

DFL



WATERLOO | ARCHITECTURE
DESIGN FABRICATION LABS
USER GUIDE



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INTRODUCTION

Waterloo Architectures Design & Fabrication Labs (DFL) is a facility that supports experimentation in design and materials, and provides facilities, equipment and space for wide scope of fabrication projects of architectural and landscape models, furniture and 3-D sketches. The shop is equipped with machinery and tools to handle fabrication in wood and wood products, paper products, metal, plastics and poured materials requiring molds (i.e. epoxies, concrete, and plaster). The WA Fabrication Labs is approximately 5000 square feet and located on the ground floor of the School building with easy internal and external access (Rm. 1006). It consists of four primary areas; machine tools, bench/assembly, metalworking and digital fabrication.

Wood Lab

The largest large portion of the lab has been allocated to wood and processing equipment. Here students have access to a comprehensive joinery shop with a wide variety of hand and power tools. Students are provided with instruction and facilities for prototype and model making, furniture building, and general fabrication techniques. The facility enables and encourages experimentation & exploration of materials and processes of wood and wood product fabrication.

METAL Lab

Metalworking is an evolving component of the labs and is currently integrated into the Main shop area as the schools looks to expand its metal capabilities. The Metal Lab provides tools, equipment, training, and workspace for small and large-scale projects involving sheet metals and steel structural sections. metal shears, and brakes as well as cutting and bending equipment are available. The Lab allows for a range of fabrication and exploratory work in support of studio and thesis work, research, and design-build projects.

ASSEMBLY AREA

A large portion of the Lab space is dedicated to the bench/assembly area that provides students ample area to construct, assembly and work on their various works and projects. A wall of windows provides abundant natural light directly to the 16 workbenches in the assembly area. A student tool cabinet is provided to allow students rudimentary tools for after hour work.

DIGITAL FABRICATION LAB [Dfab]

The Digital Fabrication Lab is a bridge between the digital and the physical and is encouraged to be utilized as an integral component of the design process. The Digital Lab is located within the main adjacent to the main entrance doors in room 1006B. The Dfab has a range of digital equipment consisting of both additive and subtractive processes tools including 3D printing, laser cutting and CNC milling. The Dfab schedule is generally the same as the shop hours and is supervised and managed by the Fabrication Lab Manager.

HOURS OF OPERATION

The Design Fabrication Labs are supervised by the DFL Manager and a Technician. Access to the equipment is dependent on the availability of one or both of these individuals.

Normal working hours for the Fabrication Labs are:

Monday	8:30-5pm
Tuesday	8:30-5pm
Wednesday	8:30-5pm
Thursday	8:30-5pm
Friday	8:30-5pm
Saturday	CLOSED
Sunday	CLOSED

Note:

The shop is closed for lunch, 12:00-1:00

During off-hours when the fabrication labs are not supervised, students still have FOB access to the main shop area, however power to the machines will be off. There is no power tool usage during the lunch hour if the supervisors are not available to monitor the labs.

Any changes to the regularly supervised shop hours will be posted on the DFL doors and the DFL twitter feed and posted on the Fabrication SharePoint calendar. Please note that due to unforeseen circumstances, these hours are subject to last minute changes.

EXTENDED HOURS

If it is determined that there is a tangible need for additional shop access, the DFL will try to make arrangements for a supervisor to be available to provide lab/shop access for special projects and busy deadline periods whenever possible.

To help moderate casual or unnecessary requests, the DFL suggests that a faculty member initiate the request on behalf of the class for the extended hours. Requests should ideally be made at least two weeks in advance prior to the required date. To warrant scheduling adjustments, the DFL requires a minimum commitment of 10 students in the lab during the duration of the supervised time.

Requests made with less than the 2-week notice cannot be guaranteed. Staff schedules cannot always be flexible enough to accommodate short notice requests. If staff cannot satisfy the request, external resources can sometimes be contracted to provide supervision. Costs for external resources are not covered within the DFL budget and will need to be approved and allocated to an appropriate account.

For scheduling, please contact:
Heinz Koller
hkoller@uwaterloo.ca
ext. 27659

LEVELS OF AUTHORITY

DFL Manager: **Heinz Koller**
The Managers responsibility is to maintain a safe and efficient fabrication facilities and equipment. The manager will ensure that all users have a safe and effective learning environment procedures and rules are being followed in the use of all tools and equipment; provide information on safe procedure, on materials and suppliers; and to maintain and repair equipment.

Fabrication Specialist: **Dan Jessel**
Reports to the DFL Manager
Has authority as a lab supervisor to ensure safe and proper procedures. Acts as a resource providing information on safe procedures, materials and suppliers. The specialist also serves as a technician responsible for the maintaining the facilities and equipment of the DFL.

Security Guards:
During the unsupervised off-hours in the Fabrication Labs, the on-duty Security Guard has authority. If Security feels there is any unsafe or inappropriate use of the equipment or facilities, they have the authority to restrict access or close the entire facility at their

discretion. Individuals or groups violating safety or operational protocol will be reported to the Administration. Individuals violating the rules will have access to the facilities suspended.

Administrative Officer: **Mona Skuterud**
Any disputes that cannot be resolved in the Fabrication Labs are to be taken to the Administrative Officer for resolution.

GENERAL POLICY – RULES, REGULATIONS, REQUIREMENTS

1. The DFL staff's primary responsibility is to ensure the proper and safe use of the tools, machines and equipment of the shop.
2. DFL staff will also provide technical guidance regarding materials, design and fabrication. Some assistance with the fabrication of projects including modest amounts of specialty or high risk machining. During high activity periods, the DFL staff's availability to assist in individual design and fabrication projects may be extremely limited.
3. The dust collector system is used to remove dust in the Shop. If you are using a power tool that requires dust collection, make sure that the dust collector is **TURNED ON** and that the individual valve gate if, present is open. After turning the machine off close the dust collector gate valve, if provided.
4. Any breakage of tools, bits & blades shall be reported immediately to a Lab supervisor.
5. Some tools are available to be used outside of the Fabrication Labs. They must be arranged and signed out with the Lab staff. A sign-out sheet is maintained in the DFL office. No tools are to be signed out on an indefinite loan. Tools not signed and removed from the shop will be considered stolen and dealt with accordingly.
6. The DFL tools are for all to use. When tools are taken outside the Labs for personal use, everyone else suffers from the lack of appropriate tools. Be considerate to the others.
7. All tools have their proper place. Be sure they are returned when you are finished using them. Do not leave bits and cutters in the machines, or tools on benches. Return them to their proper place.
8. Clean up is the responsibility of each individual shop user. Clean your area or equipment used immediately after using. Do not leave your mess for someone else to cleanup. It is your responsibility to clean up after yourself.
9. Place all waste in the proper trash bins.
10. Storing of significant amounts of material or very large projects in the DFL must be approved and arranged with the DFL Manager. Materials and projects left in the Labs without prior notification will be removed without notice.
11. Personal & non-academic projects are not allowed in the labs. All work must be academically related.
12. No treated wood can be used or processed in the DFL shop.
13. Used or reclaimed materials are prohibited in the DFL shop.
14. Project and material storage is provided under the benches in the assembly area. Use the lower shelf to safely store your project and materials with your name and date. Materials stored for longer than 20 days will be trashed or become DFL property.
15. Bring your own tape, paper, pencils, fasteners and other consumable supplies for working in the labs. These items are not provided.
16. Shop will be cleaned at the end of each term and all unclaimed items will be removed or become DFL property.

Property Damage & Loss:

The DFL & Waterloo Architecture will not be responsible for damage or loss of or to your property, including: belongings, projects and materials or your intellectual property. Anyone found responsible for causing intentional damage or loss to DFL and/or School property or that of another student will be prohibited from entering the DFL and may be the subject of legal action.

Deliveries:

Deliveries can be arranged through the DFL office. If you are expecting a truck delivery please inform the DFL staff so preparations can be made to receive it. Staff will not remove any materials off a truck without prior notification, and the staff will not accept unexpected deliveries. You or an authorized representative must be present to accept large, heavy, or hard to handle materials.

Any materials brought in must be placed in racks or other designated storage areas. The DFL is not responsible for any damage or loss to materials.

Materials and Supplies:

If you didn't buy it or bring it in, it's not yours. The DFL

does not supply building materials for your projects. If you need to source materials, talk to the staff to help determine the best resources for your needs. The shop does have some limited scrap materials available for the taking in the designated scrap areas, but it is best to ask before helping yourself.

Academic Use Policy

The primary mission of the DFL and its staff is to serve the needs of WA students in pursuing their academic work. Waterloo Architecture (WA) faculty, staff and registered WA students may use the labs during regularly scheduled hours for course related projects. Students not registered in the current term may not use the DFL or its resources.

DFL Use for Commercial Gain

No commercial, professional or financial gain is to be made by any DFL user as a result of the use of the lab and its resources. Failure to comply with this condition will result in lost of all DFL privileges.

UW Faculty of Engineering Non WA Users

All University of Waterloo Faculty of Engineering students can be granted access to the facilities and equipment however; priority is given to WA students. As with all WA students, any Faculty of Engineering shop users are required to:

- Have the required WHMIS training
- Complete the DFL shop orientation & safety tour,
- Write the DFL safety test
- Perform the DFL practical assessment
- Sign and agree to the terms of the DFL policy acknowledgement form.

Formal orientation and training sessions typically only occur a few times a year and usually at the beginning of the term. Students who have satisfied all the above conditions will not be granted access to any of the DFL tools or facilities.

Arrangements must to be made with the DFL manager to schedule the appropriate training and lab access.

By Provincial Law, the fabrication labs are required to abide by the Ontario Health and Safety act. Lab Supervisors have the authority and responsibility to determine whether any such work is permitted. Projects will be evaluated on a case-by-case basis.

Academic Contracted Services-WA DFL Fabrication Services

The DFL will often receive requests to work on projects within the School of Architecture and on occasion, external projects. The priority of working on special projects depends on the urgency, difficulty and scope of the project and the feasibility of the DFL and its staff to perform the work. The Fabrication Lab Manager will schedule any such projects into an internal job queue. Many factors can impact these project timelines. Urgency, difficulty, time and space requirements, resource demands etc., will all be considered in determining the priority of such projects. The DFL will make no guarantee to completion dates on any special projects. Students' demands will dictate allocation of time to special projects.

WA staff and faculty requesting work from the DFL for such special projects are required to fill out a DFL Work Request and submit it to the DFL manager. All work will be billed based on time and materials to an appropriate UW account or billed independently. If external services are contracted, they will be billed directly to the unit requesting the project. Overtime hours will be billed at time and a half.

Contracted Services- WA Fabrication Services

On occasion the DFL will act as a service and do projects on a contract basis. The priority of these projects again, depends on the urgency, difficulty and scope of the project. The DFL manager will add the project to a list of projects. DFL work on special projects will not be done if it interferes with student requirements.

The WA has a tiered structure for DFL shop rates:

Academic: UWSA: undergraduate	\$15.00/ hr.
Academic: UWSA: graduate	\$15.00/ hr.
Academic: Faculty of Engineering:	\$15.00/ hr.
Tri-Council/NSERC/SSHRC/CIHR	\$25.00/ hr.
Industry Partners (matched funding)	\$25.00/ hr.
Non Engineering Departments	\$45.00/ hr.
External Requests: Non-UW clients	\$60.00 /hr.

DFL OCCUPANCY

The primary responsibility of the Fabrication Lab staff is to monitor and ensure the safety of all shop users. The maximum number of users that an individual shop supervisor can effectively monitor is affected by many factors. It shall be each Lab Supervisor's responsibility to determine how many users they can effectively monitor under any given circumstances.

Generally, each shop technician should be able to monitor 10-20 users. This limit may be adjusted upward or downward at the supervisors' discretion dependent upon the activities and conditions.

At no time will the occupancy of room 1006 be allowed to exceed a maximum of 40 users.

Application of this policy will be left to the discretion of Supervisor(s) on duty.

Resolution of any disputes regarding the application of this policy shall be the responsibility of the Fabrication Lab Manager in conjunction with the Administration Officer and the Director.

Occupancy limits should be considered when assigning projects and deadlines. Notify the Fabrication Lab Manager of anticipated periods of heavy Lab use so appropriate plans can be made to adequately address the anticipated demands. If the fabrication lab occupancy is expected to exceed 40 users as a result of your class, you should make arrangements for additional shop staff to be scheduled 3 weeks prior to the day(s) of expected lab use.

SAFETY – GENERAL RULES & REGULATIONS

All students taking courses offered by the Faculty of Engineering must have appropriate instruction on The Workplace Hazardous Material Information System (WHMIS). Students must obtain a credit for WHMIS via the on-line training. Those who do not have a WHMIS credit will not be granted access to the Fabrication Lab facilities.

DFL SAFETY ORIENTATION

New students receive the Fabrication Lab orientation where they are shown the layout of the shop, various tools and equipment, emergency and safety provisions

and their location etc. Demonstrations and explanations are given on specific tools and equipment with a focus is on safety and proper execution.

All persons intending on using the fabrication labs must participate in the orientation, pass a written test, undergo a practical assessment and sign off on the Policy Acknowledgement Form. Students who have not completed all the requirements or have not submitted a signed form will be prohibited in using the Fabrication Labs.

Graduate students continuing their studies at UW will be required to participate in a safety refresher orientation and sign off on a Grad Policy Acknowledgement Form before being allowed access to the machine tools.

No unauthorized person shall use the DFL (Guests are prohibited to use any shop tools or equipment). No children, non-student, non-staff, or non-faculty shall be allowed access to the Fabrication Labs.

The DFL is a "Safety First" environment and is managed with that as its priority.

FIRST AID

In the event of an injury occurring when there is no Lab supervisor, have the injured person lie or sit down in a prone position to avoid collapse and possible concussion, and administer First Aid, while a second student if available, is to locate the Security Guard or other staff member to continue First Aid or coordinate additional help.

Contact local emergency by phoning 911
A First Aid cabinet and Eye Wash station are located by the sink at the northwest corner of the Lab

Large red Emergency power shut off buttons are located around the shop as shown on the floor plan. If you observe that there is potential for injury to occur an injury on any of the machines has occurred, hit the nearest shut off button immediately.

In the event of an injury, inform the shop supervisor immediately. The supervisor will provide appropriate First Aid treatment and arrange for transportation to the Hospital if required. Students should be prepared to assist if necessary.

University of Waterloo emergency staff recommend that antiseptics not be used on any wound, since they may cover the wound or require extra clean up by medical staff in the emergency room. Washing in cold water and wiping with sterile wipes provided in the cabinet are the only actions required.

All incidents must be reported and the supervisor must complete a University of Waterloo Incident Report with the victim within 24 hours following the injury.

Non-injury Accidents

In the event near misses or incidents resulting in machine damage, material "kick-back", jamming, or other unsafe events, a meeting is required between the user(s) involved in the accident and the Fabrication Lab Manager before any work may resume.

GENERAL SAFETY RULES

[See DFL Safety Manual for more]

All shop users are responsible for reading over the complete DFL SAFETY MANUAL and its rules and procedures. Use of the DFL equipment and facilities is conditional upon agreeing to follow all the rules and procedures outlined in that document.

Violation of these policies and procedures will result in the issuing of demerits for violations and potential suspension of some or all DFL privileges.

1. Report **ANY** and **ALL** injuries immediately to the DFL staff. All DFL staff are First Aid trained to help with any potential injuries. During off-hours, injuries must be reported immediately to the Security Guard. All WA security guards are first aid trained.
2. Students must fully co-operate with the shop supervisor(s) and must follow the rules without exception.
3. It is the student's responsibility to receive and understand instruction in the proper and safe use of the tools and equipment before he or she attempts to any operation with the equipment.
4. Do not enter shop while tired or under the influence (Drugs, Alcohol, and any Medications causing Drowsiness or impaired performance)
5. All students using the power equipment must wear safety glasses, goggles or a face shield to protect their eyes.
6. Shoes covering the entire foot must be worn at all times when in the shop. No open heels, toes or sides of the foot will be accepted. Soft-sided shoes or 'slippers' are unacceptable. Shoe uppers should provide some protection from falling objects. Students will be prohibited from working in the labs if not appropriately attired.
7. Hair should be tied back. Dangling jewelry should be removed and loose clothing avoided: adjust to keep cuffs, drawstrings out of the way.
8. Ear protection is encouraged but not mandatory.
9. Dust Masks are encouraged when you are cutting or sanding EPS foam, XPS foam, plywood, MDF or particleboard.
10. All materials must be kept off the floor and all tools need to be put away at the end of each work period.
11. Sawdust and scrap material must be cleared away.
12. No treated wood or wood products can be used in the shop areas.
13. Cellphones, iPods and headphones are prohibited when using the machine tools. These items present safety concerns and your complete attention is a requirement in a safety first environment.
14. No spraying of paint or adhesives in the DFL. The spray booth is located in the undergrad studio on the 3rd floor.
15. Use extreme care that all lumber is free from any foreign materials (nails, bolts, metal etc.) before machining.
16. Keep your work area free of scraps & debris. Clean up immediately after completing any operation at a tool, work area or bench.
17. Make sure you are comfortable with the operation of any tool or piece of equipment. If you are unfamiliar with a particular operation, seek assistance from the DFL staff.
18. Report any damaged equipment or strange sounding equipment immediately to the DFL technician.

19. To protect everybody's health, no grinding/sanding of toxic materials such as concrete, fiberglass or resin is permitted.
20. All safety guards must be kept in position while machines are being operated.
21. All adjustments are to be checked and secured before the power is turned on.
22. Never make adjustments or repairs to machines.
23. Remove all wrenches and other tools from the machine before turning the power on.
24. Have the instructor check special or unfamiliar set-ups before machining.
25. Shut the power off when you are finished or if you are leaving the machine, never leave the machine running unattended.
26. Materials should never be fed into a machine faster than it will cut or sand.
27. "HORSEPLAY" is strictly forbidden in the shop or lab.
28. KEEP HANDS AWAY FROM CUTTING AREA. Keep hands away from cutters and the cutting area. Include the safe zone in all your work operations.
29. Personal power tools are prohibited in the school. The only exceptions being hand sanders, drills and Dremel tools.
30. The Shop Supervisors shall have the authority to alter these policies and procedures.

DEMERIT POINT OFFENCES

[See DFL Safety Manual for more]

To foster a safety first culture, the DFL has adopted a demerit point system to help improve student behavior and protect against abusers of the lab privileges. Shop users are responsible for understanding the **DFL User Policy** and following all the safety rules outlined in the **DFL Safety Policy**. The system is based on the accumulation of "points" per term. The critical point value is 5 and if any one individual receives a total of 5 demerit points in any given term- their Fabrication Lab privileges will be suspended. In addition, if any individual receives 3 infractions of the same offence they will also have their lab privileges suspended. Suspension will last the duration of the term. Once the term is completed the suspension is lifted and the individuals' demerits are wiped clean. Any individual

who has been suspended will need to take the safety tour and test before their DFL privileges are reinstated.

HOUSE KEEPING

The WA custodians do not clean the DFL equipment or facilities. It is the responsibility of each and every individual using the lab to participate in keeping the labs clean and safe.

1. Each student is personally responsible for clean up and tool return.
2. Each machine and work area should be cleaned immediately after use. Demerits will be issued for lab users failing in their cleanup responsibilities.
3. DFL tools are made available for use while in shop. Anyone removing tools or abusing equipment through incorrect use will lose DFL privileges.
4. Anyone purposely damaging property will lose privileges (i.e. painting of property, x-acto knifing tables, etc.)
5. Benches will be cleared each morning. Anything not neatly stored and labeled will be removed without inquiry.
6. Appropriate precautions must be taken when using materials like paint, concrete and plasters to keep the workspace clean, (use of drop sheets, tarps, etc.) *See DFL Best Practices Guidelines.*
7. If upon completion of a project the shop has not been properly cleaned, any further shop access for that class or offending individuals will be suspended until the house keeping has been addressed properly. Demerits will apply.
8. Throw away the small scrap pieces and put the larger usable pieces in the free material storage rack.
9. Pick up the scrap pieces and off-cuts from the machines and dispense with them appropriately.
10. Do not dump plaster or concrete mixtures, paint or glue into the sink – these should be emptied into containers, cardboard boxes or garbage bags and disposed of in the appropriate garbage bins

11. Flammable and combustible liquids must be stored in approved flammable cabinets.

Keeping the DFL clean and safe is an important priority and students failing in their responsibilities will be reprimanded through a demerit system:

- Strikes and you're out
- First & second offense: Warnings
- Third offense: Loss of shop privilege for the remainder of the academic term.

FIRE

Fires are divided into three "classes". All are potential conditions in the shop.

1. **Class A:** Fires with ordinary combustible materials, such as wood, rags, and rubbish.
2. **Class B:** Fires with flammable liquids, such as gasoline, oil, grease, paints & thinners.
3. **Class C:** Fires in or near electrical equipment such as motors, switchboards & electrical wiring.

For any fire to start or remain burning, it must have the following three things:

1. Fuel - Any combustible material.
2. Heat -Enough to raise the fuel to its ignition temp.
3. Oxygen -Necessary to sustain combustion.

If any of the three is missing, a fire cannot be started. With the removal of any one, a fire will be extinguished.

Fire Alarm

1. Stop what you are doing
2. Shut off all machinery
3. Leave through nearest emergency exit and go to the parking lot

The School of Architecture Fire Wardens will instruct you to leave by the nearest exit and remain away from the building. When the shop is not supervised the security guards assume the role of Fire Warden. Wardens will be posted outside of the building to assist you in your exit and to ensure that no one returns to the building. Return to the building only if and when the Wardens have given approval to re-enter.

Open Access Tools

The DFL maintains a tool cabinet providing students round the clock access to common hand tools. These tools have been demarcated with bright orange paint or tape so that can be easily identified and managed accordingly. These tools are intended to be available to all the students and should be returned immediately after use. Please do not borrow for extended periods of time. The lab does not fund these tools. If tools are not returned or go "missing" they will not be replaced until the beginning of the next term provided funding is available. As these are non-funded assets, any funding for new tools or replacements will need to come from WASA, WEEF or individual donations.

Tool Checkout Policy

The Lab has allocated some tools to be available for checkout. These tools are loaned out for a period of one day, and are due the following morning at 10:00am. A tool checked out on a Friday is due the following Monday at 10:00 am. With the DFL tool inventory being shared among a large number of people, students who need a tool for a prolonged period of time are encouraged to buy their own.

Tools must be checked out well in advance of the Lab closing. Tools will not be signed out after 4:30pm.

Tools left in the shop are not "checked in". Tools must be returned to DFL staff and checked off in the sign out register to be considered returned.

Late tool returns will be subject to demerits. Each infraction will result in 1 demerit; three demerits for the same infraction will result in suspension of all DFL privileges.

All tools borrowed must be returned in the condition in which it was checked out. A tool lost or damaged, becomes the student's responsibility for repair or replace. Failure to pay may result in a suspension from all DFL access.

Power tools with cutting blades are prohibited from being checked out and used unsupervised. These tools include jigsaws, circular saws and routers.

Bringing in your own power tools for use in the school is prohibited. University policy prohibits the use of personal power tools in the school and will not be responsible for any unauthorized use of such tools. Cutting tools like jigsaws, circular saws and routers will be confiscated if found in the school.

DIGITAL FABRICATION LAB (Dfab)

The Lab is located within the main shop adjacent to the main shop doors in room 1006B.

The Dfab regular hours coincide with that of the DFL. The Scheduling and supervision for this Lab is managed by the Fabrication Lab Manager.

The Fabrication Lab equipment can be in very high demand during the peak deadline periods and machine time will be at a premium. The DFL maintains a strict schedule during these times and anyone who has not prepaid for his or her scheduled use will not have a guaranteed time slot. Anyone missing his or her time slot will be billed for the scheduled time. People who do not complete their cutting in time will be required to stop their job and schedule for the next available time to complete their cutting.

Priority of access

Priority of access to the dFAB facility is as follows:

- Specific course offerings, which teach digital fabrication technology
- Other course offerings, including studios, which arrange for access on a term-by-term basis.
- Faculty research projects
- Individual students who have taken the requisite training and wish to use the technology. Priority within this group is established by sign-up on a first-come-first-served basis.

LASER CUTTER

See Laser User Guide for a complete overview of the Laser Cutter

The Dfab maintains 2 ULS machines:

1 - X660 50watt machine

1 - X2660 100watt machine.

Both have 457mm x 812mm (18"x32") cutting beds. Each is equipped with a dedicated workstation capable of processing and sending files from AutoCAD, Rhino, Illustrator or Photoshop.

REQUIREMENTS FOR USE:

All currently registered UWSA students and faculty are permitted access to the lab and the equipment provided they comply with the following:

1. Complete and pass the Level 1 Laser cutter test
2. Understand and agree to information outlined in the Laser cutter user policy

3. Sign the User agreement form
4. Pay for the time used on the equipment

Training

Training is provided through user guides and training tutorials available on line through the Fabrication Labs SharePoint site. All those intending on using the laser cutter must pass the Level 1 test. Passing will require individuals to read the laser cutter user manual, laser cutter safety manual and viewing the on-line tutorials. Individuals passing the test, students will be recognized as a qualified user and will be granted access the digital lab during regular hours (9:00am-5:00pm Monday-Friday). A log of certified users list will be kept and maintained the DFL staff.

It strongly recommended that students get qualified well in advance of their anticipated cutting times.

COST

The laser equipment is charged out by the hour:

100watt	X2-660	\$10.00/hr
50watt	X-600	\$8.00/hr

All laser bookings must be pre-paid before entering the Lab.

Agreement

You must agree to pay the use charges, to take responsibility for the machine during your work session and to follow all rules governing safe use. You must also agree to accepting liability in the event the you the user contributes to any damage, defacement or loss of property due to the negligence of that user, the School of Architecture and the DFL shall assess all costs and expenses, direct and indirect, incurred in replacing, repairing or correcting such damage or defacement, or any portion thereof, against the student.

Dfab HOURS OF AVAILABILITY

Access and supervision of the Digital Fabrication Lab will be provided during regular DFL hours **9:00am-5:00pm** pending availability of DFL staff or other qualified supervisor.

Off-hour access for any Level one user may be arranged with a qualified student Lab supervisor. Student supervisors are selected each term to provide additional access to the lab and the laser cutters. They provide their service as a courtesy to you and are not under any formal obligation to do so. If making arrangements for off-hour supervision, plan in advance and make arrangements with an available supervisor prior to

booking time with the DFL staff. Supervisors can be contacted via the contact information listed on the posting on the Dfab door.

Cost: Off-Hour Supervised Laser Cutting

100watt	X2-660	\$15.00/hr
50watt	X-600	\$12.00/hr

All laser bookings must be pre-paid before 4:00pm the day of the booking. Weekend times must be prepaid by 4:00pm Friday afternoon.

Time may be reserved in advance to a daily maximum of two hours. You may extend your cutting time beyond the 2 hour limit only if there are no other bookings upon completion of your session.

Scheduling Laser Times:

The laser fabrication schedule maintained at the by the staff in the DFL office. The fabrication scheduled is available for review on-line but bookings must be made through the Dfab staff:

Heinz Koller: ext. 27659
Dan Jessel: ext. 27646

Laser cutter reservations are non-transferable; the individual listed on the reservation must be present during the operation of the laser cutter during their scheduled time. This applies to group projects. The individual listed on the booking is the person who is officially responsible for the laser cutter during that scheduled time.

If you no longer require your reserved time, contact the DFL staff ASAP to release it and make it available for the use of others. Cancellations with less than 24hrs notice may not be credited laser time. No-shows will be billed for the scheduled time. Scheduled time not paid for will result in the suspension of all DFL privileges.

CNC Router: *See the CNC FAQ or the CNC user guide for a complete overview*

The Techno CNC Router is an industrial tool capable of routing and milling complex geometries in both 2 and 3 axes. The router has a working envelop of 1475mm x 1220mm (58" x 48"). Gantry clearance in the Z-axis machining is limited to 8" providing full height machining to a maximum of 100mm (4"). The machine is equipped with manual tool change tool holder. Extremely accurate and complex shapes can be made in

a relatively streamlined manner. 2D and 3D shapes constructed digitally can be processed through VisualMill and RhinoCam to produce Numerically Controlled (NC) cut files that are sent directly to the machine tool. Prototypes, models, contours and full-size building components can be machined through this subtractive process from wood solids, composite wood products, plastics, modeling and structural foams. Cutting of any metals is prohibited. Note that undercuts are not possible with single sided machining.

Priority of access to the CNC equipment is established as follows:

- Specific courses teaching CNC or digital technology
- Other course offerings, including studios, which arrange for access on a term-by-term basis.
- Faculty research projects
- Individual students. Priority within this group is established by sign-up on a first-come-first-served basis.

Access to the CNC router is scheduled by sign-up in the DFL office upon review of a completed digital file. Priority is on a first come, first serve basis. Times are scheduled from Monday-Friday based on the availability of machine and DFL staff.

Please provide as much advance notice as possible prior to your anticipated use when scheduling CNC time. The DFL staff needs to schedule their time accordingly and short-notice bookings may not always be possible. Due to the nature of CNC programming, set-up and machining, time slots are issued based on efficiency allowing the maximum of users in any given day. More intensive projects can be multi-day sessions and due to the nature of the milling process, once a project is begun, it is preferable that it is completed in its entirety.

If bookings need to be cancelled, please notify the DFL staff ASAP. Staff and students schedule their time based on the demand and availability of the tools. Please be considerate. Short notice cancellations or cancellations during peak busy periods will be charged the CNC minimum charge. Users who cancel CNC time will be prohibited from using the equipment in the future until the fee has been paid.

It is highly recommended that new users discuss their projects with the DFL staff to familiarize themselves with file requirements, material recommendations, time allocation etc. A review of the CAD file is required before

any CNC time slot is confirmed.

Please contact the staff in the DFL office room 1006B

Dan Jessel

Email: djessel@uwaterloo.ca

Phone: ext. 27646

Heinz Koller

Email: hkoller@uwaterloo.ca

Phone: ext. 27659

CNC Fees

WA users will be charged an hourly rate to use the CNC equipment. Minimum charges will apply to any projects taking less than 2hrs. The hourly charges are material dependent.

Foam: \$5.00/hr.

Other: \$8.00/hr.

Min. Charge \$10.00

Tooling Charges

If specialty tooling or equipment is required for any given project, the additional costs will be added to the fee. Users may choose to purchase their own tooling and cutters, in which case they would not incur any of the additional charges.

User Expectations:

It is an expectation that all those intending to use the equipment must be involved in the entire process from file set up, CNC programming and CNC set-up & machining. The student is expected to participate from beginning to end. When the CNC router is actively in operation, the user must be present and attentive at all times. Users will not leave the room with the machines running, even for a moment. If one needs to leave, the machine must be paused or stopped.

Upon completion the user is expected to thoroughly clean the CNC and surrounding area. All tools are to be returned to their proper location, CNC bed vacuumed and the floor swept. (*see CNC house keeping guideline*)

No machine – computer or fabrication - will be reconfigured or otherwise modified by users beyond that which is part of the normal operation of such machine. This includes any hardware and/or software(s) used to build objects or to drive the fabrication process.

In the event of any problems or difficulties with the operation or maintenance of the machines, all work on such machine will cease, and the DFL Manager or Technician must be notified immediately.

Access to any damaged machine will be suspended until the machine has been fixed and brought back on line, as determined by the DFL Manager.

Users can only operate the equipment in presence of a qualified supervisor. (DFL staff or other appointed Faculty or student)

Eye protection is mandatory when operating the CNC.

3D PRINTING:

See 3D printing user guide for a complete overview

The Dimension 1200es 3D printer allows students to create objects from ABS plastic using an additive manufacturing process. Objects are built up in a succession of layers from the bottom up. The Dimension build envelope measures 254 x 254 x 305 mm (10 x 10 x 12 in)

3D Printing Fees

Fees are charged to cover cost of consumables. Printer charges are based on volume of the printed model.

Volume calculations and cost estimates can be provided prior to running jobs by processing an STL file of the model to be 3D printed. Because printing costs are based on volume, modeling strategies can impact part cost and grow time. Review your models with the DFL staff prior to printing.

Complete part failures due entirely to Lab error will not be billed.

REQUIREMENTS FOR USE:

1. The Dimension 3D printer requires a general knowledge base to understand how the equipment works and perhaps more importantly how to model appropriately for the limitations of the technology. You must be approved to use the printer and ancillary tools independently. Tutorials and training are available to all UWSA students.
2. The processed. A file with errors or problems has the potential of building problematic parts. The Lab Manager is not required to modify or edit CAD

files.

3. Students may not operate the 3D printer without the guidance of trained personnel. Unauthorized use of the 3D printing equipment will result in immediate suspension of Lab privileges.
4. The user is required to monitor the build process as issues can arise. Regular and periodic checks are required throughout the build process. The dfab will not be responsible for bad parts or damage to the equipment.
5. Parts must be removed from the platen and placed in the bath to remove support material. Extreme care must be taken when working with the cleaning station, as the solution is extremely corrosive. *[Refer to the cleaning station SOP]*
6. In the event of any problems or difficulties with the operation or maintenance of the machines, all work the machine will cease, and the Lab manager must be notified immediately.
7. Access to any damaged machine will be suspended until the machine has been fixed, as determined by the Fabrication Lab Manager.

LIST OF AVAILABLE EQUIPMENT

Hand Tools:

Wrenches & Socket Sets: inch & metric
Wire Cutters & Strippers
Riveters
Pliers & Vise Grips
Scales & Rules
Tri Square
Combination Square Sets
Protractors
Screwdrivers
Allen Key Sets
Hammers & Mallets
Hand Files, Rasps & Sure-Forms
Drills
Router Bits
Sheet Metal Snips
Tape Measures
Thread Pitch Gages
Wire Brushes
Ball Peen Hammer
Claw Hammer
Multi-tester
Digital Angle finder
Dowel Jig: Wolfcraft model 4641
Cross Slide Vise
Miter-Trimmer

Power Tools:

Orbital Sander: DeWalt DW421
Cordless Drill Driver : DeWalt 18V (2)
Cordless Drill Driver : Mastercraft 18V (2)
Cordless Drill Driver : Mastercraft 14V (2)
Cordless Drill Driver: Makita 1/2 18V LI-ION BDF452H
Hammer Drill: Bosch
Flex Shaft: Freedom Model SI-23A
Soldering Iron
Router: Dewalt
Dremel: Rotary tool & accessory kit
Drill Bit Sharpener: Drill Doctor Model
Engraver: Dremel Model 290-01
Electric Drill: DeWalt
Angle Grinder / Sander: DeWalt DW402
Rotary Tool: Mastercraft
Cordless Reciprocating Saw: Mastercraft 18V
Heat Gun
Cordless Drill /driver: DeWalt DC759
Jigsaw: orbital DeWalt DW318
Hand Power Planer: DeWalt
Plunge Router: 2hp DeWalt DW621
Fixed Base Router
Circular Saw: 8 ¼" HD DeWalt DW384

Trim Router
Belt Sanders: Dewalt variable speed DW433 (2)
Palm Sanders
Power Planer: Dewalt DW680
Finish Nailer: DeWalt D51275
Brad Nailer: DeWalt D51236
Compressor DeWalt D55140
Compressor DeWalt D55141
Plate Joiner: Dewalt DW682

Woodworking:

Radial Arm Saw: 14" General V-154
10" Table Saw: DeWalt DW746
12" Disk 6" Belt Sander: Delta AFM-20-1
Router Table: Veritas
20" Band Saw: Powermatic model 81
Wood Lathe: Rockwell 12" gap bed
Jointer 6": Rockwell 37-22
13" Planner: Delta Model DC-33
Scroll Saw: DeWalt
Hollow Chisel Mortiser: Delta14-650C
Compound Miter Saw: 12" DeWalt DW705
Drill Press: Delta 17-925
Bandsaw 10": Craftsman
Table workshop: Hegner MK4 (2)
Panel Saw: SSC
1" Belt/8" Disc Sander" Delta SA180
Edge Belt Sander: Progress PMC-150
Vacuum Press: Mercury MVP50
Vacuum Bag: 20MIL 2'x4'
Vacuum Bag: 20MIL 4'x6'
Oscillating Spindle Sander: Delta Model 31-780C

Plastic Working:

Disc Sander: 12"
Hot Wire Foam Cutter: Demand Model
Hot Wire Foam Cutter: Demand Multi-Cut
Model EMX-2 Stripheater:

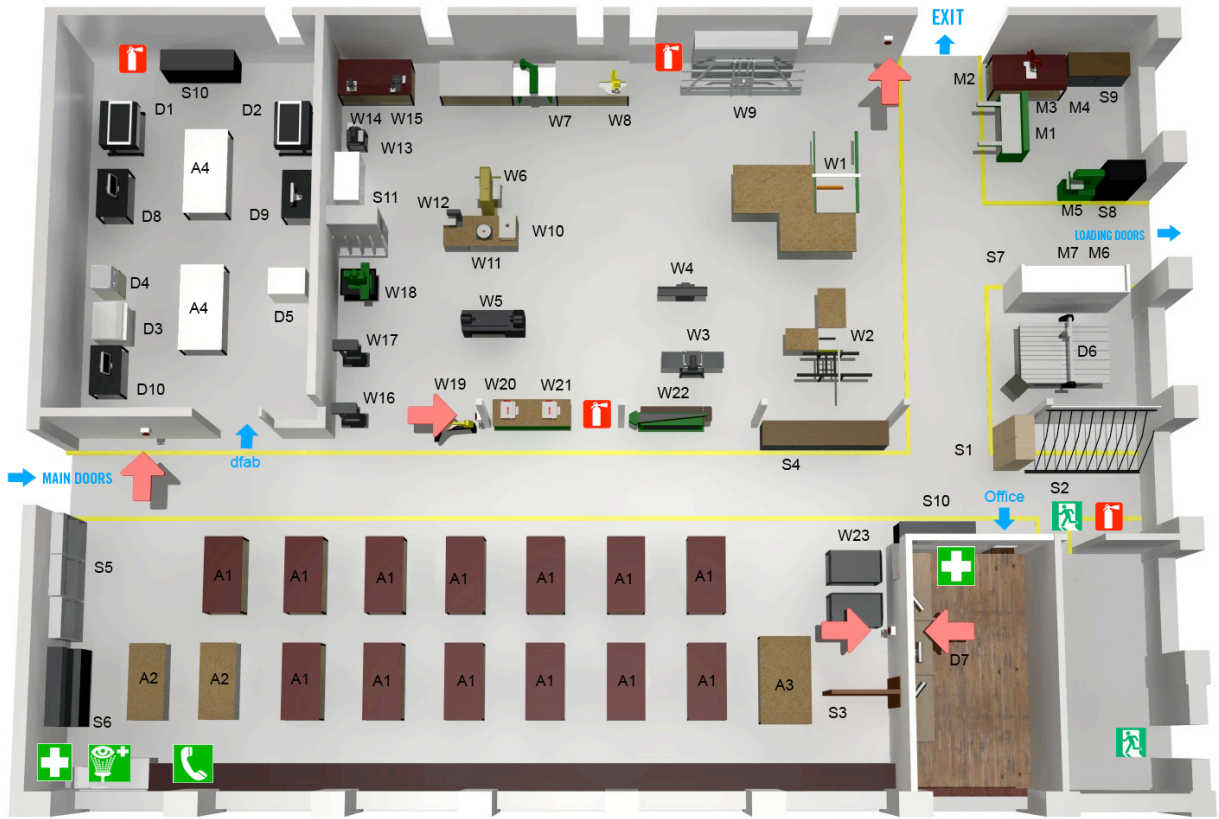
Metalworking:

Bandsaw: 15" General Model 590
Milling/Drilling Machine: General Model 75-880
Horizontal Bandsaw: General Model 735-m40
Abrasive Cut-Off Saw: Milwaukee
Bench Grinder: DeWalt
Metal Shear: Tennsmith
Brake: 24"
Metal Notcher: 18 Gauge: Tennsmith Model 16
Groze Metal Bender
12" Disc Sander
Bench top sand blasting cabinet

Welding:

Lincoln 225 Precision TIG Welder

WATERLOO ARCHITECTURE | FABRICATION LABS



WOOD WORKING

- W1 14" Table saw
- W2 10" Table saw
- W3 13 Planer
- W4 6" Jointer
- W5 12" Wood Lathe
- W6 20" Bandsaw
- W7 14: Radial Arm Saw
- W8 Compound Miter Saw
- W9 Panel Saw
- W10 Router table
- W11 Spindle sander
- W12 10" Bandsaw
- W13 6" Belt/disc sander
- W14 Mortiser
- W15 1"belt/disc sander
- W16 16"Drill press
- W17 16"Drill pess
- W18 Drill/mill machine
- W19 Scroll saw

WOODWORKING

- W20 4" Table saw
- W21 4" Table saw
- W22 Edge sander
- W23 Down draft table(2)
- M1 52" foot shear
- M2 Bench grinder
- M3 Cut-off saw
- M4 12" Disc sander
- M5 15" Bandsaw
- M6 24" Brake
- M7 Notcher

ASSEMBLY

- A1 30"X72" Work bench
- A2 34"X72" finishing bench
- A3 36"X84" assembly table
- A4 36"X84" assembly table

STORAGE

- S1 Wood hand tools
- S2 Materials storage
- S3 Clamp Rack
- S4 Tool Cabinets
- S5 Student Tool Cabinet
- S6 Paint/flammables
- S7 Metal misc.storage
- S8 Tool cabinet
- S9 Metalwork tools
- S10 Power tool cabinet
- S11 Scraps materials

DIGITAL FABRICATION

- D1 100W Laser cutter
- D2 50W Laser cutter
- D3 ZCorp 3D Printer
- D4 Depowdering unit
- D5 FDM 2000 3D printer
- D6 CNC Router
- D7 CAM Workstation
- D8 Laser Workstation
- D9 Laser workstation
- D10 3D print workstation

EMERGENCY SERVICES

- First aid
- Emergency shut-off
- Emergency exit
- Fire extinguisher
- Eye-wash station
- Telephone



DFL

Shop Rules We Live by...

If it's not yours, leave it



If you make a mess, clean it



If you borrow it, return it



If you lose it, replace it



If you move it, put it back



If you open it, close it



If you turn it on, turn it off



If you break it, repair it



If you can't repair it, replace it



If you unlock it, lock it



If you don't know, ask

POLICY ACKNOWLEDGEMENT FORM

The WA Design Fabrication Labs requires all users to meet the following requirements.

- Have completed the WHMIS training
- Read the DFL User Guide
- Read the DFL Safety Manual
- Taken the Fabrication Lab Safety Orientation
- Passed the Fabrication Lab Safety Quiz
- Complete the Fabrication Lab Safety Practical Assessment

All requirements must be signed off that they have been completed before access will be granted the DFL facilities and equipment.

ACKNOWLEDGEMENT OF REQUIREMENTS:

All completed requirements must be initialed	Initials
1. <i>I confirm that I have read and understand the DFL User Guide</i>	_____
2. <i>I confirm that I have read and understand the DFL Safety Manual</i>	_____
3. <i>I confirm that I have completed the WHMIS training</i>	_____
4. <i>I confirm that I have completed Fabrication Lab Safety Orientation</i>	_____
5. <i>I confirm that I have completed Fabrication Lab Safety Quiz</i>	_____
6. <i>I confirm that I have completed Fabrication Lab Safety Practical assessment</i>	_____
7. <i>I confirm I have attended the Fabrication Lab Safety Orientation that demonstrates safe and proper shop, machinery and tool practice. I understand the inherent risks of shop activity and I consent to exposure to these risks. In the interests of shop safety, I agree to comply with the requirements of the DFL and the DFL Supervisors</i>	_____

Print Name _____

Signature _____

Date _____

Student Number _____

Email _____

Phone: _____

DFL Supervisor Signature _____