



3D Printers in the Haverford Maker Arts Space

The Haverford Maker Arts Space is happy to provide 3D printing access and services to students, faculty and staff, who are engaged in academic, clinical and research-related projects. Below is a description of how to get an object 3D printed.

3D Printing Services

Designs can be submitted to the Maker Arts Space Technician and Coordinator, Kent Watson, for approval, and he will then forward the job requests to student workers who will print jobs during their scheduled shifts.

Though jobs can be submitted at any time, the student workers who are tasked with printing the projects work once or twice a week, so please consider that a job from submission to approval, and then to finished print, might take a week or more.

Once a job has been printed you will be notified by email that the job is ready for pick up. You can pick up your printed object outside the VCAM Maker Arts Space in the pick up/drop off cabinet.

Submit your Model

Once you have completed your model, submit your file to dwatson1@haverford.edu. He will review and get back to you with an estimate. We will use the most economical settings to ensure lowest cost possible. Please note that we reserve the right to prioritize projects, and that academic/research projects will always take priority. We also reserve the right to say the project is not feasible and cannot be done in the Maker Arts Space.

When submitting, please provide a detailed description of your project to qualify for free printing! Emails which have no explanation of a project will not be reviewed.

Once approved, your file will be given to a student lab tech who will set up your print.

File Format

To print a file, it must be exported as a Standard Tessellation Language file, with an STL extension (.stl). This .stl file must be watertight with manifold edges and no inverted triangles. Files can be fixed for free using a cloud service such as Microsoft's 3D printing platform netfabb: <https://netfabb.azurewebsites.net/>. If the .stl file you give the Haverford Maker Arts Space is not compatible with our printers we may use software to attempt to repair it, in which case we will notify you first. There are other file formats which work but if you are starting out start with the most common, the STL.

Ultimaker 5s

The lab has three Ultimaker 5s. The 3D model must fit within the build envelope that is *Left/Right Nozzle (single material)*: 330 x 240 x 300 mm (13 x 9.4 x 11.8 inches)

We use Cura to process files which gives us very specific control of infill (density of 3D print) and support structure. We will generally attempt to use as little filament as possible, so if your structure needs to be durable please let us know. We will assume it is a prototype/proof of design unless told otherwise.

Form 2

The form 2 is a desktop SLA Stereolithography printer. It's build size is 145 × 145 × 175 mm (5.7 × 5.7 × 6.9 in). This is a high definition resin printer. It is accessible but it can only be used after explicit approval from the Maker Arts Space technician.

What materials are available?

PLA plastic (limited colors, please inquire), Photopolymer Resin for Form 2

How much does it cost?

3D printing for academic, clinical, and research projects for Haverford students is currently free. We will, however, ask that students who frequently request use of the 3D Printers supply the lab with filament. Email dwatson1@haverford.edu about what kind and where to buy filaments.

Do you have to be there for 3D print set up?

Unlike a laser cut job where the Maker Arts Space requires you to be present for the duration of your laser cutting a 3D printed job request does not require this. However, if you are interested in the set up of a 3D print you are welcome to be there. If you are interested in learning how to set up your own prints there is more information on that further down the page. Note that jobs will not be set up 30 minutes prior to closing of Open Studio Hours. If you show up at 7:35PM and the space closes at 8PM the student workers will not set up your job that night.

Other Filaments?

The Maker Arts Space provides PLA for free. Both the Ultimaker and the Prusa are capable of using a variety of other filaments. On a case by case basis we can use other materials if the job requester purchases the filament. Before you do this let us know what brand, diameter, and where you are purchasing the filament from.

The Ultimaker currently has the capability to print in PLA, PVA, ABS, CPE, CPE+, Nylon, PC, PP. *Please Note: PVA soluble support material only works in combination with PLA and Nylon build materials.*

Additional Notes

- Please allow some time for the model to be reviewed.
- Be prepared to make changes to your design if we are unable to print it.
- Please ensure that file sizes remain under 100MB.
- Please mention in your email the size you want your design to be. It should be that size already but it is possible to export a design in inches when you meant mm and we won't know what you meant to do.
- The mesh or surface of the 3D model must be watertight and a solid. More technically, all faces of the object must construct one or more closed volume entities. When the faces are not fully closed, they produce gaps or holes in the model and those holes and gaps will keep the model from printing correctly.
- It is not the responsibility of the student workers to design printable projects; however, if interested in learning how to design a model using a CAD or 3D modeling software there are workshops available which address these skills. Please check the Haverford Maker Arts Space website for the workshop schedule.

Learning How To Use 3D Printers

Alternatively to submitting a job request you may gain access to using the 3D printers during the open studio hours. You gain access through training and once you show a competency with the 3D printers you will be granted use of machines during Open Studio Hours. You may not attempt to use a 3D printer if you have not yet been trained even if you have prior experience.

Please do not start a job at the end of the Open Studio Hours. If there are 30 minutes or less in a shift please wait until the next open studio to begin a job. It is your responsibility to ensure a 3D print works. Most failures occur in the beginning of a print. As someone setting up the job you must catch these failures and stop the print so it does not cause damage to the 3D printers.

If you start a print during Open Studio Hours you must stick around for at least 15 minutes after the print starts. You must do this to again be present while a print is starting out. If you choose to leave the print once it is running, after those first 15 minutes, you must inform the technician or a student worker. If the job is very big and complicated the student worker or technician might choose to pause the print at the end of their shift rather than let it run all night. In which case I will resume the print following morning.

Please get special permission from the technician if your job is going to run longer than 15 hours.

Training will be comprehensive and after initial lesson expect several walk throughs where trainer and yourself can go through the process of setting up a print together. Once you feel you can run the machine safely on your own please request access. The Maker Arts Space technician will ask you to set up a print without any assistance. Upon doing this successfully you will be granted access to that specific 3D printer (not all 3d Printers as some require different training).

To schedule a training contact dwatson1@haverford.edu