

With Autodesk Inventor software, we could make precise measurements to achieve a fully functional robot the first time we manufactured parts. We didn't have to compromise our design to save time and money.

—Cody Neslen
Cal Poly Student and
BattleBots Builder

Robots rule.

Cal Poly team creates a fierce BattleBots robot using Autodesk® Inventor® software.



Image courtesy of Christian Carlberg.

Project Summary

Christian Carlberg vacationed in California in 1995 and never left, trading his job in aerospace engineering for one in special effects. Carlberg soon started designing and competing fighting robots as a hobby with other robot enthusiasts. It wasn't long before the TV show BattleBots® was born. Among the show's 500 contestants, Carlberg earned his stripes as a BattleBots Pro Builder and fierce competitor. More than a decade later, Carlberg's company, C2 Robotics, teamed up with California Polytechnic State University (Cal Poly) students and alumni to build another competitive robot, named Chunk. In April, Chunk competed in the resurrected BattleBots competition. The team was able to quickly design Chunk and meet the competition's regulations, thanks to Autodesk® Inventor® software, part of the Autodesk® solution for Digital Prototyping. With the help of Autodesk Inventor, Carlberg and his team have been able to:

- Build a competitive BattleBots robot quickly
- Reduce the chance of design errors and the need for rework
- Create renderings that helped the team secure donations of expensive parts

The Challenge

When Carlberg learned that Trey Roski and Greg Munson had landed a TV deal for a college BattleBots competition, he began assembling a Cal Poly team. "I had recently helped Cal Poly electrical engineering students Cody Neslen and Brian Anderson with a NASA competition, and knew they would be excited to design a fighting robot," says Carlberg. "Cody Neslen secured some funding from the electrical engineering department. We were off and running in no time." Neslen adds, "BattleBots was an amazing opportunity for me to gain hands-on experience with both mechanical and electrical design in extreme environments."

The Cal Poly team had little time—and only \$1,500 after paying contest expenses—to build a competitive robot. "Working with a tight budget and schedule, it was critical for us to design a robot without major design flaws that we could assemble easily," says Neslen. Plus, that robot had to meet strict BattleBots guidelines. These included weight and material restrictions, limits on pneumatic systems, and fuel tank requirements. "One of our biggest constraints was getting the robot under 120 pounds," notes Carlberg.

The Cal Poly BattleBots team quickly created a fierce fighting robot using Autodesk Inventor software.

The Solution

Carlberg discovered the benefits of Autodesk Inventor a decade ago when he and his original BattleBots teammates, Luke Khanlian and Brian Roe, first competed. “We had to build, test, and tweak our design in a very short timeframe,” explains Carlberg. “With Inventor, it was easy to get the major brushstrokes of a design done very fast. We were always ready for competition with some of the flashiest, strongest BattleBots on the show.” When it came time to create Chunk, there was never any question about whether the Cal Poly team would use Inventor. “Once I started using Inventor, I was hooked,” adds Carlberg. “I knew it was the best way for us to get around our time and budget constraints.”

Choosing a Weapon

To keep costs down and its options open, the team decided to test two spinning weapons: a new design and one that Carlberg had salvaged from an old robot. “We hoped to get the same inertia while lowering Chunk’s weight,” says Carlberg. “When you’re talking about a spinning mass, inertia is very important. We used Inventor to compare the inertia of each weapon bar, and Inventor helped us choose the one with the most power for the least weight.”

Designing with Accuracy

Inventor also helped the Cal Poly team meet its tight deadline by reducing the possibility of mistakes. “With Inventor and Digital Prototyping, you can see how your systems will move,” says Carlberg. “We used Digital Prototyping in designing Chunk to see if we had proper clearances and to design parts we could cut with a waterjet machine.”

He adds, “What’s nice about using Inventor for the main parts is that we only cut them once—we knew they’d be right the first time.” In addition, by modeling Chunk in Inventor, the team was able to monitor the robot’s total weight throughout the design pro-

cess. “The hardest rule is that you’ve got to be under weight—and Chunk came in one pound under.”

Getting Donated Parts

With its limited budget, the Cal Poly team had to get creative when it came to securing off-the-shelf parts. Not only did they reuse parts from Carlberg’s old robots, they solicited donations from local companies. Carlberg discovered that the digital prototypes created in Inventor were key to securing interest. “I took snapshots of the Inventor model to show companies exactly what we wanted to build,” he says. “It made a huge difference that our sponsors could see the individual parts in the model, including the motors, belts, and batteries. In the end, we got motors from National Power Chair and batteries from Hilltop Batteries—we’re talking thousands of dollars in donated parts.”

Beyond the Competition

When asked why the exposure his team has gotten to Inventor software is important, Carlberg remarks: “Inventor lets students very quickly progress from beginning design tasks to creating a model that looks like something real. It’s very motivating. With Inventor, the software doesn’t slow down the creative process. It stimulates it.”

Carlberg adds, “If college students can get the basic Inventor skills down, they can be ahead of the curve when they graduate and start working in industry.”

The Result

Working with the Cal Poly team on Chunk was a positive experience for everyone involved—and one that Carlberg hopes to repeat. “The Cal Poly team was unbelievable,” he says. “We pulled together and it was an easy robot to build.”

Neslen credits Autodesk with helping the team achieve its goals. “With Autodesk Inventor software, we could make precise measurements to achieve



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a fully functional robot the first time we manufactured parts. We didn’t have to compromise our design to save time and money.”

While the BattleBots competition results are still under wraps, Carlberg says, “I can tell you that Chunk had a very spectacular fight—one of the best fights in the competition. Inventor helped make Chunk possible even with our tiny budget and crazy schedule.”

For More Information

To learn more about Autodesk Inventor software, visit www.autodesk.com/inventor.

To learn more about fighting robots, visit www.c2robotics.com.

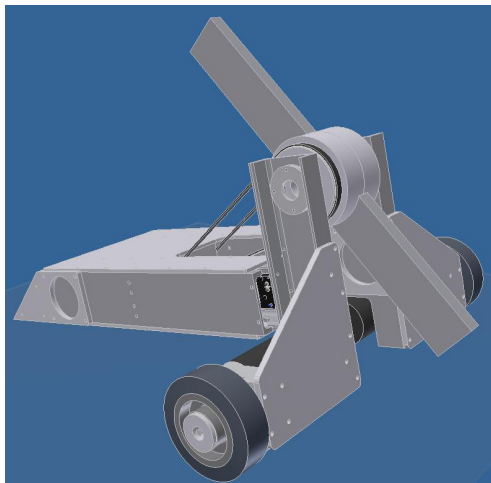


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