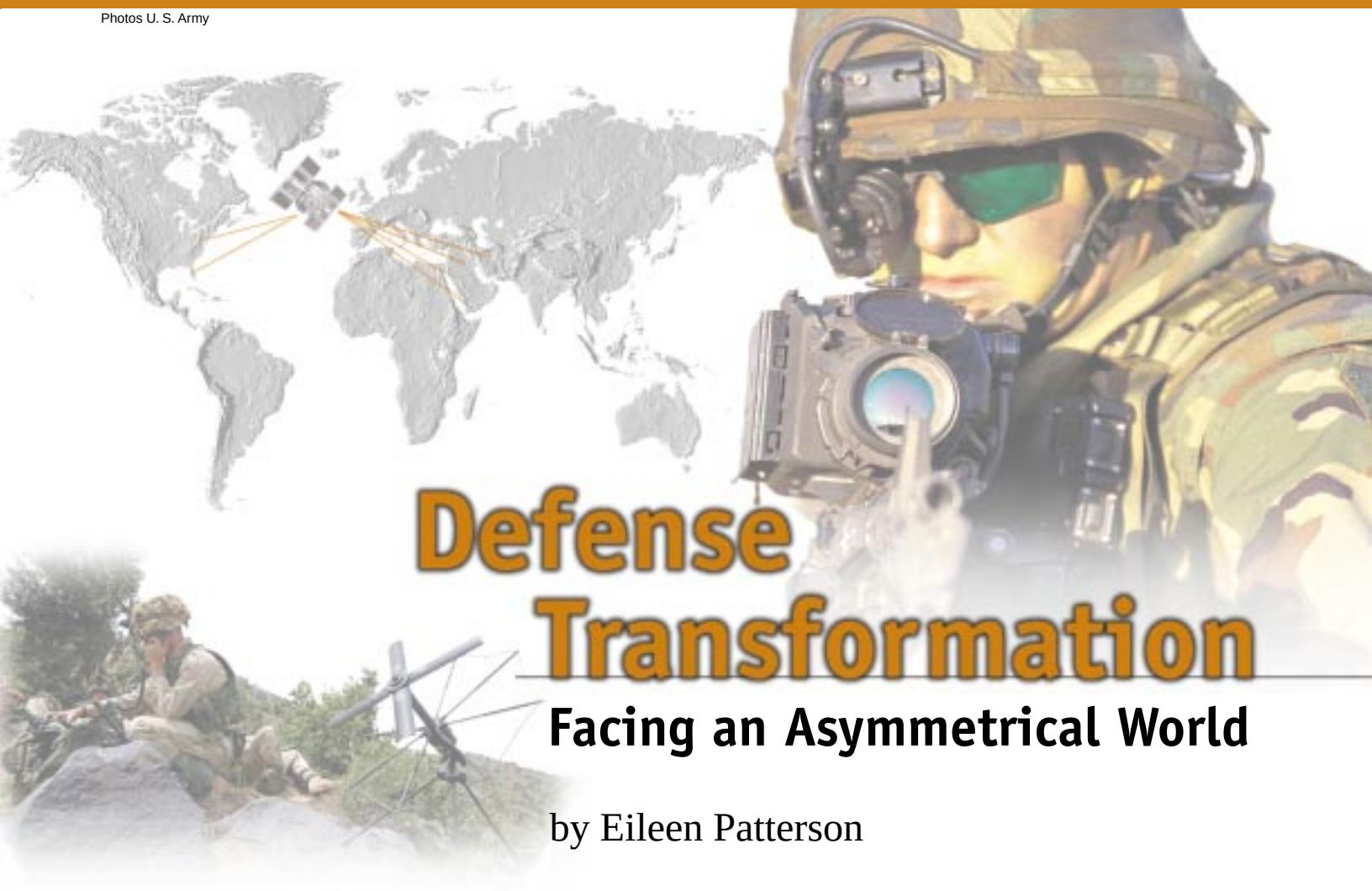
Photos U. S. Army



Defense Transformation

Facing an Asymmetrical World

by Eileen Patterson

"The future holds many unknown dangers and . . . we fail to prepare for them at our own peril."

—Donald Rumsfeld

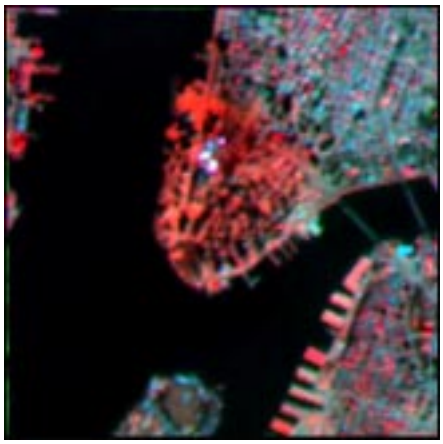
The attacks of September 11, 2001, reminded us that the end of the Cold War was not the dawn of a safer era. Although the Soviet Union's monolithic power is gone, other aggressive states and rogue groups have filled the void. In response, the Department of Defense is calling for a transformed defense policy—a constantly evolving entrepreneurial approach in which technical creativity keeps the United States' military forces ahead of the competition at every turn. It is an approach Defense Secretary Donald Rumsfeld sees as necessary because "the future holds many unknown dangers and . . . we fail to prepare for them at our own peril."

Farewell to Symmetry

Although the Cold War years were tense, it was a balanced tension—two deadlocked superpowers with comparable caches of mostly nuclear weapons. For all intents and purposes, those caches canceled each other out. Mutually Assured Destruction (MAD), the defense strategy of the time, was meant to ensure cancellation: aggression and the response it triggered would devastate both sides.

MAD worked because it pitted *like* force against *like* force and because it relied on a mutual desire for survival. It was based on symmetry, and symmetry kept the peace—mostly—for decades. What has existed since then, and what we saw exhibited on September 11, is known to the Defense Department as "asymmetry."

An asymmetrical world is a world of dissimilar forces: hostile countries or groups with inferior militaries facing the one remaining military superpower, the United States. Our nation's new enemies may possess or be in pursuit



The Multispectral Thermal Imager (MTI), a satellite-based sensor, collects data in fifteen spectral bands that provide information—for example, surface temperature and material composition—about sites on Earth. Following the events of September 11, 2001, MTI was used to help analyze the devastation in lower Manhattan. The data shown here are a color image (with a circle superimposed to indicate ground zero) and a temperature map of the area. The MTI is an R&D satellite designed to demonstrate and evaluate advanced space-based imaging technology. It was developed by the Department of Energy's Sandia and Los Alamos National Laboratories and Savannah River Technology Center.

of weapons of mass destruction, or they may be dedicated to terrorism, which does not require advanced technology to be devastating. In addition, they may have no compunction about sustaining losses when they attack. With no fear of death, an inferior force can inflict unacceptable losses on even a country that is militarily superior in the traditional sense. This new world is dangerous.

The Shift Is On

New dangers call for new thinking and a new defense posture. The Defense Department's plans for transformation focus on a lighter, more-flexible military, one that relies less on overwhelming numbers—of tanks, bombers, or missiles—and more on stealth, rapid response, and precision weaponry. Accurate, multidimensional intelligence and advanced information technology will provide the backbone. Data from diverse and globally dispersed sensor and human intelligence networks will be gathered and analyzed to give our nation's battlefield and homeland defenders a constant awareness of emerging threats.

This new "global situational awareness" will be crucial to defense in an asymmetrical world. In addition, computer networking, which has already revolutionized business communications, will interlink military units and their command posts, allowing for real-time, cooperative responses to incoming intelligence.

Defense transformation also links to a new triad of offensive and defensive capabilities. *Triad* was first used as a label for the nation's three-pronged strategic nuclear force: submarine-launched ballistic missiles, land-based intercontinental ballistic missiles, and long-range bombers. The new triad encompasses a wider range of capabilities: (1) nuclear and nonnuclear strike capabilities; (2) passive and active defenses, including missile defense; and (3) the defense-industrial infrastructure, which includes the labs and industries that develop, produce, and maintain the new-triad technologies.

There will be no one moment when the defense transformation is complete. Secretary Rumsfeld speaks of "a culture of continual transformation, so that our armed forces are always several steps ahead of any potential adversary." As the premier nuclear weapons laboratory, Los Alamos has been a major source of technology for a defense posture centered on nuclear weapons, and the Lab's continued nuclear and stockpile stewardship expertise will remain vital. But how does the Lab fit into the new defense transformation picture?

Transformational R&D at Los Alamos

The task of answering that question rests with the Directorate for Threat Reduction. Paul Weber, the directorate's newly appointed deputy associate director for defense science and technology, is leading a push to define how Los Alamos can best contribute. He is already seeing an arsenal of Laboratory technologies, developed in fulfillment of the Lab's Department of Energy mission, that fit the defense transformation bill.

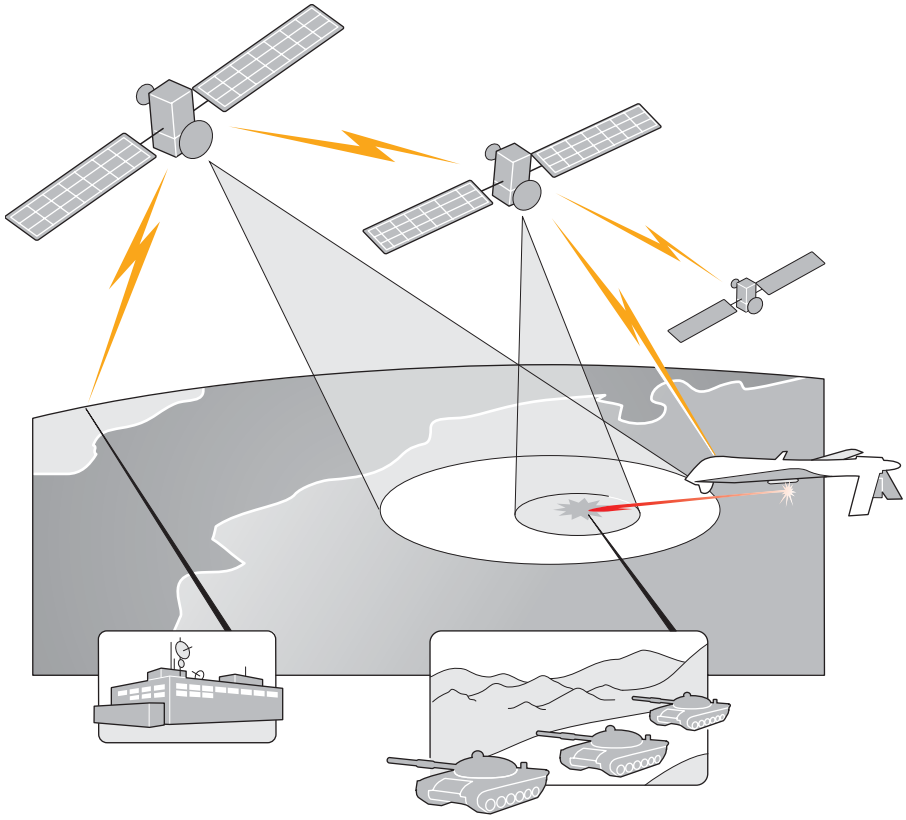
In the realm of advanced weaponry, Los Alamos is working toward the development of directed-energy weapons such as a megawatt free-electron laser that can be mounted on a ship to propagate a speed-of-light destructive beam against incoming

targets. The Lab is also working on advanced energetic materials whose energy release rates can be tailored to specific targets and others whose insensitivity to impact allows them to reach deeply buried targets.

For homeland security, Los Alamos, along with Lawrence Livermore National Laboratory, has already developed and deployed BASIS, the Biological Aerosol Sentry and Information System. Used to detect airborne biological threats at the 2002 Winter Olympics in Salt Lake City, BASIS won a 2003 R&D 100 Award as one of the year's 100 most significant technological advances. It is currently being fielded nationwide as part of the country's BioWatch surveillance program for urban areas.

Los Alamos has developed and fielded both terrestrial and space-based sensors. In fact, Los Alamos sensors already fly on all global positioning system and Defense Support Program satellites. The Lab has also developed sophisticated imaging and visual-analysis systems such as GENIE (Genetic Imagery Exploitation) and the Multispectral Thermal Imager (see the figure on page 14). These join the Laboratory's advanced data-processing and analyzing capabilities and our secure-communication technologies (for example, quantum cryptography for secure data transmission). Such technologies make the Lab a valuable contributor to the quest for global situational awareness.

Our contributions to national defense are already well documented. Our continued technological preeminence will allow the Laboratory to fit very comfortably into the defense transformation future. ■



Vision of future response to global threats. A constellation of rapidly launched minisatellites in low-Earth orbit provides continual surveillance of an area of conflict. Each satellite provides wide-area sensing and detection, local imaging and precise target identification, onboard data processing, and communication with one another as well as with unmanned aerial vehicles and command headquarters in the United States. As pictured here, the first satellite forwards information on potential activity from its wide-area surveillance to a second satellite, which identifies tank movement in its narrower field of view and directs an unmanned aerial vehicle to fire on the tanks; the third satellite then assesses the resulting damage. The elapsed time from wide-area sensing to damage assessment is only ten minutes. Such rapid response will draw on the Lab's R&D work on sophisticated imaging and visual-analysis systems, advanced data-processing techniques, and secure communication technologies.

John Flower

The Researcher

Paul G. Weber leads the Laboratory's new initiative in defense transformation. His background is in plasma physics, space and atmospheric sciences, remote sensing, and other advanced measurement systems. Weber was the division leader of Earth and Environmental Sciences before being named to his new post in the Threat Reduction Directorate. He holds a Ph.D. in physics from Flinders University, South Australia.