



Under

Shelter

In Harm's Way

**CONDITIONS IN IRAQ AND
AFGHANISTAN DRIVE
DEMAND FOR SHELTERS WITH
BETTER ENERGY EFFICIENCY
AND THREAT PROTECTION.**

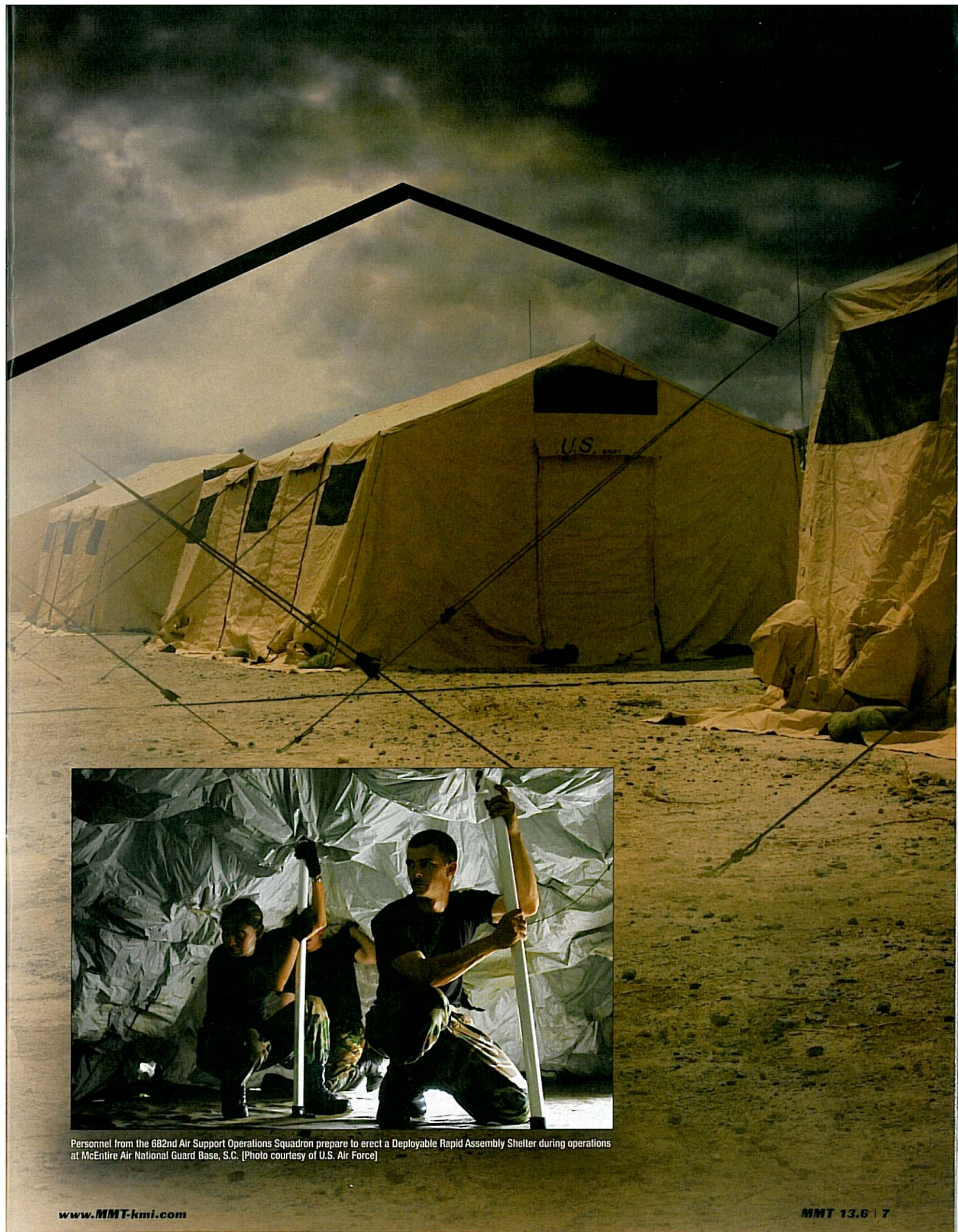
**By JOAN MICHEL
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Shelters remain as much as ever an essential requirement for forces deployed at forward operating bases, which are more often than not in remote locations without any existing infrastructure, such as water, septic and power, and in a variety of environments and conditions. In particular, conditions in Iraq and Afghanistan are driving the evolution of shelters today.

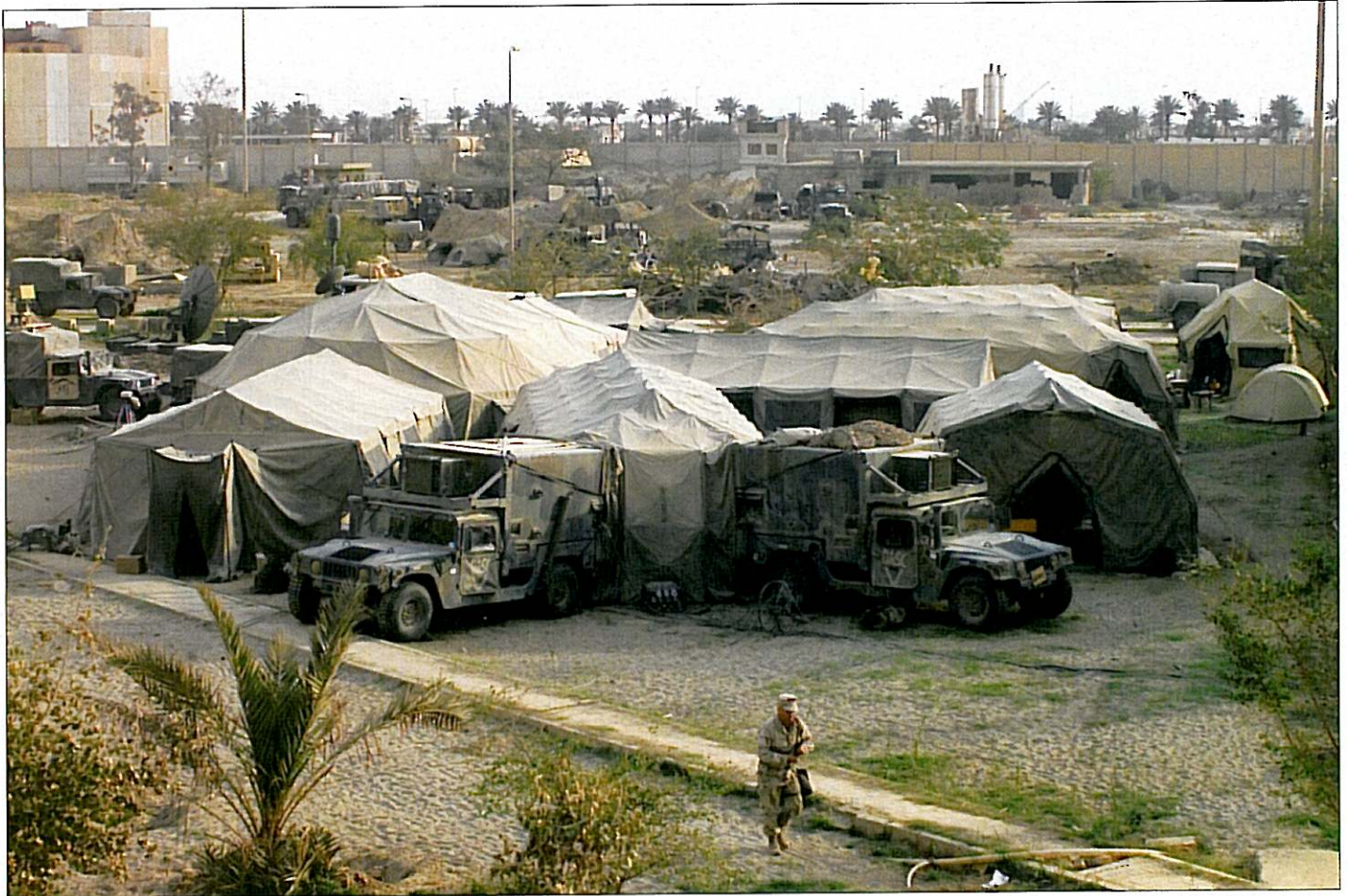
Frank E. Kostka, director of shelter technology, engineering and fabrication at the U.S. Army Natick Soldier Research Development and Engineer-

ing Center (RDEC), said today's primary focus in shelter development is on energy management because of the extreme environmental conditions found in Iraq and Afghanistan, where shelters must be both air conditioned and heated. At issue is both the logistics and cost involved in fuel supply, as a result of the protection needed for convoys traveling long distances.

"More important, coalition forces that provide the needed security to ensure that fuel deliveries arrive safely are placed at increased direct threat from improvised explosive devices and insurgent attacks," said Kostka. "As we expand efforts in Afghanistan, it becomes more complicated to move fuel into remote locations."



Personnel from the 682nd Air Support Operations Squadron prepare to erect a Deployable Rapid Assembly Shelter during operations at McEntire Air National Guard Base, S.C. [Photo courtesy of U.S. Air Force]



The Tactical Imagery Processing System area of a compound in Iraq during Operation Iraqi Freedom. [Photo courtesy of DoD]

A shelter comes in one of two designs: soft-walled or rigid. Soft-walled shelters are tents of various sizes and complexity, while rigid shelters might be constructed from aluminum, wood, foam or other light-weight material. "Hybrid" shelter designs integrate features from both soft and rigid structures. Shelter systems of all types can be assembled to create a multipurpose space, such as that for a field hospital with operating rooms, administrative space, hallways and triage and storage areas.

Kostka said the military is looking to

improve energy performance of shelters in several ways. First, by protecting the shelter against the extreme environmental conditions, the heating and cooling costs can be lowered. Natick is working with industry to develop solar covers constructed from highly porous fabric, which block the harsh solar loading found in the desert and provide good air flow, reduce heat buildup and allow wind penetration. Shelters can also be augmented with a series of internal liners that reduce the HVAC requirements.

Second, by integrating flexible photovoltaics into the solar covers, solar power can be captured and stored for use. The goal is to have a self-sustaining shelter. Kostka said that evaluations are under way at the National Training Center in Fort Irwin, Calif., as part of the Net Zero Joint Combined Technology Demonstration, sponsored by the U.S. Central Command, to make forward operating bases energy independent.

ENERGY MANAGEMENT

Industry is helping provide solutions for energy management. PowerFilm, based in Ames, Iowa, and founded in 1988 by two former 3M research physicists, is under contract to manufacture integrated shelter units to be tested in a field environment by military personnel.

HDT Engineered Technologies, a Solon, Ohio-based manufacturer of the Base-X shelter systems, is developing alternative energy sources for its line of shelters and working to reduce overall energy consumption through better insulation and design. HDT developed

Standardized Shelters

In 1975, the Department of Defense established the Joint Committee on Tactical Shelters (JOCOTAS) to organize and streamline the more than 100 shelter systems in use by the four military services. Since that time, JOCOTAS has narrowed the shelter systems in use to a standard family of tactical shelters that includes systems usable by the Army, Air Force, Navy and Marine Corps that follow a carefully standardized system for assembly and shipping. Two technical working groups meet twice-yearly to review requirements and technical advancements for possible incorporation into new generations of shelters.

a solar shade that has solar panels integrated into the fabric. The shade is placed on top of the shelter, and the energy generated is able to offset the load placed on generators that run lighting systems, computer activity and heating and cooling systems.

"We are developing turnkey shelter systems and camp setups that reduce the overall power consumption for heating and cooling of shelters and for running electronics," said James Maurer, VP of technology and business development for HDT. "We are responding to what we see as objectives that the military has to reduce power consumption and allow the operator or military unit to rely less on the supply chain and be more self-sufficient."

DHS Technologies, based in Orangeburg, N.Y., makes the Deployable Rapid Assembly Shelter (DRASH), which provides warfighters a shelter with lighting, heating, cooling and power integrated into one system movable by trailer. DRASH is part of the Trailer Mounted Support Systems, a multi-use shelter system deployed by the Army.

Ron Houle, DHS' vice president for federal programs, said that DHS is working on an "intelligent power management solution" that would improve how the Army deploys and operates tactical power solutions. Houle said that, in general, generator technology has remained unchanged for 70 or 80 years—the power is either on or off.

Better Protection for Four-Wheeled Shelters

Operations in Iraq and Afghanistan have also prompted the need for improvements to shelters of a more mobile nature, namely HMMWVs, which in addition to potentially being "up-armored," to better protect occupants against roadside bombs and rocket-propelled grenades, also may be fitted with advanced types of rooftops that better protect occupants from blowing sand and heavy snowfall, among other environmental extremes faced by the U.S. military in current operations overseas.

Wapato, Wash.-based Amtech, for example, makes molded composite rooftops that have been authorized by the Army as an alternative to canvas roofs on HMMWVs, with its roofs used on vehicles with a variety of purposes, including mobile command and control, fire control, mobile dental clinics, electronic attack, medical care and convoy escort duty.

Amtech said its rooftops won't be damaged by blowing sand; can withstand as much as 40 pounds per square foot of snow; and can handle ambient temperatures of at least 120 degrees Fahrenheit during normal operations.

"The blowing sand in theater was tearing the canvas right off the vehicles," said William Bushbaum, AmTech's SVP of business development. "So we went over there initially in Operation Desert Storm and launched products to cover the entire occupant area. Then later [we developed] products for providing environmental protection and security in the cargo area."

The cargo area products include pressurizers, which can protect sensitive radio, surveillance or other electronic equipment from sand and other particulate matter and airborne contaminants, as well as composite material liners for armor that serve as a sort of "catcher's mit," Bushbaum said, for spall, the dangerous metal fragments created by ballistic projectile piercing metal that would otherwise go flying into interior areas.

"There is no match between the supply of power and the demand for power," Houle said. "A command post may only need 4 kilowatts of power, and with the solutions out there today, that post will

get 15 kilowatts of power whether they need it or not. DHS is investigating ways to manage that better and smarter so we can more closely align the supply with the demand, which will in turn result in

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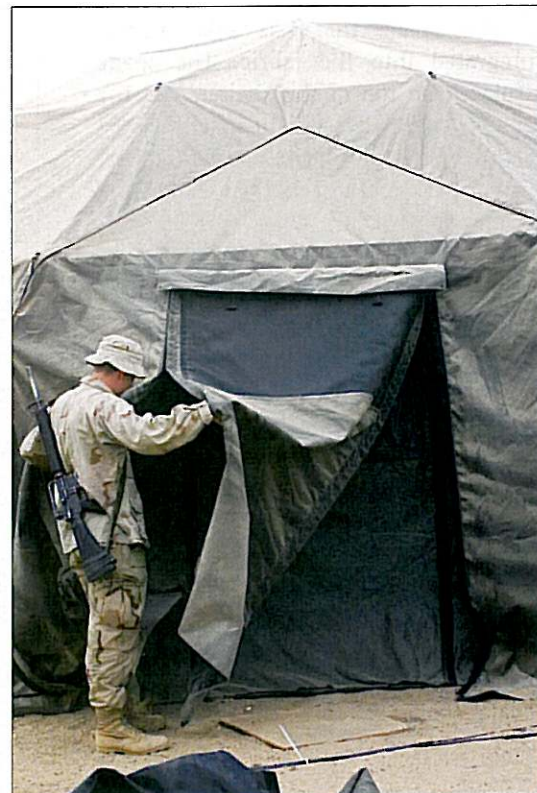
Other ways DHS said it is improving energy management in its shelters is through the use of a liner that provides a 12-inch gap between the liner and a cover for insulation space so that the shelter stays cooler in the hot weather and warmer in the cold weather. The company continues to conduct research and development efforts to ensure that the characteristics of textiles meet specific military requirements. For instance, DHS recently fielded a shelter that protects sensitive equipment against electro-magnetic signals and contains radio frequency interference signals. Additionally, DHS is looking at physical characteristics of weight and compressibility and insect repellency.

VT Milcom, based in Charleston, S.C., originally got into the shelter business as a result of developing a mobile airport communications facility that operates from a shipping container. The company designs, fabricates and installs electronic and communication systems in new or refurbished shipping containers for mobile military applications. These 20- or 40-foot containers are then shipped by truck, ship, C-17, C-130 and military helicopter transport.

“We basically designed an airport communications facility with radar into a shipping container,” said Scott Bohman, general manager of VT Milcom. “We put up a tower and plugged everything in and had an airport.”

In support of the Space and Naval Warfare Systems command, VT Milcom converted used shipping containers into various communications shelters, to include air traffic control shelters, technical control shelters, network control shelters, satellite communication test facilities and power distribution units.

“The equipment in these shelters cannot shift,” said VT Milcom department manager John Zitnick, “so we make sure the floors of these containers are beefed up to protect the shelter in the event of mortar hits. We had one take a hit recently, and it shifted just 6 inches off the pad, but nothing moved inside or stopped working.”



A Marine disassembles a command operation center's Deployable Rapid Assembly Shelter during Operation Iraqi Freedom. [Photo courtesy of U.S. Marine Corps]

OTHER DESIGN CHARACTERISTICS

Shelters deployed at forward operating bases not surprisingly are often in harm's way. Military units use sandbags and concrete barriers to provide ballistic protection, but this system takes time to get in place. So military planners some time ago began looking for ballistics protection capabilities that protect servicemembers in shelters immediately upon arrival in a hostile environment.

Kostka said that Natick worked with the Army Corps of Engineers and the University of Maine to develop a ballistics panel for shelters using the same body armor material worn by soldiers. This technology is being transitioned to PM Force Sustainment Systems.

Natick has been working with industry to develop “smart” textiles that incorporate visible detection and self-decontamination capabilities in the material. One company, College Station, Texas-based Lynntech, is developing a self-decontaminating smart textile that uses the reactivity of nanoparticles to decontaminate chemical agents. At the same time, this reaction creates a change in the color of the fabric, indicating a chemical agent is present.

The Natick publication Shelter Technology, Engineering and Fabrication Directorate Technologies Overview, which can be found at <http://nsrdec.natick.army.mil/media>, notes that this material may be integrated into currently fielded chemical and biological liners or integrated directly into the skin of a shelter. Under a cooperative Small Business Innovative Research Phase II agreement with Natick, Lynntech is investigating shelter material offering improved barrier properties, self-decontaminating characteristics and color-indicating capabilities against a variety of chemical warfare agents.

In addition, along with energy management and protection from threats, the design of shelters also contributes significantly to their ease of transport, construction and disassembly, given the need for forces to set up shop quickly and, sometimes, depart quickly as well. Seeking to make shelter lighter, HDT recently acquired a Lake Elsinore, Calif.-based company called Vertigo, creator of a proprietary technology that uses air-filled



Two-person tents, covered and aligned in military fashion on the desert floor, serve as temporary shelter for U.S. Marines with 4th Marine Logistics Group, Marine Forces Reserve, while they construct a larger tent city at Hawthorne Army Depot, Nev. [Photo courtesy of U.S. Marine Corps]

tubes instead of conventional rigid frame structures.

These air beam structures can be formed into different shapes, allowing for

many unique uses in military, aerospace and commercial applications, such as aircraft hangers. Vertigo's Small Tactical Airbeam Tents (STAT) series of shelters,



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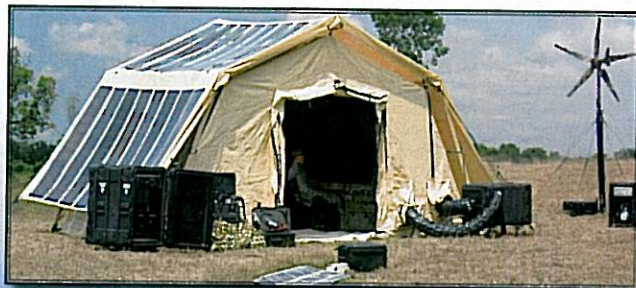
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developed in partnership with Natick Soldier RDEC, feature high-pressure Air-Beams, which have a strength-to-weight ratio superior to rigid metal beams, and also consume far less pack volume. Measuring 20 feet wide by 32 feet long each, the shelters can be set up by three people in 10 minutes with no formal training, according to the company.

In testing at Fort Lee, N.J., a STAT-based 150-soldier camp, including an air-conditioned bunk space and field kitchen, was made operational about 80 percent faster than usual, in less than 4 hours. Kostka said the technology was recently transitioned to the Army medical community, and five 84-bed hospital systems are now under construction.

"Airbeam-supported structures set up faster, take less packing space and typically are of lighter weight when compared with traditional frame supported shelters," he said. "Because of faster setup time, less weight and less cube of these structures, base camps that used to take 50 soldiers several weeks to set up can now be erected in only a few days."

Shelter manufacturers that boast of quick assembly times also include Pasadena, Md.-based EMS Innovations, whose product line includes shelters for such

purposes as portable hospitals, decontamination or spill control areas, mortuaries, communications centers, mass casualty centers, mobile or drive-through pharmacies, rehabilitation centers and command posts.

In addition, Fort Walton Beach, Fla.-based Utilis USA said its tactical shelters, which range in size from 200 square feet to 646 square feet, feature an external frame design with a pulley system to erect the outer fabric and internal liner in one motion in about six minutes, without the need for a compressor, power or a ladder.

The company recently received a \$26 million order to produce U.S. Marine Corps general purpose shelters that weigh about 810 pounds each with an interior of nearly 19 feet and a length of a little over 29 feet. Utilis USA said it is also helping develop shelters for DoD's Joint Expeditionary Collective Protection program.

Utilis partner Energy Technologies, based in Mansfield, Ohio, developed solar technology for the shelters that can

produce as much as 1440 watts for the Utilis TM-18 model or as much as 4300 watts for the TM-54 model. It also makes portable wind turbine generators that can

be set up by two people in a few minutes, according to Energy Technologies CEO and General Manager P.D. Madden.

"The wind turbines can produce energy in both daytime and night time," Madden said. "Since the loads do not always match up with the energy production, these eco power sources are fed into tactical battery modules [that] incorporate lightweight, high performance battery technology."

CIVIL RECONSTRUCTION

Shelters are by their nature temporary constructions, requiring trade-offs in lifespan, protection and other characteristics in return for benefits such as ease of transport and setup. But in rebuilding basic infrastructure in countries like Iraq and Afghanistan, where war activities have destroyed schools, hospitals and homes, some experts say shelters offer the hope of a quicker return to a more functional, stable society.

Lieutenant General Paul K. Carlton Jr. (Ret.), a former Air Force surgeon general who now directs the Office of Homeland Security at Texas A&M University's Health Science Center, advocates long-term use by both civil authorities and the military of component-based shelter systems that drive down the cost of heating and cooling and drive up the protection to include ballistics protection.

"It's OK for soldiers to stay in tents for a few days, but the majority of our



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military involvement today requires us to set up and stay in place for a long period of time," said Carlton. "The problem is that soft-walled structures provide little protection and really should be a bridge to something more efficient, cheaper and easier to set up."

Working with Texas A&M's College of Architecture, Carlton organized several think tank sessions over the past year on the subject of component-based shelter systems that included engineers and inventors from industry and academia. He is also spearheading Texas A&M's effort to insert component construction into military operations in Southwest Asia.

Earlier this year, Carlton met with the DoD Business Transformation Agency to discuss meeting a critical shortage of infrastructure in Iraq through the use of component buildings. In April, Carlton and other academics and industry representatives traveled to Iraq to get a better understanding of the requirements and needs of the people there.

While in Iraq, Carlton and others met with various levels of government to include the deputy minister for construction and housing and the director of the National Investment Council. The Iraqi government has identified an urgent need for 3 million houses, 55,000 hospital beds and 2,000 schools. Carlton sees this as an opportunity for the United States to export its component and prefabrication technology, keeping American workers busy and building opportunities for Iraqis at the same time by constructing the assembly plants in that region.

Certainly, the use of shelters for semi-permanent uses is not a new concept. Brian Johnson, co-owner of Bay City, Mich.-based Seranus-Johnson Portables and collaborator with Texas A&M, shipped buildings to New Orleans in the wake of Hurricane Katrina and to Galveston after Hurricane Ike flattened the community and injured scores of people. Called MetaSpace, these portable buildings are modular, transportable health care faci-

ties that can be erected and fully functional within days of an event, offering shelter, electrical service, heating/cooling and bathroom facilities.

"My system is essentially an erector set similar to Legos," Johnson said. "All components are synthetic—no wood—and easily snap together using basic tools. Everything is synthetic, so there is nothing that is going to rot or deteriorate over time."

This is necessary in order to provide the degree of cleanliness required for medical buildings, and also allows these types of shelters to serve as a "mid-term" solution for hospitals or laboratories that need to renovate. ★

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