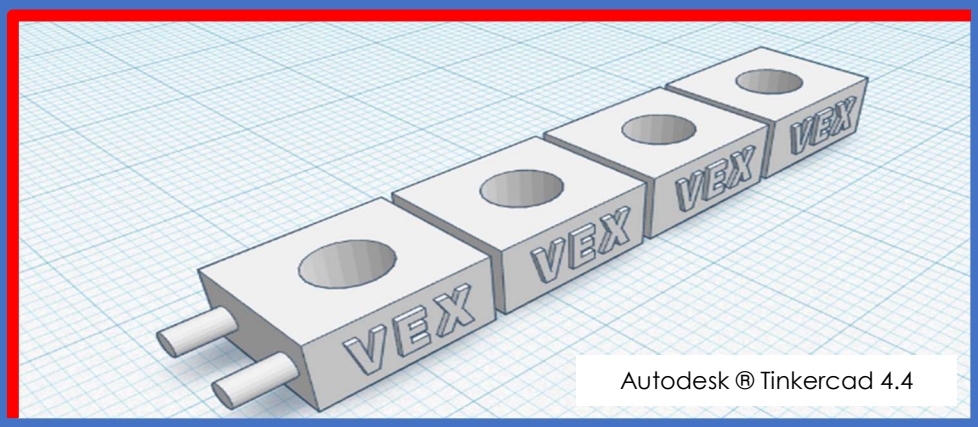
IRON EAGLES

9364X



VEX Extendable Modular Bearing

2019 Make It Real CAD Engineering Challenge
Sponsored by Autodesk ®

MIDDLE SCHOOL DIVISION

Designed by Emily Melton (7th Grade)

IRON EAGLES 9364X

Brentwood Academy

Brentwood, Tennessee, USA

VEX Extendable Modular Bearing

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Iron Eagles 9364X

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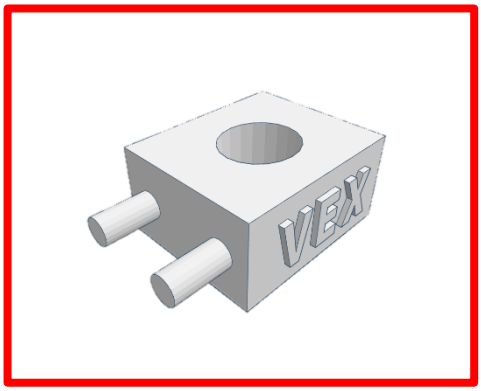

THE CHALLENGE

When brainstorming this idea, I was at a loss as to what innovation would best help the VEX community. The modular bearing idea came from hearing a few simple words from my teammate. "Ugh, I wish we didn't have to cut bearings! Why can't VEX make bearings in multiple sizes?" Then my coach noted how a 4-hole bearing could be very useful. Knowing how difficult it would be for VEX to create different sized bearings to suit all situations, we collectively came up with the idea of a more flexible solution.

Many teams struggle with sizing bearings. Bearings create less friction around an axle and are commonly used under motors or in gearing. My team often runs into problems regarding bearings because the standard three-hole bearings do not fit all robot-building scenarios. In many cases, an alternate-sized bearing could be extremely helpful. For example, a standard three-hole bearing generally needs to be supported by two screws. When making a gearbox, axles may be positioned close together. For efficiency, it would be nice to have a four- or- five-hole bearing. Then, you could support it with at least two holes and have plenty of room for the axles. On the other hand, sometimes there is not quite enough space for a full bearing. Some solutions include cutting the bearings or adjusting the whole section of the robot to fit the bearing. Often, cutting results in uneven edges or ruining the entire bearing. Making multiple adjustments results in wasted redesign time. Clearly, the standard three-hole bearings do not meet all robot needs.

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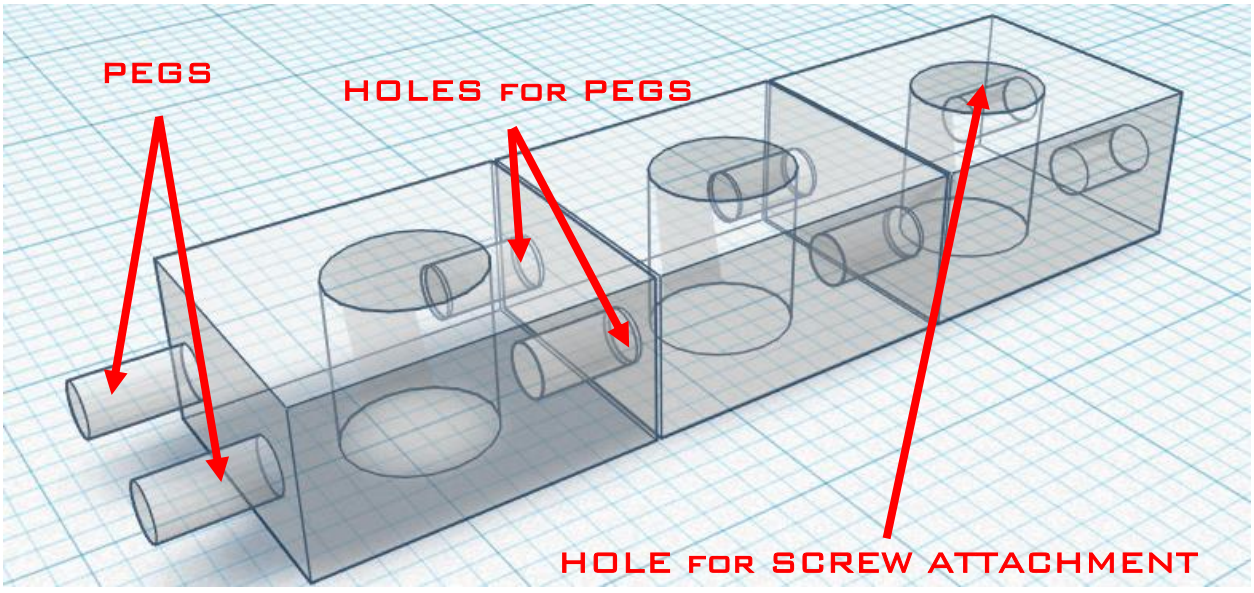
THE SOLUTION.

VEX Extendable Modular Bearings are simple, singular units that connect to create the preferred bearing size. The system consists of a simple part connected by screws and nuts that can be placed virtually anywhere on the robot. This bearing concept is comprised of a single-boxed piece with two pegs on one side and two holes on the opposing side.

The VEX Extendable Modular Bearing is made to be compatible with any VEX robot design. The unit can be used as a standalone piece or connected to additional units by sliding the pegs into the tight-fitting holes to create the desired length. When connected, the bearing pieces will not slide out unless they are intentionally pulled apart. A future modification might be to add an additional set of holes on an adjacent side to allow for a corner connection if desired. The VEX Extendable Modular Bearing is a simple and elegant solution for solving bearing sizing problems.

TRANSPARENT VIEW OF MODULAR BEARING CONNECTIONS



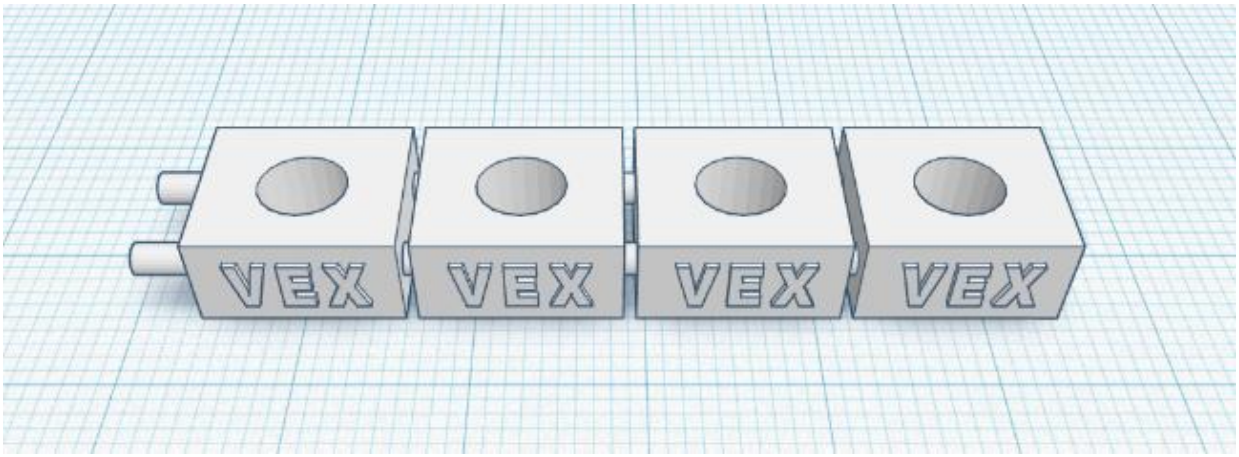
VEX Extendable Modular Bearing

SOFTWARE

To make the VEX Extendable Modular Bearing, I used the *2018 Autodesk, Inc. - Tinkercad version 4.4*. I chose to use Tinkercad because this is the software that is taught in our robotics classes at school. This program allowed me to take my initial design and implement the idea into a 3D printed object.

First, I sketched out the idea for a modular bearing that could be connected multiple times to make whatever size was needed. Then, I measured a VEX 3-hole bearing to see how long each of my units needed to be. Finally, I drafted it in Tinkercad.

I started by making a half-cube-shape with the dimensions of 10mm in width by 10mm in length by 6mm in height. My next step was to add a hole in the center with a diameter of 5mm. Then, I made two cylindrical pegs, each with a diameter of 2mm and projecting 4mm. On the backside of the object, I duplicated and inverted these measurements to create holes to fit the pegs perfectly. I finished by placing the V-E-X letters on the sides. Then, I sent the design to my school's 3D printer (which was won by my team in the 2018 Autodesk "Make it Real" Challenge) and was excited to see the VEX Extendable Modular Bearing take shape.



REFLECTION

I hope that the VEX Extendable Modular Bearing will benefit future VEX robotics builders. This challenge has given me the opportunity to learn how to use CAD which I believe will drastically improve my building concepts and enhance my Engineering Notebook. A few years back, an upper-classman from my school used CAD to design parts of her robot. She included these designs in her Engineering Notebook. This innovative approach resulted in her team winning the Design Award at the 2015 VEX Worlds Competition.

I also discovered through this process that if I begin by sketching my designs on paper to finetune measurements, it makes it easier to create them in CAD. Sketching first and then designing allows for fewer errors in calculations and is a more efficient time-saver when building a robot so we don't have to rebuild due to measurement errors. Sometimes we do not foresee where certain mechanisms will interfere. If we started designing in CAD, we would have more accurate robot diagrams to add to our notebook which may help us to determine future problems our robot may encounter before we start building. These detailed depictions would also make it easier for judges to understand our building process and what we have developed and could make us an ideal contender for the Excellence Award, Design Award, or other judged awards.

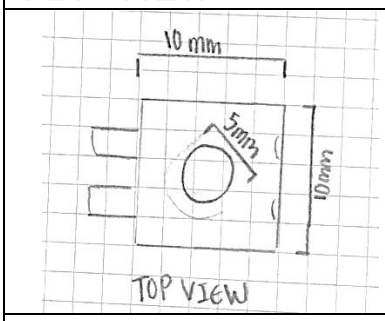
When I grow up, I would like to study Biomedical Engineering so that I may become a medical doctor. Biomedical engineering is a STEM field combining biology and engineering. Orthopedics is one field that I may explore where I can apply this CAD knowledge by designing prosthetic limbs that connect to the nervous system so that people are able to function in a more normal capacity. Being proficient in CAD would simplify my job and enhance innovations in my field. Ultimately, I hope that the VEX Extendable Modular Bearing will complement the variety of existing VEX parts and benefit the entire VEX community.

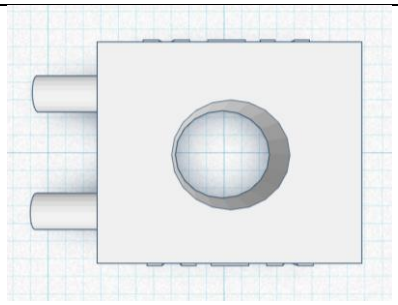
VEX Extendable Modular Bearing

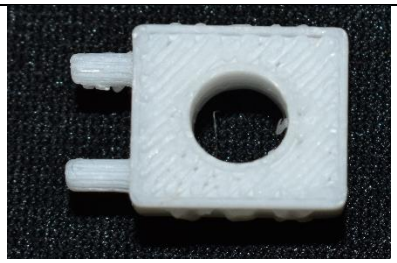
SCHEMATIC DESIGN VIEWS

(SKETCH – TINKERCAD – 3D PRINTED PROTOTYPE)

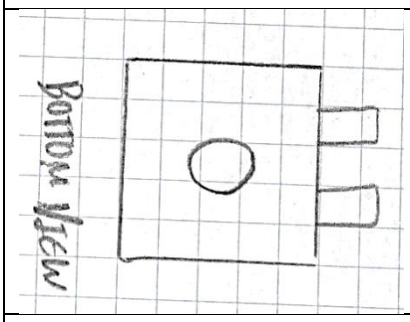
TOP VIEW

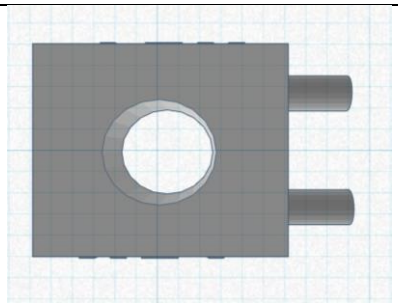




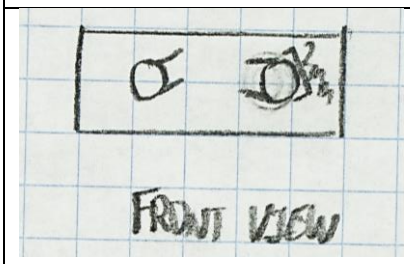


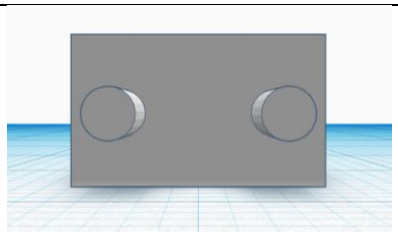
BOTTOM VIEW



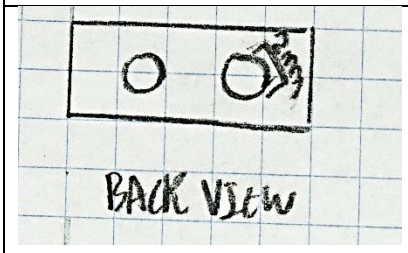


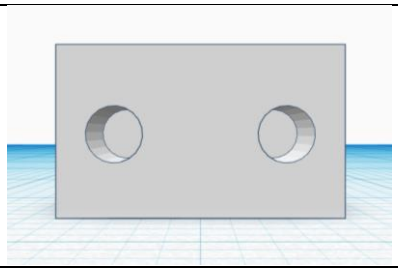
FRONT VIEW

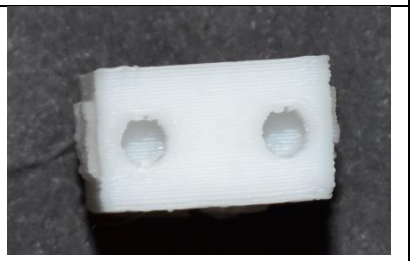




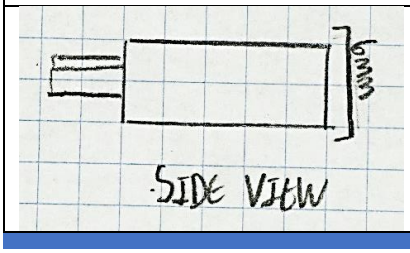
BACK VIEW

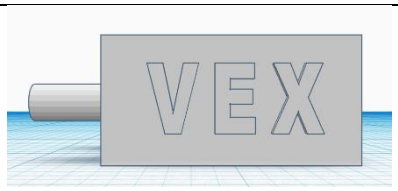






SIDE VIEW





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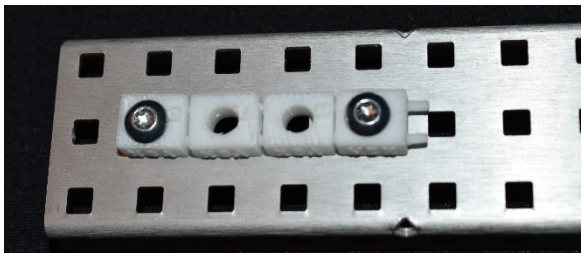
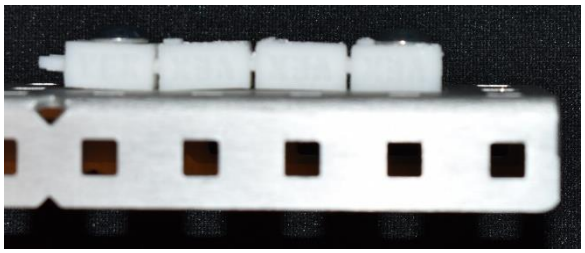
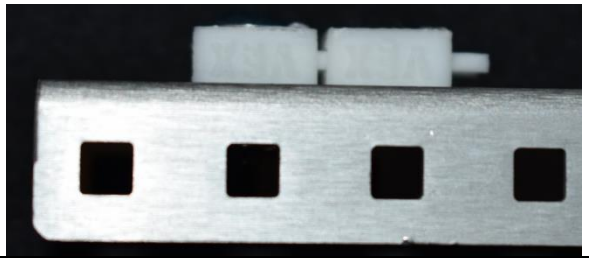
VEX EXTENDABLE MODULAR BEARING: REAL LIFE APPLICATIONS

C-CHANNEL ATTACHMENT

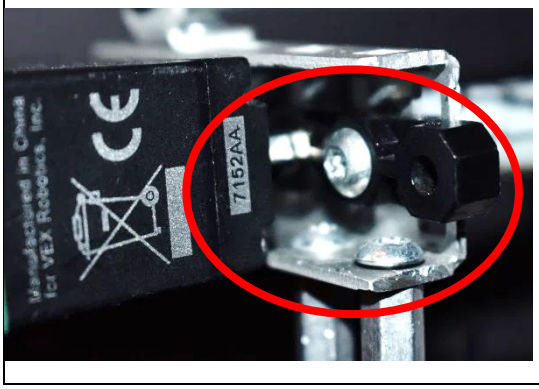


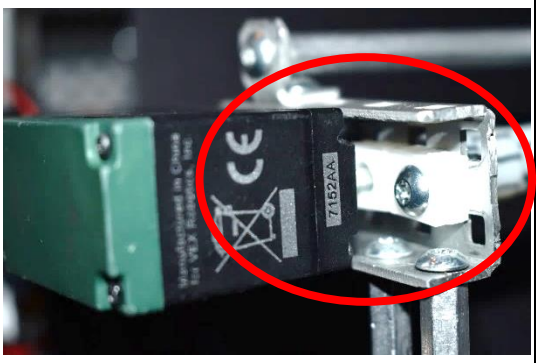




MOTOR ATTACHMENT

TRADITIONAL BEARING VS MODULAR BEARING





AXLE ATTACHMENT