**Axle Connectors**

This season, our team, 10173C, or HBS Vortex 2.0, were faced with a serious dilemma. Axles. An axle is defined as a rod or spindle, either fixed or rotating, passing through the center of a wheel or group of wheels. They can be described as spindles, and in Physics, we learn about axles being identified with pivots, where the pivotal motion of the mechanism’s connection to the motor. Axles can also be fit with gears to use gear ratio and torsional strength and speed to vary the speed that your mechanism runs at, which is directly proportional to the speed that your axle runs at, which can, vary with the gears.

Being part of a hugely extensive and successful club, at our school, Henrietta Barnett, we always relied on fundraising and, sometimes, scavenging, to get the parts that we needed. This always meant that we made use of every scrap, ever bit or piece that we ever had in our kit. We survived the Regionals and qualified for nationals. It was at this period of time, when we had begun our journey of building our Nationals-ready, masterpiece mechanism, where we faced this problem.

The issue was this: we just couldn’t find the exact correct axle length! At first we resorted to fundraising for a variety of types, both long and short. An added problem for us was that in VEX IQ, you’re not allowed to cut or modify the size of an axle and this often presented us with difficulties such as having axles that are a tad (usually an inch or a half) too short for the task needed, or too long thereby compromising the size limit, which completely disrupted our build. We started to wonder- there are a wide range of standoff connectors, and pin connectors, so you can always make the exact length of the connector that will be pushed into the bars of the robot, but no similar entity for the commonly used axle!

We began to brainstorm for all sorts of ideas- and that’s when we found it. The axle connector- the solution to our problem: the Axle Connector. It sounds almost foolish and simple when you think about it, but we have designed and come up with an excellently simple but mind-blowingly effective solution to a problem that so, so many teams are facing at this minute!

The Axle Connector we have modelled provides a customizable tool to get the correct axle size for each unique task. Our new part will be used to connect two axles when an individual axle is not compatible with the design and will fit in between two axles to connect them. Each axles end will fit into a square based hole on either side of the plastic connector. The interior of the connector is composed of rubber, the same material as of shaft collars/ washers, to ensure that the axles will not slip out of the connector and will stay in place. For our robot, we have a ball intake mechanism and aided ball retainers which require a very precise axle length to achieve the size limit and functionality, and the axle connector theory would be just the solution that we were searching for.

When we designed this small but lifesaving (it would be for us and many others, if we were to use it) part, we even included a small hole on the top of the connector for a pin to enter so that in theory this pin could be attached to another bar, or connector, ensuring complete stability and attachment to another platform. We could sing our axle connector’s praises all day!

So, how did we design this simple but effective part? We used the same design software that professionals use to model and conceptualize their products and parts- Autodesk Fusion 360 in v2.0.7046. We first created a custom cylinder which we mapped to the same size as a large pin connector, then simply created a hole modifying a shell for the relevant places of our part. We then changed the colour of the inside of our piece which is made of rubber. To create this we used Fusion 360 but then imported onto the Autodesk software.

In conclusion, we have learnt ever so much from this project. This includes how to identify an issue, choose, specify, pinpoint and define it and to brainstorm a range of ideas and various approaches to try and solve it. We modelled our solutions on 360 and have discovered a lot about it- this software is extremely crucial for us, as a competitive VEX IQ robotics team, to test out the very many ideas and design conceptions we visualize. When parts aren’t readily available to us, we often use Autodesk Fusion 360 to assist us in coming up with new, out of the box creations to aid us with using the parts that we have to formulate a solution to our problem. We also use it to figure out and discover how different segments and pieces of our robot would fit together smoothly, like a puzzle.

3D Design Software is incredibly useful because it doesn’t use any actual resources or materials since it is virtual. This means we can test out the huge range of theories and ideas we have visions of and formulate responses and efficient ways to build the best robot that we can build. It is also not constrained by any set pieces; for example, how VEX IQ robots must be made from VEX pieces.

We all aspire, at the end of the day, to choose a career in any manufacturing industry or where any physical robots have to be created, and that is when learning 3D Design software will come in handy. We can use it to test various designs effectively and virtually, thereby saving us time of using trial and error to manufacture it, and if we want to see a physical product, we can simply 3D print it.

Thank you.