3D Printing Software

AHG 2015 Preconference Session

# Key Questions

This section of the document outlines key questions and identifies significant features of interest.

## What are the key types of software and file types?

The STL file is the primary file type for 3D printing. It is a file that describes the topology of a shape but does not include details regarding size (this means STL files can be easily scaled to print at different sizes). STL files can be created and modified using 3D CAD software packages. There are free modeling programs such as Tinkercad, 3Dtin, and 123 Design, as well as free open source options such as Blender which was released by a Dutch animation studio, is very powerful, and contains many features characteristic of high-end 3D software.

Most printers will come bundled with either a proprietary app, or an open source option. The 3D printing software will open the STL file and allow it be scaled, rotated, and moved around the bed. In addition, the details for printing can be set. Layer height, printing speed, temperatures of the extruders and of the bed, as well as special instructions such as “pause at z=” which can ensure the printer pauses at key points in the build so you can change filament, insert parts, or take other actions before resuming.

If the printer is not connected to the application (via USB, wifi, or mobile) then the gcode (a text file of x,y,z coordinates that instructs the printer how to move) can be saved to a SD card for printing directly.

## The AutoDesk Collection

### Download 10K+ free 3D models, or use free 3D modeling apps to create your own!

This suite continues to grow so the list below should be considered a snapshot. It is likely to evolve.

 [Tinkercad](http://www.tinkercad.com/) Get started with 3D modeling

 [123D Design](http://www.123dapp.com/design) Easy 3D modeling for Web, Mac, and PC (offers more control than Tinkercad)

 [123D Catch](http://www.123dapp.com/catch) Generate 3D models from photos (must have good light and even coverage)

 [123D Sculpt+](http://www.123dapp.com/sculptplus) Create 3D sculptures on iPad

 [Meshmixer](http://www.123dapp.com/meshmixer) The ultimate tool for 3D mashups (great for analyzing and adding supports)

 [123D Make](http://www.123dapp.com/make) 3D models from 2D slices

 [123D Circuits](http://www.123dapp.com/circuits) Design electronic projects

 [Tinkerplay](http://www.123dapp.com/tinkerplay) Design 3D prints (mobile app)

3D Printer Materials

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## What kinds of materials can be used with a 3D printer?

The kind of material that can be used depends on the characteristics of the printer. Most models will be able to print PLA or ABS. Some of the specialty filaments require a printer capable of reaching higher temperatures, or need the bed to be heated, or need additional accessories to be in place. *Cost/kg are estimates only!*

|  |  |  |
| --- | --- | --- |
| **Filament**  | **Specs** | **Key Characteristics** |
| PLA $35 per kg  | * Extruder temp 180-220 C
* Bed temp 20-55 C
* Adhesion – Painters Tape
 | * Minimal warping and shrinking
* Can be brittle so not as good for high strength
* Does not need heated bed
 |
| ABS $35 per kg | * Extruder temp 180-220 C
* Bed temp 20-55 C
* Adhesion – Hair Spray
 | * Very strong and easy to print – a durable plastic
* Larger pieces may split during cooling
* Can be smoothed with acetone vapor bath
* Prefers a heated bed
 |
| HIPS $25 per kg | * Extruder temp 220-230 C
* Bed temp 50-60 C
* Adhesion – Tape/Hair Spray
 | * Can be sanded, glued, primed, and painted
* Is very lightweight
* Is soluble in Limonene but ABS is not, so can be used to print support
 |
| Nylon $20+ per kg | * Extruder temp 235-270 C
* Bed temp 60-80 C
* Adhesion – Glue Stick
 | * Requires glue stick on bed to ensure adhesion
* High strength can be combined to create different specialty filaments
	+ Alloy 910 produces very durable model
	+ PCTPE produces a high strength yet with flexibility - prints can twist and bend
	+ Good for wearables and electronics
 |
| Flexible$30-60+ | * Extruder temp 220 - 235 C
* Bed temp 20-55 C
* Adhesion – Painters Tape
 | * Requires a separate accessory for extruder
* Requires glue stick on bed for removal of print
* Creates soft elastic models
 |
| Conductive$80 per kg | * Extruder temp 225-260 C
* Bed temp 90-110 C
* Adhesion – Tape/Hair Spray
 | * Requires cleaning filament as post-printing step
* Modify percentage infill to modify resistance
 |
| Metal$100 per kg | * Extruder temp 190-210 C
* Bed temp 20-50 C
* Adhesion – Painters Tape
 | * Fill series are 80% PLA and 20% fill
* Can be polished like finished brass, copper, etc
 |
| Laybrick $140 per kg | * Extruder temp 180-220 C
* Bed temp 20-55 C
* Adhesion – Painters Tape
 | * Stone filament for architectural models and organic shapes
* Requires a .5mm nozzle
* Does not need a heated bed
 |
| Wood$200 per kg | * Extruder temp 175-250 C
* Bed temp 30 C
* Adhesion – Painters Tape
 | * Is very soft when hot and takes longer to cool
* Higher temperature produces darker color
 |

Note that filament quality directly impacts quality of print – always consult manufacturer’s recommendations!