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3D printing – Is it Good Enough for Scale Model Boat Builders?

Many people think that 3D printing is the latest and greatest technology. However, 3D printing has been in use for over 25 years. (The 3D printer was invented in 1983.) Only lately have 3D printers become affordable. I thought that as someone who saw this evolving technology happen, I would take a new look at it and see if there's any benefit to using 3D printers in the scale model boat hobby.

First, let me explain a little bit about my experience with 3D printing. Back in the early 1990s, my position in the company I worked for involved buying software and hardware to support computer aided design. After I ordered complete new hardware and 3D (solids) software for the company, the next step was to look into the 3D printing. I traveled to trade shows and other companies that had 3D printers. These 3D printers back in the 1990s typically were priced at \$15,000 and much higher.

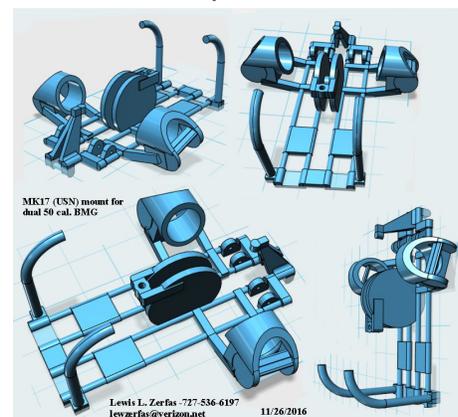


Latest Experience with 3D Modeling and Printing

Jumping forward to the last several months, but I took a fresh look at 3D printers as some of the parts that I wanted to make for my model boats were too complicated and time consuming and to fabricate by hand.

Several months ago I ordered a set of 3D printed parts for a 1/20 scale PT boat gunboat model. As all American PT boats had two dual machine guns, the set of parts included the mounting ring, pivot, the mounting frame assembly, and the two machine gun barrel with receivers and belts of ammo. It was quite expensive for these parts, about \$95.00. In order to complete the PT boat as a gunboat I needed six sets of only the mounting frame assemblies. Not wanting to pay \$300 for the sets and throw away most of the other parts, I decided to see how I can make my own 3D files (*printout, right*) and have them printed myself.

I have come to the opinion that the common 3D printers that are out there today are not really usable for making most scale model boat parts. That being said, there is a way to have very complicated parts made, and not be budget breaking expensive. I have broken this



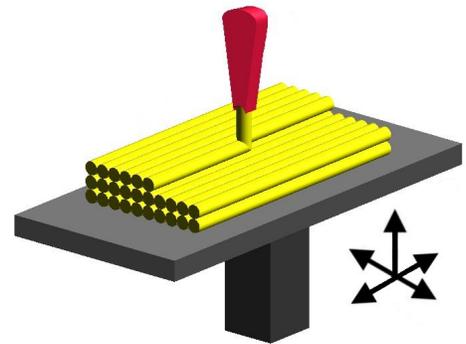
report to follow the sequence of making a model parts from paper to physical parts. As I go on I will include do's and don'ts as well as alternatives.

3D Model Overview

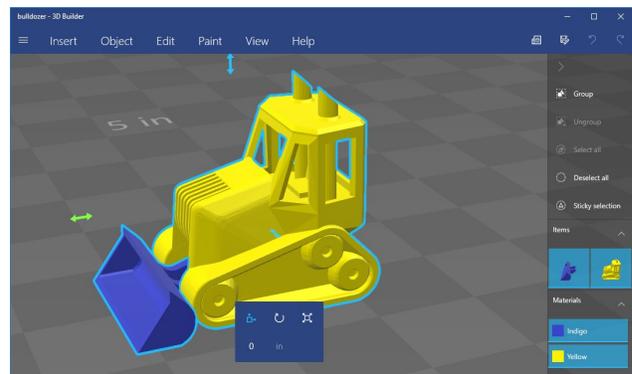
A brief overview of the 3D modeling process: the 3D model that is made to the exact dimensions of the part. (The part does not have to be one particular item; it could be an assembly of many parts that are physically attached to each other. Take for instance a gun which is made up of many parts put together to form one assembly group. All this could be one solid three D model.)

A. Taking the Part from "Paper" to a 3D model.

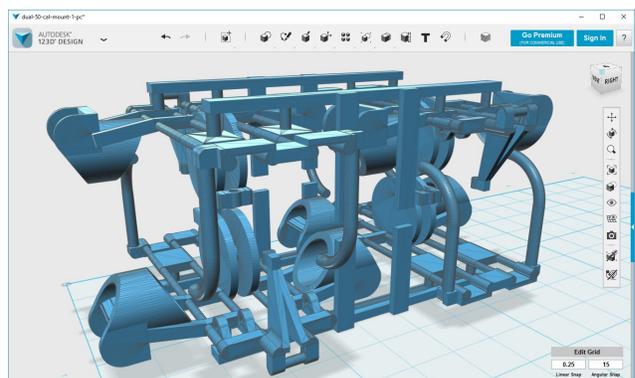
Many of us when building a new part we either get the information from either a drawing or a photograph. Sometimes we may sketch the part(s) and work from there. With 3D printing one only needs to have a solid or 3D model. When the 3D model is finished one will need to generate a "STL" (stereolithography) file. The STL file from the 3D model is then sent to the printer. The printer's software slices that 3D model into very thin sections horizontally. The printer then and takes each section, one at a time and builds up the part from the bottom to the top (*drawing, right*). This would be like taking a block of sliced Swiss cheese, sliced by slice, piling it up on a plate in the correct order.



The first step involves making 3D model. The model builder has the choice of either making the 3D model himself or contracting out to a designer to do that. This decision is usually made depending on the builders experience with using computer aided design (CAD) software. One of the software packages that is fairly easy to use comes in Microsoft Windows 10 and is called "3D Builder" (*picture, right*). 3D Builder is very limited to what can be created. If you want to use a better 3D software package, fooling around with 3D Builder will help him gain a mind set on how 3D software works.



A better 3D software package, one that I use, is Autodesk's "123D Design" (*picture, right*). It is free for noncommercial use. I have not seen any limitations to this software, but it does take some time to get used to.



Another free software package is called the "Blender." I tried it but it has a very sophisticated interface and I did not want to learn how to use this kind of a system just to build a model parts. If I needed Blender for employment, that would be a different story.

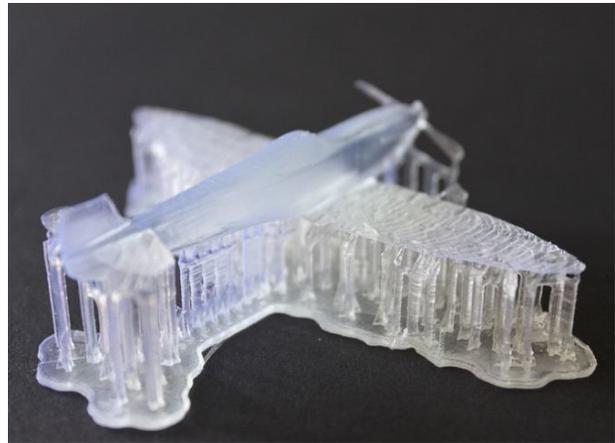
Pre-printing requirements - selection of materials for the part.

There are considerations for what you want to part to look like as well as strength, depending on the function of the part. As the parts that we built for our scale model boats have to be somewhat durable because they are frequently handled the material has to be a somewhat durable. In some instances the part may have to be very durable to handle loads.

B. Selecting the printing a process.

Low end 3D printers.

All low end 3D printers (some starting under \$200) use spools of filament which melts and is applied to a plate. Either the plate moves back and forth or the head move back and forth to create each layer. To build up the next layer, the plate either drops down or the head moves up a very small increment. This continues for subsequent layers until to the part is done. The resolution and finish of these printers are not very good. The right now, the very best (expensive) ones are down to about 50 microns (.002). At 50 microns even the smallest parts will take several hours to make. The bottom of the low ended printers has a precision of about 100 to 200 microns (.004 - .008). The worst part about these printers is that if you have overhangs (think of an inverted pyramid) the printer usually needs to add a support lattice (see *the airplane at right*) in order to prevent sagging of subsequent layers. All of this must be broken away after the park is made.



Also the finish of the parts more likely than not requires sanding or filing, and the part may break depending on size, material, fill style, and support lattice.

Don't trust the ads for 3D printers, even the ones that has the names of common hobby tools we use. I think that people in the scale of modeling hobby will not be satisfied with these printers. The cost is too high for what you get. The printers to have are not the only cost. The filaments are also expensive, some being unique to the printer.



Many of these printers foul up (*right*) making bad parts. They do require good alignment and to be kept clean. There are also hazards concerning the fumes from some of the common filaments.

High end of 3D printers (usually a service).

To get a high quality part 3D printed my recommendation is to go to a good printing service. So far as I am getting very good service and quality from Shapeways (Shapeways.com). Let me give you an example: I created a part (3D model) and sent it to a local shop that has high end printers. The quote that came back: \$41.00 plus handling and shipping for one part. An online service wanted \$50.00 for one part. Shapeways wanted about \$10.00 for 1 part (including S&H).

Shapeways will print your model or you can go through the thousands of already completed models on their site. There is a fair amount (and growing) number of completed models on Shapeways. Once you either choose from their listing or upload your own model, you will get the part(s) in the mail, usually a week or two).

These high end printing and services that I am talking about use a totally different printing process. Where the low end and printers need to build a lattice to support subsequent layers, high end printers used us some sort of powder or wax which is blown or melted away after the parts are removed from the printer. The highly and printers do not use filaments, but a liquid that his hardened with lasers. The result is having parts that are considerably better concerning the finish and detail as well as strength. All that remains to be do is some simple part cleanup.

A good example of high quality 3D printed parts (high end printer) is the set of 50 Cal PT Boat guns (*right*). Those pieces are t 1/20 scale and available from Shapeways. The designer is Pat Matthews, who makes fantastic model boats, some even published in Ships in Scale magazine. This set cost about \$95 unpainted. (Those “bullets” are about .025 diameter.)



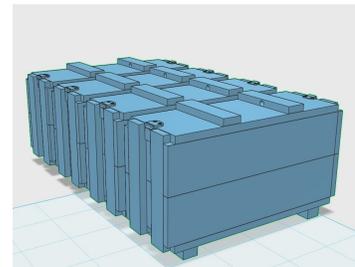
For the processes above, I did not go into looking at other 3D software packages. The three 3D software modeling packages that I've mentioned were the basic three that are commonly available and free. I did not mention all of the different types of 3D printers, as there are many different technologies. What I did focus on is what seems to work good for this model builder.

You Can't Make Your Own 3D Model?

Not everyone has the time or CAD experience to use 3D or Solids software. Irwin S. at the Tampa Bay Ship Modelers Society notified me that there are 3D designers at fiverr.com. Just need to search for 3D on their site. Prices seem very reasonable, starting at \$5 on up, depending on complexity. I looked at the feedback ratings and they look very good.

Bottom Line on Low Cost 3D Printers – My Opinion

Unless you just want to play around, skip buying your own 3D printer. I priced what I thought was a good one. Cost was about \$400 plus filaments. Let's say it comes to \$500 (tax, S&H, etc.). My ammo boxes – set of 4 (*right*), about 1-5/8" long, cost about \$13 with S&H.



My dual BMG set of 4 (*picture lower right of page 2*) came to about \$27 with S&H. Both of these are my price as I uploaded my 3D models. They are also tough and flexible plastic, much, much better than ABS or PLA from the low end printers. If you buy someone else's, you might need to add ~25% (varies) designer's markup fee.

Check out Youtube. You will find many like a particular printer but you will also find a lot of bad reviews about that same printer. They just don't make the grade for good quality detailed parts.

I hope it would be helpful for that others in this skilled modeling hobby to get an idea of an alternate way of making parts.