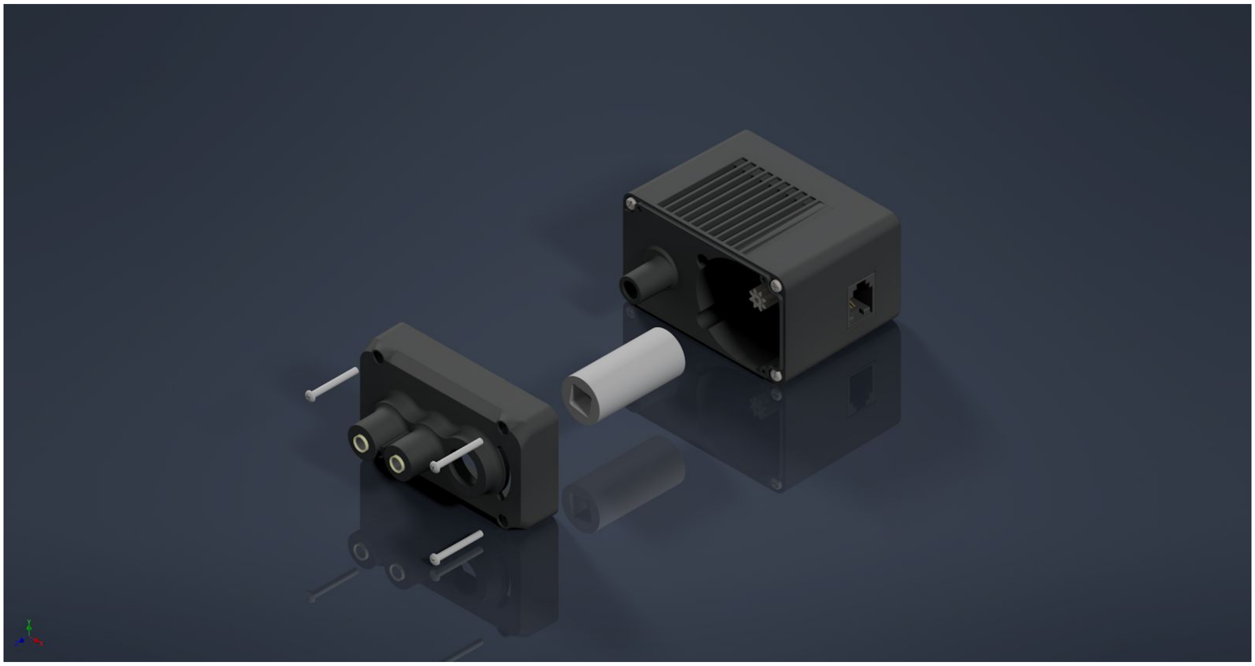
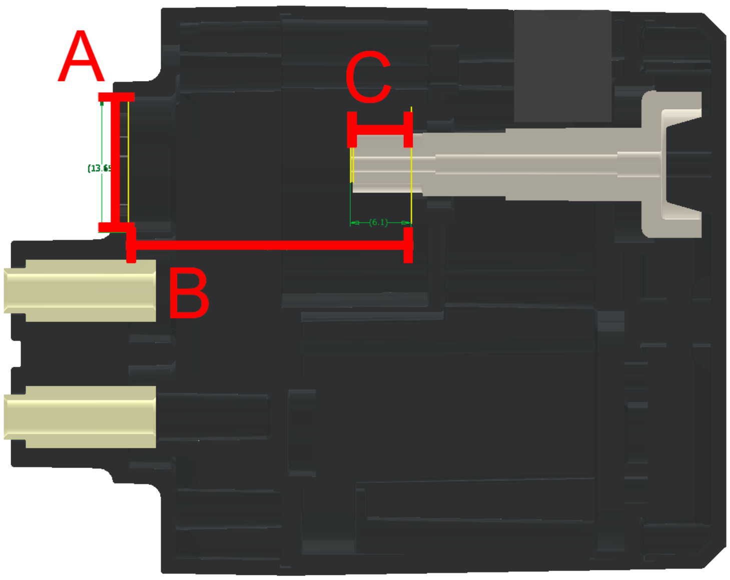
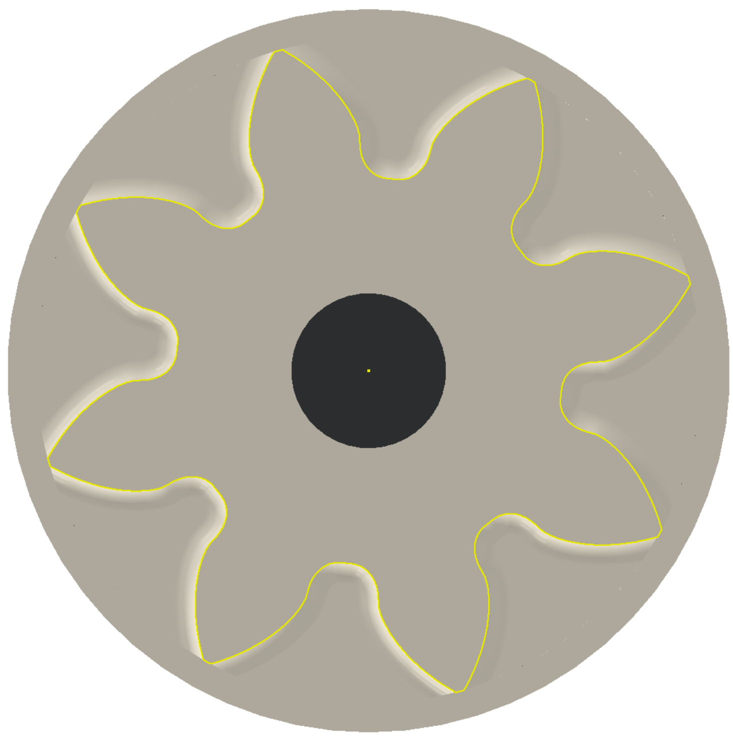


We designed the 1:1 motor cartridge for the purpose of simplifying the high-speed mechanisms which often end up being used in VRC robots. New teams tend to struggle when they build their first flywheel and may refrain from ever building a high-speed mechanism again, closing the door for a valuable learning opportunity. The impact of friction, the pain of designing multistage gear trains, and the restriction of parts prevents teams from exploring designs that utilize high speeds in order to be effective. This simple cartridge provides a simple solution to these problems.

The 1:1 motor cartridge has several potential utilities. This part is meant to be an addition to the already existing family of motor cartridges. It is designed to be easily swapped in and out of the motor, just as easy as the other cartridges available. The cartridge gives VEX teams more control over their design. It provides room for optimization by introducing new opportunities for gearing, potential for more space and weight-efficient designs, reducing friction, and eliminating backlash. Previously, flywheels had to be geared with one or two stages of gears. More stages introduce extra backlash and friction since there are multiple shafts and gears meshing creating extra connections that may be loose or resistive and add weight. In addition to this, it also replaces the gears present in the current motor cartridges 1 or 2 stage planetary gear sets, which also have a significant amount of backlash and weight. This cartridge could most easily be integrated into a flywheel system and replace the traditional gear train with a direct connection from the flywheel to the motor output, allowing for lowered weight and simplification of the system. This cartridge has the capability to greatly simplify robot design.



In order to design this part, we utilized the CAD files of a V5 motor made available on the VEX Robotics website. After it was imported into Autodesk Inventor Professional 2021 we deleted the cartridge that came inside the motor and made a sketch of the pertinent project geometry. Then, we copied this sketch into a new parts file. We found measurements inside the motor which allowed us to find the dimensions needed for our cartridge. A simple cylinder was extruded with a diameter slightly smaller than the inner diameter of the motor cap (Labeled A above) and with the cartridge length (Labeled B above). After we made this small cylinder, we found the geometry of the internal gear of the motor (shown below) and copied it onto the face of the cylinder. Once we made sure the gear profile was aligned with the center of the cylinder, we extruded it to the length of the gear, labeled C above. After I finished this, I added chamfers and fillets to smooth out the edges of the part.



Personally, I learned many things from this project. This was the first time I have ever tried designing a part on my own other than simple thin sheets of plastic with a few holes in them. I have already been using Inventor for quite some time, and plan on continuing to. I have used it for many things, primarily for designing entire robots without ever laying a hand on a piece of C-channel or a screwdriver. It helps to plan out a robot in a way that could have never been achieved otherwise, and often makes the entire build process quicker, allowing us to get started on our next robot sooner than we could have otherwise. Additionally, I could easily see this software helping me in a future career in engineering. The designing capabilities of CAD software like Inventor simply cannot be matched by using other means, and results in a higher quality finished product. This is essential in engineering where parts must be designed to fit specific requirements, but you cannot afford to use material physically remaking the part so it suits its purpose. Having the ability to use Autodesk Inventor tremendously helps our robotics team be more competitive, and allows me to prepare myself for a future career in engineering.