

Robotics competitions bring out the best in students and machines

Deep in the heart of Texas, high school students are building robots and learning a lot about engineering, thanks in part to a good-natured mentor named Tim Ousley and DraftSight, a free 2D CAD product.

A senior engineer who works in software development for National Instruments, Ousley spends a considerable amount of his spare time helping students in the Austin, Texas area prepare for BEST and FRC highschool robotics competitions.

Probably the best-known robotic competition is the DARPA Grand Challenge: Driverless cars are required to travel through a series of checkpoints as quickly as possible – through, for example, the Mojave Desert. While the high school competitions require less-demanding tasks and smaller and less sophisticated machines, the competition is no less intense.

For example, one high school competition required robots to travel to a pile of plastic rings a few feet away, pick them up, and hang them on a section of plastic tubing. Though the robots are controlled via radio by the students, tasks like this require a lot of mechanical dexterity. This means a lot of thought has to go into both design and the mechanical execution.

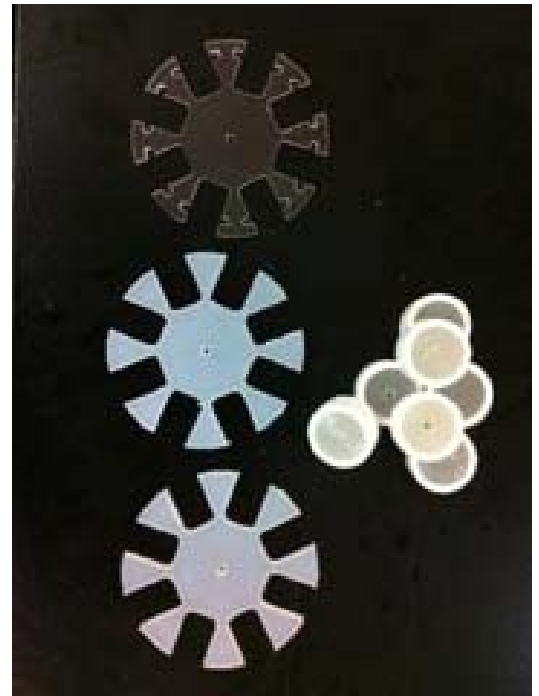
In that regard, DraftSight helps a lot, said Ousley.

“At first, making these parts was frustrating because it took too many monotonous hours of adult mentoring and practice by the students to use tools like the drill press and a mini-mill,” said Ousley.

But armed with a small CNC (computer numerically controlled) machine, some CAM tools, and DraftSight they are able to build parts with a computer instead of their hands. Ousley said DraftSight is an excellent tool to bridge the gap between design and manufacturability. His team works in SolidWorks, then moves to DraftSight.

“The interface is easy to learn and it puts as few barriers as possible between the students and the parts that we manufacture,” he said. “We load the drawing up in DraftSight, clean it up and then export it to a 2.5-D CAM package and generate the code to build the parts.”

In the fall BEST competition, the team needed a custom wheel called an “omniwheel” to enable better robot stability without constricting freedom of



motion. In a fast-moving competition, the only thing worse than a clumsy drive system is an unstable robot. A complex omniwheel could fix both problems, but most teams won't attempt to make one because of its complexity. Undeterred, one of Ousley's students designed a single omniwheel made from 18 custom parts. He was able to draw it in DraftSight, then cut it from Lexan using the CNC on a weekend afternoon.

"It is a little tricky to build this kind of stuff, but Draft-Sight makes it easier," said Ousley. "DraftSight is the perfect tool for quick 2D part design. It's easy to learn, easy to teach, and has an easy path to CAM. Plus it's free, which means no barriers for use by our school."



It worked. After winning a local competition, Ousley's Westlake High School robotics team competed at the Texas BEST Robotics Competition at the University of North Texas's Coliseum in Denton, Texas. Against 47 other teams from Texas, New Mexico and Oklahoma, they finished eighth. They also won second place in the Founders Award for Creative Design, which goes to the team that makes the best use of the engineering process in consideration of offensive and defensive capabilities in machine design.

At this spring's FIRST Robotics Competition, you can bet they'll be refining the CAD/CAM capabilities they adopted in the fall. Those robots are north of 100 pounds, use vision-enabled real-time embedded computers and are built from aluminum, carbon fiber, steel and sweat.

"Our newfound ability to design, fabricate and modify complex components during the short build season is an intense learning experience disguised as a competitive advantage," said Ousley.



The [Westlake High Chap Robotics team](#) is sponsored by National Instruments, Texas Instruments, Pixels & Verbs and others. Mentors like Ousley volunteer time to work with teams after school. While the mentors provide guidance and make sure everybody is safe, the students do most of the work.

Both the BEST and FRC contests involve more than designing, building and operating a robot. They also include building and running a website, marketing, public outreach to younger students, communications, fundraising and teamwork – "intense teamwork," added Ousley.

[YouTube video](#) of an omniwheel robot

[Wikipedia on omniwheels](#)

[Video](#) showing a BEST competition

Source:

Tim Ousley tim.ousley@ni.com

Tim Ousley | Senior Engineer | Wireless DAQ R&D | National Instruments

512-683-6671