

Mechanical Fabrication Facility Master Document

This document contains the master text for the following 8 sub documents:

1. Mechanical Fabrication Facility Charter
2. Student Shop Access Policy
3. Student Shop Training
4. Staff and Faculty Shop Access Policy
5. Shop Safety Rules
6. Shop Usage Policy
7. Student Scheduling Policy
8. Work Order Policy

Each sub document can be printed and distributed individually.

Written by Dave Barrett, Dave Anderson and Ben Linder 3/1/05.



Mechanical Fabrication Facility Charter

Version 2005-3-24

A.) A safe well used, well maintained family of student shops is critical to the overall successful execution of the engineering courses, research projects and capstone program at Olin College.

B.) There are currently three mechanical fabrication facilities on campus, the main machine shop, the mini-metal shop and the mini-wood shop. The terms of this document apply to all three.

C.) The operation, administration, staffing and purchasing for these mechanical fabrication facilities will be overseen by a standing three person committee (the Mechanical Fabrication Committee or “MFC”) appointed by the Dean of Faculty. This committee will meet at least bi-weekly during the semester to ensure smooth operation of all facilities. The current committee consists of Dave Barrett-chair, Dave Anderson and Ben Linder. Please contact us at mfc@olin.edu with any and all questions.

D) What we do:

1. Provide instruction in the safe operation of the machine tools and the equipment in the machine shops (for all students, faculty, staff and officially recognized teams and clubs).
2. Provide fabrication instruction for regularly scheduled courses.
3. Provide design and fabrication consultations during regularly scheduled hours.
4. Create, maintain and publicly post a master shop schedule on a semester by semester basis.
5. Maintain and publicly post an accurate listing of current student training levels.
6. Maintain the facility and equipment.
7. Purchase machinery, tooling and shop (not course) consumables.
8. Supervise student operators with the commitment to keep both the students and equipment safe from harm.
9. Perform fabrication work for students, staff and faculty through a work-order system on a “first come first serve” basis.
10. Develop a strategic plan for the long term operation of the mechanical fabrication facilities.

E) What we can not do:

1. Shop instructors can't make student parts on a short-term, unplanned, “on-demand” basis. We simply do not have the staff resources.
2. We can't supply independent student activities, hobbies, clubs, etc. with non-course based materials. We do not have the budget.



3. We can't accommodate last minute "walk-in" student, staff or faculty work. Limitations on available resources and staff time require us to ask all enterprises be pre-planned. We have posted a public schedule with clearly delimited blocks of shop instructor consulting times. Please plan in advance and use them.
4. The MFC does not have the staff, time or material resources to bail out poorly planned or overly ambitious projects. Please don't ask us to. Please plan carefully and pre-design the scope of all tasks to match the current time slots available and current student training levels.
5. We don't have the staff resources to offer one-on-one training sessions for personal student projects. Students need to plan appropriately and take a regularly offered training class.



Student Shop Access Policy

Version 2005-3-24

Summary:

A) Physical access to the main shop (AC104 and AC106) will be during staffed hours, Monday through Friday from 9AM to 5 PM.

B) Physical access to the mini-metal shop (AC108) will be via key card, 7days/week. The mini-metal shop will be closed from 2AM to 6 AM due to safety considerations.

C) Physical access to the mini-wood shop (AC207) will be via key card, 7days/week. The mini-wood shop will be closed from 2AM to 6 AM due to safety considerations.

(Until a key card reader is installed, the shop door will remain unlocked and MFC will ask all students not to enter the room unless they have received formal safety training).

D) All shop machinery will be color coded, Green- designates a low level of training required for safe operation, Yellow- designates a moderate level of training required for safe operation, Red-designates a high level of skilled training required for safe operation.

E) Student access to green machines, in all shops, will be unsupervised, but 2 people must present in the shop, within sight of one another, at all times.

F) Student access to yellow machines will be lightly supervised by staff or faculty during normal workday hours (9-5, M-F), but 2 people must present in the shop, within sight of one another, at all times. Please contact a facility instructor prior to engaging in work on these machines.

G) Student access to red machines will be directly supervised by staff or faculty during normal workday hours (9-5, M-F). Students must contact a facility instructor prior to engaging in work on these machines.

Conditions:

Access to a particular piece of equipment in any fabrication facility is granted when the following conditions are met.

1. Completion of the general shop safety training.
2. Completion of training for the particular piece of equipment.
3. Satisfactory completion of a safety and operational competency test for the particular piece of equipment.
4. Documentation of the test results in the shop access database document.
5. Adherence to the shop conduct and safety rules, shop usage policy and scheduling policy.
6. Students name appears on “approved operator” wall chart, posted by shop door.



Loss of access privileges will result from inappropriate use of the facilities in the following situations.

1. Use of any machine for which a student does not have approved, documented access will result in immediate suspension of all shop access privileges for the remainder of the semester and will be considered a serious honor code violation.
2. Working without a buddy, present in the shop whenever your machine is operational, will result in immediate loss of all access privileges for 3 weeks and will be reported to the honor board as a violation.
3. Failure to follow posted safety rules will result in immediate suspension of all shop access privileges for one day.
4. Dangerous conduct in the form of any action, intended or accidental, that could cause bodily harm to personnel or costly damage to capital equipment will result in suspension of access privileges for a time period commensurate with the dangerous conduct.
5. A record of repeated loss of access privileges will result in the review of a student's records and may result in the permanent loss of all shop access privileges.

Student Shop Training

Version 2005-3-24

1.) The Mechanical Fabrication Committee (MFC) is charged with ensuring the safe, efficient use of all the shops with the following mandate: Every Olin student will be granted the privilege of using the machine tools within our three mechanical fabrication facilities, **BUT only after receiving formal safety and operational training for that class of equipment.**

2.) Students will be allowed to use any class of machines for which they have successfully completed formal, documented operational training. The scope of this training will take the form of 9 specific instruction sessions that will stress the safe operation of each specific class of machine tools within the fabrication facilities. This formal training will be made readily available via two paths. The first will consist of a set of sequential mini-courses (1-6) covering **ONLY** the basic safe operation of each class of simple machine tools. These mini-courses will have limited enrollment and be offered twice per semester starting at the beginning of each semester. The scope of these mini-courses will **ONLY** cover the safe operation of the machines and will not include detailed instruction on expert design, fabrication and machining practice.

Formal training at a deeper level will be offered via a second path. Specifically, detailed instruction in the areas of mechanical design, fabrication and machining skills will be offered as integrated components of the existing mechanical engineering core curriculum courses. The MFC highly recommends that those students seeking to develop a high level of proficiency and operational skill in the mechanical fabrication area pursue these mechanical engineering courses.

3.) The required MFC training will consist of the following course content:

Table 1: Training Courses

Level	Course Name	Permits:	Color Code*
1	Basic Shop Orientation, Safety, Hand Tools and Bench Work.	Access to shop facilities and use of hand tools.	Green
2	Basic Sawing, Sanding and Polishing.	Use of power saws, sanders, grinders and polishing wheels.	Green
3	Basic Drilling and Tapping.	Use of drill presses and tapping machines	Green
4	Basic Sheet Metal Work.	Use of shear, notcher, brake, rolls and punch.	Green
5	Basic Milling Machine Operation.	Use of Yellow milling	Yellow



	Covers simple drilling, facing, pocketing and end mill operations.	machines.	
6	Basic Lathe Operation. Covers simple turning, facing, and drilling operations	Use of Yellow lathes	Yellow
7 [^]	Advanced Machine Shop Operations. Covers advanced precision machine operations.	Use of the Red mills and Lathes.	Red
8 [^]	CNC Machine Tool Operations.	Use of milling center, turning center, water-jet cutter and laser cutter.	Red
9 [^]	Welding and Fabrication Operations.	Use of welding facilities.	Red

*Each machine tool in a facility will be clearly color coded as to level of access required to operate it. Courses will be offered sequentially, each level acting as a pre-requisite for the following more advanced levels.

[^]Not offered in spring 2005, formal course content under development.

4.) Course content 1-6 will be offered in two forms; Safety focused mini-courses and (with the addition of mechanical design content) as components of ENGR1200, Design Nature and ENGR3330, Mechanical Design.

5.) Course content 7-9 is currently under development and will not be offered in the spring 2005 semester. In the interim, students with a pressing need to use these machines should contact MFC@olin.edu directly.

6.) Students who have had some previous fabrication training at Olin will be considered to have passed some courses (from level 1-6) at a level appropriate to that training. Determination of the applicability of previous training will be at the discretion of the MFC.

7.) Students who have previous external training corresponding to course content at any level 1-9 may ask the MFC to take a pre-specified fabrication test demonstrating their capability at that level in lieu of additional training at that level. Such tests should be considered the exception and will only be allowed within the available time and staff constraints. Contact the MFC for scheduling.

8.) Each student's name and current training level will be publicly posted in an "approved operator list" hung in a prominent place within each fabrication facility. Each machine in the facility will be color coded as indicated in the above table. Student use of any machine outside their posted training level will result in an immediate suspension of their use of the facility for the remainder of the semester and will be considered a serious honor code violation.

9.) Students may get their name added to the list by:

a) Signing up for and passing the pre-specified operational test for that machine.

- b) Taking and passing the appropriate mini-course for that class of machines and signing the mini-course registration log.
- c) Taking and passing ENGR1200, Design Nature or ENGR3330, Mechanical Design.



Staff and Faculty Shop Access Policy

Version 2005-3-24

1) All Olin staff and faculty will be given access to all shop facilities, upon request, to support both their course instruction and research needs. Access will be granted following a formal safety and orientation meeting with members of the MFC. Please contact the Mechanical Fabrication Committee directly for card key access (MFC@olin.edu). Non-Olin faculty and staff may not be covered by our insurance policy, please contact the MFC directly to discuss granting access to them.

2) Please note: with access comes a very high level of personal responsibility. There is equipment in the shop which can easily kill or maim an untrained operator and/or seriously injure innocent students or staff standing nearby. Additionally, an unskilled operator can easily cause massive capital damage to some of the machines, far beyond the shop's current budget to fix. Please specifically note, the long term ramifications of an under-skilled staff or faculty member seriously damaging themselves or others in the shop will have extremely serious long term ramifications for the entire Olin Community. A single bad accident, would not only be tragic, it could cause the permanent closure of the shop and would deprive all future students of an important component of their Olin education.

3) *SAFETY FIRST*. ---The Mechanical Fabrication Committee's primary function is safety and we have a standing ZERO casualty policy:

There are currently three classes of machines in the shops:

- a) Green machines –relatively safe, requires a low level of training for safe operation.
- b) Yellow machines -moderately dangerous, requires a moderate level of training for safe operation.
- c) Red machines -potentially lethal, require a high level of skilled training for safe operation.

If you do not currently have the needed levels of skill to safely operate a machine, PLEASE DON'T.

Please don't take unnecessary risks.

Please don't damage or destroy a machine students will need for course work.

Please don't lose a part of your body to an easily preventable accident.

PLEASE DO contact the MFC (at mfc@olin.edu) and we will work with you to arrange operational training, staff assistance or a highly trained student operator to meet your needs.

The responsibility for the safety of all personnel in the shop is shared by all Olin faculty and staff. If we work together we can achieve zero casualties.



4) Please use the following guidelines to assess individual level of skill required to safely operate a class of machines;

a) Never used a machine tool before, but would like to. The MFC offers faculty “green machine” training on Friday afternoons, please join us.

b) ~3+ hours of training on similar machines at any time in the past. At least this level of experience is recommended for safe operation of green machines. If you would like to brush up your skills, the MFC offers faculty “green machine” training on our specific machines on Friday afternoons, please join us.

c) ~40+ hours of recent operational experience on similar machines in home shop, at Olin, or previous place of employment. Please contact the MFC and we will provide you with a brief overview of the particulars of the machine we have in our shop (location of controls, where parts are stored, etc). This level experience is recommended for operation of the yellow machines.

d) ~300 hours of recent operational experience on similar machines in home shop, at Olin, or previous place of employment. Please contact the MFC and we will provide you with whatever information you request to begin work. This level experience is recommended for operation of red machines.

e) 6+ months of operational experience on similar machine in a professional or educational venue. Please contact the MFC and we will recruit you to become a local “shop expert” and assist us in instruction, planning and acquisition for the mechanical fabrication facilities.

f) The following machines:

- 1) Abrasive Water jet Cutter
- 2) CNC Machining Center
- 3) CNC lathe
- 4) Laser Cutter
- 5) Welders

currently require Olin-specific operational knowledge and hands-on experience to operate safely. Please contact the MFC directly to coordinate work with them.

5) Please note that the shop instructors are available to manufacture parts for faculty and staff via the standing work order system, if you feel you do not have the training or the time to perform the work yourself, they would be happy to assist.

6) All faculty and staff in the shops must follow the posted shop safety rules, scheduling policy and usage policy. Repeated failure to follow these rules and policies will result in action by the MFC and the Dean of Faculty.



7) Dangerous conduct in the form of any action, intended or accidental, that could cause bodily harm to personnel or costly damage to capital equipment will result in an action by the MFC and the Dean of Faculty.

8) In order to ensure a safe environment for all and for the greater good of all parties, please, only send students to the shop to do work commensurate with their current level of training. Unskilled operators attempting to do work beyond their training level will be the chief source of preventable accidents going forward. We can all avoid creating the foundation for a serious accident by properly sizing the shop tasks we ask our students to execute to closely match their individual current levels of training.



Shop Safety Rules
Version 2005-3-24

Failure to follow these rules can result in the loss of shop privileges and/or referral to the student disciplinary system (Honor Board)

General Shop Conduct and Safety Rules

1. **Eye protection must be worn at all times when in the workshop.** This applies regardless if you are working on machinery or not. Activities of others can affect your safety.
2. **No student is allowed to work in any shop alone.** Period. You must have at least one other person within eyesight of you. If there is an accident, the other person can call for help and come to your aid.
3. **Obtain first aid immediately for any injury.** Report all accidents/injuries to the shop supervisor no matter how insignificant they may seem at the time. This will help us to mitigate hazards in the future.
4. **Do not operate machinery that you have not been authorized to use.** This will protect both you and the equipment from harm. All machine tools require machine specific training. Contact the Mechanical Fabrication Committee or a shop instructor for training information.
5. **Only Olin students who have taken the appropriate safety course are permitted in the workshops.** Untrained personnel can be unaware of hazardous conditions and may unintentionally cause or take part in an accident.
6. **No pets allowed in the workshop.** Pets are a distraction and become a tripping hazard by free roaming the shop floor.
7. **Do not attempt to oil, clean, adjust or repair any machine while it is running.** Performing maintenance on moving machinery exposes you to additional hazards. We wish to reduce hazardous situations.
8. **Ensure that all machine guarding is in place and functioning properly.** Inform a machine shop instructor if the guarding is absent, damaged or malfunctioning. Malfunctioning guarding will not properly protect you and can become a hazard itself.
9. **Do not leave machines running unattended.** Others may not notice the machine is running and be injured by moving tooling.
10. **Do not try to stop the machine with your hands or body.** Stopping the machine with your body can result in entanglement. Let the machine come to a stop naturally.



11. **Always keep hands, hair feet etc. clear of all moving machinery at all times.** Be aware of all moving parts, especially cutting tools and chucks.
12. **Double-check that tooling and work pieces are properly supported and clamped prior to starting the machine.** Starting a spindle with loose tooling or machining a loosely clamped work piece can produce flying projectiles.
13. **Heavy or unwieldy work pieces often require special support structures to machine safely.** Ask for help if you are unsure if your work piece requires additional support.
14. **Remove chuck keys, wrenches and other tools from machines after making adjustments.** Chuck keys left in the chuck when the machine turns on become dangerous flying objects.
15. **Ask for help when moving awkward or heavy objects.** This will protect you and those around you from injury.
16. **Deburr sharp edges of freshly cut stock.** This includes the piece of stock that goes back in the stock rack. Eliminating burred edges minimizes the chances for personal injury and marring of precision machine surfaces.
17. **When working with another person, only one person should operate the machine.**
18. **Do not talk to others while they are operating a machine.** Do not become a distraction to others. Concentrate on the work and the machine at all times, it only takes a moment for an accident to occur. If you must talk, turn off the machine.
19. **Be sure you have sufficient light to see clearly when performing any job.** Well lit workspaces are much safer and less straining on the operator.
20. **Work at a pace that is comfortable for you.** Rushing will compromise safe working practices along with part quality and increases the chance of damaging equipment.
21. **Listen to the machine(s) - if something does not sound right, shut it down.** Often if the machine sounds abnormal to you, it probably is not operating properly. Inform a shop instructor if you believe the machine to be operating abnormally..
22. **Never use compressed air for cleaning machinery.** This will embed particulates into the precision machine ways and will drastically reduce the life of the machine tool. Use the supplied chip brushes and rags to clean machinery.



23. **Never use compressed air to clean your clothes or any part of your body.** Particles can become embedded in skin and eyes. In extreme cases, air can be introduced into the bloodstream.
24. **If you do not know how to do something – ASK!** Do not engage in any activity that may have unusual risk. Trust your judgment. Check with a shop instructor if you have any doubts about what you are doing.

Shop Cleanliness Rules

1. **Keep floors free of oil, grease or any other liquid.** Clean up spilled liquids immediately, they are slipping hazards.
2. **Store materials in such a way that they cannot become tripping hazards.** Immediately return all excess material to its proper storage place.
3. **Put tools away when not in use.** This prevents loss of tools and also makes them available to others.
4. **Place all scrap in scrap containers or trash.**
5. **Stop work 10 minutes prior to the time you need to leave the shop.** This will provide ample time to clean and replace tools to their homes.
6. **KEEP THE SHOP CLEAN AT ALL TIMES.** It is everyone's job to keep the shop clean. There is no excuse for a cluttered/messy workspace. If your workspace is cluttered, then you are working too fast. Slow down. Know this; you will not anger someone if you clean up after them. In fact, they will likely do the same for you.

Dress Code

1. **No open toed shoes or high heels or bare feet.** To provide secure footing, choose shoes with softer soles and stable platforms. Wearing appropriate footwear will help protect feet from falling objects and hot sparks or chips and lessen fatigue.
2. **No loose clothing allowed.** This includes but is not limited to ties, scarves and loose-sleeved shirts. Short sleeves or sleeves rolled above the elbow are preferred. When welding, long sleeves are required for protection from arc-flash and metal sparks.
3. **No shorts or short skirts allowed when working in the shops.** Burred edges of freshly cut metal such as sheet stock are razor sharp. Wearing of long pants will protect you and those around you. Additionally, hot chips will burn/cut exposed skin potentially startling the operator.



4. **Remove all jewelry that could be caught in moving machinery.** This includes rings and loose bracelets. Remove necklaces and the like, if not securely restrained.
5. **Restrain all hair that has potential for entanglement with moving machinery.**
6. **Wearing of gloves when working on moving machinery is prohibited.** Gloves can easily become entangled in moving machinery and thus are not allowed.. The only exceptions to this rule are; 1) the wearing of membranous gloves (such as latex or nitrile) for personal protection or contamination control; 2) The wearing of gloves while using a bench or portable grinder or buffing wheel. If you need to wear gloves, see workshop instructor for acceptable types for your application.

For Emergency Assistance immediately contact Babson & Olin's Office of Public Safety @ 781-239-5555 or @ x55555



Shop Usage Policy

Version 2005-3-24

All persons using the shops are required to follow this shop usage policy.

1. A dimensioned printed paper detail drawing of the final design is required prior to making any parts on the machinery.
2. A design consultation with a fabrication instructor (see master schedule posted outside the shop) prior to scheduling machine time on a Green machine is highly recommended, on a Yellow or Red machine is required.
3. The fabrication instructors do not make parts except for work orders. They will gladly review techniques with you to the extent they are available.
4. You or your project sponsor must supply all materials. The shop can not afford to. This includes but is not limited raw stock, fasteners, bonding agents, paints etc.
5. You or your project sponsor must supply special tooling not common to the shop inventory. Check with the fabrication instructors if you are unsure if the tooling required exists.
6. Please plan ahead to do your work in the appropriately scheduled block of time. The shop staff does not have the resources to effectively deal with walk-in and last minute rush/emergency work.
7. You may not leave a part set up on a machine for any block of time over 3 hours without direct approval of a fabrication instructor. Please place a sign describing the task, its owner and when it will be complete on the machine.
8. You may not set up a part in a machine, and then leave the shop for a block of time longer than 15 minutes, without prior approval from a shop instructor. We will remove setups left unattended for this length of time as needed.
9. After completing work, you must clean up all tooling, parts and chips from any and all machines used and return tooling, stock and waste to the appropriate locations.
10. Do not remove any tooling from any of the shop facilities.
11. Our shop instructors would love to assist you, but Please do not interrupt them while they are working with other students in the shop. Please do plan, schedule time ahead and make full use of their consulting office hours.



Shop Scheduling Policy

Version 2005-2-23

1) The mechanical fabrication facilities are joint use facilities that will be heavily loaded by course, capstone project and research work during each semester. Access to all facilities will be on a weekly scheduled time basis. Scheduling time priority will be given first to standing courses with shop support needs, second to support of the capstone projects, third to support of research projects, fourth to officially sanctioned student clubs, and finally to open general use time. Exclusive blocks of time will be reserved to support each of these activities. Each shop facility will have an individual schedule, but all schedules will interlock based on available staff and material resources. A new schedule will be generated and executed at the start of each semester. This schedule will be clearly posted in each facility. Details of scheduling system employed will be given in a subsequent section. Access to all shop facilities will only be permitted in accordance to the current posted schedule. Please contact the Mechanical Fabrication Committee (MFC) to request time on the schedule.

2) Student use of the shop in all but the posted “general use” time slots must be done in consultation with course faculty or instructor, capstone faculty advisor, research advisor or shop instructor prior to scheduling machine time. This is to ensure that the part can be made in the machine shop, the student has the appropriate level of training to do the work and that task time will fit within the available block of prescheduled time on the posted master schedule. The posted faculty or staff “owner” of a specified block of time has priority use of the shop during that time, and is directly responsible for all student activity during that time. They also are responsible for ensuring that the shop is clean and all equipment is returned to its original location in time for the next scheduled user. It is specifically not the shop instructors or the MFC responsibility to do the students work for them or bail out a poorly scoped enterprise. The MFC will arbitrate all scheduling disputes. Their 2/3rd vote decision will be considered final by all parties. Continual disregard for this policy will lead to a semester long removal of shop access.

3) For all work performed in the shop a dimensioned printed paper drawing of the final design is required prior to making any parts on the machinery. This is to prevent designing on the fly which consumes valuable machine time. We have “Many users and only a Few Machines”. In fairness to all and in order to maximize access time on the existing few machines for all parties involved, students must be pre-prepared with drawings; tools and stock, prior to logging onto a machine so that they may execute their machining operations in a timely, efficient manner. Students may not leave a part set up on a machine for any block of time over 3 hours without direct approval of a member of the MFC or a shop instructor. Students may not set up a part in a machine, leave it unattended and then leave the shop for any block of time beyond 15 minutes. Joint use of a small set of machine by many people requires that scarce machine time be efficiently used. Machine set ups left unattended for more than 15 minutes or that are left set up



beyond scheduled block of shop time may be removed by shop instructors, without notice. After completing work, students must clean up all tooling, parts and chips from any and all machines used and return tooling, stock and waste to the appropriate locations.



Shop Work Order Policy

Version 2005-2-23

This policy is under development. Please use the work order form on following page and contact any member of the MFC for assistance.



Machine Shop Work Orders				
WO#				Reviewer
Date Received				Requestor
Requested Due Date				Sponsor
Time Estimate				Drawings Complete
Time Actual				Materials / Supplies Kitted
Date Completed				Addtl Shop CAD / CAM Required
Job Description				
Material (check all that apply)				
Aluminum	Brass	Plastic	Other (describe)	
Machine (check all that apply)				
Waterjet	Manual Milling Machine	Manual Lathe	CNC Lathe	CNC Machining Center
Horizontal Saw	Vertical Saw	Laser Cutter	ThermoFormer	Other (describe)
Special Processes (check all that apply)				
Welding / Brazing	Bending/Forming	Shearing	Abrasive Cutoff	Other (describe)
Recommenations / Action Items				
Process Steps				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				