

Samson Design Associates, Inc.

SPINNING OUT AN INNOVATIVE VERTICAL RESCUE SYSTEM WITH SOLIDWORKS SIMULATION



With SolidWorks Simulation software, Samson Design was able to validate the thermal response of the centrifugal brake on the VRS-X vertical rescue system.

- Cut development cycle in half
- Saved more than \$200,000 in prototyping costs
- Confirmed performance of lightweight composite material
- Validated thermal response of centrifugal brake

Samson Design Associates, Inc. specializes in helping clients develop concepts involving human interaction – such as exercise equipment, medical products, and safety systems – into actual products that clients can manufacture and sell at a profit. In response to tighter client budgets and shorter delivery deadlines, the firm investigated ways to streamline its development processes, including the use of integrated modeling and design analysis capabilities to save time, reduce prototype cycles, and cut costs, according to Nick Smith, mechanical engineer.

“Samson Design purchased SolidWorks® 3D CAD software 10 years ago,” Smith explains. “When fully integrated SolidWorks Simulation design analysis software became available, the combination of SolidWorks and SolidWorks Simulation became our preferred solution because of its direct integration. When you are developing a part, it is just so fast and easy to turn on SolidWorks Simulation and run a quick analysis. SolidWorks Simulation is the only FEA (finite element analysis) software that we use because it meets the vast majority of our needs.”

Smith notes that while Samson Design has used SolidWorks Simulation Premium software regularly on a variety of projects (e.g., exercise equipment) to evaluate stress and displacement concerns, the engineering team has relied on SolidWorks Simulation extensively to meet the safety challenges related to the development of an innovative, hands-free vertical rescue system for Spidescape Descent Systems.

Innovating a hands-free vertical descent system

The VRS-X vertical rescue system from Spidescape Descent Systems solves the problem of safely rescuing people from high up in a burning building. The VRS-X system allows a firefighter, first responder, fire victim, or military personnel to descend safely from heights of up to 75 feet to the street below, like a spider dropping from a web. The challenges facing Samson Design included creating a self-contained descent device with a changeable spooled rope inside that was

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Samson Design utilized SolidWorks Simulation analysis software extensively in the development of an innovative, hands-free vertical rescue system for Spidescape Descent Systems.

light enough to become part of a first responder's standard gear, strong enough to control the descent of loads up to 330 pounds, and dependable enough to lower human beings safely. By using SolidWorks Simulation software to analyze components modeled in SolidWorks, the design team was able to iterate on several critical components in the software, minimizing the need to create expensive prototypes and cutting the development cycle in half.

“We used SolidWorks Simulation early on to resolve our weight issue. Our initial prototype was made of machined aluminum, and we needed to explore other materials to reduce weight while maintaining strength. Using SolidWorks Simulation, we learned that we could use a modified, glass-filled polymer composite to drop the weight of the unit from seven to less than four pounds. Our analytical studies enabled us to eliminate five prototypes, at \$50,000 each, and to cut approximately two months from the prototyping process,” according to Smith.

Meeting safety requirements

In addition to cutting weight, time, and cost from the project by using SolidWorks Simulation to simulate the performance of lightweight composite materials, Samson Design employed the software to verify quickly that the design would meet several different safety regulations and requirements. Because first responders use the VRS-X device not only to lower themselves to safety, but also to rescue fire victims trapped in a burning building, it must meet a range of different safety standards, including those of the American National Standards Institute (ANSI) and the National Fire Protection Association (NFPA).

“With SolidWorks Simulation, we were able to show that our device would support the ANSI controlled-descent requirement of lowering 330 pounds, representing a fully outfitted firefighter with 70 pounds of gear, a distance of 70 feet on a 4.5 mm rope,” Smith points out. “Our analysis results gave us the confidence that our design would meet the performance specifications without the need for extended testing of prototypes.” By using SolidWorks Simulation prior to physical tests, Samson Design was able to confirm the product's performance more efficiently.

Validating thermal response of the centrifugal brake

One of the greater engineering challenges facing Samson Design while developing the VRS-X vertical rescue system involved the centrifugal brake that the system utilizes to slow and control descent. The centrifugal brake uses the force of gravity to create torque and friction, dissipating the energy of the fall, which, in turn, generates heat.

“Because the composite material we are using has low thermal conductivity, we used SolidWorks Simulation thermal analysis capabilities to validate that the heat generated by the brake would not overstress the brake components or adhesives,” explains Smith. “The analysis data confirmed the viability of our solution and allowed us to develop an innovative, fully functional product.”



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