

It takes a village – and a heap of nuts and bolts – to build a robot. At Menchville High School, that translates into 17 students and a dozen mentors laboring for weeks over an original design. High-tech sponsors underwrite much of the cost and help a concept become reality. Students' parents cater to needs like hot meals and rides and make sure homework gets done. Moral support comes from all sides.

All the efforts support the school's entry in the FIRST Robotics Competition. FIRST – For Inspiration and Recognition of Science and Technology – is an organization founded in 1989 to boost interest in math, science, and technology. At the high-school level, it sponsors competitions for which teams have to design and build a robot tailored to perform specific tasks in a game with detailed rules.

The game is not a mechanical demolition derby. It's a fantasy of the organizers. This year's game is Breakaway. Its description takes up 13 pages (of 171) in the competition manual. It requires robots to maneuver on a 27-by-54-foot field with obstacles, tunnels, and towers. Robots score points by propelling soccer balls through goals. They get extra points for hoisting themselves onto platforms or hanging from towers and by lifting robot allies. And, that's just the offense. Robots can play defense, too, since there are six on the field in a game. If it's difficult to envision, there's a game animation on the team's Web site: <http://www.menchvilleroobotics.org/TheGames.html>

Menchville's team, Triple Helix, is in its third year of competition and has already collected hardware for its trophy case. But, with a match lasting only 135 seconds, it's clear the real meaning of robotics competition is in the process. Teams don't even learn details of the game until early January, after they've been active for months. They have to ship the robot – whatever its state of readiness – 45 days later.

There's an all-important lesson about getting a job done in the time allotted. Chester Langston, who works at the Army Research Lab and NASA as an electrical engineer and volunteers with the students, notes that meeting the shipping deadline may be the robotics team's most important lesson.

Bill Yeager, another mentor, is a retired aerospace engineer from the Army Research Lab, one of the team's sponsors. His specialty is mechanical design, and – like Langston – it's his third year helping the Menchville team. He says the process teaches students about collaboration, communications, problem solving, and teamwork.

Time-management is another life skill reinforced by participation in robotics, according to Head Coach Matt Wilbur, a senior research engineer for the Army Research Lab. The program's lengthy time commitment (students spend upwards of 120 hours on robotics activities, much of it just before the shipping deadline) has caused some students to think twice about robotics. Wilbur says the students who stay with the program become skilled at setting and managing priorities.

The support system for Triple Helix (the name comes from DNA's double-helix structure, augmented by a mechanical chain) was obvious during a Saturday meeting in February, 17 days before the robot needed to ship. The previous weekend's work had fallen victim to snow. As students and mentors, all wearing safety goggles, crowded around their prototype, a procession of parents bearing gifts – steaming slow cookers, caffeinated drinks, a tray of raw veggies, and chocolate – trudged through pesky snow flurries.

Part of the team was using computers to test the wiring to the robot's mecanum wheels, which can move in any direction. Assistant Coach Matt Lythgoe, a Menchville teacher, looked on. Another group assembled the housing, with the help of Allen wrenches, locking plastic ties, a vise grip, and tape measure. Surgical tubing secured the kicking mechanism. A third group was in the machine shop, where tool drawers and boxes of parts gaped and a manual sat open on a table.

The team has specialists among students and mentors. There's a lot of on-the-job learning, so students don't need technical expertise to participate. Junior Allison Kelley is the team's safety officer. Wilbur's daughter Rachel, a sophomore, is team captain. The students are coaches, too. The Menchville team mentored a FIRST Lego League team at nearby B.C. Charles Elementary in the fall. Kelley and Rachel Wilbur say Triple Helix would like to get a team off the ground at Gildersleeve Middle School, too. They're looking for a sponsor.

Tension grew as the shipping date neared. A note on the chalkboard counted down the days – seven – until shipping. The FIRST program requires robots to be shipped and stored until the competition to ensure even footing for all teams. The program also espouses sportsmanship and encourages teams to be active in their communities. Triple Helix sponsored a robotics camp for middle-schoolers during the summer, raised money for local charities, and helped staff a preschool carnival. The team's Web site (<http://www.menchvilleroobotics.org/>) documents its activities.

Even though the robot is headed to a competition, team members acknowledge friendly collaboration – and commiseration – with other teams in online forums, where motor gear ratios and pneumatics systems are the topics of discussion. Sophomore Michael Snider says the team's design has changed a lot since initial brainstorming sessions. He was eager to test the kicking mechanism. Freshman Joron Foster worked on the motor controls and tracking system designed to make the robot's kicks more accurate. He became interested in robotics at summer camp. Jim Farmer is a Christopher Newport University student who helps the team. He competed in robotics for four years at Mathews High School. Farmer says Triple Helix has the same worries that his high-school teams did.

Three days before shipping, the robot was off the sawhorses. The drive train worked like a charm. Two student programmers, Rachel Wilbur and Snider, and the team checked the pneumatic system that propels the soccer ball. They found a hitch in the voltage running to the relays. One group checked the specifications in the manual. Langston had the robot on its side. Matt Wilbur searched for a photo of the relay on the Internet. Anton Riedl, a CNU professor, loosened his tie and asked the programmers about the values on their code.

A few minutes later, a hiss and a thump broke the silence and suspense. A soccer ball arced across the room, and Lythgoe's arms lifted in triumph. There was a collective sigh of relief, but no time to relish the feat. The team moved on to other tasks: capturing their preparations on a video, improving a roller mechanism to capture the soccer ball, and preparing for an open house for friends, families and sponsors.

On Monday, the day before shipping, the robot weighed 101 pounds, well under its limit. The Web site was updated. The team had built and attached bumpers for the robot, but members were still debating where to place a camera that would help it aim the ball more accurately. As activity waned, fretting seemed to increase.

But the process worked. Triple Helix tweaked its creation throughout the competition, and the robot, Genome Beta, earned a 7-2 record in its first competition, March 4-6 in Washington, D.C., finishing near the middle of a 59-team field. Triple Helix also won an award for safety. The Menchville team will participate in another competition at Virginia Commonwealth University March 18-20, against a field that includes a team from New Horizons Regional Educational Center with NNPS student members. There are 63 teams registered for that event. Teams that qualify in regional events will face off in the FRC Championship in Atlanta April 15-17.

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