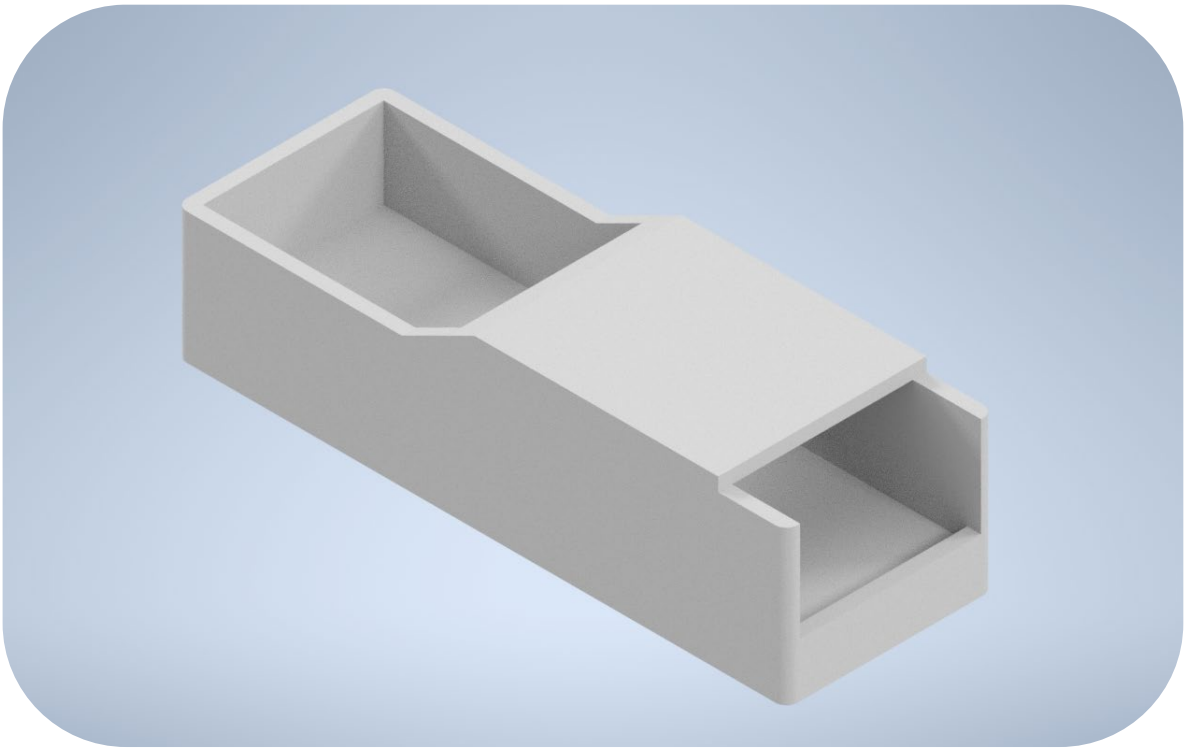
VEX Battery Shell



For the
VEX Robotics “Make It Real”
CAD Engineering Challenge
Sponsored by Autodesk®

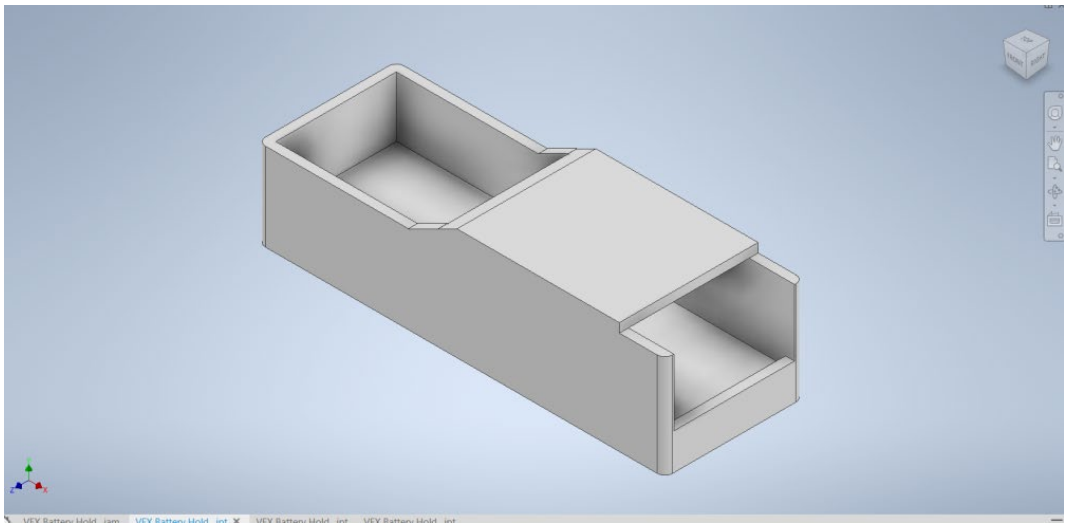
By Team 62880A

COAST 2 COAST
ROBOTICS

Introduction

In order to come up with an idea for the "Make It Real" CAD Challenge, our team made lists of different parts of our robot build and design process that we wanted to improve. Since Covid-19 is still a big concern we had all our meetings on Zoom.

One of the areas that we wanted to improve and that we thought would be useful was to figure out how to improve the V5 battery holder. Many people on our team have had bad experiences with the VEX V5 battery clips. For instance, fingers can get pinched in between the battery and the clip, the battery can get jammed in the clip, and the battery clip can break or become loose. To improve this, we redesigned the battery clip to a battery shell with screws to connect the shell to the robot. This way the battery is easier to put on the robot and there is less risk of getting hurt. Our team used Autodesk Inventor Professional 2020 to design our concept.



Our battery shell is designed to be used very easily. It will practically be part of the robot. Simply insert the screws into the shell and screw them into the robot. Afterwards, you can easily slip in the battery and hear a satisfying click. That click means that the battery is secure. Because our shell is a box-like shape, it prevents the battery from falling out as well.

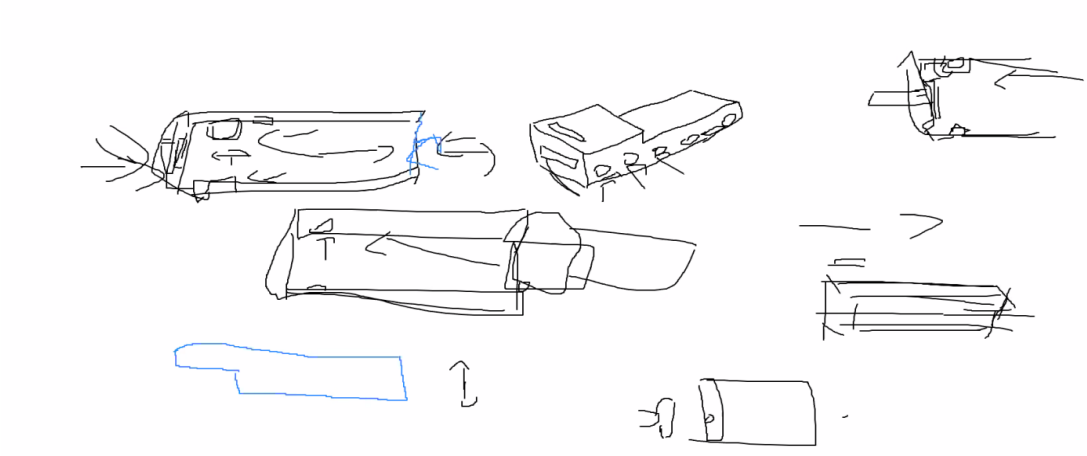
Our Design Process

From experience, we know that the robot battery is probably the most often replaced part of a robot. We change it every time we complete a match, including Skills matches, and after every practice we do. So, in a normal tournament, we probably change a battery around fifteen to twenty times. During an entire season, we probably change the battery over four hundred times. That's a lot of times when our fingers get pinched or the battery clip breaks. Our experience led us to make a robot battery shell.

When we first created this, our idea in mind was to increase efficiency and decrease likelihood of being hurt. When brainstorming, we first thought about the current battery clips and looked at the battery features. One thought we had was to maybe redesign the battery, but then we looked at the cost. A battery is about $55 while a pack of battery clips is only $5.49 which is 10% of the total cost of a battery. If all the batteries needed to be redesigned it would cost a lot of money and the chemicals inside would also need to be thrown away properly. We decided to focus on a new battery retainer.

VEX V5 Clips and Battery

We drew some ideas and designs on a Zoom whiteboard. It may be a bit difficult to figure out what we drew, but we drew sketches of the battery and we also drew arrows to figure out the best way that the battery could be inserted and removed inside a holder. A big factor was the battery wire that connects to the brain and the four LEDs on the battery that show the charge level. After looking at what seemed best and all the pros of certain designs, we cut down to one design.



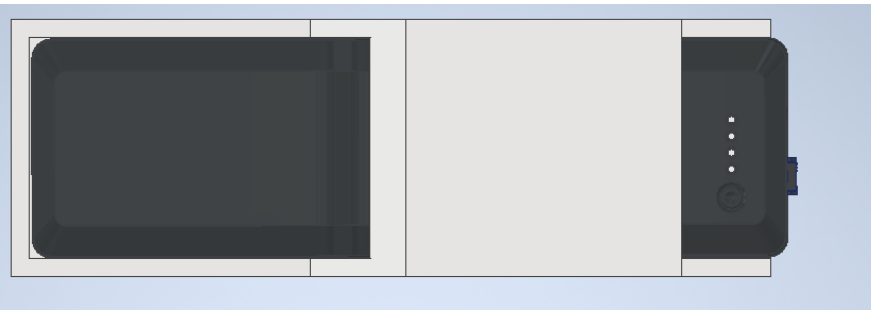
Our Drawing Skills on Zoom

Afterwards, we started to design it. We started out with one plastic cuboid, and afterwards created three walls for the back and two sides. We cut the back end down so that it fit the shape of the battery. This is effective because the shell won't use as much materials. Next, we created a lid that would hold the battery in place. However, the battery could possibly slide out sometimes. To prevent this, we created a lip that was 0.15 inch high to avoid this. Lastly, we created screw holes on the bottom of the model so that it can be attached. Some of the skills we learned while using Autodesk Inventor to make a new part were:

- Planes and 3D views
- How to create a sketch
- How to make rectangles, triangles, and circles in a sketch
- How to extrude a sketch or make an extruded cut

We learned how to use the measure tool so we could open the STEP file that we downloaded from the VEX Robotics website. It was important to use the measure tool to figure out what measurements we need to hold the battery. We also learned that an IPT file is an Inventor part file.

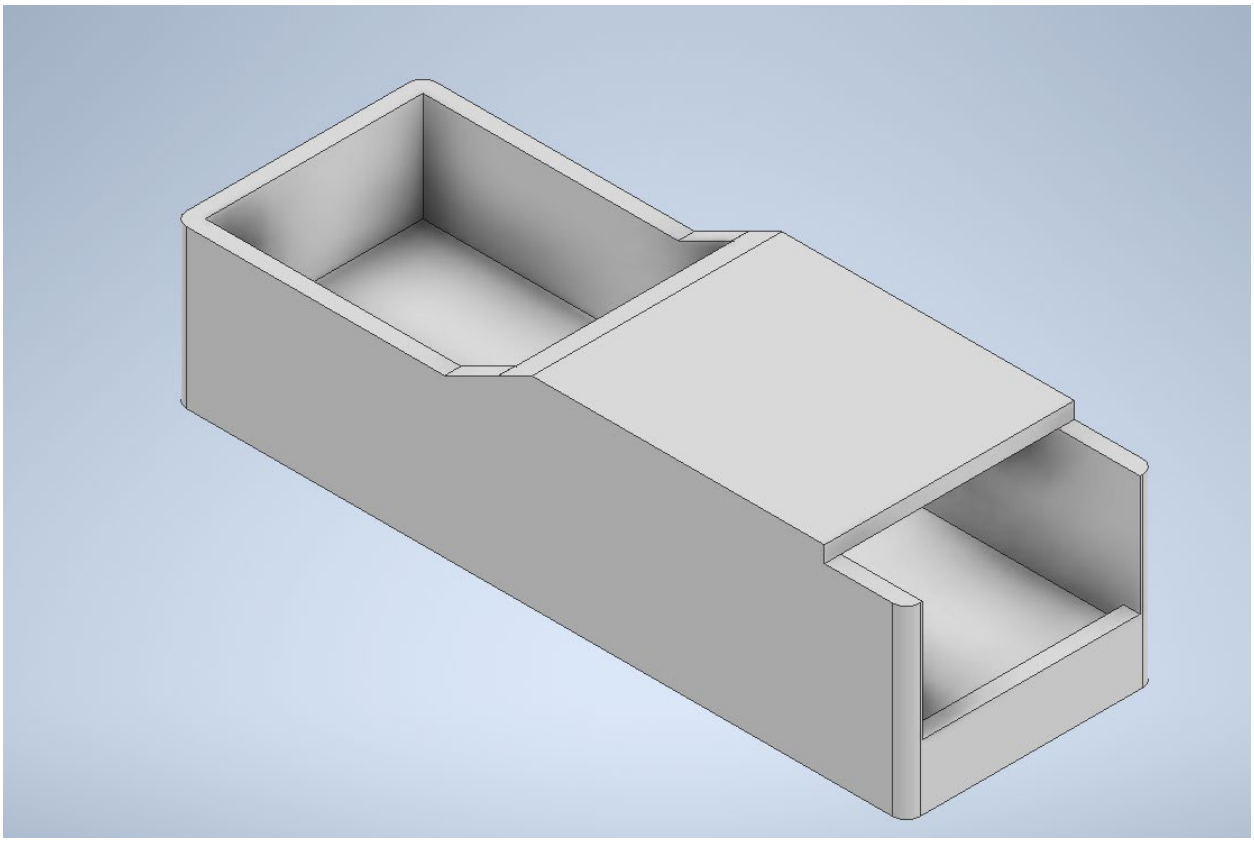
Once we made our battery holder, we wanted to print it immediately. However, when we thought about it some more, it made sense to first see if the model we made would fit a virtual battery. To do this, we learned how to make an Inventor Assembly file with an IAM file extension. The assembly file was pretty cool and something we have done before when trying to figure out how to make our robots. For this assembly, we used our part, a V5 battery, and a 3-hole C channel. When we used the Constraints to Mate the battery to the shell, we saw that the shell was too small. The reason is because we made the distance between the walls the same width as the battery. Then we saw that the battery didn't fit length wise. And lastly, the screw holes were not spaced out correctly.



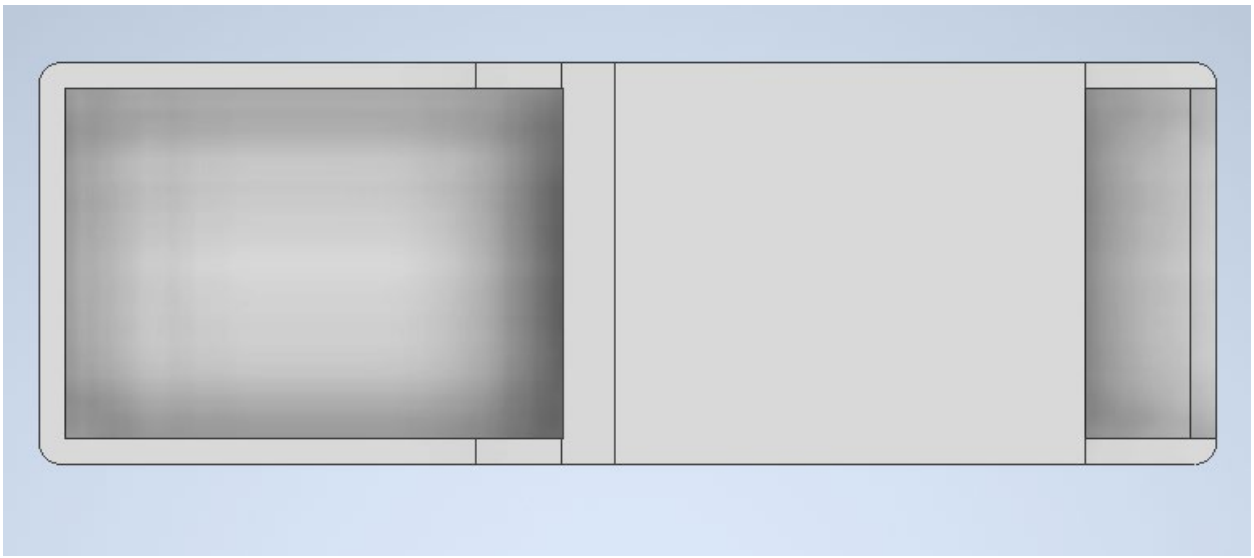
Initial Assembly Top View

We changed the model and improved it. This is our final result and the 3D prints. Because the printer we had was too small, we had to divide the shell into parts before exporting STLs to print.

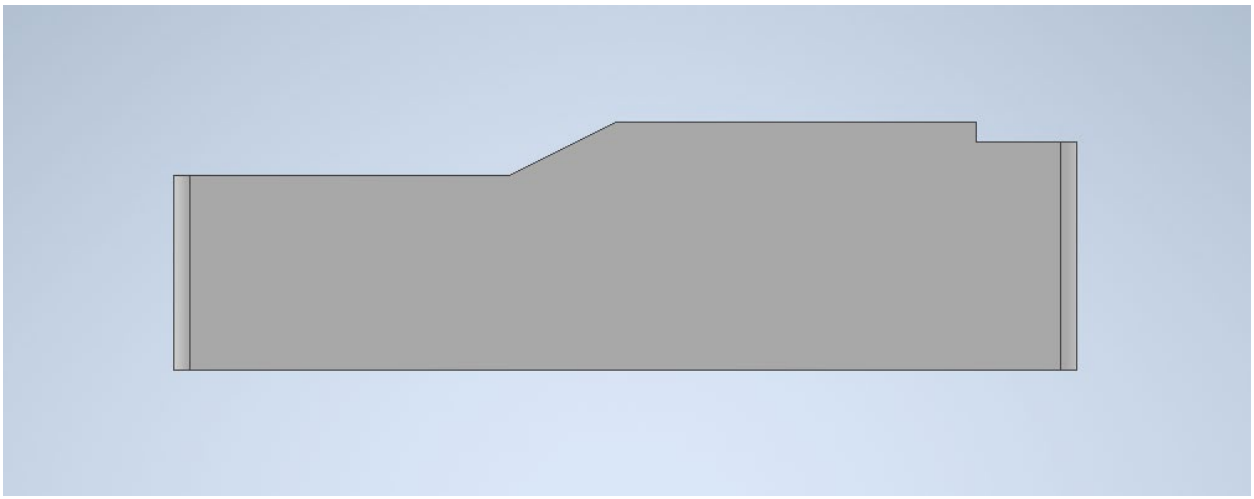
From this challenge, we sharpened our CAD skills as well as our design skills. We also experienced for ourselves how useful it is to know CADing because it can help explain how parts will fit together in a robot. It also gives us a BOM which lets us figure out how much money we might need to spend. 3D design should be learned because it will make things much more efficient and it will save money and time.



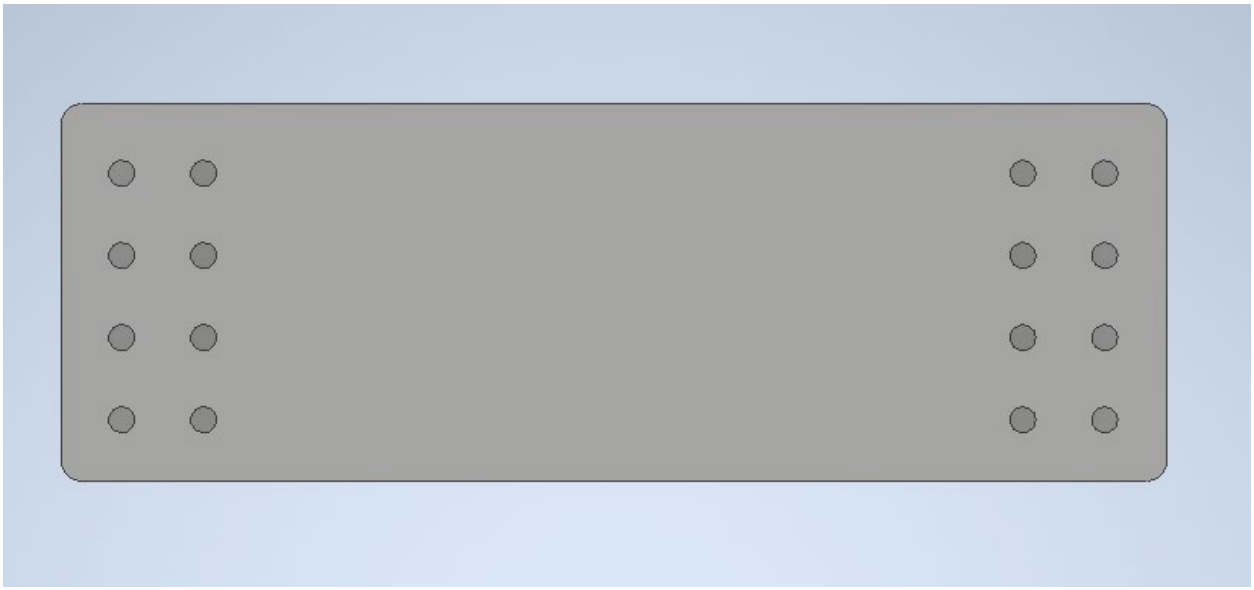
Isometric View – Whole Shell



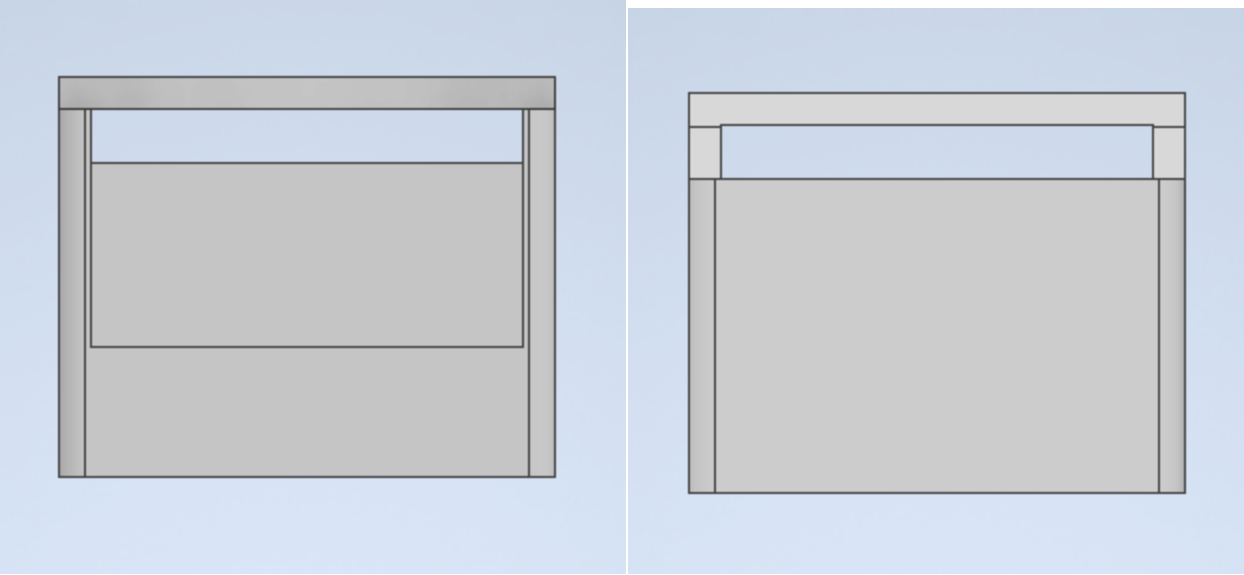
Top View – Whole Shell



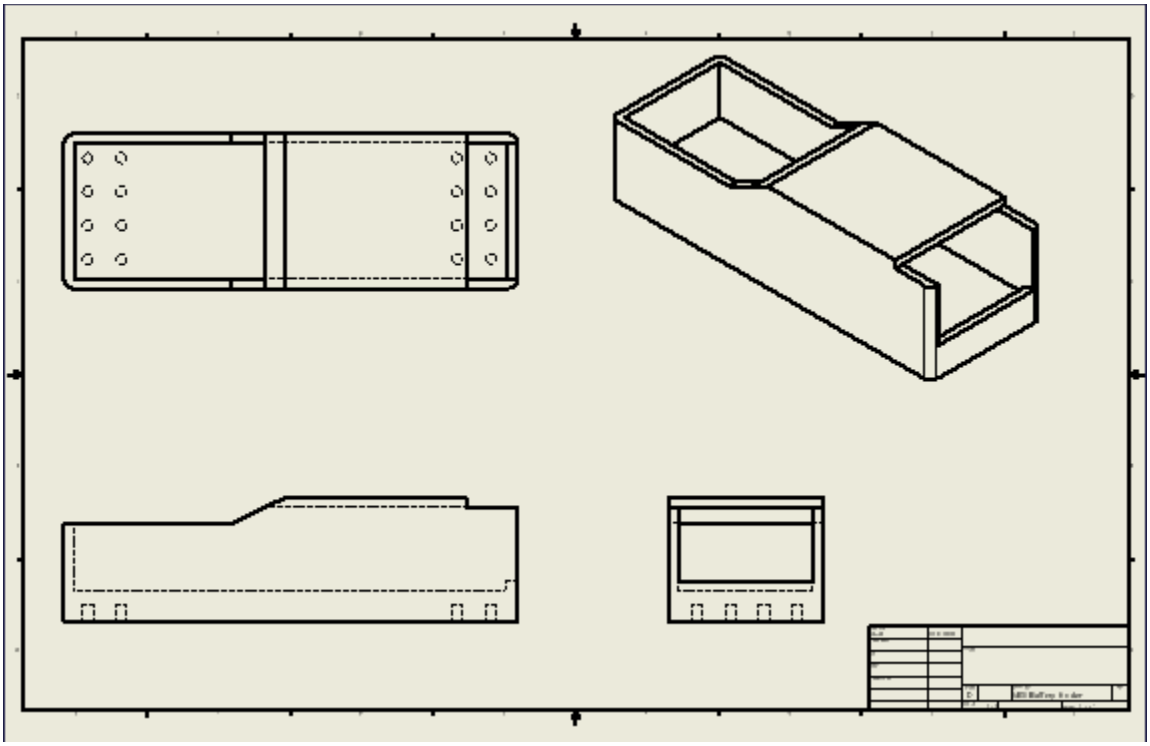
Front View – Whole Shell



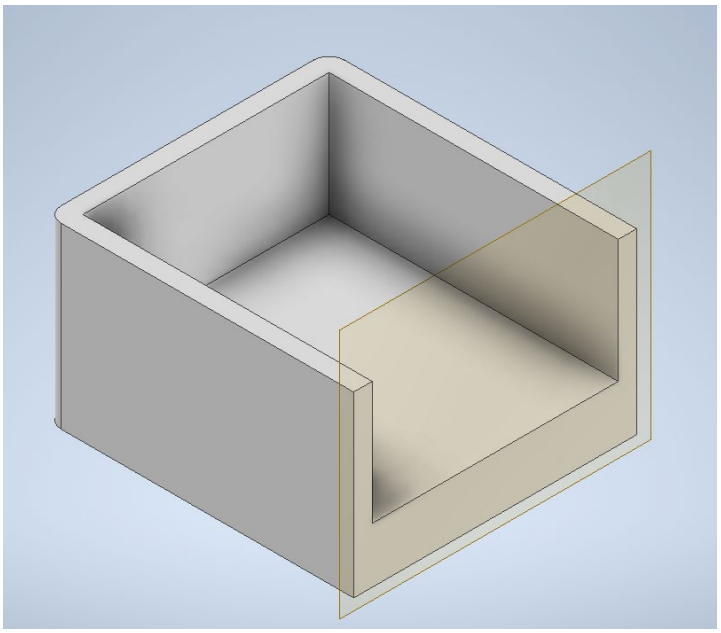
Bottom View – Whole Shell



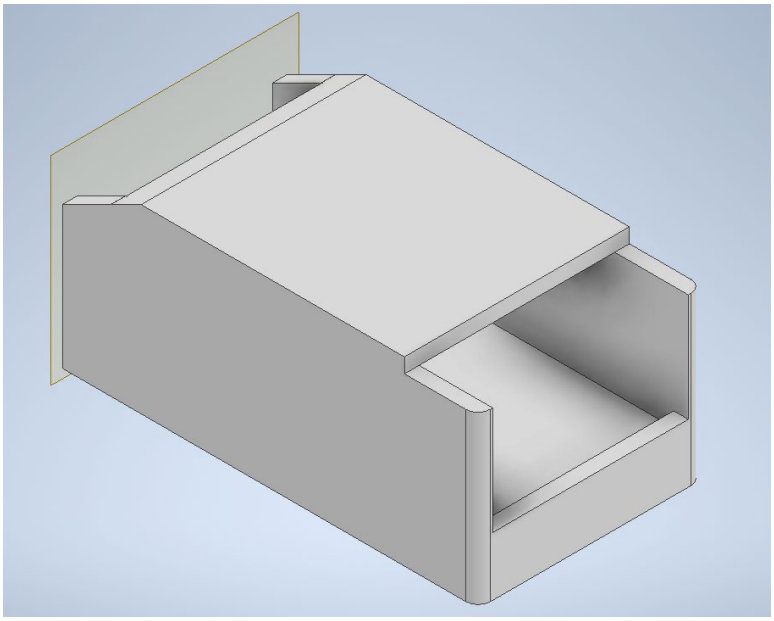
Left and Right Views – Whole Shell



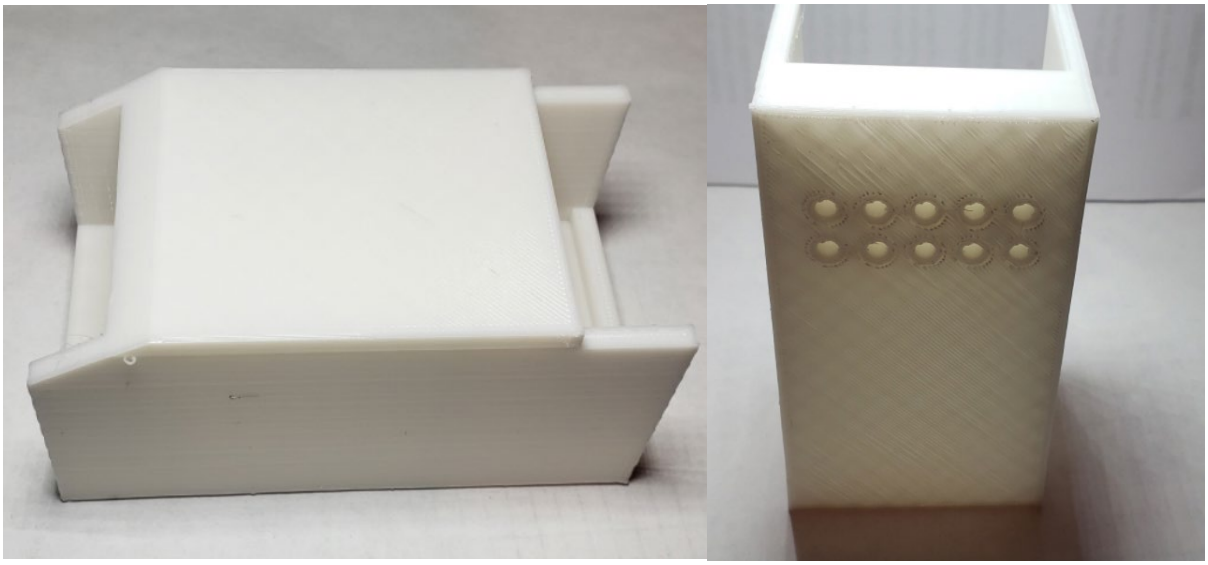
Attempt at Making a Drawing



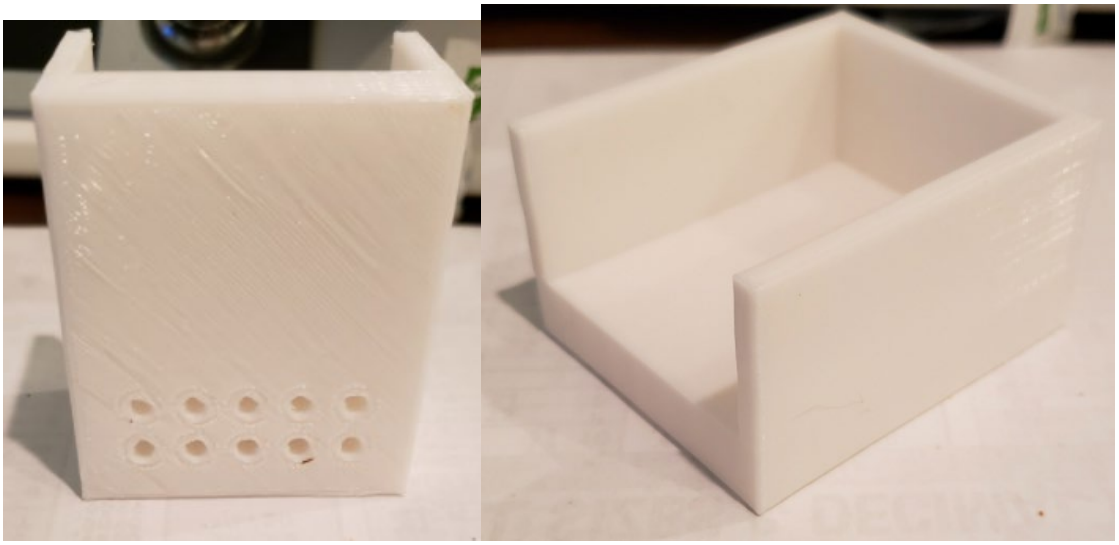
Small Half for Printing



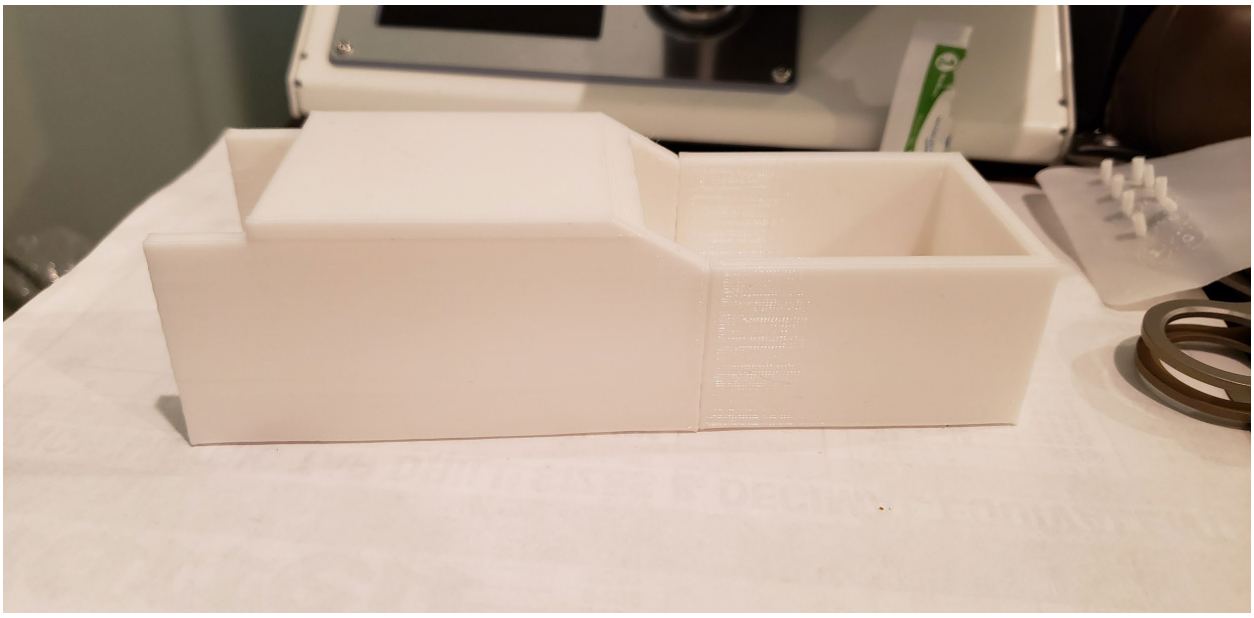
Large Half for Printing



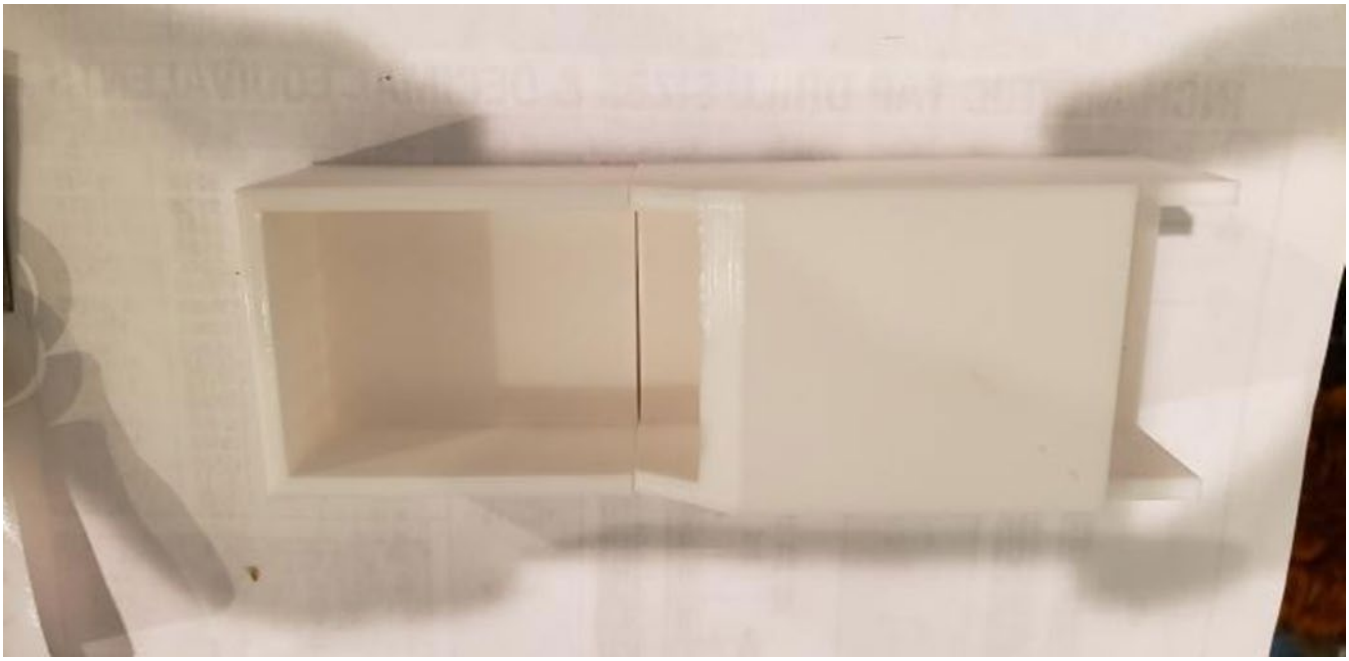
Large Half 3D Printed



Small Half 3D Printed

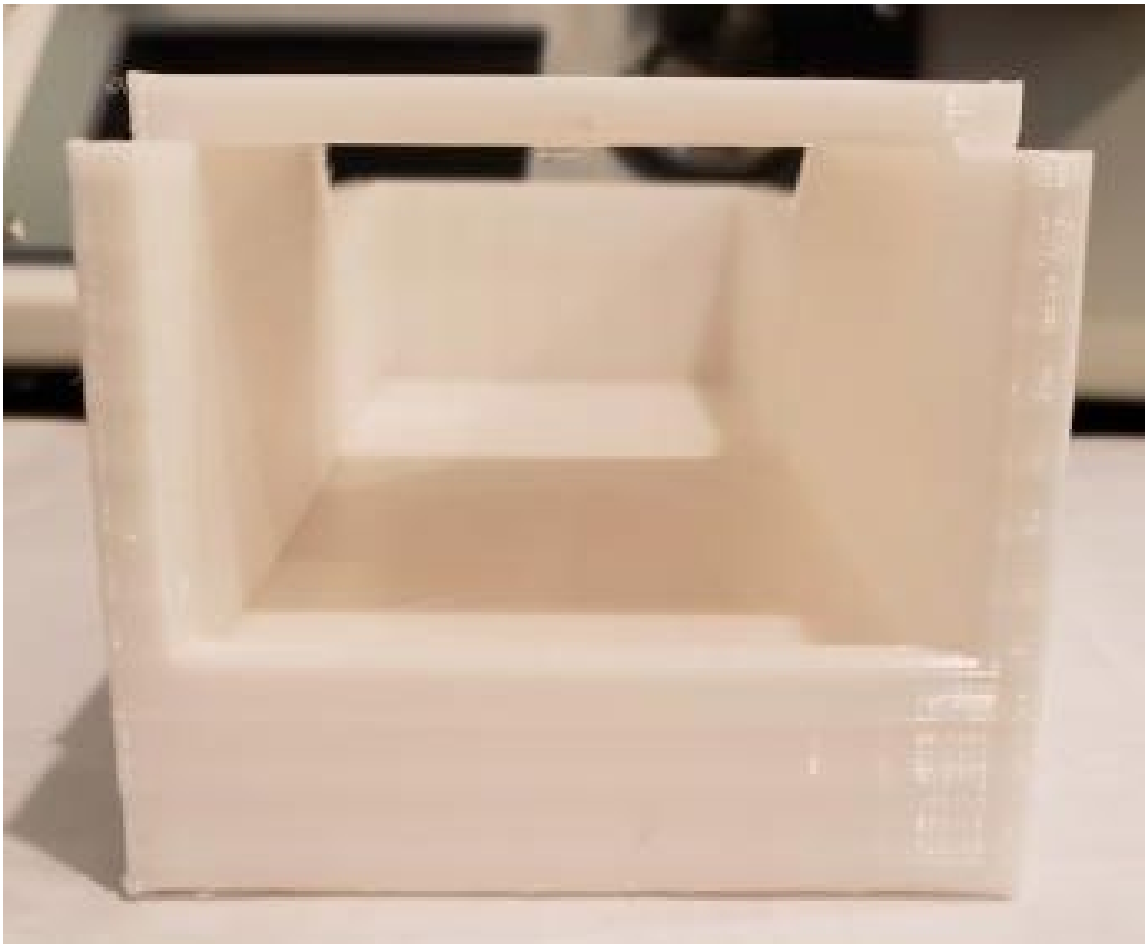


Whole Shell Combined after 3D Printing – Side View



Whole Shell Combined after 3D Printing – Top View

Whole Shell Combined after 3D Printing – Bottom View



Whole Shell Combined after 3D Printing – Left View