIONS | SECTION 3.1 | 25 MINUTES

Frequently Asked Questions

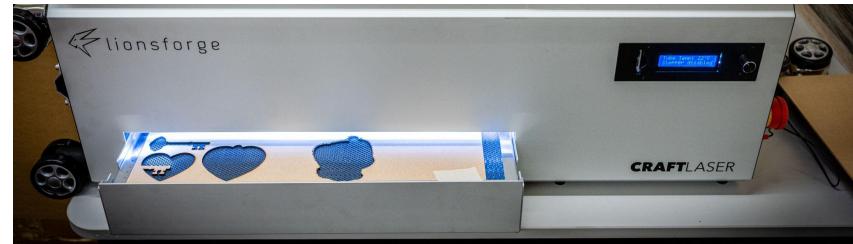
HOW CAN I APPLY WHAT I'VE LEARNED?

Applying Knowledge



Vector Design

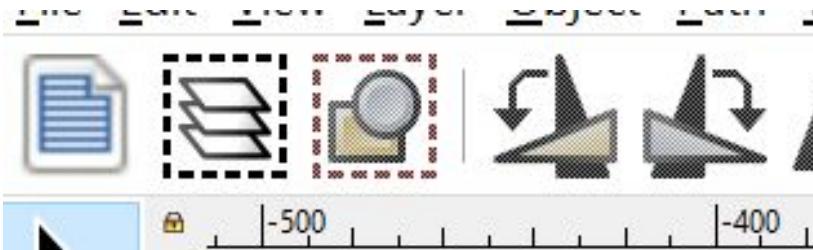
1. Seek learning resources for Inkscape (either from online sources or through NLB OneSearch)
2. Participate in Inkscape challenges to build out your skills



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



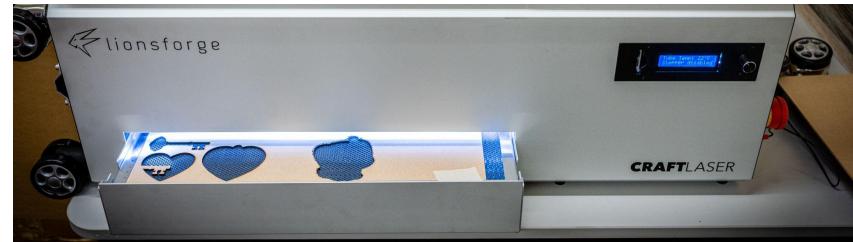
Vector Design - Youtubers to Follow

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 3.1 | 25 MINUTES

Applying Knowledge

Join our MakeIT Facebook Community Group to share ideas and access our online learning guides!

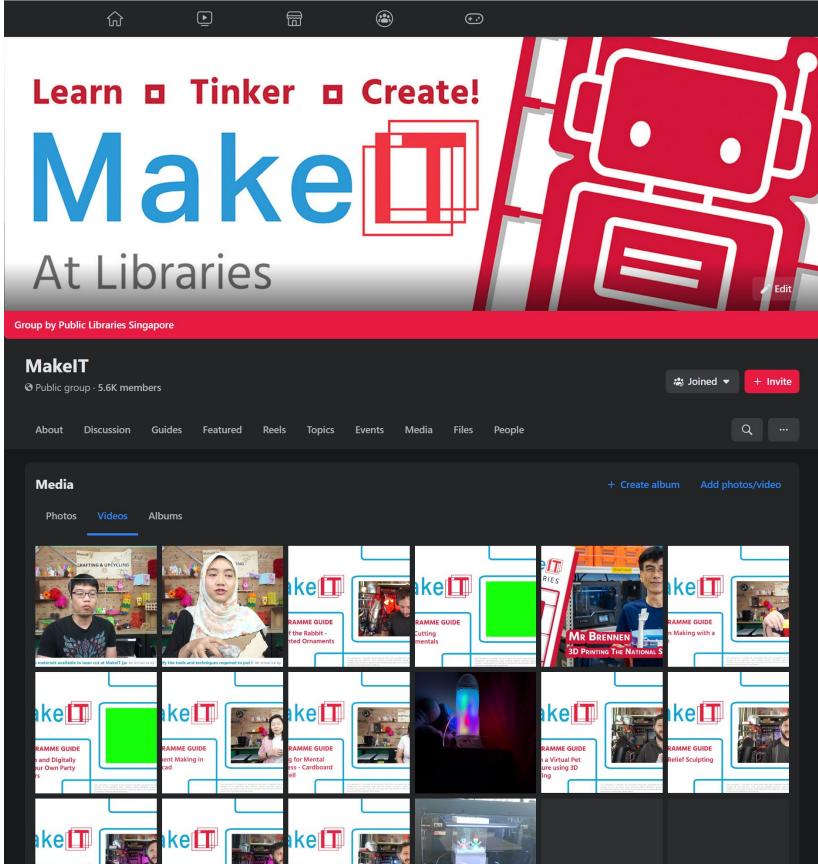
To access additional guides on laser cutting, navigate to the Media tab, select Videos, and search for:

[Laser Cutting Fundamentals](#)

[How to Laser Cut a Wooden Book](#)

[Cover](#)

[Laser Cut Box](#)



The screenshot shows the MakeIT Facebook group page. At the top, there's a banner with the text "Learn □ Tinker □ Create!" and "At Libraries". Below the banner, the group name "Group by Public Libraries Singapore" is displayed. The "Media" tab is selected, with the "Videos" sub-tab highlighted. A grid of video thumbnails is shown, each with a "FRAMME GUIDE" watermark. The thumbnails depict various projects such as paper lanterns, wooden book covers, and 3D printed objects. In the bottom right corner of the grid, there's a thumbnail for "Mr BRENNEN" and another for "3D PRINTING THE NATIONAL'S". At the bottom left, there's a QR code with the text "GO.govsg" on it. To the right of the QR code, the text "Scan the QR code or visit" is followed by a blue link "<https://www.Go.Gov.sg/makeit>".

EXTENSIONS | SECTION 3 | 25 MINUTES

Frequently Asked Questions

TINKERING AT MAKEIT AT LIBRARIES

MakelT 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

myLibrary

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 I SECTION 3.1 | 25 MINUTES

MakeIT at Libraries - Making a Booking

Simplybook

Equipment bookings are handled through Simplybook. Talk to our Centre Manager to register for an account, then visit

<https://makeitsq.simplybook.asia/v2/> to book 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

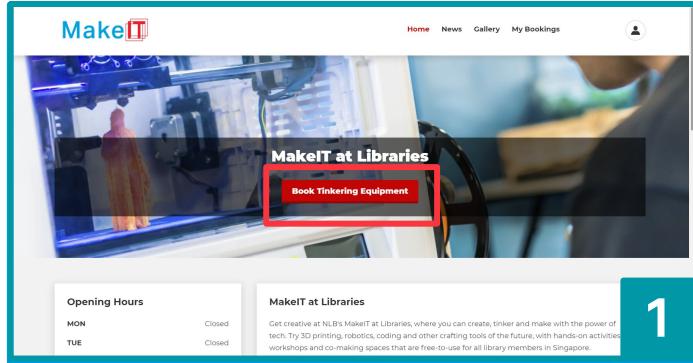
Recommendations

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

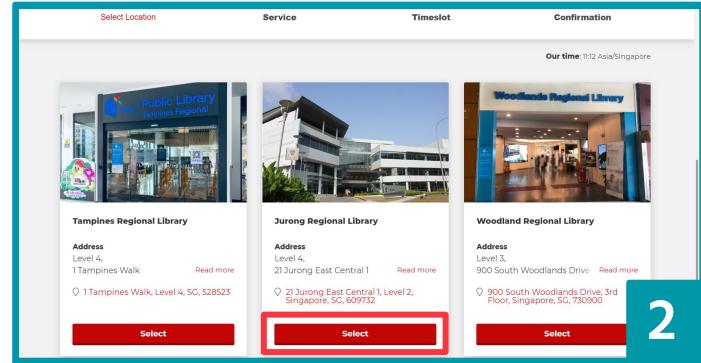
MakeIT at Libraries is an initiative by NLB.

[Book Tinkering Equipment](#)

MakeIT at Libraries - Making a Booking

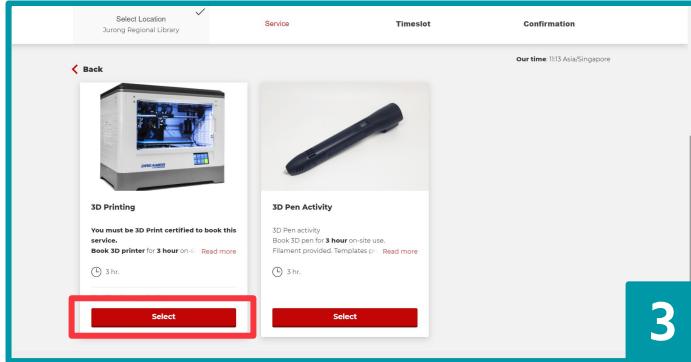


Once you have logged in, click on “Book Tinkering Equipment”.

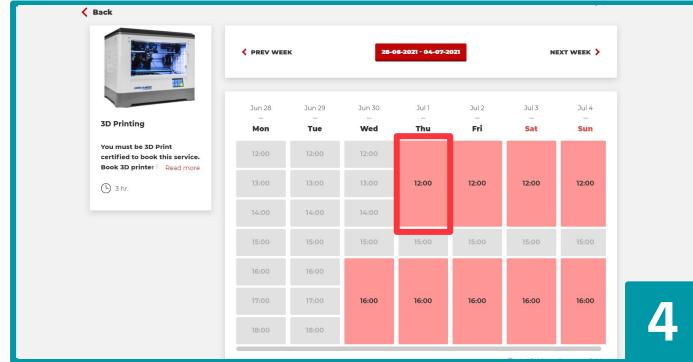


You will be redirected to a page that allows you to choose which MakeIT branch you will like to visit. Select one of the branches by clicking the respective branch “Select” button.

MakelT 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

MakelT at Libraries - Making a Booking

The screenshot shows a booking confirmation interface. At the top, there are dropdown menus for 'Select Location' (Jurong Regional Library), 'Service' (3D Printing), and 'Timestamp' (01-07-2021 12:00). Below this is a 'Confirmation' section showing 'Our time: 12:00 Asia/Singapore'. A 'Back' button is on the left. The main area has a heading 'PLEASE, CONFIRM DETAILS' and a message 'You are logged in as [username] Logout'. It lists a booking for '3D Printing' on '01-07-2021' at '12:00' at '21 Jurong East Central 1, Level 2, Singapore'. The category is '3D Printing'. There is a dropdown for 'Select certification' containing '3D printer certification [21-11-2020 - 21-11-2022]'. Buttons for 'Add another service' and 'Confirm booking' are at the bottom.

5

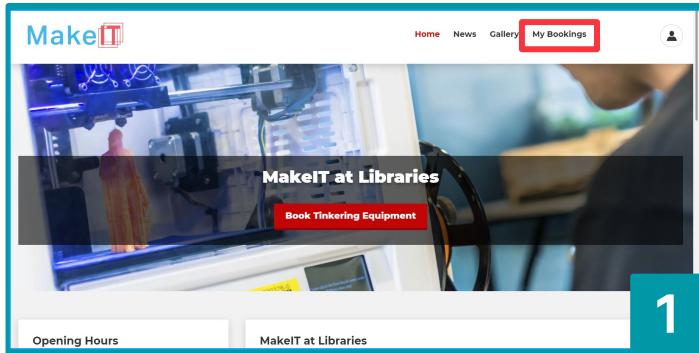
Ensure that you have selected the correct slot and click on “Confirm booking”.

The screenshot shows a confirmation page for a booking. At the top, a message says 'You've successfully reserved the service. Please check your email to see the notification.' A 'Back to services' button is on the left. The main area shows a booking for '3D Printing' on '01-07-2021' from '12:00' to '16:00' at '21 Jurong East Central 1, Level 2, Singapore'. The category is '3D Printing' and the booking code is '42397ya'. Buttons for 'Cancel', 'Book More', 'Add to calendar', 'Show all bookings', and 'Back to site' are at the bottom.

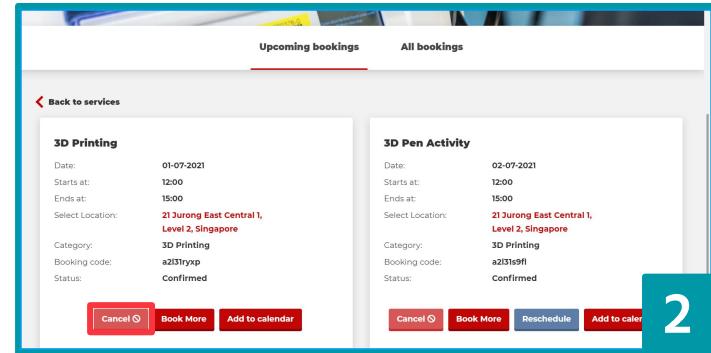
6

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

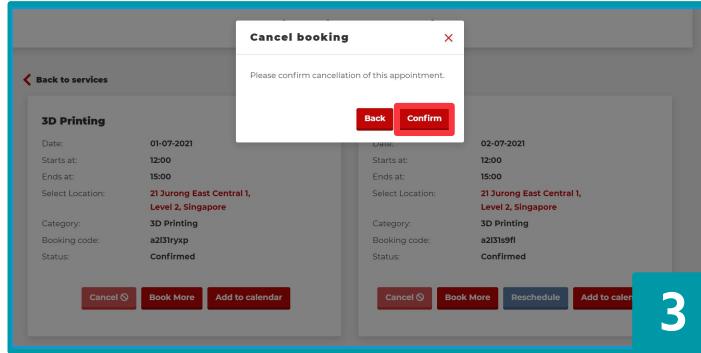


Once you have logged in,
click “My Bookings”.

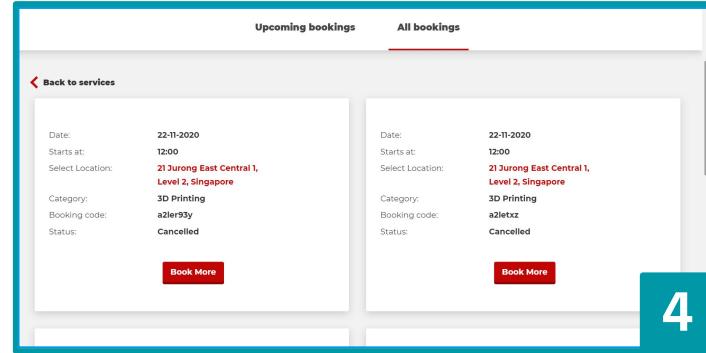


Your upcoming bookings
will be displayed as shown
above. To cancel your
booking, click “Cancel”.

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 MakelT'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 MakelT.

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.

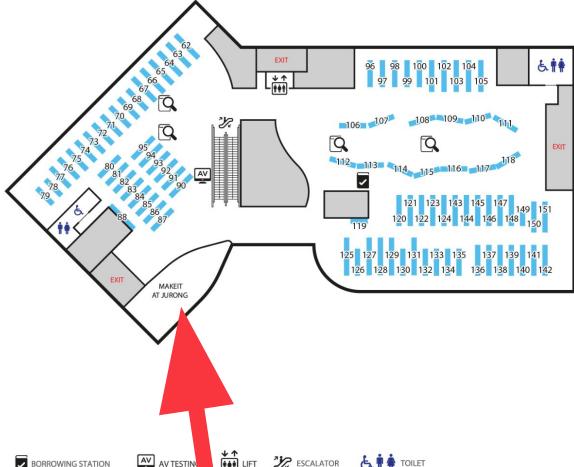
5. What can I cut? Can I bring my own materials for cutting?

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 MakelT. You may not bring your own materials for cutting at MakelT.

MakelT 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



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

MakelT 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
31

Teens' Non-Fiction
English
Chinese
Malay
Tamil

9 - 13, 16 - 18
2 - 3
7
8
3, 7, 8, 9

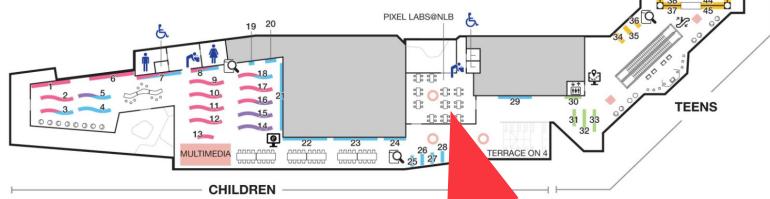
Children's Non-Fiction
English
Chinese
Malay
Tamil
Accompanying Items

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 eKIOSK LIFT * 4 LANGUAGES ESCALA
MALE TOILET FEMALE TOILET HANDICAP TOILET NURSING ROOM WATER DISPEN

Location

Tampines
Regional Library,
4th Floor

Address

1 Tampines Walk,
#02-01 Our
Tampines Hub,
Singapore 528523

Closest MRT Station

EW2 — DT32
Tampines

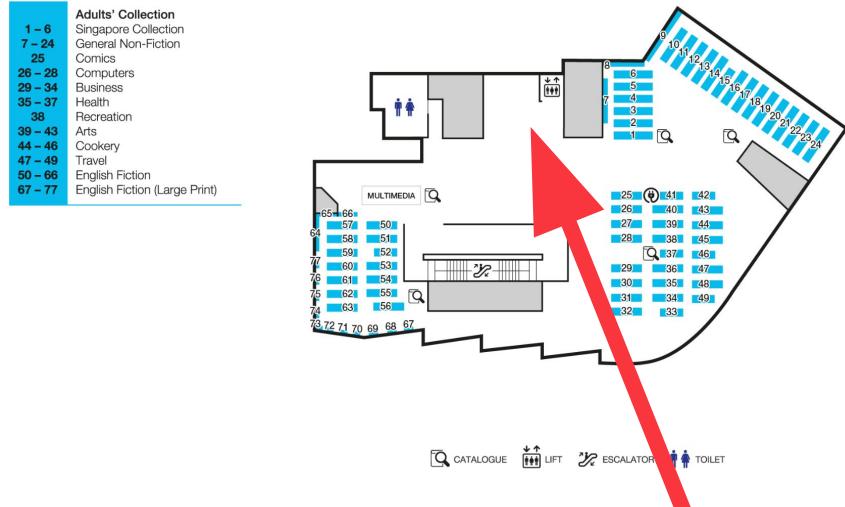
Opening Hours

Wednesday -
Sunday, 12 - 8PM

MakelT at Woodlands

WOODLANDS REGIONAL LIBRARY • LEVEL 3

MAP DIRECTORY



Location

Woodlands
Regional Library,
3rd Floor

Address

900 South
Woodlands Drive
#01-03. Singapore
730900

Closest MRT Station

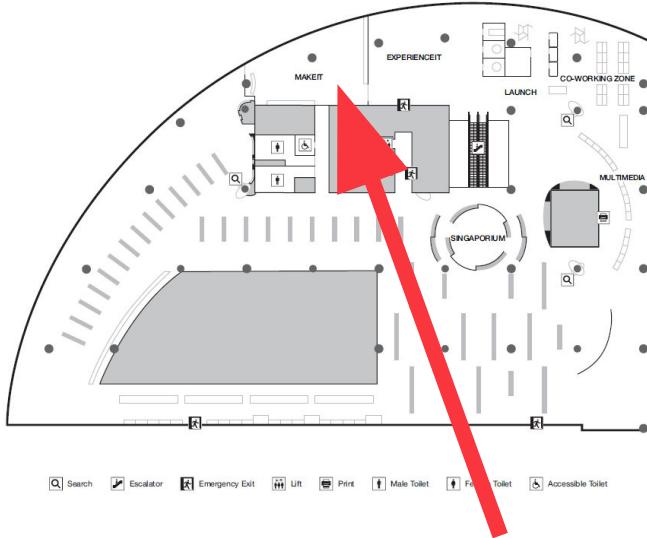
NS9 TE2
Woodlands

Opening Hours

Wednesday -
Sunday, 12 - 8PM

MakelT 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

MakeIT

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!

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.



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

MakeIT
AT LIBRARIES
go.gov.sg/makeit

National Library Board
Singapore



THANK YOU!



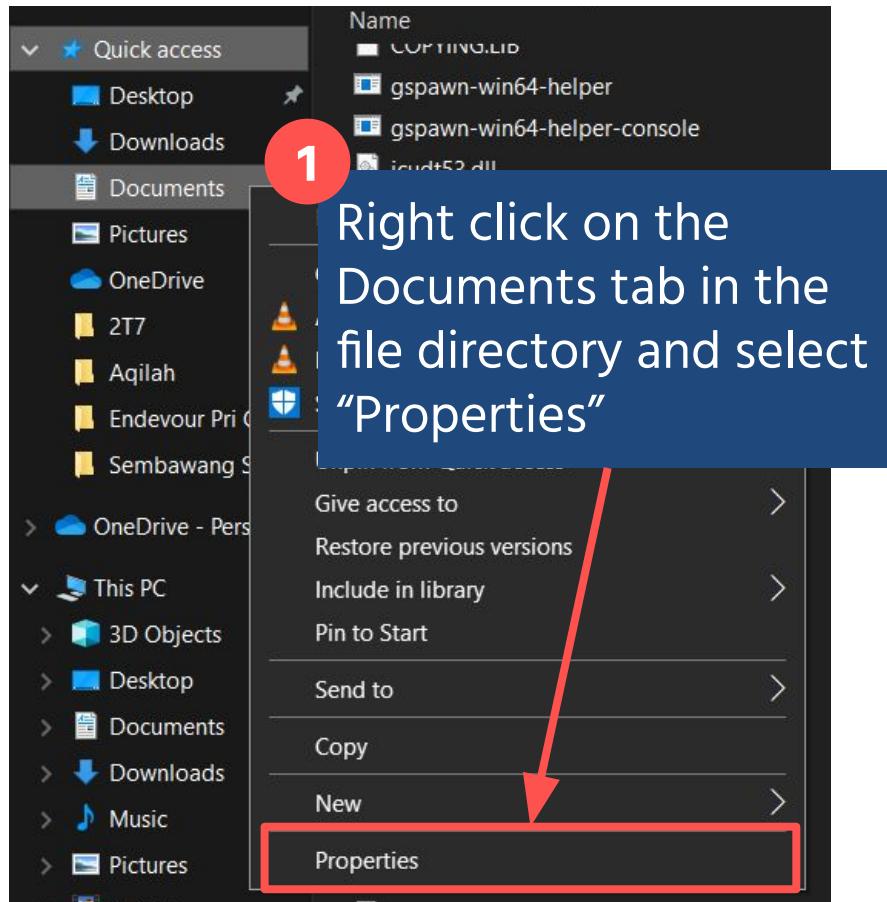
Please follow the link above to provide feedback for this workshop. We'll use this information to continue to develop your learning journey within MakeIT.

•

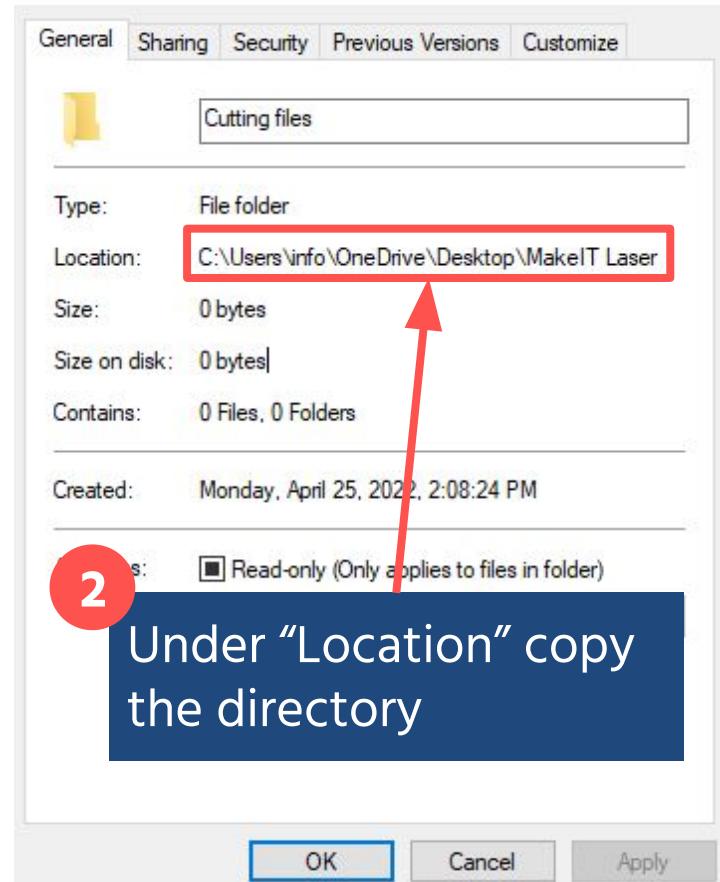
NKER
3D PRINT
NLB
EVERYONE CAN MAKE
UPCYCLING
MAKERSPACE
HELLO
SEWING
3D PRINTER
ROBOTICS
EVERYONE CAN MAKE
MAKE CODING
TINKER CREATE
EXPLORER COMPUTER
CREATIVITY

Explore MakeIT
Everyone MakeIT
Can Make MakeIT
Upcycling Sewing
Makerspace Everyone
Hello Can Make
Sewing 3D Printer
Robotics MakeIT
Everyone Make
Tinker Create
Explore Computer
Creativity

Designing Laser Cut Parts



3. Use Inkscape to Engrave Object

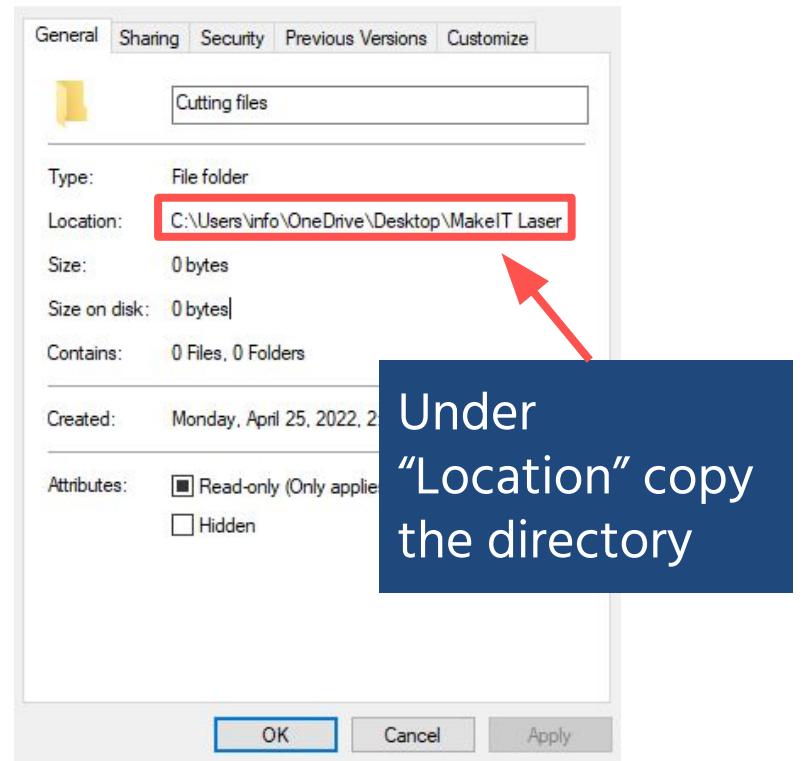


This slide is meant as notes for presenter

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



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/>

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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 styled 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>



EXTENSIONS | SECTION 3.1 | 25 MINUTES Applying Knowledge

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

S\$19.98 S\$36.98 46% off

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Buy now

30-Day Money-Back Guarantee

This course includes:

- 🕒 3 hours on-demand video
- ♾ Full lifetime access
- 📱 Access on mobile and TV
- QM Certificate of completion

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What you'll learn

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

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

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REQUIRED MATERIALS

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