**Operations Manual (aka “Ops Manual”)**

**In case of any emergency dial XXX**

# 1. Introduction

The Operations Manual is the master document for Teaching Assistants (TA’s) on how to run [LAB]. This is a living document, changed as our equipment and policies change.

**First day on the job?**

A full-time staff member should have set you up with the following items:

- 1. **Student Employment Form**: You should have filled out this form and taken it to XXX
  2. **Trello**: You should be signed up for trello.com and added to all [LAB] boards
  3. **Google Groups**: You should be signed up for the email list
  4. **Google Docs**: The [LAB] collection of docs XXX
  5. **Google Calendar**: The TA schedule should be shared with you, and you should be added to it
  6. **Key Request**: A key request email should be sent to the department assistant. XXX

  7. **Phone Numbers**: You should add all full time staff employees to your phone’s contacts in case of emergency. The current Manager, XXX. The current Manufacturing Specialist, XXX. Please do not distribute these numbers unless given permission to do so.

  9. **Recordkeeping**: Add this TA to the top of the “TA Contact Info” sheet in the

  10. **Welcome Email**: An email sent to the TA email list introducing you to the team.

Go ahead and start the following on your own:

- 1. Ask another TA to show you how to add yourself to the “Teaching Assistants” whiteboard
  2. Ask another TA to show you how the “Maintenance” whiteboard works
  3. Read through this operations manual from top to bottom, asking if you have any questions
  4. Read through our policy documents:
     a.
     b.
     c.
     d.

**Teaching Assistant Job Description / Functions**

1. Learn how to use all of the fabrication machines available at [LAB], help lab users learn to use machines you have been approved to use, and supervise lab users and their safety
2. Assist in keeping [LAB] clean and organized, including sweeping and mopping as needed
3. Assist in producing gifts for donors and other VIPs, as needed
4. Give tours of [LAB] to visitors, new users, VIPs, and small groups of up to 20 individuals
5. Assist in writing documentation on how to use lab equipment
6. Complete special fabrication projects as assigned
7. Perform other duties as assigned
8. Help lab users learn to use software as necessary to use the machine.
9. **NOT** here to assist in design.

**For each person that walks in to the lab, do the following in this order:**

1. Say “Hi, welcome to [LAB]”

2. Look at their feet. If they are wearing sandals or open-toe shoes let them know our safety policy is very strict and that they have to wear shoes while in the lab. They can put on toe protectors, or return with closed toed shoes.

3. If they have food and drink, let them know our safety policy is very strict and that they can’t have food or drink in the lab. VIPs may leave their food or drink on the TA desk. Others need to leave and come back without food.

4. Ask the visitor to use the sign in sheet.

5. Ask the visitor to put their bags and coats on the rack by the front door.

6. Tell them “Let me know if I can help you with anything”

# 2. Employee Information

Here you will find information pertinent to Teaching Assistants, such as how to answer the phone and what to do if you need to call off work.

**Timesheets**

**Nothing to work on?**
Check the maintenance schedule, float around asking if anyone has questions and make sure they're using things safely, dust the computers and machines using shop rags, and see if there's anything else that needs cleaned up.

**TA Calendar**
If you would like to see who is scheduled to work a certain time slot, visit our XXX

**Mailing List (the Party List)**
Feel free to start discussions on our private Teaching Assistants mailing list.  Send your email to XXX

**Illness / Absence / Calling Off Work**

**The 3 Strikes System**
When one of us is late, or doesn't clean up after ourselves, it puts an unfair burden on the rest of us to pick up the slack. For all the time and energy we put into making this lab great, it's extremely disrespectful to the rest of us when one person is late or leaves a mess. A strike is indicated by a red dot next to a name on the "Teaching Assistants" whiteboard. Any TA that receives three strikes will be asked to return their key and lose after-hours access. If a TA receives six strikes they will permanently forfeit their position at [LAB]. The strike system is reset each semester.

Receive one strike:

- Leave a mess.
- More than 5 minutes late.
-

Receive two strikes:

- Does not show up for a time slot without prior excuse.
-

**Phone**

Answer the phone, ask if you can help them.

- There's technically two numbers, line 1 is the Operations Manager's office phone line, line 2 is the
- General Lab phone line. Answer both lines.

**One Sheets: What Are They?**

These are single sheet instructions for a specific task (such as changing the plotter paper) that are laminated and hung near the machine in question. They may be single-sided or double-sided, and an image accompanies each step.

**Tutorials: What Are They?**

These longer-than-one-sheet instructions can be found on the [LAB] website, and will instruct you how to use a machine in a step-by-step manner. Generally, an image accompanies each step.

**Radio and Music**

You can play music and the radio after-hours, if you are considerate to other TAs using the lab after hours and ask if they mind the noise. When not in use, the radio should be properly stored back in its cabinet.

**Kicking People Out of the Lab**

If someone comes in with sandals or food or drink, you MUST ask them to leave and return with proper footwear and no food or drink. If you feel its necessary to remove a person from the lab for other reasons (ex: physical altercation), you may call security XXX, OR inform the Operations Manager about the situation and let him or her take care of the situation, OR you may tell them they need to leave now and should contact the Operations Manager regarding when they may come back to the lab. This gives you some authority while ultimately letting the Operations Manager mediate and potentially take any heat.

**Media Inquiries**

Now and then a reporter or other media person will come to the lab to write up a story. The university and the school of engineering are very particular about how [LAB] is represented in the media. Media requests absolutely must go through proper channels. Do not give an interview or other media to a reporter, instead tell them that all requests must go through the Operations Manager, and give them the manager's contact information. Don't let them pressure you into giving a "quick interview" or providing "anonymous comments",

media requests really truly must go through proper channels. Direct them to the Operations Manager. If you cannot find the Operations Manager, call him or her on their cell phone XXX

**Shipments (Outgoing)**

If you need to ship something (for example, a broken part you have received an RMA number for), pack it up in a cardboard box using plenty of padding (boxes and padding are located in Cabinet 2), seal the box with packing tape (located in Cabinet 1), put the mailing address and any other information (RMA number, etc) on a post-it or the box, and give the box to the Department Assistant for mailing.

**Shipments (Incoming)**

Typically, we receive incoming packages in XXX Department staff email the [LAB] Operations Manager when packages are ready for pickup. If the Operations Manager asks you to pick up packages, pick them up from XXX and make sure to sign and date the log sheet on the clipboard on the desk. Sometimes we also receive packages in XXX. The Operations Manager will let you know where to look for packages if you are assigned this task.

**After Hours Access**

**As of October 10, 2013**, major changes to the after-hours policy have been made. Until further notice, teaching assistants may not use [LAB] after posted hours.

Teaching assistants who have received keys to [LAB] may use it after hours, given the following rules:

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**Rule 1: SAFETY FIRST, ALWAYS USE THE BUDDY SYSTEM**

- If you are in the lab after hours, you ABSOLUTELY MUST bring a buddy with you. If you get hurt and are unable to call for help, your buddy will be there to assist you. The importance of this cannot be overstated. In 2011 a student at Yale died because they were using the machine shop without a buddy, in violation of their safety policy. This is really serious.

**Rule 2: CLEAN UP AFTER YOURSELF**

- We have had a serious problem with TA's working in [LAB] after hours and leaving a mess for others to clean up. Put away your tools, clean up your chips and sawdust. Put your project away. For others who have to clean up after you, even putting away one drill bit can be very disrespectful and aggravating to those of us working hard to keep the lab clean. See the "3 Strikes System" section of this document to understand what to expect if you leave a mess.

**Rule 3: AFTER-HOURS IS NOT A FREE-FOR-ALL**

- Do not use machines you are not trained on. Do not let untrained people use the metal shop, shopbot, etc. Do not let your project group use [LAB] while you go home to sleep. In the past the Operations Manager has walked in at night to find a TA brought in a project group, and untrained group members were using the drill press. These types of mis-use will result in serious disciplinary action for the TA in question.

**Injuries**

If anyone is injured at any time, they can use the substantial first-aid kit mounted on the front doors of [LAB]. They can apply bandages themselves, or you can help. You are protected from liability thanks to the

If you are a teaching assistant and you get injured on the job, you are covered under

**Power Outage or Fire Alarm**

In the event of a Power Outage or a Fire Alarm lasting longer than 60 seconds, ask everyone in the lab to leave their work and exit the building. Remind them to use the stairs and not the elevator, in either scenario, and that they can pick up their belongings after the emergency is over. Then, close the lab. Only the Operations Manager should re-open the lab. If there is someone in a wheelchair who cannot exit the building, the procedure is to ask them to move into the nearest stairway, and to call XXX to alert them that a person in a wheelchair needs rescuing in the XXX. Let security know if the person is in the stairwell

have special equipment to help people in wheelchairs. Alternatively, if the adjacent XXX buildings have power and their alarms are not going off, people in wheelchairs may use the connecting hallway to leave XXX

**Scrap Metal Disposal**

We have a sign in the hallway indicating we accept scrap metal. Indeed, we do. If a user drops off scrap metal, put it in the corresponding bin (steel, aluminum/copper, etc) in the metal shop. If you're not sure which metals they are, see a full-time staff member.

**Paint Disposal**

We have a sign in the hallway indicating we accept paints for safe disposal. Indeed, we do. The reason we don't have a bin in the hallway is because grad students have an annoying habit of dropping off a big box of solvents, acids, all sorts of chemicals, and thinking they are all "paint." If someone says they are here to drop of paint, direct them to a full-time staff member. What the full-time staff member will do is evaluate the materials per these guidelines:

- For cans of latex paint, acrylic paint, and adhesives, we just open them and let them dry and harden, and then throw them out.
- For spray cans of paint or adhesives, we drag a trash can outside, spray the stuff into the can until it's empty, toss the can into the trash, and then take out the liner and toss that into the dumpster behind XXX.

- For most anything else (including oil based paints), we follow the procedure for Hazardous Waste disposal.

**Hazardous Waste Disposal**

We have a sign in the hallway indicating we accept hazardous waste for safe disposal. Indeed, we do. If a user has hazardous waste to drop off, have them see a full-time staff member. If one is not available at the moment, the user needs to come back. Do NOT accept the waste yourself. The full-time staff member will evaluate the material per these guidelines:

- For 2-part epoxies, resins, silicones, etc, they can be mixed and allowed to cure and harden, and then thrown away with regular trash.
- For Hydrogen Peroxide (H2O2), it can be disposed of in the sewer along with water in the ratio of 20:1 water to H2O2.
- For oils, solvents, acids, bases, fuels, gas cylinders, or anything else that might be considered hazardous waste, the full-time staff member will write the person's name, phone number, and speedtype onto a hazardous waste tag, tape it to the container, and add that info to the form that should be on a clipboard at the hazardous material shelf. If the user does not have a speedtype, go ahead and accept the waste, but mention that it costs us money to dispose of it, so they should consider giving back to [LAB] in the future. For reference: on that form, a faculty member (not staff) will be listed as the PI, each bottle MUST be listed on its own line even if multiple bottles contain the same thing, and finally the units MUST be in liters or kilograms and not 'bottles' or 'pounds' or anything else. There's a regular maintenance task that TA's can do to actually submit this form periodically to the safety department, to have them safely dispose of this stuff.

**Equipment Disposal**

We have a sign in the hallway indicating we accept equipment for proper disposal. Indeed, we do. If a user has equipment to drop off, have them see a full-time staff member. If one is not available just then, the user needs t come back. Do NOT accept the equipment yourself. The full-time staff member will take the person's name, phone number, and speedtype, and then fill out this XXX and submit it to the department of health and safety services. Once we receive approval we can call facilities XXX

**Facilities Emergencies**

In the event that there is a flood, a busted air pipe, or another urgent facilities request, call Facilities at XXX and let them know there is a serious situation that needs to be addressed quickly.

**Facilities Non-Emergencies**

If a light is out, the temperature is uncomfortable, the water fountain is broken, or any other building-related issues come up that are not really emergencies, create a facilities service request through the work management system. Follow the XXX and please note that we are in XXX

**How we use (and how to avoid mis-using) Trello**

Currently [LAB] uses three Trello "boards" to organize tasks and projects, and store communications between dozens of teaching assistants and the Lab Manager.

- **[LAB] 3D Printing Queue:** The easiest board to deal with is the “3D Printing” board. This board contains cards that represent 3D printing jobs for the Fortus machine. Make sure to archive each job when it is picked up and paid for. More information is available in the “3D Printer” section of this document. If you are unsure of how this board works, or how to perform a particular task (sending jobs to the machine, moving parts into the bath, cleaning parts, etc) ask another Teaching Assistant or the Operations Manager. Be aware that this board is public, meaning our lab users can read every comment on every card. This was made public so users could check on the status of their part without taking up our time. Use your best professional communication when commenting on this board, to give users the best possible impression of [LAB] and our team.

- **[LAB] Action Items:** This is easily abused and great care must be taken to avoid common pitfalls. An action item is a simple task you can sit down and do. For example, “Organize VIP Party” is not a task you can sit down and do. If the Lab Manager assigns you an action item like this, you have every right to complain. “Organize VIP Party” would be appropriate for the *Projects* board. From a project like that, action items are generated. Action items might be “Email ORGANIZER and ask how many people will be at the event.” No further decisions or discussion is needed, you can just sit down and complete that task. Be very careful to think clearly about what the next actionable item might be. For example, can you really “Organize 3D Printer Cartridges” or do you need to “Create empty space in a cabinet for 3d printer materials” first? Can you really “Install hanging photo backdrop” or do you need to “Decide where to hang photo backdrop” and then “Purchase mounting hardware for photo backdrop” before you can install it? Often the next thing to do is to make a decision, so label the task appropriately.

- **[LAB] Projects:** These are where we put projects we’d like to do, and projects we’re working on now. As you’re researching a project, put links and photos in the card, add your comments about decisions, and so on, so that other TA’s can see the process and make helpful suggestions, and also so that we can revisit the card in the future to remember why we made a certain decision, or how something was accomplished. When you figure out an actionable item, go ahead and make a card for that in the “Action Items” board.

- **PLEASE RECORD YOUR WORK.** Don’t do work without recording what you’ve done. We need to know who did what work so we can keep track of these things and be able to give praise (or track down issues, as appropriate). Lab management uses this list when justifying why we need so many teaching assistants, so it’s important to be able to show off all the work we’re doing. Also, and even more importantly, with dozens of people working in the lab that might never see each other, it’s absolutely critical to have a central communication hub, and this is it. This is how we communicate. Use it often, as more communication is always better in our situation.

- **Trello Email Integration.** When users submit the “STL Upload Form”, our website emails a special address XXX, that automatically adds the job as a card in the “Unprocessed” list of the “3D Printing” board. Likewise, submitting the “PCB Upload Form” emails a different special address XXX that adds a card to the “PCB Routing” board.

**Key Cabinet**

The combination for the key cabinet is XXX. The sheet on the inside of the cabinet door shows what each numbered key goes to. There are many keys inside the key cabinet that go to everything from the tool chests in [LAB] to various locations around campus including the XXX machine shop and the XXX storage building. You do not need permission to use keys that go to things within [LAB] (tool chests, cabinets, etc.), but you must get permission from a full time staff member to use keys that go to things outside of [LAB]

# 3. General Lab Policies

The following is the TA accompaniment to the XXX that the public sees. Whereas that guide will say (for example) that lockers are available, this section will indicate how a Teaching Assistant may assign someone a locker.

**Individual Tours**
Individual tours are given each weekday at 1pm. The goal is to try to nudge people towards this timeslot, so we can group them together and give fewer overall tours (thus freeing our time for other purposes). If a visitor wants a tour and can't come back at 1pm, give them a tour anyways. You never know who the next big inventor will be. Remember what it was like to be a novice.. practice patience and friendliness.

**Group Tours**
If someone asks to schedule a tour for their group or class, direct them to the Department Assistant, who will handle this. If the Department Assistant is not present, the visitor can visit the tour webpage on our website, or email

**Lockers**
To assign a particular locker, open the XXX spreadsheet and fill out the corresponding row on the "lockers" sheet. Then get a whiteboard marker and write the person's name and project (if applicable) on the whiteboard marker nameplate on that locker. We do this so visitors can get an idea of how many people are using the lab.

**Storage**
People often ask if they can store things in [LAB]. Generally the answer is no, sorry, we just don't have the room. If they have something glued and clamped together in the wood shop, they can leave it there overnight. Just let them know that if they don't pick it up the next day, it will probably be moved to the lost and found.

**Office Supplies**
The office supplies cabinets contain a whole bunch of things that are not for lab users. These supplies are for maintaining the lab, do not give them out. There should be masking tape, scissors, stapler, etc in the drawers of the Media Center, these are the only office supplies we stock for users. Don't give out our gaff tape, pens, batteries, permanent markers, label maker, and so on. Our office supplies are for lab use only.

**Tool Loans**
People can borrow any hand tool and they can also borrow cordless power tools. As collateral to ensure that users return the tools they borrow, please ask for their ID and put it in the cash box for safe keeping. Regarding power saws, ask what material they're cutting and give them *one* appropriate blade. If they break it, they can buy replacements at Home Depot or Lowes, etc. Regarding power drills, if they borrow any driver bits (phillips, flat-head, etc), make sure they record it on the tool sign-out sheet. If they want to borrow drill bits, they can borrow the gray case of bits that's on the black steel shelf next to the drill press. We have multiples of those, so it won't affect lab users. Other bits may not be borrowed. Have them read the rules on the "tool signout" sheet. THEN ask them if they agree to the rules. If so, they can sign out the tool(s) they would like borrow. Make SURE they read the rules. For more information, read the XXX document.

**Sign-In Sheet**
It's essential that anyone entering [LAB] sign in, as this both serves as a waiver for liability as well as a record of who used what when, in case of any damage or issues. If we run out of the Sign-In sheets, you can re-print them, you'll find it in Google Docs. When the sheets are full, put them in the sign-in sheet folder in File Cabinet 1, behind the Operations Manager's desk.

**Safety Apparel**
If you go in the metal shop or wood shop, even for 1 second to get a drill bit, you MUST WEAR PROPER SAFETY APPAREL. This is paramount. If you're not in practice of doing this EVERY TIME, then an accident is bound to occur. You'll walk in to grab a hand tool while someone's using the sander or drill press or something, and a tiny piece of their work will end up in your eyes. You need to be in excellent practice and wear safety glasses and other proper apparel every single time. No exceptions.

**Don't Gum Up The Works**
We have very few computers here in [LAB]. If people want to sit down and spend hours working in SolidWorks, CREO, CorelDraw, Illustrator, Photoshop, or Office, they should really do that over in Nord Computer Lab or at their homes. Yes, XXX Lab has these software titles. From home, all XXX affiliates can use the XXX to download the full Adobe Suite and CorelDraw. Also, people with active XXX login accounts can get their own copy of XXX for their computer, details on the [LAB] website's

If you see that folks are gumming up the works, and there's a real line of people waiting to use the computers, tr saying "Hi everyone, we have an issue right now where we don't have that many computers. Most of this software is available in the XXX lab, which has a lot of computers, so that's the best place to do your design work, and then come back to [LAB] when you're ready to use the machines. Would some of you volunteer to go use XXX lab now so that people ready to use the machines can do so?"

**Cleaning Up**
This is very important as it is not anyone else's job to clean up a mess you make. This takes up time that could be better spent helping users. Messes can also pose a safety hazard. Make sure students clean up after themselves. Be polite but firm.

**Community Board**
People wishing to post flyers may do so on the metal doors beneath the three clocks. Use the pushpin magnets

There's also a magnetic whiteboard in case someone wants to leave a note. If you see flyers for past events please remove and discard them.

**"Notes For XXX" Board**

On the double doors beneath the clock there is a magnetic whiteboard where people are welcome to leave notes for the Operations Manager.

**Billing / Invoice System**

When people want to pay for laserable stock, 3D printed parts, or other things that we sell, let them know we can accept Cash, Checks, Speedtypes, or if it's for a XXX class **and they have approval from their professor to charge these items to their class account** - we can accept the XXX course number. In any of these scenarios, follow these instructions:

1. Open our XXX (Google Docs) and fill it out with the appropriate information. Pay careful attention to entering all of the information correctly, as incorrect information can make lots of work for the people depositing/approving the payments. Instructions for each type of payment follow.

    a. **CASH:** If the user pays with cash, put it in the cash box, located in the TA security cabinet. Enter "CASH" into the "Speedtype" field on the Invoice spreadsheet and proceed to step 2.

    **b. CHECKS:** If the user pays with a check, have them make the check out to "XXX " and put the check in the folder labeled "CHECKS" located in the TA security cabinet just behind the cash box. DO NOT endorse or sign the check in any way. Enter the check number into the "Speedtype" field (Ex: "CHECK #1234") on the Invoice spreadsheet and proceed to step 2.

    c. **SPEEDTYPE:** If the user pays with a Speedtype (an account in the XXX financial system) enter the number into the "Speedtype" field of the Invoice spreadsheet and enter the name of the PI into the "Name of PI..." field, then proceed to step 2.

    e. **STUDENT PROJECT FUNDS:** [LAB] offers funding for student projects (see web page). If a user wishes to pay for something using Student Project Funds that were awarded to them, **STOP**. Send them to the department assistant. These payments involve more than just filling out the invoice, and the department assistant is specially prepared to handle these requests. If the department assistant is unavailable, the user will need to come back another time.

2. Click the [LAB] **Tasks** menu item and select **Send Invoice**. It may ask you to authenticate/allow the script to run. If it does so, allow it to run. It should only prompt you once. What's happening is the script will automatically log this invoice in the Invoice Log spreadsheet, archive a pdf copy of the invoice

in XXX, and email the receipt to the user. When the script has finished running, it will empty all the fields and increment the invoice number. It takes a few seconds for the script to finish running, and when the fields are emptied you know it's done running. If it doesn't empty the fields after 30 seconds or so, try running the script again.

**Payment Policy**
Lab users must pay for things *before* leaving [LAB]. We've had a number of students come in with partial payment, claiming they are rushed and will "totally come back later" to pay the remainder. As a compromise, we can accept someone's XXX ID or State ID as collateral to ensure they come back. Put this in the cash box.

**Cash Box**
The Cash Box is located in the lockable cage cabinet next to the teaching assistant desk. If the Cash Box is getting low on change (singles, quarters, etc) please notify the [LAB] Administrative Assistant.

**Multimeters For Sale**
One of our fearless leaders and major benefactors, XXX, had a batch of hand-held multimeters made that say "XXX" on the label. He has asked us to sell these at the lab for $10. The multimeters are stored in a box in the bottom of Cabinet 2. We accept cash, just put it in the cash box.

**Returns Policy**
Regarding users returning goods, the following general policies apply. If someone wants to return unused and undamaged stock materials (ex: a piece of laserable plywood), we accept the return. If someone returns a piece of laserable plywood or other stock because it was warped or otherwise defective, we assume the responsibility and accept the return. In that case, write "FREE - WARPED" on it, and put it in the User Storage area in the wood shop. If someone wants to return a Multimeter, put it in DC voltage mode and test it on a battery or a benchtop power supply (ask another TA if you're uncertain how to do this), and if it works then it's probably undamaged and we can accept the return. If they damaged it, we don't accept the return. If they claim it was damaged when they received it, we have to take people at their word and accept the return (in this case, throw away the broken multimeter).

If the buyer paid cash return the cash to them via the cash box. If they paid with a [LAB] account you can use the online billing system to make a new Charge and use a negative quantity (ex: -2 pieces of laserable plywood) to indicate a return.

If someone wants to return a 3D Printed part, please tell them you are sorry but all sales are final on 3D Printed parts. If the 3D Printer made a mistake we can reprint of course, but if someone doesn't like their own design or it broke due to poor design, it's entirely their responsibility.

**Green Hardware Bins**
Currently the hardware in the green bins is unpriced and is thus free for people who need it. This is for people who need a couple nuts or bolts (etc). If someone needs fifty of something, they should really be buying it on their own and not taking advantage of this system. If you see someone taking tons of hardware, let them know they should be buying it at a hardware store or on a website such as McMaster.com

**Ability Badges**

If a user (including yourself, a TA) needs an ability badge, there are four steps involved. This is purposefully not a fast process, to emphasize the seriousness of using the metal shop, and ensuring people have seen the rules before entering the machine shop.

1. User must read our entire ACCESS POLICIES and page 2 and 3 (Dress Code) of the SAFETY POLICIES these are located in the yellow binder on the TA desk.
2. User must read and sign a MACHINE SHOP AGREEMENT (located on one of our clipboards), which you should store in the "M Shop Access Agreements" folder in our filing cabinet.
3. Give the user a blank Ability Badge (from Cabinet 1) and lend them a permanent sharpie marker (also in Cabinet 1). User should write their name **very** clearly on the front of the badge, **AND write today's date on the back of the badge**. Tell them congratulations, they now have a [LAB] Ability Badge.
4. Show the user where to store their Ability Badge (alphabetically in the binders on the TA desk), and where to find the armband badge holders (in a box on the TA desk). Tell them the ability badges MUST be stored in the binders (do not take them home), and they do not need to ask to get their Ability Badge from the binders the next time they come in, they can just grab it. Ask them if they have any questions. Please note: Teaching Assistants should store their badges in the rack underneath the three clocks, and should use the blue badge holders in the wooden box just underneath the rack. Only TA's should use the blue badge holders, this is how regular users can identify who is a teaching assistant. If you are in [LAB] but not on duty, use a regular badge holder (not a blue one) and hopefully users will leave you alone.

**Approving TA's on Machines**

So this is halfway set-up. If you are a Teaching Assistant, when the Operations Manager is comfortable with you on a certain machine (laser cutter, 3d printer, etc), he or she will put a green square in the corresponding box on the "Teaching Assistants" whiteboard. In the future, a more formal test will be put in place.

**Party Rocking**

It is acceptable for individual TAs to party rock, provided they use the buddy system. For obvious safety reasons, do not party rock alone in [LAB]. However, please see the Operations Manager before bringing LMFAO or any other pop rock group into [LAB].

**K-12 Policies : Staff Policies:** [LAB] staff and teaching assistants, please be aware of the following:

1. **Minor Guidelines:** XXX maintains a list of guidelines to follow when working with minors. The Compliance Office maintains a FULL LIST, however the applicable points are:
    a. A [LAB] staff member or TA should never be alone in a closed room with a minor. There should always be two adults (persons 18 years or older) present.
    b. A limit of five (5) K-12 students per adult supervisor must be respected by the school or group stewarding the visit.
2. **Release Forms:** Make sure to get a signed release form from every minor entering [LAB], with the exception of those here just for a tour. Store the forms in [LAB] File Cabinet 1, in a folder labeled ex: "Release Forms 2013"

# 4. Equipment

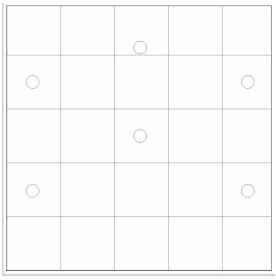
Most machines are thoroughly documented in the “equipment” page of our website. For those machines, when students come in with questions you can just direct them to the website. Don’t let students take up your time unt they’ve thoroughly read the website. Remember, we have a potential audience of over 15,000 people just counting students alone, so we can’t spend too long with any one user. If you are frequently receiving some question that’s not answered on the website or in the tutorials, email the Operations Manager.

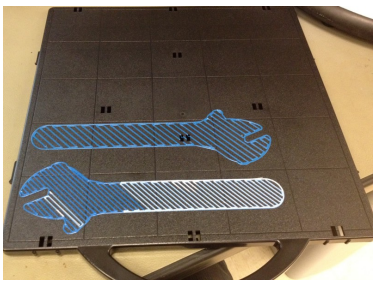
**3D Printer (Fortus 250mc)**

- When emailing users to let them know their part is finished, use this template:

| | |
|---|---|
| **Subject** | Your [LAB] 3D Printed Part(s) Are Ready For Pick Up |
| **Message** | Dear [NAME],<br><br>Your 3D Printed Part(s) are ready to be picked up and paid for at [LAB]. Please stop by at your earliest convenience.<br><br>**Important Note:** Make sure you talk to a teaching assistant before taking your part.<br><br>Thanks,<br>The Staff of [LAB] |

- When lab users ask about this 3D Printer, direct them to the “Equipment” page on our website, which has all the information they need to use this machine.
- When loading the machine, use the used trays, not the new trays, unless you absolutely have to use a ne tray. Ask another TA if you are unsure of what this means.
- The 3D printer trays can be reused if we are clever about it. In Control Center you'll see six little circles, these are the touch-off points the machine uses to calibrate Z-Zero. If you avoid covering these circles when building jobs, we can re-use the tray. Of course, eventually the tray will be full, and we'll have to cover the circles, and then the tray is kaput. When a tray is no longer usable, throw it away in our scrap bin. However, let's do our best to try to maximize the life of each tray. In the photo there's tons of tray space left, but we have to toss the tray because the upper wrench was built on top of the lower-left calibration point. We can do better.





- Due to heavy demand on the 3D Printer, we are currently only offering White model material. With the amount of users we have, we just don’t have time to be changing color cartridges, batching things by color, etc. We are streamlining and only printing in white... with the exception of donor gifts, which we sometimes do in XXX blue or another color.

- While loading parts into the machine, open “Control Center” software before you open “Insight”, otherwise it will crash.
- If you are running Insight to process an STL and encounter an “Open Curves” error, take a screenshot of Insight showing the offending area, and email it to the user. Tell them to fix the issue and re-submit their STL file. Archive the trello card that has the offending STL file.
- If you are running Control Center to send a part to the 3D Printer and you receive an error saying some maintenance is needed on the machine, check the USER GUIDE to see if it’s something you can do yourself. If it’s in the user guide, carefully follow the guide and perform the maintenance. Log tha you have completed the maintenance in the MAINTENANCE LOG spreadsheet.
- If you use the last spare parts in inventory to perform maintenance on the machine, make a Trello card in the “At Computer” list of the “Action Items” board, for the Operations manager to order more parts. If it looks like a service person needs to be called in, make a Trello card in the “At Computer” list of the “Action Items” board, for the Operations Manager to contact Stratasys Technical Support.
- If a cartridge (either ABS or support material) is running low, please leave it in the machine. Even if it's not enough material to print the job, please leave it in the machine. The cartridge will run out, and then we'll be given the option to change it. It's no problem to change the cartridge in the middle of the job, the machine is designed to do this. The issue is that these cartridges cost hundreds of dollars, and having dozens of cartridges that have 5% left in them is a big waste of money. Our policy is to completely use up a cartridge before swapping it for a fresh one.
- If the cartridge in the machine runs out, put it back in its box (should be in the stand under the 3D Printer) and put it in Cabinet 11 (for later re-use) and get a new FULL cartridge from Cabinet 7. Open the box, cut and discard the ESD bag, put the cardboard box in the stand under the 3D Printer, and insert the cartridge into the machine.
- If someone’s part breaks during printing, handling, or in the bath, take a look at it and try to guess why it broke. If the part was designed well and it broke because we mishandled it, be honest and re-print it. Email the student to let them know what is happening. However, if the cause of the breakage was ridiculous geometry (walls too thin, features too thin to hold the parts they’re attached to, etc), email them to let them know their part is ready for pickup and payment, and that due to poor geometry part of it has separated. Just to be clear: they still need to pay for this. On the same point, it’s not our job to review each design for possible issues. We’re trying to make the instructions clear, and beyond that we’re letting people learn through the normal process (by making mistakes). If you do get a part that broke due to poor geometry, take a picture of it and send it to the Operations Manager for possible inclusion in the 3D Printer Tutorial, as an additional warning for our users of what not to try to print.
- When processing STL files using Insight, we always select the “Solid - Normal” modeling option instead of any of the “Sparse” options. The “Sparse” options produce pieces with honey-combed interiors, which reduce the amount of modeling material used (that’s good!)... but unfortunately when we put the parts in the lye bath, the lye seeps into the part and leaks out of it for weeks to come (that’s bad!). By producing Solid parts, we avoid this problem.
- Typically you want to orient parts so they are short and flat, not tall and skinny. You can easily accomplis this using *STL => Automatic Orientation* and choosing the “Minimize Support” option. The issue is that if you orient parts so they're tall and skinny, the quality of the part significantly deteriorates along the height of the part. It'll be good near the tray, but terrible at the top of the part. Although you may think it's a goo idea to orient parts in the tall-and-skinny orientation because then you can fit more on a tray, the machine actually moves faster in X-Y than it does in Z, so printing two parts of trays in the correct orientation would actually be 1.5 to 2 times faster (total time, including both trays) than one tray using the tall-and-skinny

approach. There is one exception to this approach, if you have a part that's fairly cylindrical, AND the Height/Diameter ratio is less than 5, print it in the vertical ("tall and skinny") orientation to achieve better part quality.

- When commenting on the 3D Print queue trello board, be aware that this board is open to the public. Our users can read every comment on every card. Use your best professional communication style when commenting on these cards, to give lab users the best possible impression of the [LAB] team.

**3D Printer Cleaning Bath (Lye Bath)**

- When putting parts in the SCA cleaning bath, sometimes a part is too delicate to remove from the tray. In this rare instance, it's acceptable to put the entire tray into the bath, provided the lid closes properly. If the lid won't close, and you're not sure what to do, leave the tray on the Operation Manager's desk with a note explaining the situation.
- When using the Support Cleaning Apparatus (the Lye Bath), if you get a beeping noise and the bath won't start running, check the level in the bath. If it's below the fill line, PUT ON GOGGLES, then put some water in a bucket and slowly pour it in the bath until the level reaches the fill line. Water evaporates over time, so sometimes we have to add more water.
- The lye bath is changed when the pH reaches about 10. There are litmus strips for measuring this in Cabinet 1. Changing the lye bath involves draining it, filling it with water, draining it again to get rid of sediment, filling it with water again, turning on the heater and pump until the water is 150°F then adding 1.5 bottles of Waterworks Lye or 8 packages of Ecoworks Lye and waiting for the lye to completely dissolve into the bath. Lye is dangerous! See the Operations Manager for the details on how to do this safely.
- The sink that's integrated into the bath unit will occasionally clog. The common issue here is the one-way check valve (down below in the cabinet underneath the sink) gets clogged with bits of material and won't properly open. To fix this, drain the bath entirely.. use pressurized air or a plunger to force the sink to drain.. then open the cabinet and take out the check valve (it's the only white plastic plumbing bit you'll see) and clean it thoroughly before reinstalling it and refilling the bath.

**3D Microscope (Lynx)**

- If the red warning light illuminates on the power supply unit and the light starts dimming, the issue is most likely that the LED ring light is overheating. Take the LED ring light out of the stack (see a full-time staff member if you're not sure how to do this), take the fan out (requires removing one screw), and use shop air and/or shop vacuum to blow the dust out of out the fan and also the aluminum heatsink you'll see inside the unit once you take the fan out. Then, reassemble. The problem should be fixed.

**3D Printer (MakerBot)**

- Not available to lab users until (and if) we can get reliable results on this machine. TAs may use this to experiment if you are so inclined.

**3D Printer (3D Touch)**

- Not available to lab users until (and if) we can get reliable results on this machine. TAs may use this to experiment if you are so inclined.

**Plotter**

- We charge for the amount of paper used. Paper is the dominant cost, so the linear inches used in cost

calculation is the amount of paper they end up holding.

- This is self-serve, when students want to use the plotter tell them that the instructions are posted above the plotter, and if they have any questions they should ask instead of damaging the machine.
- If you see a message saying that the plotter is low on ink, just ignore it. It can print many posters while st "low" on ink. At some point the cartridge will be fully empty, and someone's poster may print without that color. Don't charge them for this. Find a replacement cartridge in Cabinet 1 and install it in the Plotter. HP does not recycle these cartridges, so just throw the old one away.

**Printers**

- Currently we have two printers, a Color Laser Printer (Kyocera C5150DN) and a B&W Laser Printer / Scanner / Copier (Kyocera 1135 MFP). Both of these are leased to us by XXX. They are responsible for fixing the printer when it's broken, and also for supplying replacement ink.
- Currently these printers are free. They're here as a convenience to print out a page or two here and there. If people abuse this and print hundred-page documents, we will have to start charging. Let people know: Don't break the streak! This has been free since [LAB] opened, don't mess it up for everyone else.
- If a printer is low on ink, let it keep printing until it's completely out of ink. We are not in the business of throwing away cartridges that still have ink. When it's totally empty, or the printer refuses to print, first loo in Cabinet 1 to see if you can find the right cartridge. If so, gently replace it. If you're not sure how to replace it, and you're worried about damaging the printer, google for the printer online and see if you can find help in the User manual. Finally, you'll need to call the help desk and request replacement ink cartridges, so they are available in Cabinet 1 the next time the printer runs out. Make a Trello card for yourself in the "Calls" list of our "Action Items" board with one of the following titles:
    - Call XXX
    - Call XXX

  After you call them, you can go ahead and archive the card.

**PLEASE FOLLOW THESE INSTRUCTIONS REGARDING TRELLO CARDS.** Don't do work without recording what you've done. We need to know who did what work so we can keep track of these things and be able to give praise (or track down issues, as appropriate). With dozens of people working in the lab that might never see each other, it's absolutely critical to have a central communication hub, and this is it.

**Flammables Cabinet**

- Only Teaching Assistants should be going into the flammables cabinet. This is a "TA's Only" cabinet.
- The yellow flammables cabinet is used to store solvents and flammables, as well as acids, paints, and
- other chemicals that are NOT basic in their ph level. ALKALI SUBSTANCES, SUCH AS THE SODIUM HYDROXIDE USED IN THE 3D PRINTER SUPPORT CLEANING BATH, MUST NEVER BE STORED IN THE YELLOW FLAMMABLES CABINET. This cannot be overstated, do NOT store acids and bases together, as one small leak in a bottle could cause a chemical disaster.
- In general, the materials stored in the flammables cabinet are for projects that TAs and lab staff undertake to improve the lab. This is not a free-for-all, we do not stock these things for general student use. They are not for sale. Just to be clear, do not give these things out. The **only exceptions** to this rule are **acrylic solvent**, **wood glue**, **epoxy glue (amazing goop)** and **denatured alcohol** (ethyl alcohol plus a poison), which we do stock for students. Currently there is no fee for using these three

things. If students want to use any of these, MAKE SURE they use safety goggles (stored above the flammables cabinet), and not merely safety glasses. The difference is that goggles form a seal with your face.

**Metal Shop**

- Lab users MUST obtain an ability badge before walking into the metal shop. If you see someone in the machine shop without their badge, ask them "where is your badge?" - and if they don't know what you're talking about let them know that we have a new policy that everyone in the metal shop must go through a process to get an ability badge before entering the metal shop. If someone comes in and wants "one hole drilled" or "one cut" or something simple that's only going to take a few minutes, AND if you are trained, then you may help them out if you are feeling generous. The procedure is to ask them to make a dimensioned sketch of what they want to end up with. If they have an Ability Badge then ask them to do their own layout (scribing lines, using automatic center-punch to start dirlled holes, etc). If they do not have an Ability Badge, ask them to wait outside the metal shop and take care of it for them. If the student is asking for more than just a couple cuts and holes, they need to go somewhere else. Direct them to Engineering Services (see "Engineering Services" section of this document).

**Drill Press**

- From time to time there will be an issue on the drill press where the motor tension handle will get "stuck" and won't move. To fix it, follow GUIDE
- If a drill bit breaks, you can find replacement bits in the drill index drawers in cabinet 9 in the multi-purpose room. If you use the last replacement bit of a certain size, please let the operations manager know so that more bits can be ordered.

**Laminator**

- Currently the laminator is unpriced, and is thus free to use. This will change as soon as the Operations Manager finds time to price this machine. In the meantime, enjoy!

**PCB Router**

--- Ask XXX --

**Laser Cutter (Epilog Legend 36EXT - We have two of these)**

- Clean optics (lens and two mirrors)
  - Focus on the highest point of a cupped workpiece
  - Move focus into center of thickness
  - Set a new home position
  - Engrave and Cut a piece of scrap
  - Clean up
  -
- These 120 Watt CO2 laser cutters can cut and etch wood and certain types of plastic. They can't etch or cut metal. I repeat, it cannot etch or cut metal. What it **can** do is etch paint, or ink, or anodization, off of a metal surface. If someone tries to etch (or worse yet, cut) bare metal, what may happen is the laser cutte will be slightly damaged.
- Lab users should be directed to the online tutorial for how to use the laser cutter. When following that tutorial, they'll eventually reach a "stop" sign that tells them to get a TA to check their work before sending

the job to the laser cutter. Here are the things to look for:

- At least 0.060" clearance exists between design and edge of canvas
- Canvas size is identical to workpiece size, which is also identical to the size entered on the blue
- "printer properties" screen (where you set speed/power)
- Things intended to be cut (instead of etched) are vectors of hairline width

- The rotary attachment is currently "on watch". You can use it, but beware of the consequences. Prior use of this attachment caused one laser cutter to fry its motherboard, and another laser cutter had its head crash into the rotary attachment. Whether due to user error or poor design, it's immaterial, the attachment is currently banned. We can't afford the downtime on these machines. Follow the tutorial very very carefully, and ask if you have any questions.
- It's **very important** that these machines are connected to compressed air. The air blows away the burnt material, revealing fresh material for the laser to burn, thus making a cleaner cut. More importantly though, the air also moves fast enough to blow out the flames that would normally erupt from the material. If the air is not on, flames will erupt from wood, plastic, you name it, damaging the air assist and possibly the laser optics. **If you notice the air is not on for some reason, immediately shut down the laser cutters, put an "Out Of Service" sign on them, and contact the operations manager.**
- All approved materials are listed in the speed/power settings chart. If a lab user wants to lase a material not listed on the chart, first they must find the MSDS (Material Data Safety Sheet) for that material, and present it to the Operations Manager.

  **Notes For Operations Manager:** If the Firefighting section of the MSDS indicates any hazardous gasses are produced during combustion, it may not be lased. Teflon (PTFE) can't be lased in [LAB] because it produces Hydrogen Fluoride. FR4 Fiberglass can't be lased in [LAB] because it produces Bromide. PVC produces Chlorine gas compounds... and so on. This is not an exhaustive list, merely just a few examples. The MSDS may not state specifically which hazardous chemical is produced, it may just say "wear self-contained breathing apparatus". When in doubt, contact the XXX office of Environmental Health and Safety.
- Warped Materials: Every once in a while we get a piece of laserable wood that's significantly twisted (warped). If it's cupped (like it just comes up in the middle) that's OK, but if it's twisted - so it's able to rock back and forth no matter which side is up, that's not usable in the laser cutter. If you see a piece of wood like that, write "twisted, do not laser" on both sides in pencil, and put it in the lowest shelf of the wood shop pallet rack, for wood projects. It's fine to bandsaw it, it can be screwed down to the Shopbot and routed, etc, but just not lasered.
- Laser Head Alignment: If the laser seems to be experiencing a dramatic loss in power, and a "drop-shadow" has appeared next to the cut like this photo, chances are the head mirror needs to be aligned. Follow this GUIDE

- Leveling the Laser Bed: If the focus height seems to be significantly different from one side of the bed to the other, the laser bed may need to be aligned. Follow this GUIDE
- Aligning the Mirrors: If the bed is level (see above) however the laser is cutting all the way through on one part of the bed but not on other parts, the mirrors may need to be aligned. Follow this GUIDE

- Firmware Freezing Issue: It's a known issue that now and then the firmware on the laser cutter crashes, and the machine no longer responds when you press the buttons on the control panel. One TA reported that you can overcome these crashes by hitting the green GO button. If you try this and it works doesn't work, please notify the Operations Manager with any new information. The solution for now is to cycle power (turn the machine off and on again).
- Staying at the machine: Users are required to stay at the machine while their jobs are etching, and if they see sustained fire they should press the emergency stop and find a teaching assistant. You can put out the fire using the special "Halotron" fire extinguisher mounted on the wall in between the laser cutters and the 3D Printers. This is a special extinguisher that will not leave a powdery mess in the machine and will not destroy the optics. This risk is real. A fab lab in North Carolina burned down, taking with it part of their main library building, because a laser job was left unattended. We require users to stay next to the machines and watch for fire during their jobs.
- Don't let users monopolize the machine. If you see someone running job after job, and not letting other users in there, go ahead and ask them to run one job at a time (not ten jobs in a row) and share the machine. They may just be unaware that others are waiting to use the machine. Don't be afraid to just say "hi, there are some other users waiting to use the machine, when this job is done can you write your name on the queue and wait for your turn to come around again?"

**Shopbot**

When you first try to start PartWorks, it will ask you for registration data. Here is the info:

- Don't put a workpiece on the table and then walk away nor leave a job half-finished and then leave the lab. Plan ahead. Set aside enough time so you can finish your job without having to leave the room. This is a serious problem, if you leave your workpiece on the table you have effectively broken the shopbot for all other lab users. Typically, if you leave your workpiece on the table longer than 24 hours, you can expect to see it removed and put into the scrap bin. If an emergency or an unusual situation occurs, such as a power outage or a bit breaking, see the Operations Manager about what to do.