Adjustable Support Beams

I. Introduction

Mechanisms susceptible to heavy usage, oscillations, and/or violent impacts may need added support from beams or elastics. However, in many cases, the set of pieces available to VEX EDR teams limits the way in which effective support systems can be built. The pattern of holes in c-channels usually prevents non-orthogonal structures from being built. Even so, in many cases, certain mechanisms are built such that these holes still do not line up well, which prevents any support from being added. This forces teams to either deform pieces (drilling, cutting) or forcefully fasten pieces that do not correctly line up, hindering build quality.

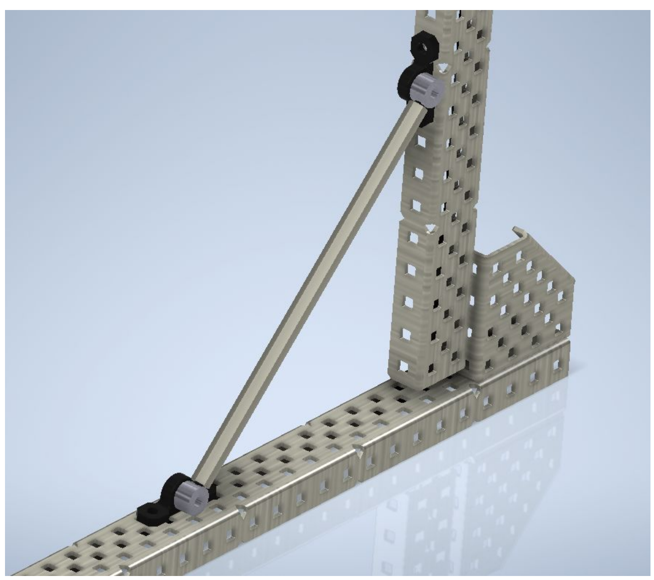


fig. 1

Pictured in ***fig. 1*** is a common support method used by many teams, where the standoff acts as a support beam and adds stability to the upward facing c-channel. It acts as an effective non-orthogonal support, but it is difficult to line it up well. Notice that the bottom pillow bearing does not line up with any holes on the bottom c-channel. The holes can be made to line up with spacing or drilling, but the endeavor requires excessive trial and error and often results in an imprecise beam that adds tension to the frame rather than adding support, creating more flaws in multiple subsystems. In ***fig. 2***, for example, tension created by the two standoff supports will deform the drivetrain, causing unreliable motion and possible motor overheating. In addition, the support beam can pull/push the supported piece and cause unforeseen problems if the length is even ⅛” incorrect.

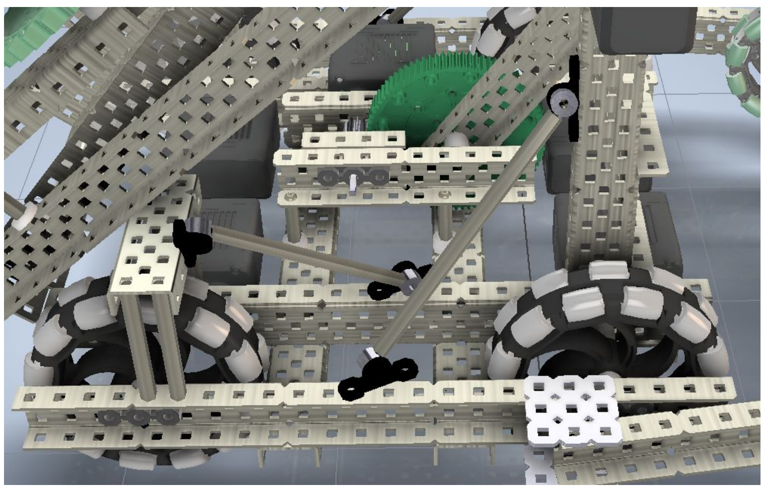


fig. 2

Our adjustable support beam allows for perfect, adjustable support beams of any size to be made without any need for precise drilling or excess trial and error. This eliminates issues with stress added from support beams, drastically reduces build time, and increases longevity of the robot’s mechanisms.

II. Design and Usage

The beam consists of two cylindrical shafts, with one sliding inside of the other.

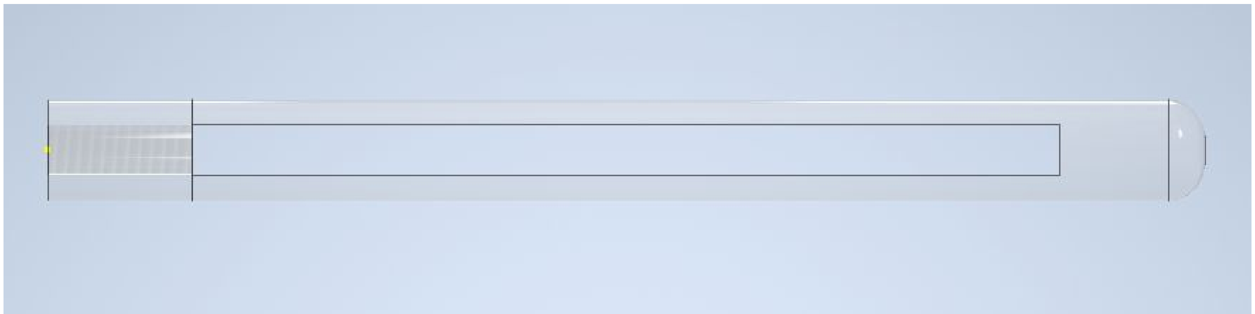


fig. 3

Pictured in ***fig. 3*** is the primary shaft. The left end is threaded for standard vex screws, with a 0.175" gap in the middle portion of the shaft to allow for a screw to fit through. The right end is chamfered to allow for easy insertion into the secondary shaft.

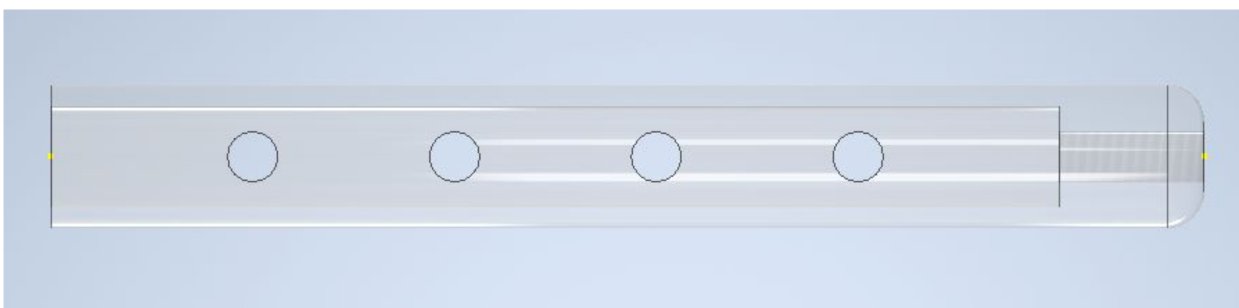
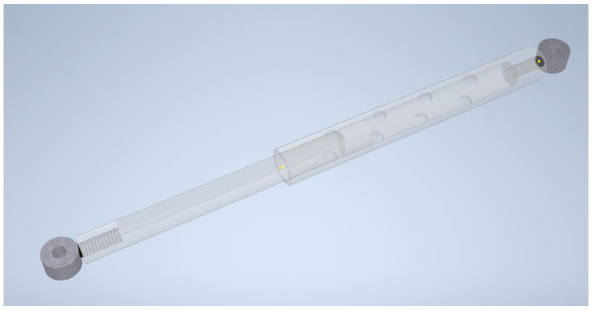


fig. 4

Pictured in *fig. 4* is the secondary shaft, which is a 0.5" cylinder with a 0.375" cylindrical hollow throughout to allow insertion of the primary shaft. The right portion of the shaft is threaded for standard vex screws. The cylinder is also lined with four screw holes for fastening both shafts in place to stop any sliding.



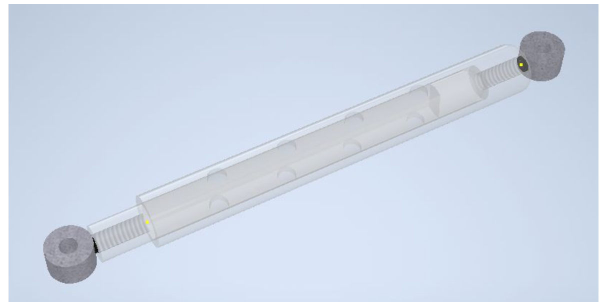


fig. 5

To assemble for usage, the primary shaft is inserted into the secondary shaft. Then, a shaft collar is fastened to each end with couplers. Then, it is ready to be fastened onto the robot with a pillow bearing attached to each shaft collar as shown in *fig. 6*.

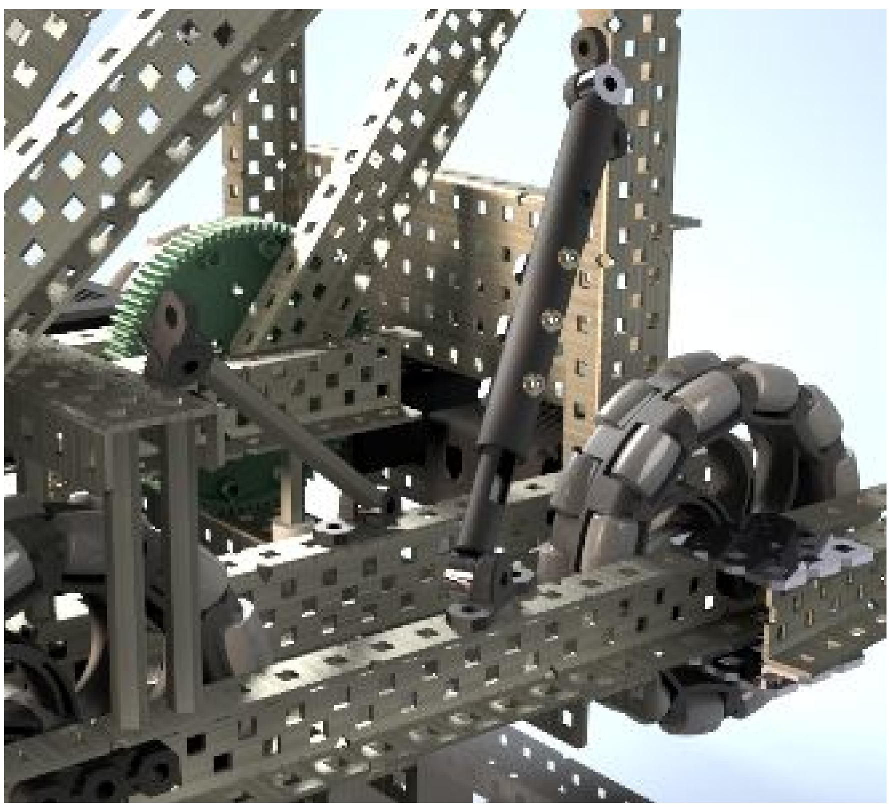
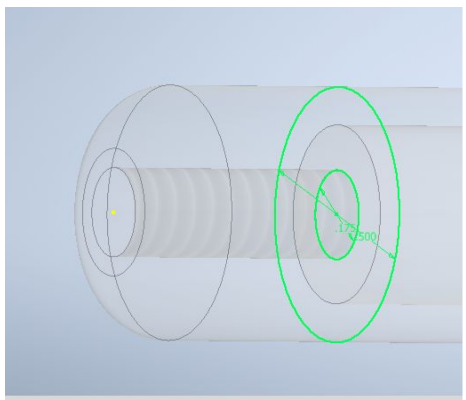


fig. 6

III. Software Used

To create this piece, I used **Autodesk Inventor Professional 2020.** I began by making the primary shaft, starting with the diameter of vex screws as a starting point. I created a part and made a 2d sketch of two concentric circles, with one having twice the radius. I then extruded this shape ½”. This is the threaded section. I then extruded it 3 more inches, then created rectangular negative space in the middle of it to make space for a screw to fit through. Then, I chamfered the other end. **(see *fig. 2*)**



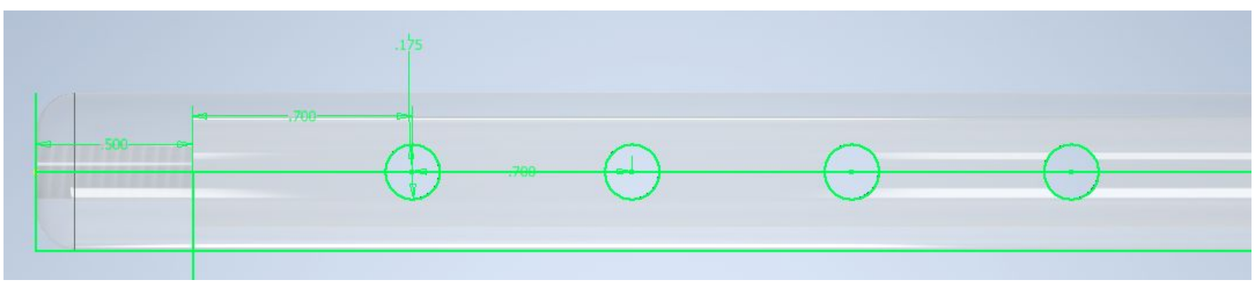


fig. 7

For the secondary shaft (**see *fig. 3***), I began by extruding two hollow cylinders, one threaded 0.5” long cylinder for the fastener, and another much longer cylinder that houses the primary shaft. I then sketched a screw hole and created a rectangular pattern to make three more equally spaced holes. Finally, I extruded this sketch and used the cut option to make negative space in the cylinder.

IV. Conclusion

CAD Software is extremely useful to design many things easily without wasting time and resources. Doing this project helped us learn how to design a part fully from scratch and was a very insightful experience. We learned a lot about the Autodesk Inventor interface and a lot of the tools that make it easy to create geometry and 3d-print parts with ease and analyze structures. We will continue to use Inventor to make 2d sketches and 3d designs to make prototyping much more streamlined. One of us is looking to pursue mechanical engineering, so these skills will be useful when designing parts. Another is looking to pursue electrical engineering, and there are also many tools to create circuitry. It is also coming in very useful for personal projects; right now I am building a mechanical keyboard with a custom layout and I am using Inventor to design the PCB.