

## **3D Printing on the Baden, Vogt & DeSmet A Clinic for Model Railroaders**

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Well, the Gateway-X Virtual Convention of the NMRA for 2020 is now over, and I'm looking for something new to do, and 3D printing is where I am headed. I don't yet know how I am going to organize this section, or when it will be really ready for sharing, but I already have learned some things.

I started out in early May, 2020, and visited YouTube where I saw some encouraging ideas. My first attempt was to make room dividers for the "Randomizing LEDs" project for the "Amazing Arduino Animations" clinic described above. I used free "TinkerCAD" software and the "makeXYZ" service bureau to print the design, and eventually it worked.

The project was really simple, just a bunch of extruded rectangles for floors, ceilings and walls, and it took me three tries to get something that worked. The makeXYZ service bureau folks were very helpful in understanding what I was trying to do and explaining where I was going wrong. I did learn that in order to have walls and ceilings that indeed are bonded together, the top and bottoms of the walls must be extended through their corresponding floors and ceilings, not just to them, but through them. They also need to be thicker than the 1.0mm I first used (2mm worked, but I want to try 1.5mm in the future). The thing that I didn't like with the service bureau was that it took about 2 weeks to fabricate and deliver my design, and in many cases their printer network would decline to fabricate my design at the quoted price. Also, be aware that service bureaus charge based on the amount of resin used to create the design, and how fast you want it done.

I had hoped that the St Louis County Library would have a 3D printer that I could try, without using a Service Bureau or buying one myself, but they had none. The St Charles Library's web site indicated that they did have one, but that was only occasionally, when aficionados taught an evening clinic, and these were not particularly oriented to model railroading. St Louis City and University City libraries each had one, but they were not that conveniently located to me in Florissant, and at the time the libraries were closed due to COVID-19. So if I wanted to cut my turn-around time, I was going to have to buy my own 3D printer.

I first purchased a Monoprice "Cadet" 3D Printer from Amazon for about \$250 because it seemed really simple, and I was attracted to their claim that the bed was self-leveling (that feature never worked for me). But the first one was Dead On Arrival. Monoprice Customer Support's Chat Line said, "Send it back to Amazon for replacement", which I did. The replacement worked for about a week before failing, and again, Monoprice

said to send it back; I was extremely disappointed with their technicians, as they made recommendations that someone with a background in Computer Science, as I have, would know to be incorrect

My next attempt was to purchase an "Ender 3 Pro" from Amazon, again for about \$250. It arrived on a Thursday evening, and on Friday morning, before ever unboxing the unit, MicroCenter sent out an email offering them for \$199. So, I returned the unit to Amazon and bought one from MicroCenter (I subsequently learned that the "Ender 3 Pro" is scheduled for replacement with a "Version 2" model containing some upgrades, but they are not shipping, just announcing, and since the aftermarket for upgrade parts is extremely rich, I decided to go for the "better deal" now).

The Ender 3 Pro unit comes "semi-assembled", but I had it together in about an hour. The instructions were illustrated only with no textual instructions (think "IKEA"), but they worked (watching an "unboxing" video on YouTube would have made the task a bit easier, but it wasn't really that difficult). I leveled the bed manually, which was easily done. I tried their test print, a "Fortune Cat", and it worked.

Creating your own 3D models of anything more difficult than building interiors is difficult, but fortunately there are literally millions of designs for free on web sites such as <http://www.thingiverse.com> and <http://sketchup.3Dwarehouse.com> and several others. I wanted some motorcycles, so I did a web search, found some and downloaded them in ".STL" format ("STereo Lithography"). TinkerCAD was a feature that allows one to import 3D models and scale them, so I imported a Harley model file. A motorcycle is about 8 feet long, or about one inch in HO scale, and is full of fine details, such as spokes and handle bars, but I gave it a try. It ended up as a pile of mush, and filament backflowed around the "hot end" of the printer, necessitating a full clean-out. The moral of this story is "Not all free images will print well when scaled down to HO".

Now we come to some recommendations for YouTube videos which got me back up and running. There is a YouTuber whose moniker is "Tomb of 3D Horrors" and I liked him a lot. He has a video on cleaning out on the Ender 3 at <https://www.youtube.com/watch?v=dlkjR2Ytx-g>. I started by heating the hot end to 210 degrees C. I followed the instructions, including turning the nozzle all the way in, and then backing it out 3/4 of a turn before fully inserting the Bowden Tube and filament, then tightening the whole thing up.

I have had differing levels of success with different brands of PLA filament. The stuff from SHENG TIAN (some gold and some purple sold by ERYONE) have been good, but some from GizmoDorks were brittle, poorly wound and tended to break during printing. Metallic filament from MIKA3D were in the middle; they looked great and did not break, but the winding was poor, which necessitated pulling enough from the reel to complete the job prior to starting, or to visit the printer hourly to make sure there was some slack in the reel along the way.

A YouTuber, "Just Vlad", is a fountain of knowledge of Ender 3 Pro upgrades, and I purchased several, including replacement connectors surrounding the ends of the Bowden Tube, a "Capricorn" Bowden Tube (BTW, the Bowden Tube length of an Ender 3 Pro is 1/3 of a meter), "TL Smoothers" (diodes that eliminate back-EMF when the steppers change direction, a bracket for the top end of the "Z Screw", and a metal extruder assembly to replace the plastic one (be advised, the one I purchased from AMAZON, (ASIN:B089YN54Z8) used a different connector for the Bowden tube at the cold end, and did not document that there was a difference, and I lost a week of productivity while I figured out what was changed (the new unit used a small black "press-in" plastic fitting instead of the screwed in metal fitting which originally came with the unit).

"Just Vlad" also has several videos where he prints useful parts for the Ender 3 Pro, and I intend to print some of them myself, including a back plate for the display, clips for the cable from the CPU to the display, a shim for the Z axis motor to eliminate stiffness in the Z-axis threaded rod, a tool drawer, a filament advancement knob, and several others; I like this guy.

More to come in the following weeks.

PS: Luke Hatfield is mentioned as a YouTuber who is respected for Ender 3 Pros, but I have yet to review his videos.