

# Winning Innovations

*Readers have chosen three designs for the top prizes in the Product Design & Development Engineering Awards.*

By Colleen Olexa, Technical Editor

The competition was fierce. The 50 finalists in the 11th Annual Product Design & Development Engineering Awards were judged on the same three factors — innovation, creativity, and usefulness. The finalists were presented in the December 2005 issue of *Product Design & Development*. As their fate was put in the hands of the readers, who voted to determine the Gold, Silver, and Bronze Award winners, all the competitors could do was await the final vote.

In the end, three diverse products were awarded the top prizes. A locking shoulder joint, a miniature two-stage diaphragm pressure regulator, and a 3D color printer were announced as the winners during National Manufacturing Week. Each winner was presented with a crystal globe, a symbol of how engineering is improving our world.

Although they created greatly different products, the engineering teams that brought these winning products

## The Best of the Rest

In addition to the Gold, Silver, and Bronze winners, seven other finalists rounded out the top vote getters.

Completing the top 10 is the Linemaster IR wireless foot switch from Linemaster Switch Corp., the SpeedRay 1000 vehicle-mounted antenna from RaySat Inc., the BERS IC high-efficiency rectifier from ON Semiconductor, the Meshscape 4.0 wireless communication system from Millennial Net, the Soundbridge network music player from Roku LLC, the EasyPack rechargeable battery pack from Varta Microbattery Inc., and the Rollerforming metal forming fastening process from Orbitform.

to market share a common goal — to make life a little easier for the end user. This goal is what drove them through all stages of product development.

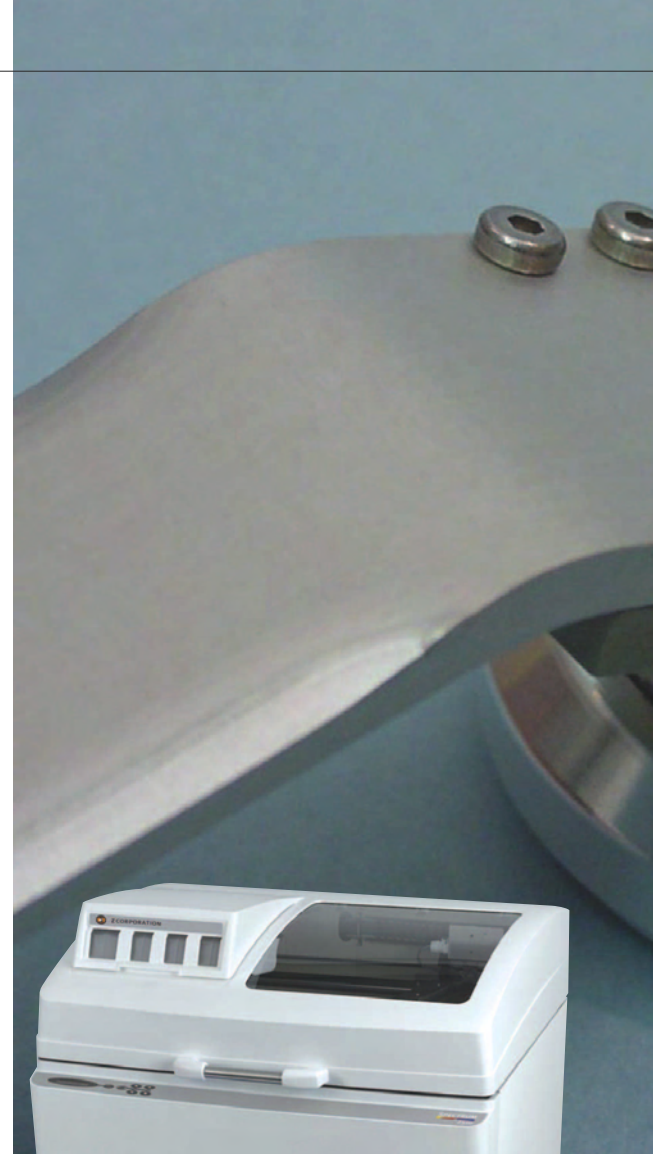
## Gold Award

The LTI Locking Shoulder Joint set the gold standard for design in this year's competition. This fully integrated prosthetic shoulder joint is offered by a duo of companies equally committed to improving the lives of amputees — Liberating Technologies, of Holliston, MA, and Reactive Metals, of Angleton, TX. The LTI Locking Shoulder Joint is designed for amputees with shoulder-level disarticulation, which is typically the result of military or industrial accidents.

T. Walley Williams, director of product development at Liberating Technologies, and Johnnie Rouse, engineering consultant at Reactive Metals, pooled their design, development, and manufacturing talents to create a locking shoulder joint that can hold a prosthetic arm secure in 36 different positions and allow it to swing freely. The only option previously available to patients was a friction-type joint, which offered users no way of making a prosthetic arm swing freely. Instead, the prosthetic arm had to be moved manually.

"The most important feature of the locking shoulder joint is its unlocking feature," Williams says.

The locking and unlocking function of the LTI Locking Shoulder Joint operates much like a ballpoint pen, Rouse explains. "A nudge switch typically located between the neck and shoulder allows users to lock the prosthetic arm in position with their chin." With one nudge of the switch, the joint is locked. With another, it's unlocked, allowing the prosthetic arm to swing freely by the user's side. In this free swing mode, the ball bearing flexion action of the device allows the



**The Spectrum Z510  
3D Color Printer**

amputee to have a normal arm swing while engaged in a variety of activities, such as walking.

Although everything that locks and unlocks the device is made from hardened steel, the LTI Locking Shoulder Joint weighs just 143 grams. By keeping weight to a minimum, the designers are helping to ensure that patients can actually lift their prosthetic arms. "We watched every gram that went into the device during its design," Rouse explains. Despite its lightweight construction, the device offers an impressive load-bearing capacity of 50 lbs.

The feedback from end users has been extremely positive — and so has the reward. "When we visit the Walter Reed Army Medical Center and see soldiers that lost an arm and we offer a product that makes their life better, that's a big deal," Rouse says.

## Silver Award

When engineers at Greenland, NH-based Beswick Engineering began designing the company's PRD2

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**The PRD2 Ultra-Miniature Two-Stage Diaphragm Pressure Regulator**

Ultra-Miniature Two-Stage Diaphragm Pressure Regulator, they knew they had to create a small, yet precise device capable of providing extremely stable output. After assessing industry needs, the company developed and introduced the space-saving PRD2. As small as a stack of 10 quarters, the PRD2 is built to control outlet pressure down to 0.5 psig and compensate for wide changes in input pressure.

Simply stated, “the PRD2 is very small for what it is,” says Paul Beswick, CEO of Beswick Engineering. The device is well suited to control output pressures from 0 to 20 psig, handles varying inlet pressures, and provides maximum rated inlet supply pressure of 500 psig.

“The design profile for the PRD2 emerged from our previous, single-stage, version,” says Gary Treadwell, chief engineer at Beswick Engineering. The profile was built from inquiries the company received after introducing its single-stage device. Thanks to users’ feedback, Beswick’s team of engineers discovered the need for a two-stage device and developed the PRD2 in approximately two months. “After a qualifying period, the PRD2 was brought to market about one year after the single-stage version,” Treadwell adds.

The size of the PRD2 is not the only feature that makes it innovative. A low-friction sensor and proprietary valve arrangement ensure excellent regulation, and a unique spring arrangement allows the PRD2 to handle a range of regulated output pressures. “The

valve and spring arrangement at the core of the PRD2 allows the device to be consistent even in such a small package,” Beswick notes. The “nested” stages in the PRD2 also keep the regulator’s size to a minimum.

Weighing approximately 23 grams in aluminum and 50 grams in brass and stainless steel, the PRD2 is suitable for applications where size and weight are critical. For example, the regulator can be used in portable fuel cells, remotely operated aircraft, and instrumentation equipment. It is also well suited for applications with varying input pressures, such as gas storage tanks.

Beswick Engineering expects the innovation behind the PRD2 to create a ripple effect, enabling engineers to design new, unique products in smaller packages.

### **Bronze Award**

“We try to make printing a 3D part as easy as printing on paper,” says Marc Tremblay, vice president of product management at Z Corp. This Burlington, MA-based company has done exactly that with its Spectrum Z510 3D Color Printer.

Offering prototype-model quality, the Spectrum Z510 is a high-definition printer with 600 x 540 dpi print-head resolution and a build size of 10 x 14 x 8 in. Companies such as Fisher-Price, Reebok, and Pixar rely on this device to print full-color 3D physical models with crisply defined small features and complex parts.

Although based on inkjet printing technology, the

Spectrum Z510 uses a liquid-based binder instead of ink. Pulling data directly from CAD files to create a part, the printer first spreads a layer of powder only a few thousandths of an inch thick. Next, the binder is printed in the cross-section of the part being created. A build piston then makes room for the next layer and the process is repeated.

“The build chamber within the printer lowers itself as the part grows,” Tremblay explains. What is left at the end of the process looks only like a box of powder. When swept away, however, the powder reveals a finished part that can be carefully examined that very moment. Engineers can recycle the unused powder and use it to create another model.

The speed at which this process occurs can greatly impact an engineer’s design cycle.

With a build speed of two layers per minute, the Spectrum Z510 can print a part in less than a few hours. As a result, engineers no longer have to wait a week or more for a prototype. This gives them the opportunity to print and evaluate physical models of their concepts and refine them throughout the design process. The result is better products and improved production planning.

In addition to being used for design review, models can also be used as patterns for casting applications, mockups for form and fit testing, and prototypes for market feedback.

Thanks to its 24-bit color functionality, the models the Spectrum Z510 creates look like actual products. “The Spectrum is the first of our printers to cross the color barrier,” Tremblay says. “In the past, color models could look like gimmicks.” Now, full-color 3D printing produces models that accurately reflect part labeling, feature coloring, and texture mapping.

To further replicate the look and feel of a final product, engineers can drill, tap, sand, paint, and electroplate the composite, elastomeric, or direct casting models they print with the Spectrum Z510. They can also strengthen the model via a variety of infiltrants, including waxes, urethanes, and resins.

### **NEXT STEP**

- More information on Beswick Engineering Co. is available at [www.beswick.com](http://www.beswick.com) or by calling 800-354-5014.
- More information on Liberating Technologies is available at [www.liberatingtech.com](http://www.liberatingtech.com) or by calling 508-893-6363.
- More information on Reactive Metals is available at [www.n-abler.org](http://www.n-abler.org) or by calling 979-849-7179.
- More information on Z Corp. is available at [www.zcorp.com](http://www.zcorp.com) or by calling 781-852-5005.