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 This kit includes different shaped bearing flats and detachable half-gears. While the gears are more solid-filled (ideal for 3D printing bottom-up), they do not serve any different mechanical purpose than the preexisting VEX gears. Their convenience lies in the build process; you can attach them without having to remove a shaft from its bearings or other components on the shaft. The bearing flats with the likeness of Tetris pieces are ideal for gear trains with small or diagonally-connecting gears where other holes on the VEX chassis pieces are occupied. Finally, the i-lock bars are just lock bars with the shaft insert on the end. Personally I would use these in many places on my bot for 4-bar lifts. These are convenient because with the shaft insert at the very end of a c-channel rather than one hole in, you can get the extra distance of an arm or lift. With 4-bars limited by their maximum rotation that the two rotating bars collide at, this is more than just half an inch.

 I designed these by CAD in Autodesk Inventor Professional 2018 (Build 112, released 2/16/2017). I downloaded the CAD of the original VEX gears, bearing flat, and lock bar from the VEX Robotics website and altered each to obtain the kit I have. The gears I filled in with extrusions, rotated the shaft inserts slightly so I could divide the gear symmetrically between the teeth, and added or altered holes so they could be attached by screws. The bearing flats I stuck to the same dimensions as the original but simply did in different patterns to get one four holes in length, one L-shaped, and another square. The i-lock bar in this is missing the shaft insert because that is a part that already exists in the regular lock bar.

 The reason I designed the parts I did was actually popular demand and simple convenience in building. Their solutions were simple, as most mechanical ones are. On a competitive robotics team, CADing a robot before building is very helpful in spotting design flaws, sizing, and optimizing without making those errors in the real world. It saves a lot of time and is also good for presenting ideas or build propositions to teammates. In an engineering career in the future, 3D design software will help me in similar ways.