Flex Wheel Inserts

E-Bots PiLons 5225A

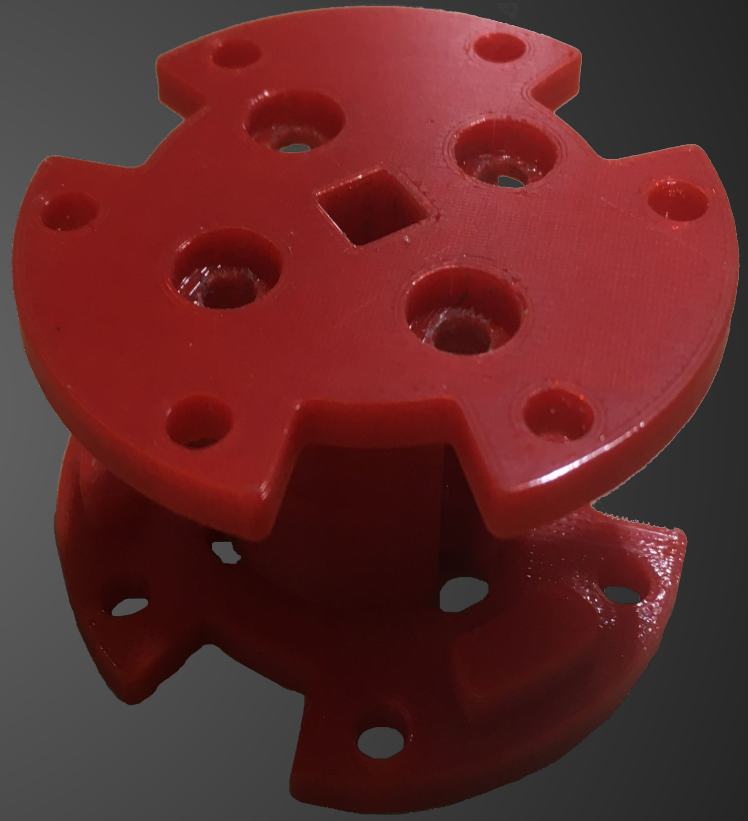
AUTODESK

Make It Real CAD

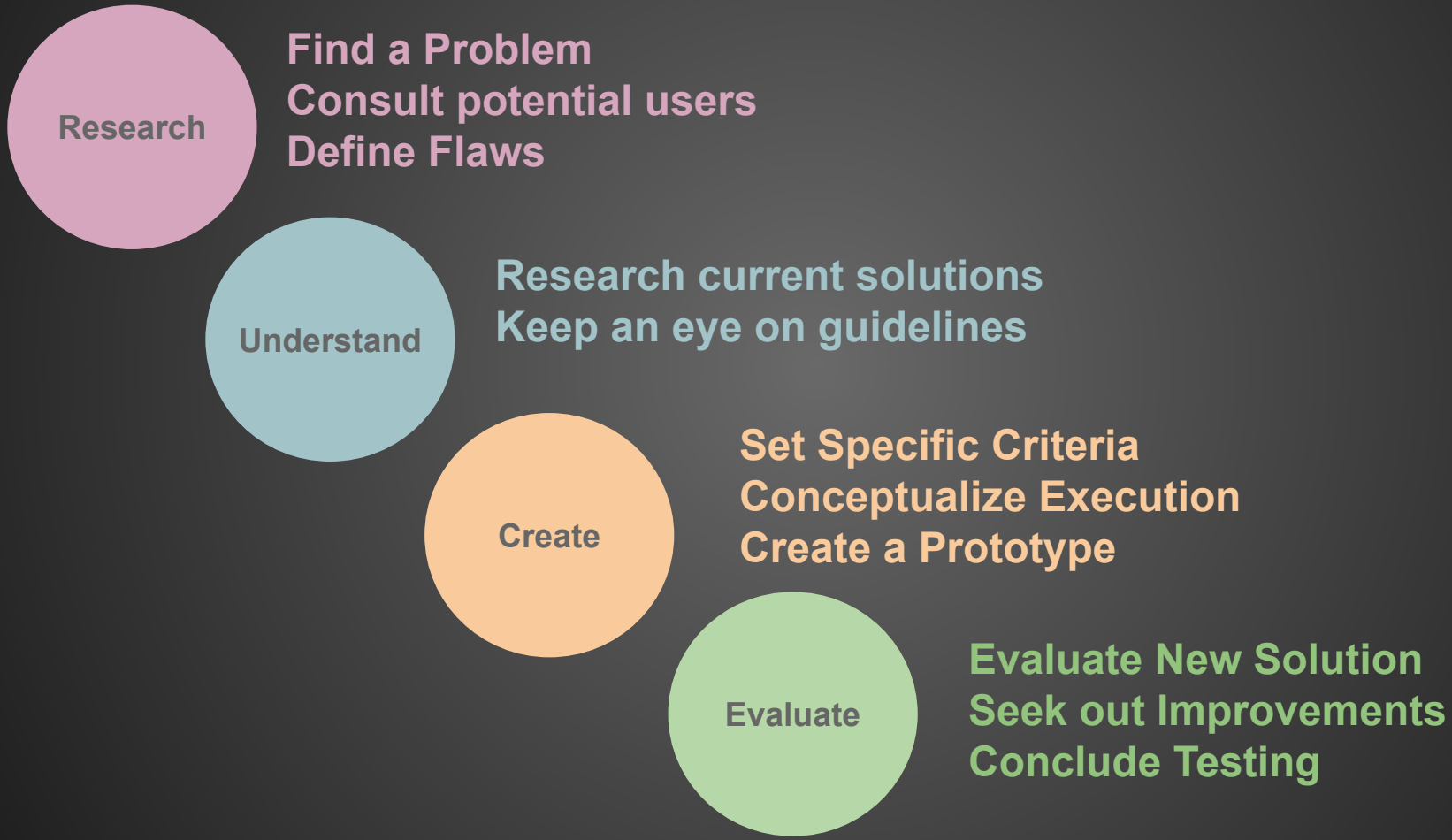
Engineering Challenge

Summary

This year, for the first time ever, Flex Wheels were made legal for VRC competitions at the highschool level. Because of this, we began experimenting with them, and found the VersaHex Bores to have numerous flaws, primarily no way to securely attach gears and “clunky” assembly. We developed a new insert designed with fixing these flaws in mind. In developing this solution, we used our standard CAD design process.

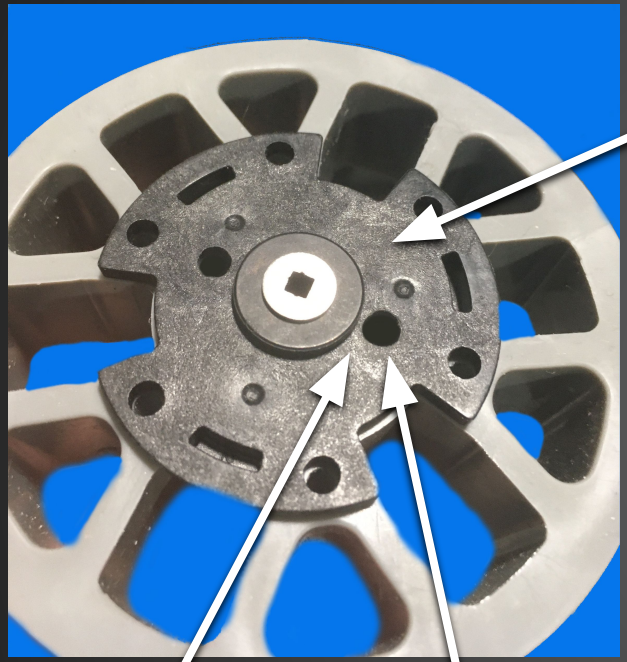


Our CAD Design Process



What's the problem?

Research



3 Parts Per Side (And the need of VersaHex Adaptors)

(Drilled-in Holes by Us)

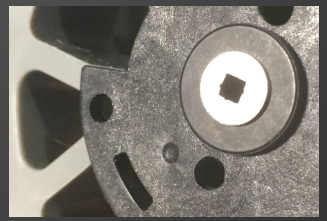
No Sprocket/ Gear Compatibility

Upon the Flex Wheels becoming legalized for VEX competitions, we immediately came up with 3 very clear flaws in the Bore system. One, the three-piece assembly is mildly annoying to put together and keep together during assembly. There are also no holes lined up to attach a gear or sprocket to the mount easily without drilling a hole, something that is very useful in VRC.

Why are these problematic?

Understand

While using gears and sprockets, it is best to screw on gears for both structural integrity and size restrictions. Without the holes, there is no way to attach gears and sprockets in this way, without using a drill of what can be imprecise and a hassle. The assembly is also a hassle with the 3 part system, and more parts to grab to assemble something is always more hassle than needed when it can be a simple design execution.



Our Solution Criteria

Create

Criteria number one, add holes to make the Flex Wheel Bore compatible with the holes on Sprockets and Gears. Also allow the screws to be held into the wheel and inner core of the bore for something solid to grip to, and not be loose and sloppy.

Criteria number two, make the default insert on the Bore a high strength axle, and remove the need of less common VersaHex products. To use low strength's or screw joints, you can use the common pre-existing inserts.

Other Criteria

Create

Criteria number three, make it to where the screws do not protrude from the bore and act as a flat surface on the “female” part.

Criteria number four, make it to where the “male” part has an indent to fit both nuts and/or sprockets, so it has the option to be flat or has built-in sprocket support.

Criteria number five, don’t sacrifice the original design integrity for the system. Dimensions of the bore on the wheel should stay the same, and so should all non-mentioned features.

**Not to scale

Execution

Create

The result works excellently, operating exactly as intended. The gear mounts were smooth, the pieces worked together beautifully, insert compatibility was lovely, and the flush surfaces were perfect.

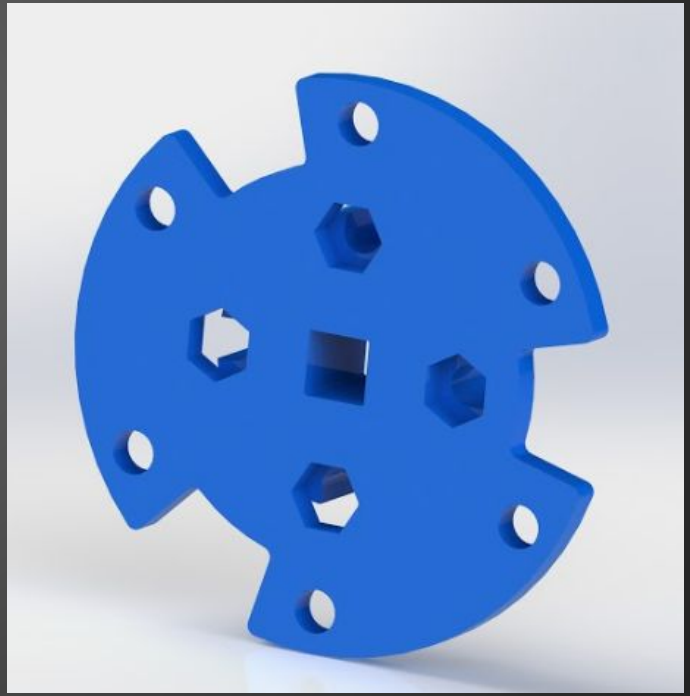
The part was designed to be used exactly as the VersaHex Bores for the Flex Wheels, as such would be utilized the same way, but with that added gear functionality (see image on right).

CAD Details

Evaluate

Alike to past 3D prints done for CAD ideas and concepts for the team, we printed the part with a Prusa i3 mk3s, and CADded the system.

The file is exported as STL, created in TinKerCad (Tinkercad 2019_10_14). The image on your right is opened using “stlviewer.kewbpia”, a resource available through Google Drive (our file sharing method of choice).



Evaluation

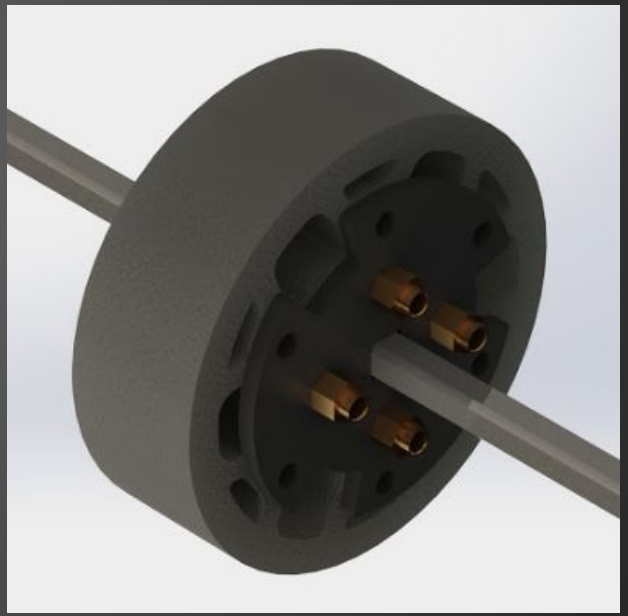
Evaluate

Overall, it fulfills all criteria we've set for ourselves. The two sides both have a flat surface, one of them attaching smoothly to gears or sprockets of varying sizes using the original screw holes, the entire bore assembly is 2-4 parts instead of 4-6 (bore VersaHex insert small axle insert). Most importantly, all prominent parts of the original bore are on the new Flex Wheel Insert - the tabs to keep the bore fixed to an angle on the wheel, the screw placements, the inner lip, and of course the axle area. Overall, this prototype is a massive success!

Lessons Learned

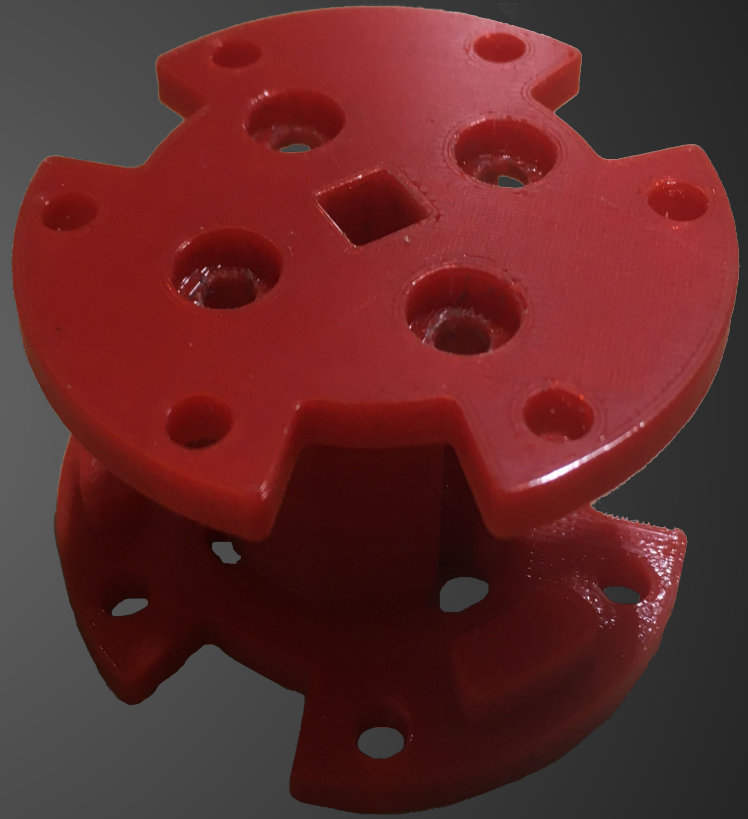
Evaluate

CAD is more than extremely useful in making assemblies of robots and testing, but in the field of designing for in particular this part is also extremely useful. The tools provided made taking an idea, an image in the mind, and executing it to a real life product extremely gracefully and conveniently. We have ideas to make greater use of CAD in the future for those of us who desire pursuing an experience in VEX U, and the ability to design testing parts and products can be crucial to many career opportunities we have down the road.



Final Remarks

Going from testing a new VRC legal part, to finding issues with the design we can adjust to improve the product, creating in in CAD, printing it and testing it, it was a phenomenal experience and we are very glad to have done it. The added utility to the base bore allowing compatibility with gears, sprockets, and fixing the hassle that is assembling a 3 part system, makes this new Flex Wheel Insert far more versatile without sacrificing anything the other system has to offer in the confines of VEX Robotics Competitions.



VEX ROBOTICS

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Thank You!

team5225@gmail.com