Soldier Armed

Advanced Bomb Suit

By Scott R. Gourley

One iconic image of modern tactical operations is the bomb suit. Utilized by explosive ordnance disposal (EOD) personnel in all services and many government agencies, the full body ensembles use material technologies and design techniques to optimize what some view as an "EOD triangle" of suit weight, user mobility and protection levels.

The U.S. Army's current design, called the Advanced Bomb Suit (ABS), was type classified in 2002. The design is also known as the Med-Eng EOD-8 (the Med-Eng brand is owned by Allen Vanguard, which purchased Med-Eng in 2007). Approximately 1,400 suits have been fielded to the Army to date, with the last major buy of new suits taking place in 2010.

According to Rob Reynolds, vice president of explosive ordnance disposal at Allen Vanguard, previous U.S. Army bomb suit designs focused on fragmentation protection and included things like chest-mounted visor assemblies for facial protection.

"It was like a big windshield that came off the chest of the suit," he recalled, "but it also made the suit quite front-heavy, so from an ergonomics and mobility perspective it wasn't the easiest suit in which to operate.

"In the early days, when the company was named Med-Eng and we started on the earlier EOD-7 design, what we brought to the marketplace, which was very new, was the understanding of a blast event," he said. "A blast event is very different from being shot by a bullet. In a blast event, there are four threats that an operator faces. The first is blast overpressure, which is the actual blast wave that travels rapidly through the air. The second is fragmentation—explosively driven fragments that fly through the air. The third, if you are close to the device, is a fireball or flash/flame, so you have to be protected not just from heat but also the flame itself. The fourth threat is what we call impact, which is twofold: One is head acceleration and concussion-type injuries, and the other is when the blast overpressure actually throws an operator who eventually lands on something."

U.S. Army

Reynolds said the study of blast event threats started a company research and development program to explore the correct mix of materials to optimize protection against all of those threats.

"We also provide a lot of education to our end users to show them the benefits of wearing a bomb suit in an event," he said.

Describing how the suit design optimizes weight, mobility and protection, he said, "When we build the suit, we also look at injury criteria and where the most vulnerable organs reside in the body in order to shape the protection levels that are offered. If you look at typical soldier body armor, for example, you're looking at the same protection level, in terms of soft ballistics, at 360 degrees within the vest. That's fine for vests and those types of products, but because the bomb suit covers the entire body, you can't give the same [ballistic protection] level for all areas on the suit. If you did, the suit would be too heavy and you wouldn't be able to move in it, so we have customized the protection levels based on injury criteria and the different areas of the body. For example, you could survive with losing a finger. You would not survive, however, if you were to take a shot through the heart. So the protection levels are tailored based on the vulnerabilities of the organs within the human body."

While the Army's ABS is based on the EOD-8 suit design, the other armed services have adopted a visually similar follow-on suit design designated EOD-9.

"For the EOD-9, we beefed up the protection levels on the rear of the suit," Reynolds explained, adding that "secondary threats" justified the rear protection. "At the same time, if you beef up the protection levels on the rear, you are going to have to give it up elsewhere in order to maintain a certain weight. So we streamlined some of the protection on the front of the EOD-9. We moved some ballistic materials around and came up with a different mix of protection levels. We still have very similar protection levels as in the EOD-8, but they're just tailored a little bit differently."

U.S. Army/T. Anthony Bell

Soldiers accompany PVT Joseph Czachowski as he demonstrates his ability to perform duties in a protective bomb suit during the Explosive Ordnance Disposal Challenge, a four-day, end-of-course test for students enrolled in the U.S. Army Ordnance School's advanced individual training at Fort Lee, Va.

Reynolds said part of the reason that the U.S. Army has remained with the EOD-8 involves the Army's "stringent test criteria" that address protection levels against multiple fragment sizes, with higher protection value requirements against larger-sized fragments.

"It's not a completely clear-cut case," he said. "It's basically providing different material specifications and saying, 'X protects against X and Y protects against Y. So what's your threat?' We will work with you to better choose the protection levels you require based on your theater of operations."

Reynolds noted that the EOD-9 also includes a new helmet design with increased protection levels as well as a range of integrated technologies. "That was one of the big changes for EOD-9, the helmet of which has things like onboard ventilation and power systems, microphones, speakers, LED lights on top of the helmet, and a visor defogger."

While maintaining the EOD-8 bomb suit design, the Army upgraded the ABS system with the new EOD-9 helmet in 2007.

While the Army's ABS activities are currently focused on system sustainment, industry continues to explore new technologies that could be applied to future system designs in both the near term and far term. Reynolds offered representative near-term advances in the area of camera-mounted helmet enhancements. One new camera can be used to record forensics evidence and for after-action reviews of "render safe" procedures. The other new camera will provide live streaming video, which sends what the operator is seeing back to the command post. While the recording video camera upgrade option has already been made available as an enhancement to the EOD-9 helmet, the live streaming option is slated for product launch in fall 2013.

Another near-term upgrade planned for the fall 2013 launch introduces voice-activated operator commands.

"Operators downrange typically have their hands full," Reynolds said. "They are usually carrying a tool called a disrupter under one arm and a tool kit or X-ray system under the other arm. If they are walking into a dark room and need to turn their helmet lights on, they typically have to put all those things down, raise both of their arms and activate the button on their sleeve. If they had the capability to turn the helmet lights on merely by saying, 'Helmet, lights up,' then they could just carry on with their mission. Likewise, if they are working on a device and holding something under tension, and they start to drip sweat across their faces and need the 'turbo' ventilation feature of the helmet, all they have to say is, 'Helmet, turbo up,' and they will get that blast of ventilation across their faces without sacrificing what they are doing with their hands."

Reynolds said the company is looking at additional technologies for introduction further down the road in areas like superior protection, a targeted 15 percent system weight reduction and improved in-suit electronics capabilities.

"The U.S. Army type classified EOD-8 for ABS in 2002," he said. "That was 11 years ago. They got the helmet in 2007. We all know that the young soldiers of today are coming into the military with today's technologies. They are the operators of the future, and if they are comfortable with those technologies, then those are the types of things we should start embedding into our solutions."