C-Channel Low Profile Motor Mount

Make It Real CAD Engineering Challenge

YNOT Robotics
Change Up: 2020-2021
University of Tennessee, Knoxville
VEXU Competitive Robotics Team

C-Channel Low Profile Motor Mount

Introduction

Using space efficient designs in VEX is a fundamental part of the design process. When designing anything with a motor, significant space must be allocated and even then, the traditional motor mount is unstable. The current motor mounting process lacks a small, compact, and structurally secure motor mount. The motor mount we have designed is a low profile motor mount for c-channels to more closely attach motors to their direct-driven shafts. The part replaces the traditional function of the motor cap (**Image 1**) in order to connect the motor through the mount to a three or two wide c-channel (**Image 2**). This allows for a better connection to direct-drive motors and makes the motors significantly harder to break or shear off.

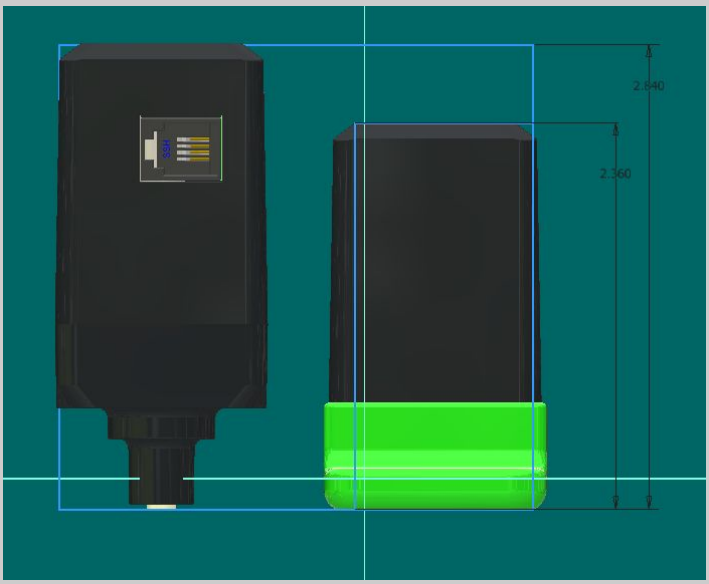


Image 1: Render of the two wide c-channel (left) and the three wide c-channel (right) low profile mounting blocks with the motors.

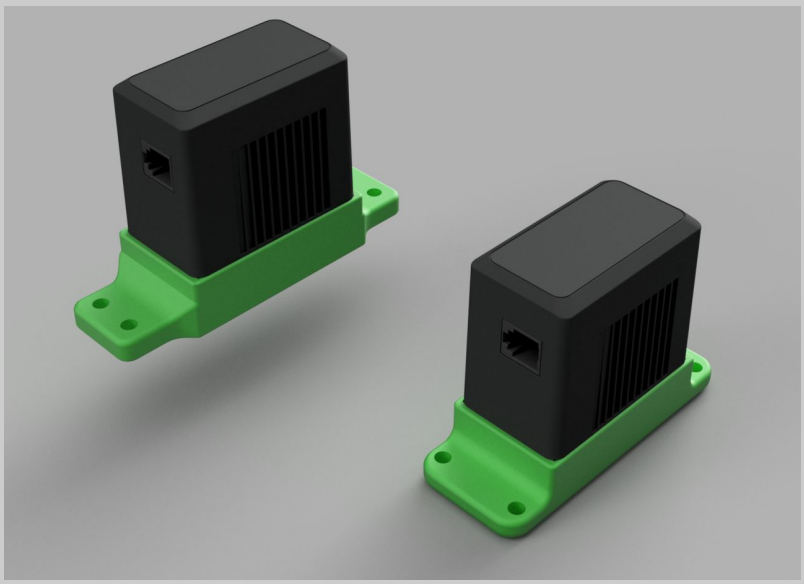


Image 2: Render of the two wide c-channel (left) and the three wide c-channel (right) low profile mounting blocks with the motors.

C-Channel Low Profile Motor Mount

Introduction Continued

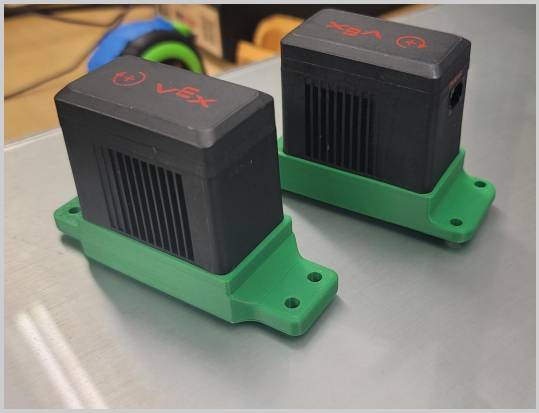
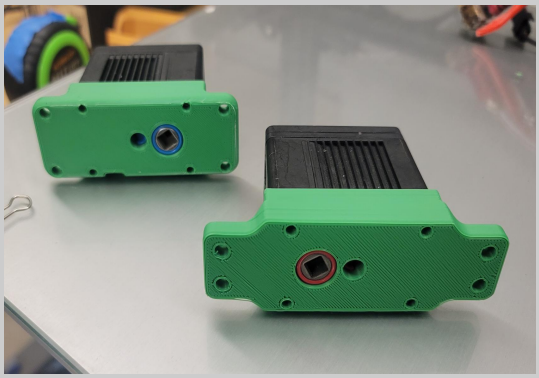
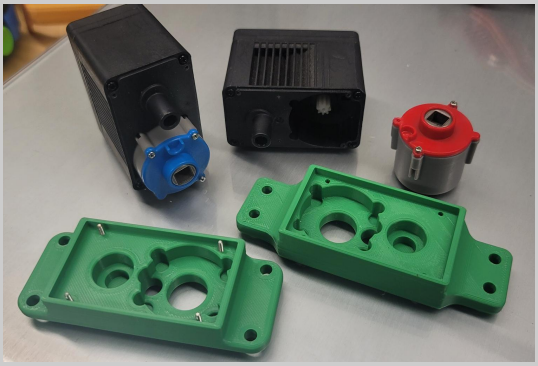
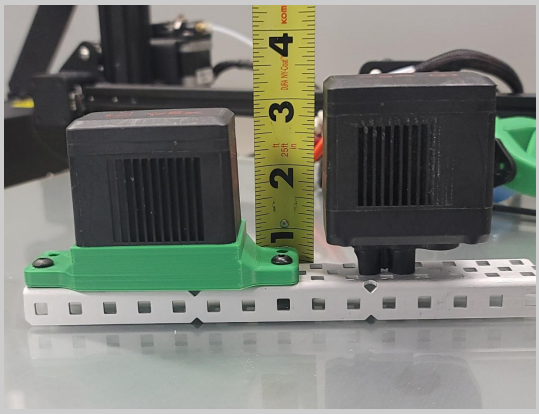


Image 3.1-3.4: Images of the 2 wide and 3 wide 3D printed low profile motor mounts.
3.1: Upper Left - both mounts containing their motors
3.2: Lower Left - both mounts containing their motors, tilted to the side to reveal mounting holes.
3.3: Upper Right - Motor in the 3 wide 3D printed mount, imprint of motor visible in 2 wide part
3.4: Lower Right - Different motor cartridges displayed with corresponding mounts, demonstrating ease of access to internal elements







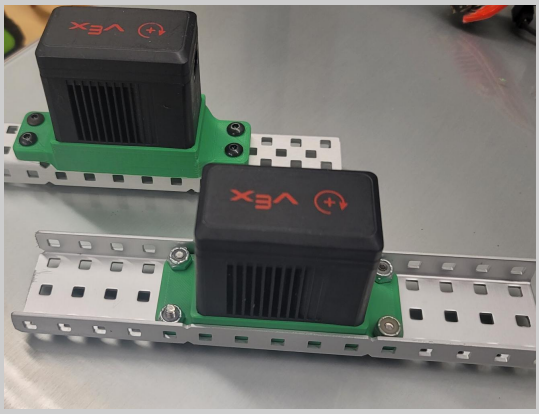
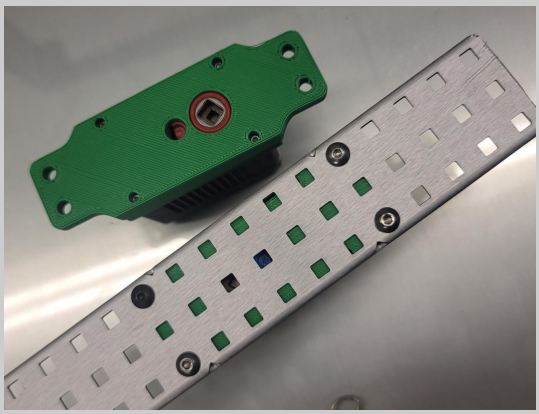


Image 4.1-4.4: Images of both 3D printed motor mounts connected to c-channels.
4.1: Upper Left - height comparison between the current mounting process and the motor mount
4.2: Lower Left - both mounts connected to c-channels
4.3: Upper Right - both mounts connected to c-channels
4.4: Lower Right - the underside of both motors, with 3 wide connected to c-channels



Functionality

The low profile motor mounts created would be used to directly drive a shaft through a c-channel hole into the motor while saving space. The current process to mount a motor requires two screws through the c-channel and into the provided screw holes and threaded inserts in the motor cap. The new motor mount removes the motor cap and directly connects the motor to the mount via four corner mounting screws, or a zip tie through the available zip tie mounting holes (**Image 5**). With the motor being so close to the mount and thus the c-channel, it is a much stronger mount and is exponentially harder to shear off the robot. Not only is our new mount stronger, it's also space saving. This can be used on any two wide, three or five wide c-channel a motor would be mounted to.

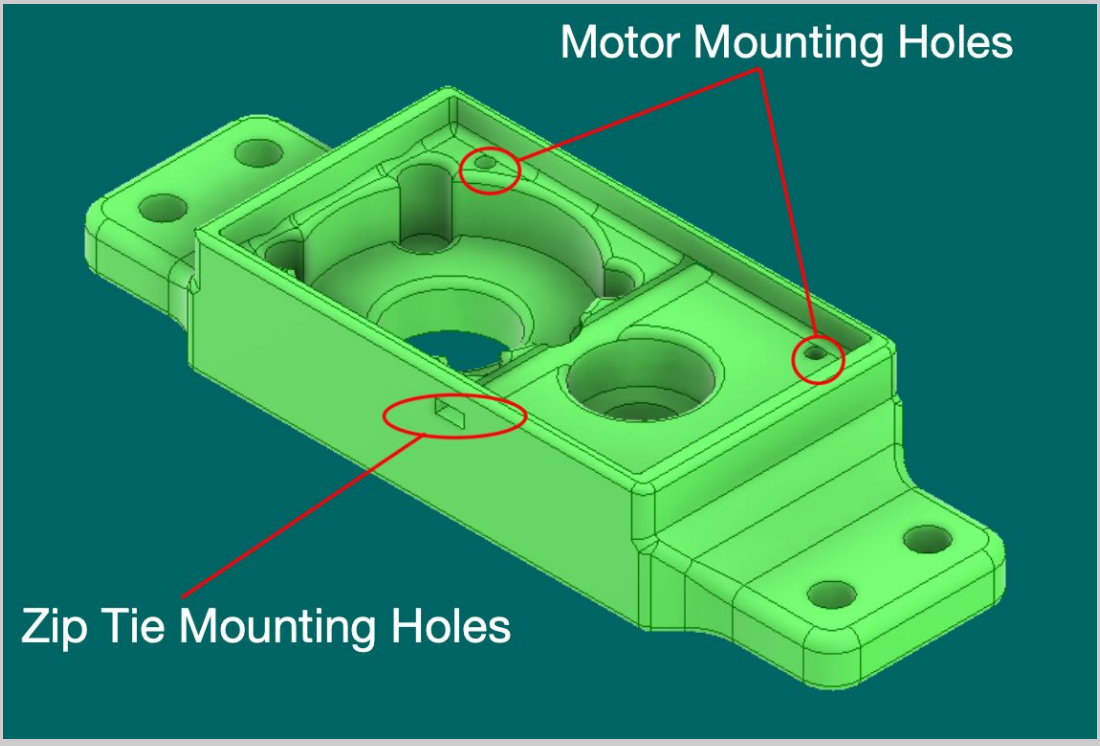


Image 5: Labeled Inventor screenshot showing the two different mounting holes available in our motor mount.

Design

In order to create the motor mount, a V5 Smart Motor cap was referenced in Autodesk Inventor Professional 2021. This reference allowed us to achieve a secure fit to the gear cartridge. First, the motor was opened in Inventor and the motor cap was taken off in order to view the geometry of everything that stuck out and needed to be designed around (**Image 6**). Such pieces include the gear cartridge size and flange, the motor cap aligner, the lip around the edge, and the screw holes that hold the motor cap in place. These pieces were measured out and an initial holding block for the motor was designed and printed. After three iterations of printing and changing the spacing on the holding block, the fitting was finalized. Then, the model was rebuilt to add screw and zip tie holes, as well as a mounting block for c-channels. Two versions of the motor mount were made, one that can mount inside a three or five wide c-channel, and one that mounts to the outside of a two wide c-channel (**Images 7.1 and 7.2**). The mounts were also rendered in Autodesk Fusion 360 (**Images 8.1 and 8.2**).

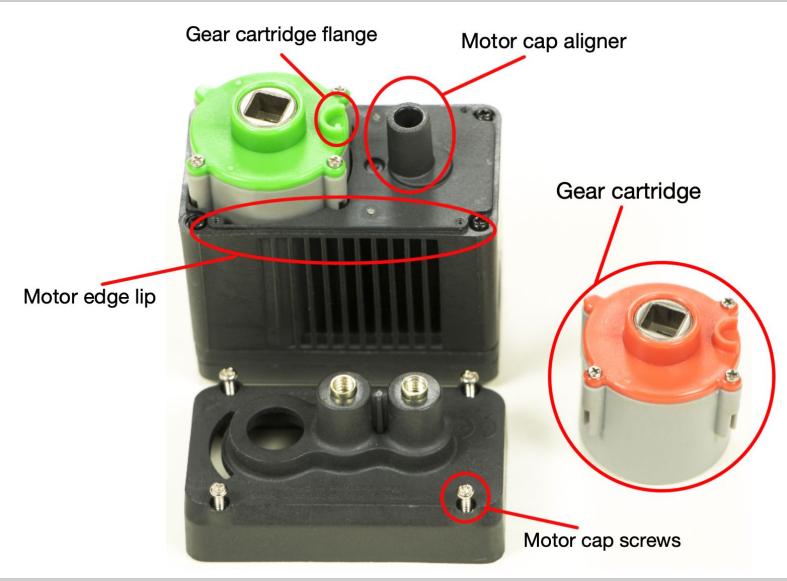
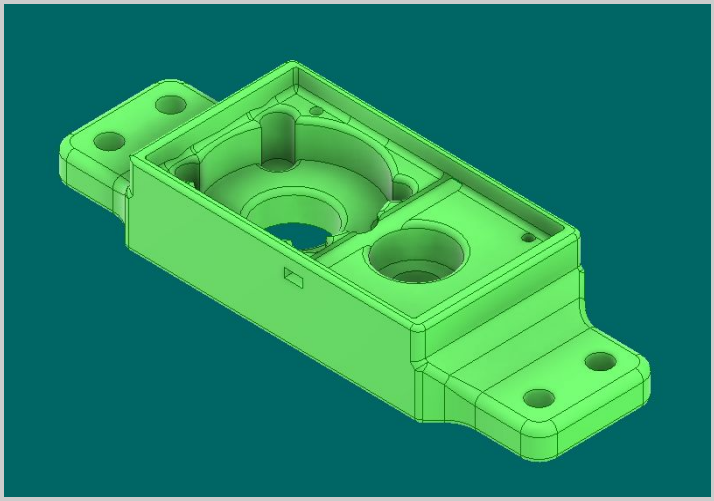
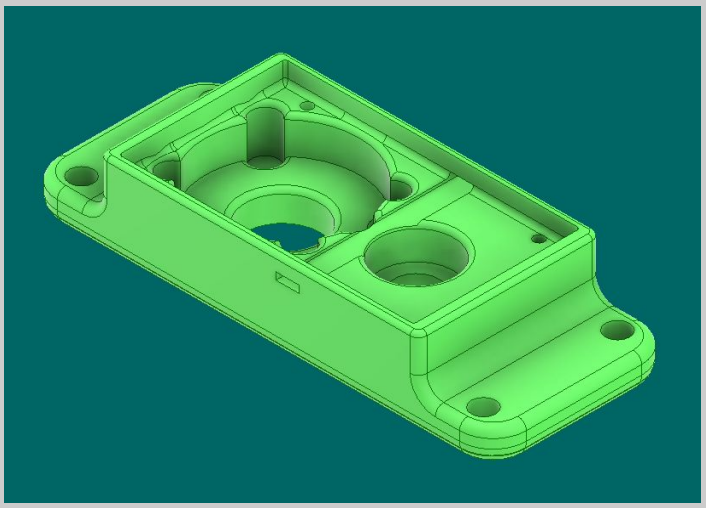


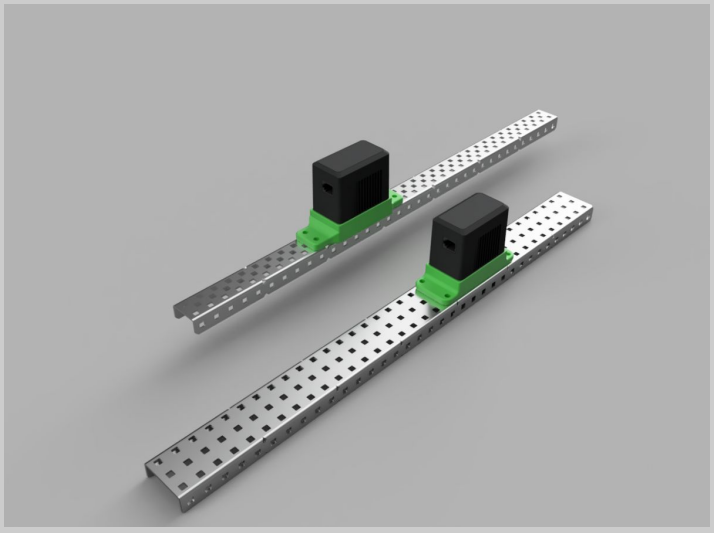
Image 6: Labeled diagram of motor pieces taken into account when designing the mount. Motor cap is displayed with elements currently used to mount motors.

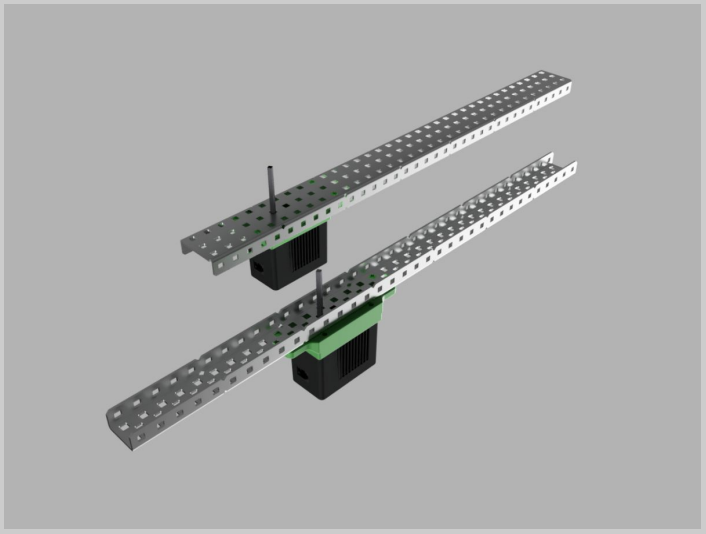
Design Continued





Images 7.1 and 7.2: Inventor screenshots of the two mounting blocks without motors. Two-wide c-channel mount (left) and three-wide c-channel mount (right).





Images 8.1 and 8.2: Renderings of the mounting blocks mounted to their respective c-channels. Top (left) and bottom (right) views. Right displays the direct-driven shafts attached to the motors.

Conclusion

From this project, we learned how to make custom motor mounts. This is especially important, as all of our motors on all of this year's robots are custom mounted, including custom gearboxes, low profile and extremely low profile mounts. 3D design software is a fundamental part of our team's design process. Team YNOT constantly utilizes these programs to innovate in VEX. Our robots this season have over one hundred 3D designed pieces. Seventy percent of the elements composing our robots will be 3D printed. Being on a competitive robotics team, 3D design software is an integral part of the VEXU robot design process. We hope to maximize the potential of this technology to enable us to create more advanced, custom parts. Team members have received internships specifically because of their ability to use 3D design software, such as Autodesk Inventor. It has greatly impacted their lives and available career opportunities. Autodesk Inventor and other Autodesk 3D design softwares that are available to the public will continue to open doors for our team members and for the young students that we mentor across the United States.