Chapter 3

Use of Space Systems

As the Army continues its transition from a Cold War European-oriented force, requirements of a force projection Army will be further defined and new problems uncovered. Many of these requirements can be met by using space systems. This chapter explains the Army's doctrinal application of space systems and their capabilities to support Army operations. It focuses on planning considerations and the operational context of the space system capabilities further described in Chapter 4. It describes, using joint terminology, the four military space functions and the general planning considerations for space support, from the strategic to the tactical levels, including joint planning.

MILITARY SPACE FUNCTIONS

Army planners must be familiar with the space support available and its capabilities, as well as the procedures for requesting support from space systems not directly allocated to or supporting their operation (see Figure 3-1). Personnel and equipment not organic to a deploying unit must be made available to support these operations. Required in many cases is the reallocation or redistribution of space assets or the development and maintenance of contingency space support packages for use by deploying units. To describe the aggregate warfighting capability offered to combat forces, space system capabilities are further divided into four military space functions: force enhancement, force application, space control, and space forces support. Each of these functions should be considered during the initial stage of mission planning.

FORCE ENHANCEMENT

The Army's involvement in space is largest in this functional area. Force enhancement involves space support that helps the land force accomplish its terrestrial mission. It is analogous to combat support with space capabilities that improve the effectiveness of forces across the full range of military activities. It includes, but is not limited to, communications, navigation, weather, terrain, environmental monitoring, and surveillance support. The efficiencies resulting from the use of these space capabilities can have a dramatic effect on Army operations: reducing uncertainty, facilitating battle command, and moderating the effects of friction and fog of war. As one of the biggest users of satellite systems—GPS receivers, satellite communications (SATCOM) terminals, multispectral imagery (MSI) processors, and TENCAP systems—the Army is responsible for articulating its requirements, influencing the satellite design process, and acquiring ground terminals to satisfy its space needs.

FORCE APPLICATION

Force application addresses the conduct of combat operations from, in, or through space with the intent to destroy terrestrial targets. While force application capabilities from space are limited, the role of space in force

Figure 3-1. Space Support to Army Operations

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application is evolving. It consists of the offensive and defensive use of space and space-related capabilities to project combat power and defend US military forces and their allies from attack. In the broadest sense, any space system capable of providing and disseminating information contributes to force application. Consistent with treaty obligations and national policy, this capability could include the use of space- and ground-based systems to provide protection from ballistic missiles, in programs such as national missile defense (NMD) and theater missile defense (TMD), and to extend the Army's force projection range against surface targets.

The strategic defense of the US is one of the Army's most important missions. When strategic defense systems are fielded, the Army is an integral part of the total system, providing command and control facilities and ground-based sensors and interceptors to support the defeat of strategic and theater ballistic missiles. An important component of the TMD system is the transportable equipment that can be moved into *a* theater or region to protect Army contingency and allied forces. As a result, the Army will continue to upgrade the existing systems and support research and development efforts designed to extend the range and effectiveness of follow-on sensors and interceptors.

SPACE CONTROL

Space control, like control of the air, is a mission shared with the US Air Force and other military services. The purpose of this function is counterspace operations, that is, to ensure freedom of action in space for friendly

forces while denying it to the enemy. It includes the conduct of offensive and defensive space operations to prevent an enemy's space forces from gaining and maintaining space superiority and to ensure survivability and protection of friendly space systems. The Army's role in this function will be from the terrestrial perspective, such as jamming up/ downlink frequencies and attacking satellite control nodes and facilities from the ground.

Our force projection Army will continue to support the requirement for a counterspace system to facilitate space control, assure space support, and deter nations from attacking US satellites. Access to a counterspace capability by more nations may increase over time. The impact could be significant. For example, the destruction of US space-based surveillance systems would limit the ability of commanders at all echelons to see the battlefield clearly. A commander's freedom of action can be enhanced by counterspace operations that provide freedom from space-based surveillance. Space control facilitates mobilization, deployment, and employment of Army units.

SPACE FORCES SUPPORT

The US Air Force has the primary responsibility for space support, with other services providing assistance as needed. This function addresses the military infrastructure to deploy and maintain military space systems. It includes the forces and activities responsible for launching, maintaining telemetry, tracking and commanding space systems, recovering spacecraft, and providing logistics support for space systems and their ground control elements. The Army has limited involvement in this function.

PLANNING CONSIDERATIONS

Joint Pub 0-2 sets forth principles and policies to govern the joint activities and performance of the US armed forces. It provides guidance for use and employment of space assets by the Army and other services. Joint Pub 3-14 provides doctrine and principles for joint forces to plan, prepare, and execute military space operations. FM 100-5 is the Army's keystone warfighting doctrine. FM 101-5 provides the Army staff officer with instructions on how to plan and document Army operations. The space operations annex to the operations plan is where the use of space systems in support of Army operations should be addressed. A template on what such an annex should look like is provided at Appendix A. Broadcast dissemination of intelligence and targeting information (see Figure 3-2) is an important element in providing commanders at multiple echelons with a common picture of the battlefield that facilitates parallel planning. Broadcast provides a "dial-up" intelligence capability for commanders. Additionally, space systems enable commanders to "pull" information from strategic through tactical echelons.

STRATEGIC-LEVEL PLANNING

Space systems provide a global perspective that supports strategic-level planning done by all services. Planners at this level use space capabilities to focus on reducing uncertainty. The capabilities of space systems help strategic planners to assess the risk of using the military and other instruments of national power. The information provided enables them to formulate and coordinate appropriate responses and to tailor the force for the mission.

OPERATIONAL-LEVEL PLANNING

At the operational level, planners focus on the design and conduct of campaigns and major operations to accomplish the unified commander or higher military authority's strategic objectives. Projecting the force may require the use of split-based operations in which significant support is provided the operational commander from elements that remain in CONUS or elsewhere and do not deploy to the theater of operations. During split-based logistical operations, fully integrating supply and transportation

Figure 3-2. Broadcast Intelligence Dissemination Via Space Systems

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functions into a vertical distribution system is critical. Enhanced, assured communications from space-based assets allow some logistics management functions to be accomplished from CONUS or another theater, deploying only those functions necessary. This stretches the lines of communications from CONUS ports and support areas to the theater of operations. The Army must develop and employ space system capabilities to enhance

the operational commander's capability to support operations throughout the theater. Split-based operations reduce the burden on the deployment flow and prevent unnecessary stockage in theater. Specifically, space systems provide information to support planning, a means for disseminating information, tracking and managing assets, and controlling forces during war or MOOTW.

TACTICAL-LEVEL PLANNING

At the tactical level, planners focus on operations that will achieve the desired operational results during the conduct of close, deep, and rear operations. The boundaries between these operations are not firm and often shift, depending upon the mission. However, they are synchronized and are usually conducted in a manner that appears to the enemy as one continuous operation. Planners must concentrate on areas that can affect the outcome of the force's immediate operation as well as future operations. During combat, space capabilities enhance the synchronization of close operations where Army forces are in contact with the enemy. Seeing deep is critical to disrupting the enemy's tempo and the effectiveness of his follow-on operations. Space systems provide weather, targeting, terrain, and ingress/egress information needed to support deep operations. Rear operations are designed to sustain current close and deep operations and to posture the force for future operations, Space systems support operations from the port all the way to the operational area by improving command and control, facilitating freedom of action, and ensuring continuity of operations.

JOINT PLANNING

Both deliberate and crisis action planning that involves two or more military services will be conducted under Joint Operations Planning and Execution System policy and procedures. Since space is an integral component of the NMS, and force projection operations in particular, space operations planners need to be brought into the planning process from the beginning. From the planner's perspective, the primary advantage of using space assets is their near-continuous presence, enabling planners to focus on specific problem areas and to develop viable recommendations and alternatives for commanders. This is particularly important given unforeseen and continually changing conditions that may have precluded detailed contingency planning. The information needed to support planning includes not only military-related intelligence, but also political, economic, geographical, and demographic data. Data from supporting systems can be processed, collated, and disseminated simultaneously to multiple users. This capability speeds the planning process at all echelons of command and greatly facilitates parallel planning. As plans are developed, the planning staff must understand and optimize the type and amount of space support required for the various stages of the operation to satisfy mission requirements and to achieve terrestrial objectives: deterrence and stability.

APPLICATION OF SYSTEM CAPABILITIES

Application of space capabilities should be considered for all phases of a force projection operation, whether supporting a combat mission or MOOTW. Planning is inherently joint and it generally follows a logical sequence. The stages in this sequence, however, may not be distinct and often will blend together or overlap. FM 100-5 identifies the stages of force projection as mobilization, predeployment activities, deployment, entry operations (unopposed and opposed), operations, war termination and postconflict operations, redeployment and reconstitution, and demobilization. Active and reserve forces should be trained, to include proficiency in applying space capabilities during each stage of force projection operations. While the leverage offered by space-based systems is significant during all phases, to reduce redundancy the stages have been grouped into three broad areas: predeployment, deployment, and entry operations; operations; and redeployment and reconstitution.

PREDEPLOYMENT, DEPLOYMENT, AND ENTRY OPERATIONS

The key to ensuring successful operations is the early identification or situation assessment of the problem or threat, including identification of enemy activity, operational capabilities, vulnerabilities, and limitations. Many of the decisions concerning which units will be deployed and when will be based on information gathered and disseminated by space systems. These systems and their capabilities enhance the deployability of Army forces by facilitating a knowledgeable entry, whether opposed or unopposed, into the area of operations. Based on this information, deploying units and sustainment operations will be tailored for the mission and then sequenced and tracked into the area of operations.

During peacetime operations, prior to any deployment decision, the Army must monitor world situations and prepare its units for missions across the full range of military operations. National space systems can cross international boundaries unobstructed and perform reconnaissance, These reconnaissance efforts are focused on building and maintaining data bases to satisfy the Army's training and operational requirements associated with force projection. This information may allow the US to reach a political settlement to an emerging crisis situation without deploying Army forces. The information also facilitates the development of predictive models, situation displays, and simulations useful for planning and training prior to deployment. Specifically, the Army uses space systems to detect the problem, provide early warning, identify information gaps, reduce the vulnerability of its forces, and facilitate entry into the theater of operation.

Spaced-based assets are especially useful in acquiring and providing support to early-entry forces. Regardless of the early-entry category—unopposed when no combat conditions exist, unopposed under combat conditions, or forcible entry—assured communications, reliable intelligence, necessary logistical support, and dependable and accurate fire support can be greatly enhanced when space systems are employed. Many unknowns and questions can be eliminated regarding the area where the early-entry force will be inserted. Space systems can provide insights and risibilities to the commander that will reduce the uncertainties and facilitate situational awareness and battle command throughout the force.

Communications

Military satellite communications (MILSATCOM) systems provide communications connectivity prior to deployment and while en route from CONUS or forward staging areas to the destination, The deploying units use single and multichannel terminals that are part of the unit's table of organization and equipment (TOE) or are the result of redistribution as part of the contingency plan. These systems facilitate command and control, split-based operations, data base/information updates, readiness reporting, mission and movement, and planning and coordination. The unit signal officer should plan for the use of MILSATCOM systems to support communications surges during the initial and follow-on phases of the operation. The connectivity provided by satellite communications systems enhances the flexibility, agility, and battle command of Army forces once in the area of operations. Specific MILSATCOM applications and considerations during this phase of the operation include the use of—

- The Defense Satellite Communications System (DSCS) to provide strategic, long-haul, super-high-frequency (SHF), high-data-rate communications between NCA/ Joint Chiefs of Staff (JCS), CINCs, and other JCS-approved users via multichannel terminals such as the AN/TSC-85/93. Allocation or redistribution of these terminals to other units or to lower echelons is possible depending on the mission and communications requirements. These terminals provide the user with data connectivity through the Worldwide Military Command and Control System (WWMCCS), which provides long-haul communications for the deploying unit.
- Fleet satellite (FLTSAT) systems, Air Force satellite communications (AFSATCOM),

and leased commercial satellite (LEASAT) systems provide UHF, single-channel, secure-voice, low-data-rate communications to support requests and the dissemination of information/data necessary for mission planning and battle command via receivers such as the AN/PSC-3, AN/VSC-7, AN/PSC-10 (LST-5), AN/PSC-7 (MST-20 Plus), and enhanced manpack UHF terminal AN/PSC-5. JCS has mandated that UHF MILSATCOM systems be demand-assigned, multiple-access compatible, and provide the necessary communications security required. The Army response to this mandate is the AN/PSC-5, which will satisfy the need for single-channel communications at corps echelons and below. Special operations, airborne, and light division forces, and the corps and division warfighter net will primarily employ the terminal. The AN/PSC-5 will eventually replace the AN/PSC- 10 LST-5), AN/PSC-3, AN/VSC-7, and the AN/PSC-7 (MST-20 Plus) systems. Redistribution to lower echelons can be requested depending on mission requirements.

- Commercial international satellite systems, such as the International Telecommunications Satellite (INTELSAT) and International Maritime Satellite (INMARSAT), provide worldwide voice and low-data-rate communications through commercial phone systems at fixed sites or through portable terminals such as very small aperture terminals (VSAT).

Milstar is the next generation US military communications satellite. It will provide highly survivable, jam-resistant, worldwide secure communications to strategic, operational, and tactical forces (currently planned down to division level). Milstar primarily uses extremely high frequency (EHF) for uplink and downlink, but the satellite also has some UHF capability for broadcast communications. This system will reduce some of the load on DSCS and Army reliance on FLTSAT and AFSATCOM. The single-channel antijam man-portable terminal and the secure, mobile, antijam reliable tactical terminal (SMART-T) transceivers will be used to support this system.

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Intelligence is fundamental to effective planning and vital prior to beginning operations. Data' bases and regional assessments developed during peacetime should provide planners information on the availability of infrastructure such as roads, ports, and airfields as well as existing resources and facilities, Data bases also will provide seasonal weather and terrain conditions, the capabilities of potential adversaries, and other impediments to stability. As planning progresses and deployment decisions are made, requirements for information accuracy and timeliness are increased. Both vary by echelon of command and both affect operational decisions.

National space systems are capable of providing worldwide surveillance and reconnaissance and can satisfy many predeployment intelligence requirements. While these systems are controlled at the national level, Army forces can receive this information through the TENCAP Program, TENCAP provides Army commanders with high-leverage equipment that can leverage, process, correlate, exploit, and disseminate data provided by national space systems. Initially, equipment such as the Digital Imagery Test Bed and Interim Tactical Electronic Processor were developed for corps utilization. Through preplanned product improvement and technology insertion, systems were modernized and downsized to field at EAC, corps, and echelons corps and below. These systems include the Modernized Imagery Exploitation System (MIES), Enhanced Tactical Radar Correlator (ETRAC), Electronic Processing and Dissemination System (EPDS), Enhanced Tactical Users Terminal (ETUT), Mobile Integrated Tactical Terminal (MITT), and Forward Area Support Terminal (FAST). Redistribution can be made to other units in accordance with mission requirements. Factors affecting these decisions vary

according to the nature of the command, the priority and timeliness of the requested information, and the type of intelligence requested, for example, imagery and signals.

During the mobilization and pre-deployment phase, space systems provide the critical linkage between the contingency area and the units in CONUS (see Figure 3-3). This link allows units still in CONUS to perform IPB and tactically tailor the force to be sent to the contingency area.

During deployment and entry operations, the deployable intelligence support element (DISE) (see Figure 3-4) provides the deployed commander accurate, detailed, continuous, and timely intelligence via direct downlinks from IEW sensors and communications satellites providing broadcast dissemination,

Weather, Terrain, and Environmental Monitoring

Knowledge of current weather and terrain in the area of operations, along with an accurate prediction of future conditions, will support deployment decisions and operational planning. Analysis of weather, terrain, and other environmental factors is a critical step in the planning process for the deploying unit. Satellite systems provide Army units imagery data to support mission planning, terrain analysis, and mapping, and the meteorology information to support trafficability analyses and route selection.

Figure 3-3. ACE Support During Mobilization/Premobilization

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DMSP and geostationary operational environmental satellite (GOES) data is received at the Air Force Global Weather Central where it is processed. Weather-related products are disseminated to users throughout the world, including staff weather teams supporting the Army. The primary use of DMSP during predeployment is to provide atmospheric data for input into weather prediction models. Requests for DMSP data will be received via mail or courier and formatted in hard copy or on tapes and disks. Currently, DMSP does not link directly to tactical Army units, but some prototype receivers—small weather terminals (SWT)—providing this capability have been developed and may be available down to the division level. When tasked by Army DCSOPS, USARSPACE Army Space Support Teams (ARSSTs) can deliver direct downlink high-resolution satellite weather receivers (DMSP-capable) to deploying Army divisions or corps. The SWT will be integrated into the Integrated Meteorological System (IMETS) in the future. The staff weather officer (SWO) must plan for and request the use of DMSP prototypes,

Figure 3-4. ACE/DISE Support to Early-Entry Operations

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particularly when Army aviation operations play a significant role in the anticipated mission.

Data and imagery from satellites facilitate deployment planning, knowledgeable entry into the area of operations, the selection of assembly areas, trafficability analyses, and route selection. Numerous countries have developed satellite systems to gather data on the earth's environment from space. The US's Landsat and GOES, France's SPOT, Japan's MOS, and Europe's ERS-1 are all capable of providing a variety of imagery and other data ranging from 5- to 80-meter spatial resolution. This data supports deployment decisions and operational planning and is also useful in computer-assisted analyses of terrain in denied areas.

To support the other phases of operational planning, Landsat and SPOT MSI data maybe procured to-

- Update geographical data and data bases.
- Support mapping requirements.
- Analyze trafficability.
- Develop predictive models.
- Display situations.
- Develop simulations.
- Support mission planning and rehearsal.
- Train.

MSI data can also be used to identify potential assembly areas, main supply routes, and location of battlefield control measures. MSI prototype workstations, using commercial software and hardware, are available to the terrain teams supporting tactical units—normally the division-to enhance images and merge MSI data. The USARSPACE ARSST delivers compact MSI processing and exploitation equipment to deploying Army divisions and corps when directed by Army DCSOPS.

Position and Navigation

Accurate, responsive position determination and navigation are essential to the conduct of all military operations. By establishing connectivity with NAVSTAR GPS, users anywhere in the world will be able to receive signals from at least four satellites at all times, providing three-dimensional position, velocity, and time information. Approximately 40,000 GPS receivers are being distributed throughout the Army. These include small numbers of expensive, bulky, first-generation receivers (AN/ASN-149, AN/WRN-6), commercial hand-held receivers (AN/PSN- 10), and large numbers of the current second-generation receiver, the precision lightweight GPS receiver (PLGR), AN/PSN- 11. Over the next decade, the PLGR will remain the primary hand-held GPS receiver. It will be supplemented by the use of embedded GPS, wherein GPS is built into a variety of mobile systems including armored vehicles and weapons firing platforms. Prototype hardware and software systems that integrate GPS and other SATCOM systems, such as the GPS Army Battle Command System (ABCS), are being developed and will be used to support resource tracking,

Missile Warning

Army forces are particularly vulnerable prior to and during deployment, Using space capabilities, missile warnings can be provided to Army forces during predeployment and deployment operations. Data from Defense Support Program (DSP) satellites is centrally processed and warning is transmitted to tactical units via satellite communications systems using the Tactical Event Reporting System (TERS) or similar capability. The information provided is used to protect the force during all phases of the operation, although during other phases the capability is available to direct downlink DSP data to joint tactical ground stations (JTAGSS).

OPERATIONS

Successful operations require the ability to anticipate situations, to respond with greater agility and capability than the enemy force, and to support an increased operational tempo. Timely and accurate information is necessary to plan operations, promote stability, deter conflict, and defeat the warfighting capabilities of potential adversaries. Whether in combat or

noncombat operations, the force commander must establish conditions conducive to effective and decisive operations. He accomplishes this by isolating the enemy force or impediments to stability-for example, nontraditional threats—and seizing and maintaining the initiative. Helping develop economic infrastructures and training and equipping indigenous security forces are examples of noncombat operations that help create conditions to support economic and/or political programs. In combat situations, friendly forces are positioned to facilitate decisive operations—for example, shaping the battlefield to avoid enemy strengths and generating overwhelming combat power that leads to a quick victory. The timeliness of these actions is critical to establishing conditions for decisive operations and protection of the force. Supporting the allocation of resources requires a current and accurate assessment of the situation.

Communications

Space-based communications systems provide the global connectivity necessary to support the command and control functions of planning, coordinating, directing, and controlling. This capability is essential for the real-time direction of operations at each echelon of command and for the establishment of a global communications capability. Requirements for military satellite communications support must be submitted to the CINC, who prioritizes the requests in accordance with the theater operations plan. These requests are then forwarded to the JCS for action.

SATCOM systems with multichannel capability provide range extension for mobile subscriber equipment (MSE) and the Joint Tactical Communications System (Tri-Tat), SATCOM also support joint service interoperability. Single-channel terminals support battlefield voice and data communications as part of combat radio net and Army special communications for force management, emergency action message **(EAM)** dissemination, and special operations forces (SOF) communications. These systems provide responsive, beyond-the-line-of-sight communications throughout the battlefield and permit users to access large data bases necessary to support strategic, operational, and tactical missions. Coupled with space-based intelligence support, tactical forces are afforded improved capabilities to target the enemy, coordinate fires, conduct operational maneuver on both linear and more open, less structured battlefields, assess the effects of previous operations, and anticipate enemy actions.

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A variety of satellites provides links to ground stations for timely dissemination of information to enable Army forces to recognize critical events as they occur, influence the decision-making process, enhance IPB, and support total force positioning within the battle space. Observation, terrain sensing, weather, communication, and positioning and navigation satellite systems provide information that updates and increases the commander's situational awareness.

Timely information is essential to support the operational tempo required to shape the battlefield and to attain positional advantage. Space-based sensors have the advantage of unrestricted access over battlefields and other areas that are difficult to observe due to political or military reasons. Space systems allow commanders to see some areas of operations far better than current terrestrial systems; however, cloud cover can affect the use of space systems operating in the visible spectrum. Commanders can receive deep operations information as quickly and as accurately as close operations information. When information derived from space-based reconnaissance, surveillance, and target-acquisition sensors is merged with information from ground and airborne systems, situational awareness is improved and uncertainty reduced.

The availability of information from national space systems via the MIES, FAST, and MITT will be critical to establishing the tempo of Army operations. Space systems facilitate the maintenance of a high tempo by providing accurate and timely information. During offensive operations, commanders seek a tempo that maintains relentless pressure on the enemy to prevent him from recovering from

the effects of the attack. In the defense, commanders seek to disrupt the enemy's tempo and synchronization. Near-real-time information available from space systems permits Army forces to observe enemy activities and to determine their intent. This facilitates rapid decision making, coordination of fires, and maneuver of friendly forces. It enables the force to avoid enemy strengths and to exploit enemy weaknesses. Access to data from space-based observation platforms also limits the ability of the enemy to strike unexpectedly. Satellites provide early warning data that can be integrated directly with Army terrestrial weapon systems and capabilities of other services to attack, separate, isolate, and attrit enemy forces. This makes massing difficult for hostile forces, making them vulnerable to decisive maneuver by friendly forces. Space-based sensors also provide information essential to the battle damage assessment process. This information greatly enhances the efficiency of deep fires by reducing the number of reconnaissance missions and the redundant expenditure of munitions.

Weather, Terrain, and Environmental Monitoring

Each theater of operations is supported by an Air Force weather team that has a transportable DMSP receiver, the Mark IV van. DMSP support to the Army is indirect—via facsimile or courier to the SWOs and G2s. DMSP prototype receivers may be available to support weather requirements, movement decisions, trafficability analyses, and so forth. SWOs supporting deployed divisions and separate brigades use the Wraase weather receiver to provide near-real-time local weather images. Wraase receivers operate independently of land line communications. MSI and hyperspectral imagery (HSI) from space have proven invaluable for mapping and monitoring vegetative, geological, oceanographic, and environmental conditions and changes. This data provides timely and unique information to terrain analysts that can be integrated with other intelligence to support IPB for a more complete picture of the battlefield. MSI/HSI workstations, normally operated by terrain teams, are used to manipulate multispectral data to support terrain analyses and provide up-to-date, large-area views of the battle space. Specific applications include-

- Change detection.
- Perspective views to support mission planning, route selection, and so forth.
- Battle damage assessment.
- Obstacle overlays.

Position and Navigation

NAVSTAR GPS satellites enhance command and control, support fast-paced operations, permit efficient maneuver, and reduce fratricide by providing extremely accurate, three-dimensional location data for continuous day and night operations. Passive receivers convert signals from the satellites into timing, position, and navigation data to support Army forces worldwide. This capability enhances joint and multinational operations by providing a common datum grid (for example, World Geodetic System-84) upon which all operations can be based. Positioning and navigation satellites facilitate the rapid and accurate survey necessary for positioning weapon systems, sensors, and minefield without the use of traditional survey teams. The integration of these capabilities with weapon systems will improve weapon system performance. Other applications of GPS include-

- Enhancing coordination with the other services and allied units.
- Facilitating synchronization of combat operations by providing universal timing and common grid information.
- Precisely positioning indirect fire systems, thus improving weapon system performance.
- Tracking critical assets.
- Assisting in linkups and coordinating offensive/defensive responsibilities.
- Reducing the potential for fratricide due to friendly fires.

Missile Warning

The ability to detect and track potential threats—for example, aircraft and missile launches—and to warn designated ground systems is essential to protect the force, facilitate freedom of movement, and retain the initiative. For example, DSP satellites can provide the first indications of ballistic missile attack. This data is transmitted to control segment ground stations for processing. Subsequently, it is passed to air defense and other units deployed in theater. Army forces can receive the warning within two to four minutes of launch, reducing the element of surprise. Using DSP data, units can determine the location of the launch point and the probable point of impact. Other national satellite systems can be used to provide early warning of enemy troop activities, movements, and critical events (see discussion on RISTA).

Space control operations facilitate freedom of action in the area of operations as well as in space. These operations include surveillance of space activities and systems and antisatellite operations designed to ensure space support to Army forces. Space control operations, when directed, suppress and negate enemy space capabilities, permitting land forces tactical, operational, and strategic flexibility and preventing an adversary's satellites horn monitoring ground operations. The development of a force application capability from space will extend the power projection capability of terrestrial forces. This capability will support deterrence and will permit the attack of high-value targets throughout the area of operations. Additionally, it will facilitate maneuver and assist in protecting land forces from attack by strategic and tactical aircraft and missiles,

REDEPLOYMENT AND RECONSTITUTION

Reconstitution of the force relies on communications and the transfer of information in order to anticipate requirements. Responsive and efficient actions to respond to such requirements are facilitated by the range and data capability of space-based systems and their ability to collect information on all forces and the environment. Asset visibility and movement tracking are essential for effective reconstitution operations. They enable CSS units to tailor and adjust assets in response to the needs of the force. Using the versatility of modern computers, communications satellites can be linked with space-based position location and navigation systems to provide the requisite asset visibility, decrease the length and size of the logistical pipeline, and ensure real-time battle command of all CSS assets within the area of operation, Space capabilities also support real-time battlefield damage assessment, casualty reporting, and asset location, routing, and tracking. These capabilities facilitate unity of effort and economy of force.

Communications

Military and commercial space-based communications satellites-DSCS, FLTSAT, INTELSAT, INMARSAT, and so forth-can be used to provide long-haul strategic communications between the redeploying unit, CINC, and CONUS to support movement planning and coordination. During this phase of the operation, these systems can be used as the theater communications infrastructure while the unit is preparing for redeployment and dismantling other supporting communications systems, for example, MSE. The DSCS provides strategic communications via the AN/TSC-85/93 terminals, which interface with the WWMCCS. Availability of these systems may be limited based on national priorities. When required, commercial satellite systems capable of voice and low-data-rate communications through telephones and portable terminals may be employed to support communications needs, coordinate movement, update data bases, and report readiness of redeploying units. INTELSAT and INMARSAT terminals cannot be utilized during movement; however, industry is developing systems that may be available to support Army communications requirements during mobile operations. Signal officers at each echelon of command plan and coordinate for use of these systems.

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During reconstitution and redeployment operations, national space systems can be used to

maintain situational awareness, monitor postconflict operations, and assess the condition and availability of the host nation infrastructure-for example, roads, ports, airfields. These systems can also support crisis and battle damage assessments. The near-real-time information available from space systems is vital to the planning and execution of reconstitution and redeployment operations. It facilitates decision making, helps prevent surprises, and makes regaining the initiative difficult for hostile forces. The capability of these systems to collect information on all forces and activities enables commanders to tailor and adjust assets in response to operational requirements and to facilitate unity of effort and economy of force.

Commanders must clearly define and articulate RISTA requirements during this phase of an operation since the number of receivers and processors may be limited. Equipment not required for subsequent operations will be redeployed to the home theater and prepared for future missions. Redistribution of assets may be required to ensure adequate support born national systems. Depending on the requirements in the area of operation, these assets may be centralized, moving from tactical units to higher echelons of command.

Weather, Terrain, and Environmental Monitoring

Near-real-time weather information on the local area can be received at tactical units using the Wrasse receiver. These receivers provide sufficient weather information to support redeployment activities and planning. Normally, the SWO or supporting Air Force weather team will continue to provide DMSP data to support weather prediction and redeployment planning. DMSP data may only be available via land line-normally via facsimile-depending on the location of the DMSP receiver and disposition of Army forces.

During reconstitution and redeployment operations, multispectral imagery can be used to support mapping requirements, trafficability analysis, and overall weather, terrain, and environmental monitoring. Coupled with data obtained via weather satellites, units can determine equipment assembly and preparation areas in theater and the conditions in the areas to which the units are redeploying. Accurate recording of actual postwar conditions may be a key mission for departing terrain analysis teams assembling updated ground observations for corrections to existing maps. Hand-held data-logging computers coupled with GPS receivers can provide effective reconnaissance recording to augment imagery coverage of areas of interest.

Position and Navigation

GPS receivers are used for navigating, tracking, and positioning units and assets to support reconstitution operations. Depending on the number of receivers available, units may have to redistribute the assets during the reconstitution phase to support continuing operations, Redistribution also may be necessary to support redeployment operations. Applications in either phase would be about the same as those used in combat, but would be focused primarily on transportation support and logistics operations. The data available from these receivers increases the efficiency and effectiveness with which Army forces maintain asset visibility.

Missile Warning

Once a crisis has been terminated or the decision made to withdraw Army support, national systems—in conjunction with any sensors remaining in the theater of operations—will be used to monitor the situation to ensure stability and support the withdrawal of forces. DSP assets will continue to monitor the area of operations and to provide warning information needed to protect redeploying forces.

OPERATIONS DEMANDING SPECIAL EMPHASIS

Operations demanding special emphasis include MOOTW, special operations, and information operations.

MILITARY OPERATIONS OTHER THAN WAR

The use of Army forces in support of MOOTW is becoming more frequent and

requires commanders and staff planners to exercise a very high degree of global situational awareness. Using space system capabilities can significantly enhance the provision of short-notice assistance due to natural disasters, to include floods, forest fires, earthquakes, and so forth. The efficiency and effectiveness of conducting successful MOOTW within the US and abroad also can be greatly improved when space systems are employed. Employment of space systems during peacekeeping, disaster relief, noncombatant evacuation, and other MOOTW provides the agility needed to ensure success.

SPECIAL OPERATIONS

For the most part, special operations differ from other land operations in that they span the full range of possible military operations, including covert and clandestine operations. Short of war, the main purpose of a special military operation may be psychological, the focus being to undermine the legitimacy of the government or influence the attitudes of the people. When planning for the organization and deployment of SOF, the best systems for communications, navigation, and intelligence support are required. Due to the nature of special operations, precise location of targets and low-probability-of-detection-and-intercept operations are the norm. Space assets can provide the edge needed in areas where these capabilities do not exist.

INFORMATION OPERATIONS

According to FM 100-5, "... the primary purpose of the Army is deterrence; but should deterrence fail, the Army's purpose is to win the nation's wars by fighting as part of a joint force of the United States." Only by leveraging and protecting the wide array of current and evolving space-based capabilities in support of information and other Army operations can the US remain capable of deterring, or if called upon, winning the nation's wars.

When supporting a national-level information warfare campaign, IO can prevent the initiation of hostilities by imposing the perception that taking hostile actions against the US or its allies would not be in the best interest of a potential adversary, Space-based systems offer an unrestricted environment to affect these operations.

Space-based systems offer an extensive array of active and passive capabilities to support IO. They facilitate the use of IO to deter war and, if required, can support IO throughout the spectrum of conflict. Space-based systems offer significant political and technical advantages to force projection operations, allowing global monitoring and the assessment of capabilities without concern for national boundary restrictions. Space-based assets are particularly supportive of intelligence during force projection with supplementary input from non-DOD and non-US systems. Additionally, these systems support IO by compressing the friendly decision cycle while allowing means to access and influence the adversaries.

Space-based systems provide commanders reconnaissance, surveillance, navigation, and positioning that greatly facilitate battle command. They significantly upgrade the speed and accuracy of information that commanders exchange with subordinates.

The efficiencies resulting from the use of space capabilities have a dramatic effect on ground combat operations. Precise knowledge of the location of friendly and enemy forces allows decision making, quick adjustments of fires, and greater protection of the force.

Space-based support to IO is varied and global. Military and civilian communications satellites provide responsive, worldwide, line-of-sight communications links to tactical forces. TENCAP also provides reconnaissance, surveillance, and target acquisition support to tactical units. The DMSP and civilian environmental monitoring satellites provide weather and terrain information.

IO battle space is also global, requiring the full integration of strategic, operational, and tactical capabilities. This means that space systems must be integrated into the Army's IEW capabilities for support to the warfighter to ensure commonality of graphically depicted

data and overall focus. Commanders and operators alike must be trained on the capabdities and limitations of national systems and how the entire warfighter support process can be strengthened through the synchronization of organic, theater, and national systems. Proper training will ensure better understanding of, ensure more effective use of, and capitalize on the advantages of all systems to meet the warfighter requirements: accuracy, timeliness, resolution. No one suite of systems or echelon of support can do it all.

US ARMY SPACE ORGANIZATIONS, OPERATIONS, AND PROGRAMS

Army decision makers, staff planners, organization designers, and resource managers at every level must ensure that the importance and dependence of today's force projection Army on space systems is fully recognized, planned for, and addressed in force requirements documents. Mission success across the full range of military operations is directly dependent upon the efficiencies employed to ensure realization of effective battle command. Space systems are needed to establish assured communications, disseminate orders, and promulgate passage of the commander's intent throughout the command. To accomplish this mission, the Army has committed resources to form dedicated space organizations and to implement space-specific programs to ensure continued support of the Army's space policy requirements and attainment of national security objectives.

US ARMY SPACE AND STRATEGIC DEFENSE COMMAND

The USASSDC is the Army's space organization directly responsible to the Chief of Staff, Army, for ensuring Army efforts are focused on finding ways that space systems can best serve the warfighter. USASSDC works with other Army major commands to ensure space systems required by Army forces are properly identified, developed, and fielded to the warfighters. As the responsible command for the development and deployment of the Army's integrated air and missile defense systems, USASSDC operates the Army's portion of the technology and research base of the Ballistic Missile Defense Organization. Through the ASPO, USASSDC manages its mission of leveraging the exploitation of national space assets through the TENCAP Program.

US ARMY SPACE PROGRAM OFFICE

ASPO, a field operating activity of USASSDC, is responsible for executing the Army's TENCAP Program. As the Army's interface to classified national space programs, ASPO leverages those efforts to deliver systems that provide commanders with space-derived data to support operations. ASPO is responsible for working with national programs to develop, procure, test, field, and sustain TENCAP systems.

Due to the exceptional nature of the TENCAP Program, ASPO receives direction and guidance from the Headquarters, Department of the Army DCSOPS. A TENCAP General Officer Steering Group provides strategic guidance and oversight for the TENCAP Program.

TENCAP systems currently function both as preprocessors and as correlation and fusion systems. As the ASAS and the common ground station (CGS) mature, TENCAP systems will assume the role of preprocessors with both direct and indirect links to national and theater systems, feeding that data to ASAS or the CGS.

US ARMY SPACE COMMAND

USARSPACE, a major part of USASSDC, serves as the Army component to USSPACECOM. It is responsible for commanding the Defense Satellite Communications System operations centers (DSCSOCS), managing joint tactical use of DSCS, conducting "user" planning of Army BMD forces, serving as the "user" representative for

BMD, assuring access to and use of space capabilities to enhance accomplishment of Army operations, and executing the Army Space Exploitation Demonstration Program (ASEDP). Support from specially trained space forces, such as the ARSST based at USARSPACE, will often form the nucleus of space support augmentation to deploying Army forces. Availability of these resources is essential, since the application of space capabilities directly impacts on the effectiveness of the force.

US ARMY SPACE EXPLOITATION DEMONSTRATION PROGRAM

The ASEDP managed by USARSPACE is not a training program per se; however, it provides an opportunity to introduce Army personnel to space-related capabilities that can enhance the execution of Army operations. Numerous capabilities have been demonstrated to Army units since the program's inception in 1986. The program focuses on new ideas and technologies to solve deficiencies and satisfy requirements that the Army identifies. Some demonstrations have resulted in operational capabilities such as small lightweight GPS (SLGR) and Wrasse receivers; others have been deployed to support Army missions throughout the world. Operations Desert Storm and Restore Hope are examples. The demonstration program has been instrumental in showing the field Army the value added by space capabilities.

The Army is exploiting space capabilities through the battle laboratories and Louisiana Maneuver processes. Lessons learned from these processes must be passed to tactical units and then applied in a field training environment to ensure adequate support is provided to the deploying space capabilities and personnel. These space-related capabilities do not have the benefit of an embedded traditional support system. If the Army is well versed in using space capabilities, the normal train-up period required to effectively use them in an operational environment will be reduced significantly. Simply stated, the Army needs to train with space systems to make them a normal part of Army operations.

USARSPACE ARMY SPACE SUPPORT TEAMS

Recognizing the value of space-related capabilities to current contingency operations, Army leadership directed the establishment of the ARSST concept, with the ARSSTS assigned to USARSPACE. These teams possess communications, weather, and battlefield visualization equipment whose utility was proven via the ASEDP during Operations Desert Shield/ Storm and many subsequent military operations. ARSSTs are provided to selected forces when responding to contingencies. For example, these teams are presently equipped with briefcase-size INMARSAT terminals ideal for early/forced-entry communications in force projection operations. Numerous other communications satellite systems are capable of providing similar services. This capability can be used to augment military systems. Staff planners responsible for communications and unit signal officers need to determine requirements and request this support as early as possible in the planning phase of the operation.

Army DCSOPS approves apportionment of these teams, which are sized to support a division-size commitment such as Operation Restore Hope in Somalia, to augment Army component units in the planning and execution of contingency operations. ARSSTs may be tailored to fit a variety of contingencies and may be augmented by newly developed technology that impacts warfighting.

During peacetime, ARSSTs participate in division- and corps-level exercises to train unit personnel on space system exploitation and to develop the habitual relationships vital to effective operations. As improved space-based capabilities mature, new systems may be added to the ARSST equipment inventory. Army planners and staff personnel must know the capabilities of the ARSST, how to support the team when deployed, and how to obtain its support through the DCSOPS.

BALLISTIC MISSILE DEFENSE

While the risk of strategic attack has decreased significantly over the past few years, deterring attack must remain a high priority for the US. Strategic deterrence results in part from development of defensive capabilities that

will guard against the possibility of an attack. The goal is to discourage an enemy attack. The Army has a role in a number of areas that have strategic defense deterrence value.

The Army began its involvement in programs to defend the United States against intercontinental ballistic missiles (ICBMs) in the 1950s. In recent years, the Army has been an important participant in the Strategic Defense Initiative (SDI) Program (see Figure 3-5) and has received more than one-third of the program's funding for research and development. The Army's participation in the SDI Program focused on the ground-based interceptors and sensors. This research and development reflect an innovative technology base supported by careful economic planning capable of sustaining it. The Soviet Union realized that nothing was to be gained from an arms race with the US. This provided the US with the arms control leverage necessary to successfully negotiate the Strategic Arms Treaty which resulted in a significant reduction in the numbers of nuclear weapons on both sides.

Over the years, as US security policy has changed from one of retaliatory offense to one of strategic defense, the concepts of how to achieve ballistic missile defense have evolved significantly:

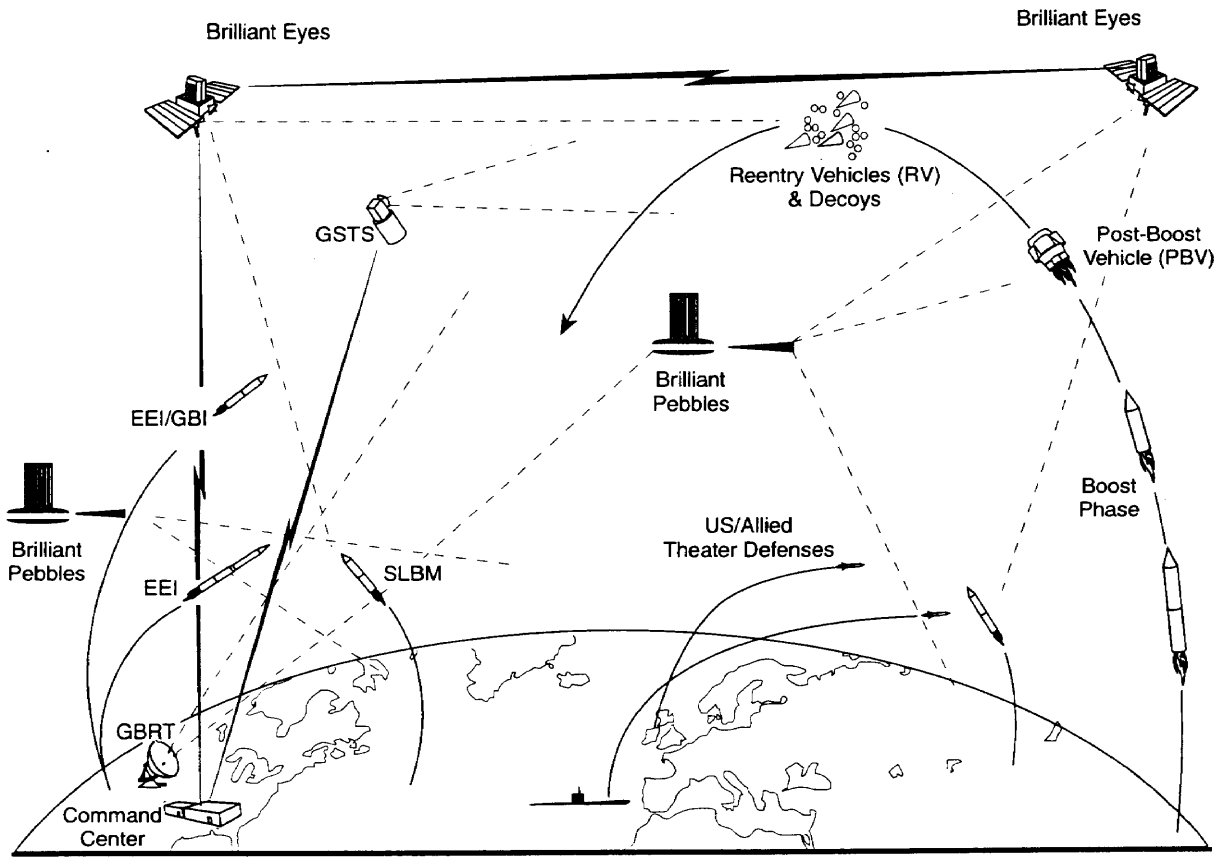
- March 23, 1983 - President Ronald Reagan announced the original concept of a near-perfect "star wars" shield to protect the US from an all-out surprise attack.
- January 29, 1991 - President George Bush redirected the US missile defense efforts to focus on limited or accidental missile attacks. This concept, known as global protection against limited strikes, included the research and development of tactical, theater, and strategic ballistic missile capabilities to provide protection to the US and deployed forces. Under this concept, the Army was to operate the ground-based sensors and interceptors in support of USSPACECOM.
- May 13, 1993 - Defense Secretary Les Aspin declared the official end of the "star wars" era and established the Ballistic Missile Defense Organization to focus primarily on ground-based defense systems. Space-based weapons systems were relegated to the laboratory to support follow-on technologies.

Present policy divides ballistic missile defense into three categories: TMD, NMD, and supporting follow-on technologies. The highest priority is given to TMD, with a goal of countering Scud-type missiles. The Army's experience in missile defense technology developed over the last 40 years postures the Army to be a major contributor in both the TMD and NMD programs. The pursuit and ultimate deployment of TMD and NMD systems will lead to full-up objective systems that will provide a new level of strategic security. With the Army's historical role in missile defense technology and emerging national priorities, the Army will probably operate ground-based sensors, interceptors (at both higher and lower altitudes), and battle command networks.

COUNTERSPACE AND ANTISATELLITE OPERATIONS

The rationale for developing a counterspace capability is to protect the force from enemy satellites and assure friendly access to space. With the collapse of the Soviet Union, the threat to US satellites has been greatly reduced in the near term; however, the acquisition of space capabilities by potential adversaries has increased. Currently, the only means available to the Army to defeat an adversary's space capabilities is to jam or destroy the ground segment of the space system. As the ground segments become smaller and more mobile, finding and targeting them will become more difficult. In some situations, ground or air attacks may be too risky or politically unacceptable. Given the proliferation and potential of space capabilities, if an adversary's ground segment cannot be destroyed or neutralized, a capability to destroy or neutralize the space segment is required to support force projection operations and the national military strategy.

Figure **3-5. Original SDI Concept**



DSCS OPERATIONS

The DSCS is a high-capacity, SHF system designed to provide worldwide, long-haul, secure-voice, high-data-rate communications to support strategic, operational, and tactical requirements. It is a subsystem of the Defense Communications System (DCS). USARSPACE, as the operational component of the Army Space and Strategic Defense Command, has a critical role in the operation of DSCS. USARSPACE performs payload and network control, supports tactical users from all services, and trains DSCS personnel for contingency operations. USARSPACE also operates ground stations for the DCS network for national communications in accordance with joint services tasking and in support of US SPACECOM. To perform these functions, USARSPACE uses—

- The DSCSOCs .
- The Satellite Communications Control Centers (AN/MSQ-114).
- The Regional Space Support Centers (RSSCs).
- The DSCS Operations Control system Certification Facility (DCF).

The DSCSOCS exercise strategic/tactical network and payload control with the assistance of the mobile satellite control terminals for tactical ground mobile forces (GMF) communications requirements. The RSSCs control network planning and power/

bandwidth allocation for GMF missions. The DCF performs a critical DOD mission by providing training to selected Army individuals in platform, payload, and network control of the DSCS satellites.

KWAJALEIN ATOLL

To support strategic offensive and defensive program testing, the USASSDC operates the US Army Kwajalein Atoll (USAKA) as a national test range asset. The range is capable of collecting highly accurate data vital to both testing and space surveillance. It enhances strategic security by reducing the chance of surprise with regard to space objects. The Army also operates radars that support data collection for the terminal and midcourse portions of ICBM trajectories.

The Army's development and operation of Kwajalein supports DOD and other government agencies in tracking and collecting data on missiles and space launches. USAKA provides sensor support to USSPACECOM, under the scientific and technical direction of the Massachusetts Institute of Technology Lincoln Laboratory, for space surveillance and space object identification (SOI). The USASSDC executes daily operations in support of NMD and TMD testing. USARSPACE monitors the USASSDC contractors to ensure optimal support to the space surveillance task. It coordinates with USSPACECOM and USAKA for any new sensor mission requirements.

ARMY ASTRONAUT DETACHMENT

The Army Astronaut Detachment provides a means for testing space capabilities that may have potential applications for command, control, communications, and intelligence functions for the warfighter. One of its missions is to explore and provide information on the operational utility of applying man's unique power of observation and decision making to the space environment. Information provided by Army astronauts can be measured by conducting various concept evaluations on the space shuttle, Concept evaluations are described as those manned space flight activities that evaluate man's ability to enhance or conduct military operations in or horn space. Concept evaluations attempt to discover what man can do in space to improve the effectiveness of military operations. Human observation, interpretation, versatility, dexterity, motivation, adaptivity, and decision making are capabilities that machines cannot duplicate. To accomplish this mission, the Army maintains a detachment at the Johnson Space Center in Texas under operational control of NASA. Just as Army members were instrumental in exploring our nation's western frontier, today our Army astronauts are playing a key role in exploring the frontier of space. The detachment's other missions are---

- To support the national manned space program.
- To provide engineering expertise for human interface.
- To enhance Army doctrine by focusing Army manned efforts in space operations and requirements.

TRAINING

A final note on the application of space systems: We must train the way we intend to fight. Training to high standards is essential. Emphasis must be on integrating training related to space systems into formal leadership-officer, NCO, and civilian—courses throughout the Army training community, Defense Mapping Agency (DMA), and other DOD activities appropriate to the individual's level of involvement with such systems. This training must include the use and application of space systems available to these individuals in their current assignment. Special management of officers who have been awarded Skill Code 3Y (Space Activities) are required to ensure maximum utilization of their space skills in support of operational requirements.

The value of using space systems has been demonstrated in war and MOOTW. During past operations, space assets were made available at the last minute, providing little or

no opportunity for training and developing ways to best exploit them in support of ongoing operations. Since space systems are leading-edge technology and may still be in research and development or demonstration stages, the incorporation of support requirements and lessons learned from past deployments into training is essential. As space awareness increases and the use of space systems and capabilities becomes common across the Army, increase in operational effectiveness should result. Soldiers and leaders need access to space systems and capabilities as a routine part of training in the classroom and field environment. This access can either be to the actual systems or to surrogate computer-generated simulations.