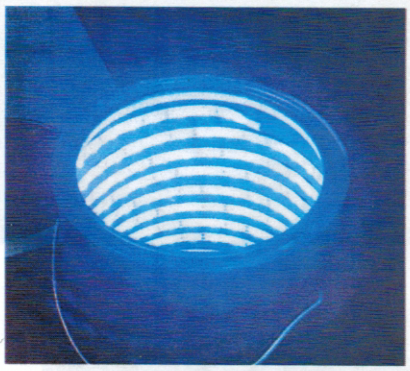
Basics of 3d Printing, Part 2

By Ken Mosny

DLP printers are readily available and the prices are quite competitive. For introductory printers the specs are all essentially the same, so I bought the cheapest one, a Voxelab Polaris® 2K Color LCD, for under $200. This model is now obsolete. I expect that the introductory printers will keep a price point around $200-$300, and get better with new models introduced about once a year. The technology is evolving rapidly so look at the moving target of prices and features when you buy. After adding a light can, resins, solvent and ventilated work station, my actual start cost was about $350.

The smallest build volume right now for introductory printers is about 3"W x 5"L x 6"H and goes up from there along with the price. My printer has a 50µ resolution is good enough for most detail work. Some entry level printers now have 18µ resolution. In other words, the smallest features that can be printed almost a third the size of what your are seeing today. This means better surface finish and crisper detail.



Curing and Rinsing

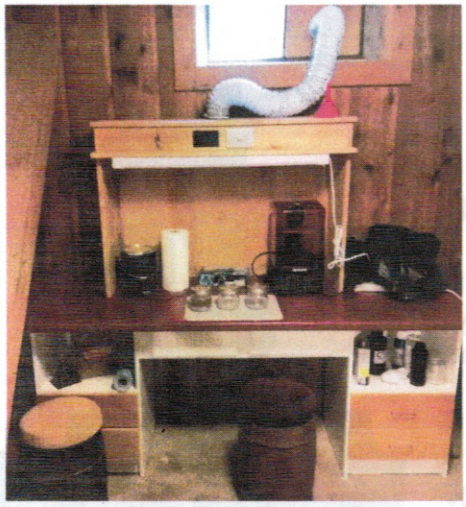
Your fresh from the printer 3d parts need to be cured with UV light. 5 minutes in bright sunlight will work or you can buy rinse and cure stations costing as much as the printer, I built a light can using a 5m long 395nm UV adhesive light strip wrapped inside a clean gallon paint can. I added a solar powered display turntable that spins the part to even exposure.

After the parts come out of the resin, the uncured resin needs to be rinsed off. Rinsing is done by swishing parts in 99% isopropyl alcohol (or other solvent specified) in three jars of successively cleaner solvent. Solvent is reused by putting the jars in the light can and filtering out the cured resin jell which forms with a paper towel. There is enough loss of the solvent that I just keep filling the cleanest jar and pour that solvent into the next dirtiest jar.

IMPORTANT: Uncured resin is considered **hazardous materia**l. All unused resin, paper towels with resin on them, empty resin containers, used solvent and so forth must have the resin on or in them cured by exposing them to UV light until the resin is cured. Only then can you throw them in the trash. Old solvent, even if it is water, can be left outside in the sun to evaporate and the residue discarded.

Keeping Clean

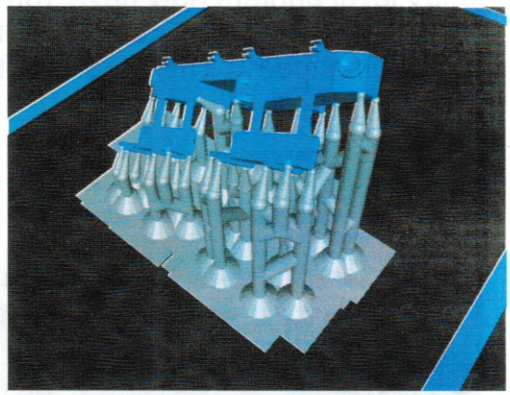
You will want a dedicated area for printing because printer resin is messy. In spite of your best efforts, the sticky resin gets on your gloved fingers and transfers all over. It is handy to have a slop sink such as a laundry tub nearby for washing up. Use disposable gloves to keep the resin off your hands. You will use lots of paper towels. Soap and water will not get resin off but hand cleaner with a lot of scrubbing will. I use Orange Goop®. You will constantly be wiping down the printer, drawer handles, door knobs and light switches with alcohol and paper towels. There are water wash resins which don't need solvent clean up.



Printing Workstation

This is a dedicated area for printing because printer resin is messy, sticky, hazardous stuff requiring stinky solvents for cleaning parts. Absence of sunlight is critical to prevent unwanted curing of the resin so a windowless room is ideal. Good electric lighting from this LED cabinet light is, however, essential to inspect parts. I built this workbench from used cabinets and counter top purchased at our Habitat for Humanity salvage store. The wood ventilation box on top was built from scrap lumber and has two bath vent fans ducted to the outside. The basement window above is on the north side of the house and what sunlight that comes in seems not to cause curing problems. It is handy to have a slop sink such as a laundry tub nearby for cleanup.

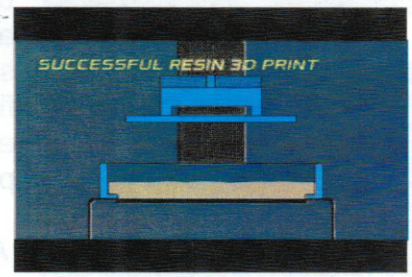
Using Slicing Software
Adding Supports



In order to support the model during printing, rafts and supports must be added to suspend the part in the resin. This is done with slicing software like Chitubox®.

Generally it is best to orient the part at an angle to avoid printing large flat areas at once. The printing process is a "tug of war" because each layer adheres somewhat to the bottom of the resin tank when the support plate lifts. Large areas can adhere sufficiently to the bottom to tear the part as they are lifted.

The first supports are the square rafts in the picture. These are fully cured flats of resin that adhere the part fully to the support plate. The part is printed upside down from the picture and the purpose of the rafts are to sufficiently stick to the support plate. This pulls the part from the bottom of the tank as it is formed layer by layer.



Next come the posts. These and the rafts are automatically formed by clicking on the point where you want to attach to the part. You can adjust the size and angle in the software, and remove or add them as you go. In general, thin areas need more posts than thick ones, and if in doubt, I add more. You will have many failed parts as you gain experience.

Last, the model is sliced. The slicing cuts the part into tiny cubes' 50µ (0.002"), for my printer, or less in size. Each cube is the size of a pixel for the printer screen. As the part is built up layer by layer, each cube is exposed to the UV light passed thru the tiny squares, pixels, of the LCD screen on the printer.

3d Printers

Voxelab® https://www.voxelab3dp.com

Elegoo Mars® https://www.elegoo.com

Amazon® https://www.amazon.com has lots, sometimes the manufacturer direct is cheaper.

Software

Fusion 360® free https://www.autodesk.com/products/fusion-360/personal

Chitubox® free https://www.chitubox.com/en/download/chitubox-free