Laser Cutting

This book describes how to use the laser cutters at Dundee Makerspace

- Introduction
  - The machines
  - Health and Safety
- Getting started
  - Preparing the design

Introduction

General information about using the cutters in the space

The machines

Dundee Makerspace has two laser cutters, one of which is operational. Laser cutting involves uploading a digital design to the laser cutter, which will then use a high powered UV laser to burn through the material of choice.

The operational laser cutter is a JustAddSharks Blacknose A3, affectionately named *Baby Shark*. This model is no longer made and the company are out of business, however there are many manuals and much documentation online. This cutter is located in the digital making room (the *shark tank*) and is connected to the necessary accessories, a PC and has exhaust ducting to the outside of the building.

The second laser cutter has a larger bed size and has a more powerful laser. It is currently in a state of requiring repair.

Please read this book carefully so you can use the cutter safely and effectively. If you have any questions or need to raise a concern then please contact Makerspace.

There is an hourly charge for using this machine.

Health and Safety

As well as the standard health and safety procedures when using any machine, Laser cutting has specific risks.

1. **The laser.** It uses a CO2 laser that can cause permanent damage even when not looking directly into the beam. It is after all designed to burn through things. It is absolutely forbidden to remove or tamper with any of the interlocks that prevent the laser being disabled when the case is open. The windows on the cutter will protect from any scattered UV radiation though the light may be uncomfortable when it hits the metal support grid. Do not try to view the cut through the ventilation holes in the side of the machine.
2. **Toxic fumes.** The laser works by burning away material. This results in the release of fumes which can be unpleasant or hazardous. Some fumes can be extremely dangerous and materials that produce these fumes are not permitted to be used in any of the laser cutters. A list of approved materials can be found in the Material Selection chapter. **You may not use any material other than those listed in that chapter without consultation with Makerspace directors.**
3. **Fire.** Some materials can support combustion. As the laser is quite literally burning the material away there is always a risk of fire. **You may not run the laser cutter unattended.** This means that you must be in the downstairs space (shark tank or workshop) and monitoring the cut. If there is fire, the first action is to stop the cut using the emergency stop button on the cutter. This will cut the power and remove airflow (blower and extractor). Any fire will usually self extinguish very quickly. or can be extinguished with a fireproof cloth. If the fire is not extinguishable without putting yourself at risk, follow the appropriate fire alarm procedure and evacuate the building.
4. **Mechanical components.** The cutter head is moved by motors that are powerful enough to cause damage to hands and other implements. Do not place hands or other tools inside the bed when the head is moving. These can cause damage to the machine, injury to persons and be messy to clean up.
5. **Noise.** The cutter itself is relatively quiet but the associated chiller, air pump and extractor can provide a level of noise that is uncomfortable. The use of hearing protection is recommended if remaining in close proximity for prolonged periods.

Materials that must not be cut with a laser

Laser Cutting Materials to Avoid	Reason
PVC	Melting releases toxic chlorine gas

Laser Cutting Materials to Avoid	Reason
Polycarbonate	Difficult to cut, absorbs most of the laser light.Discolors after laser cutting.
Coated Carbon Fiber	Resin coating releases toxic fumes on melting
Fiberglass	The glass refracts the laser light. Resin coating releases toxic fumes
Galvanized Metal	The zinc or nickel coating turns to dangerous volatile oxides.
ABS	Melting releases toxic cyanide gas
HDPE	Quickly catches fire
Polystyrene	Quickly catches fire

Materials that can be cut with a laser

Material	Notes
Acrylic sheet (perspex etc.)	Easy and simple to cut. Cuts by ablation (ie material vapourises)
Polypropylene	Can be tricky as it melts. Lots of small cuts instead of one big one
Styrene	Same as for Polypropylene
Foam (check the type)	Foams can be readily cut but do check that it is not pvc or similar.
Wood	Wood cuts by burning. Many small cuts can give a better finish than one big cut. Risk of fire. Different woods have different compositions so try on a sample first. MDF will vary widely depending on source.
Slate	Can engrave but not cut

Getting started

Describes the basic workflows for laser cutting

Preparing the design

The laser cutter can take two forms of input. It can take a raster image (pixel by pixel) for engraving, or a vector image for cutting and engraving.

Typically you will prepare your input file offline using software such as Inkscape, Illustrator, Fusion 360 or Corel Draw (amongst many others). This file will then be exported in Autocad DXF format and imported into the laser cutter software. Following tweaking it will be sent to the laser cutter for burning.

Design considerations

Think carefully about your design before you start. Trying to make deep cuts too close to one another will not give a satisfactory result.