CAD for VEX Robotics

(updated 4/30/19)

The question of CAD comes up from time to time, so here is some information and sources you can use to help your students get started with CAD.

First off, the nature of VEX in general, is a highly versatile prototyping system, and this leads to "tinkerbots" (for good or bad, how many robots are truly planned out down to the specific parts prior to building?). The team that actually used CAD for design (that is, CAD is done before building), will usually be an advanced high school team, juniors or seniors (and VEX-U teams, of course), and they will still likely use CAD only for preliminary design, then future mods and improvements will be tinkered onto the original design. The exception is 3d printed parts (U-teams only, for now) which obviously have to be designed in CAD.

Here's some reality: most VEX people look at CAD to document their design and create neat looking renderings of their robots. If you don't have the time to learn CAD, I suggest taking pictures. Seriously, though, CAD stands for Computer Aided Design, not Computer Aided Documentation. It takes time to learn, which is why community colleges have 2-year degrees in CAD, or you can take weeks of training (paid for by your employer, of course). Basics, however, like assembling/constraining parts can be learned in a few hours, especially if you have a mentor to help out. To get started, modeling your existing robot(s) is a good way to learn, then you can do some real design work next year.

The major industrial CAD packages are SolidWorks, Solid Edge, Inventor, and Fusion 360. There are some artistic drawing/modeling software out there too, but someone else will have to comment, as I don't use anything but SolidWorks. SnapCAD is available for VEXIQ, to give an introduction to young students. (SnapCAD details are here: https://www.vexrobotics.com/vexiq/resources/cad-snapcad) It is my opinion that, with some guidance, Middle School students can learn SolidWorks assembly well enough to build IQ Bots.

In southeast Michigan (center of the Automotive industry), most people use SolidWorks or Catia (Catia is optimized for working on curves and surfaces like car fenders). But elsewhere in the country, things are probably different. Check to see what your local community college is teaching, since they will do what local industry needs. We encourage our students to learn both SolidWorks and Inventor (and SnapCAD for the elementary IQ), but they all seem to prefer SolidWorks in the end. Solid Edge is an equivalent competitor to SolidWorks, but it will be tough to find Solid Edge part libraries (you'll have to convert from .step format). Being equivalent parametric CAD packages, SolidWorks and Solid Edge can

load each other's part and assembly files (but not drawing files), without loss of assembly data; however, a conversion will take place and you can't just switch back and forth. There is no compatibility with the Autodesk programs or "hobby" software (other than the universal file formats like .step). All the software packages can make files for 3d printing in the .stl format.

For SolidWorks, you need a team sponsorship to get the software free. You'll generally get enough licenses for the entire team, and it is an annual renewal.

SolidWorks link: www.SolidWorks.com/sw/education/all-student-competitions.htm .

Solid Edge has a student download for each person to get their own, no sponsorship required.

Solid Edge link: https://www.plm.automation.siemens.com/plmapp/education/solid-edge/en_us/free-software/student

AutoDesk software downloads are free for each person as well:

Inventor link: https://www.autodesk.com/education/free-software/inventor-professional

Fusion 360 link: https://www.autodesk.com/products/fusion-360/students-teachers-educators

For parts libraries, here's where you can find stuff:

The official CAD for every part can be found on the products pages in www.vexrobotics.com. Go to the part listing in the catalog, and you can download a .step (.stp) format file of every VEX and VEXIQ part. "Step" is a universal ISO part format that can be imported to most any software package. There are more versatile part libraries, however. For example, in Inventor, there are features called I-mates which can help with assembly. AutoCAD maintains libraries include both EDR and VEXIQ parts and builds of the trainers. Here is where some "unofficial" parts libraries can be found: https://www.autodesk.com/education/competitions-and-events/vex/recommended-software#Kit-of-parts

The Purdue Sigbots created an Inventor library, with axis features added to the square holes to

https://www.mediafire.com/?222qx89cjxe3qe5

Here's an Inventor library by team 5062E that includes V5 parts:

https://drive.google.com/open?id=1MrJhDGJBQGRkEB-MyYnweJlluZD-xqxS

And another Inventor library by team 6142W:

https://drive.google.com/file/d/1Hb6ZZx6DezmiXDbrLP1zW8cwH4IPcGX6/view?usp=sharing

In SolidWorks, libraries are harder to come by, but you'll find parts in the "3d Content Central", and also Team 7479 has worked on a library of parts here:
http://www.mediafire.com/download/3v7rf1xkqs7kh75/Team_7479_SolidWorks_Library.zip

The parts in the 7479 library have an extra circular feature which I added to the VEX square holes to allow rotating concentric mates to be made.

For a V5 update in SolidWorks, you'll find a complete V5 Clawbot Trainer model here:

https://grabcad.com/library/vex-robotics-v5-clawbot-1

You'll have to make a GrabCAD account to get it. This model has all the new V5 components except the camera, all as proper SolidWorks models. The assembly is mated for full motion. In this model, the structural parts do not have the circular features added: they are straight conversions from the VEX step files.

For V5 from AutoCAD, Lucas Lyra has uploaded a V5 clawbot trainer here:

https://gallery.autodesk.com/projects/134041/clawbot-v5---vex-robotics---robo-de-manipulacao-terrestre