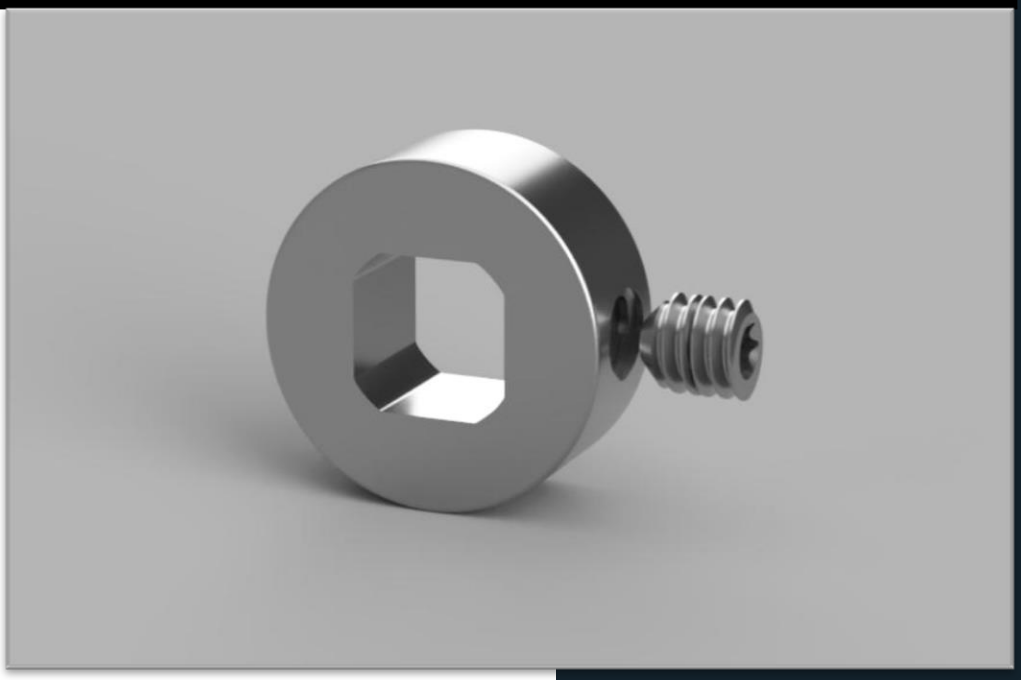
2019

MAKE IT REAL CAD CHALLENGE



HIGH STRENGTH SET SCREW SHAFT COLLAR

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INTRODUCTION

We are a new independent Middle School VEX Team founded to fuel our passion for technology and inspire others in the community. It has been very challenging experience, we did not have all the answers, but with a growth mindset, grit and resilience we dived in.

Throughout the 2018-2019 Turning Point season, one of the problems that we have encountered was issues caused by the high strength clamping collars.

The CAD challenge was a great opportunity to present and solve the problem creating a custom part using Autodesk.

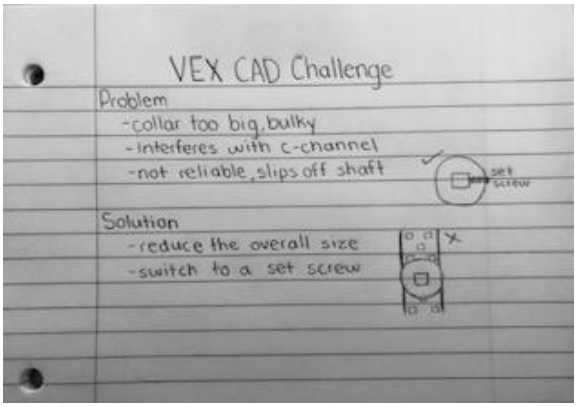

Figure 1 Initial Problem and Solution

WHY WAS THE PART CREATED?

The high strength axles are tougher, more resistant and have greater strength than the regular ones, so were necessary for high-pressure situations. In VEX there's only one shaft collar for the high strength axles though, which is the "High Strength Clamping Shaft Collar." The current clamping collars are big, plastic, and not reliable, sometimes not locking the shaft to stay in place. Also, they are not able to rotate inside the two-hole width c channels and were interfering with our lift. Our solution was to design a steel set screw collar that fit the square axle perfectly and was reduced in size to fit the small C channel.

Figure 2. Clamping Shaft Collar Extends Past C-Channel

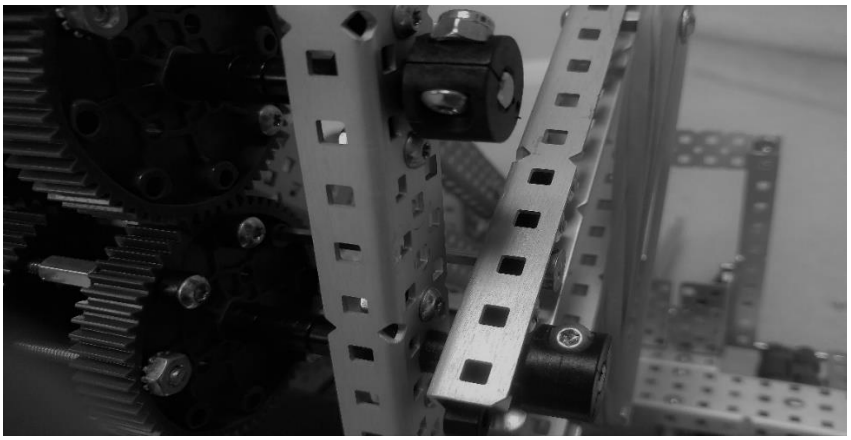

Figure 3. Two Bulky Clamping Shaft Collars

HOW WOULD IT BE USED?

This collar is applicable in any part of a robot that utilizes a high strength shaft. For this year's challenge specifically, many teams are using these shafts in their lifts and cap flippers as well as their ball catapult. Our team uses the high strength shafts multiple times on our double reverse four bar lift. However, the existing collars have been a problem.

With the new collars that we designed, teams will be able to use the stronger shafts without worrying about the reliability and where to find space for them. The overall size decreased from 0.75 in. x 0.3 in. (VEX collar) to 0.6 in. x 0.3 in. (new designed collar). Also, the set screw uses the same threads, #8-32, and is compatible with the existing 5/64 hex key to tighten it.

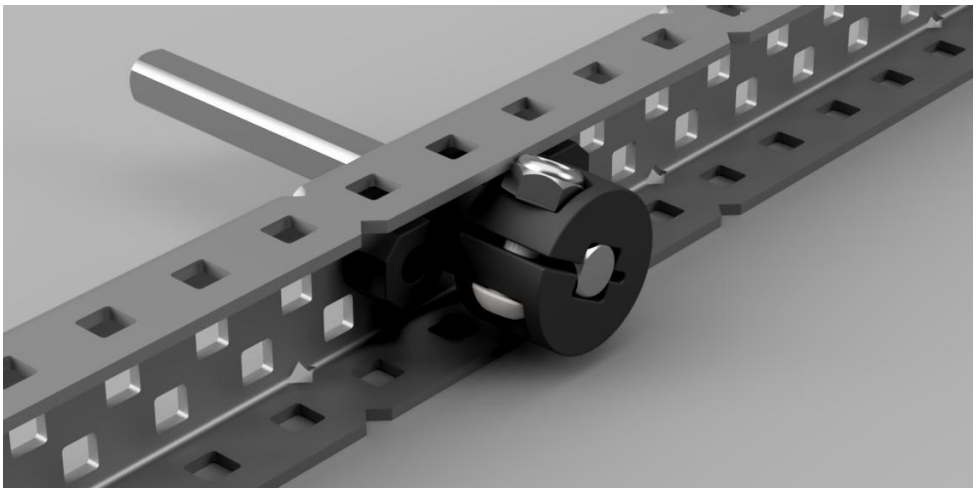

Figure 4. Fusion 360 Rendering of Clamping Collar

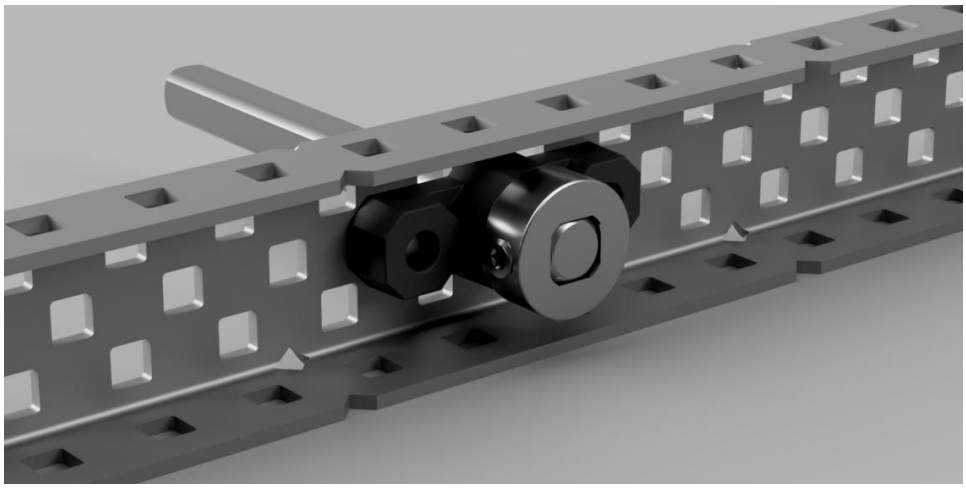

Figure 5. Fusion 360 Rendering of our Design, Rotates Perfectly in 2-Hole C-Channel

AUTODESK FUSION 360

Over the summer I completed the Autodesk CAD and Digital Manufacturing Specialization through Coursera and also passed the Autodesk certification exam in Fusion 360.

Participating in this challenge was a great learning experience where I was able to apply my CAD knowledge and skills to solve a real VEX robotics issue that we, and many other competitive teams, have encountered.

For this project, I used Fusion 360, Version 2.0.5331.
To create the base sketch, I utilized the project tool to "copy" the outline of the shaft onto the center of a 0.6 in. diameter circle. To let the shaft be inserted easily, I increased the size of the shaft hole by 0.02 in. to control what is called geometric compensation. For this I used the offset tool in the sketch drop down and added 0.02 in to each side. To make the design 3D, I raised the sketch up 0.3 in. using the extrude tool. The last step was making the hole for the set screw. To accomplish this, I sketched a small circle on the z-axis and extruded it through one half of the collar. It is made to be used with a shortened VEX #8-32 Coupler as the set screw and has the correct threading inside. The smallest coupler VEX sells is 0.5 in, so I needed to cut it down to 0.175 in. to fit our design. I threaded the hole #8-32 so it stays consistent with the rest of the screws made in VEX. I also made sure that it was modeled so that it would be an accurate representation of the final product.

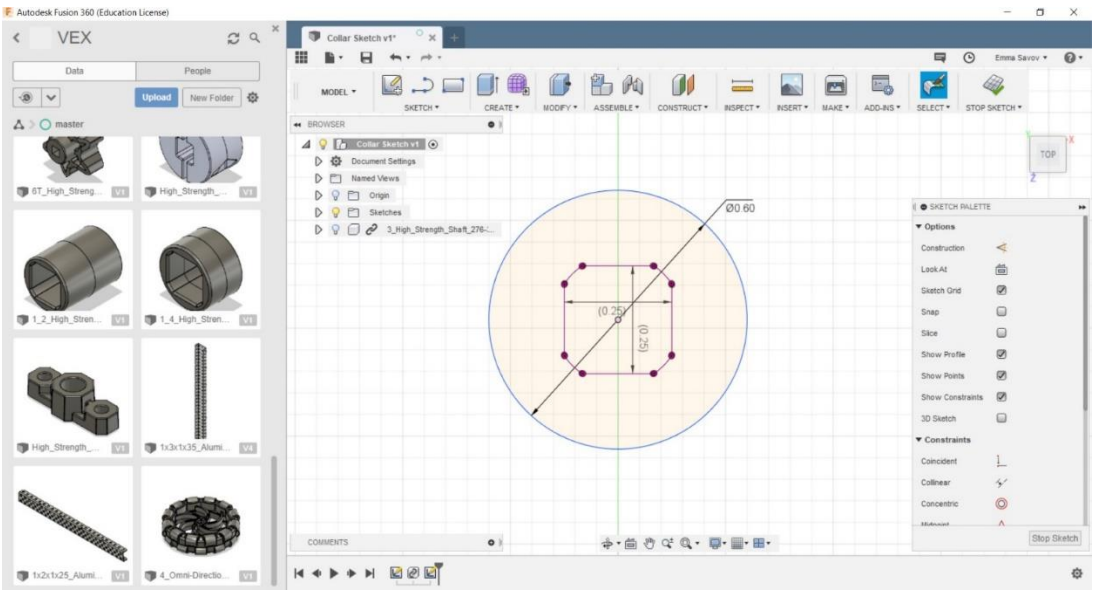

Figure 6. Fusion 360 Base Sketch

CONCLUSION

3D Design software can help competitive robotics teams test a design ahead of time before it is physically built, making sure that all parts fit perfectly. Using CAD is beneficial to find and correct any flaws at an early stage and save time in the build stage. By having the progress documented, all involved team members can stay updated and will be able to make future modifications onto the original design.

As a person who plans on pursuing engineering career, CAD would be useful for me to visualize a concept, analyze it and make changes with high accuracy.

3D design software is allowing me to turn my ideas into reality.

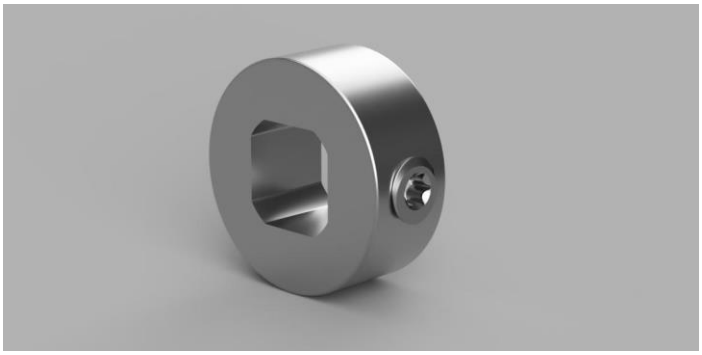

Figure 7. Fusion 360 Final Rendering with Set Screw Inside

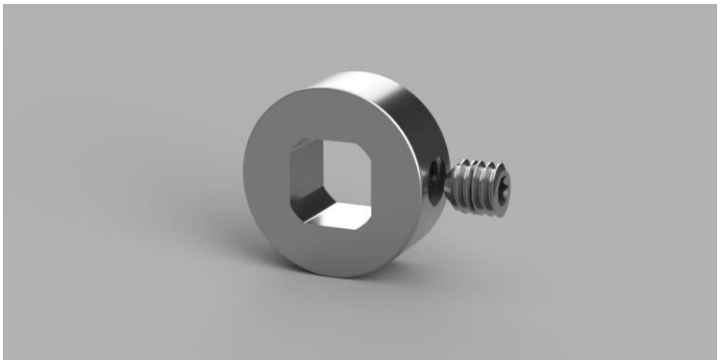

Figure 8. Fusion 360 Final Rendering with Set Screw Outside