

# FIRST Robotics Team 1640

## Downingtown Area School District Board Meeting

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[[Sasha]] Good evening, and thank you for inviting us to this meeting. We're here to represent the Downingtown Area Robotics *FIRST* Robotics Competition team and its 25 students from Downingtown East and West High Schools, the Downingtown STEM Academy and surrounding Chester County High Schools.

I'm Team Captain, Sasha Wall, and this is one of our mechanical leads, Doug Moyer.

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We had the honor of being invited here by Dr. Mussoline for winning the "Sport of the Mind" Tri-State Regional Championship earlier this year. Using a robot [[gesture]] we'd engineered under the guidance of professional mentors in only 6 weeks, we excelled in *seven* rounds of elimination play at two different events. The problem-solving, performance and technical skills we developed propelled us (and our two-team alliance with whom we learned to work cohesively) above *96* other teams in our region. Our Alliance is now considered one of the top 6 in the entirety of *FIRST* Robotics!

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*FIRST* Robotics is an amazing program and has been a fantastic learning opportunity for me personally. *FIRST*, or For Inspiration and Recognition of Science and Technology, is a truly international organization with over 2,300 teams from 12 countries competing on 4 continents. At the beginning of the year, we're all given 6 weeks to conceive, design, build, wire, program, test, troubleshoot and practice with a robot for an annual game. This challenging process, I'm told by my engineering mentors and the multinational CEOs that invest in *FIRST*, closely parallels and prepares us for the reality of engineering projects.

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[[Douglas]] For instance, this year, the international challenge—designed by the Game Design Committee comprising inventors, University professors and engineers from top international corporations—is to play 3-on-3 basketball with large steel bar dividing the field, and then balance as many robots as possible on top of pivoting seesaws, called bridges. In addition to consistently scoring balls, our team was one of the few in the world to balance *three* robots on a bridge, with one even hanging off the edge!

While it sounds novel, hidden within this inspiring game are very real engineering problems we strove to define and solve. We dealt with dozens throughout the season, but have time to demonstrate a few here:

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Firstly, the foam game pieces [[hold]] we had to pick up and shoot varied much more in density, center of mass and elasticity than ordinary basketballs. We identified this problem early and ran systematic tests measuring the shot spread of different shooter configurations before settling on this specific geometry. We then fabricated it out of lightweight carbon fiber to lower our center of gravity and help us balance on the seesaw.

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In addition to this, our computer programmers and electricians [[wave]] undertook the control challenge of shooting and scoring baskets accurately [[gesture to driver]] They tested and programmed a camera and sonar range-finder to align with the basket and set shooting distance, and even created a custom-circuit tachometer to sense shooter speed, letting us shooter faster and earn extra points. Alas, we won't shoot during this meeting.

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Finally, we learned a lot about the engineering of powertrains in the third-generation of our award-winning swerve drive. [[quick demo]] Each of our four wheels is independently driven and steered, allowing us to use our wide side to pick up balls and get on the bridge, but our narrow side to cross the mid-field barrier. [[gesture to wide & narrow respectively]] This difficult and unique engineering was only executed by a few of the most elite teams in *FIRST*. To top even that, though, we realized in our prototyping that we would need to add a secondary drive system to quickly and reliably cross the barrier. Unfortunately, we were out of suitable motors, so we figured

out how to make it also run our ball intake with a wrap-around power takeoff! [[gesture to power takeoff, demo intake running ball to top]]

*Change in attitude—more serious*

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[[Sasha]]When this team started eight years ago, we were nowhere near the top of our class and consistently finished in the bottom half at all our competitions. Over the past four years, we've improved steadily and both our program and our new students have grown leaps and bounds. This year, we've *won* half our competitions and earned a slot at the World Championship as one of the best teams in the world, where we placed 13<sup>th</sup> in a division of 99 of the best young leaders FIRST has to offer.

We're now gearing up for our third appearance at the annual international All-Star Tournament, where we'll go head-to-head with an even more select group of perennially successful teams. We're looking forward to giving it our all, but also learning a lot from them—a uniquely cooperative element of FIRST reflective of real-world Gracious Professionalism, which is personally one of my favorite aspects.

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In addition to our high school team, Downingtown Area Robotics operates 17 very successful VEX teams serving mostly Middle School Students and six award-winning Lego League Teams serving 4th & 5th grade students. Altogether, we reach close to 200 students in the Downingtown Area.

We're very happy to have participated in tonight's board meeting and hope for the board's renewed support. Thank you and good night.

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