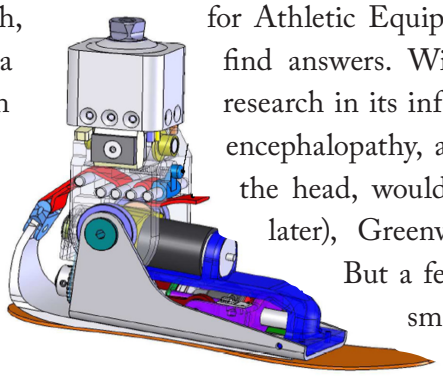
A STEP UP

With Help from an SBIR, A New Hampshire Company Creates Cutting Edge Prosthetics

One cold night in Park City, Utah, Rick Greenwald found himself at a party with some of the best skiers in the world.

The year was 1992, and Greenwald, a biomedical engineer by training, was near his home in advance of the upcoming Winter Olympics in France. The night was a fun one, Greenwald remembers, full of the lighthearted carousing to be expected from athletes with the biggest event of their careers on the horizon.



But a few of the revelers stood out. They were quieter, staring into their drinks as if lost in thought.

During a quiet moment, Greenwald asked a friend who the skiers were.

"Those are the aerialists," his friend told him, referring to skiers who launch themselves off jumps into twists and flips as high as 60 feet in the air.

As someone who had lived in and skied the mountains of the Northeast, Greenwald's interest was piqued. The next day, he attended a practice session to watch the aerialists. Most of the time, the skiers landed their jumps without any problem. But one out of every six or seven went awry, whipping the skiers' heads—clad in their helmets, which turned out to be kayaking helmets—into the hard-packed snow.

"I said, 'What is that doing to them?'" Greenwald later recalled.

With grant funding from U.S. Olympic Committee and the National Operating Committee on Standards for Athletic Equipment (NOCSAE), he set out to find answers. With head impact and concussion research in its infancy (CTE, or chronic traumatic encephalopathy, associated with repeated blows to the head, wouldn't be discovered until a decade later), Greenwald found the going difficult. But a few years later, with the advent of smaller, more cost-effective sensor technology, he secured a Small Business Innovation Research (SBIR) award from the National Institutes for Health for work on developing head impact exposure monitoring technology that was eventually commercialized for use in football through sports equipment manufacturer Riddell.

It was one of Greenwald's first experience with SBIR, or its sister program, Small Business Technology Transfer (STTR), through his product development company Simbex, located in Lebanon, New Hampshire, and it wouldn't be his last. Together with serial entrepreneur and amputee Robert Dean, the company began its first forays into lower limb prosthetics, securing several Phase II SBIR awards to commercialize technology for automated volume management of lower limb prostheses. At a conference hosted by the American Academy of Orthotists and Prosthetists, Greenwald found himself seated next to Hugh Herr, PhD, the famed MIT biophysicist and renowned climber who himself is a bilateral amputee. Herr was interested in commercializing his bionic limb technologies that marry human physiology with electromechanical systems. Together

the pair set out to build a new company—powered by Herr's intellectual property and MIT research and Greenwald's product development experience—which they called iWalk.

"It was hard to commercialize that technology," Greenwald said. "There were many technical and financial challenges to overcome"

With big names and cutting edge technology behind the project, iWalk accrued a slew of funding, including an STTR contract for a proof of concept and feasibility studies in 2005.

"The best use of SBIR funding is when you use those funds to drive commercialization forward rapidly and realize that the value of your company can increase dramatically following the use of an SBIR," Greenwald said. "It's not trivial money; it's real, important non-dilutive funding."

The problem the company was trying to solve was how to build a prosthesis that could push itself off the ground. With the help of the STTR, which requires collaboration with a research institution such as MIT, the company created a novel bionic prosthesis called the BioM, complete with series elastic actuators and a lithium battery that create powered propulsion, mimicking the muscles of the lower leg.

"This technology gives you that ability to have powered propulsion, improved balance, as well as the equivalent of standing on your toes. The idea is you get a more normal gait, can walk faster and for a longer time without getting tired," Greenwald said.

According to Troy Turner, then the manager for the Department of Defense Military Amputee Research Program within the U.S. Army Medical Research and Materiel Command (USAMRMC) who authored the STTR topic and oversaw the award of the STTR contract, iWalk's approach ticked all the necessary boxes for the DoD.

"We needed a military do-it-all prosthetic foot, something that was going to be rugged and not a burden and that would help the wearer walk along" Turner said. "As it turned out, the iWalk Powerfoot answered that question to a large degree."

Turner, who is now the CEO of Mesquite Road Consulting Group, said the USAMRMC still uses the Powerfoot as an example of the success of the STTR funding program for visiting VIPs such as Senators, Congressmen, General Officers, and other VIP's.

"It became a symbiotic and beneficial relationship because they paid as much attention to us as a customer as their own customers, and not just as a funding agency," Turner said. "The Simbex/MIT STTR responded strongly to all those things we were looking for."

Following its early success that saw the technology spread from military service members to the general public, iWalk and its technology changed names several times before, in 2017, it was purchased by German prosthetics giant Ottobock HealthCare.

Greenwald and Simbex continue to help develop products with the assistance of the SBIR program, including a bed support system to prevent pressure ulcers and fall prevention technology for physical therapy and rehabilitation, among others.

"Turning university-based technology into commercialized opportunities, that's where the SBIR program has always been so valuable," Greenwald said. "It's a great program.

"The best thing we can do is keep helping accelerate tech development for products that help people's lives," he added. "That's what motivates our staff and that's a passion that we'll continue as long as possible."

Rick Greenwald

Simbex

Modernization Priority: General Warfighting Requirements (GWR)

Lebanon, NH • STTR contract: W81XWH-06-C-0392 • Agency: Army • Topic: A06-T031, A powered foot and ankle prosthesis for improved maneuverability and reduced metabolic cost.