***FIRST*** **(FOR INSPIRATION OF SCIENCE AND TECHNOLOGY) WAS FOUNDED BY INVENTOR DEAN KAMEN TO FOSTER STUDENTS' LOVE FOR TECHNOLOGY. *FIRST* ROBOTICS COMPETITION (FRC) AND *FIRST* TECH CHALLENGE (FTC) ARE INTERNATIONAL HIGH SCHOOL ROBOTICS CONTESTS THAT CREATE A COMPETITIVE ROBOTICS ENVIRONMENT USING SPORTS-BASED CHALLENGES. WILL GUNDERSON HAS COMPETED IN BOTH. THIS YEAR, HE EXPLAINS, HE'LL TAKE WHAT HE'S LEARNED NOT ONLY INTO HIS FINAL YEAR OF COMPETITION, BUT INTO A MIDDLE SCHOOL CLASSROOM.**


# My First FIRST

by Will Gunderson

Since I was little, I have loved putting things together. I had bins full of LEGOs that became anything but what the instructions said they should be, and I knew how to make more paper airplanes than the rest of my third grade class combined. But I never knew what to do with these abilities, at least not until I reached my freshman year of high school.

In October 2012, a family friend forwarded me an email about an upcoming meeting for high school students interested in robotics. I wasn't sure I wanted to join a robotics team, but I was curious enough to get my father to drive me to a remote branch of the library to learn more. I walked tentatively to the back room, where the Des Moines Area *FIRST* Robotics Competition (FRC) team was meeting for the first time. Looking inside, I saw a group of students who were two or three years older than I was, discussing technology with professional engineers. A computer cycled through code as several small robots clacked around on the table. Now I was sure I wanted to join the team.

### Ultimate Ascent

After two months of weekly meetings, I gathered with my seven teammates and our local engineering mentors for the live stream of the "game reveal" for the 2013 FRC season. In rapt silence, we watched as the 2013 game, Ultimate Ascent, was described.

Teams were challenged to build robots that would score points by tossing Frisbees into goals 8 feet off the ground, climbing a 10-foot pyramid-shaped tower, or both. This meant that our robot potentially needed systems to drive around, pick up Frisbees off the ground, shoot Frisbees into the goal, attach itself to the tower, and lift itself up the tower. Our small team knew that we would never be able to build a robot that could do all these things within the six-week time limit, so after an in-depth point-by-point analysis, we decided to design a climbing robot.

On January 6, the day after kickoff, we dove into our work. Because our team had students from six different schools, we met in the machine shop of a local community college. Every night for the first two weeks I sat and watched, as quietly as my outgoing personality would let me, while the older, more experienced students discussed the pros and cons of Acme rods, winch systems, and pneumatic hooks. I loved it, no matter how confused I felt. I had never learned to use power tools or design something in CAD (computer-aided design). I had never even heard of the programming language C++, and I didn't know when to use different types of motor controllers. All of this, however, just made me want to learn more. I would cut and file metal and do grunt work while I soaked it all in.

**THIS FLIPPER DESIGN WAS MY PRIDE AND JOY. IT WAS THE FIRST THING I HAD DESIGNED AND BUILT WITHOUT THE HELP OF A VETERAN STUDENT, AND I WAS EXCITED TO SEE IT WORK ON THE ROBOT.**

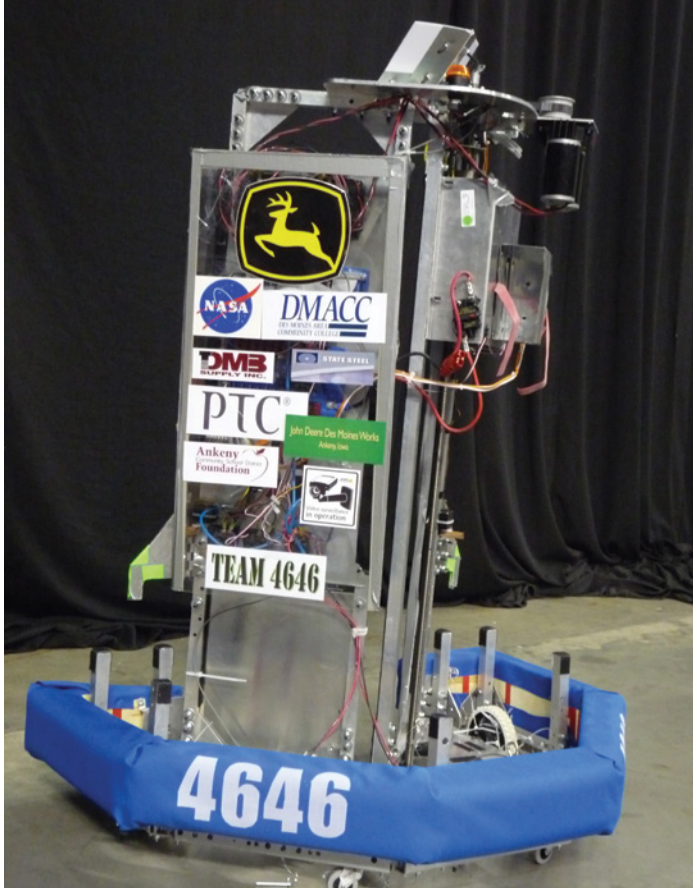
After three weeks, I was finally allowed to design a system of my own. I was partnered with an adult mentor, an electrical engineer from John Deere. My job was to design a system that would shift our robot from a vertical position to a tilted position on the tower without harming the robot. I spent hours figuring out the perfect way to design it. I have a vivid memory of sitting in front of a chalkboard with my mentor, staring at three separate designs and trying to pick one. Together, we worked to find every fail point and identify where every hole would need to go on each design. I decided on a design that used a small motor to push a metal bar down on one side of the robot, flipping the robot on its side.

This flipper design was my pride and joy. It was the first thing I had designed and built without the help of a veteran student, and I was excited to see it work on the robot.

### The High Point

However excited I was to see my design in place, I was worried that we wouldn't get the robot completed by the deadline of February 19. Going into our fifth week, we had yet to complete even basic tests on our robot. We worked feverishly every night for four or five hours. I drilled, cut, filed, and bent metal for hours at a time.

Will (third from left) with his teammates and mentors during Team ASAP's rookie season




Team ASAP built a robot that scored points by climbing a tower—a design that earned them a spot at the 2013 FRC World Championships.

Our robot had to be sealed in a massive plastic bag by the Tuesday night deadline, so Monday night was crunch time. Although our robot was largely assembled, we had barely installed our electronics—in part because none of us had ever used the required FRC electronic components. You could feel the nervousness in the workshop as the more experienced students tested and installed the electronics, and the newer students (like me) wiped down the robot and put all of the sponsors' names and logos on the robot. We worked until 11:30 Monday night, leaving for home only when the workshop security angrily demanded their sleep. We still had not fully tested our robot.

Then it was Tuesday night, "bag night," and I was pumped. I hadn't been able to focus in school; I tapped incessantly and drew little tower-climbing robots on everything. By 6:30 p.m. I was in the shop working. By 8:30, we were ready to run our first full-bot test. We carefully set the bot at the base of the tower and held our breath. The drivers started, triggering my flipper system. It worked! The bot tipped onto the pyramid and began its first ascent. I watched in awe as our robot surpassed the 10-point mark, then the 20, and then, ever so tenuously, the 30-point mark at the top.

No matter what happened next, we had made it. Everything I had spent so much time on—committing literal blood, sweat, and tears—had come to life. While I loved every minute of my first FRC season, I will always remember the first time our robot climbed to the top of the tower.

In March, we entered the St. Louis Regional competition knowing that we were not going to win, but we also knew that our robot embodied the best that our team and mentors could offer. By the time the competition was over, we had won the Rookie All-Star Award, and we were the highest-seeded rookie team and ranked ninth overall. We left with an invitation to the World Championships, held about a month later. Although we didn't do as well there, ranking 78 out of 100, we had a great time and were proud just to have been there.

**Ripple Effect**

Everything about that first season was an incredible learning experience. I couldn't wait to begin FRC in 2014, and I desperately wanted to continue in robotics. So the following fall, I started a *FIRST* Tech Challenge (FTC) team at my high school. FTC is similar to FRC, but it uses smaller robots and has a longer build season. I was working with different students, we had different mentors, and we worked out of my garage, but I loved it just as much.

Between FTC and FRC, I have learned more than I ever would have imagined about robotics, teamwork, and staying focused on a goal. Since my freshman year, I have competed in five *FIRST* seasons, and I have loved every single one. That's why, when a gifted and talented counselor from my school district recently asked me to develop a curriculum to introduce middle schoolers to robotics, I jumped at the chance. As I've tried to figure out how to attract and maintain the attention of my future students, *FIRST* has provided a great model. My curriculum started with a traditional classroom setting in mind, but it has slowly morphed into the project-based learning that *FIRST* exemplifies.

I hope the students I teach this year will get involved in *FIRST* when they get to high school, and that they will develop new skills, as I have, that they can use throughout their lives. *FIRST* taught me not only how to build robots but also how to work as part of a team and communicate my ideas effectively. These are skills I'll keep developing in the next FRC season, but in the meantime, I'm excited to share what I know with kids who want to do more than fold paper airplanes. ■

**Will Gunderson** is a senior at Theodore Roosevelt High School in Des Moines, IA, where he is captain of the robotics team and a member of the cross country, swim, and tennis teams.

**Learn more about *FIRST* at www.usfirst.org and more about Will's FRC team at www.team4646.org.**