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**Space, Missile Defense
and Computer Network Operations Challenges:**

Space—A Key Enabler of Effective Land Force Operations

**(Second in a series of three Background Briefs based on information
provided by U.S. Army Space and Missile Defense Command)**

No nation relies more on space for its national security than the United States.

Secretary of Defense Donald H. Rumsfeld
2002 Annual Report to the President and the Congress

Space is the high ground today, tomorrow, and in the future. . . . If the Army is to maintain overmatch capabilities, space systems must be shaped and influenced to provide the information and support our forces require to conduct decisive operations across the full spectrum of conflict.

General John M. Keane
Vice Chief of Staff, U.S. Army
Foreword to *United States Army Space Master Plan*, March 2000

Space and Military Operations

Space enhances all aspects of military operations, as has been evidenced in the ongoing war on terrorism. The conduct of military operations is no longer limited to the traditional dimensions of land, sea and air. The Army views space, the new high ground for military operations, as a vertical extension of the battlefield and an integral part of the battlespace. Space capabilities are key force multipliers for land force operations. As such, the Army leverages the overhead constellation of national military and civilian space platforms for beyond-line-of-sight communications; position, navigation and timing; weather, terrain and environmental monitoring; missile warning; blue (friendly) force tracking; and intelligence, surveillance and reconnaissance (ISR).

The integration of these space-enabled enhancements into military operations creates the ability to achieve the information superiority and full battlespace awareness necessary for full-spectrum dominance. Operationalizing space capabilities, protecting space assets and denying adversaries the ability to leverage space to their advantage are critical to our national security and the Army's ability to conduct full-spectrum operations.

Space, Joint Operations and the Objective Force

Space is an essential enabler for joint operational concepts such as Rapid Decisive Operations (RDO) and the Objective Force characteristics of responsiveness, deployability, agility, versatility, lethality, survivability and sustainability. As advances in information technology inspire new concepts for conducting military operations, the Army will become increasingly reliant on space capabilities to effectively carry out its missions across the full spectrum of military operations. Two of these emerging new concepts are at the very heart of the armed forces' ability to implement their visions—Network-Centric Warfare (NCW) and the Global Information Grid (GIG).

The idea behind NCW is that by linking sensor networks, command and control (C²) networks, and shooter networks, the United States can achieve efficiencies in all military operations from the synergy derived by simultaneously sharing information in a common operating environment. By linking these networks, the military will be able to collaboratively plan and execute operations, saving time and benefiting from the input of multiple “sensors”—both physical and human.

While NCW is the operational concept, the GIG, a major Defense Transformation initiative, will provide the globally interconnected, end-to-end set of information capabilities, associated processes and personnel for collecting, processing, storing, disseminating and managing information on demand to warfighters, policymakers and support personnel.

Space-based assets are at the core of translating these theories into reality and, in turn, achieving the services' missions. Because the Army will be increasingly reliant on the capabilities enabled by NCW and the GIG, it has a vested interest in assuring they provide for the full and seamless integration of space capabilities in support of land force operations.

U.S. Army Training and Doctrine Command (TRADOC) Pamphlet 525-3-14, *Concept for Space Operations in Support of the Objective Force*, provides the Army's holistic concept for integrating space and land force operations for the Objective Force. The concept addresses Army contributions to joint space missions and presents ideas on evolutionary and revolutionary capabilities leveraging the military advantages of space operations.

Space Operations in Support of Land Force Operations

As the largest consumer of space products, the Army uses space capabilities in several functional areas to support land force operations:

- **Communications.** Space-based communications capability is the key to leveraging all other space capabilities. Satellite communications provide a robust, flexible and seamless surface-through-space network that extends terrestrial capabilities. Systems with embedded direct links provide a reachback communications capability that allows implementation of split-based command and control and logistics support concepts. These links also create the opportunity for interoperability with joint, coalition, commercial and civil communications networks.

As a result, the Army has reliable, on-demand, non-line-of-sight communications it can use to provide enhanced early warning, en route mission planning and rehearsal, and responsive combat service support (CSS) while maintaining a reduced footprint in theater. This sets the conditions for increased responsiveness, agility, versatility, survivability and sustainability. Over the next decade new Department of Defense (DoD) communication systems will replace the existing systems. These systems will be more capable and responsive to warfighter needs.

- **Position, navigation and timing (PNT).** Embedding global, real-time PNT in maneuver systems, command and control systems, and support systems contributes to enhanced situational awareness,

lethality, agility and survivability for the warfighter. The ability to locate and identify friendly forces on a common, relevant operational picture of the battlespace, for example, greatly reduces the chances for fratricide during decisive operations. Precision guidance and timing capabilities have enhanced lethality and effects for long-range munitions. Over the next decade, enhancements to the Global Positioning System (GPS) will make its use more secure from jamming while maintaining the precision critical to so many military activities.

- **Weather, terrain and environmental monitoring.** Access to real-time and predicted “tactical” weather through organic small weather satellite terminals enhances planning and decisionmaking for ground commanders. Combined with terrain and environmental data from space sensors, such monitoring allows warfighters to determine weather effects on munitions and obscurants; assess trafficability; and determine changes to terrain or infrastructure that may constitute obstacles to maneuver. Exciting developments are taking place now in the use of spectral imaging data from newly launched satellites to significantly increase the ability to identify surface materials—including vegetation, soils and man-made features.

Not well known is the impact space weather (sunspots, solar flares) can have on military operations. Knowledge of periods of increasing solar activity that will affect certain communications capabilities, or that GPS availability will be degraded, contributes immensely to enhanced operational planning.

- **Missile warning.** The operational value of missile warning from space was proven in Operation Desert Storm. Since then early warning to deployed forces has been improved by the fielding of the Joint Tactical Ground Station (JTAGS), which provides an in-theater processing capability for data from Defense Support Program (DSP) surveillance satellites. This improved warning enhances the active defense, passive defense and attack operations elements of missile defense by providing improved launch-site location and impact-point predictions. The next generation of missile detection satellites, the Space-Based Infrared System (SBIRS), and the Multi-Mission Mobile Processor upgrade to JTAGS will further enhance the ability to detect the launch and determine the impact point of ballistic missiles.
- **Intelligence, surveillance and reconnaissance (ISR).** Many space systems contribute to the collection, processing, dissemination and use of battlefield data and tactical information. In fact, space-based ISR capabilities will most often be the first “eyes on target.” From the first intelligence preparation of the battlespace assessment to final updates on aerial ports and seaports of debarkation, to a deep look at support operations in depth, space systems provide critical ISR products and targeting information. In the future, a space-based radar with moving target indications from space can track adversary vehicles on the ground. This information, combined with highly accurate digital terrain elevation data, will provide the information for precision attack of time-critical targets.

The Use of Army Forces to Support Space Operations

The Army has been, is and will continue to be a prominent player on the joint space team. The Army makes key contributions to U.S. forces’ space capabilities in the areas of global communications, ISR, missile warning, and position, navigation and timing. Additionally, because space capabilities are so important to the warfighter, the Army also makes significant contributions to assuring access to space through its contributions to space control.

One of the Army’s primary contributions to space capabilities is defining land force requirements for products and services that space capabilities must provide. The U.S. Army Space and Missile Defense Command (SMDC), through its Force Development and Integration Center, integrates these requirements for the Army and plays a key role in the development and testing of these capabilities, to

include Doctrine, Organization, Training, Materiel, Leader Development, Personnel and Facilities (DOTMLPF).

The Army also provides operational space forces and capabilities. The 1st Satellite Control Battalion of Army Space Command (ARSPACE) operates Defense Satellite Communications System ground terminals and control centers around the world. These centers are essential for providing the secure worldwide communications necessary for a responsive, deployable contingency force.

To provide deployed forces with access to many satellite-based capabilities, ARSPACE provides Army Space Support Teams from its 1st Space Battalion and 193rd Space Support Battalion. These teams bring organic equipment and expertise to provide land component forces critical data on space communications, weather, imagery and other related space capabilities.

ARSPACE's 1st Space Battalion also provides in-theater missile-warning capabilities through the deployment of JTAGS to the theater of operations. Teams are located in Korea, Europe, the Middle East, Colorado Springs, Colorado, and Fort Bliss, Texas.

The Army Space Program Office (ASPO), located at Fort Belvoir, Virginia, has the lead for the Army's Tactical Exploitation of National Capabilities (TENCAP) program to determine the intelligence needs of operational and tactical commanders and identify national capabilities that help meet the commanders' needs. TENCAP systems leverage national- and theater-level assets to provide intelligence products directly to tactical commanders. They do this by fielding the evolving set of TENCAP equipment and procedures. The Army's newest TENCAP system, the Tactical Exploitation System (TES), provides commanders with near-real time correlated imagery and signals intelligence products from national and theater sensors. TES operators can redirect specific sensors to provide commanders with unprecedented ability to see and affect the battle space. With TENCAP systems, tactical commanders have the communications and processors needed to receive and use the intelligence in near-real time.

The Army is also developing a cadre of trained Space Operations Officers, Functional Area 40 (FA 40). These officers provide in-depth expertise and experience to adequately leverage space assets for the Army. As the Army identifies requirements and develops capabilities for the "space-empowered" Objective Force, Army Space Operations officers are being integrated aggressively into current operations, future planning, research and development, and acquisition positions at all organizational levels within the Army and Department of Defense. The infusion of FA 40 Space Operations Officers into existing headquarters will ensure current and future space force enhancement tools and products are integrated into Objective Force operations.

Space Control

U.S. dominance in the dimension of space is not guaranteed. Adversaries understand the advantages of operating from space. Some forty nations have space programs, and the array of commercial systems is growing daily. Many commercial systems have military applications such as targeting, intelligence and communications. Adversaries will probe U.S. space systems for vulnerabilities; they might alter the space environment to disrupt or deny U.S. space operations. They might gain access to U.S. systems and tamper with data or exploit it for hostile purposes, or they might turn to third parties to buy services and products of military significance without making the huge investment of resources to develop their own space infrastructure. Each of these approaches has unacceptable implications for U.S. land forces.

Space control, a mission shared by all services, includes combat and combat support operations to ensure freedom of action in space for the United States and its allies, and, when directed, actions to deny an adversary freedom of action in space. The space control mission area includes the elements of prevention, surveillance, protection and negation. The Army contributes in many ways to the space control capabilities of the Commander, U.S. Strategic Command and the various theater combatant commanders:

- Through strict operational security measures and adherence to national laws and policies on technology transfer, the Army contributes to the **prevention** of adversaries' developing and/or exploiting space capabilities.
- The U.S. Army Kwajalein Atoll provides unique space **surveillance** capabilities. There, the Army provides powerful ground-based space surveillance systems that assist Commander, U.S. Strategic Command in identifying and characterizing potential adversary space capabilities. This contributes to the land component commander's situational awareness of the entire battlespace.
- The Army develops technologies to **protect** U.S. space systems (space, ground and communications link segments) from electronic warfare and other potential denial, disruption or destruction. The High Energy Laser Systems Test Facility (HELSTF) at White Sands Missile Range, New Mexico, helped determine the vulnerability of satellites to laser weapons by the actual employment of ground-based directed energy against a low-orbiting U.S. satellite. The Army Space and Missile Defense Technical Center in Huntsville, Alabama, is assuring space access for the Objective Force by conducting research on hardening and electromagnetic pulse (EMP) that will enhance the survivability of U.S. space systems. The Technical Center is also analyzing a tactical laser communications system that has the potential to provide increased capacity for communications satellites while lowering vulnerability to interception and jamming.
- The Army has always been the lead in ground-based air and missile defense and the enabling technology. Today those efforts include development of technology to **negate**, both temporarily and permanently, an adversary's space capability. This will be a key capability in future conflicts and a strong deterrent to potential adversaries.

Conclusion

Military use of space is inherently joint and increasingly critical to land force operations. Terrestrial systems alone will not enable full-spectrum dominance. It is clear the Army is, and must continue to be, an active participant in the design and development of space architectures and capabilities. Commanders at all levels (strategic, operational and tactical) must have assured, direct access to the full range of space capabilities, and they must be able to protect that access while denying access to any adversary. The Army equity protected by maintaining space dominance is nothing less than achieving the Transformation.