On the right track.

Digital Prototyping with Autodesk® Inventor® software helps BigToys design environmentally friendly commercial playground equipment.

Designing with Inventor software is seamless. We can go from the initial idea to finished part with very little redesign. We also have the added benefit of sophisticated rendering and animation, which helps us better communicate our design intent to others and eliminate potential manufacturing errors.

— Brian Lovgren
Engineering Manager
BigToys, Inc.

Project Summary
For nearly 40 years, BigToys, Inc. (BigToys) has earned a reputation as a manufacturer of high-quality commercial playground equipment that encourages children of all ages and abilities to play, exercise, think, communicate, and cooperate. Located in Olympia, Washington, the company is known for caring for the environment as much as for children. BigToys’ sturdy and durable steel and plastic play structures contain 100-percent U.S.-made recycled materials, and its use of post-consumer, high-density polyethylene plastic helps keep hundreds of thousands of milk jugs out of landfills every year.

To design its award-winning playground equipment, BigToys relies upon the Autodesk® solution for Digital Prototyping. Using Autodesk® Inventor® software to create 3D digital prototypes helps the company to:

- Design, visualize, and simulate products before manufacturing
- Develop more innovative and flexible product designs
- Achieve a more efficient design process
- Create safe and environmentally friendly play spaces

The Challenge
Until late in the 20th century, seesaws were found in nearly every public park and school playground in America. Due to safety concerns and increased litigation, seesaws had all but disappeared by the beginning of the 21st century. In 2005, BigToys sought to reinvent the traditional seesaw by developing a new design concept that could meet today’s safety and sustainability standards while providing children with the same movements and sensations loved by generations of riders.

The Solution
BigToys used Autodesk Inventor software to develop a new product called the Rock ‘n Cross™, which redefines the seesaw concept by combining a multi-rider teeter-totter with a dynamic overhead activity. The unique design of the Rock ‘n Cross removes the dangers of traditional teeter-totters by eliminating pinch points and sudden stops through an internal spring-assisted action. Designed to meet or exceed all applicable safety standards, it provides children with opportunities for both physical and social development in a fun and exciting play activity.

“Designing with Inventor software is seamless,” says Brian Lovgren, engineering manager at BigToys. “We can go from the initial idea to finished part with very little redesign. We also have the added benefit of
BigToys used Inventor software to design its Rock 'n Cross product, redefining the traditional seesaw.

sophisticated rendering and animation, which helps us better communicate our design intent to others and eliminate potential manufacturing errors.

“The flexibility and faster iterative capability we have realized through the use of Inventor has led to more innovative product designs and a more efficient design process,” Lovgren continues. “Its intuitive interface ensures that our time is spent designing, not searching for toolbars and dialog boxes.”

In developing the Rock 'n Cross, BigToys focused on three key steps: customer collaboration, concept development, and prototype testing.

Customer Collaboration
As part of the early design work on the Rock 'n Cross, BigToys collected input from several types of potential customers: children ages five and up, playground supervisors and schoolteachers, playground equipment specifiers, safety standards organizations such as the Federal Consumer Product Safety Commission and ASTM International, and installation and maintenance workers.

Focusing on meeting customer requirements helped BigToys to identify the market opportunity for the product. These requirements included enjoyable and developmentally appropriate play experiences, minimal supervision, overall durability, cost-effective installation and maintenance, compliance with industry safety standards, and the ability to be either surface mounted or installed in-ground.

Concept Development
BigToys contracted with John Underbrink, an industrial designer who specialized in playground equipment and had worked closely with the company for many years to develop ideas for cooperative play products. He saw the decline of the traditional seesaw as an opportunity and presented sketches of what was to become the Rock 'n Cross.

The sketches showed the original germ of the concept. In each, the tilting of the traditional seesaw had been replaced by a mechanism that moves the riders in the same circular path as is traditional, but using a rotating arc rather than a pivot. Whereas seesaws balance due to weight distribution, this concept was centered using springs.

The idea of using springs to center seesaws was not new as there were units on the market where the springs only centered the riders rotationally, they supported them and provided lateral stiffness. The performance of this style of seesaw was very dependent on the weight of the riders, and it was unconstrained in its motion about all axes and in all directions. The Rock 'n Cross, on the other hand, was constrained to a single degree of freedom like a traditional seesaw.

Prototype Testing
As the initial concept was further developed in Inventor software, all the springs and guides were made internal to the part, above the ground. This design change enabled the Rock 'n Cross to be surface mounted for easier installation. “Inventor’s ability to check interference and employ collision detection allowed us to verify fit and function throughout the full range of motion,” says Lovgren.

After digital testing with the 3D Inventor model, a prototype was built from plastic materials, and it was sufficient for testing the functionality with children in an internal environment. A second prototype was developed and installed on a playground at a local school. During this phase, BigToys observed and interviewed the children, and it learned that five-year-olds played on this unit differently than 12-year-olds. The younger children were more cooperative, with some children acting as helpers to those who were sitting on the Rock 'n Cross. The older children were more competitive and enjoyed the challenge and risk of hanging on the middle while others tried to shake them off.

This graduated play challenge added unique appeal to the Rock 'n Cross.

The Result
Using Inventor software to create a 3D digital prototype of the product design helped BigToys minimize the number of physical prototypes needed. “A bill of materials was exported making implementation of the product much simpler and more accurate,” says Lovgren. “Inventor also made it possible to determine shipping weights and dimensions early on in the process.”

As such, the company was able to develop a 21st century seesaw that not only meets today’s safety and sustainability requirements, but is a favorite play structure of children and playground supervisors—proving to be fun and challenging, while fostering cooperative play.

For more information on completing projects faster with Autodesk Inventor and Digital Prototyping, visit www.autodesk.com/inventor.

1 David G. Ullman, Reinventing the See-Saw at BigToys: A Case Study for The Mechanical Design Process, 2009. Read the full story at http://www.mhhe.com/ullman4e. David G. Ullman does not endorse nor support the use of any specific engineering support system, technology, or methodology.

The flexibility and faster iterative capability we have realized through the use of Inventor software has led to more innovative product designs and a more efficient design process. Its intuitive interface ensures that our time is spent designing, not searching for toolbars and dialog boxes.

—Brian Lovgren
Engineering Manager
BigToys, Inc.