### SOLIDWORKS Education Blog (https://blogs.solidworks.com/teacher/)

## FIRST Comes First: Team YETI, Queen City Robotics Alliance, and TPM, Inc.

By Sara Zuckerman (https://blogs.solidworks.com/teacher/author/szuckerman) March 26, 2018



FRC Team 3506, Team YETI

True story: here at SOLIDWORKS, we're crazy about FIRST Robotics (https://www.firstinspires.org). What kind of engineering nerds wouldn't be? Created by Dean Kamen (https://www.firstinspires.org/node/2541), FIRST (**F**or **I**nspiration and **R**ecognition

of **S**cience and **T**echnology) Robotics aims to inspire students to become leaders in science and engineering, to teach them important, life affirming skills, such as team work and team building, and become masters of gracious professionalism

(https://www.firstinspires.org/about/vision-and-mission). It's a fantastic program, one we at SOLIDWORKS are proud to support, and we are also proud to be the modeling solutions partner for this year's FIRST Robotics Competition.

FIRST Robotics holds many levels of competition for students of all ages: FIRST Lego League Junior (https://www.firstinspires.org/robotics/flljr) (grades K – 4), FIRST Lego League (https://www.firstinspires.org/robotics/fll) (FLL) (grades 4 – 8), FIRST Tech Challenge (https://www.firstinspires.org/robotics/ftc) (FTC) (grades 7 – 12), and the FIRST Robotics Competition (https://www.firstinspires.org/robotics/frc) (FRC) (grades 9 – 12). Every year since 1992, FIRST Robotics has held its annual FIRST Robotics Competition, where students from around the globe come together and compete in exciting and creative competitions that change yearly. This year, the FRC is called FIRST Power Up, based on old-school 8-bit video games.

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A worldwide phenomenon, FIRST Robotics requires considerable time, patience, and effort from all of its participants. That includes students, parents and mentors, the adults who keep the teams focused and are ready to step in whenever a team needs guidance. It takes a lot for a group of teenagers, some in their first year of competition, to create an autonomous robot from scratch: money, guidance, and, most importantly, a place to do it all. In Charlotte, North Carolina, there is the Queen City Robotics Alliance (QCRA) and the FIRST Zone (http://queencityrobotics.org/). I spoke with FIRST students James Ramich, Colin Evans, and Trenton DeSear, and one of their mentors, Robbie Hoyler, to learn more about the FIRST Zone, QCRA, and their own experiences with SOIDWORKS and this year's competition.



Team YETI working in the FIRST Zone

#### Get in the (FIRST) Zone

"North Carolina's not seen as a very competitive region inside of FIRST Robotics, but we're trying to change that," Robbie Hoyler told me over the phone. Robbie is a SOLIDWORKS Elite Application Engineer (AE) at TPM, Inc. (https://www.tpm.com/), an engineering and architect solutions company that services North and South Carolina. TPM is a certified SOLIDWORKS reseller, and part of Robbie's job is teaching professionals how to use SOLIDWORKS for their businesses. On the rare occasion one of his classes has a seat or two empty, he will fill those seats with his other students, his FIRST students. Meaning high school students sometimes get the chance to sit in on professional, advanced engineering classes with engineers from massive international companies.

Robbie mentors Team 3506, a.k.a. YETI Robotics (https://yetirobotics.wixsite.com/team3506). YETI and three other teams, Team 4290 (Bots of War) (http://www.botsofwar4290.org/), Team 4935 (T-Rex) (http://www.trex4935.com/), and Team 6894 (Iced Java) make up the non-profit Queen City Robotic Alliance. The teams currently meet and work together in the FIRST Zone, a section of warehouse space in TPM's Charlotte office set aside specifically for the teams to build, practice, and succeed together. "It's basically one big hub for a bunch of FIRST teams in Charlotte," said James Ramich, a 9<sup>th</sup> grader at Charlotte Catholic High School and top CAD student on YETI. "We have a machine shop that teams are welcome to use, we hold classes for them to learn things like Java and CAD."

While there are other build spaces around the country, what sets QCRA apart is the fact that anyone in the surrounding Charlotte community can come in and join the teams who use it. "Queen City Robotics is really an awesome outlet for all these different FIRST teams to come together under one roof and share ideas and have fun together building robots," explained Colin Evans, a homeschooled 10<sup>th</sup> grader who is the electrical lead for YETI. "But it's a great non-profit organization, because we're going out, we're helping others, we're raising awareness of STEM with our outreach, and I think that's something that is definitely going to continue in the future and is going to have many people looking into [QCRA and FIRST]."



"Our [space] is open to the community," said Robbie. "We'll quote-unquote 'charge' the teams to come in, but it's usually stuff like supplies...bring picnic supplies, bring toilet paper, or paper towels, or food, or something like that for the Zone for the day. And that's really all they ever have to pay to use the space if they're an outside team...We split the rent among the teams that live [in the FIRST Zone] and we fundraise together as a group. It's a lot easier for larger companies to donate to an organization of teams rather than an individual team."

Donations are an integral part of all FIRST teams' operations, but running an organization as large and unique as QCRA is very expensive. And when you don't have a local school supporting you, as so many other FRC teams do, costs begin to add up. When YETI started in 2010, they were small enough to work out of Central Piedmont Community College in Charlotte. But as YETI and QCRA's outreach grew, so did their size, and after five years at the college they had to move. After receiving a grant from the Argosy Foundation (http://www.argosyfnd.org/) in 2015, they were able rent a 10,000 square foot warehouse, an old airplane hangar plopped between runways at Charlotte-Douglas International Airport, where they could build a full sized FRC field, and full sized FTC and FLL fields. The move to the larger space led to incredible upgrades: not only were the teams given more room and the ability to practice with their robots on a life-sized field, QCRA was also able include new team partners that were having difficulties at their local schools and transform into the organization they are today.

But the warehouse was "inordinately expensive," reported Robbie, and while no one wanted to scale down the actual size of the space they were in, the leaders at QCRA knew they couldn't afford to stay in that space for long. Cue Robbie and TPM, Inc.



Robbie Hoyler and the YETI mascot

#### Homecoming

Robbie Hoyler is a former FIRST Robotics student—he was part of FRC Team 587, the Hedgehogs, in Hillsborough, NC, during his high school years, and when he graduated he became a FIRST mentor. Robbie knows what his FIRST students want, and what they need; he's been in their shoes, and he is well aware of the limitations placed on them by their location, and their means. After all, he was student in the same region, and he was the first in his family to go to college immediately after high school and graduate. Robbie experienced a dearth of college preparation and STEM education from his high school, and part of his love for FIRST comes from the opportunities and real-world knowledge it provided him as a teen. He wanted to share those experiences with other students in North Carolina. And so, Robbie partnered with Lia Schwinghammer, the current leader of QCRA, and other mentors from former teams in the Charlotte area that had folded, and Team YETI was born. "[Lia] helped give me the opportunity to start this team with her and the other mentors," Robbie told me. "I help [the kids] build robots, she helps them succeed in life while doing it."

Eight years ago, YETI started with 17 members. Now they have over 30. The kids come from all over the Charlotte area, and although the Charlotte-Mecklenburg school district has 36 high schools, there are maybe two or three students in YETI who go to school together. YETI started with many homeschooled children, and grew into what it is: a community team where anyone in the Charlotte-Mecklenburg area can join. And now they get members from all over. Kids will drive from over an hour away, from the more rural areas of North Carolina, from different counties all together, so they can join the teams in the FIRST Zone.

According to Robbie, the Charlotte-Mecklenburg school district wasn't a huge fan of FIRST Robotics—North Carolina public schools have been on a bumpy road the last few decades (http://www.wral.com/study-ranks-nc-public-schools-40th-in-nation-citing-insufficientfunding/17284114/), and teachers know how much time and energy an FRC team can require from a student, not to mention the adults guiding them. Starting and maintaining a team can be incredibly difficult. Robbie knew this going in, and part of his work as both a FIRST mentor and an AE at TPM was networking and reaching out to get as much support as possible. And, as it turned out, a lot of that support came from TPM itself.



YETI's old view from the airplane hangar

While the rent at the old airplane hangar was becoming truly untenable for the FIRST teams, TPM was having its own space issues. TPM owned a warehouse that was approximately 80,000 square feet, and they were renting it out to a glass company and a t-shirt company. They wanted to move their office to a new space and thus needed to sell the building; the glass and t-shirt companies had to go. "To make a long story short," Robbie told me, "[TPM] tried to make a bid on another building, it didn't work out...so TPM was going to get stuck with [their current] building and have a new building, so we had to retract our offer on the [new] building." The powers that be at TPM decided to use the money that would have been spent on a new building and funnel it into renovations on their original office space and stay. That left the warehouse, now tenant-less. The glass company moved back in, but the t-shirt company stayed out, leaving TPM with 60,000 square feet of unused warehouse. So Robbie came up with an idea.

"I'm like, 'Well, we're not asking for it for free, but is there any way [TPM] could cut us a deal on some space?'" he recalled. "That started a conversation with Queen City Robotics and TPM to help support us by letting us move into that space at a reduced price."

Now, in 2018, QCRA has more space than ever before, and it's being utilized to much better effect. The teams now use 6,000 square feet for their workspaces and full-sized areas, and they have access to the warehouse offices. The floorplan at TPM is better than the airplane hangar, and it also means the kids don't have to drive to the airport. "We have three or four FRC teams in the building on Saturday. We'll have two FCT teams during the first three or four weeks of build season. We'll have over 100 kids in there, and it's worked out great so far," Robbie said with pride.

The partnership has other benefits—TPM gives the FRC teams deals so they can use their inhouse print shop, where teams can print banners and boards. They allow Robbie to utilize old SOLIDWORKS supplies and teach the students the software. Robbie said, "We're pretty excited that TPM has allowed us to come into that space, and it's going to make us a lot more sustainable."



A YETI team member helping a rookie team build their bot.

#### **Outreach and Impact**

A huge part of any FRC team's success comes from their outreach. "We do a lot of outreach on our team," said Trenton DeSear, a homeschooled 11<sup>th</sup> grader who is dual-enrolled at Central Piedmont Community College, "especially what we call 'camps' for younger FLL teams...I personally have mentored two teams in the past. We also hold classes in various locations around Charlotte where we teach basic programming to younger kids." Over the past year, Trenton has probably accrued over 300 hundred hours of outreach through his work with camps and FTC teams. Different FRC teams practice different sorts of outreach, and for the teams involved with QRCA, it's mainly through classes and camps. While companies and individuals are free to donate directly to a specific team, the teams that use the FIRST Zone like to approach donations and grants by having companies donate directly to QRCA—thus, they are able to spread the money to all the teams who work alongside one another in the FIRST Zone. If one team is having issues with their fundraising, the donations to the non-profit can be spread to that team. Instead of having a company donate a lump sum to them, the teams will host camps in that company's facilities and the company will pay them to do so via donation.



YETI team member Soenika (Sunny) in India, Bala Bhanu Vidyalayam. She taught local children how to program and build a Lego EV3 robot.

Outreach isn't just about fundraising. It's about helping the local community and spreading the gospel of STEM. If a team can prove their impact on the community, they may be eligible to win FRC's Chairman's Award (https://www.firstinspires.org/resource-library/frc/submitted-

awards), FIRST's most prestigious award. Winners of the Regional and District Chairman's Award are automatically entered into the FIRST Championship and can travel to world finals. YETI has won the North Carolina Regional and District Chairman's Award twice, and that award, for them, is more important than winning matches with their robot. "When we won the state championships in 2016, we were really happy we won with our robot for the first time ever," Robbie told me, "but we were absolutely ecstatic when we won the Chairman's Award...It's an award that pitches your most measurable impact on the world and your community, so a team that wins the Chairman's, in the judges' eyes, has had more impact than any other team in the competition." YETI may spend six weeks building their powerful robots, but affecting their community is just as, if not more, important to them.

"I really enjoy outreach," said Colin. "The one in particular that stuck out to me is Project 658, which is going and helping refugee children and teaching them basic programming and code." FRC team members will referee matches between FLL Jr. and FLL teams. This year, YETI has started a series on their YouTube channel

(https://www.youtube.com/channel/UCYA8Z1wk99PGGslPxck-igA) that explains how they work as an organization and will help other teams learn how to fundraise and market themselves, to teach other teams how to reach out to their communities and spread the word about FIRST and STEM. One member of YETI started a FIRST Lego League in her family's home village in India last year. The team plans on sponsoring her and continuing their efforts to support the fledgling league. Hopefully, YETI will mentor an Indian FRC team in the future.



Inspiration

When asked about the future of STEM in North Carolina, Robbie was very blunt: "Schools in North Carolina simply do not prepare you for college. All these kids..." He paused, thought for a moment, then said, "I would be afraid of what they would do if we weren't around." For him, FIRST and YETI are more than just fun competitions for students; they're lifelines, they're career starters, they're the best bet for some of his team members' futures. According to him, there is no way, outside of FRC teams, that his teenage students would know about SOLIDWORKS or CAD design or anything beyond the bare bones of programming and engineering.

The students I talked to agree. "YETI has been a great opportunity for me because my school doesn't offer many things that would be considered in the field of STEM," said James, who, by the way, is 14 and knows sheet metal, weldments, advanced assembly, and advanced parts in SOLIDWORKS and may be looking at certifications

(https://www.solidworks.com/sw/support/solidworks-certification.htm) in the future. His school doesn't start touching on Auto Desk Inventor, the only CAD program they teach, until his junior or senior year. Learning SOLIDWORKS and 3D CAD now gives him and other YETI members the opportunity to learn what types of STEM disciplines they're into and, more importantly, not into before they get close to college.



A YETI student hard at work

"Before I joined YETI, I had never touched any band saws or any of this machinery, but now I've gotten used to it and I can do it," said Trenton. And he likes it. Trenton started at the FIRST Zone when he was 13, working with his FTC team, and graduated into Team YETI two years ago. Now he's on the strategy team, where he and other veteran students decide what their robot needs to do, design the robot, and then give the design to the rest of the team to start prototyping and implementing. "I don't think I would have joined robotics if I hadn't been able to find a place like this, where I can meet other people who have the same interests as me and have a place where I can actually build a robot."

Colin added, "YETI has definitely been a great outlet. Not only to meet more people who have similar interested [to me], but to gain more knowledge that I can use going into a job later, and into college. It's helped me to build interest in certain areas and see where my interests lie." Colin's interests include troubleshooting robotic wiring and working on what he calls "the brain and nervous system of the robot." He's also trying to learn a bit more about the coding side of the controls.

I asked Robbie if he kept track of the amount of YETI students who go on to college and get engineering degrees. "98%," he answered confidently. "Out of the eight years I've [mentored YETI], I've only had two or three kids not go to university. And that's because they went on an internship through hire, or a two-year technical program, such as machining and welding type of thing." This past year, one of Robbie's former students, who graduated high school in 2011 and now works for NASCAR, came to him at TPM and purchased SOLIDWORKS for his team. "That kid is now old enough to work for a team and make buying decisions in his company and he chose SOLIDWORKS as his CAD platform." It was the first time Robbie had seen the cycle go full circle, and he expects that continue as his team members age out of FIRST and enter the workforce. "I respect all of the CAD products for what they are and what they can do, but it's not even a question," Robbie added. "SOLIDWORKS, for what we do as manufacturers and students, SOLIDWORKS is just the better tool."

#### FIRST Queen City, Next North Carolina



At the end of FIRST's six week build period, which started the first week of January (get it? January? First? FIRST?), Team YETI went down to the line building their bot. They always do. But when build season ended, they had not one but two robots. They spent most of the season building the first one, and then decided to improve upon it, to make it the best robot they could possibly produce. Their hard work gave birth to Avalanche, their entry into FIRST Power Up. Seeing their bots inspired the other teams who work in the QCRA. Another team in the space attempted to build, and built, a second robot for the first time ever. And QCRA's rookie team, Iced Java, built their first robot ever and had it ready to be bagged and packed away by the deadline.

#### At the UNC Pembroke District Event (http://frc-

districtrankings.firstinspires.org/2018/NC/NCPEM), YETI ended up ranking 12<sup>th</sup> out of 37 teams. They were picked by 4<sup>th</sup> seed and made it to the semi-finals, before being defeated by the event winners. But they are also, once again, the winners of the District Chairman's Award and will be competing in the North Carolina State Championship on April 7. Iced Java will be joining them. "Both teams had a rough time in the beginning with gearbox issues but both teams were pretty well respected for their strategies on the field and were selected for play in the brackets," Robbie informed me in an e-mail. YETI has a chance to win multiple awards at the State Championship and make it to the world finals, and they're ready and rearing to go.



Team YETI winning the Chairman's Award at the 2018 UNC Pembroke District Event

All the teams in the Queen City Robotics Alliance's FIRST Zone do well because of their community, their space, their members, and their mentors. Robbie is one of many YETI mentors who guides students, but only when they need it. For the most part, the kids are the leaders and they cooperate with each other, with only the occasional helping hand from an adult. YETI is student led, which means all their successes belong to the students. They're a supportive, unique community, sort of like the FIRST Zone itself. Having a space where students can build robots, and practice, and collaborate over marketing initiatives, and practice, and lead community building camps, and practice, and practice, and practice, have all contributed to YETI's success as a FIRST team, and as a diving board from which kids can plunge themselves into the world of STEM years before they may have otherwise had the opportunity to do so.

So what does it take to be a FIRST student? Time, smarts, initiative, cooperation, and a love of learning, a love of your community, and a love of STEM. To be a FIRST mentor? "You have to be a little on the crazy side," explained Robbie, who is very sane and very passionate about what he does. But we all know what he means. "You have to believe that what you're doing is going to help, because there is a shortage of engineers and folks in manufacturing...You have to really enjoy engineering and you have to really believe that it's great for the world and that these kids are going to want to do that if you can just show them that way of living." If FIRST is the type of program someone is going to go crazy over, they have chosen well.



Thanks to Trenton DeSear, Colin Evans, James Ramich, and Robbie Hoyler for taking the time to discuss Queen City Robotics, the FIRST Zone, TPM, and their personal experiences with FIRST. All images courtesy of QCRA and YETI's various social media accounts and YouTube.

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#### Sara Zuckerman

Sara Zuckerman is a Content Marketing Specialist in Brand Offer Marketing for SOLIDWORKS and 3DEXPERIENCE WORKS.

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