Komodo Build Log

Sam Bucior
Updated August 18, 2019

Table of Contents

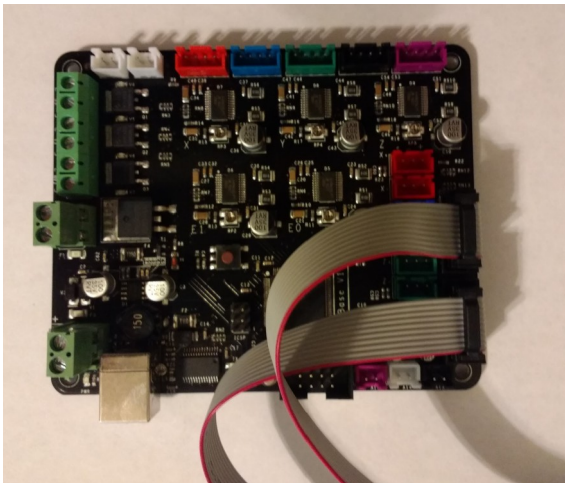
Summary

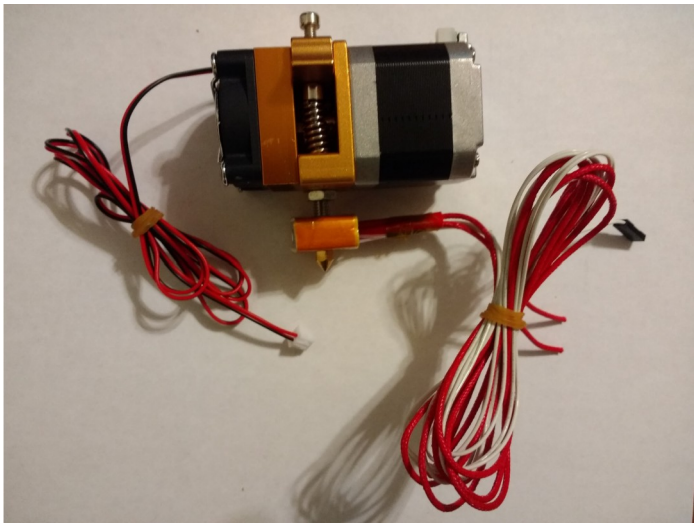
The Komodo 3D printer was designed as a large format 3D printer with a small footprint. Instead of moving the extruder within a large frame, the overall frame would move, enabling a theoretically infinite build length. Coupled with the relatively wide width and tall height, the printer build volume could accommodate objects the size of the coffee table. This form factor is somewhat impractical for FFF due to the price of filament and slow deposition rate. In the long term, the FFF extruder is intended to be replaced by a concrete extruder for large, fast, and cheap components.

April 2017

Finished Solidworks modeling and scoping analyses.

Ordered components including controller board, display, extruder, motors, frame components, bearings, etc. Installed firmware and performed basic functionality test with extruder.

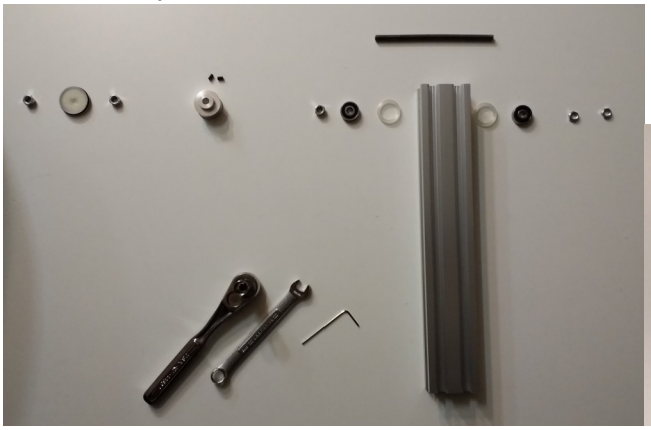


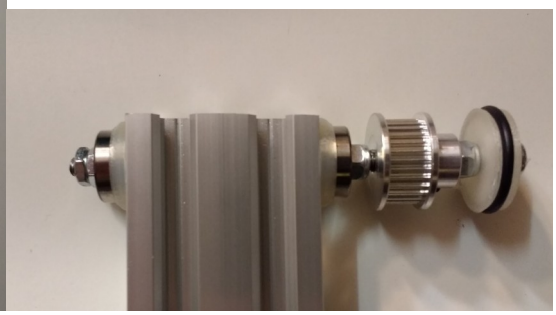


Prepared drawings for customized (cut, drilled, tapped, etc.) extrusions, leadscrews, drive shafts, and other components. Machined as necessary.

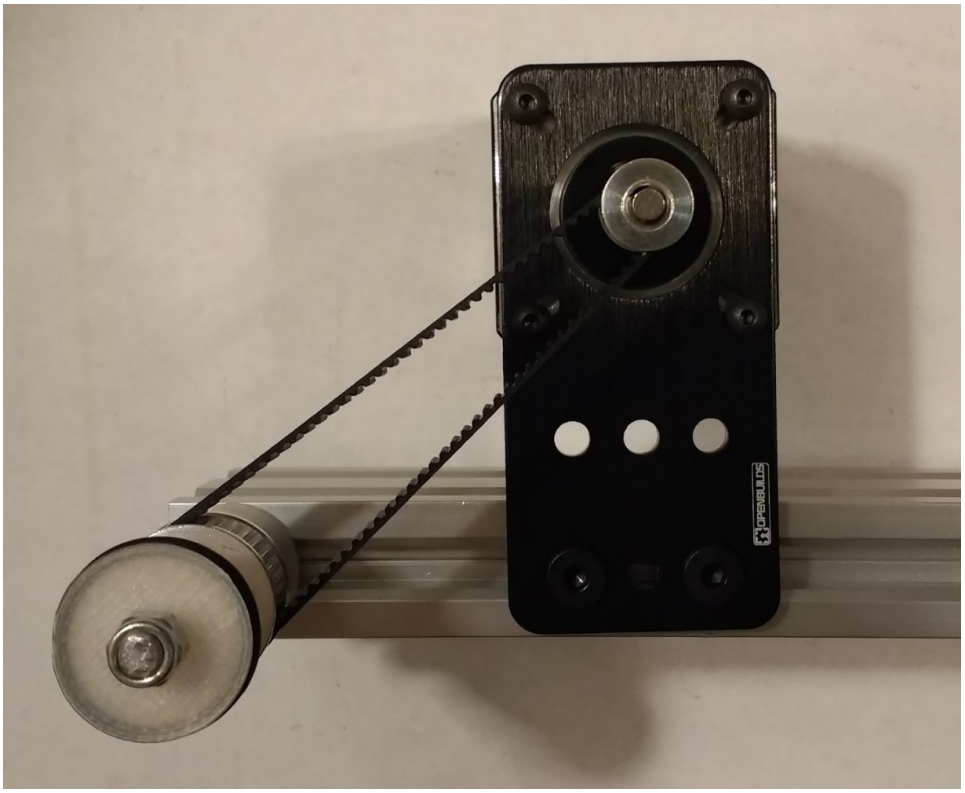
Assembled main frame.

Assembled y-axis friction drive shaft.

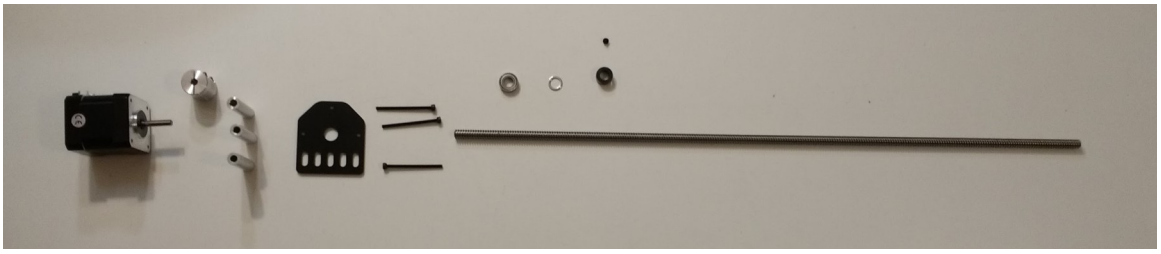




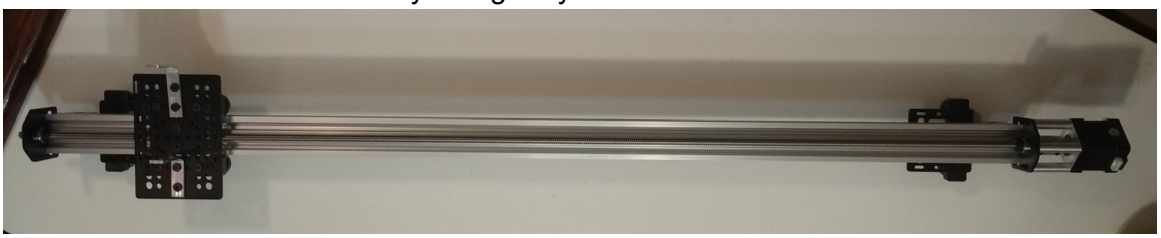
Installed y-axis motion assemblies on y-axis extrusions.



Assembled z-axis motion assemblies.

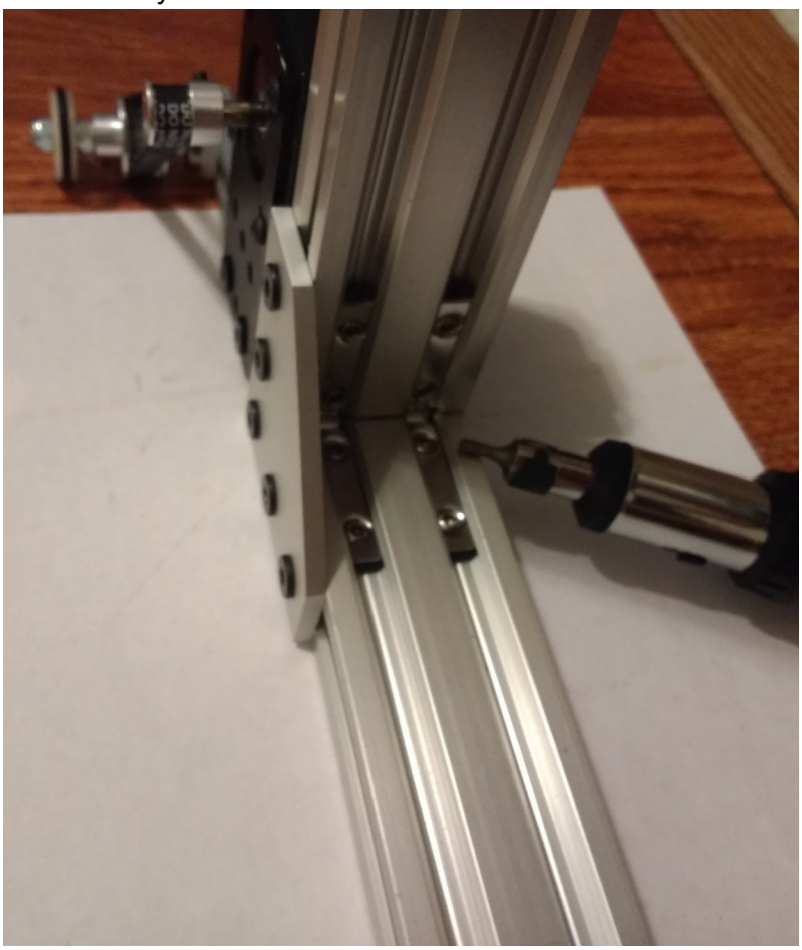


Installed x-axis motion assembly and gantry.



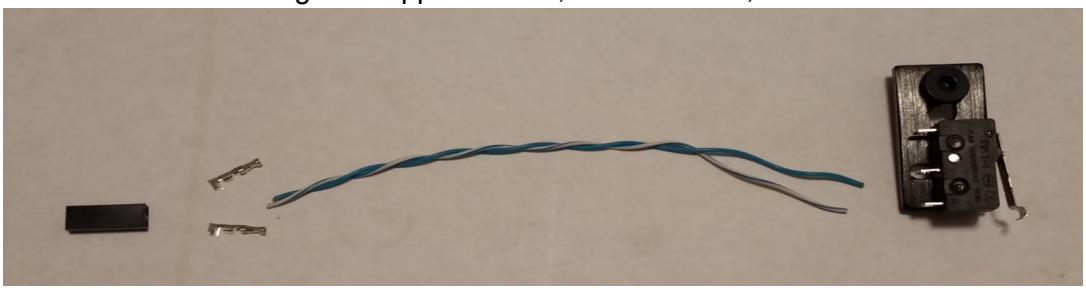
May 2017

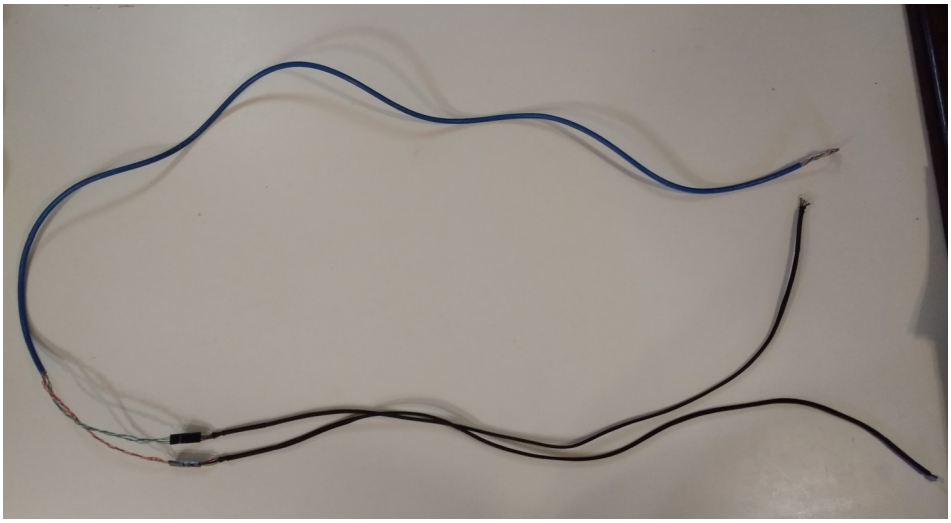
Assembled y-axis extrusions to frame.



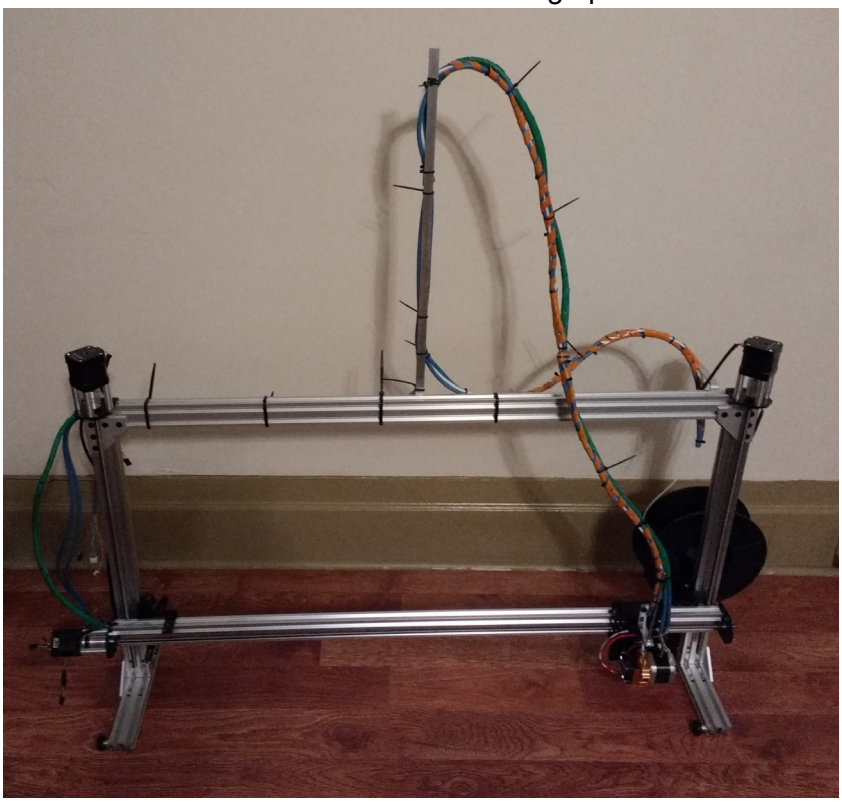
Installed extruder on gantry.

Created custom cabling for stepper motors, limit switches, and extruder heater and thermistor.



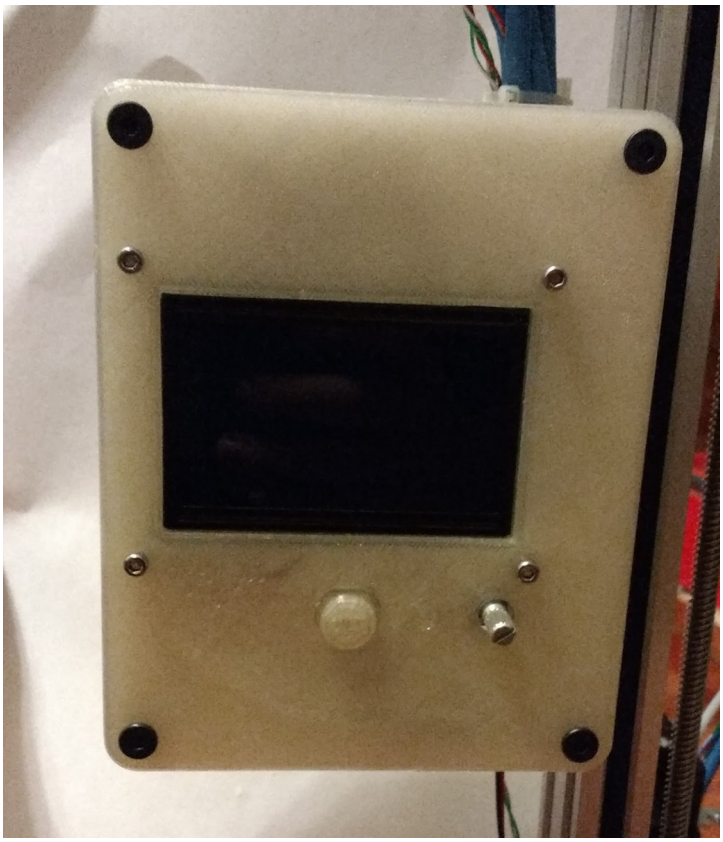


First fit-up test. Began cable management. Added “antenna” feature for simple, reliable extruder cable management. Wrapped moving cables (x-axis and extruder) with spiral sleeving (sprial cut straws) as cheap but effective reinforcement. Secured y-axis and z-axis cabling to frame via zip ties since those cables are immobile during operation.



July 2017

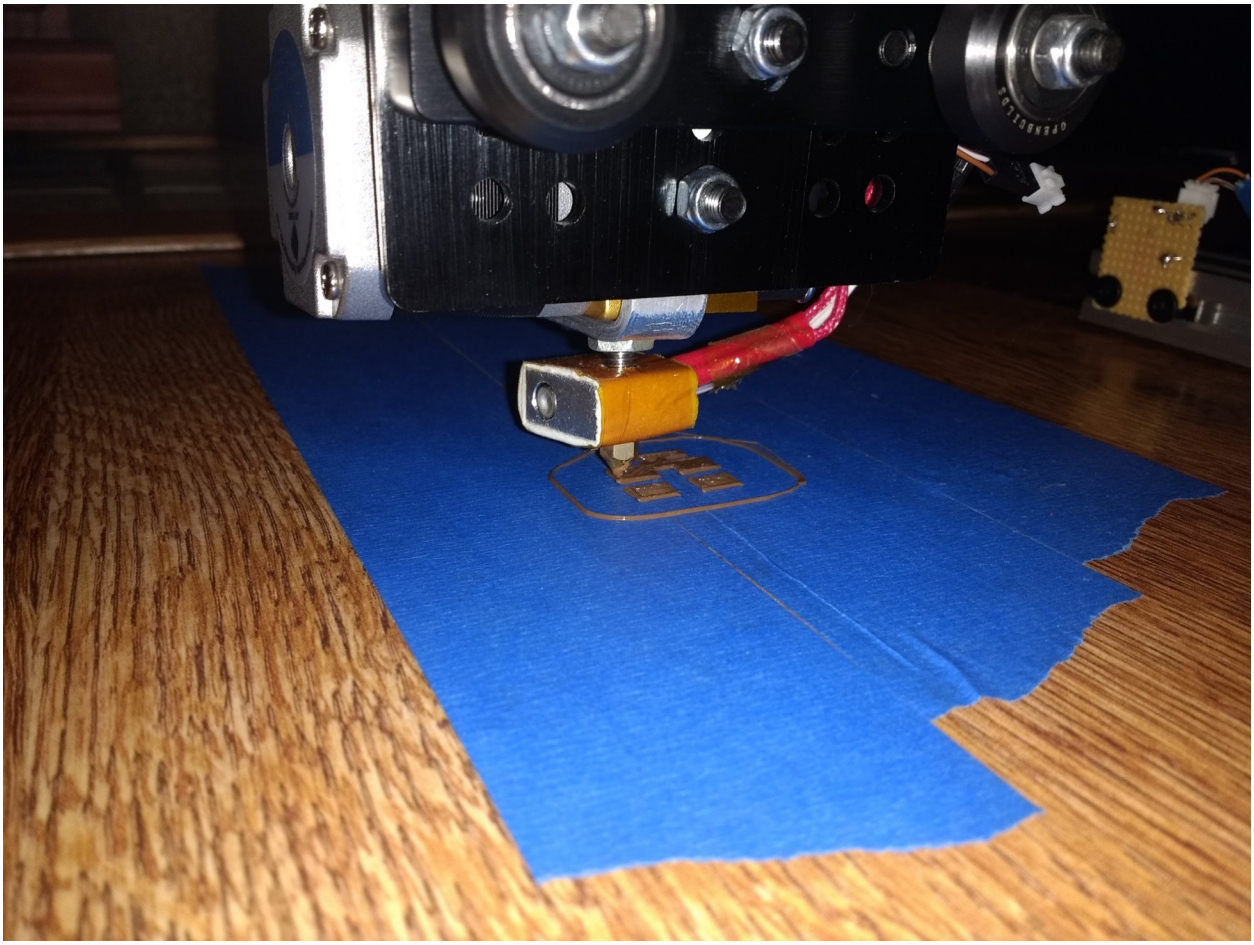
Printed and installed the controller board case.

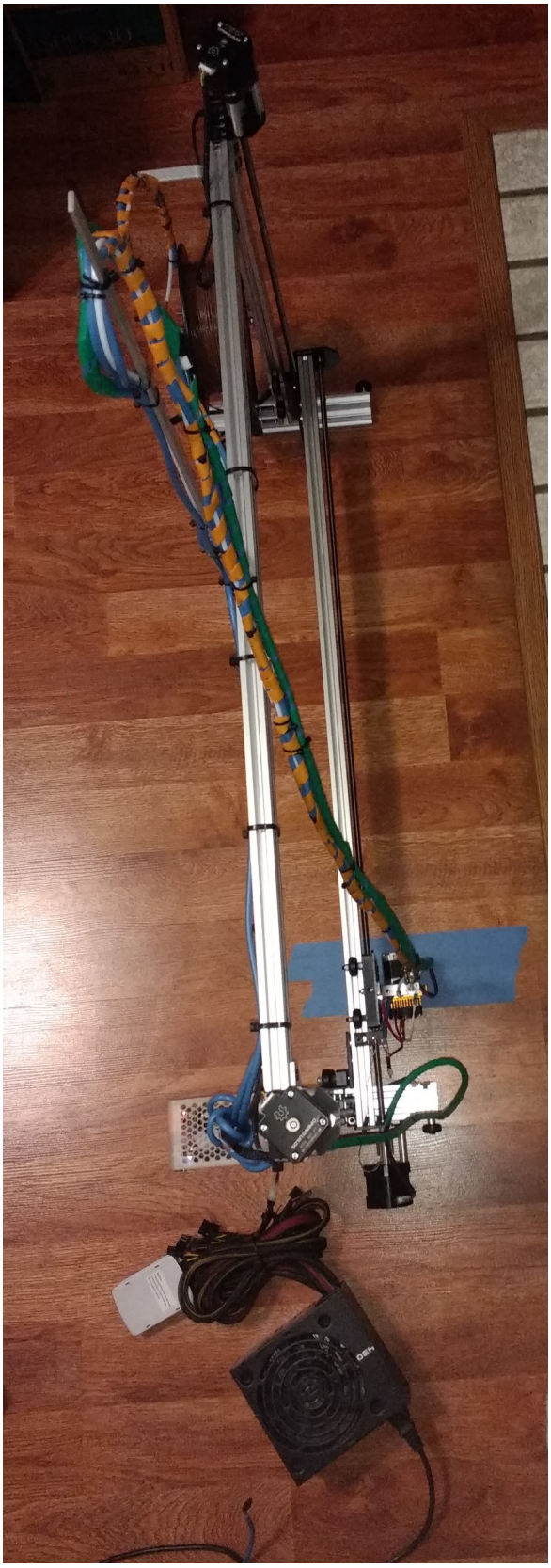


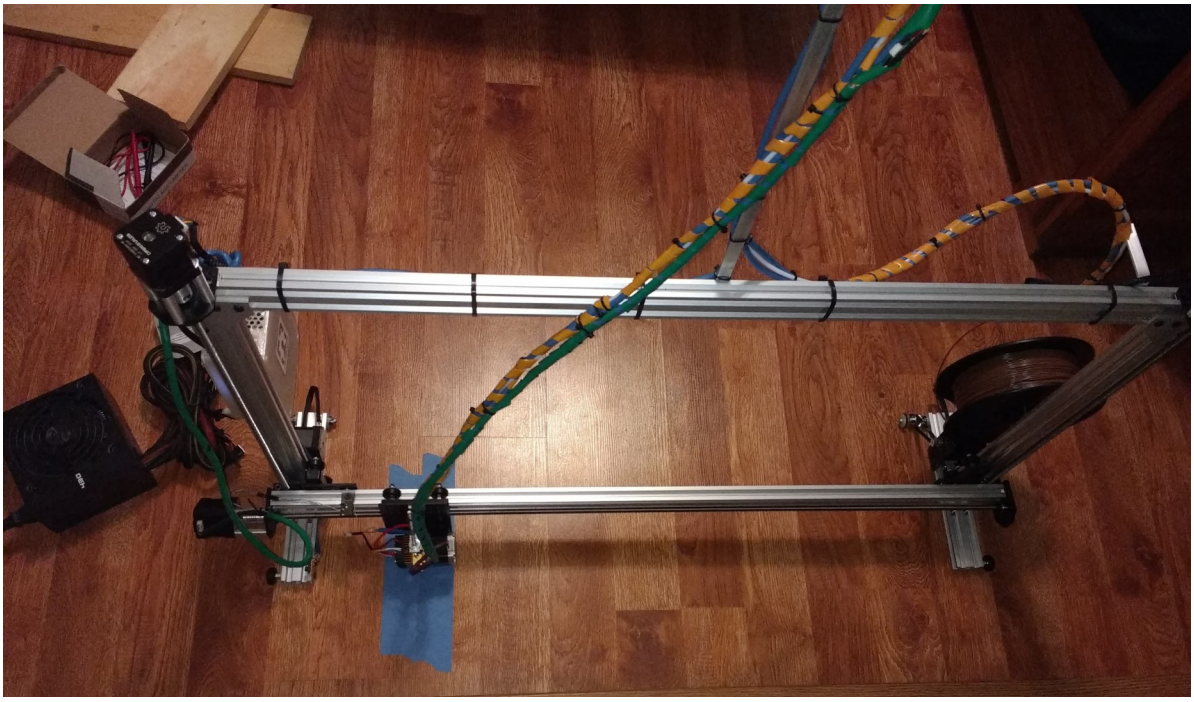
August 2017

Completed first test prints using Cali-cat model, available at https://www.thingiverse.com/thing:1545913. This model has sharp corners which were expected to maximize the likelihood of friciton drive problems.

The friction drive tended to lose steps at initially calculated settings. At decreased speeds and accelerations, position control was acceptable. I realized that my scoping calculations were based on static equilibrium and thus did not account for the dynamic load imbalance between front and rear wheels needed to produce horizontal accelerations. Theoretical accelerations from revised calculations matched the experimentally derived new accelerations. The performance loss can be significant, particularly on detailed parts, so I plan to upgrade to all-wheel drive to reduce the performance penalty from dynamic loading.



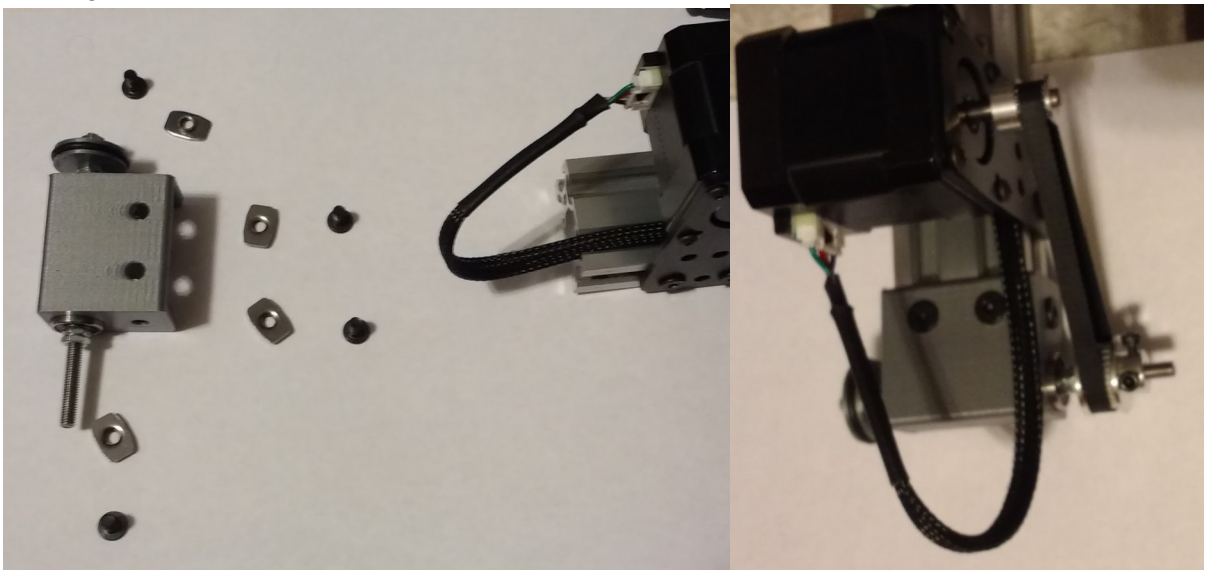




September 2017

O-rings previously used as tires have experienced creep and compression set. Also, the frame began to rest on the floor, indicating that additional clearance may be prudent for trouble-free operation. Printed new, larger wheel and replaced o-rings.

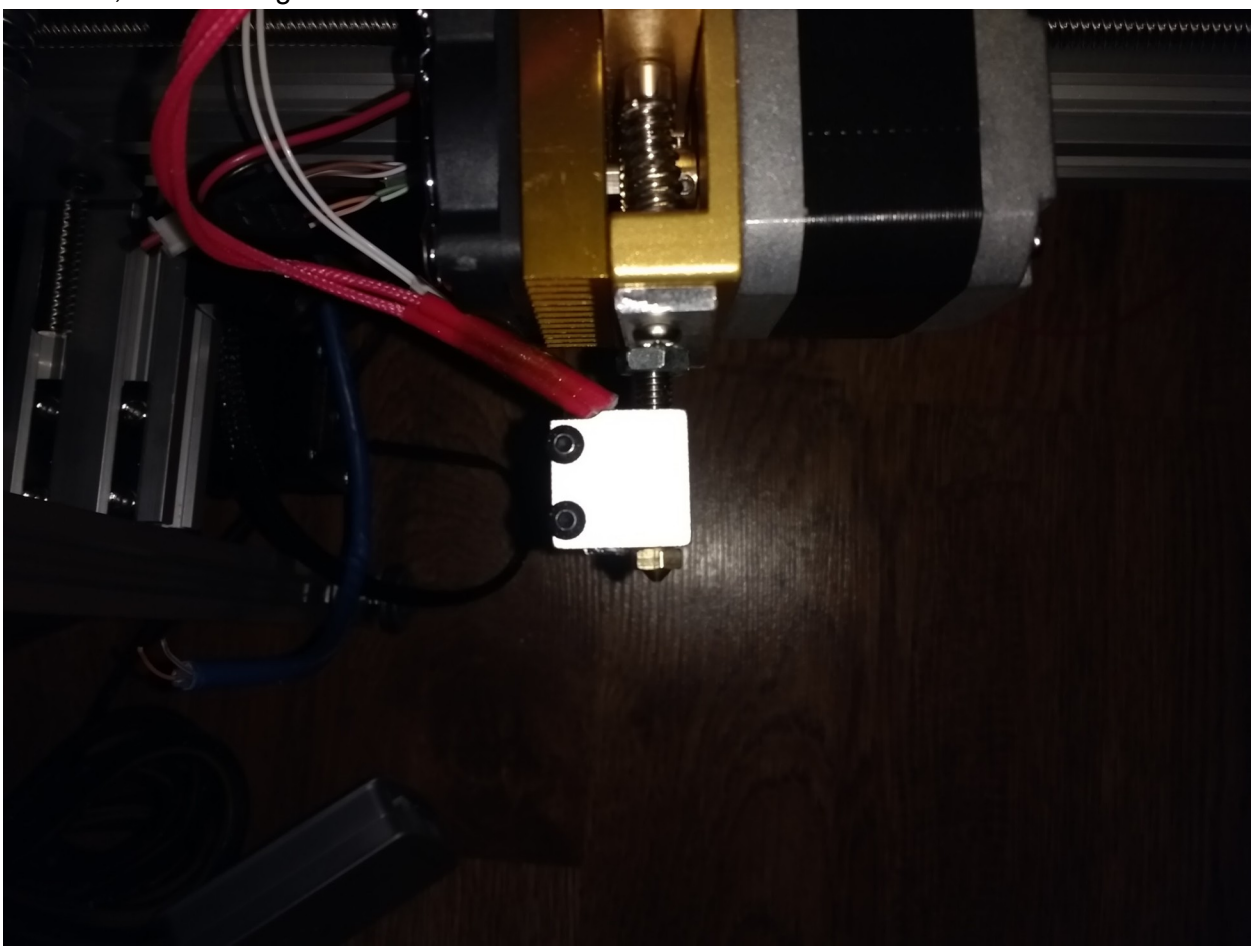
Upgraded y-axis drive shaft to mount via fixed position bracket rather than friction-adjusted bearing races.



Upgraded z-axis limit switch from direct frame mounting to custom bracket with fine-adjustment screw. I no longer have access to Solidworks and have transitioned to Fusion 360.

November 2017

Upgraded to Volcano hotend for greater deposition rates. Nozzle diameter increased from 0.4mm to 1.2mm, which deposits close to the limit for the extruder heater despite the relatively slow speeds necessary for the friction drive. Speeds and plastic costs are still prohibitive, however, and the long term idea to use concrete would still be much better.



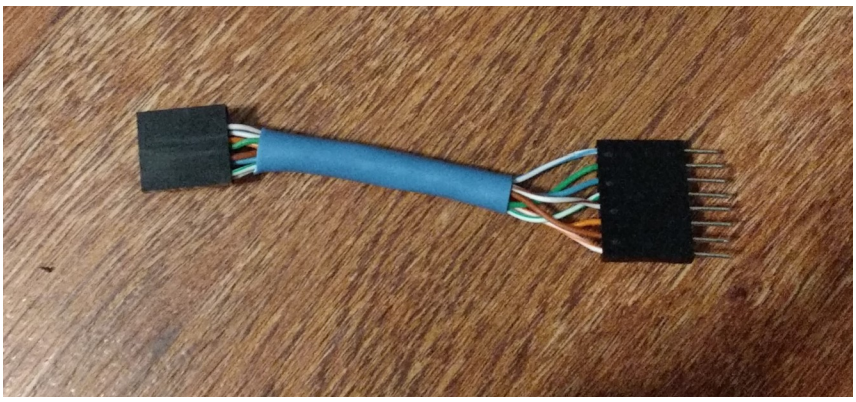
December 2017

Happy holidays!

March 2018

Added infrared sensor for y-axis end stop, enabling reasonably consistent positioning off arbitrary objects on the floor.

Added cabling and components for all-wheel drive. Replaced plastic wheel and o-ring tire with printed all rubber wheel.



Noted issues with intermittently bad connection to the extruder thermistor during longer builds (e.g. intermittent disconnection or short). In the event of a lost temperature, the firmware is set to turn off the extruder to avoid fire issues. However, this also stops operation prematurely during longer builds, wasting a large amount of plastic and time. A faulty crimped connection in

the custom cabling is judged to be the most likely culprit. Will evaluate remaking cabling and/or upgrading to heavier gage wire for decreased resistance and increased reliability.

Noted potential improvements to motor drive system. Y-axis (friction drive) is currently underpowered. Could upgrade from 12V to 24V power supply to decrease impact of the impedance of the long wires. Could revise y-axis wiring from 4x parallel on Z channel to 2x parallel on Z channel and 2x parallel on Ext 1 channel. Could evaluate running motors in series to increase current at cost of increased impedance (likely better top speed, worse acceleration and/or jerk).

August 2018

We adopted a cat! Her name is Terra, and she seems to also have an interest in 3D printing. :P

Burning hot plastic at floor level doesn't really work with a cat, especially a curious one. This printer is too big to build an enclosure, and it's not realistic to keep it attended throughout multiple day builds. Unfortunately, that means that Komodo must cease development in my apartment.

In the meantime, I'll convert this into either a mini CNC router or slightly smaller scale, more conventionally designed printer. The aluminum extrusions and leadscrews seems much more rigid than typical belt driven/sheet metal frame router, and a CNC router would be more useful, so I'll pursue that first.

August 2019

It's been a busy year, and I haven't prioritized this project. I assembled the overall router frame and planned to attach my corded rotary tool with 1/8" HSS tooling. Based on the frame size and rigidity, I expect it'll be good for small engraved decorative signs and making functional 2.5D parts. However, since I designed Komodo to use all-wheel drive for the y-axis, I'm missing standard components like a leadscrew and bearings. Before I invest more money into parts, I'd like to create a new CAD model to minimize fit-up issues. However, since my old models were Solidworks and I have Fusion 360 now, I almost have to start from scratch. So for now, I have the world's most expensive etch-a-sketch.