US Army Corps of Engineers ®
Omaha District

Program of the Month

Getting to know the Omaha District

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Protective Design Center

An answer to a private war . . .

By Sheri Hronek

USS Cole…Oklahoma City…Khobar Towers…Beirut barracks…World Trade Center…Kenya…Tanzania...

The names are familiar, and they pack the same emotional wallop for younger generations that Pearl Harbor did for their grandparents. But these were a different type of infamy. These were not acts of open war, one government against another. These were individuals and private groups declaring a private war, using terror attacks against the unsuspecting for political gain.

The U.S. government is responding to the terrorism threat, and Omaha District is in the forefront of those efforts. The district's Protective Design Center (PDC) is the U.S. Army Corps of Engineers' resource for anti-terrorism and force protection engineering support. It is a Corps Center of Expertise.

"Since destruction of Khobar Towers, we've seen a lot more awareness... a lot more things were done that were not done before." (Dan Sommer)

PDC's work is in two mission areas — security engineering and hardened structures. The first deals with criminal and terrorist threats, the second with military weapons. The district's sister office in Huntsville handles electronic security systems.

War time, peace time

"Ours is the brick and mortar side of engineering," said Dan Sommer, PDC chief. The same physics of explosives apply whether the bomb comes from a terrorist or an aircraft. "The hardened structure is a wartime mission, and the force protection is our peacetime mission."

"We write the manuals here for both worlds, so we can coordinate both," said Curt Betts, who does threat and vulnerability assessments and site surveys.

Hardened construction is usually massive concrete. In the past, such structures had no windows, only one door, and may have been underground.

"After Desert Storm, we know a target can be hit from anywhere," said Patrick Lindsey, Chief of Hardened Structures Section. "So we're looking at the effects of smaller conventional weapons on structures."

For the last two years, most of the need has been in anti-terrorism force protection, especially for existing conventional buildings like offices and barracks. That need is predicted to increase in the next 10 years, but it does not detract from another PDC specialty – expeditionary temporary structures for troops deployed to places like Bosnia and Kosovo.

To accomplish these tasks, PDC includes all building disciplines — structural, mechanical, electrical, civil, and architectural. "But in security engineering, a lot of times those disciplines seem to

PDC answers the call

disappear because security is an overarching application," Sommer said. "The hardened structure side is obviously pretty serious structural engineering. When you get into anti-terrorism design for, say, car bombs, the two work hand-in-hand. You have security engineers who look at the standoff distances and how to protect windows from shattering. They work closely with structural engineers who look at the building to harden it against blast pressures from explosions."

Standoff distance is how near vehicles or individuals are allowed to come to a building. "In installations in the U.S., there's usually some standoff distance," said Betts. "The problems escalate outside the U.S. In Germany, for example, there isn't a lot of land, so often there's little standoff." Standoff is also a problem in densely populated areas like Japan and Korea.

Dan Sommers, Chief, PDC

Because DoD has an immense inventory of structures throughout the world, much of PDC's work is retrofitting existing buildings. "In response to a presidential directive, we're in a three-year program to survey all DoD installations," Sommer said. "In that program, there's about 200 surveys. We have one year under our belt, but we haven't done a third of the surveys yet because many of the requests came during the first year."

New construction

PDC expertise is also applied to new construction. A Joint Chiefs of Staff committee developed criteria, like standoff distances, for a new DoD construction standard for anti-terrorism force protection. (Betts is co-chair.) An interim version has been in effect for a year; the final version will be released later this year. The new standards address new construction, existing construction, and expeditionary structures.

Those criteria impact the cost of construction. For example, decreasing standoff distance increases cost. "If there's a bomb really close, it's hard to make that building stand up," Betts said. "Move the bomb away, and the effect is less severe. That's when we talk about minimum standoff. Keep that bomb a minimum distance away, and you can design the building with minimal cost increase."

Glass is a major hazard in any blast. PDC works with research and development organizations to make buildings perform better.

PDC also works with manufacturers to ensure materials meet criteria. "We're always looking for things that are proven. Anything off the shelf is attractive if it's been tested," Betts said. "Unfortunately, a lot of times a manufacturer claims something works, but they have no real proof. Until it's actually been proven using standard testing techniques, we can't take it seriously. But that's part of what our testing program is doing. They're taking a lot of commercial products and testing them on structures to see how they work." Much of that work is done at the Engineering Research and Development Center labs.

Glass is a major hazard in any blast, and PDC works with research and development organizations to make office buildings perform better. "If a blast occurs, the majority of injuries (not deaths) occur because of glass," said Ed Conrath, who specializes in blast resistance. "If we can put in better glass and anchor it better at a nominal cost increase, we've gone a long way toward solving the injury problem."

Conrath spent a couple months in Israel testing glass. "They built a full-scale test structure out in the desert. We'd set up the different part of the test in this structure, whether we were testing a wall or a window

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or a column or whatever. I gathered data after the tests."

Technology transfer

Technology transfer is another major part of PDC's mission. PDC staff consults with all services, and calls also come from private firms that contract with the military. Betts estimated that about a quarter of each day is spent answering questions by phone or e-mail.

To aid technology transfer, PDC is creating tools to help users understand information. "The complexity is so high, the average engineer just can't stay up with it all," Betts said. "So part of our process is boiling it down to a simple tool (a computer program, or a look-up chart, or something) that helps them make their decisions quickly and get on with the design."

"Our 14-pound manual for designing conventional systems is much nicer on a CD," Lindsey said. PDC has also put standard information into computer programs. Using an autodesigner, an engineer can select different explosives, weights, and types of munitions, then get an analysis that can be applied to a structure. (This product is still in progress.)

To also help DoD designers, PDC has set up a web site for the Blast Mitigation Action Group. The web site has commercial products that have been tested, with links to the manufacturers' web sites.

Tele-engineering is another new PDC tool. "Anybody in the field can talk to us by video conference rather than us jumping on a plane to go there," Betts said. "We try to be responsive in as many different ways as possible, but we're stretched. So if we can do that without going there, it saves us time and reduces our customer's cost."

Interest in this information waned a little after the Beirut bombing in 1985, but the destruction of the Khobar Towers barracks created new priorities. "Since 1996, we've seen a lot more awareness and a lot more things done that weren't done before," Sommer said. "Structures are being built to standards even as we speak."

Training

Interest has also grown in security engineering training. "We've taught this class since 1987," said Doug Wehring, Chief of the Security Engineering Section. "Before '96 we tried to have a mix of engineers and security people, but we had a problem getting engineering interest." But since 1996, engineering interest has grown. "We've had installation master planners, and other Army and DoD engineering interests. There's a huge interest, primarily because of top-down emphasis that force protection has received since Khobar Towers."

The minimum construction standards have also increased emphasis on learning about force protection. Four years ago, PDC taught six to eight classes a year. In 2000, there were 21 classes. Two to four classes are taught at Fort Belvoir, Va.; the rest were taught throughout the world. Contractors are included because they must incorporate the standards into their designs.

"The success of all this is the teamwork

When this hardened aircraft shelter, designed by PDC Structures Section, was taken over by Saddam Hussein, the U.S. Air Force took it out. "We built it and we knew how to blow it up," says Sommers.

PDC answers the call

between the different players in a project, including engineers, security people, and many others," Betts said. "That's why we teach our classes the way we do. It's imperative for Corps people to understand that they can never work in a vacuum. They have to consult with security people and other installation people."

That teamwork includes assessment. Installation personnel are part of the planning team to help PDC engineers understand their particular requirements. "We don't set the threat environment," Wehring said. "We approach it from the engineering perspective. They need to know what their threats are and what they want to protect. Do they have to worry about car bombs? We don't know; they have to tell us."

"Doug can help that local commander identify where money needs to be spent to improve force protection," Sommer said. "With that understanding, requirements can be set for projects, and money can be designated for them."

In the field

"One unique responsibility we have that other government agencies don't is the expeditionary requirement," Betts said. Compounds are sometimes in the middle of a field in places like Bosnia or Kosovo. "When we build a structure in Nebraska, the design is protective *just in case* someone attacks us. In Kosovo, you're potentially taking fire every night. One of the most important parts of our mission is to support troops in the field.

"Historically, the Corps' mission has been building fixed facilities, and it's only recently that we started to emphasize troop deployment," Betts said. "We determine what we think the threat will be and how we can mitigate it. One thing we looked at in Kosovo was mortars. We used the same basic principles we'd use for a fixed facility, but we use a lot more improvisation. We use things like timber and sandbags and soil. Things you wouldn't use in an office building, but it works perfectly well in the middle of a wheat field."

Getting involved early helps identify issues early. Wehring received the Kosovo call at 4 a.m.; Betts found out when he walked in the office at 9 a.m. He was on a plane by 3 p.m. "Curt was standing in front of the task force commander less than 24 hours after

Ed Conrath specializes in blast resistance

Curt Betts "Success equals teamwork"

they asked us to be there," Wehring said. "That's what it took for us to be effective; get there early and have an opportunity to affect the basic layout."

The time to get there may be minimal, but time spent in-country can be for extended periods. "We were supposed to be in Kosovo six days; we were there six weeks," Betts said. Betts also spent two months in Bosnia. Conrath spent three weeks in Bosnia and Croatia and a month in Albania. Other PDC team members have similar stories.

On-site work is a broad topic. The Bureau of Alcohol, Tobacco, and Firearms hired PDC to collect data after the Oklahoma City bombing. Conrath was on the UN inspector team in Iraq, and spent three months in Kuwait after the Gulf War to help with rebuilding.

Minimize travel

Video teleconferencing will minimize some travel, and increase PDC availability to the other services. But there are times when the team must be on-site. They will continue to work throughout the world, whether it's office buildings and installations in the U.S., hospitals in Korea, dormitories in Greece, facilities in Kuwait or Saudi Arabia, or shelters in the Balkans.

For more information on the PDC, check out its web site, http://pdcunx.mro.usace.army.mil.