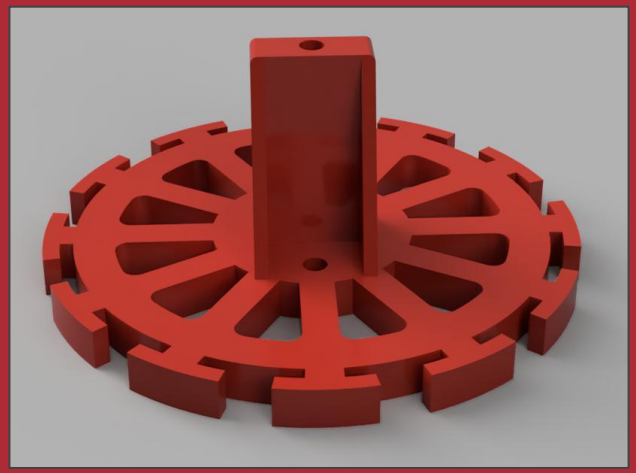
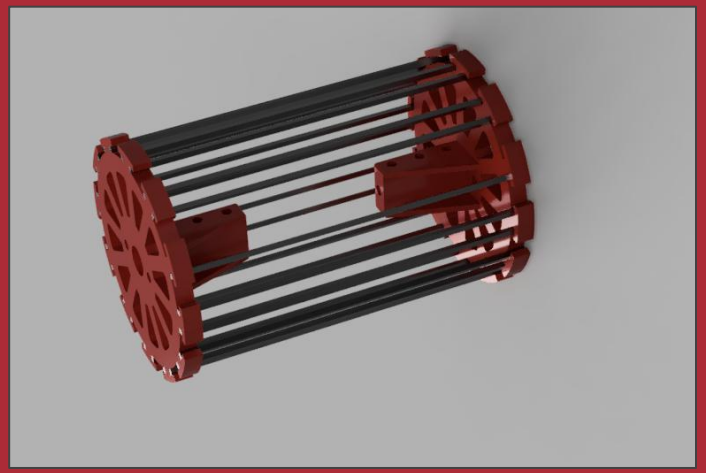
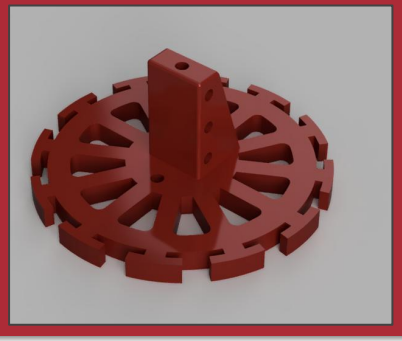
Optimized Rubber Band Roller

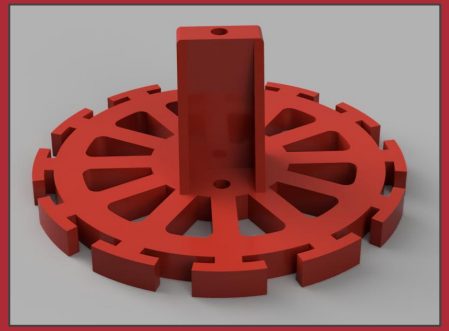


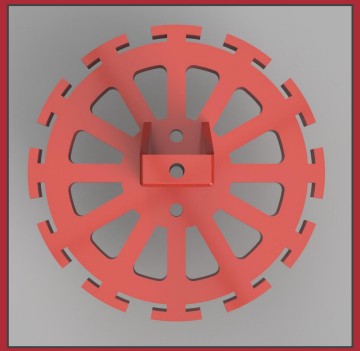


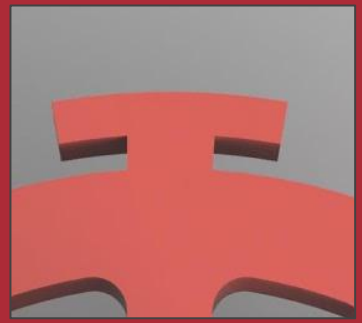
Team WPI0

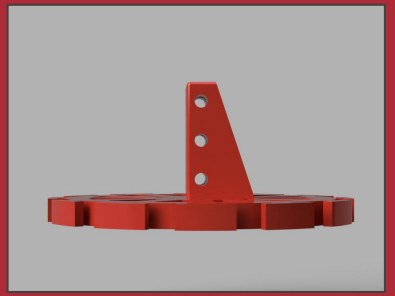
Introduction







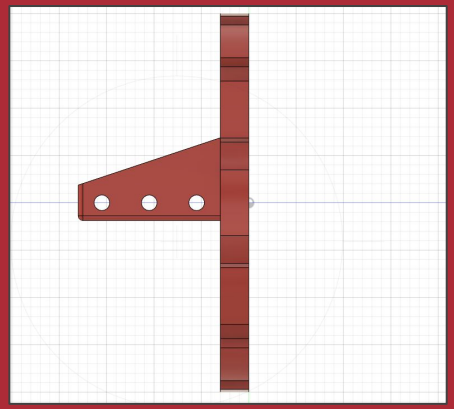




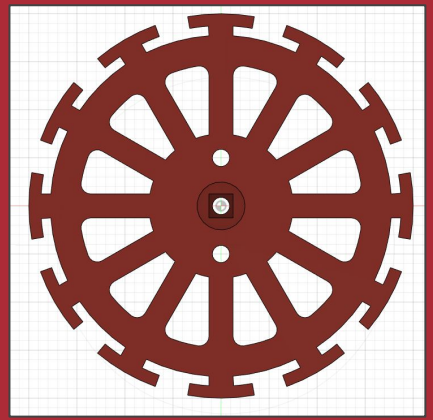
Teams in competing in VEX robotics commonly use sprockets as part of a rubber band intake or indexer system for spherical objects. Games such as Change Up are well suited to these designs We set out to create a dedicated part that offers a number of advantages over the traditional sprocket system:

- **Cleaner, stronger rubber band mounting:** The rubber bands fit perfectly into the slots of this part, making them less likely to slip or come off
- **Tough but low profile:** The c-channel mounting is stronger than the typical standoff supports while occupying less space
- **Screw joint supported:** Just like newer VEX sprockets and gears, the part can take either a metal insert for a driven shaft or a plastic insert for a screw joint
- **Low maintenance:** With rubber bands locked in position, and a mounting system designed not loosen easily over time, the intake minimizes maintenance time in competition

More Detail

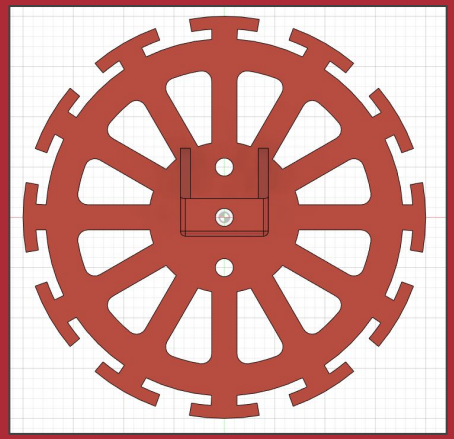


Three through holes allow multiple mounting options:
With a .165 inch hole diameter, quarter inch screws can be threaded into the part, allowing a shaft to run through the part. Using all three holes protects the relatively weak plastic threads
When using screw joints longer screws can pass through the part and be held in place by nuts on the other side. This necessitates only one or two holes be used as this joining method does not rely on threads in the part for support

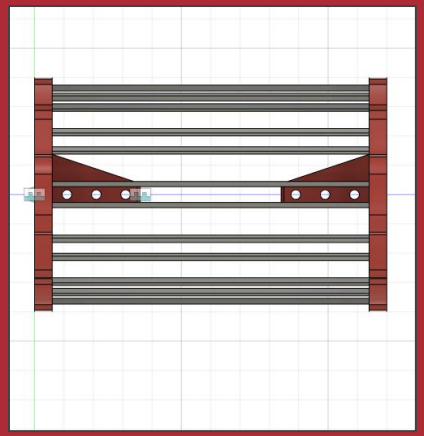


Insert (square or circular) can be recessed into the part
PLA plastic is too easily damaged to rotate smoothly on a VEX low strength shaft or screw

Using inserts spreads out the force, increasing the parts lifetime significantly, as well as making it more resistant to damage in competition

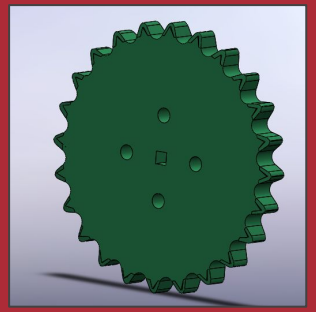


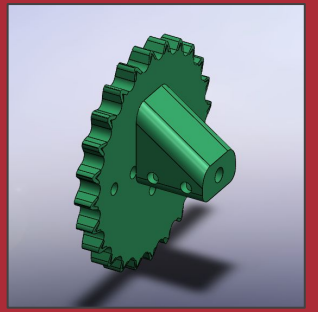
Two mounting holes on the face allow this part to be directly attached to a sprocket, preventing the and making screw joints easier to assemble and stronger



Outer diameter of this part is equivalent to that of a 24 tooth sprocket, and it can easily upgrade sprocket based systems without necessitating geometry changes

Design History

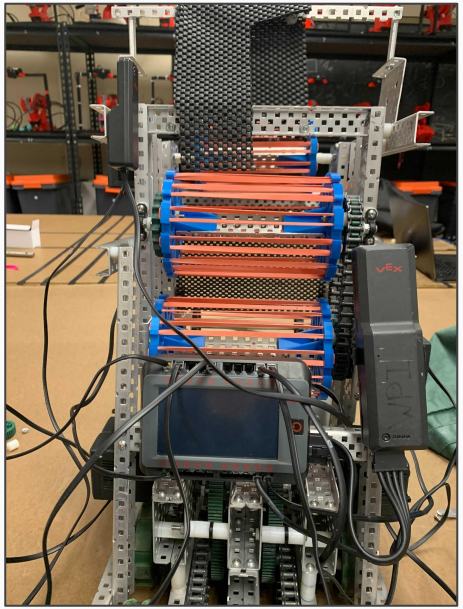




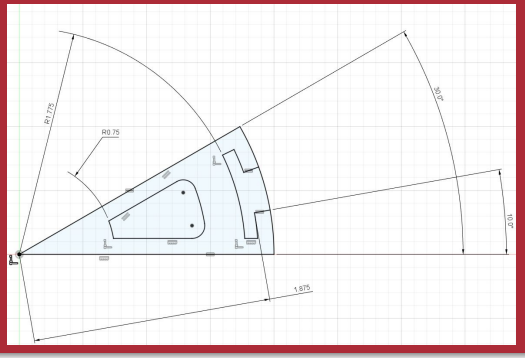
- Based on 2019 “Not-a-sprocket” - drop in replacement for 24 tooth sprocket in intakes (top left)
  - 20 grams of plastic - $0.6 and 2 hours of print time
  - Enabled our team to free up actual 24 tooth sprockets for power transmission, using these prints to hold rubber bands on both robots
- C-channel mount variant (top right) allowed a wider intake
  - Used on the 24” robot, this version allowed a 17.5 inch c-channel to connect the sides of the intake
  - Dramatically larger ball pick up area allowed us to collect balls from off the top of the cap in autonomous as we flipped it over our robot
  - This intake was destroyed in competition by an opposing robot with a powerful 10 motor drive. Despite the c-channel being bent by nearly 30 degrees, the prints were unharmed and the intake was able to be repaired at the event
- The newest version for Change Up trades the compatibility of its predecessors for a much more robust and adaptable design

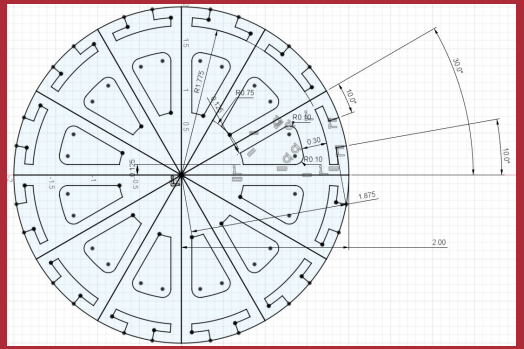
The Robot

Our 24” robot this year uses a total of 6 roller prints in 3 rollers. Using the swappable inserts, we have 4 mounted using low friction screw joints (circular inserts)while the other pair receive power through shafts (square inserts)



Design



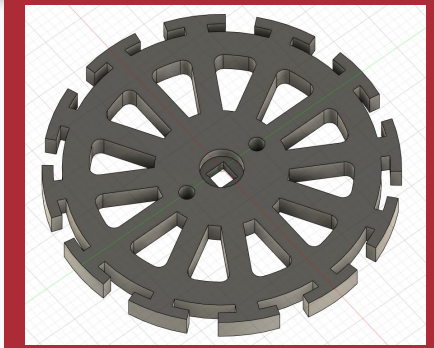


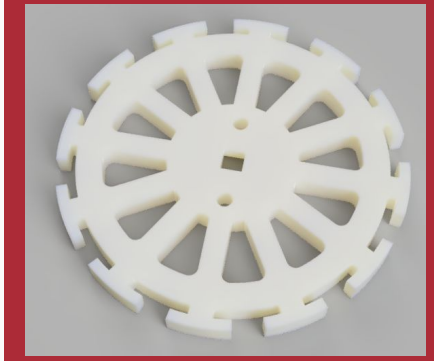
This part was modeled in Autodesk Fusion 360 version 2.0.9313

The shape of the rubber band holding section of this part was created in a single sketch. First, we decided that we were going to use 12 rubber band mounting points. This meant that each spoke occupied a 30 degree slice of the part (*Top left*). Additionally, we defined the outer diameter as 4 inches, and thus constrained the slice to a 2 inch radius. We then drew out the cutout that holds the rubber band, and the weight saving cutout.

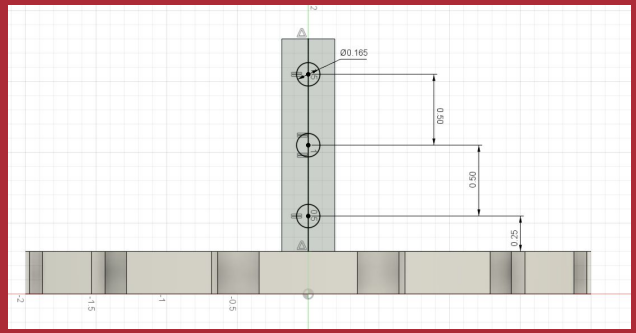
Having completed a single slice, we used the circular pattern tool to make 11 more copies of the slice (*Top right*) and then extruded from that sketch. This means that the entire part can be modified by editing the dimensions of a single slice, allowing changes to be made easily.

Completing this section, we added the insert cutout in the center, and the sprocket mounting holes on each side of it (*Middle*)

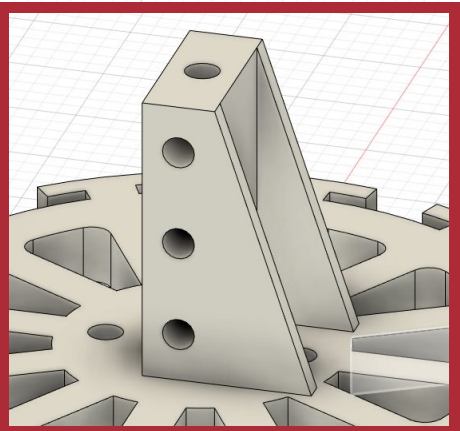


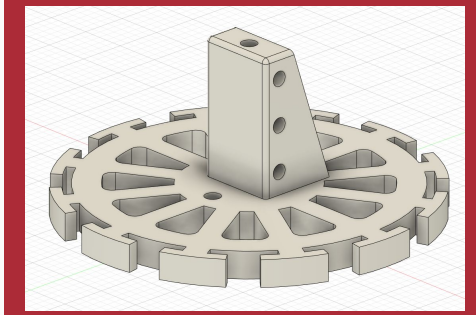


Design (Continued)



The next section was the c-channel mounting. We started by creating the mounting block 1.5 inches long, and 0.375 by 0.875 inches across to fit inside of a c-channel. The block has a 0.18 inch diameter circular hole through the center to allow it to spin cleanly on a shaft or screw. From this block, we created the 3 c-channel mounting holes (*Top*). Unlike the other holes, these were 0.165 inches in diameter, a much tighter fit for standard VEX screws. This allows screws to be threaded into the part, opening up additional mounting options.





Results

This project is part of our team's ongoing mission of moving beyond the limitations of the provided VEX parts. For the first time this year we have developed complete CAD models of both 15" and 24" robots prior to physically building them. Using CAD models has facilitated the development of custom parts that can be produced through modern manufacturing techniques like laser cutting or 3D printing to make our vision into a reality.