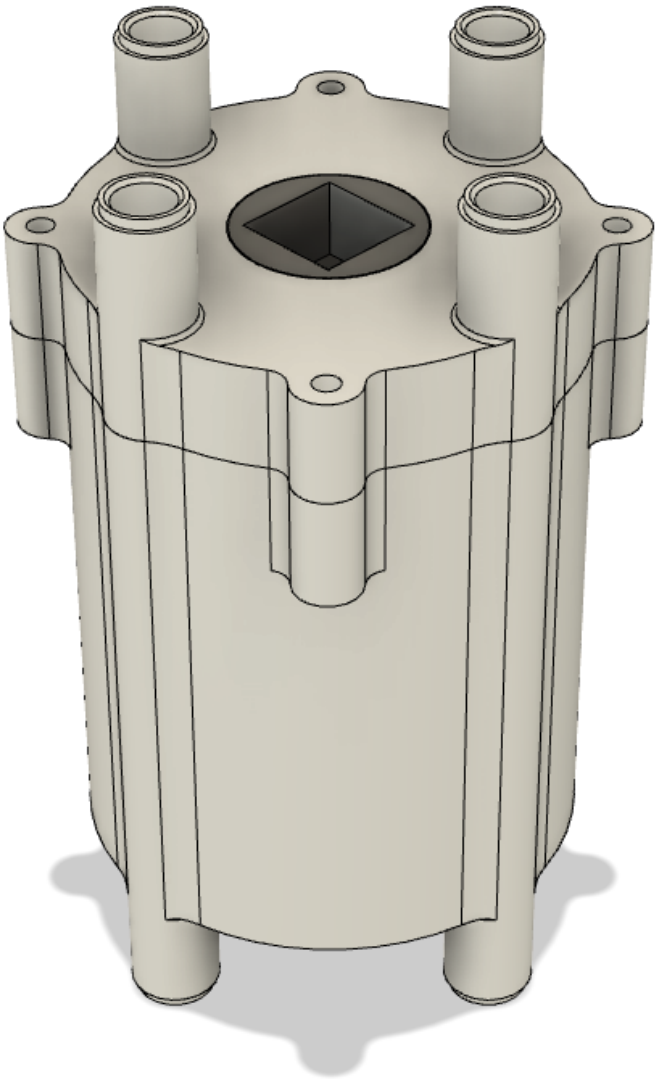
Vex External Gearbox

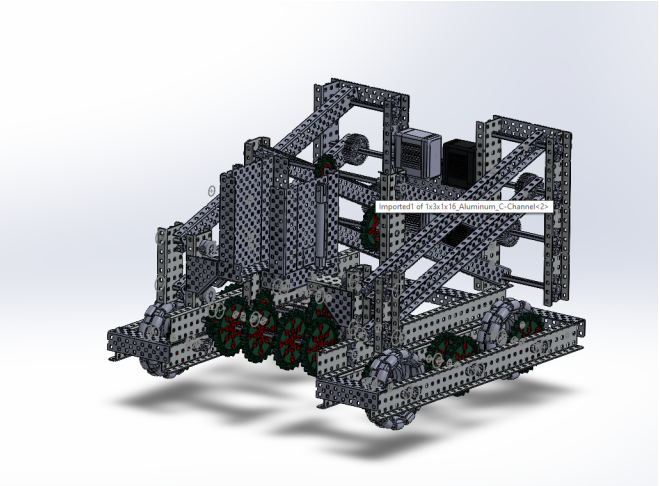


VRC Make it Real Challenge Submission

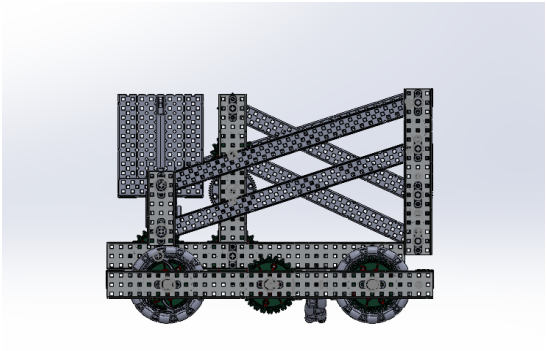
Submission By: Tristan Brady of Team 5760D, from Fort McMurray, Alberta

The Problem:

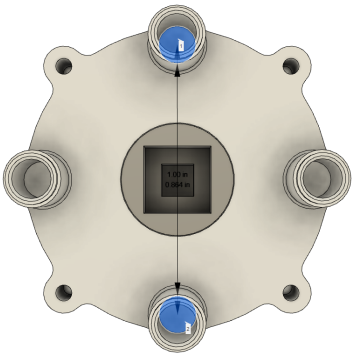
When we were designing our robot at the start of the season, we wanted to pick up rings and put them on the branches of the highest mobile goal. To do this, we knew that we would need a lift. However, we decided to design the robot from the bottom up, and the lift became an afterthought, designed around everything else. When we finally got to the lift, we found that it would need to take up a lot of space to reach high enough. This meant that we would need to be right up against the size limit. This wasn't a problem. We built the lift without any more major problems appearing. However, when we started testing, we noticed that we had forgotten something major.



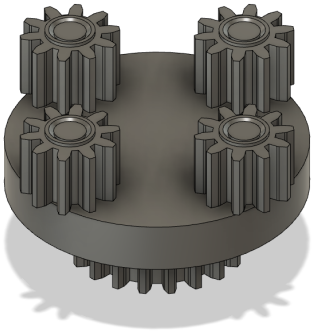
Our team is mostly made up of programmers, and nobody had ever built a double reverse four-bar lift before. We had forgotten to take into account how much our motors could lift, and just decided to directly power the lift with four motors. Even with red gearboxes in the motors, the lift would not go up. We tried multiple things but kept running into a major roadblock. Our designs had put our motors right next to the size limit, and they could not be moved without a major redesign. This meant the biggest gear we could use in the area was a 36 tooth, and the best ratio we could make in the space was 3:1. Even with this, the lift would not work.

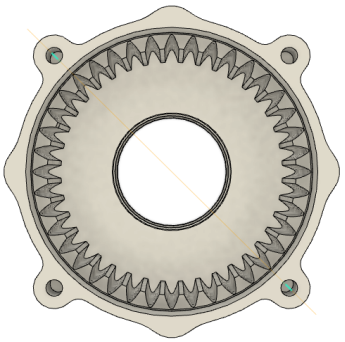


The Design:

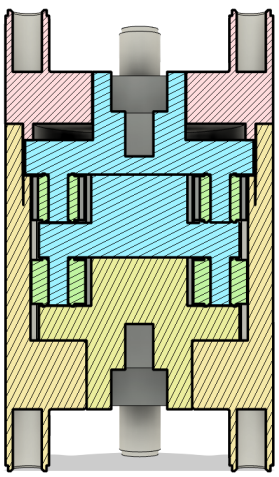


With this in mind, our submission for this challenge is an external gearbox. By choosing a specific ratio, the size could be brought down majorly. After talking with the team, I decided on a 9:1 ratio, which was as close as we could get to the largest ratio possible using only two gears; 7:1. This new part mirrors the design of the Vex Motor Gearboxes, fitting in a space 2 inches long and 1.2 inches wide. Four anchor points have been added in a circle with a radius of 0.5 inches so that the gearbox will fit on 1x3x1 and 1x5x1 C-Channel. The powered axle goes into the casing side for a torque ratio or can be put into the cap for a speed ratio.





Using this part, we would have been able to fit in the ratio we needed into the space we had, only requiring us to widen parts of the lift. However, since nothing like this existed, we were forced to choose between a major redesign of the robot to make the lift work or a change in strategy. We eventually decided on the latter.



How It Was Made:

For this project, I used the education version of Fusion 360 V.2.0.11680. I chose this software because I had heard that it would allow me to quickly transition from working in robotics to working at home without the need to upload files, as well as the ability to work in teams. Most of this model was made by sketching and extruding, along with a few uses of circular patterns, fillets, and chamfers. When it came time to assemble the parts, joints were a major help, allowing me to lock pieces in place with only a few clicks.

What Was Learned:

The major thing that I learned while doing this project was how to use Fusion 360. All of the CAD students Father Mercredi are taught to use Solidworks, and so having to work in Fusion taught me a fair bit. Key points include the use of joints instead of mates, timeline-based construction, a general construction file instead of separate parts and assemblies, and online file storage. Overall, the differences between the two programs were interesting, and working with both has helped expand my abilities.

I also learned a few things on the mechanical side while working on this project. To start, I have not had much exposure to planetary gearboxes, and the research I did on them during this project has taught me a lot. This information was crucial to the design, and as such, I consider it the most important thing I learned. I also refined my knowledge of gear design, which has been a weak point in my CAD since I started.

All of this will be helpful to me in the future, as being able to use multiple industry-standard CAD software increases my versatility. By using my knowledge of both software, it will be easier for me to adapt to a workplace that uses either one. As well, using both allows me to transfer specific skills and thought processes between the two. The way I might design in Solidworks is different from how I design in Fusion 360, but by becoming proficient in both I can bring the best of both worlds.