An Overview of Wesleyan's Makerspace

Safety and Standards
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INTRODUCTION

This document was written as an introduction to the makerspace as well as a guide to ensure safe operation of the equipment and tools we have to offer. If you can’t find an answer to a question, please talk to one of the lab monitors.

What is a Makerspace?

One way to think of the lab is as a Digital Shop - much like a Metal Shop or a Wood Shop - containing a core set of niche equipment for specific processes. Like the traditional disciplines, digital craft carries an expectation of creative engagement with the physical world. What sets a makerspace apart is the integration of computers and automated tools.

On one side of this coin is the idea of digital fabrication. In addition to the familiar hand and power tools such as screwdrivers and orbital sanders, digital fabrication involves the use of automated machines that are driven by CNC or Computer Numerical Control. This includes the laser engravers, waterjet cutter, vinyl plotter and 3-axis router, as well as the 3D printers.

The other side of the coin is physical computing; the creation of objects that interact with the real world via an array of sensors and motors linked to programmable microcontrollers. In recent years, the name Arduino has become synonymous with physical computing. While serving as an effective and user-friendly introduction to this category of device, it’s really just the beginning.

Underlying all this is the concept of DIY, or Do It Yourself. Standing in counterpoint to the immediate gratification of disposable culture, it promotes a sense of personal empowerment through active participation in the creative process. At the IDEAS Lab, no one is going to do your work for you. But we’ll be happy to show you how.
Where is the IDEAS Lab?
We are in the basement of Exley Science Center. Room 40. Take the double staircase from the first floor and turn left. Look for the glowing sign.

Who can use it? When?
If you are an active member of the Wesleyan community who has passed the requisite training, you are welcome in the lab. Classes are held five days a week with exclusive class use during certain evenings. Open Lab times are held on Friday, Saturday and Sunday. Please refer to the online calendar for specific times.

How do I receive training?
This booklet comprises the first and most general set of guidelines. After reviewing and signing off on the information contained, you must pass a multiple choice quiz covering basic safety knowledge. This qualifies a patron for general access to the space, along with use of the basic set of hand and power tools.

For the remaining machines, further training is required. The laser engravers and the 3D printers each have a self-guided module on the lab’s Moodle page. Score out of the quiz, receive a demo from an instructor or monitor, and you are on your way. The Axiom CNC router, ProtoMAX waterjet cutter and Tormach CNC mill are somewhat more complex and are typically not used without supervision. Weekend workshops and demonstrations will be held throughout the semester. Announcements will be made through our web page and through social media. Please sign up if you are interested.

Safety
While it is not possible to eliminate all risk associated with a DIY shop, there are a number of steps that can be taken to reduce risk to acceptable levels. Lab patrons must accept a minimum level of personal responsibility. Safety glasses are useless if they are not covering your eyes. And it’s up to you to know if you are too tired to safely use a drill. Participation is expected at all levels. Please read through the next pages for an overview of available makerspace equipment along with their associated safety concerns. The final pages contain a safety and standards contract that you will need to sign before moving on.
TOOLS AND EQUIPMENT IN THE LAB

A SHORT OVERVIEW

Safety Level 1: Hand Tools
Included in these groupings are tools that have no motors and run on human power. It is easy to let safety standards slip when using these devices as they do not readily advertise their danger. Out of everything we offer, however, it is the simple utility knife that causes the most accidents. Always be aware when using this class of tool!

### BLADES
Includes X-Acto Knives, Utility Knives, Box Cutters, Razor Blades

**CONSIDERATIONS**
- Extremely sharp edges.
- Deep cuts are possible requiring stitches and a hospital visit.
- Be aware of the location of fingertips, especially when using a straight edge or ruler.
- Wear safety glasses to protect from pieces of broken blade.

### HAND SAWS
Includes Coping Saws, Hacksaws, Bow Saws

**CONSIDERATIONS**
- Serrated edges sharp enough to cut wood.
- Deep cuts to flesh unlikely.
- Stock should be held securely.
- Watch fingertips and hands.
- Wear safety glasses to protect from splinters and dust.

### HAMMERS
Includes Mallets, Dead-blow, Ball Pien, Claw

**CONSIDERATIONS**
- Made to produce a high impact.
- Can break bones and cause severe bruising.
- Fingers are at greatest risk.
- Protect your hearing.
- Wear safety glasses to protect from broken pieces of struck objects.

### PLIERS/NIPPERS
Includes Needle Nose, Channel Locks, Wire Strippers, Flush Cutters

**CONSIDERATIONS**
- Hand-held lever designed to pinch and hold or pinch and cut.
- Can break skin or cause bruises.
- Injuries likely shallow
- Always know what is in the jaws of the pliers.
- Wear safety glasses to protect from chips or flying offcuts.
**Safety Level 2 : Corded and Rechargeable Power Tools**

Unlike level one hand tools, the majority of these devices announce their inherent hazards through noise, high-speed rotation and vibrations. Because of that, these tools can be intimidating at first. Follow safety recommendations closely.

<table>
<thead>
<tr>
<th>Tool Type</th>
<th>Description</th>
<th>Considerations</th>
</tr>
</thead>
</table>
| **DRILL PRESS**    | Stationary drill with movable belts for speed control.                      | • Work must be held securely using clamps or a vise. Small objects held with fingers can get wedged in the bit and spin, causing lacerations or abrasions.  
                   |                                                               | • Gloves can get caught and drawn in. Do not wear them.  
                   |                                                               | • Loose clothing or long hair can get caught in rotating chuck. Tie hair back, push up sleeves.  
                   |                                                               | • Do not attempt to adjust belts yourself.  
                   |                                                               | • Wear safety glasses to protect from debris and dust.  
                   |                                                               | • Do not operate with key in chuck! |
| **HAND DRILLS**    | Includes rechargeable and corded units. Hammer drills and impact drivers are available. | • Units are portable and have a surprising amount of power.  
                   |                                                               | • Rotating bit will pierce material. Be sure to drill on top of something that can be damaged. Drill boxes are available.  
                   |                                                               | • Bits can break during use.  
                   |                                                               | • Wear eye protection for dust, debris and broken bits. |
| **BELT/DISK SANDERS** | Stationary machine with rotating disk or belt. | • Abrasive moving at high speed.  
                   |                                                               | • Rotation hazard can pull in loose clothing or long hair. Same with gloves, so do not wear them.  
                   |                                                               | • Most injuries arise from knuckle scrapes. Can remove a fair bit of skin, but most abrasions are shallow with no hospital attention required.  
                   |                                                               | • Use vacuum dust collection when running.  
                   |                                                               | • Dust mask recommended.  
                   |                                                               | • Eye protection required.  
                   |                                                               | • Hazards associated with layer being removed. Old paint can contain lead and old surfaces can contain asbestos. If you don’t know what you’re working with, don’t work with it. |
| **PORTABLE SANDERS** | Rotating or oscillating disk of abrasive. | • Hand-held device with a disk of abrasive material moving at high speed.  
                   |                                                               | • Though there is a small dust collector on-board, a large amount of debris escapes.  
                   |                                                               | • Eye and breathing protection are required.  
                   |                                                               | • Gloves may be used.  
<pre><code>               |                                                               | • Hazards associated with layer being removed. Old paint can contain lead and old surfaces can contain asbestos. If you don’t know what you’re working with, don’t work with it. |
</code></pre>
<table>
<thead>
<tr>
<th><strong>JIGSAW</strong></th>
<th><strong>SCROLL SAW</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Portable saw with thin blades. Must always cut through material.</td>
<td>Stationary unit using thin blade. Capable of intricate cuts.</td>
</tr>
</tbody>
</table>

**CONSIDERATIONS**
- Blade emerges from underside of material during normal operation. Keep area clear. Keep body parts out of the way.
- Be sure blade is secured tightly in receiver after installation. Ask if unsure.
- Eye, ear and dust protection required.

<table>
<thead>
<tr>
<th><strong>DREMEL ROTARY</strong></th>
<th><strong>SOLDERING IRON</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand held unit with interchangeable bits, incl burrs, abrasive disks and buffs</td>
<td>Heated device for soldering electronics.</td>
</tr>
</tbody>
</table>

**CONSIDERATIONS**
- Does its job with speed, not torque. Rotates at thousands of revolutions per minute.
- Tool has a tendency to "climb" across work surface, pulled by the rotation.
- Most hand injuries surface-level.
- Eye injuries can be quite serious. Wear safety glasses.

<table>
<thead>
<tr>
<th><strong>HOT GLUE GUN</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Heated device for adhering material.</td>
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</tbody>
</table>

**CONSIDERATIONS**
- Tip can cause burns.
- Hot glue can stick to skin
- Glue will continue to flow if left on. Turn off when finished.
Safety Level 3: Further Training Required

Because of their complexity or inherent danger, each piece of equipment in this section requires its own specialized training. Some are available as self-guided Moodle modules, others are on request or through weekend workshops.

2 Epilog Helix laser engravers Bed size 24”x18”. One 75W, the other 80W. A rotary attachment is available for cylindrical objects. Cuts medium and light density materials such as acrylic, wood, paper, cardboard. Can engrave glass, stone, anodized aluminum, painted steel. Training module in Moodle.

5 Ultimaker 3 3D printers FDM extrusion. Four with 8.5”x8.5”x11.8” extended build platform. We've had most success with PLA and TPU filaments, most trouble with ABS. PVA supports are preferred. Training module in Moodle.

ProtoMAX waterjet cutter Bed size 12”x12”. Max Z height 1”. 30,000psi at nozzle. For cutting dense, resistant materials such as steel, aluminum, tile, carbon fiber, stone, brass. Training available via appointment.

Axiom Precision CNC router Three axis. Bed size 24”x48”. Max Z height 6”. Water-cooled 1.5HP electrospindle. Ball-screw drive. For thicker, medium-density materials that can’t be cut via laser, including wood, plastic, MDF, extruded nylon, polycarbonate, and acrylic. Relief carvings from 3D files possible. Training through workshops scheduled throughout the semester.

Tormach PCNC 1100 mill Four axis. Work envelope 18”x9.5”x16.25”. 1100W 1.5HP spindle. PathPilot control. For high-density materials that need rigid tooling and flood coolant. Steel, aluminum, brass, iron, titanium. Training through workshops scheduled throughout the semester.

Formech 450DT vacuum former Forming area 11”x17” w/ 7” draw depth. For making relief molds of solid objects. Works well in tandem with router for creating multiples. Training available via appointment.

Roland GS-24 CAMM-1 vinyl cutter Work area 24”x985”. For contour cutting of adhesive vinyl sheet, films, heat transfer material, acid resist masks.
IDEAS LAB SAFETY AND STANDARDS CONTRACT

A SIGNED AGREEMENT MUST BE ON FILE BEFORE USING THE LAB

Community patrons may use the IDEAS Lab only after reviewing the safety documents, submitting a passing grade for the associated quiz, and participating in a live demo. Students in IDEAS classes will be cleared by their professor. The lab is open for community use only during designated weekend hours. The rest of the time is reserved for students registered in a participating course. All patrons must sign this contract stating that they have read, understand, and will abide by Community and Safety Standards.

Safety Standards

• No food in the makerspace. If drinks are brought in, make sure they are covered and kept in the classroom portion of the lab.

• Wear eye protection at all times when operating any piece of equipment. This applies to obvious tools like the belt sander and the drill press, and also to the seemingly innocuous like soldering stations, x-acto knives and hot glue guns. Goggles and safety glasses are available.

• No sandals or open toed shoes in the lab. Any dropped tool can cause injury. You may be paying attention but your neighbor may not be.

• No listening to music with ear buds or headphones when using equipment. Power tools are dangerous. Your complete attentiveness while using these them is required.

• Dangling items can be caught in motors and cause injury. Button or roll up loose sleeves. Remove scarves, rings, bracelets or other jewelry. Tuck in hoodie strings. Tie or pin back long hair.

• Awareness is everything. Do not use machines while intoxicated, overtired, or emotionally distraught. Make sure you have plenty of room around you, and that people working nearby are aware of your presence. Watch your fingers at all times.

• Protect your lungs and respiratory system. Turn on dust collectors to machines where applicable. Particle masks are available for hand sanding and other operations.

• Basic permissions given through this form are for general hand and power tool use only. Intermediate and advanced equipment requires further instruction. Training is available, either self-guided through the lab Moodle page or via participation in a weekend workshop.
Community Standards
The IDEAS LAB is a space that is intended to be shared among members of the entire Wesleyan community, from student to staff. Our footprint is modest and the lab can fill up quickly. It’s easy to get in one another’s way. For the lab to function smoothly, each patron must be responsible for maintaining the environment at multiple levels.

• First and foremost, it is important to address the social atmosphere. Regardless of race, religious belief, gender pronouns or level of experience - all are welcome here. The lab is intended to be a place for expression and creativity. If harassment of any kind takes place, please report the incident to a monitor or to the coordinator.

• Patrons must thoroughly clean up after themselves. Vacuums, dust pans and brooms are all available.
  - Turn off and unplug any power tools, especially the hot glue guns.
  - Clear and sweep tables.
  - Vacuum machines and floor.
  - Wash adhesive from 3D printing plates.
  - Replace tools in designated drawers.
  - Put waste material (no trash!) in the dry bin.
  - Place usable scrap back in cubbies.
  - No projects or materials may be stored in lab without authorization.

• No spray paint or spray adhesive in lab or on asphalt. Spray over newsprint or cardboard outside by the loading dock.

• Raw materials in storage cubbies are for class use only. Community patrons must provide their own sheet stock for the laser cutters and CNC machines as well as filament for the 3D printers.

• The makerspace is not a production facility. Our machines do not have the capacity to manufacture multiple copies of specialized lab equipment for other departments. We are here for self-directed prototypes and one-offs. If production is desired, talk to Bruce and Dave in the Machine Shop. There are also many places online that can fulfill your request.

Print/Sign: ____________________________
WesID#: ____________________________
Date: ____________________________