

Sandia Labs' device helps U.S. troops in Afghanistan disable improvised explosive devices

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Airman 1st Class Patrick Connolly of Dayton, Ohio, demonstrates the placement of a water disruptor developed at Sandia National Laboratories near its target in a simulated village used to train soldiers heading overseas. (Photo by Randy Montoya)

(PhysOrg.com) -- A device developed by Sandia National Laboratories researchers that shoots a blade of water capable of penetrating steel is headed to U.S. troops in Afghanistan to help them disable deadly improvised explosive devices, or IEDs — the No. 1 killer and threat to troops in Afghanistan, according to the Pentagon.

Sandia licensed the patent-pending technology to a small minority-owned business, TEAM Technologies Inc. The Albuquerque-based company made its first shipment of about 3,000 new water disruptors to Afghanistan this summer.

“The fluid blade disablement tool will be extremely useful to defeat IEDs because it penetrates the IED extremely effectively,” said Greg Scharrer, manager of the Energetic Systems Research Department at Sandia. “It’s like having a much stronger and much sharper knife.”

Soldiers who had served in Afghanistan and Iraq field-tested the device during training at the federal laboratory and suggested improvements while the product was being developed.

The fluid blade disablement tool was invented by Steve Todd, a mechanical and materials engineer with extensive Navy experience fighting IEDs, Chance Hughs, a retired Navy SEAL explosives expert on contract to Sandia, and [mechanical engineer](#) Juan Carlos Jakaboski in Sandia’s Energetic Systems Research Department for a National Nuclear Security Administration sponsor.

The portable clear plastic device is filled with water and an explosive material is placed in it that, when detonated, creates a shock wave that travels through the water and accelerates it inward into a concave opening, Todd said. Therefore, when the water collides, it produces a thin blade.

“That allows you to have a high-speed, very precise water blade to go through and do precision type of destruction on whatever improvised explosive device it’s going up against. Immediately behind the precision water blade is a water slug, which performs a general disruption that tears everything apart,” Todd said.

Unlike traditional explosives, which release energy equally in all directions when they go off, researchers use shaped-charge technology to deliberately manipulate the explosives so that they create a certain shape when they explode, allowing

the operator to focus the energy precisely where it's needed. The inventors of the fluid blade disablement tool took a different tack. Rather than changing the shape of the explosive, Todd, Hughs and Jakaboski used an explosive modeling tool to figure out how to change the shape of the water when designing the water disruptors.

"We're putting the explosive in a flat tray and we're shaping the water," Scharrer said.

The process happens in microseconds and can't be captured by the human eye, so researchers used computer simulation and high-speed flash X-rays, which can view the interior of imploding high-explosive devices and record the motion of materials moving at ultrahigh speeds, to fine tune the design.

They also used another approach. Soldiers rotating out of Afghanistan and Iraq worked hand-in-hand with researchers and developers to test the device for several months in the New Mexico desert.

Paul Reynolds, TEAM Technologies' program manager, said the company improved the tool based on the soldiers' input after it was exposed to dust, water and banging around by the troops. The improvements included providing a better seal and redesigning the water plug so it is easier to insert.

"The soldiers helped on the design to make it more ruggedized and small enough," Todd said. "It was a very good collaboration."

TEAM Technologies is a small business of 75 employees based in the Sandia Science & Technology Park adjacent to the Sandia.

"The first year we moved into the park here our business just exploded. We grew 70 percent that year," said Bob Sachs, president and CEO of TEAM Technologies.

Jackie Kerby Moore, the park's executive director, said one reason businesses move to the park is so that they can better engage with Sandia.

"This is a real-life example of how the research park helps make companies aware of technology

transfer opportunities and help fulfill Sandia's mission to license technologies to private companies," Moore said.

The company's first priority is to get the device to troops in Afghanistan, but eventually they would like to sell it to law enforcement and airport security agencies. The device also could be used for forced entry into buildings.

"We saw the opportunity to move into a product line and we jumped on it," Sachs said "We're very excited about it. We see it as a whole product line."

Reynolds said the tool can be placed almost in contact with the target or a distance away without losing its effectiveness. It uses minimal explosive material, its plastic legs can be attached in various configurations so that it can be placed in different positions to disable bombs and it's built so that robots can easily place it near a target, he said.

"This is a giant leap forward in technology," Reynolds said.

Those researching and developing the fluid blade disablement tool said they felt a sense of urgency to get it into the hands of soldiers as they read nearly daily media reports about deaths of U.S. troops from IED attacks.

"When I look back on how this all took place, the thing that comes through to me was that people were motivated to get a lifesaving technology onto the battlefield," Reynolds said. "This is a lifesaving technology."

Provided by Sandia National Laboratories

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