3D Printing in the Amateur Radio Hobby

Turning Ideas into Functional Reality.

Kevin, W0AEZ. March 2025.

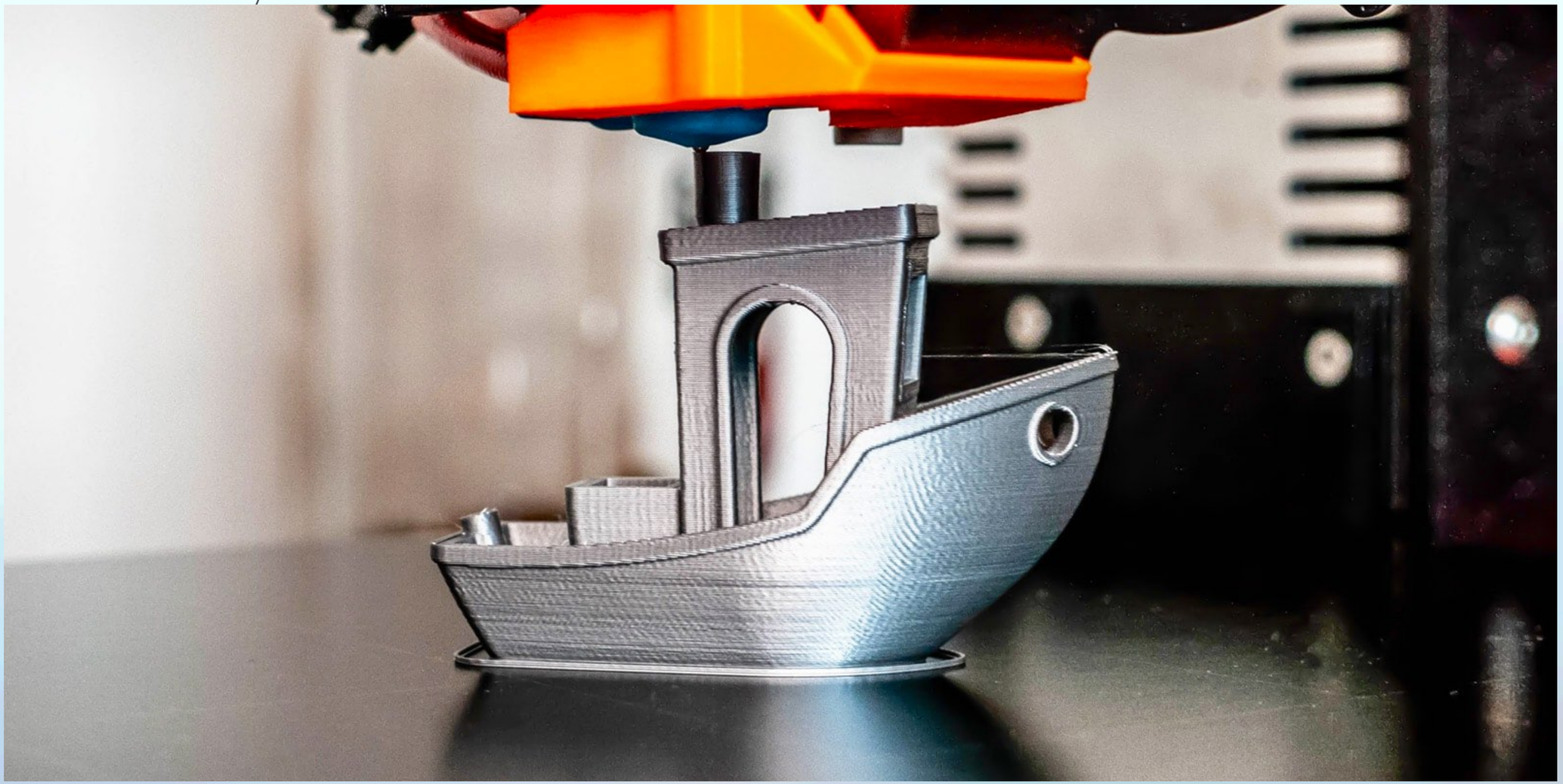
What is 3D Printing?

Basic Overview

- There are 3 common types of 3D printing, 2 of which are easily accessible.
- FDM (Fused Deposition Modeling). Works by depositing molten plastic one layer at a time. This is how the ‘standard’ 3D printer works. Very cost effective with fewer drawbacks.
- SLA (Stereolithography). Works by using a UV light to cure liquid resins. Very accurate and detailed, however brittle and not great for functional items. Large health and environmental concerns.
- SLS (Selective Laser Sintering). Works by using a laser to fuse powered material, such as thermoplastics and metals. Excellent for complex geometries.
- For the purpose of this presentation, we will focus only on FDM printing.

FDM Printing

A little benchy.



Source: https://clevercreations.org/wp-content/uploads/2021/10/ft-fdm-vs-fff-what-is-difference.jpg

FDM Pros and Cons

Pros

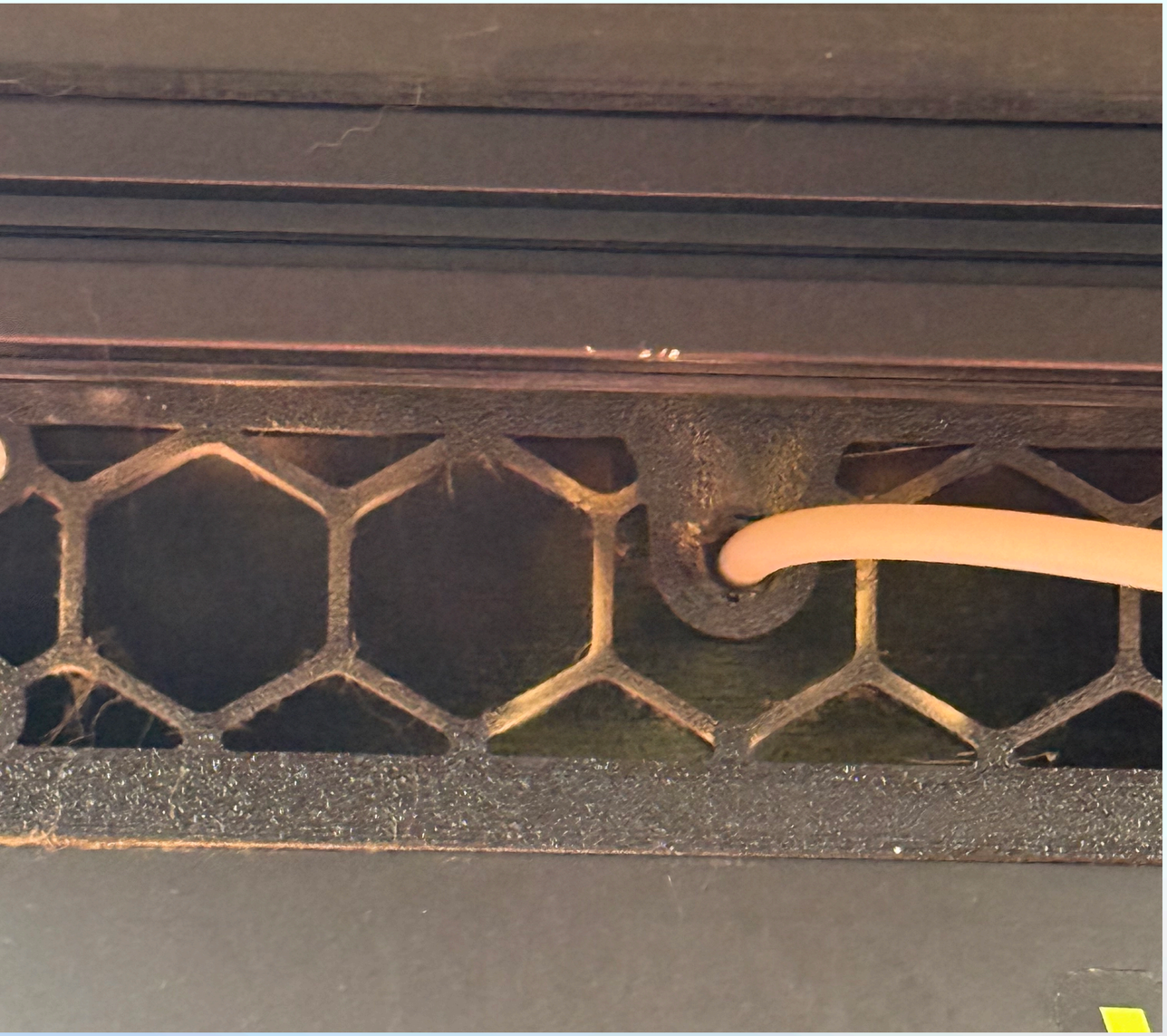
- Low Cost and widely available. Machines and filament from every manufacture and brand you can imagine.
- Wide capabilities and material variety. (PLA, PETG, ABS, ASA, TPU, etc)
- Easier to use and maintain. Lower barrier to entry with modern machines being more of a ‘click and print’ type of appliance.

Cons

- Lower resolution with visible layer lines. Fine for prototypes and functional prints.
- Warping issues with different materials, such as ABS.

Health and Environmental Concerns

- All filament, especially ABS and ASA, release VOCs and fine particles. Good ventilation is suggested, while a good filter can help. Long term effects are unknown, but some of the components released are listed as known carcinogens.



How does 3D printing fit in the Amateur Radio hobby?

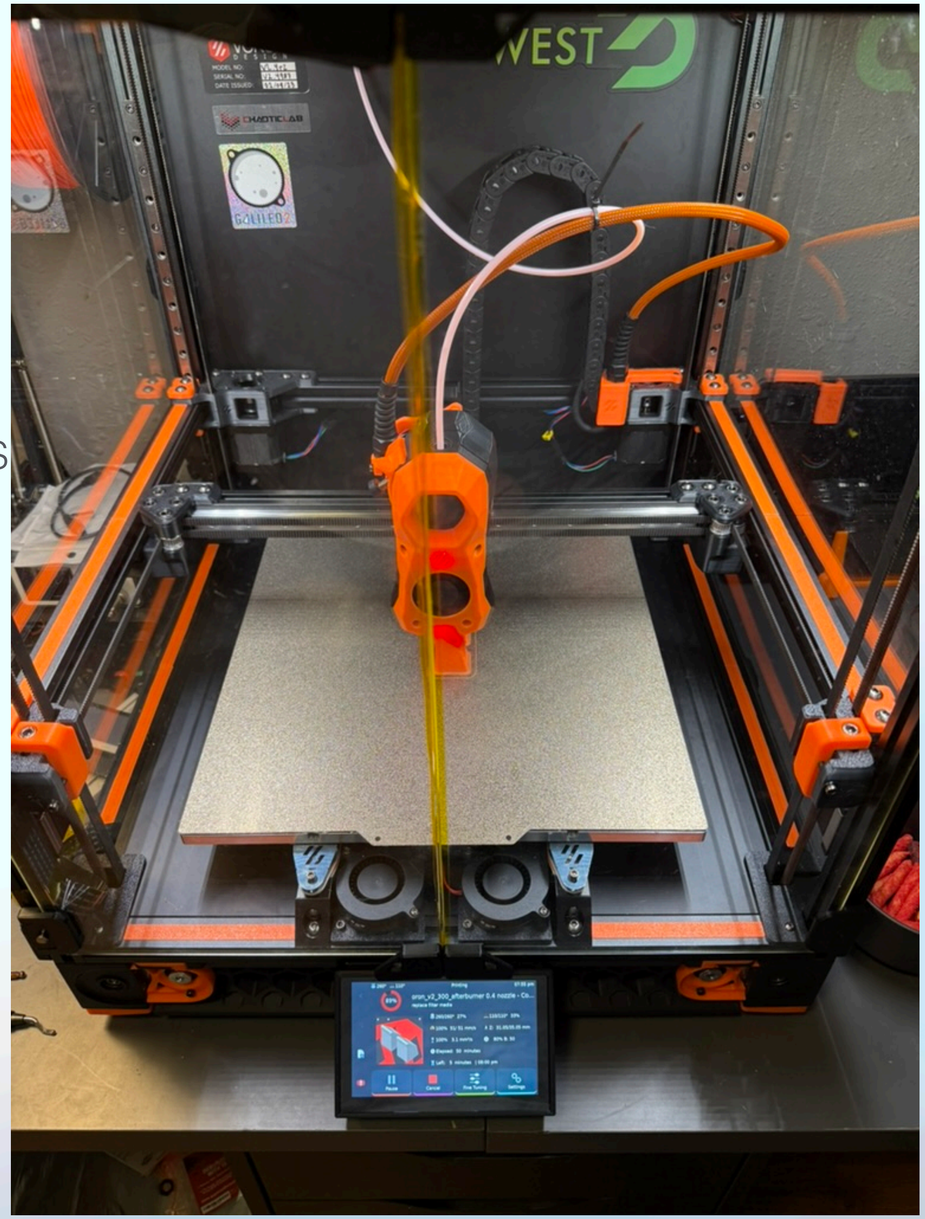
Why 3D printing for Amateur Radio?

Its the answer to problems we didn't know we had!

- Customization and creative problem solving! Think cases, antenna holders, shack organizers, mounts, etc. Your imagination is the only limit.
- Can be cost effective for custom solutions that don't have commercial answers. It IS cost effective for prototyping and development.
- Rapid iteration and personalization. Custom desk call sign? What about a carry case label?

My 3D Print Setup

- I use a Voron 2.4r2. It is an open source printer that personally. It is my reliable work horse that now has
- For product design, I use Fusion360.
- For my slicer software, I use OrcaSlicer. Previously I



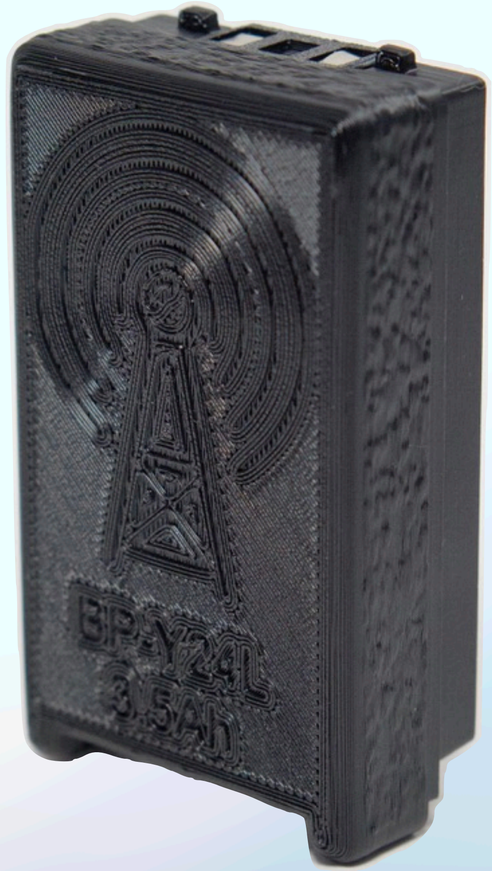
Some Examples of 3D Printed Radio Gear

A Custom Case for My NanoVNA H4

A Custom Case for Meshtastic Node

A Case for a QRP Battery

A Battery for a Yaesu HT



An antenna Mount

Design Challenges & Lessons Learned

Try, try, try, try, and try again.

- Materials used greatly affect durability! PLA gets soft in the sun and deforms. PETG is better, but still deforms in a hot car. I find ABS to be the best. It can survive 160F without deforming.
- You have to learn to design a product around the desired material. Tolerances are affected by the printing materials as well. PLA and PETG print without much shrinking. ABS shrinks about 1-2%, causing tolerance issues.
- ABS and ASA shrink! Meaning they can warp during a print. Understanding your printer, having a clean build plate, an enclosure, and the right hot end are critical for ABS/ASA.
- Don’t be afraid to scrap and try again. Nothing is perfect the first attempt.

The Big Picture

Don’t be afraid to try.

- The uses of 3D printing and 3D printed parts are vast, and only limited by ones imagination.
- The ability to create solutions for unique and individual issues makes 3D printing even more impactful. There isn’t a commercial solution to every problem.
- You may not be the only one with said issues. Don’t be afraid to share your creations and help the community as a whole.

The Big Picture for Amateur Radio

Suggestions for 3D printed Items

- Custom Cases for your equipment. A nanoVNA, an HT, an enclosure for a balun. These can be pretty straightforward to create.
- A Custom hand mic, or lightweight cw key for the POTA/SOTA enthusiast.
- Battery spacers for a custom battery you are trying to make.
- Special mounts for your radio, such as a mount for a remote head unit, or a microphone mount.
- Things that I can’t even think of! Scroll through Printables and Thingiverse and search ham equipment. There are dozens of pages of great creations.

Suggestions to Help You Get Started Into 3D Printing and Creation

Printing Materials

A Material Comparison Chart

3D Printing Material Comparison

Material	Strength	Flexibility	UV Resistance	Heat Resistance	Ease of Printing	Water Resistance	Common Use Cases	Health & Environmental Concerns
PLA	Moderate	Low	Low	Low (~55°C)	Easy	Low	Prototypes, decorative prints	Biodegradable but not easily recyclable
PETG	High	Moderate	Moderate	Moderate (~75°C)	Moderate	High	Functional parts, outdoor use	Releases VOCs, better ventilation needed
ASA	High	Moderate	High	High (~100°C)	Hard	High	Outdoor enclosures, automotive parts	Emits styrene fumes, needs good ventilation
ABS	High	Moderate	Low	Moderate (~95°C)	Hard	Moderate	Mechanical parts, enclosures	Releases VOCs, enclosure recommended. Needs good ventilation.
TPU	Flexible	Very High	Moderate	Moderate (~80°C)	Moderate	High	Phone cases, hinges, flexible parts	Can be difficult to recycle, some fumes when printing

Questions to Ask Before Printing

How to pick the ideal filament?

Parts to stay inside and out of the sun. A trinket. A quick fix.

- PLA

A part that needs to survive. Some weather tolerance. Durable

- PETG

A part where durability is key. Weather resistance is a must.

- ABS or ASA

Flexible parts. Maybe to make a seal or vibration dampener?

- TPU

Other Questions to Ask

How do I set up some slicer settings?

The part does not need to be weight bearing or strong.

- Walls: 3. Floor and Ceiling: 3. Infill Type: Dealers choice. Infill Percentage: 10-15%.

The part needs to withstand some beating, or needs some structure.

- Walls: 4-5. Floor and Ceiling: 4-5. Infill: Gyroid, honeycomb, 3D honeycomb, Grid. Infill Percentage: 20% Minimum.

The part has to be strong and take some abuse.

- Walls: 6 minimum. Floor and Ceiling: 6 minimum. Infill: Gyroid, honeycomb, 3D honeycomb, Grid. Infill Percentage: 30% minimum

These are starting suggestions. Make sure to experiment and find what works best for your situation.

You want to start making your own stuff

I’m glad your feeling inspired.

CAD Software.

- TinkerCAD*, OnShape*, OpenCAD, Fusion360*, SelfCAD, etc.

3D Printers

- Creality, Bambo, Prusa, Elegoo, etc.

Model Repositories

- Printables, Thingiverse, Thangs, Cults3D.

- * Free account available for hobbyists.

Thank You Everyone For Your Time

Q&A Time