QUARTERLY OF THE INDUSTRIAL DESIGNERS SOCIETY OF AMERICA **SUMMER 2012**

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Wounded Warriors + Design

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The e-sync watch gives you the freedom of motion, by instantly displaying all notifications from your smartphone.

Concept by Radius Senior Designer Mario Gonzalez

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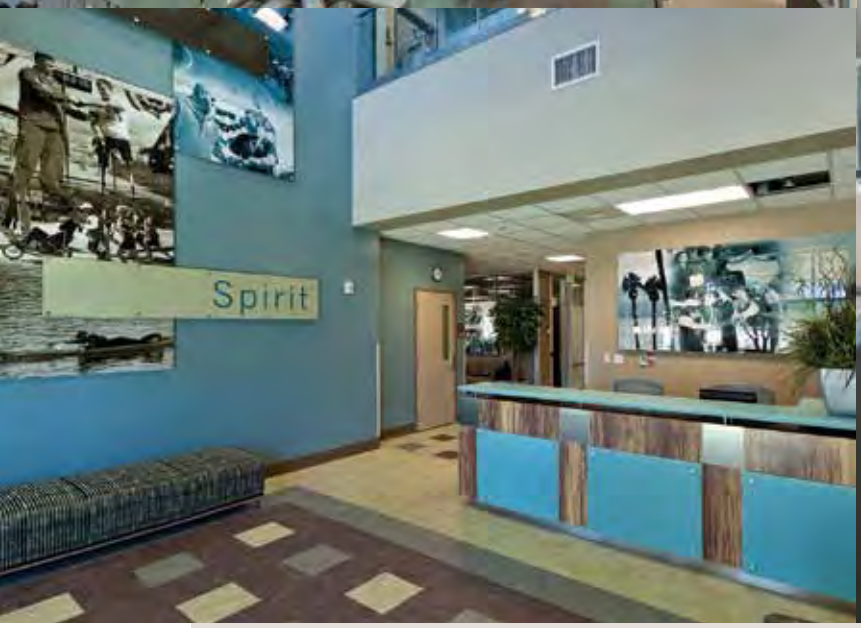

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The quarterly publication of the Industrial Designers Society of America (IDSA), *Innovation* provides in-depth coverage of design issues and long-term trends while communicating the value of design to business and society at large.

WOUNDED WARRIORS

FEATURES

IN EVERY ISSUE

"The Wounded Warrior Complex helps injured combat veterans to find independence and new hope."

Wounded Warrior Complex, Camp Pendleton, CA (left) designed by Parron Hall Office Interiors for US Marine Corps; www.dirtt.net

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Cover photo: Marine Captain and Iraqi Vet Jonathan Kuniholm wearing a prototype of a neurally controlled prosthetic arm developed by the DARPA Revolutionizing Prothestics project. Mike McGregor / Contour by Getty Images

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Advertisers' Index

Far Left: More Showcase submissions on page 53.

By Dean Kamen

Dean Kamen is the president of DEKA Research & Development Corp., based in Manchester, NH, and the founder of *FIRST* (For Inspiration and Recognition of Science and Technology). DEKA technologies include the HomeChoice portable dialysis system, the iBOT Mobility System and the Segway Human Transporter.

ARMING OUR VETERANS

During the Civil War, a soldier who lost an arm from a combat wound, infection or illness would receive as a replacement a wooden stick with a hook on the end. That was the most advanced prosthetic device available at the time. Consider how far technology has evolved since then.

Photos: DEKA Research & Development Corp. (DEKA)

A newer model of the arm holds a grape, one of the original capabilities outlined by DARPA.

Early iteration of the arm holding a pen.

The weapon that may have caused the injury 150 years ago—a musket or cannon, perhaps—has been replaced by the M4 carbine and the B-2 stealth bomber. But a soldier who loses an arm today in Iraq or Afghanistan will still be given a stick (now plastic) with a hook on the end. The great advances in technology that the military has developed have not included progress in the area of prosthetic devices. This was the reason that Defense Advanced Research Projects Agency (DARPA) asked DEKA to develop an advanced prosthetic arm for our returning veterans.

This was a tall order. The arm had to be the same size and weight as a 50th-percentile female arm while being totally self-contained and powered. It had to be able to pick a raisin off a table without dropping it—requiring fine motor control—and it had to be able to pick up a grape without crushing it—essentially, complete haptic response. Besides meeting all these criteria, it had to be ready for trials in two years.

After hearing this pitch, I gave the DARPA officials my honest opinion: I told them they were nuts. Even though this was just the sort of project—one with an undeniably positive societal impact—on which DEKA thrives, it just didn't seem possible to meet those criteria in such a short timeframe. I was about to move on when a particularly passionate doctor from DARPA informed me that more than a dozen soldiers have returned from Iraq and Afghanistan with bilateral amputations. That night, I tossed and turned in bed thinking about how difficult it would be to lose one arm and how much worse it would then be to lose both. It even occurred to me that a person with bilateral amputations wouldn't even be able to toss and turn in bed. The next day I told DARPA that we would do it.

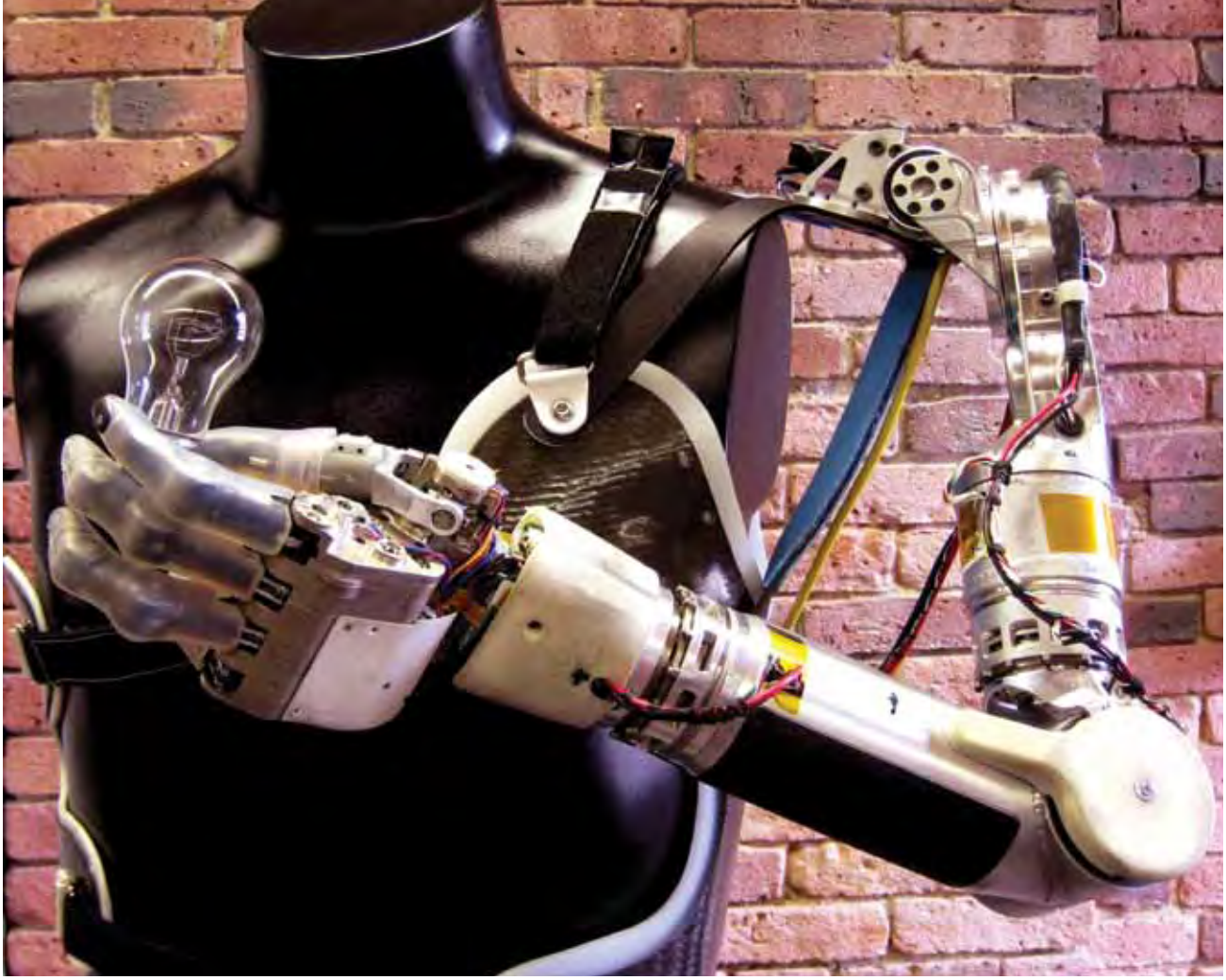
Unexpected Inspiration

As my engineers and I began to develop our initial prototype, we spent some time touring Walter Reed and other veterans hospitals to learn what sort of arm we should create from those who would end up using it. We expected these visits to be productive from an engineering standpoint, and indeed they were. We had the opportunity to witness the shortcomings of previous prosthetic technologies and to gain a better idea of the types of features our arm should possess. But these meetings with our nation's wounded warriors were rewarding for another reason as well. One story in particular illustrates this point.

In a conference room, we had assembled a collection of patients who had experience with prosthetic arms; not surprisingly, the young men were quick to provide insights and suggestions. However, I noticed that one of the patients at the far end of the table had been conspicuously quiet. I called over to him, asking for his input. The young man looked up and said, "You know, I'm one of the lucky ones. I lost my right arm—but I'm a lefty." As we were leaving, I saw the same man push away from the table—only to reveal that this "lucky" soldier had lost one of his legs as well.

To this day, I am still stunned by the depth of that young man's courage and resilience. I had warned my engineers beforehand that the patients we would meet would likely be frustrated and angry, both with their conditions and with the poor quality prostheses that were available to them. I expected that we would need to provide encouragement and support in order to earn their trust and help. But after meeting that young man, it was clear that my engineers and I did not need to provide our wounded soldiers with inspiration; instead, their bravery and optimism inspired us.

The development of our arm provided no shortage of challenges for our talented team of industrial designers. The appearance of a prosthetic device will naturally be the subject of close scrutiny, as comparisons to the "original equipment" are inevitable. DEKA's industrial design team was confronted with a range of questions: Should the arm appear more mechanical or more natural? How difficult would it be to re-create the idiosyncrasies of human flesh? Added to these fundamental questions were the practical considerations outlined by DARPA. However, like all of our engineers, the industrial designers were inspired by the input and inspiration of the veterans we consulted, and they created a finished product that both embraced the appearance and capabilities of the human arm while reflecting the intricate engineering contributed by our team.



The DARPA-funded DEKA arm.

Within a year we had developed the first generation of the arm, a device that met and exceeded the criteria outlined by DARPA. Beforehand, I had told the military representatives that learning to control the arm would take more time than was needed to build it. But during testing, I was once again reminded just how remarkable the human capacity to adapt is. With less than 10 hours of use, our users were playing with a rubber ball, picking up cups and drinking, and, as promised, picking a grape up off a table and eating it.

One of our users, Chuck, had lost both arms in an accident nearly 20 years earlier. He quickly became one of our most talented users and was able to do something I cannot—scoop up cereal with a spoon and eat it without spilling a single drop of milk. As he did this feat, his wife was standing behind him with tears in her eyes. "Chuck hasn't fed himself in 19 years," she said. "So you have a choice: Either we keep the arm or you keep Chuck!"

Engineering a Better World

In the years since, our arm—nicknamed the Luke Arm after the prosthesis Luke Skywalker wears in the *Star Wars* films—has undergone additional developments and improvements. We continue to work tirelessly to deliver a device that not only meets the expectations of DARPA but also meets the high standards that our wounded warriors deserve.

As with many of DEKA's projects, the Luke Arm has faced its fair share of hurdles and setbacks. What kept us going, and what gives us the energy and momentum to press on, is the same quality that inspired us to take on the project in the first place: the belief that this device will change lives for the better. Our returning veterans deserve the finest care and treatment possible; they've certainly earned that and more.

The 21st century will present no shortage of challenges and opportunities for engineers. (This is the reason I founded *FIRST*, a nonprofit robotics competition that inspires kids to get excited about science and technology, www.usfirst.org.) Scientists, technologists and designers have the ability to shape our world and the way we live. With this power comes the responsibility to use this talent and expertise to improve the lives of people around the world. Whether it's caring for our wounded warriors or providing clean water and electricity to the developing world, DEKA is committed to this mission. I ask all designers and technology professionals to examine their own ethos and to use their talents and expertise to engineer a better world for this and future generations. ■

(The views expressed are those of the author and do not reflect the official policy or position of the Department of Defense or the US Government.)

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