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FABRICATION SHOP

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DIGITAL FABRICATION SERVICES

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FABRICATION CREDIT AND USER DATA BASE

First time users, after having finished the orientation, create an account in our user database in order to start using the Fabrication Shop including the shop tools, tool checkout, laser cutting, CNC and 3D printing. User accounts can be created in the Fabrication Shop using a valid SSA ID card for SSA students who have finished their fabrication orientation; contact aaskarinejad@ccny.cuny.edu . For digital service, users should be present with their ID for submissions and initial processing of their file.

Account Credit: Every semester each student is provided with a virtual sum of money, as a Fabrication Shop credit for the free use of CNC and 3D printing machines (Laser cutting is only limited by 1 hour weekly reservations at no charge.) Each student has a credit of 2 hours of CNC milling and 1200 grams of 3D printing per semester. After each CNC or 3D printing job, it will be deducted from your semester long credit. After the free credit has been used, the students can pay for the services after the job is finished. An individual can only use his/her own credits and sharing or combining accounts is prohibited. Team projects may only be submitted under one student name/credit. Those who share their credits (both parties) risk losing the privilege of Fabrication credits for up to two semesters. If a user's account has a negative balance from past projects they may not be allowed to continue using that service until the fees have been paid. To pay for service fees, funds can be deposited into student's/faculty's CCNY ID using a "FLEX" account which will be used for recharging the their account at the Fabrication shop. (Complete Link: <https://citycollege-sp.blackboard.com/eAccounts/AnonymousHome.aspx>)

LASER CUTTING

- a. The SSA Fabrication Shop has two Universal Laser Cutters with 18" by 32" beds. They are the most commonly used machines for building architectural models. The laser cutters are operated by staff and projects can be done by file submission.
Additionally, the MArch students may have access to their dedicated laser cutter – if the MArch laser cutter is not operating, MArch students can submit to the general machines.
- b. The Laser Cutting service is **only** available for school projects; commercial use is strictly prohibited.
- c. The files should be prepared in DWG format, according to the template available on the SSA website.
 - The file units must be inches.
 - The stock material should be measured carefully and drawn within the 18"x 32" boundary of the laser bed located at the top left corner.
 - The pieces should be scaled and placed within the stock with a ¼" margin around the material outline to ensure a safe cutting operation; lines must be trimmed beyond the margin lines.
 - Limit your layers to the following: 0(Black/White color for borders, notes, etc. that will not be cut or etched), CUT (CAD default Cyan), ETCH (CAD default Green), and ENGRAVE(CAD default Blue).
 - The lines on the CUT layer will be cut out of the stock material.
 - The etch and engrave operations are similar and create the line pattern on the surfaces; etching draws thinner lines.
 - The drawing should be checked to avoid duplicate lines both with the "Overkill" command and manually. Doubled lines result in longer cut times and over-burning of the material.
 - The laser cut line is about 1/32" thick and thus parallel cut lines must be more than 1/16" apart.
 - Pieces smaller than ¼" x ¼" may fall into the laser bed's honeycomb.
 - All fonts should be the AutoCad's "romans"- otherwise the laser cutter wouldn't read it or creates a hatch within the font area resulting in a significant time waste.

- Save your DWG with a 2010 format on your computer AND a flash drive. (Save As)
- d. We recommend finalizing your file with the staff beforehand. Preparing the files is the students' responsibility and file adjustments should be done on the users' personal computer. The Fabrication lab computers may not be used for file modifications or downloads.
- e. Prepare your material. Carefully measure the width, length and thickness. In general, maximum sheet thickness is 1/8". The thicker the sheets, the longer the cutting time. For 1/8" < sheets, a recut may be necessary to cut through the thickness doubling the cut time. Thicker materials can be etched and engraved only.
The material piece must be flat with consistent thickness; warped sheets will result in cutting problem and fire hazard. The materials that can be cut on the laser cutters are Basswood, Balsa, Chipboard, Museum/mounting board, Plexiglass/Acrylic and paper. Corrugated cardboard and foam core can only be cut with simple line work as a high density of cut lines can cause a fire. The use of any other materials should be coordinated with the Director of Fabrication. Lexan, PVC, styrene, polycarbonate, vinyl, glass, and metal are not allowed. Prohibited materials could melt on the laser bed, cause fire or release toxic gas which, beside health hazards, could damage a machine. Plastics can release carcinogens such as benzene.
- f. There is a weekly 1 hour limit for using the laser cutter including the time spent preparing the file, material and machine. After one hour the remaining sheets will be placed on hold until the queue has ended (i.e. in effect the user will be moved to the end of the line.) If one sheet takes longer than one hour, it will be interrupted in the middle of cutting resulting in an incomplete operation.
- g. We do not recommend using the laser etching function as a print. In other words, using excessively detailed drawings for etching (e.g. hatches, large urban maps from ARCGIS, detailed facades) or cutting (e.g. human figures) because they are time consuming and are likely to take more than one hour and remain unfinished. Excessively detailed files may be rejected.
- h. To submit a file go to the room 213 with your valid SSA ID, DWG file on a flash drive and the material along with a masking tape (to tape the cut pieces together preventing their loss). Write your name on ALL sheets and tape.
- i. The files should be submitted 72 hours in advance of your deadline. This time may increase during the busy periods such as finals weeks. We can let you know about the number of people in front of you but any time estimates are NOT guaranteed.
- j. You will receive a text once your project is ready.

3D PRINTING

We have a series of Ultimaker S3 3D printers at the Fabrication Shop with a maximum print volume of 9"x7.3" bed(XY) and 7.8" height(Z). These prototyping machines are a fast way to create complex forms from three dimensional modals. Our default material is 2.85 PLA Filaments provided by the users (other filaments may be coordinated). We recommend Ultimaker filaments. Be mindful that generic brands may be rejected due to substandard qualities that can cause damages to 3D printers (eg. Polyterra). Transparent PLA is not accepted until further notice. The printers are operated by the shop staff only. The 3D printing service credit is only available for school projects and experiments; personal or commercial projects are not allowed. 3D printing is charged per grams of material (filaments provided by the users) to the semester long credits. As of September 2021 each student has a free 3D printing credit of 1200grams per semester. Sharing/ pooling the semester credit is not allowed.

The guidelines for submitting the files are as follows:

- a. Preparing the 3D model is the user's responsibility. The shop computer systems may not be used for correcting the files and they should be prepared in advance.

- b. The 3D printer is only able to print volumes. Any unclosed surface in the 3D models should be given a thickness of over 1/16" minimum. Geometries thinner than 1/8" increase the risk of failed prints
- c. Volumes should be 'water-tight.' If you are working in Rhino, it means they should be closed polysurfaces (see its properties). Use the "Show Edges" command to check.
- d. Make sure your units are in inches.
- e. Scale the model to fit inside the printing limits of the printer. (For Ultimaker it is 9x7.3x7.8 inches)
- f. Lay your volume flat on the XY plane (with the least Z height), on the most stable side (most contact with the XY plane) and with minimal overhangs to avoid supports.
- g. "Export Selected" only the printable volumes in STL format.
- h. Name your file with this format: "Last Name-First Name Professor Model Name"
- i. Bring your ".STL" file to the Fabrication Shop on a flash drive. To make sure about the correct printer settings, ".UFP", ".gcode", ".x3g" files exported from the 3dprinter software are not accepted.
- j. Mark your filament with your name (the person whose name will be on the Sign-up sheet.)
- k. The user should be present at the time of submission with their ID – prints cannot be done under someone else's name. Contact the director of fabrication for urgencies.
- l. Submit your file to the staff at the laser/3D printing room (located on the second floor.) We will review your file to make sure it is printable. You will be notified about the cost of printing and we can inform you about the credit remained on your account. Credits may not be shared.
- m. Our staff prepare the file as soon as they are available and a Machine is free. Nevertheless, make sure to submit your files 72 hours in advance of your deadline. This time may also increase during the busy periods such as the final weeks or due to machine failures during the printing process.
- n. Models with more than 15 hours of printing time may not be accepted during the busy times in order to give everyone a chance of using the machines. If a file takes longer than 15 hours and there are more files left for that user, (s)he will be put on hold until the other projects in the queue have been printed.
- o. Prints longer than 24 hours should be cut into smaller pieces.
- p. You will receive a text (alternatively and email) once your job is ready.
- q. If the 3D prints are not finished due to printing defects you will not be charged for the prints. We can retry the print one more time on another machine if the student chooses but after than the file will be marked as "failed". The Fabrication Facilities is not responsible for the loss of materials in the failed prints.
- r. Come to the Laser-3D Room, if applicable, pay for your job and pick up your model and filament.

CNC MILLING

The SSA has a large CNC router with a functional bed size of 4.5 feet by 8 feet. It can be used for prototype fabrication as well as models, topographical bases, etc. After preparing the file students or faculty schedule a meeting with the shop staff to discuss their project. You can make an appointment by coming to the Fabrication Shop in person. For questions, contact aaskarinejad@ccny.cuny.edu. The CNC routers are operated by the shop staff only.

The CNC service is only available for school projects; personal and commercial projects are not allowed. CNC cutting fees are on an hourly basis, deducted from the user's credit or paid (see p.4, Fabrication Credit and User Database).

- a. First step for a CNC project is to determine the appropriate material. You can consult the shop staff in order to find the best material option for you. Materials are provided by the users. The CNC machine is commonly used for cutting flat sheets such as Foam, MDF, Plywood and Wood. A variety of foams may be used on the CNC

machine; we suggest the use of foam for projects with no structural requirements (such as architectural models) as the time of cutting is significantly reduced and thus the possibility for the shop staff to be able to schedule your project is higher. Also, shorter cut time deduces less from your semester long free credit. Metal or glass cannot be cut on the CNC machine. Discuss the use of any other materials with the director of Fabrication Shop. Unless it is impossible, the material should be larger than the intended final size. A 1" margin will allow for fixing the material on the bed securely.

- b. The combined maximum height of material and cutting tool (i.e. depth of cut) is 8". The material itself may be up to 6" high (in which case the cut depth can be only 2"). Therefore, the depth of cut may not exceed 4".
- c. Laminating the boards should be done 24-48 hours in advance under pressure and using a material-appropriate glue. It is common that an inadequate preparation results in the delamination of materials.
- d. It is crucial to check the material and make sure there are no metal pieces such as nails, screws and staples. The metal pieces can be dangerous during the operation and will damage the tool. Loose knots in wood should be removed or glued in advance.
- e. Bring your Rhino (.3dm) file to the Fabrication Shop for further directions. The file name should be formatted as a Rhino6 file or older and named as such: "Last Name-First Name Professor Material Model Name"
- f. After your file has been approved, an appropriate time should be allowed for the toolpath to be prepared. You may be asked to be present when your file is being processed.
- g. The size of file that can be accepted varies during different periods of semester. Material type and size are the two factors of the timing of a job aside from the design details. Large projects should be discussed with the Director of the Fabrication before planning to cut them. They may not be accepted if it is estimated that they will disrupt the normal workflow of the services for other users, when it will be a great burden on the machine or the staff are not available for those services.
- h. For large/group projects, you may be asked to provide your own tool.
- i. Students from the third-year undergraduate class and higher have the priority for using the CNC routers.
- j. Once the file is ready for milling you will be notified (in person or via text/email) to schedule a cutting time.
- k. Bring your material to the shop on the day of milling. The Fabrication Shop does not accommodate material storage in advance.
- l. Users are required to be present at the time of cutting. That is necessary in case of any complications during the operation. And to clean up.
- m. Wear safety goggles and ear protection when you are in the vicinity of the router.
- n. It is the user's responsibility to clean up after the milling is complete. All scrap material must be taken to the outdoor dumpster and all debris/dust on and around the machine must be swept and discarded.
- o. If the CNC job fails due to reasons other than staff errors (e.g. material failure) the user's credit is deducted for the time spent on the machine. The Fabrication Shop is not responsible for the loss of materials.
- p. You will be notified of the fees after milling (you may also ask for an approximate estimate before milling.) You may use your fabrication shop credit for your CNC jobs. Students may not share their credit. If applicable, pay for your milling job and pick up your model.

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