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Better Prosthetics Coming for Wounded Warriors

Donna Miles | American Forces Press Service

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From developing a new microprocessor-controlled prosthetic leg to a non-chafing socket device, the Telemedicine and Advanced Technology Research Center at Fort Detrick, M.D. is making big strides in advancing prosthetic science to improve wounded warriors' quality of life.

The center, tucked away at this western Maryland post, reaches out to a broad spectrum of researchers at universities, hospitals, and small businesses to promote next-generation, cutting-edge prosthetic technologies.

"The objective is to help amputees and traumatically wounded servicemembers return to the highest level of functionality that they are capable of," said Troy Turner, who manages the center's advanced prosthetics and human performance portfolio.

"We do this with the understanding that it is really their initiative and their motivation that gets them there," he said. "But we want to make sure that there is nothing we can do to help them get there that is left undone."

One of the center's biggest triumphs to date is the X2 microprocessor leg, developed by Otto Bock HealthCare with TATRC funding. The new "C-leg," being tested by above-the-knee amputees at Walter Reed Army Medical Center in Washington, uses a microprocessor to control the knee's hydraulic functions. This, in turn, gives the wearer more flexibility to change speeds or directions without sacrificing stability.

The device takes the advanced computerized leg to a new level, Turner explained, enabling users to walk backward or up and down ramps, and even to swim.

"In its latest iteration, somebody would actually be able to wear it water-skiing and even surfing, because of how weatherproof and amenable it is to hostile environments," he said.

Focused primarily on the lower extremities – which Turner said account for 80 percent of wounded warriors' limb losses – the center is funding a variety of research programs aimed at improving not just leg, but also knee, ankle and foot prostheses.

One promising program is aimed at developing a robotic ankle that will give users more flexibility to move over different types of terrain, with a motor that provides a "spring" after each step.

Other programs are tackling what Turner calls the biggest gap in prosthetic development: the socket itself.

The hard, plastic cups currently used as socket devices can be painful to wearers, chafing when the surrounding muscles swell or the wearer sweats. "Even the best-fitting socket can be painful," Turner said.

No one-size-fits-all solution is available, because every limb is different. "So there is a universal problem, but the way it's addressed has to be individually," Turner said.

Along with the socket, researchers are exploring new liners and sleeves that provide a better, more comfortable fit for prosthetic devices. "Any time you are going to put a body part into a hard plastic cup and leave it all day, you are going to have chafing and swelling, and the introduction of moisture in there will cause additional friction," Turner said.

Two promising research programs under way, one in Los Angeles and one in Boston, are exploring ways to provide more comfortable sockets that use breathable or wicking materials to prevent moisture buildup.

"Both of these projects, if successful, will result in sockets that are very nontraditional, and in some cases, don't operate

or even look like traditional sockets,” Turner said. Among concepts being explored is a socket that’s pliable and flexible when there’s no weight on it, but goes rigid to provide support when the wearer stands.

As the Telemedicine and Advanced Technology Research Center advances these technologies, Turner said, the ultimate goal is to provide comfortable, adaptable prosthetics that operate almost intuitively, recognizing what the user wants them to do and responding on cue.

“We want to try to create the capability of the device to behave the way the user wants it to behave, and to understand what the user wants it to do,” he said.

The center is exploring different approaches toward achieving what Turner calls “user intent control.” One involves putting a miniature sensor on the muscle or even injecting it directly into the muscle to pick up electrical signals and relay them directly to the prosthetic device. “If we are able to do that, we can tell that prosthetic device to do something,” Turner said.

“Achieving that is a matter of integrating all these capabilities [being developed] into a system and putting it all together,” he said. “And that’s a lot of our job – creating awareness and serving a little bit as an information clearinghouse to help bring it all together and help [researchers] understand what other people are doing.”

Bringing together a research community can add up to big promise for wounded warriors, he said. “If you put yours with theirs,” he said, “this one-plus-one could equal three.”

With a vast portfolio, and many research efforts under way simultaneously, Turner conceded that sometimes it seems “like we are going in a lot of directions.”

“But the thing that binds it all together is our mission of bringing together as much as possible – whatever revolutionary concepts and technology we can – to help the warfighter achieve the highest level of functionality possible,” he said. “Our goal is to help them come back to as close to a normal life as possible.”

Marine Sgt. Adam Kisielewski, who lost his left arm and his right leg from the knee down during an explosion at a booby-trapped school near Fallujah, Iraq, in August 2005, said he’s excited about the possibilities the center is opening up for him and his fellow wounded warriors.

Kisielewski served until recently as a project officer in the center’s prosthetics department, providing unique, personal insights into the projects under way.

“It’s great to provide input, to be able to get the broad picture of everything that is going on [in the research arena] and to see what is going to be available in the next couple of years,” he said.

“When I see some of the stuff coming out, I get really excited,” Kisielewski added. “It is going to do a lot to increase the standard of living that the guys are going to have when they come back from war with really serious wounds.”