

# Mind Sport

## Stronghold Competition Puts the Fun in FIRST Robotics

Matthew Jaster, Senior Editor

Here's what we know about Tremont, Illinois: It's a small village in Tazewell County, (population 2,400+), holds an annual summer turkey festival (quite popular) and the courthouse is a famous historic site where politician James Shields challenged an "up-and-coming" lawyer named Abraham Lincoln to a duel with cavalry broad swords (they showed up, but the duel never materialized). In 2016, you can add FIRST Robotics Competition World Champion to the village's rather eccentric list of accomplishments.

Tremont High School's robotics team (Roboteers Team 2481) has been battled-tested since this season's competition kicked-off back on January 9, 2016. "The game this year was called FIRST Stronghold. It had a medieval theme that was comprised of attacking your opponent's castle by crossing defenses and shooting boulders (foam balls) into scoring openings in the tower. Disney Imagineering came up with this year's theme," said Team Mentor Tim Koch.

For those new to robotic engineering competitions, these events are played with robots that can weigh almost 150 lbs. and have a 120" maximum perimeter. The robots can travel 10-14 feet per second at top speed and play in three robot alliances on a 27' wide by 54' long carpeted playing field. "The FIRST Robotics Competition is designed to be a spectator sport and is played in arenas where hundreds or thousands of spectators cheer as the robots play the game," Koch said.



FIRST Stronghold is a medieval themed robotics competition where teams attack their opponent's castle by crossing defenses and shooting boulders (foam balls) into scoring openings in the tower.



Tremont High School's Roboteers Team 2481 took 1st place in the FIRST Robotics Competition World Championship in St. Louis with their robot nicknamed Broadside.

Team 2481 designed, built, programmed and tested their robot during a six-week build period. They also built a second identical robot to use for driver practice and to continue to refine the controls software. During the build season, Koch said it is common for students to work 20-30 hours per week *over and above* time in school and other extracurricular activities. "We also spend a lot of time learning about the teams we are playing with and against to develop a game strategy," he added.

The Roboteers built a robot with two, 2-speed transmissions (one for each side of the robot powering the wheels that are shifted by small pancake air cylinders). The intake roller has a 3:1 planetary transmission reduction using a VexPro transmission. The shooter wheels are direct drive off the motor. There is also an in-line encoder that provides direct feedback via a PWM cable to the motor controller. The team used a proportional-integral-derivative (PID) controller to spin the shooter up to its target speed in the shortest possible time and maintain target speed without significant oscillation. After winning regional events in Central Illinois and Knoxville, Tennessee, Team 2481 took part in the May 2016 World Championship in St. Louis. They were one of a four-team coalition that took first place in the FIRST Robotics Competition World Championship, beating over 2,800+ teams to capture the world title. And they did it utilizing a robot they affectionately nicknamed, *Broadside*.

While skilled labor continues to be a huge problem in manufacturing, the data Koch has collected on the high school robotics team looks promising. "We track metrics on our team's involvement in STEM. Over the last eight years, 82 percent of our participating students have gone into STEM fields."

The Roboteers will participate in several off-season events where they will re-play Stronghold, sometimes with slightly different rules to keep things interesting. "We now have the opportunity to spread the word about FIRST in our surrounding communities and state, allowing more students to participate," Koch said. "We agree with FIRST Co-founder Woodie Flowers, that this is the hardest fun we ever had!" **PTE**

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