Overhead PROTECTION

The U.S. Army Corps of Engineers has developed a new method of providing wide-area protection for U.S. base camps in Iraq.

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Base camps and forward operating bases have been constructed throughout Iraq and Afghanistan to support all aspects of the U.S. military mission. Living quarters, dining and recreation buildings, post exchanges and other support facilities are an important component of base camps and occupy significant space within the camp.

The concern has been that the infrastructure for these bases often consists of pre-engineered metal buildings, modular trailer units, or structures that existed when the camp was established. While the structures satisfy the need for speed and efficiency in establishing a base camp, they often do not address force protection needs and provide little or no protection for the occupants if attacked. This, coupled with continuing insurgent attacks against base camps by rockets and mortars, has created a need for protective measures that can be applied throughout the support areas—as retrofits—quickly and cost-effectively.

Research, Development and Testing

The U.S. Army Corps of Engineers (USACE) Engineer Research and Development Center (ERDC) addressed the need for improved force protection by focusing on rapidly developing measures to counter the effects of indirect fire attack. During the research and development process, ERDC engineers worked with the USACE Protective Design Center (PDC), the Army Rapid Equipping Force (REF), the Joint Improvised Explosive Device Defeat Organization, and the Counter-Rocket, Artillery and Mortar Program Office to identify a holistic approach to base camp protection. They developed a matrix of material solutions for three major components of indirect fire protection: sidewall protection placed around a facility's exterior; internal compartmentalization of large facilities; and protective cover placed over the facilities.

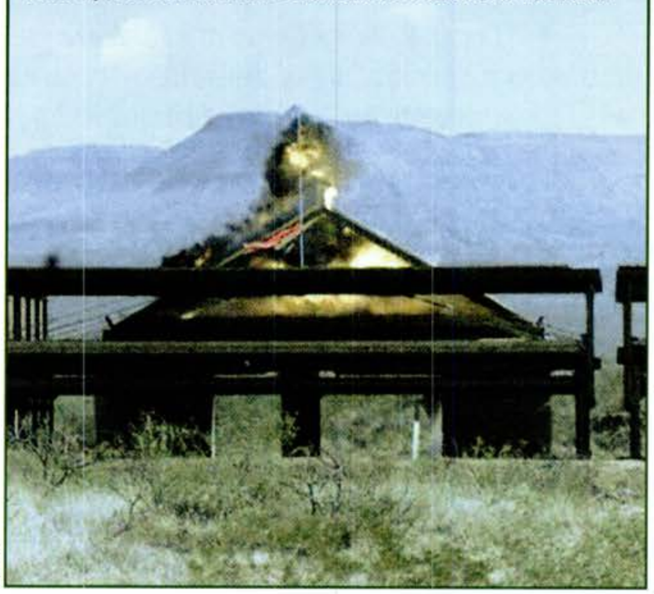
In the early stages of overhead protection research, ERDC engineers found that using a multi-layered system would reduce the weight requirements of protective material along with the size of the associated support structure. They applied innovative uses of commercially available materials to intercept and mitigate incoming munitions on the premise that the multi-layered approach would allow the system to manipulate blast and fragmentation loads on each layer of protection, minimizing the weight and cost of materials.

To validate this approach and identify materials for each protective component, ERDC initiated an intense static detonation and live-fire experimental program in early 2004. From January 2004 to August 2005, ERDC conducted near-continuous field experiments, testing some 100 materials or material combinations and firing nearly 275 live rocket and mortar rounds at full-scale prototype structures.


Tetra Tech Inc.

This aerial view of an overhead cover protection is part of the Overhead Coverage System under construction in Iraq.

Full-scale prototype validation tests conducted at Fort Bliss, Texas, provided valuable solutions to soldiers in the field.



ERDC

ERDC also recognized the need to provide protective measures to in-country units during the testing phase. ERDC used its strong ties with forward engineering forces and a novel reporting scheme to send results to Iraq, sometimes within 48 hours of a test's conclusion. As the spiraled research and validation continued, ERDC worked directly with REF to implement certain protective measures to specific critical facilities in Iraq.

These research efforts culminated in two full-scale prototype validations at Fort Bliss, Texas. In 18 months, ERDC generated a matrix of solutions that soldiers could use in the field.

As troops in Iraq continued to face attacks from rockets and mortars, Congress also recognized the immediate need for overhead cover protection, providing $250 million in FY05 supplemental funding. Recognizing the scale of the impending construction effort and the unique challenges of this type of construction, USACE engaged the Transatlantic Program Center (TAC) to lead the project, with technical guidance and support from ERDC and PDC.

Design and Construction

Once the overhead cover protection approach was developed, tested and validated by ERDC, TAC initiated the Overhead Coverage System (OCS) design and construction project, selecting Perini Corp., with Tetra Tech as the lead design engineer on the multi-firm team. Steel structures were designed and fabricated by Butler Manufacturing Co., with assistance from Saudi Building Systems of Jeddah, Saudi Arabia. Once the contract was awarded, TAC transferred construction management and contract administration to the USACE-Gulf Region Division.

Because OCS was targeted as retrofit protection for existing buildings, the multi-layered protection system had to be designed to be built over existing facilities. This required a superstructure composed of a steel frame with the primary columns and roof beams made of welded, tapered plate sections with rigid joint connections. The secondary members supported by the roof beams were cold-formed Z purlins. The overall steel structures were founded on reinforced concrete isolated spread footings or continuous strip footings, depending on the individual structure and geotechnical conditions at the site.

Because no "as-built" documentation existed for the facilities that were to be retrofitted, engineering teams visited Iraq to perform surveys, data gathering and subsurface investigations, working 12-hour days, seven days a week, in extreme heat, in remote and hostile areas.

Designs were reviewed and approved prior to fabrication and construction, and separate design packages were prepared for utilities and equipment that had to be relocated before foundation excavation. This was followed by a separate foundation package to allow field work to begin as early as possible. Finally, a separate package was prepared for review and approval of each structure to be constructed, including an overview of engineering services to be provided.

The OCS project presented many unique challenges during the design and construction phases. In addition to the blast live load to simulate weapons effects, the design team also had to address how to prevent progressive structural collapse. The team developed a design that allowed OCS to bridge over the loss of a main structural member and prevent progressive collapse. This was vital to ensuring the protective cover did not become an even larger threat to a facility's occupants. The team also faced the challenge of providing a design for compliant facilities that were both cost-effective and could be delivered within a very aggressive schedule. Designs for these first-of-a-kind structures also had to be based on employing easily obtained materials, semi-skilled labor and readily-available construction equipment.

Less than four months after the contract was awarded, construction of the first OCS began in January 2006. The OCS project is currently programmed for completion in June 2007.

Meanwhile, ERDC engineers continue to push the limits of imagination in an effort to provide the latest technology solutions to our military forces in theater and are presently working to develop a protective system that will be modular and threat tailorable in contingency environments. TME

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