CED’s CAD/CAM Lab 2013-14

Dear Students:

CED’s CAD/CAM Lab at Wurster is a place for experimenting and learning how to fabricate your computer-generated vision in the real world of wood, plastic, foam, metal, paper, and various powders. The facility primarily serves students currently enrolled at CED, who may have courses that explore the modeling and execution of three dimensional designs. However, the Lab is available to all Wurster students, faculty, staff, and CED alumni for your own extra-curricular projects (more details on Alumni access on page 6).

A new CAD/CAM facility is being built on the old Shop Yard and we anticipate moving in sometime during the year. This facility will allow us to consolidate our equipment and services and incorporate additional machines and students.

We wish you success in building or printing your designs.

—Assistant Dean IIT Patty Mead
—Lab Manager Chris Palmer

CAD/CAM Equipment

ZCorp Powder 3D Printers: CED has two ZCorp powder machines that produce monochrome physical 3D models generated from digital files (see picture above).

Plastic 3D Printers: CED has a BFB Fuse Deposition Modeler (see page 3) and a Type A Machines 3D FDM plastic printer (see page 6) that print physical models from digital files (.stl format). The plastic is available in a variety of colors, speak with the Manager.

Laser Cutters: CED has one large ILS 12.15D, two VLS 6.60 medium, and one Universal V460 smaller scale laser cutters to assist users in precisely cutting a variety of flat materials used by students in creating realistic models (see page 4).

CNC-Mill CED has a Techno Isel LC Series 4896 CNC router (see page 3) and a Prolight 1000 3-axis CNC metal mill (see page 6), which are computer controlled machines that use a rotating tool to cut 2D shapes from thicker, larger, and harder materials. The CNC cuts plywood, and also produces a 3D surface on material such as wood, foam, etc. The Mill is for use on thin metals.

Lab User Requirements

There are requirements that all affiliates of CED must meet before they can use the CAD/CAM/CNC Lab.

1) Pay the appropriate Lab fees in #477 and receive a CAD/CAM ticket to verify eligibility
2) Bring your ticket to the CAD/CAM orientation, and successfully complete the Lab use and safety training
3) Read and sign Lab-use waivers and policies
4) Affix current Lab sticker onto your UCB id card

Student Status and Access

Undergraduates: Undergraduate use of the Lab is limited to posted “open hours” when a Technician is available to review and assist. No “after hours” access will be granted.

Graduates: Graduates may sign up for time slots during staffed hours if they need to use the 3D printers or require special assistance on projects; however, they are strongly encouraged to utilize the open time slots during un-staffed hours in order to maximize the availability of the equipment for those requiring supervision. Any user who fails to show adequate competence on the machines will be restricted to Lab use only during open hours.

Unauthorized access: Any unauthorized persons found in or using the lab, along with those who aided or allowed their access, may have their work confiscated, access privileges cancelled, and may be charged a penalty payment equal to the full Lab fee.

Alumni/Staff: CED Alumni and Staff who want to work on personal projects are able to sign up for use (see page 6).
Lab Manager
Christopher Palmer

Chris coordinates Lab activities with Instructors, Mechanicians and student Technicians. Specifically he manages orientations, oversees EH&S/CalOSHA safety compliance, collects and disposes hazardous waste, maintains equipment, purchases supplies, and manages the budget. To see more of Chris’ personal work and resume please go to: www.shadowfolds.com

CNC Mechanician
Mei-yen Shipek

Mei-yen is a CNC operator and fabricator who makes furniture and scaled Architectural models.

Machinist
Ramon Quiambao

Ramon is responsible for all aspects of inventorying, using, and maintaining the Shop and CAD/CAM equipment.

General CAD/CAM Lab Policies

Updates to the Lab Rules will be posted inside the Lab and on the bulletin boards outside #477.

All authorized after-hours users, while in the Lab unsupervised, assume responsibility for the Lab, its equipment, and observance of the Lab Rules. Do not let unauthorized users in the Lab.

Cameras are installed in the Lab to assist with accident and negligence documentation.

The CNC and Mill are machines that operate with force and at high speeds, and can cause serious injury or death. Be safe and observant.

All machines have limitations on the type of materials they can handle, speak with the Lab Manager, Mechanician or student Technician to verify that what you are intending to use is approved.

The Lab Manager, CNC Mechanician, and student Technicians have the authority to shut down the Lab or remove users in cases of emergency, unsafe user activity, user negligence, inappropriate Lab or equipment use, or for breaches of policy such as being an unauthorized user in the Lab.

Training—Orientation

All users must attend a training session that covers Lab policies and procedures, basic file preparation, and laser cutting operations.

Professors and GSIs are encouraged to arrange to have their class attend a training session during posted operating hours. Contact the Lab Manager to make these arrangements.

Laser Cutters

Before operating Laser cutters independently, new users will be asked to attend an orientation and complete a Laser job or pass a test under technical supervision. If successful, the student user will be granted access to the Lab and reservation system. No untrained person may use the Lab’s machines.

Other Equipment

Specialty training for 3D printing (plastic or powder), CNC routing, or Mill use must be scheduled and completed with the Shop Manager 2 weeks before midterms or finals.

Clean Up & Maintenance & Storage

All users are expected to clean up by recycling or appropriately disposing materials before leaving the Lab.

Leavings from any print, cutting or layout must be recycled or disposed; sharp objects must be put in the appropriate collection box; and all beverage or food containers disposed and any spills cleaned. Remove memory storage devices from the Lab computers (or they will be collected and placed in the 477 “found” box). For Laser Cutters, check the lens frequently and, if necessary, clean the lens.

The Lab is not a store-room for builds. For the sake of lab safety and functionality, completed projects should not be left for more than 48 hours. Tables at the rear of the Lab may be used for organization and temporary assembly of work. Flat files can be used if users label the drawer with their name and semester. (Be sure to empty these drawers at the end of the year as items will be tossed.)
Fees, Printing & Refunds

2013-14 Student Fees

The CAD/CAM Lab is currently subsidized in part from student fees; specifically, the Miscellaneous Student Fees (MSF) and the Professional Degree Supplemental Tuition (PDST). The current approved use fee is $250/semester.

Access is granted on a semester basis. Thus all students must sign up each semester to receive a Lab “ticket” to be given to the Lab Manager as proof of payment.

Fees Cover What?

Your Lab access fees cover staffing; all supplies (masks, cleaning supplies, filters, etc.); normal wear-and-tear replacement parts (lenses, honeycombs, etc.); computer hardware and software; equipment and ventilation system maintenance.

Your printing fees cover the costs of printing materials, binders, cleaning supplies, replacement parts, maintenance of the printers, etc.

What is not Covered?

PDST fees cover Fall and Spring Lab Access, but Summer is not included. (Exception: MUD students are covered for the full year.)

MSF/PDST fees do not cover the costs of actual CNC, Robotic Arm, or the Mill’s base materials (wood, metal, plastic, foam, etc.) which are used to build your designs.

3D Printing Fees

Consumable materials for 3D prints are paid on a job-by-job basis. A request for payment will be generated before the job is sent to the printer. All prints, including failures, must be paid for by the user. Sales tax (9%) will be collected as part of the fees.

2013-14 (plus tax)
Plastic = $0.10/cu cm
Starch = $1.00/cu in

Fee Payment

The Student Technology Center (#477 Wurster, South tower) processes all facility-use or printing payments. Your student id card (also known as the Cal1 Card) is a prepaid debit card. To put money into your account, go to the Cal 1 card website. Be sure to log off after this transaction or others will be able to use your account.

If you want cash refunds, you will need to make arrangements with the Cal1 Card office directly. We anticipate being able to also process Visa and MasterCard sometime during the school year.

Negligence

If the user operates machines negligently, or misuses the machines to where repairs are required, that user will be liable to pay for repairs.

The user must also retake the orientation, and will either be limited to using the Lab only during posted supervised time or may have the use of the shop revoked depending on the severity of damage.

3D Print Refunds?

Payments occur before or after the print job has been completed and before you can take the print from the Lab.

Requests for exemption from the cost of a faulty print must be made within the same day of the completed print job and be approved by the Manager or Mechanician. There are no exemptions for judgment-based or user-based mistakes, such as: printed in the wrong medium or color, printed outside the bounding bed, or for any design-based problems.

Lab Use Refunds?

Requests for an access fee refund must be made within 4 weeks from the start of instruction. Do not sign up if you are not sure your class requires Lab use. No refunds at the end of a semester regardless if you used the facility or not. No refunds will be given if you have taken orientation or used the facility in any capacity.
Approved Laser Cutting Materials

Mat Board, Paper, Cardboard and Chipboard
Bass, Poplar, Balsa Wood (≤ 0.25")
Plywood (≤ 0.25")
Styrene, Mylar, or Acrylic (up to 1/2")

Materials Not Allowed for Laser Cutting
No cutting PVC, Vinyl, or foam-core
No cutting Polycarbonate
No cutting Masonite or MDF
No cutting hardboard, glass, or uncoated metals

(See posted lists in the lab for machine specific details. Unlisted materials are subject to Manager or Technician approval.)

Laser Cutting Operations

Why a Schedule?
The CAD/CAM Lab has only four laser cutters to service all the Lab users. While we hope to add more Laser Cutters over the next year, we still need to distribute use. So we have implemented a scheduling system to help equalize Laser access as much as possible. But in order for this to work, the expectation is that you do your design elsewhere and come to the Lab ready to cut.

Scheduling System
http://www.ced.berkeley.edu/facilities/cad-cam/resources/SchedulerCADCAM/Web/
This is a first-come-first-served scheduling system that breaks out reservations in 1/2 hour slots. Graduates and Undergraduates have their own schedule.

Graduates can schedule up to 4-hours/week during non-open hours.
Undergraduates may schedule up to 2-hours/week during open hours.
Lab open hours are posted on the entry door and vary depending upon the number of Undergraduate users and Technician schedules. Lab users are expected to adhere to this schedule.

If you need more time, and cannot get it by using unreserved hours, additional time can be requested from the Lab Manager.

Scheduled users have workstation priority. Jobs taking longer than the allotted time may be stopped by the next scheduled user or a Technician.

Users should consult in advance with the Technicians about reformattting jobs to conform to the scheduled time.

Laser Standby
Users must start cutting within 10 minutes of the scheduled start time. If your job is not running after 10 minutes it indicates you are not ready and standby users may bump any late or unprepared user off the Laser for the remaining time.

Standby users may use extra time left from scheduled users who finished early, as long as the job is small enough not to bump into the next hour time slot.

When users finish early they are encouraged to let as many others know as possible that a Laser is available.

Laser “No Shows”
Users who cannot show up for their appointment are responsible for arranging to have another user fill the slot. If a user fails to make this arrangement and the machine is idle during their appointment they may lose privileges and will have limited access as a standby user only for the following week.

Laser Emergency: FIRE
While cutting, Lasers must be watched at all times. There is no exception to this rule and if you do not, you may have your access revoked. All of the fires experienced in the Lab have been due to unwatched Laser cutting.

Small fire procedures are carefully reviewed during general Lab orientation; there are many ways to stop small fires before they grow.

In case of a sustained and growing fire in a Laser Cutter, use the Halon extinguisher located next to the Laser cutter, close all windows and doors in the room, and leave as you call 911 describing your location and nature of the situation. Then if feasible please call the Lab Manager.

Laser Materials
Cutting capacity varies with materials, thus it is recommended that you consult with a technician about the limits on cutting thickness and materials.

All material brought into the CAD/CAM Lab must conform to UCB and CED building guidelines regarding allowable, safe substances.

Unlisted materials are subject to approval.

No hazardous material may be used in the Lab (e.g., acetone, resins, or spray paint). If you have need of these materials, please consult with the Shop.
Controlled Substance Policy

As a matter of life and safety concerns we are posting the following policy: **Alcohol, drugs, and all controlled substances are prohibited in the Lab and Shop at all times.**

Users under the influence of alcohol, drugs, or any other controlled substance are not to enter the CAD/CAM Lab or Shop and/or use any of the equipment in these facilities. Violation of these rules will result in an immediate loss-of-use of the Lab or Shop for the remainder of the semester (without reimbursement). **Working while fatigued is also very dangerous.** **CAD/CAM Lab and Shop staff have the obligation to require users showing signs of weariness or an inability to follow safety instructions to leave the facility until a later time.**

CNC Router Operations

To use the CNC Router, first schedule an orientation with the Lab Manager or Mechanician. If you want, come with a digital model file for review.

Our CNC has a 4’ x 8’ bed size. Height limitations are more complicated and may vary depending upon project dimensions, tool choice, and tool path design; this is covered in detail in the CNC orientation.

A CNC job has four steps and may require separate appointments for each one.

1. Propose a project to the Lab Manager for a consultation on materials, and best practices.
2. Review preliminary designs with Lab Manager, and discuss file prep for the job.
3. Materials agreed upon for the job must be purchased and processed in the Shop according to instructions.
4. Complete final preparation of files. Schedule an appointment for the job. (5) With the Manager or Mechanician on hand, start the job.

**Caution**
- At least one authorized person has to watch the machine at all times while it is running.
- No laptop, mobile device or ear-buds may be used or worn during the job.
- Eye protection is required for anyone in the room while the CNC is running. Ear protection is highly suggested, and available in the room.
- Use of the protective shield is required.
- Users must clean the entire room after a job has been completed and put all tools back in their proper place.

**CNC Materials**
- Foam, mdf, plywood, and wood are okay.
- With Manager or Mechanician approval you may use plastics and cast plaster.
- No metal or glass allowed.

Desktop Mill Operations

To use the Mill, first schedule an orientation with the Lab Manager. This orientation must occur at least two weeks in advance of reviews.

A mill job has five steps and may require separate appointments for each one.

1. Propose a project to the Lab Manager for a consultation on materials, and best practices.
2. Review preliminary designs with Lab Manager, and discuss file prep for the job.
3. Materials agreed upon for the job must be purchased and processed in the Shop according to instructions.
5. With the Manager or Mechanician on hand, start the job.

**Caution**
- Do not wear loose fitting clothing, or jewelry (rings, bracelets, wristwatches) when operating the machine.
- Tie back loose hair and wear safety glasses.
- Check the machine before using. Look for damaged tools or clamps, broken fixtures, non-working guards, and clear away debris.
- Power should be off before plugging in the cord.
- Do not operate without the safety shield in place. In an emergency always press the Emergency Stop button before opening the safety shield. Pull the Emergency Stop button out only after closing the safety shield.
- The mill is a rotating cutter hazard, so always keep hands clear until all motion has stopped.
- At least one qualified person has to watch the machine at all times while it is running.
- Users must clean after each job and must put tools back in their proper place.
- Only personnel familiar with the machine’s service instructions should be near or service the machine. If service is required contact the Lab Manager immediately.

**Mill Materials**
- Aluminum (6061 grade), plastics, and machinable wax are okay.
3D Printers (Plastic and Powder) Operations

The CAD/CAM Lab has two 3D plastic and two 3D powder printers available for us.

In order to use these printers you need to schedule an orientation with the Lab Manager to learn how the plastic and powder printers work. Then you may be asked to produce one test print to show competency.

Because this is time consuming, and many students wait till the last minute, note that this orientation must occur two weeks or more in advance of mid and final reviews.

To set up an appointment, contact the Lab Manager at chriskpalmer@berkeley.edu or see him during his posted office hours.

Come to the orientation prepared with a file of a digital model so it can be reviewed and used for the test print.

**File Review**

All 3D prints are scheduled through the Lab Manager or Mechanic. Prep your final 3D print files. Then setup a review appointment to process the file, which may take 15-25 minutes, prior to running your job. Finally, schedule an hour to start the final print.

3D printing slicing software is available to run on users personal computers and should be obtained from the Lab Manager to insure the latest version is being used.

Find build chambers dimensions for the machines on-line: [http://www.ced.berkeley.edu/facilities/cadcam/resources/](http://www.ced.berkeley.edu/facilities/cadcam/resources/)

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**3D Printing Slicing Software**

**Slicer**

- **Cura**
- **Cura++**
- **Slic3r**
- **Octavus**

**File Formats**

- **.stl**
- **.obj**
- **.3ds**
- **.wrl**
- **.gcode**

**Printers**

- **3D Nanoscribe**
- **3D Systems**
- **3D Printing Solution**
- **3D Systems Wanda**

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**Miscellaneous & Special Programs**

### CAD/CAM Alumni Memberships

CED Alumni may sign up to use our fully equipped and staffed CAD/CAM Lab during Summer. This is the time to work on personal (not for resale) projects.

Cost will be $300, and includes an orientation to the Lab and Laser Cutters session as well as optional orientations on additional equipment.

**Summer 2014**: Monday to Friday, 11:30 am to 8:00 pm. Limited to 15 participants.

For more information contact Chris Palmer directly at chriskpalmer@berkeley.edu

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### Shop Alumni Memberships

CED Alumni may sign up to use our Fabrication Shop during the school year to work on personal (not for resale) projects. Cost is $300 per semester, and includes an orientation session.

**Fall 2013**: Friday to Tuesday, 11:30 am to 8:00 pm starting on 8/22/13 until 12/20/13. Limited to 25.

**Spring 2014**: Friday to Tuesday, 11:30 am to 8:00 pm starting on 1/14/14 until 5/16/14. Limited to 15.

**Summer 2014**: Monday to Friday, 11:30 am to 8:00 pm starting on 5/28/14 until 8/16/14. Limited to 50.

For more information contact Semar Prom directly at s.prom@berkeley.edu

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### Artisan/Crafts Workshops

We are now offering specially artisan/craft workshops. Though mainly a Summer Program, workshops will be offered at various times throughout the year. Priority will be given to CED faculty, students, staff, and alumni; but these workshops are open to all people.

Sample workshops include: Construct a table, flat goods engineering (Lasers), construct a tool box, quilling and 3D printing, construct a chair, textile folding, construct a bed frame, origami, etc.

Emails will be sent to the CED community once this year’s schedule has been confirmed.

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### No Business in the Lab

Wurster is a state-funded facility, and as such may not sponsor “for profit” functions in the Shop or Lab. If you are building something either as a fundraiser or to directly sell to others then you must seek another facility.

If you are building for your own use, CED research, or as a gift, you may use our facilities.

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**Type A Machines—Plastic Printer**