WALK THIS WAY

The DoD sponsors Innovations in wearable robotics

It began with a device called BLEEX, or Berkeley Lower Extremity Exoskeleton. The world's first untethered, powered exoskeleton was designed to augment soldiers' mobility, allowing Warfighters to cover more miles with less fatigue. But BLEEX had some issues. "Imagine a lawnmower on your back," said Russ Angold, co-founder and chief technology officer of Ekso Bionics, Inc., in Richmond, California.

The 5-kilowatt machine was loud, heavy, and slow. But it also eventually led to such groundbreaking wearable robotics as the EksoGT, the first FDA-approved exoskeleton for stroke and spinal cord rehabilitation.

BLEEX was originally developed at the University of California, Berkeley, with funding from the Defense Advanced Research Projects Agency (DARPA). Their breakthrough was a streamlined hydraulic system that shunted the weight of the exoskeleton down through its joints to the ground.

With growing interest and need from the Department of Defense for wearable robotics for the Warfighter, there was an opportunity to commercialize the BLEEX technology. In 2005, a Small Business Technology Transfer (STTR) award from the Office of Secretary of Defense (OSD) aided in the process.

The EksoGT was launched in 2012. A ro-

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Lockheed Martin

Wearable robotics for Warfighters, such as the HULC system, left, have grown out of the SBIR/STTR program.

botic platform running on patented software controlled by a physical therapist, this technology was in line with a growing body of research that associates resumed mobility to better outcomes for those with stroke and spinal cord injury, the EksoGT gets patients back on their feet and walking with a reciprocal gait as soon as possible. The therapist can adapt the amount of power to either side of the patient's body to correct gait and weight shifting as it occurs, as well as adjust for fatigue and, over time, strengthened muscles.

Other products developed under this line of R&D are purely mechanical and boost endurance by canceling the effects of gravity and making tools weightless. For example, the EksoVest has a spring-based lift assist to support workers who use small hand tools to complete tasks done at chest height to overhead. Put on like a backpack, the vest provides five to fifteen pounds of assistance per arm and weighs less than ten pounds. For those who work with heavy hand tools, the EksoZeroG is an arm exoskeleton attached to the work platform. By inserting his or her arm into the exoskeleton, the worker can precisely control the hand tool without bearing any of its weight.

By mid-2017, the manufacturer had 30 U.S. patents and nearly 200 international patent cases (granted or pending), and much of that IP arose out of a series of Small Business Innovation Research (SBIR) and STTR awards from various DoD programs that advance the military science as well as offer commercial potential. The company's Artemis prototype completed for DARPA in 2017, for example, is a 13-pound soft exoskeleton that can offload up to three-quarters of the weight of a soldier's payload.

Angold values the interconnectedness of the process. "There's synergy there, with the government taking the risk on development of the technology. We then commercialize it, and it eventually can come back into the DoD," he said. Angold sees great potential for the EksoWorks line at shipyards and other military sites, and the EksoGT is already in several VA hospitals where soldiers are benefiting from its enhanced rehabilitation capabilities.

Ekso Bionics

Modernization Priority: General Warfighting Requirements (GWR)

Berkeley, CA • STTR contract: W81XWH-05-C-0147 • Agency: OSD Topic: OSD05-T005, Military Specific Advancements in Prosthetic Limb Design and Performance