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Special Projects Office
A Program to Counter Underground Facilities

Underground tunnels and caves where military forces and terrorist groups hide weapons, ammunition, ballistic missiles, command and control sites, and personnel are a serious and growing asymmetric threat to our nation's security and operational dominance. Defense Secretary Rumsfeld earlier this year noted that the elaborate tunnel systems available to Taliban and al Qaeda forces in Afghanistan are "sophisticated and hard to detect, and Afghanistan is not the only country that has such underground facilities. Many countries have gone underground."

With our current campaign against terrorism focused in countries rich with tunnels and cave facilities, the need for effective counter underground facilities (CUGF) technologies is significant. In fact, a surprisingly large number of countries use underground facilities for military purposes. These underground facilities have the potential to support both tactical and strategic uses, including the production and storage of weapons of mass destruction, ballistic missile basing, leadership protection, and top echelon command and control sites. Many of the facilities are deep buried facilities, making them particularly difficult to characterize and ultimately hold at risk. With our current campaign against terrorism focused in countries with numerous tunnel and cave facilities, the need for effective new technologies to counter underground facilities has never been so prominent.

In response to this multifaceted challenge, DARPA has committed itself to the development of systems and technologies to combat the emerging UGF threat. Meeting the challenge posed by our adversaries' underground facilities will require a number of advances. At a minimum, these include improvements in our ability to find, characterize, and engage underground facilities as well as improvements in our ability to perform UGF battle damage assessments following an attack. With a focus on improving the Defense Department's overall capability to achieve its objective of holding threat UGFs at risk, the DARPA Counter Underground Facilities Program is developing techniques and technologies to meet this challenge. In particular, we at DARPA are addressing two key elements required for UGF defeat; namely, characterizing UGFs prior to attack and assessing battle damage after a UGF attack.

The technologies we investigate are subjected to rigorous, scientifically disciplined evaluation. The CUGF program focus is on technologies that directly contribute to the objective of holding a threat UGF at risk by providing critical information on the timeliness of an attack, specific information regarding facility vulnerabilities, and post-attack battle damage assessment.

Our program's objectives include:

- Identification of the UGF's function
- Evaluation of the UGF's occupancy and pace of activity
- Characterization of the facility's attributes with sufficient detail and accuracy to support physical and functional defeat
- Location of critical support systems such as power, water, and ventilation
- Determination of the orientation and depth of underground structures
- Monitoring the facility immediately before, during, and post-attack to support evaluation of UGF attack effectiveness

To achieve our goals, the CUGF Program has placed emphasis on two primary approaches: passive, acoustic, seismic, and electromagnetic monitoring or PASEM; and characterization of UGFs by the use of effluents.

For each of these sensing technologies, DARPA is developing and validating robust modeling capabilities for predicting signals associated with normal UGF operations, as well as signals generated before, during and after an attack. Particular attention is paid to capturing the span of environmental variability and uncertainty associated with characterizing UGFs in realistic contexts to ensure that we develop techniques and technologies that are robust and well-characterized.

Under its PASEM work, DARPA emphasizes the use of sensors to characterize critical equipment signatures and to localize vents, power lines, and vital near-surface equipment. The PASEM approach exploits cross-mode correlation and spatial coherence to enhance sensor performance providing greater robustness, improved localization accuracy, and increased maximum detection range. Later in this talk, I will describe our continued efforts in this area.

Under our effluents work, program goals include the detection and localization of facility vents, monitoring operational status and tempo, and battle damage assessment. We are carefully developing a comprehensive understanding of these observables, with a strong emphasis on understanding the signature variability and the competing environmental clutter. In tandem with the development of an understanding of the signature science, we are evaluating a number of sensor exploitation concepts. As this work matures over the next few months, we hope to define new opportunities in this area. I encourage you to keep an eye on our website.

In recent program activities, DARPA completed a series of model validation testing for both PASEM and effluents using a simulated command and control tunnel facility at the Nevada Test Site. The two testing periods were an overwhelming success, resulting in an extensive collection of very well characterized data, which is being analyzed and evaluated for use in upcoming CUGF program work areas.

The initial modeling and concept exploration efforts for PASEM and effluents have resulted in a follow-on activity that is underway. This new activity is directed at development and initial evaluation of innovative methods and designs for detection and exploitation of UGF-related observables created by the tactical use of caves, as well as generated by the use of strategic-level UGFs. For a detailed description, I refer you to DARPA BAA 02-04. In summary, this new effort is divided into two work areas.

The first Work Area, which recently closed, will begin the process of transitioning the PASEM capabilities. It focuses on the development and demonstration of a ground sensor system prototype for monitoring critical activities and for localizing vulnerabilities for facility attack. This new system includes sensors, local communications, and algorithms and will result in a demonstration in the FY 2004 timeframe.

The second Work Area, which remains open, solicits innovative methods and technologies relevant to the UGF problem ranging from the tactical use of caves to strategic-level UGFs. The Army Science and Technology Master Plan (ASTMP) 1997 emphasizes that "new technologies are needed to detect deep underground structures, and to assist SOF in disabling or defeating systems in such facilities". Considering the environments in which U.S. forces are currently deployed in the war against terrorism, this is clearly an imperative.

The DARPA CUGF Program is heeding the call and working diligently to develop the requisite technologies needed to defeat the growing threat of underground facilities. We continue to look for new ideas in this area.

My partner, Dr. Dan Cress, and I look forward to opportunities to discuss our program and your new ideas at this DARPATech and in the future.

Thank you.