TEAM SAWBLAZE
BLAZING INTO WORLD OF BATTLING ROBOTICS WITH SOLIDWORKS SOLUTIONS
Case Study

BattleBots Team SawBlaze, whose robot is shown here during a match with its distinctive blazing fire, relies on SOLIDWORKS mechanical design, simulation, visualization, and PCB design solutions to develop and improve each version of its robot that competes in the popular "BattleBots" television series.

Challenge:
Develop battling robots quickly and cost-effectively to maximize the competitiveness of robot SawBlaze as part of the "BattleBots" television series, while simultaneously demonstrating its overhead saw and flamethrower design.

Solution:
Utilize Dassault Systèmes SOLIDWORKS CAD, simulation, PCB, and visualization software so the team can leverage a range of productivity-enhancing solutions.

Results:
- Developed sensor board to control brushless motor in one week
- Reduced motor spin-up time by 60 percent
- Accelerated BattleBots application development with photorealistic visuals
- Completed design checks and built robot in one month

BattleBots Team SawBlaze Captain Jamison Go's initial forays into the world of fighting robots began when he was still in middle school. Unlike some of the other BattleBots veterans who got into designing and building fighting robots through formal, established competitions—such as Lego® League, FIRST® Robotics, and BattleBots IQ—Go got his start in the amateur, underground circuit of miniature fighting robot competitions. In these contests, all of the robots weigh less than 15 pounds, as opposed to the 250-pound weight limit for robots competing in "BattleBots."

"I remember watching the original 'BattleBots' television show on Comedy Central as a kid," Go recalls. "I saw it on a VHS tape recorded by my dad's friend—one of his co-workers—because we didn't have cable at our house. I thought it was the most amazing thing that I had ever seen, and it thoroughly piqued my interest in becoming an engineer and building battling robots."

Go had always had an interest in building things as a child, spending time gathering old aircraft parts, traffic lights, and other materials from a local surplus store. Go says it was his "tinkerer's dream" to first build electric vehicles and then competitive fighting robots. "The very first fighting robot that I built was a three-pound version of what would later be SawBlaze, and I took it to one of the underground competitions, which were run by a loose community of robotics aficionados that proliferated at that time and continues to this day," Go recounts.

> "Our weapon's brushless motor was designed to only run sensorless, so I used SOLIDWORKS PCB to develop our own sensor board, which resulted in a 60 percent reduction in our motor's spin-up time. I was able to develop the first version of our sensor board in less than a week and ultimately improve our weapon performance. SOLIDWORKS gives us all of the tools and functionality that we need to move quickly and design accurately."
>
> — Jamison Go , Team SawBlaze Captain

"I won that very first event and found a home in that welcoming community of creative folks. I've learned a lot over the years, and fighting robots has been a guiding hobby that parallels my engineering career."

Go's fighting robot hobby continued while he earned degrees in mechanical engineering and electrical engineering at Georgia Tech, and later while he earned his master's degree in mechanical engineering at MIT. Now an R&D engineer at Desktop Metal, Go and Team SawBlaze's journey to the BattleBots arena differs from that of many of the other teams because, participating in the underground circuit, Go and team members were not as well known as those that had participated in more formal competitions.

"I didn't get a call from 'BattleBots' to participate in the reboot, but a group of us in the Northeast formed a super team that we dubbed JACD, using the first initial in our names, and we were accepted on the show as a group," Go explains. "Each member had a long history of participating in battling robot competitions, so in the next season of the reboot, we each decided to apply with our own individual machines and pursue multiple entries. All were accepted, including SawBlaze. The design featured a fireman's rescue saw and green-fire flamethrower mounted to a pivoting arm. Referring to our flamethrower, the producer simply said, 'We have to have that green fire.'"

A SOLIDWORKS® CAD user since middle school, Go used his student copy of SOLIDWORKS from MIT to develop the first SawBlaze robot with his team for the 2015 season. Since then, the team has secured a sponsorship from Dassault Systèmes SOLIDWORKS in the form of CAD, PCB design, simulation, and visualization software licenses.

GIVING BRUSHLESS MOTOR SENSORS WITH SOLIDWORKS PCB

Using the printed circuit board (PCB) design tools of SOLIDWORKS PCB software, Team SawBlaze has improved the responsiveness of the brushless motor used for the robot's spinning weapon by designing a unique, sensor-laden PCB that transforms a sensorless, brushless motor into a motor that spins up faster than the same motor without the sensor board. "When we're in the midst of battle, we need our spinning weapon to have a very fast response rate while withstanding the shock of collision because you just can't waste seconds when you are in a BattleBots fight," Go points out.

"Our weapon's brushless motor was designed to only run sensorless, so I used SOLIDWORKS PCB to develop our own sensor board, which resulted in a 60 percent reduction in our motor's spin-up time," Go continues. "I was able to develop the first version of our sensor board in less than a week and ultimately improve our weapon performance. SOLIDWORKS gives us all of the tools and functionality that we need to move quickly and design accurately."

LEVERAGING VISUALIZATION AND DATA MANAGEMENT TOOLS

Two other SOLIDWORKS solutions that are becoming increasingly important to Team SawBlaze's development efforts are SOLIDWORKS Visualize rendering and SOLIDWORKS PDM Professional product data management (PDM) solutions. The team has to make a presentation to "BattleBots" producers to show how its robot will look and operate, and the rendering tools of SOLIDWORKS Visualize enable the team to accelerate the creation of stunning visuals, including fine details like sponsor logo positioning, for inclusion in the application.

With SOLIDWORKS PDM Professional, Go hopes to tighten revision controls and work more accurately and concurrently with other members of his team. "I had the experience of using SOLIDWORKS PDM at MIT where I had access to the PDM server as part of my student license," Go notes. "I found it to be invaluable for maintaining revision control while working on a team of just five people. SOLIDWORKS PDM will certainly help our current team of 10 to keep our data straight."

## PAVING THE WAY FOR FUTURE ROBOTICS ENGINEERS

Team SawBlaze has become a recognizable, well-liked BattleBots team with a growing fan base. The team is committed to inspiring the robotics engineers of the future, using SOLIDWORKS visuals and robot parts to support the team's community outreach. "I am gratified to be able to help young people find their way to a robotics or engineering career," Go says.

"Robotics competitions are very fun and very cool, and are surrounded by a community of people that are passionate about STEAM [science, technology, engineering, arts, and math]," Go adds. "I want to pass my experience along and pave the way for the engineers of the future, like the young kid at the Boston Children's Museum who I recently told, "I was your age when I started. Do you know how to use SOLIDWORKS?"
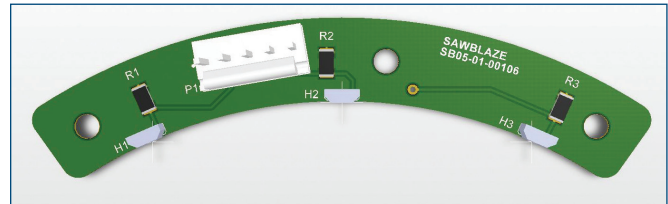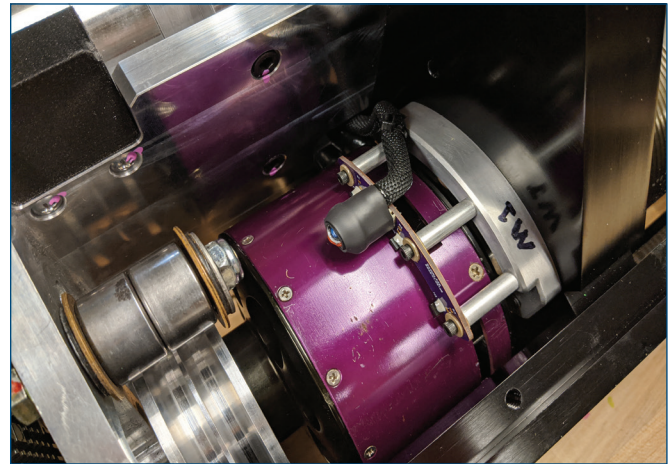
Using SOLIDWORKS PCB design tools, Team SawBlaze was able to improve the spin-up performance of its primary weapon by designing a unique, sensor-laden PCB that transforms a sensorless, brushless motor into a motor that spins up faster than the same motor without the sensor board.

Team SawBlaze also leverages SOLIDWORKS visualization tools to create high-quality photorealistic renderings, like the one shown here, and plans to take advantage of the SOLIDWORKS PDM Professional product data management (PDM) system to tighten revision controls and work more accurately and concurrently with other members of the team.

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