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Team F: ADD\_IN

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## I - Individual progress

My goals this time were to test printing around COTS items on the printer 2, and fix the jamming issues in printer 1 and have it functional as well.

### 1.1 Printing around COTS items:

I tried printing various parts having enclosed COTS items, such as the ones that were shown in the PR. Since G-codes generated by our software are still causing a drift because of a firmware bug, we are using a temporary Matlab script that can generate G-code for concentric cylinders, which actually enabled me to test some of our SVE test parts while we are working on fixing the glitch.

So using the script I printed a set of parts enclosing cots items such as the threaded round standoff shown in figure 1, which was also shown during the PR.

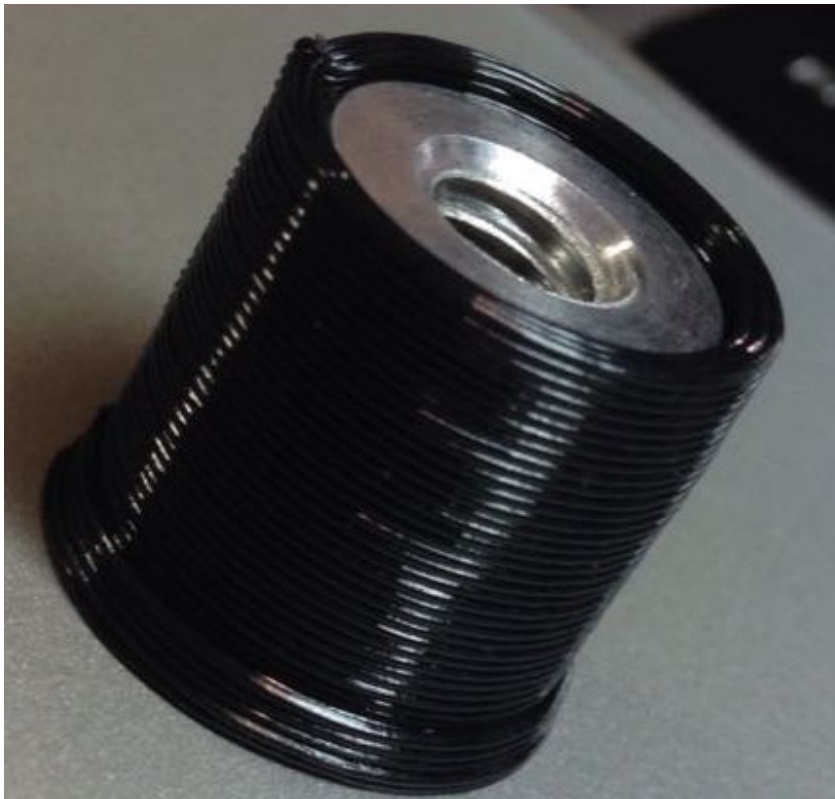


Figure 1: Part enclosing female threaded round standoff

After some time consuming experimentation, I now have a pretty good idea on the optimal clearances from the CoTS item while printing, and the layer height at which the printer should start covering up the item. This is illustrated by Figure 2 below, at the left, the clearance from the item. And I actually found that it is possible to set this to zero, even though the nozzle tip occasionally touches the cots item, the filament is thus extruder and squished against the wall of the cots item, which results in really great adherence. Care has to be taken though when printing the locating feature and inserting the CoTS item, since the nozzle tip is always facing towards the center, printing a cylinder where the nozzle path is exactly the outside diameter of the CoTS item will result in a cylinder that is slightly smaller, since the filament is extruded out of the nozzle, it is still possible to insert the CoTS item in small parts since the filament is flexible when only few layers are printed, but on larger parts, the locating feature has to be slightly larger, providing about 0.2-0.4mm clearance depending on extrusion width, to easily insert the CoTs item, the rest of the part can then have no clearance with the CoTS item.

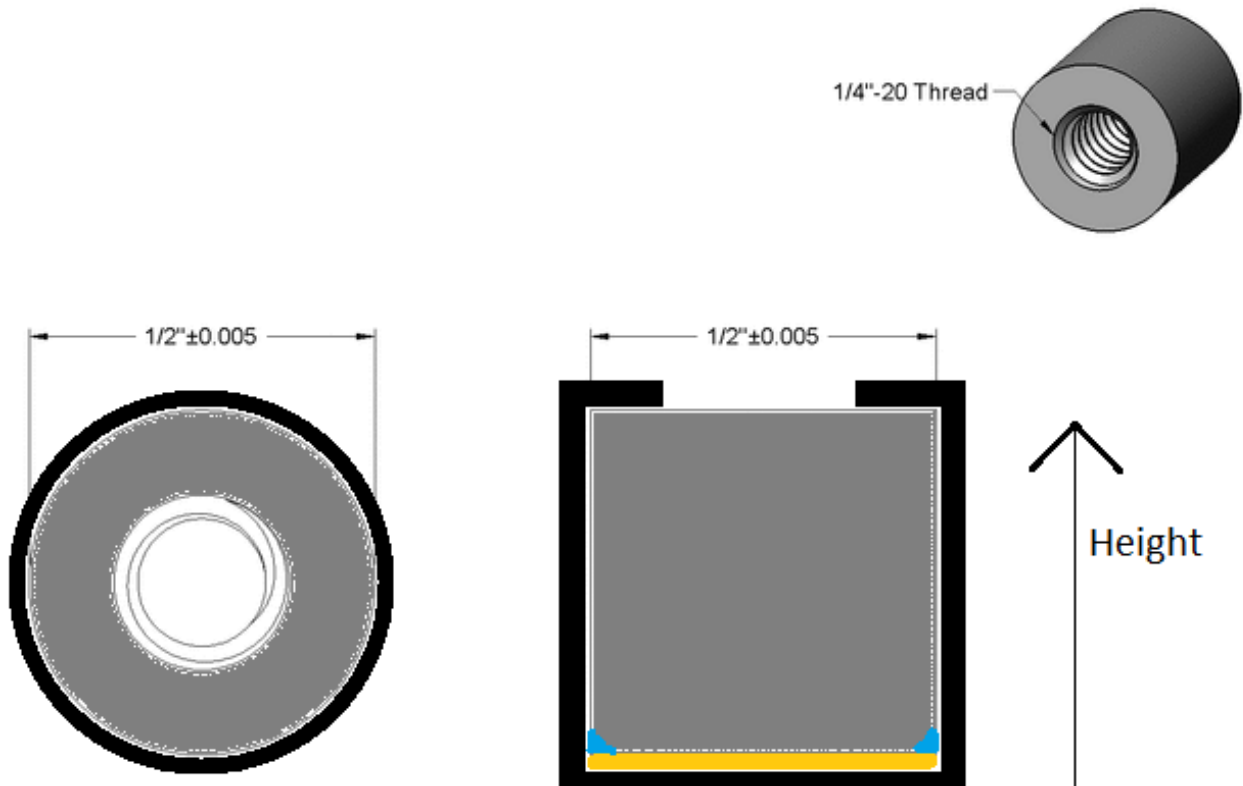


Figure 2: CoTS item in gray, printed part in Black.

Left: horizontal cross sectional view. Right: Vertical cross sectional view.

The right part of figure 2 is to illustrate the second issue, namely at what layer height to start printing over the CoTS item. If that height is too low the nozzle will hit the CoTS item, if it is too high the filament will not stick to the top base, both resulting in failed prints. Since the height of the CoTS item is known, this is basically about knowing the height of the empty space drawn in yellow in figure 2. Due to finish imperfections I was expecting the CoTS item to be offset by a small value. Since the imperfections, or burr, are more present in the corners, it is easier to work with parts that have rounded edges (blue in Figure 2), for which it is only necessary to leave about half a layer height clearance, or 0.2mm in the parts shown at the PR.

## 1.2 Old printer:

I also worked this week on the old printer, Dan made a similar heat block for it and I used a new insulator so it is now printing without jams, and giving similar results to the newer one.

## II - Challenges

The main challenges these two weeks for me were how time consuming testing 3D printers can be, especially considering the fact that to get good results we are printing at average, or slightly low speeds. This makes testing on larger parts undoable at the moment. One way to fix that, at the expense of finish quality, is to print using larger nozzle diameters, i.e. larger layer height and extrusion width. That will result in lower resolution, but we can then print bigger parts in similar times. It will also result in rougher prints that are less sensitive to small errors.

## III - Teamwork

These past two weeks, Dan machined the 2 new heatblocks we are using, and Nikhil and Astha made progress towards fixing the last issues with the software and firmware. Everyone is also occasionally doing tests and printing parts with a printer as it takes time.

## IV - Future Plans

The future plans are to print a set of parts to show for the demonstration Friday, and prepare some presentation materials. And during the weekend, we expect the Software issues to be fixed and we will print the SVE test parts, while recording videos to show during our SVE.