

## Make It Real CAD Online Challenge.

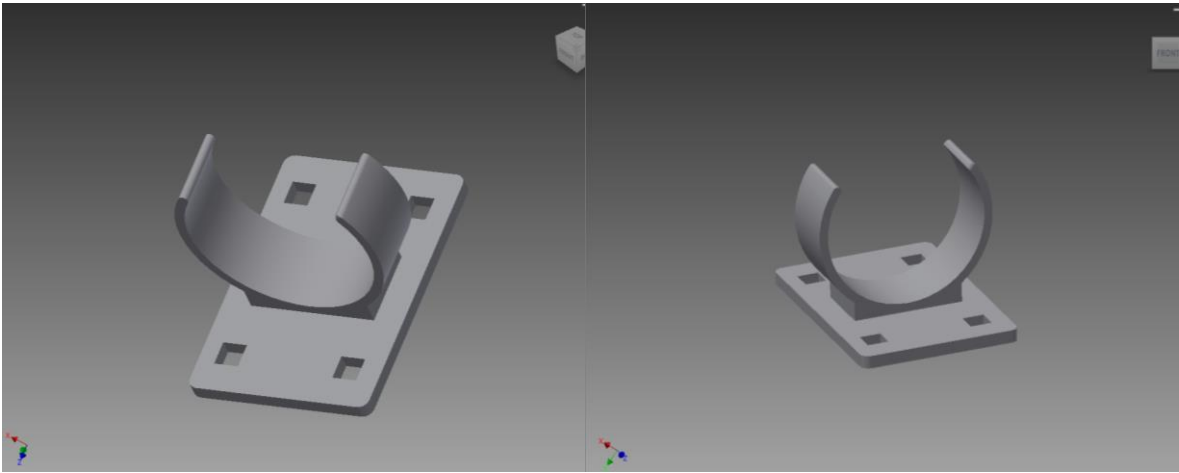
Online challenges are important because they make VEX teams show their skills in ways different from building and programming the robots. For the Make it Real CAD Engineering Challenge, we are designing a hexagonal nut, which is used in tandem with a 6-32 size head motor screw and clip, which is plastic based and designed to restrain motion. These pieces are designed for mounting the VEX pneumatic system. Specifically, they are used to mount the air reservoir and the solenoid from the VEX pneumatic system. We realized that the solenoid has a hole in its structure. However, this hole is too small for a regular 8/32nd inch head star screw, but just the right size for a 6/32nd inch motor screw. There are no nuts for these 6/32nd inch motor screws that VEX Robotics manufactures as competition legal hardware, so our team decided to design one and print a prototype. The pneumatic system also does not come with a designated clip to attach the air canisters, so we have been using zip ties as a temporary fix to this known problem. For the Turning Point competition season, our team used the pneumatic system for our lift and experienced significant difficulties firmly attaching the system. So, for this season, our team decided to design parts to help us mount the VEX pneumatic system as our Design a Part CAD challenge. By doing this, we solved the problem of how to firmly attach a pneumatic system, as well as make pneumatics more compelling for new teams. The clip and the nut that we have designed and made can be used in multiple scenarios. Not only can the parts be used for mounting the VEX pneumatic system, but they can also be used for locking mechanisms and weight distributing ballasts.

To build these parts, we used the [Autodesk Inventor 2015 Professional](#) software. Originally, we were going to use the Autodesk Fusion 360 software, but the software on our school's computers (Windows 7) was not advanced enough to run it. We do our online and computer-based work with school computers, and we cannot upgrade the operating system as our school has many policies and needs to go through many steps to approve the upgrade. Therefore, we decided to make our design on Autodesk Inventor, which was still a fairly good choice, despite our previous inclinations. We ran into only one major technical issue throughout the project, which was the compatibility of the software we used to create the part and the file type which that software produces. As such, we had some technical difficulties with 3D printing our part properly because of the file type and how we set that file up when we first started the design process for the part. One problem with Inventor, is that threads do not fully exist on the platform. If a thread is placed within the part file on the Inventor platform, it treats it as a picture, and will not appear once 3D printed. This is a big problem because the nut for our solenoid requires a thread. To counteract this adversity, we saved the part file to a USB stick, and brought the file to a computer which ran Windows 10. Through the Windows 10 operating system, we downloaded and ran Fusion 360. This allowed us to convert the file type to one compatible with threading so that we could 3D print the part.

From this online challenge, we have learned the incredible and endless possibilities of CAD. We realized how convenient and easy to learn CAD is, and how we could make any number things which may help us in the future. The possibilities of Computer Aided Design and what you can make with it, while they are endless, are also boundlessly applicable. Any single person from a fine artist to a construction worker can find benefit in CAD software and 3D printing. The reason why most people join VEX is because they want to be future engineers and product designers. One resource that they will most likely use throughout their VEX experience and engineering career is CAD. It introduces young aspiring engineers to the future of engineering, the design process, and prototyping, as many engineers use 3D printers to make prototypes of their designs. With CAD, people can also recreate parts that have been destroyed, make models for large scale engineering projects, and much more. We will certainly use 3D designing software in the future to make a great deal of useful parts and tools for our engineering ventures.

These pieces that we are making will help influence other future VEX Robotics teams to use pneumatics. Pneumatics are a major part of the VEX EDR lineup, however many teams stray away from its many uses simply due to its difficulty to implement. If our parts were to be made and sold as VEX competition legal parts, teams would realize that there is an actual, consistent way to mount the VEX pneumatic system. Not having a secure way to attach pneumatics may have stopped many teams in the past from using pneumatics, and almost deterred our own team from its boundless opportunity. The VEX pneumatic system is extremely versatile and can help teams in any of the games VEX throws at us. They would have helped our team far more than they did, but without these important parts we were not able to get the entire benefit of pneumatics. Although we were not able to unlock the full benefits of the system, we were able to see the possibility that it held when the system is implemented properly and firmly with a stable mounting system. We hope that the possible creation of these parts will help encourage the future participants of the competition to utilize not only pneumatics, but also CAD software to aid them in their VEX journey.

Mounting Clip CAD Picture:



Hexagonal Nut CAD Picture:

