FM 3-14
(FM 100-18)

SPACE SUPPORT TO ARMY OPERATIONS

MAY 2005

HEADQUARTERS
DEPARTMENT OF THE ARMY

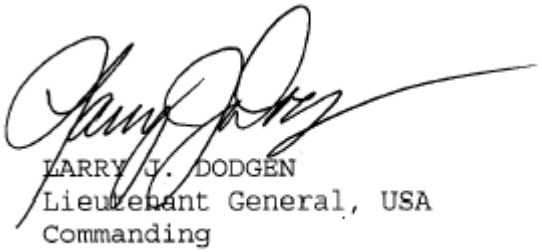
Foreword

The Army is critically dependent on space capabilities to enable and enhance land warfare. Virtually every Army operation uses space capabilities to some degree. Today, we use space largely for its ability to enhance the effectiveness of our combat forces. We can communicate; navigate; target, find, and fix the enemy; anticipate weather; and protect our forces based on combat and support assets available from space. We also strive to control space so adversaries cannot overcome our asymmetrical advantages in space. Space provides tremendous leverage to the Army's land warfare capability.

The Army views space as a vertical extension of the battlefield and an integral part of the battlespace, one that has been especially instrumental during the ongoing global war on terrorism. The Army's transformation also integrates space into all phases of planning and operations as a core element of that process. The Army's future force, serving as part of the joint force, will be even more adaptable and lethal, leveraging the capabilities of the ultimate high ground. The nature of warfighting is changing rapidly, and the Army's strategic role in space is evolving as a result.

Our dependence on space will increase in the future as space-based capabilities enable the future force concepts of information superiority, enhanced situational awareness, and high-tempo, non-contiguous operations. Space use will increase as technology propels us toward more flexible and less expensive access, and development of more comprehensive space warfighting tools. History and the march of technology tell us that the time will come when we use space not only to enhance land warfighting capabilities, but also for direct combat, in other words, force application from space.

The doctrine contained in this field manual is an essential component of the Army's efforts to maximize the contributions that space capabilities bring to land warfare. It describes the work our soldiers do now to use current space capabilities effectively. It also provides the Army framework for success as we grow more sophisticated and capable in our employment of space capabilities. Development of this space doctrine is an important step along the Army's transformation journey.



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***FM 3-14**
(FM 100-18)

Field Manual
No. 3-14

Headquarters
Department of the Army
Washington, DC, 18 May 2005

Space Support to Army Operations

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*This publication supersedes FM 100-18, 20 July 1995.

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Preface

This manual establishes guidance for employing space capabilities to support U.S. Army land warfighting dominance. It provides a general overview of space capabilities, reviews the direction for using space for national security purposes, and outlines the relevance of particular space capabilities to Army operations.

The doctrine in this manual documents Army thought for the best use of space capabilities. It provides traditional doctrine and a basis for advancing intellectual discussion and improvement of practical applications of space capabilities. This manual also contains tactics, techniques, and procedures outlining how to plan, prepare for, and execute space operations. The appendixes contain additional relevant information concerning use of space capabilities.

Space has domain characteristics vastly different from air, land, and sea. It would be misleading to capture in this document all that is done now with space and imply that is the end of it. New capabilities are commonplace in the space domain. Therefore, this manual is not a definitive "desktop" handbook for soldiers. It is important that soldiers continue to look to the future with responsiveness, adaptability, and flexibility toward what space can bring.

Unless this manual states otherwise, masculine nouns, and pronouns do not refer exclusively to men.

This manual applies to the Active Army, the Army National Guard (ARNG), and the U.S. Army Reserve (USAR). All soldiers, particularly senior operational commanders, their staffs, and space operations subject matter experts, will use this manual. Army forces will likely deploy this doctrine as part of a joint, interagency, or multinational military operation. Therefore, while this manual supports Army operations, it does so in the context of Army operations as part of a joint, interagency, or multinational task force.

The proponent for this field manual is the U.S. Army Space and Missile Defense Command (USASMDC). Send comments and recommendations on DA Form 2028 (*Recommended Changes to Publications and Blank Forms*) directly to—

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PART ONE

Principles

The objective of Army use of space is to support the Army's land dominance. Space is undeniably a critical element of Army operations. Moreover, the need for the Army to accomplish space operations is firmly established in policy and practice; in fact, many space capabilities are already well integrated into Army operations. The space mission areas are both critical and routine components of maneuver, stability, and support operations. Army space operations support Army and joint warfighting, and use of space capabilities is an inherently joint venture. This field manual is rooted in basic Army and joint doctrine that is characteristically progressive and evolving.

Chapter 1

Army Space Operations

Space is the newest of the warfighting media, alongside air, land, and sea. The harsh space environment, vast distances, and high speeds of orbiting satellites are all very different from what the Armed Forces deal with in the air, on land, and on or under the sea. Still, many of the principles that successfully guide operations in those environments are applicable to the space medium. The Army is committed to using space to its best advantage. Indeed the advantages are so great that it is clearly worthwhile to overcome the characteristic difficulties of the space environment. Use of space-based capabilities is not only common; it is critical, in Army operations.

SECTION I – SPACE OPERATIONS OVERVIEW

1-1. Space-based capabilities contribute to all Army operations. The Army continually incorporates existing and emerging space capabilities to further improve the effectiveness of its operations. The Army executes space operations and contributes to establishing and maintaining space superiority consistent with land warfighting dominance needs.

1-2. The Army of today leverages space capabilities to accomplish a wide variety of missions. Space-based and space-enabled communications; position, velocity, and timing; environmental monitoring; intelligence, surveillance, and reconnaissance (ISR); and missile warning support are robust capabilities that continue to be necessities for success on the battlefield. Robust space capabilities are a prerequisite for the Army of the

future. They enhance information superiority and situational awareness, aiding high-tempo, noncontiguous, simultaneous distributed operations.

1-3. The medium of space begins above the atmosphere of the earth and extends infinitely outward. Practically, however, the area between 90 miles and 22,300 miles above the earth is used for orbiting earth satellites. This, generally, is *space* as the Army uses the term. Operationally, *space* most often indicates the practical use of space assets, including satellites in this orbital envelope. *Space assets* are satellites in orbit, the ground equipment that interfaces with them, and other ground systems performing space missions. *Space capabilities* are derived from those assets. *Space operations* are those enabling operations that create or present opportunities to employ space to enhance the warfighting potential of the U.S. military and its allies and friends.

1-4. *Space forces* are the space and terrestrial systems, equipment, facilities, organizations, and personnel necessary to access, use, and control space for national security (Joint Publication [JP] 1-02). Other personnel are directly involved in routinely using space-based capabilities but are not "space forces" per the joint definition in JP 1-02. This includes satellite communications (SATCOM) equipment operators in signal battalions, satellite imagery analysts, and soldiers using global positioning system (GPS) equipment, for example. The reason for the distinction is that, as JP 3-14 indicates, Department of Defense (DOD) space forces "…are directed by [USSTRATCOM] component commanders…" whereas signal battalions, imagery analysts, and most soldiers are commanded by their Army Service component commander (ASCC) to the regional combatant commander or joint force commander, not by the United States Strategic Command (USSTRATCOM) ASCC.

1-5. Space operations are conducted by space forces and by personnel who routinely facilitate the use of space assets, bringing satellite communications; position, velocity, and timing; environmental monitoring; space-based intelligence, surveillance, and reconnaissance (ISR), and missile warning to the warfighter. Army space operations fall into two general categories: controlling space and exploiting space. Controlling space means to affect space to benefit U.S. efforts or detract from adversary efforts. Exploiting space is making space-based capabilities available to benefit operations.

1-6. The ability of the Army to capitalize on space systems, along with the ability to protect them and attack the adversary capability to use them, yield military power, and contribute to U.S. military space superiority. *Space superiority* is the degree of dominance in space of one force over another that permits the conduct of operations by the former and its related land, sea, air, space, and special operations forces at a given time and place without prohibitive interference by the opposing force (JP 1-02). The purpose of space superiority is to secure the freedom to take advantage of the capabilities provided by space systems (JP 3-14).

SECTION II – THE CHARACTERISTICS OF SPACE

The Commission unanimously concluded that the security and well being of the United States, its allies and friends depends on the nation's ability to operate in space.

Report of the Commission to Assess United States National Security Space Management and Organization

1-7. Space is the high ground. Space systems, consisting of satellites on orbit, ground stations, and launch bases, and the communication signals between the satellites and ground equipment, give land forces the advantage of an overlook of their battlefield from on high. Space hosts communications transponders, observation posts for ISR, transmitters broadcasting location and exact time information, sensors for weather and other environmental data, and sensors that can warn of enemy actions.

Space is a medium like the land, sea, and air within which military activities shall be conducted to achieve U.S. national security objectives.

JP 3-14

1-8. Space is the area above the earth's atmosphere. Satellites orbiting the earth are normally from 90 to 22,300 miles above the surface of the earth, traveling on the order of 17,000 miles per hour. Below 90 miles, there is too much atmospheric drag. The 1967 International Space Treaty dictates that satellites on orbit must be allowed free passage over countries. Nations cannot claim the space above them as their own, as they can the airspace. This allows the United States, other countries, and commercial entities to orbit satellites that freely traverse or occupy space.

1-9. Earth orbits are generally grouped into three basic categories defined by their altitude above the earth:

- Low earth orbit (LEO)—90 to 1,000 miles above the earth. Satellites in this orbit are close to the earth but moving quickly relative to the ground. This orbit is used mainly for reconnaissance, communication, and weather satellites, and manned space missions.
- Medium earth orbit (MEO)—1,000 to 12,000 miles above the surface and used mostly for GPS satellites.
- Geosynchronous earth orbit (GEO)—approximately 22,300 miles above the earth. Satellites at this altitude in circular orbits in the equatorial plane appear to be stationary relative to the surface of the earth. This orbit is very useful for communications, weather, ISR, and missile-warning satellites. This is the most used of the orbits.

1-10. There are two subcategories of orbits in terms of inclination to the equatorial plane and eccentricity (how oval the orbit is, with zero eccentricity being circular and the orbit becoming more oval as eccentricity increases), in addition to altitude. The first of these is the polar orbit, which can be 1,000 to 12,000 miles in altitude and is inclined approximately 90 degrees from the equatorial plane so the satellite goes over the earth's poles. Satellites in these orbits can view the entire surface of the earth over the course of several

orbits. This is useful for weather, reconnaissance, and earth resources monitoring satellite missions.

1-11. The second orbit subcategory is the highly elliptical orbit (HEO). These orbits are oval-shaped with the earth near one end inside the oval. The satellite goes from about 600 miles above the earth when it is closest, to 24,000 miles above the earth at the opposite end of the orbit. The orbit is inclined so the total effect of the eccentricity and inclination is that the satellite spends nearly all of its time over one hemisphere. The HEO is popular for Russian communication, scientific, and ISR missions due to Russia's high northern latitude. It is used because standard geosynchronous orbits do not provide adequate access to higher latitudes.

1-12. For perspective, if the Earth were represented by a basketball, most LEOs would be within an inch of the surface of the basketball. GPS satellites, in MEO, would be 14.5 inches above the ball, and satellites in a GEO would be 27 inches above the ball. An important aspect of satellite utility comes to light here. Consider the very small amount of the surface that can be seen from the LEO at any one time and the much larger area visible from GEO. Note also, GEO satellites can "see" more but are farther away so resolution and signal strength become constraints, while at LEO the faster relative speed of the satellite to the surface is a constraint. MEO orbits offer something of a good compromise but are very harsh environmentally due to high radiation levels. On the other hand, MEO orbits used by GPS are very stable and therefore excellent for navigation satellites.

1-13. Except for those positioned in GEO, satellites are constantly moving relative to the surface of the earth. A satellite may be able to view a point on earth for just a short time. Nevertheless, satellites as part of a larger constellation provide line-of-sight access to terrestrial terminals, linking them globally. Satellites facilitate broadcast and point-to-point communications. GPS satellites continually send position and timing data to users anywhere in the world for navigation and synchronization. Weather data is collected and disseminated far more efficiently than terrestrial platforms alone would allow. Satellites are well suited for reconnaissance and surveillance, photographic/mapping, and intelligence missions because they provide access for observation.

1-14. In-place orbiting space assets are quite responsive to warfighter needs. However, if the assets are not in place before the conflict or operation begins, it is unlikely more assets will become available. It takes weeks to move satellites from one orbit location to another, and this movement can deplete limited fuel supplies and shorten the satellite's operational life. Moving satellites can also affect several theaters of operations. Finally, launching new satellites can take months; the additional weeks or months required for on-orbit checkout makes launching to augment a theater impractical for short-term needs.

SECTION III – KEY TERMS AND ORGANIZATIONS

1-15. Space operations are divided into four general categories, or space mission areas, per JP 3-14: force enhancement, space control, space force application, and space support.

Force enhancement operations ***multiply joint force effectiveness*** *by enhancing battlespace awareness and providing needed warfighter support. There are five force enhancement functions: ISR; integrated tactical warning and attack assessment; environmental monitoring; communications; and position, velocity, timing, and navigation. They provide significant advantage by reducing confusion inherent in combat situations. They also improve the lethality of air, land, sea, space, and special operations forces.*

Space control operations will provide freedom of action in space for friendly forces and, when directed, deny the same freedom to the adversary. They include offensive and defensive operations by friendly forces to gain and maintain space superiority and situational awareness of events that impact space operations.

The application of force would consist of attacks against terrestrial-based targets carried out by military weapons systems operating in or through space. The force application mission area includes ballistic missile defense and force projection. Currently, there are no force application assets operating in space.

Space support operations consist of operations that launch, deploy, augment, maintain, sustain, replenish, deorbit, and recover space forces, including the C2 network configuration for space operations.

JP 3-14

1-16. The United States Army Space and Missile Defense Command (USASMDC), a major Army command (MACOM), is the Army proponent for space. USASMDC is also the ASCC for USSTRATCOM, in this capacity called Army Strategic Command (ARSTRAT).

"CG, U.S. Army Space and Missile Defense Command…[is the] supported commander and Army proponent for planning, integration, control and coordination of Army forces and capabilities in support of CDRUSSTRATCOM mission areas: global strike, global ballistic missile defense, C4ISR, information operations, and space operations and missions."

Army Campaign Plan

1-17. ARSTRAT, as the Army operational component to USSTRATCOM, executes command and control (C2) of ARSTRAT space forces worldwide. ARSTRAT provides existing and emerging space capabilities to U.S. Forces and allies to deliver decisive combat power on the battlefield. ARSTRAT plans and executes continuous military space operations and ensures combat readiness of assigned units supporting USSTRATCOM. ARSTRAT supports all USSTRATCOM space-related operational mission areas and is the focal point for the employment and integration of ARSTRAT space forces into global, national, and military operations. ARSTRAT supports land component commander (LCC) operations plans and Army, USASMDC, and USSTRATCOM policies and objectives.

1-18. ARSTRAT commands a space brigade consisting of three space battalions. An Active Army space battalion and an ARNG space battalion provide theater missile warning (TMW), space control, and space-based capabilities and expertise to the warfighter. The satellite control battalion provides communication satellite network and payload control. Successful integration of space into Army operations results in practical proponency of some space capabilities being executed outside USASMDC. For example, SATCOM force integration is accomplished by the U.S. Army Signal Center, which does lifecycle management of all major communications-electronics systems under study, in development, or in use in the field Army. Space-based ISR force integration is accomplished by the U.S. Army Intelligence Center.

SECTION IV – SPACE AS A COMPONENT OF NATIONAL SECURITY POLICY

1-19. Historically, the policy of the United States has been to use space for military advantage while developing civil and commercial use of space. The national space policy clearly articulates this. Current national and DOD space policy, joint direction, and Army space policy embrace the prudent use of space for security purposes. These policies make it clear that space is a critical element of U.S. defense capability and should be carefully and purposefully developed, as appropriate by each Service, to help provide a balanced overall capability for full-spectrum dominance.

NATIONAL SPACE POLICY

1-20. National policy (Presidential Decision Directive National Security Council-49/National Science and Technology Council-8 [PDD NSC-49/NSTC-8]) issued in September 1996 recommits the U.S. space program to a leadership role in the world. The United States will use space to preserve peace and protect national security, civil, and commercial interests. The policy reaffirms many of the goals of the previous policy while establishing the new objective of economic competitiveness through the expansion of U.S. commercial space activities. The specific goals of the space program are to—

- Promote international cooperation to further U.S. domestic, national security, and foreign policies.
- Enhance knowledge of the Earth, the solar system, and the universe through human and robotic exploration.
- Strengthen and maintain the national security of the United States.
- Enhance the economic competitiveness and scientific and technical capabilities of the United States.
- Encourage state, local, and private sector investment in, and use of, space technologies.

1-21. The policy identifies a set of guidelines for the major areas of civil space, national security space, commercial space, and intersector coordination. The United States will conduct those space activities necessary for national security. The Secretary of Defense and the Director of Central Intelligence (DCI) will oversee these activities. Prominent national security space activities intend to—

- Improve U.S. ability to support military operations worldwide, monitor and respond to strategic military threats, and monitor arms control and nonproliferation agreements and activities.
- Ensure the Secretary of Defense and DCI closely coordinate defense and intelligence space activities, integrate space architectures to the maximum extent feasible, and continue to modernize and improve their respective activities to collect against, and respond to, changing threats, environments, and adversaries.
- Ensure critical capabilities necessary for executing space missions are provided.
- Carry out research and development of technologies needed to effectively verify international agreements to control special nuclear materials and nuclear weapons by the Department of Energy in coordination with DOD, the Arms Control and Disarmament Agency, and DCI.

1-22. These activities contribute to U.S. national security by—

- Providing support for the United States' inherent right of self-defense and defense commitments to allies and friends.
- Deterring, warning and, if necessary, defending against enemy attack.
- Ensuring hostile forces cannot prevent U.S. use of space.
- Countering, if necessary, space systems and services used for hostile purposes.
- Enhancing operations of U.S. and allied forces.
- Ensuring U.S. ability to conduct military and intelligence space-related activities.
- Satisfying military and intelligence requirements during peace and crisis as well as through all levels of conflict.
- Supporting the activities of national policy makers, the intelligence community, the President of the United States/Secretary of Defense, combatant commanders and military services, other federal officials, other government agencies, and continuity of government operations.

1-23. The national space policy has specific guidelines for DOD:

- DOD shall maintain the capability to execute the mission areas of space support, force enhancement, space control, and force application.
- DOD shall protect critical space-related technologies and mission aspects.
- DOD, as launch agent for both the defense and intelligence sectors, will maintain the capability to evolve and support those space transportation systems, infrastructure, and support activities necessary to meet national security requirements.
- DOD will pursue integrated satellite control and continue to enhance the robustness of its satellite control capability.

- The Secretary of Defense will establish DOD's specific requirements for military and national-level intelligence information.
- The Secretary of Defense, in concert with the DCI, may propose modifications or augmentations to intelligence space systems, as necessary.
- The United States will develop, operate, and maintain space control capabilities to ensure freedom of action in space and, if directed, deny such freedom of action to adversaries. The United States will maintain and modernize space surveillance and associated battle management command, control, communications, computers, and intelligence to effectively detect, track, categorize, monitor, and characterize threats to U.S. and friendly space systems.
- The United States will pursue a ballistic missile defense program.

DOD SPACE POLICY

1-24. DODD 3100.10 implements the national space policy and assigns responsibilities for space and space-related activities. This directive states that the primary DOD goal is to provide operational space force capabilities to ensure the United States has the space power to achieve its national security objectives in accordance with the national security strategy (NSS). Space capabilities and applications will be integrated into the strategy, doctrine, concepts of operations, education, exercises, and operations and contingency plans of U.S. military forces. DOD operational space force structure will be sufficiently robust, ready, secure, survivable, resilient, and interoperable.

1-25. The management of DOD space activities will focus on improving both national and international cooperation. The establishment of partnerships between the defense space sector and the intelligence, civil, and commercial space sectors will be pursued to ensure that all U.S. space sectors benefit from the space technologies, facilities, and support services available to the nation. Improvement of the coordination of defense and intelligence space activities shall be a priority. International cooperation and partnership in space activities with U.S. allies and friends shall also be pursued. Such cooperation will strengthen the defense capabilities and alliance structures that are crucial supports to national security.

ARMY SPACE POLICY

1-26. The Secretary of the Army and the Chief of Staff of the Army approved the Army Space Policy in April 2003.

Space dominance and the full exploitation of space systems are vital to achieving the precision, information superiority, and battle command capabilities essential for executing the responsive, full spectrum, distributed operations envisioned for Land Force units…. The Army's functions are expanded to include the following: Operate select spacecraft and space systems; Organize, train, equip, and provide forces for Army and Joint Space Operations; Develop Army doctrine, tactics, techniques, procedures and equipment employed by Army and Joint forces used in the conduct of Space Operations; Interdict enemy space power through operations

on or from land; Participate with other Services in Joint operations, training and exercises; and provide forces for DOD Space Operations when directed.

Army Space Policy

1-27. The Army space policy clearly indicates the commitment to develop and use space, including the following:

- Operating space systems.
- Providing space forces.
- Developing and using equipment for space operations.
- Executing terrestrial-based space control.
- Providing appropriate doctrine and tactics, techniques, and procedures.

1-28. The Army space policy confirms that Army access to, and use of, space capabilities is essential to operational success. Army space and space-related activities enhance operational support to warfighters and contribute to successful execution of Army missions.

1-29. It is clear that the national space policy, DOD space policy, and Army space policy reflect the critical importance of space for current and future U.S. military operations. Space is already an integral part of Army operations and will continue to contribute to the increasing effectiveness of the Army and joint land warfighting dominance. The Army's use of space and its effort to further develop space capabilities for land warfare has been very effective. The intent of this doctrine is to capture and codify the elements of that success and provide the basis for continuing success.

SECTION V – ELEMENTS OF SPACE OPERATIONS

1-30. Space operations cover the entire spectrum of activities from launching, controlling, and maintaining satellites to denying space capabilities to an adversary. Space operations also include facilitating the use of space assets and enabling soldiers to apply space capabilities to other Army operations. These are all actions that contribute to using space to dominate the battlefield and ensure superiority. Army space operations consist of those activities concerned with controlling and exploiting space to enhance land warfighting.

CONTROLLING AND EXPLOITING SPACE TO ENHANCE LAND WARFIGHTING POWER

1-31. Army space power is the ability to control and exploit space assets to contribute to U.S. land warfighting dominance. Army space power is a terrestrial entity and is land warfare centric. The two primary functions—control and exploit space—form the basis for leveraging space capabilities to enhance Army operations. Of course, the Army is not solely responsible for either of these. In the joint context, the majority of space operations are accomplished by the Air Force, and the Army benefits from much of this.

1-32. The prerequisite to exploiting space to U.S. advantage is the same as in other realms of warfare: control the domain of operations. Land power cannot function effectively without control of territory. Sea power cannot function effectively without control of sea lanes. Air power cannot function effectively without control of airspace. Accordingly, to exploit space, the first task is to control it. Controlling space for security purposes is the same as controlling the seas for security purposes. It is not necessary to exercise absolute control over all enemy operations and movements on and in the sea. Rather, defense forces control certain areas of the sea at critical times, and control certain heavily used lines of communication at all times. There are so many ships and boats over the broad expanse of the ocean that it may be impossible to control all of them all the time. The same is true of space. The Armed Forces require maximum control of particular space assets at particular times; this requires the ability to exercise control of any space asset at any time. Note that this is different from exercising control over all space assets all the time. The Army may need to establish control of space relevant to battlefields during specific periods, coinciding with preparation or execution of battlefield operations, and at other times take no space control negation or prevention actions. (Space situation awareness and space control protection are continuous processes and are always at work.) The essence of space control for land force purposes is to exercise the Army's will at decisive points for space operations in support of the joint and Army land campaign.

1-33. FM 3-0 contains Army doctrine concerning decisive points in operational design.

A decisive point is a geographic place, specific key event, or enabling system that allows commanders to gain a marked advantage over an enemy and greatly influence the outcome of an attack…. Normally, a situation presents more decisive points than the force can control, destroy, or neutralize with available resources. Part of operational art consists of selecting the decisive points that will most quickly and efficiently overcome the enemy center of gravity.

FM 3-0

1-34. Accordingly, it is essential to control decisive points or exercise control during specific, limited periods. When defense forces do this well, they establish space superiority, which is the space equivalent to air, land, and sea superiority. Having space superiority maximizes the contribution space can make to land warfighting dominance.

1-35. Having established space control where and when necessary, the U.S. can exploit space to gain maximum military advantage. The Army plays a strategically responsive, decisive role across the range of military operations. Whether joint, interagency, or multinational, Army military operations include full-spectrum dominance capability. Units develop situations out of contact, maneuver to positions of advantage, engage enemy forces beyond the range of enemy weapons, destroy the enemy with precision fires, and conduct tactical assault at times and places of their choosing. Commanders accomplish this by maneuvering dispersed tactical formations linked by battle command and enabled, in part, by integrated space systems.

1-36. Space-based capabilities enable the implementation of these concepts, particularly with respect to achieving information superiority, creating situational awareness, and operating within the high-tempo, noncontiguous, simultaneous framework of distributed operations. Land forces should see first, understand first, act first, and finish decisively as the means to achieving tactical success. Space systems provide critical support to each of these capabilities:

- See first: missile warning, space-based ISR, space control (in-theater negation and surveillance), SATCOM.
- Understand first: SATCOM; Blue Force tracking (BFT); in-transit visibility; information operations (IO); space control; and position, velocity, and timing (PVT).
- Act first: space control, in-transit visibility, PVT, and SATCOM.
- Finish decisively: space control, PVT, precision engagement, ISR, continuous battle damage assessment (BDA), and SATCOM.

1-37. Army space operations are guided by the five mission-essential tasks in the Army space policy:

- Enable situational understanding and joint battle command en route, off the ramp, and on the move.
- Support precision maneuver, fires, and sustainment.
- Contribute to continuous information and decision superiority.
- Support increased deployability by reducing the in-theater footprint.
- Protect the force during all phases of operations.

1-38. To accomplish these tasks, space-based capabilities and services provide assured, responsive, and timely support all the way down to the tactical level commander and will be fully integrated with other battlefield systems, to include air and terrestrial-based systems. The Army continues to routinely exploit communication, intelligence and surveillance, early warning, position/navigation, weather, terrain, and environmental space systems integrated through direct links and global broadcasts. Space system support is generally transparent to the warfighter as it is often fused with other system support into integrated processes and products.

1-39. Integrating civil, commercial, and foreign space assets will sometimes be vital to mission accomplishment. However, interoperability issues and leadership perspectives may make effective integration very difficult. Similarly, integration of military space and intelligence capabilities may also present interoperability issues and leadership challenges. The solutions for these challenges are generally not found in creating exclusive space and intelligence realms, but in purposeful integration that capitalizes on the traditional missions and strengths of each.

1-40. Space is inherently joint. The Army, as an interdependent member of the space community, relies on space products and services provided by the other Services, DOD agencies, intergovernmental agencies, and commercial space capabilities to enable situational understanding and joint battle command. This fully integrated joint space capability provides depth, persistence, and reach capabilities, from the national to tactical levels, that

organic systems cannot provide. Space capabilities are, and will continue to be, particularly valuable in remote and immature theaters with insufficient or unreliable infrastructure. A joint seamless space-to-soldier continuum of terrestrial air- and space-based sensors, networks, and information is the goal, integrating space with land force and joint operations and contributing to continuous information and decision superiority.

SPACE AND THE ARMY'S ENDURING CAPABILITIES

1-41. FM 1-0 details Army enduring capabilities. These capabilities support the Army's core competencies: to train and equip soldiers and grow leaders, and provide relevant and ready land power capability to the combatant commander as part of the joint team. Space has grown from a niche capability that could be effectively employed only for specialized instances, to routinely affecting each of the Army's enduring capabilities.

SHAPING THE SECURITY ENVIRONMENT

1-42. The conspicuous and personal presence of the soldier in the field markedly affects the Army's ability to shape the security environment. Adding to the soldiers' ability to build confidence among U.S. allies and signal a warning to potential adversaries is the routine use of sophisticated combat multipliers such as GPS, SATCOM, and space-based remote sensing.

PROMPT RESPONSE

1-43. The ability to quickly begin to limit enemy achievement of objectives and reversing success toward eventual decisive defeat is greatly facilitated by space capabilities. This includes providing strategic warning through intelligence, monitoring for force buildups through surveillance and reconnaissance, precisely fixing the locations of force elements and providing targeting information to Army attack elements, and finding optimum staging areas and lines of communication.

MOBILIZING THE ARMY

1-44. Training, logistical, and operational challenges of an expanding Army after presidential callup of additional forces are mitigated by space capabilities. Communications, including surge capabilities, and satellite tracking of material movements supporting increased deployments are good examples.

FORCIBLE ENTRY OPERATIONS

1-45. Space-enabled capabilities (such as en route mission planning and rehearsal system [EMPRS]) provide en route planning and intelligence updates during troop travel. This allows soldiers to exploit optimum access points to engage and prosecute with full fighting force from the instant they contact the enemy.

SUSTAINED LAND DOMINANCE

1-46. The world's premier land fighting force is the U.S. Army; the Army's ability to win and hold territory hinges not only on soldiers and firepower,

but also on comprehensive situational understanding enabled by space assets.

- **Close with and destroy enemy forces.** Knowing how and where to strike the enemy to force his defeat is partly a function of knowing the enemy strength, movement, and situation (such as terrain and weather). Gaining and maintaining early, accurate, and comprehensive knowledge of the evolving battlespace is facilitated by indigenous Army capabilities to access information streams made available by national and DOD assets, and the ability to sort and fuse information and provide dissemination to battlefield planners and commanders. This is facilitated by synoptic, or wide-area graphics of the battlespace as well as detailed information features, both of which can be provided partly through space-based ISR and environmental monitoring resources.
- **Use precision fires and maneuver.** Space assets help find and identify targets and help fully understand their location and setting. Terrain and weather are identified and factored in to maneuver planning and choosing appropriate weapons. When precision-guided munitions are selected, space-based navigation signals enable lethal accuracy.
- **Gain information superiority.** Information superiority is that degree of dominance in the information domain that enables the conduct of operations without effective opposition (JP 3-13). This superiority is gained by having more timely and correct information in the hands and minds of Army soldiers than in those of the adversary. There are two implications. First, information must be of correct fit, format, and function to be transformed to knowledge and then to understanding. Second, adversary information should be affected so it does not provide the enemy with knowledge and understanding. Army space capabilities contribute to both. For example, the Army capitalizes on space-based reconnaissance, which provides information, and on space communications assets that move the information to analysis and fusion centers and then back to field commanders. The Army can also use space control to deny, disrupt, degrade, or destroy adversary space-based information streams. Facilitating friendly information while, if necessary, disrupting adversary information ensures that information superiority belongs to U.S. forces.

Information superiority is that degree of dominance in the information domainwhich permits the conduct of operations without effective opposition.

JP 3-13

- **Command and control of joint and multinational forces.** The Army provides long-haul communications critical to C2 through its defense satellite communications system (DSCS) constellation, and through integration with other space systems such as Iridium, international maritime satellite (Inmarsat), international telecommunications satellite (Intelsat), military strategic and tactical relay satellite communication system (Milstar), and ultra-high

frequency (UHF) follow-on (UFO). Interoperability between command elements across joint and multinational forces is a necessity the Army will continue to use and develop.

- **Control and defend land, people, and natural resources**. The best success in controlling and defending land, people, and natural resources requires maximizing situational understanding. Space force enhancement capabilities make major contributions to that understanding. The Army keeps pace with current and changing situations in part through the use of multispectral imagery, weather data from meteorological satellites, space-enabled in-theater communications between Army units, and reach to multiple analysis resources in the United States.
- **Conduct sustainment operations.** Army multifunctional theater support command and functional transportation (ground and aviation lift), supply, engineer, finance, medical, and personnel units all benefit from space capabilities adapted to improve their operations. The most ubiquitous is intra- and inter-theater communications provided through communication satellites and specialized Army terminals. Another example is use of GPS to track supply movements from embarkation at continental United States (CONUS) facilities through points of debarkation to the soldiers intended to use the supplies.
- **Support civil authorities**. The Army uses these same organic space capabilities previously mentioned in the execution of its responsibilities in domestic and international contingencies, including homeland security and defense.

SECTION VI – ARMY JOINT SPACE OPERATIONS RELATIONSHIPS

1-47. Space operations, by their nature, are joint operations. Each Service component contributes to an integrated whole that is synchronized by the joint force headquarters. All Army space operations flow from and support the combatant commander's campaign plan. Army space operations support joint force missions and receive support from Service and other joint force, government, civil, and commercial space assets. Based on unit mission, space operations are integrated throughout the land component forces and other components of the joint force to maximize the space contribution to the joint fight (see JP 3-14 and FM 3-0).

1-48. The joint operations concepts (JOpsC) document provided by the Secretary of Defense articulates the overarching concept that describes the conduct of future joint military operations.

Joint Operations Concepts. An overarching description of how the future joint force will operate across the entire range of military operations. It is the unifying framework for developing subordinate joint operating concepts, joint functional concepts, enabling concepts, and integrated capabilities. It assists in structuring joint experimentation and assessment activities to validate subordinate concepts and capabilities-based requirements.

Joint Operations Concepts

1-49. The JOpsC supports the strategic guidance provided by the national security strategy, the defense strategy articulated in the Quadrennial Defense Review and the Defense Planning Guidance, and the military strategy of the Department of Defense. To implement these strategies, the JOpsC sets the goal of being full spectrum dominant, which is a driver for the Army's development of space operations capabilities.

Full spectrum dominance is the defeat of any adversary or control of any situation across the full range of military operations.

Joint Operations Concepts

1-50. As the Army applies space capabilities to current operations and develops future space capabilities, it builds toward the future joint force as described in the JOpsC. The joint operating concepts (for homeland security, major combat operations, stability operations, and strategic deterrence), joint functional concepts (for battlespace awareness, focused logistics, force application, joint C2, and protection), and joint enabling concepts flow from the JOpsC. Army space operations personnel contribute both to the development of these concepts and to their execution.

1-51. Operational experience consistently demonstrates the need for joint space doctrine. JP 3-14 lays the foundation of joint space doctrine by establishing principles for the integrated employment of space capabilities. The Air Force and Navy provide military satellites, the Air Force provides launch services, the Army, Navy, and Air Force provide ground hardware, and all Services use space capabilities. JP 3-14 recognizes that the Services have unique roles to play in providing space capabilities, including specific Army roles.

The Army is to provide space control operations and space support to the joint force and Army component, coordinate and integrate Army resources in the execution of [USSTRATCOM] plans and operations, provide theater missile warning through employment of joint tactical ground stations (JTAGS), provide space support through the use of Army space support teams, and perform Defense Satellite Communications System payload and network control. Additionally, [USASMDC/ARSTRAT] functions as the SATCOM system expert for Wideband Gapfiller System super-high frequency (SHF) communications satellites and is the parent command for regional satellite communications support centers servicing all combatant commands, their components, and the Defense agencies and other users. U.S. Army Space and Missile Defense Command is the U.S. Army major command that organizes, trains, equips, and provides forces to [USASMDC/ARSTRAT] and plans for national missile defense.

JP 3-14

1-52. USSTRATCOM plans for and employs space forces to execute operational missions. JP 3-14 assigned this mission to U.S. Space Command, however that command was merged into USSTRATCOM in 2003. USSTRATCOM controls assigned space forces through its component commands: USASMDC/ARSTRAT, Naval Net Warfare Command (NETWARCOM), and Air Force Space Command (AFSPC).

1-53. JP 3-14 defines four primary space mission areas: space control, force enhancement, space support, and force application, which are covered in detail in this manual. Also, "…Commander, [USSTRATCOM] may…direct space component commanders to provide tailored space support through [space support teams]." The Army provides Army space support teams (ARSSTs) (Appendix C), commercial exploitation teams (CETs) (Appendix B), and TMW detachments (Appendix B). The Army also provides space capabilities, which do not require deployed teams. These are detailed in appendixes and elsewhere in this manual.

SECTION VII – THE G3 SECTION AND SPACE OPERATIONS

1-54. The corps and division G3 has overall coordinating staff responsibility for space operations at their level. The G3 section normally has assigned officers and noncommissioned officers (NCOs) comprising a space element. The space element provides space operations planning and coordinates space mission execution. At the corps and division headquarters, one or more of these individuals is a functional area (FA) 40, space operations officer (SOO). Detailed information concerning the SOO is in appendix D. The G3 coordinates the space-related activities of other staff sections, primarily the G2 and G6.

1-55. The G3 space element serves as the staff focal point for coordination of most space activities. The primary function of the space element is to synchronize space mission area activities throughout the operations process, maximizing the positive impact of space-based capabilities on Army land warfare. Space element members coordinate space operations objectives and tasks with their counterparts at higher and lower echelons. The functions of the space element can be fulfilled from within the G3 organization or by various augmentation capabilities that are normally assigned to the G3. The function and organization of augmentation units vary, depending on the capabilities required.

Note. The employment tactical and operational headquarters include a space support element (SSE). Details are included in Appendix E. The SSE provides much the same function as the space element in the corps and division G3 as described here.

1-56. SOOs are aware of corps and division operations and plans and are thoroughly educated in space capabilities available for theater operations. The space element actively participates as their corps and divisions develop and implement plans and operations. SOO identify opportunities for space capabilities to provide effective solutions for warfighting problems. The SOO advises the G3 to request an Army space support team (ARSST) for contingencies or exercises when space operations activities would otherwise overwhelm the space element. Functions of the ARSST are in appendix C. The ARSST normally deploys to the corps or to the division and supports the space element.

1-57. The G3 space element and SOO also recommend to the G3 and commander other space capabilities that should be used to support the

mission. These include the basic force enhancement capabilities already covered in this chapter and those detailed in the appendixes to this manual, which are the USASMDC operations center, space-based Blue Force Tracking Mission Management Center, regional and global SATCOM support centers, wideband SATCOM operations center, spectral operations resource center, commercial exploitation teams, and TMW teams.

SECTION VIII – ARMY SPACE CADRE

1-58. The Army is developing a cadre of space professionals to acquire, operate, maintain, and employ space systems as its dependence on space continues to grow. This concerns the Army's space education and literacy training program for both the general Army and the Army's cadre of space professionals. Space is a functional area for the Army, dynamic by its very nature, and inherently far-reaching in that it affects literally every Army operation. Although the Army's cadre of space professionals performs operations that are space unique, every soldier needs to know how to use space capabilities to enhance warfighter operations.

1-59. The Army is identifying and growing a cadre of soldiers ranging from specially trained space professionals to those with specific skills to operate space assets and related equipment. These soldiers go well beyond "awareness" and are able to articulate the relationship between space capabilities, the tenets of Army operations, enduring capabilities, and elements of Army combat power. While the space cadre is not yet formally defined, the Army has a recognized body of space capability experts with extensive practical skills in using space-based capabilities for land warfighting dominance.

1-60. The Army's space cadre works in the disciplines of operations and systems acquisition in virtually all ranks and grades. These personnel are responsible for ensuring that space capabilities are fully integrated into the warfighter's operations. The Army's space cadre currently informally consists of those officers specifically trained as FA 40 SOOs and individuals in other core functional areas who are performing, or have performed, space-related or tactical exploitation of national capabilities program (TENCAP) functions in the areas of space force application, space force enhancement, space control, or space support. These individuals include acquisition corps personnel working in the National Reconnaissance Office (NRO), Army Space Program Office (ASPO), and other intelligence-related research and development positions and many of the operators working TENCAP, routine military intelligence (MI), and space control functions. The following types of personnel may be included in the definition of Army space cadre when it is formalized:

- FA 40 SOOs who were trained in various branches of the Army prior to their designation as an SOO. The experience gained in various branches adds depth to the knowledge base of the SOO and allows them to further apply space concepts to other mission areas.
- Officers who possess the additional skill indicator (ASI) of 3Y (space) and 3E (TENCAP), trained in the functional area branches. These officers may be in the acquisition or research and development fields

and play a fundamental role in meeting Army future requirements for space.

- Acquisition specialists, primarily scientists, engineers, analysts and acquisition personnel who are involved in research and procurement of space systems. These personnel are critical to ensure basic system integration. These personnel come from functional areas other than space operations.
- Operations personnel who plan and execute space operations. These SOOs, military operations planners, MI and strategic intelligence officers, signal and air defense officers, and enlisted personnel who are operating space systems are also responsible for integrating space into warfighter operations.
- Sustainment and support personnel responsible for ensuring the Army's space systems are properly maintained and sustained, including hardware and software maintenance for Army unique systems. This discipline requires personnel with logistics backgrounds.

1-61. For professional development purposes, a large number of officers with the 3Y identifier are not considered part of the core space cadre for the Army. They are not directly involved in the acquisition, operations, or sustainment/support of space systems. However, these officers possess the knowledge, skills, and attributes to assist the warfighter in integrating space into combat operations.

Chapter 2

Space Mission Areas

Global power brings global responsibilities to our nation and the Army. Among the Army's array of formidable capabilities designed to fulfill those responsibilities is its global space reach, with assets and operations literally around the world. A doctrinal construct used to organize the many resulting space issues is that of space mission areas. Consistent with JP 3-14, the Army divides the space mission into four primary mission areas: space force enhancement, space control, space force application, and space support. Space capabilities are seamlessly integrated with terrestrial land warfighting capabilities so there is no loss of information at the interfaces, and just as important, no loss of time. Continuity is maintained among sensors, shooters, and command and control through thoughtful application of space capabilities. These four mission areas are the operational foundation of Army space capabilities. This chapter discusses the four mission areas.

SPACE FORCE ENHANCEMENT

2-1. Space force enhancement functions are similar to combat support operations in that they improve the effectiveness of forces across the full spectrum of operations by providing operational assistance to combat elements. Command and support elements also integrate space force enhancement functions into their operations. The functions include communications; position, velocity, and timing; environmental monitoring; ISR; and theater missile warning.

2-2. Civil, commercial, and allied capabilities may augment DOD systems to support military space force enhancement requirements. The efficiencies resulting from the use of these space capabilities can have a dramatic effect on Army operations. Users should be aware of the vulnerabilities associated with using civil, commercial, and allied space systems.

COMMUNICATIONS

2-3. Space-based communications offer many unique features to the warfighter. Figure 2-1 illustrates some of these features. Using a global network of military and commercial communication satellites, warfighters at all levels of command can overcome limited infrastructure, execute reach-back operations, enable two-way flow of data to critical nodes, provide support to special users, and increase overall C2 effectiveness. Further, satellite communications provide critical connectivity for maneuver forces whose rapid movement and nonlinear deployments take them beyond inherent line of sight (LOS) communication networks. Finally, satellite

communications are a key enabler to emerging transformational concepts of net-centric operations.

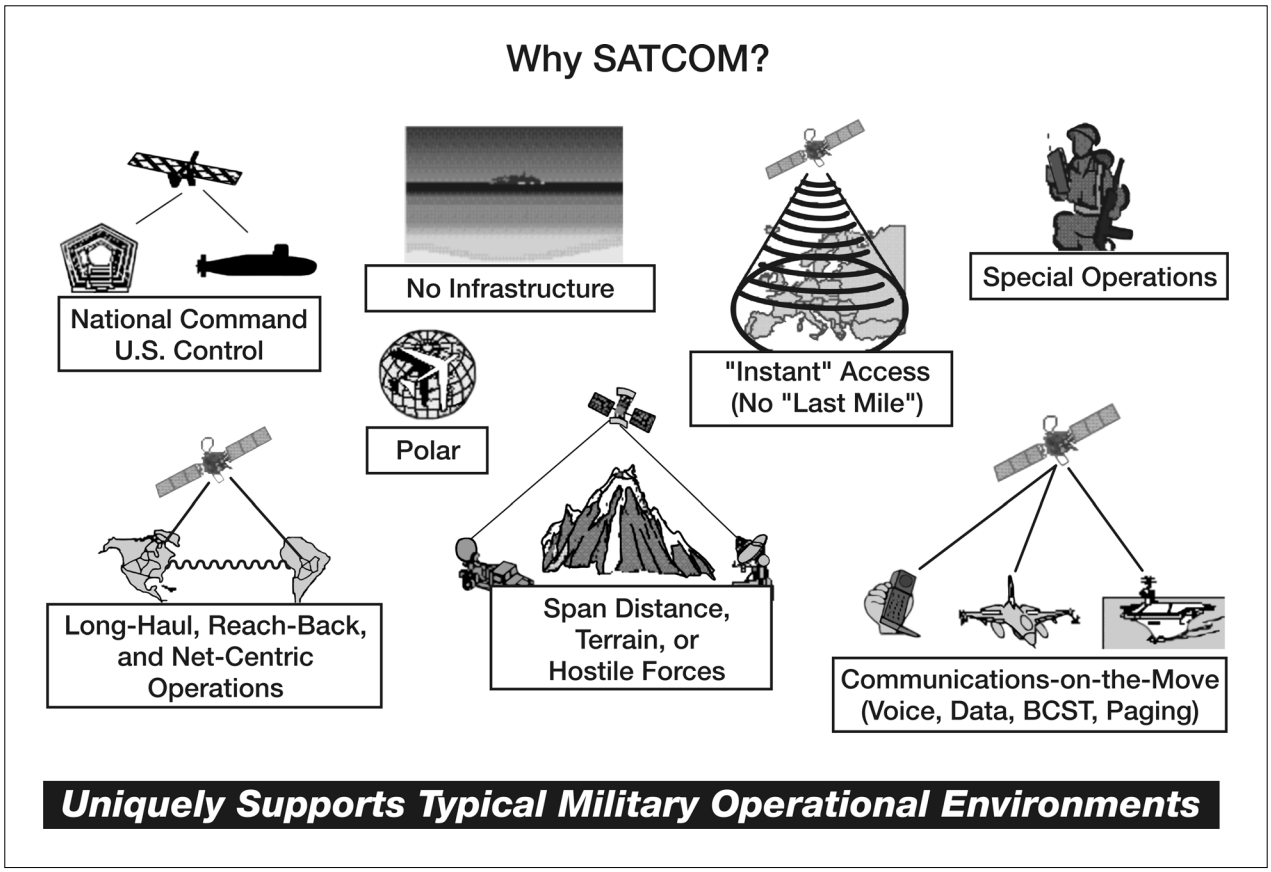

Figure 2-1. Key SATCOM features

2-4. Satellite communications collectively provide an essential element of national and DOD communications worldwide. They allow for information transfer from the highest levels of government to the theater and tactical level for all matters, to include operations, logistics, intelligence, personnel, and diplomacy. SATCOM supports a variety of media, including voice, data, and video services. The satellites are generally transparent to the user; they do not create information, but they serve as a transport medium.

2-5. The frequency bands over which the military satellite communications operate are ultra-high frequency (UHF), super-high frequency (SHF), extremely high frequency (EHF), military Ka-band, commercial L- and S-bands for narrowband communications, and commercial C-, Ku-, and Ka-bands for wideband communications (which correspond to SHF). The frequency band and waveform of a signal influences the throughput capacity and the degree of protection provided to the communications system (antijam [AJ], low probability of intercept [LPI], and low probability of detection [LPD] capabilities). Table 2-1 summarizes these general attributes.

Table 2-1. SATCOM attributes		
Systems/spectrums	***Advantages***	***Limitations***
DOD narrowband (UHF) DOD wideband (SHF, Ka) DOD protected (EHF) Commercial narrowband (L-, S-bands) Commercial wideband (C-, Ka-, Ku-bands)	Global coverage Near real-time transmission Data relay broadcast Security Flexibility Support to mobile forces	Capacity Orbital considerations Frequency constraints Antenna size, data rate, mobility Jamming, interference

SATCOM Systems/Spectrums

2-6. DOD employs a combination of military and commercial systems to support its requirements (see figure 2-2).

2-7. DOD narrowband satellite communications systems support secure voice and data transmission at relatively low data rates for both mobile and fixed users, by providing access on a single dedicated channel or on a demand assigned multiple access channel. In particular, these systems support highly mobile, tactical users. Compact terminal equipment and omnidirectional antennas allow deployed warfighters to conduct tactical C2 and quickly exchange both voice and data communications. These systems typically operate in the UHF frequency; examples include fleet satellite communications system (FLTSAT), UHF follow-on (UFO), and the emerging mobile user objective system (MUOS).

2-8. DOD wideband satellite communications support multichannel, secure voice, and high data-rate communications for C2, crisis management, and intelligence data transfer services. The heaviest use of wideband communications is multiplexed, wideband, switched networks. Many wideband users employ large, fixed ground terminals to support DOD enterprise-wide voice, data, and video wideband networks. Smaller mobile and relocatable terminals support exercises and deployed operations requirements of tactical forces for high-capacity, multichannel communications aboard ships and aircraft as well as in support of ground forces. These systems typically operate in the SHF and Ka frequency; examples include DSCS, global broadcast system (GBS), and the emerging wideband gapfiller system (WGS).

2-9. DOD protected satellite communications support survivable voice and data communications not normally found on other systems. Its unique characteristics, such as its narrow beamwidth and use of spread spectrum and frequency hopping, give it capabilities such as AJ and scintillation-resistance along with LPI and LPD. Because of these capabilities, use of the protected satellite communications frequency band has often been associated with the most critical strategic forces and C2 systems, but these capabilities are also in demand by tactical and special forces that require AJ and LPI/LPD for the completion of their missions. These systems typically

operate in the EHF frequency (examples include Milstar and EHF packages on UFO satellites).

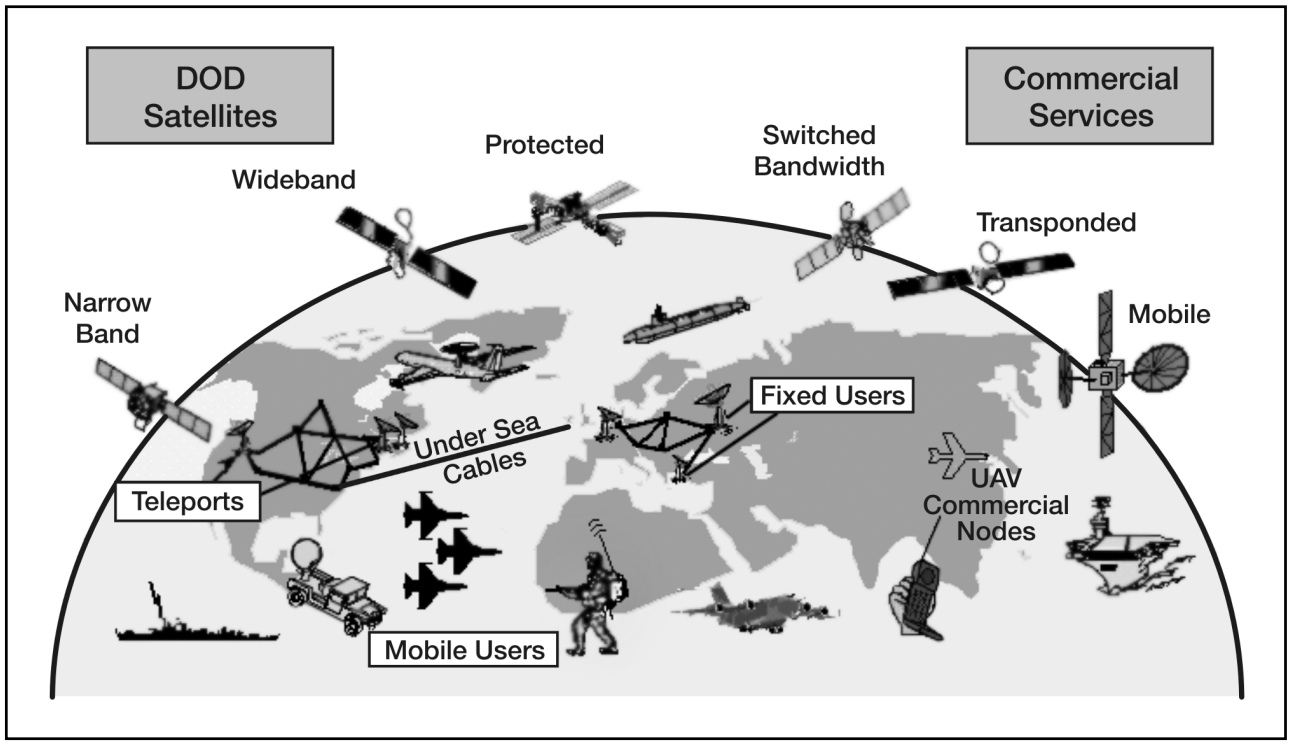

Figure 2-2. Global system-of-systems

2-10. Commercial satellite communications offer capabilities that can be exploited to meet and augment the Department of Defense's rapidly growing information needs. Some wideband services and personal communications services such as cell phones are examples of current commercial SATCOM support to strategic and tactical mobile users. Commercial systems should also be good candidates to support much of the Department of Defense's predictable, wideband fixed SATCOM needs, requiring little or no AJ protection or U.S. control. Leasing commercial services may also afford the Armed Forces of the United States faster access to advanced capabilities and services than traditional government research, development, and acquisition programs. However, in an environment where both the United States and its potential adversaries have almost equal access to the same advanced technologies and commercial services, sustaining military advantage may largely rest on U.S. ability to integrate those technologies and commercial services into its force structure faster and more effectively than the adversary. These systems typically operate in the L-, C-, Ka-, and Ku-band frequencies (examples include Iridium, Inmarsat, and Intelsat).

2-11. Not all DOD communications needs can (or should) be met by commercial means, especially in an unpredictable threat environment. Competition for access with other customers, non-U.S. ownership or control of

commercial SATCOM services outside the borders of the U.S., and the lack of quickly accessible commercial SATCOM capacity raise substantial questions about the Department of Defense's ready assured access to those services when and where needed. Military-unique communication needs, such as nuclear survivability; robust C2 links; netted voice; U.S. control; and secure, protected, and/or covert communications, may not always be adequately served by commercial means. Access and availability to commercial services are based on the terms of the lease or contract that could be terminated at militarily inconvenient times. Experience shows that foreign commercial telecommunications media may sometimes become unreliable during periods of political tension or open hostilities. While commercial SATCOM is an important component of DOD communications, mission requirements are thoroughly reviewed before employing these communications.

SATCOM Processes

2-12. There are two primary SATCOM planning processes: the requirements process and the access process. The Joint Staff administers the requirements process, which formally documents user needs for satellite communications as a precondition for satellite access. USSTRATCOM, as the DOD SATCOM operational manager (SOM), has responsibility for the day-to-day access process, which authorizes users to access satellite communication resources. These processes are further detailed in CJCSI 6250.01 and USSTRATCOM consolidated system control and operations concept (C-SCOC) documentation.

Army Support to SATCOM

2-13. USASMDC operates three regional satellite communications support centers (RSSC) , as directed by USSTRATCOM. These centers plan and manage global communications support to the warfighter. They are multi-Service organizations under USASMDC operational control, and provide a single point of contact for UHF, SHF, EHF, and commercial satellite communications support. Additionally, USASMDC provides manning to the global satellite communications support center (GSSC), operated by USSTRATCOM, to perform a mission similar to the RSSC. See appendix B, section III, for a detailed discussion of the RSSC and its capabilities.

2-14. USASMDC 1st Satellite Control (SATCON) Battalion provides communications network and satellite payload control of the DSCS by operating and maintaining five wideband satellite communications operations centers (WSOCs) and a DSCS certification facility. See appendix B, section IV, for a detailed description of the WSOC and its capabilities.

POSITION, VELOCITY, AND TIMING

2-15. The GPS provides precise, reliable position and time information, enabling friendly forces to plan, train, coordinate, and execute operations more effectively.

2-16. The Navstar GPS is a constellation of orbiting satellites and associated ground control stations that provide navigation data to military and civilian users all over the world. The system is operated and controlled by the Air Force. Each GPS satellite broadcasts continuous navigation signals. With the proper equipment, users can receive these signals to calculate time, location

and velocity. Receivers are available for use in land vehicles, aircraft, and ships, as well as for hand carrying.

2-17. GPS provides 24-hour navigation services, including—

- Extremely accurate, three-dimensional location information (latitude, longitude, and altitude), velocity, and precise time (position accuracy is within 16.5 feet [5 meters], velocity within a fraction of a mile per hour, and time within ten billionths of a second).
- A worldwide common grid that is easily converted to any local grid.
- Passive all-weather operations.
- Continuous real-time information.
- Support to an unlimited number of users and areas.
- Support to civilian users at a slightly less accurate level.

2-18. Coded signals from the satellites are broadcast so properly equipped users with direct LOS access to the satellites can receive them, and an unlimited number of users can receive and use them at the same time. When signals from at least four satellites can be received simultaneously, the GPS receive equipment can calculate three-dimensional position and time. These signals can be received and the calculations made in a high-dynamic environment, so the GPS signal receive and processing equipment can be used in precision-guided munitions as a means to increase their accuracy. The position information is provided in a common grid system, which can be automatically converted to latitude, longitude, and elevation, or other grid systems can be used. GPS receive equipment is integrated in most Army platforms.

2-19. Users must be aware that civil GPS receivers do not offer the same performance or protection that military receivers provide. CJCS directives prohibit using civil GPS equipment in combat or combat support roles.

2-20. GPS systems enhance navigational accuracy in featureless or obscured terrain. They allow precise maneuver without sighting specific geographic features. Soldiers can rendezvous to assigned points using GPS, either as a waypoint or to join or support other troops. GPS is a passive system; therefore, a soldier can receive and use the signal without emitting a signal that might compromise location. The use of satellite-based navigation is widespread not only for position information, but also for weapon system applications.

2-21. Accuracy of the GPS navigation signal can be 16.5 feet or better, but may exceed that value. Precision munitions may require greater accuracy; therefore, GPS receive equipment is sometimes coupled with a terrain matching system, terminal homing device, or automatic target recognition capability to increase accuracy.

2-22. GPS is integrated in equipment such as field artillery cannon and rocket systems and munitions that significantly increase delivery accuracy. The Army tactical missile system (ATACMS) uses GPS and inertial sensor systems for guidance. This system accurately delivers ordnance beyond the capability of existing cannon and rockets. The GPS components enable

missile in-flight corrections that significantly improve accuracy over previous inertial-guidance-only versions.

2-23. Offensive and defensive maneuver operations are enabled through precision navigation aids and through networked command, control, and communications capabilities that are dependent on timing signals on the GPS transmission.

ENVIRONMENTAL MONITORING

2-24. Space-based equipment can identify environmental factors that might affect operations in the four operational media of air, land, sea and space. Knowledge of these factors enables commanders to avoid adverse terrestrial environmental conditions (such as poor surface conditions or severe weather) while taking advantage of other conditions to enhance operations. Multi-spectral imagery (MSI) provides military forces current information on terrain, vegetation, and land use. It can also provide information on an area of operation such as surface trafficability, vegetation, and beach conditions. Imagery can be linked with precise location data from GPS to provide highly reliable maps for ground operations.

INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE

2-25. Space-based ISR is one component of the seamless ISR enterprise comprising all joint and coalition air, ground, sea and space assets. The advantages of space-based ISR complement and offset the disadvantages of air and ground based ISR. Surveillance from space enables the warfighter to overcome terrestrial LOS restrictions and affords coverage of virtually the entire globe. In some cases, the only early surveillance available will be from a space-based asset, especially in forced entry operations.

2-26. Space-based ISR sensor equipment provides no unique capabilities to the holistic, complementary ISR enterprise. Space-based ISR uniqueness is a function of characteristics of earth orbits, not the sensors themselves. For example, ISR spacecraft may have frequent revisit rates and long dwell times that produce a “near-persistent stare” capability and nearly global access.

2-27. While unfettered access from high and relatively safe earth orbits provides a tremendous advantage for ISR, there are limitations. Spacecraft must follow strict laws of motion and orbital mechanics. Revisit rates, coverage area, and dwell time over areas targeted for observation are functions of spacecraft orbits. For example, a HEO yields a long dwell time but lacks global access, while a LEO provides global access but a short dwell time.

2-28. Generally, only minor changes to these orbits can be made after initial spacecraft insertion. Changes require prohibitively large quantities of fuel, the same fuel used to keep the satellite properly oriented and properly placed in its orbit (a function called station keeping). When fuel is used for significant orbit changes, it is no longer available for station keeping, resulting in decreased mission life. (See chapter 1, section II, for the specific orbits and their associate impacts.)

2-29. A related limitation is predictability. Orbits are difficult to change and can be mathematically calculated with good accuracy; therefore, predictions (based on current orbit characteristics) of satellite locations can be made for weeks and months in advance. This predictability makes space-based ISR susceptible to camouflage, denial, and deception. In addition to these limitations, ISR spacecraft are high-demand, low-density assets and cannot satisfy all information requests.

2-30. Generally, all Army organizations gain access to space-based ISR derived products through all-source fused intelligence products that were derived and compiled from the entire complementary ISR architecture. For those instances that spacecraft are the only available source of necessary information, there is a strict and highly competitive process to make it available.

2-31. The architecture for using space-based ISR involves numerous organizations (both within and outside the Army). Figure 2-3 depicts the process and architecture as an information requirement becomes a request and finally a product returned to the original requester. Within the Army, an information requirement moves up the echelons to the Defense Intelligence Agency (DIA), where the determination may be made to use space-based ISR to satisfy the requirement. At that point, standing organizations such as Central Imagery Tasking Office (CITO) and Overhead Collection Management Center (OCMC) evaluate, prioritize, and decide which requirements will be designated for collection. All Services are represented in these forums. However, due to the large number of requirements (mostly generated by the intelligence community [IC] to support national leadership), competition for each spacecraft's collection capability is immense.

2-32. When a requirement is designated for collection, a tasking is sent to the appropriate asset through a ground station. Once the tasking is collected, there are three general methods by which the collected information is sent to the original requester. They are direct downlink (DDL), theater downlink (TDL), and reach. Table 2-2 provides an overview of the three different methods. On its way to the requester, the collected data must go through an exploitation center, such as Washington Naval Yard, regional signal intelligence (SIGINT) operations center, or "in theater" to the tactical exploitation system.

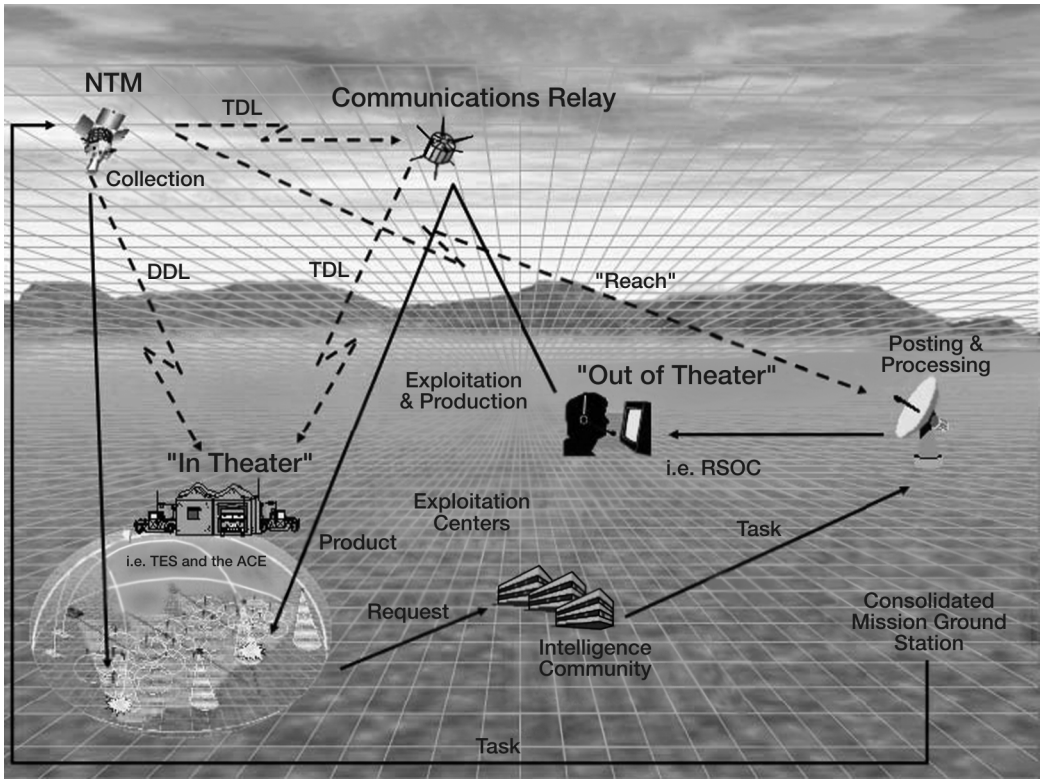

Figure 2-3. Space-based ISR architecture

2-33. The tactical exploitation system is the Army's deployable, primary system to access space-based ISR capabilities. It is the interface between national systems and in-theater tactical forces. It receives, processes, exploits, and disseminates data from direct downlinks and from ground stations for national and theater platforms.

2-34. The tactical exploitation system function is currently being included in the early spirals of the distributed common ground system—Army (DCGS-A) development. DCGS-A will consolidate the capabilities and functionality found in the tactical exploitation system and other select intelligence systems, and migrate their capabilities into an integrated system. DCGS-A enables the commander to achieve situational understanding by leveraging multiple sources of data, information, and intelligence to synchronize the elements of joint and combined arms combat power (maneuver, maneuver support and maneuver sustainment support). DCGS-A is the Army's primary system for ISR tasking, processing, exploitation, and dissemination (TPED) and will evolve to tasking, posting, processing, and using (TPPU). It supports the commander's ability to execute battle command, synchronize fires and effects, rapidly shift battle focus, achieve situational understanding, and protect the force.

Table 2-2. Methods of dissemination

Method	*Description*	*Advantages*	*Disadvantages*
DDL	Spacecraft collects data, uses onboard processing (OBP), and immediately disseminates information in NRT to multiple terrestrial receivers, generally using a broadcast signal.	• Timely (NRT).	• Limited access. • Limited bandwidth. • Higher cost for spacecraft (OBP, special transmitting equipment, and additional hardening).
TDL	Spacecraft collects data, usually uses OBP, and immediately disseminates information in NRT to another spacecraft or constellation with the sole duty of relaying data to either multiple terrestrial receivers or a designated receiver.	• Timely. • Near-continuous access. • Higher bandwidth.	• Requires additional spacecraft. • Additional cost for spacecraft (OBP). • Additional "hops."
Reach	Generally, implies that the information is sent back to a consolidated mission ground station (CMGS) where it is processed, exploited (or sent to another organization for exploitation), and disseminated to the original requester.	• Lower cost (initial processing sites are fixed facilities). • Low risk of loss to site and personnel (sites are not in theater of conflict).	• Not as timely. • Multiple "hops." • Requires substantial architecture to push information/products to operational/tactical sites with limited bandwidth.

2-35. Through integration, networking and use of updated technology, DCGS-A—

- Orchestrates, synchronizes, and integrates joint, interagency, multinational, and Army ISR sensors in all operational phases across the spectrum of conflict.
- Eliminates information barriers.
- Provides fusion and analytical capabilities to support situational understanding.
- Supports targeting and effects.
- Provides BDA and effects damage assessment.

2-36. The Army leverages space-based ISR by submitting information requirements through standard collection management processes and procedures at all echelons, including national level. Space-based ISR is a complementary capability to provide for commanders critical information requirements (CCIR) through the standard intelligence functions of indications and warning (I&W), intelligence preparation of the battlespace (IPB), situation development, support to force protection, support to targeting, and BDA.

2-37. The ASPO provides the Army with robust capabilities to exploit national ISR assets and products through execution of the Army TENCAP. As such, it is fully integrated into the NRO and the IC. The Army has numerous U.S. Army Forces Command (FORSCOM) and U.S. Army Intelligence and Security Command (INSCOM) deployed units providing tactical TENCAP support throughout the force in MI battalions and brigades. Additionally, Army soldiers are fully integrated in NSA, National Geospatial-Intelligence Agency (NGA), the NRO facilities, as part of the IC, tasking and exploiting national intelligence space systems on a daily basis.

THEATER MISSILE WARNING

2-38. Air and missile defense command and control nodes use theater missile warning to cue active and passive defenses against enemy theater ballistic missiles (TBMs). Active defense includes use of Patriot missiles to destroy enemy TBMs before they impact their targets. Passive defenses include taking cover and donning chemical warfare protective gear. Missile warning sensors are hosted on platforms in space, in the air, and on the ground. The defense support program (DSP) provides space-based platforms. These satellites have infrared sensors that detect heat emitted from sources such as missiles during powered flight. Data from DSP satellites is transmitted to the missile warning theater event system (TES) .

2-39. The missile warning TES has two unclassified components.

- The first is joint theater missile warning (TMW) detachments, which are deployed to the area of operations (AO) and receive data directly from DSP satellites in their fields of view. TMW detachments deploy to provide onsite downlink, processing, and distribution of theater ballistic missile warning information. TMW detachments identify missile launch points, trajectory, and locations where warheads are likely to impact. These detachments are transportable/mobile and, therefore, can be located to optimize warning data receipt and missile warning dissemination.
- The second component is the mission control station (MCS) located at Buckley Air National Guard Base in Colorado. The MCS is a high confidence operational system that provides assured theater missile warning to warfighters worldwide. The MCS monitors all major regional conflict areas and potential hot spots simultaneously by fusing the full DSP constellation and other data sources into a cohesive picture.

2-40. The United States also exchanges missile detection and warning information with its allies and coalition partners. The objective of shared early warning (SEW) is the continuous exchange of missile early warning information derived from U.S. missile early warning sensors and, when available, from the sensors of the SEW partners. Information on missile launches is provided on a near real-time basis and is approximately the same quality and timeliness as that which would be provided to U.S. Forces, if collocated.

SPACE CONTROL

2-41. Space control operations ensure freedom of action in space for the United States and its allies and, when directed, deny an adversary freedom of action in space. Space control involves five interrelated objectives:

- Surveillance of space to be aware of the presence of space assets and understand real-time satellite mission operations.
- Protect U.S. and friendly space systems from hostile actions.
- Prevent unauthorized access to, and exploitation of, space systems.
- Negate hostile space systems that place U.S. interests at risk.
- Directly support battle management, command, control, communications, and intelligence.

2-42. Surveillance of space is accomplished via a global array of ground and space-based sensors collectively called the space surveillance network (SSN). The SSN contributes to the space operational picture critical to the operational commanders' overall common operational picture (COP). The goal is not only to know where satellites are located, but also to be aware of friendly and adversary space capabilities and current operations. This provides what is commonly referred to as space situational awareness. The Army includes space situational awareness in the commander's COP largely through the commander's IPB and the space estimate detailed in appendix A.

2-43. Space control protection ranges from guarding space facilities to encrypting data and command links, to preemptive strikes against weapons that endanger space assets. Space control prevention may be accomplished by such operations as physically denying access to satellite uplink and downlink footprints, monitoring communication channel usage, or selectively jamming the GPS navigation signal used by the enemy. Space control negation is accomplished by denying, disrupting, deceiving, degrading, or destroying enemy space systems, including ground assets, orbiting assets, and communications links between the two.

2-44. As stated in the Army space policy, the Army is to "interdict enemy space power through operations on or from land" so terrestrial-based space control is an Army responsibility for the purposes of supporting joint and Army operations. The Army is not the sole provider of space control "on or from land."

2-45. IO tools may be used to accomplish space control. Information is defined as "facts, data, or instructions in any media or form. It is the meaning that humans assign to the data by means of the known conventions used in their interpretation" (JP 3-13). Therefore, any accomplishment of space control, whether it is protecting U.S. space assets, preventing unauthorized use of U.S. assets, negating those of the adversary, or simply surveilling assets to note their location and function, affects information. Operations to change the state of information, whether it is gaining more for U.S. use or denying it to the adversary, can be related to information operations.

2-46. IO tools are helpful in executing some types of space control. Using selected elements of IO to affect satellite control station operations or space data processing and distribution are potential methods of accomplishing

space control negation. Using camouflage, concealment, and deception (CC&D) to hide assets from adversary ISR satellites is another IO approach, which is also space control negation.

SPACE FORCE APPLICATION

2-47. This mission area encompasses combat operations in, from, and through space to influence the course and outcome of conflict. Space force application operations consist of attacks against terrestrial-based targets carried out by military weapon systems operating from, in, or through space. According to JP 3-14, this includes ballistic missile defense (BMD). However, BMD doctrine is beyond the scope of this manual and is not addressed here. Other than BMD, the Army currently provides no space force application weapon systems.

SPACE SUPPORT

2-48. Space support includes operations to deploy, sustain, and modernize military systems in space. This mission area includes launching and deploying space vehicles, maintaining and sustaining spacecraft on orbit, and deorbiting and recovering space vehicles, if required. It involves actions to sustain and maintain U.S. space-based constellations, such as space lift, surveillance of systems in space, and the day-to-day telemetry tracking and control (TT&C) needed for optimal performance and health of assets. It is a combat service support operation to deploy and sustain military and intelligence systems in space.

2-49. While space support is essential to enable exploitation of space capabilities, space support is primarily the responsibility of the Air Force as the DOD Space Executive Agent. The Army role in providing space support is payload and network control of the DSCS constellation for DOD use. While day-to-day satellite bus operations are provided by the Air Force through Air Force satellite control network common user equipment, the Army maintains a backup contingency control capability through its WSOCs.

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Chapter 3

Space Operations in Land Warfare

In all environments, the initiative of Army leaders, agility of Army units, depth of Army resources, and versatility of Army soldiers combine to allow Army forces to conduct decisive full spectrum operations. Space capabilities are thoroughly integrated into the force structure to enable all of these Army operations, and are essential for mission accomplishment. This chapter explains the integration between space support and general Army operations.

SECTION I – SPACE CONTRIBUTIONS TO JOINT LAND WARFARE

3-1. Effective use of space enablers is essential to the conduct of successful Army operations. Information provided by and through space-based systems, coupled with information from airborne and terrestrial systems, increase tempo and the number of offensive options. Better situational understanding allows commanders to shift forces and efforts from one area to another. Opportunities to exploit nonlinear operations in noncontiguous AO can be created. Commanders can project attacking forces on multiple axes throughout the AO. Lines of operations in the offense are related less by geographic proximity than they are by purpose; thus commanders can selectively bypass unfavorable terrain and unnecessary battles to focus combat power at decisive points.

SPACE OPERATIONS ACROSS THE SPECTRUM OF CONFLICT

3-2. This section provides examples of how land operations are tied to space. In conducting decisive full-spectrum operations, the Army depends on space capabilities to accomplish missions in all environments and in performing any combination of operations. Different phases of operations have varying needs for space capabilities.

3-3. The Army conducts a variety of missions, extending from humanitarian assistance and disaster relief to peacemaking and peacekeeping to major theater wars, including conflicts involving the potential use of weapons of mass destruction—the full range of operations. Commanders can tailor agile and versatile Army forces to create combined arms teams for operations at the strategic, operational, and tactical levels. Strategically responsive Army forces move wherever needed and are capable of transitioning quickly from one type of operation to another. Forces shift seamlessly from engagement to deterrence to war to postwar reconstruction. As missions change from promoting peace to deterring war, or from resolving conflict to war itself, operations become more complex.

3-4. Commanders conduct four types of operations (offensive, defensive, stability, and support) to accomplish missions in support of the joint force commander's objectives. Offensive operations aim at destroying or defeating an enemy. Their purpose is to impose the will of the United States on the enemy and achieve decisive victory. Defensive operations defeat an enemy attack, buy time, economize forces, or develop conditions favorable for offensive operations. Defensive operations alone normally cannot achieve a decision. Stability operations promote and protect U.S. national interests through a combination of peacetime developmental, cooperative activities and coercive actions in response to crises. Support operations employ Army forces to assist civil authorities, foreign or domestic, as they prepare for, and respond to, crises and relieve suffering.

3-5. Transitioning between the four types of operations normally requires adjustments in the space support needs. Offensive and defensive, or maneuver, operations drive the most intense needs for space force enhancement products, but space contributes to literally every Army operation. Therefore, space contributions to stability and support operations can be significant. For example, information needs may shift from targeting data to environmental monitoring, providing insight into agricultural production (spectral products can indicate the need for changes in irrigation or fertilizer application) to aid reconstruction in postwar support operations.

SPACE CONTRIBUTIONS TO OFFENSIVE AND DEFENSIVE OPERATIONS

Satellite Communications

3-6. SATCOM allows the commander to exercise effective C2 away from his tactical operation center (TOC) (for example, beyond LOS battle command on the move). The ability of the commander to lead from the front has always been hampered by limited communications capabilities. Mobile SATCOM enables the commander to receive a clear COP of the battle and remain at the front to see and assess the situation. SATCOM is especially of assistance during exploitation or pursuit, where units are moving swiftly and covering significant distances.

3-7. SATCOM provides units with secure broadcast information from dispersed locations around the globe. Army units can benefit directly from intelligence data fusion and analysis. They can also receive near real time (NRT) intelligence, exchange logistics information, coordinate movements and plans, and, therefore, accomplish better planning and execution of operations.

Position, Velocity, and Timing

3-8. GPS provides invaluable support to the unit conducting maneuver operations. GPS is essential to effective command and control of maneuver forces since the timing signal is used to synchronize communications equipment. GPS, either as the sole source of guidance or coupled with other means such as inertial navigation, is used for precise guidance of munitions. This facilitates target destruction with minimal weapons used and greatly reduces collateral damage. It also enables strikes in direct support of combat

action to be executed closer to friendly positions. Similarly, this GPS position accuracy aids maneuver since soldiers and platforms can move to precise locations along precise pathways. Combat search and rescue operations can be executed with less exposure to danger since search platforms can maneuver directly to locations precisely identified by GPS.

3-9. The deployment of friendly force tracking capabilities that use space-based components adds another significant dimension in support of tactical navigation operations. BFT capabilities allow the commander to track friendly forces and maintain exact location information on subordinate elements. Force location data is of great benefit for C2, situational awareness, and avoiding fratricide incidents in the mayhem of combat. The use of BFT devices associated with national technical means (NTM) is managed by Space-Based Blue Force Tracking Mission Management Center (SB/BFT MMC). (See appendix B for further discussion of SB/BFT MMC capabilities.)

Environmental Monitoring

3-10. Space-based meteorological systems such as the Defense Meteorological Satellite Program (DMSP) provide timely and accurate weather, other environmental conditions, and space environment data. Current technologies provide the commander a clear understanding of the weather/environmental impacts on operations throughout the depth of the battlespace. Space-based environmental monitoring benefits for planning support to operations include—

- Detect terrestrial weather throughout the area of responsibility.
- Detect space weather to forecast potential effects and understand actual effects on communications and space-based assets.
- Detect soil moisture content (unrestricted, restricted, and severely restricted terrain based on recent precipitation and analysis of soil type).
- Detect obscurants and differentiate between dust, smoke, fog, oil mist, and so forth.
- Detect ionospheric scintillation, which can impact UHF SATCOM and GPS reliability.
- Increasing overall understanding of the area of responsibility by using MSI/hyperspectral imagery (HSI).

Space Intelligence, Surveillance, and Reconnaissance

3-11. Current and near-term space-based electro-optics (EO), synthetic aperture radar (SAR), infrared moving target indicator (MTI), and MSI/HSI and SIGINT capabilities provide the following to the corps and division:

- NRT information from sensor to shooter.
- Direct downlink of space-based ISR sensors into Army TENCAP systems in support of both situation understanding and targeting.
- Measurement and signature intelligence (MASINT) to defeat enemy CC&D operations.

- Space-based information requirements (IR) to rapidly locate enemy theater ballistic missiles, surface-to-air missiles, and multiple rocket launcher system; support timely combat assessments; and provide potential location information for combat search and rescue.
- Commercial space imagery to supplement national sources, providing additional imagery to support planning, combat assessment, and situation analysis.

Theater Missile Warning

3-12. Space-based missile detection capabilities assist the unit commander by providing early warning of enemy theater ballistic missile launches via the TES supporting the missile defense operational elements of active defense, passive defense, attack operations and battle management, command, control, communications and computers, and intelligence. TES broadcasts data to forward units where the air defense element (ADE) coordinates warning distribution to both subordinate units and allies. The TES warning supports maneuver operations as follows:

- Identification of missile type (supporting passive defense). This may help determine the appropriate force protection measures (for example, if the missile is capable of carrying a chemical warhead) maneuver units may need to go to a higher mission-oriented protective posture (MOPP) level.
- Predicted impact point and time (supporting passive defense). TES cues units near the impact point to take protective action. A very significant implication is that maneuver units confirmed not to be in danger can continue normal operations.
- Estimated launch point (supporting attack operations). This provides target intelligence in support of deep attack operations. The commander may employ combat maneuver forces and/or fires to attack mobile launch systems, their support areas, and installations.

Space Control

3-13. Space control operations ensure friendly unit access to space and deny the enemy use of space. Ensuring friendly access to space enables maneuver forces to benefit from space force enhancement. At the same time, space control ensures the enemy is selectively denied use of space. This significantly contributes to gaining and maintaining information superiority, an obvious advantage to friendly maneuver operations. For example, movement of troops and materiel often relies upon position information from GPS. Some precise attack methods use the GPS signal to guide weapons to a predetermined set of geographic coordinates. When adversaries jam the GPS signal in an attempt to prevent Army use of it, the Army will often find and destroy the jammers. This is an example of space control protection because in restoring its use of the GPS signal the Army is protecting its ability to use the space-based navigation capability.

3-14. Adversaries need not develop, launch, and operate their own space capabilities; many are available commercially. An enemy could buy space-based imagery, which could reveal troop movement, supply storage, and so forth. Buying all rights to the imagery in advance to disallow adversary

access is a form of space control negation. Full-spectrum IO also provides space control negation. Methods such as camouflage, concealment, and decoy employment are used to disallow adversary satellites from "seeing" friendly assets. Computer network attack and electronic warfare (EW) can be used against enemy satellite control or data downlink and distribution stations. (See FM 3-13 for use of these IO tools.)

3-15. A similar case is true for commercially available satellite communications, or SATCOM. An enemy may gain a military advantage by using SATCOM capabilities leased from a commercial vendor. Normally, it would pay for communications channels on specific transponders on commercial satellites. The vendors may elect to voluntarily deny enemy access to the transponder. They may also accept an alternative lease agreement, allowing friendly forces to take over the transponder. If the vendor is sympathetic to the enemy (or neutral) and cannot make a business case supporting either of the options described, it may be necessary to selectively jam the transponder or specific channels to deny enemy use.

3-16. In extreme cases, ground stations providing access to the satellite in question could be captured or destroyed to make further access impossible. All the above are examples of space control negation that could be used to support maneuver operations.

3-17. Space control prevention is accomplished to prevent an enemy from using U.S. and allied space capabilities. If an enemy were to use the GPS signal for navigation purposes in a specific situation, the Army could jam the signal in a local area to prevent its use.

3-18. A final example of space control supporting maneuver operations is the use of surveillance of space. Surveillance operations are continually ongoing to ensure the current and future locations of all satellites are known with reliable accuracy. Maneuver forces are warned when adversary space-based ISR assets will be in a position to view and record U.S. activity. Forces can then use CC&D techniques, if necessary, to protect themselves. This is an example of force protection enabled by space control surveillance.

3-19. Friendly and adversary space capabilities can affect terrestrial operations in a great many ways because forces are heavily dependent on space force enhancement capabilities. Each of these uses comes to the battlefield through specific channels involving ground stations/operations, the satellites on orbit, and the communication links between the satellites and the ground stations and users. Each of these channels provides various points to be attacked or defended. This leaves a large number of options for adequate space control operations in support of maneuver operations.

SPACE SUPPORT TO STABILITY AND SUPPORT OPERATIONS

3-20. Stability operations include a range of actions that Army forces conduct outside the United States and its territories. Their purpose is to promote and sustain regional and global stability. Stability operations are diverse, continuous, and often long term. However, the credibility and staying power of Army forces allow them to conduct these operations until the situation is resolved. Army forces may execute stability operations as part of a theater

engagement plan, smaller-scale contingency, or follow-on operation to a campaign or major operation. They are inherently complex and place great demands on leaders, units, and soldiers. Stability operations require the mental and physical agility to shift among situations of peace, conflict, and war and between combat and noncombat operations.

3-21. Army forces conduct support operations to relieve suffering and help civil authorities prepare for, or respond to, crises. Army forces have specialized capabilities and provide important support. Support operations usually aim to overcome manmade or natural disaster conditions for a limited time until civil authorities no longer need help. Support operations are divided into two categories:

- Domestic support operations are conducted within the United States and its territories.
- Foreign humanitarian assistance is conducted outside the United States and its territories.

3-22. Space capabilities provide important contributions to Army stability and support operations. Army deployments to Bosnia, Kosovo, Haiti and other locations demonstrated the need to have timely and effective space support when conducting the variety of peacekeeping, security assistance, humanitarian aid, counterterrorism, and other operations that have become common in the Army today. These space-based assets provide great assistance in the conduct of both stability and support operations.

Satellite Communications

3-23. Numbered Armies, corps and divisions employed in stability and support operations may find their subordinate units deployed over large geographic areas, conducting a wide variety of mission requirements. In this environment, SATCOM provides the primary means of ensuring reliable and secure communications with all subordinate units.

Position, Velocity, and Timing

3-24. The GPS signal with its position information can be used in stability and support operations to maintain a distance buffer between opposing forces in a truce or stand-down situation. Providing both sides with GPS receivers and the coordinates for a demarcation line may make it easier for forces on both sides to remain on their own side of the demarcation. Forces equipped with GPS receivers are not likely to cross over the demarcation inadvertently.

3-25. In stability and support operations, there are no clear boundaries separating friendly units from insurgents, terrorists, or the local population. BFT systems provide the commander the ability to track small unit patrols and force protection teams that are often intermingled with the local populace. This capability can be of great importance if a friendly force unit needs to be quickly extracted from a difficult situation. BFT systems automatically provide the exact location information necessary to track units, and thus contribute to effective C2, situational awareness, and force protection. GPS is used to map out minefields and facilitate mine clearing operations.

Environmental Monitoring

3-26. Environmental monitoring provides a variety of capabilities, including—

- Determining changes in activity in a given area. This can be especially beneficial supporting counterdrug, law enforcement, detecting and monitoring environmental damage, and other missions.
- Detecting soil moisture (determine trafficability, go/no go terrain, and so forth).
- See through foliage (important benefits to counterinsurgent and law enforcement operations).
- Timely receipt and access of weather observations from remote locations.

Space Intelligence, Surveillance, and Reconnaissance

3-27. The same basic ISR capabilities described above to support maneuver operations are tailored to support stability and support operations as well. Space-derived ISR, especially EO imagery from commercial systems (because it is unclassified), is used to give civil authorities the impression space-based systems are always watching them. This creates uncertainty (in the target audience's mind) of their ability to do anything undetected. Unclassified EO imagery can be shown to adversary leadership to prove the friendly force can effectively monitor the actions of potential enemies of the United States. Space-based ISR is used for disaster relief support, refugee management support, consequence management, and so forth.

Theater Missile Warning

3-28. Shared early warning allows U.S. Forces to provide missile warning to civilian populations of coalition partners, or neutral parties; this is specifically called shared early warning. Sharing allows partners or neutral parties to take protective measures that could help stabilize political and military situations as well as help protect noncombatants.

Space Control

3-29. Space control is used to deny communications and propaganda tools, such as TV and radio, to adversary leadership. Space surveillance systems monitor the status of enemy and commercial satellite operations to determine potential threat to friendly forces.

SECTION II – COMMAND AND CONTROL

JOINT SPACE OPERATIONS

3-30. JP 3-14 outlines two general situations for space command and control operations: global C2 and theater C2. Due to the nature of orbiting space assets, changes to satellite tasking to support one theater can affect other theaters. Therefore, day-to-day command and control is accomplished from a global perspective. Commander, USSTRATCOM is responsible for conducting space operations and coordinating and conducting space campaign planning

through the joint planning process in support of the national military strategy.

3-31. Combatant commanders seek and employ space solutions for their operational needs. They coordinate on USSTRATCOM campaign plans and provide force protection in coordination with USSTRATCOM for space forces not assigned to (but operating in) the area of responsibility (AOR).

3-32. USSTRATCOM delegates appropriate operational control to the component commanders; components maintain this global perspective in their space planning and operations. The Army component for USSTRATCOM is USASMDC/ARSTRAT. The mission of USASMDC/ARSTRAT is to conduct space operations and provide planning, integration, control and coordination of Army forces and capabilities in support of USSTRATCOM missions.

3-33. In joint operations, the joint force commander (JFC) is responsible for coordinating the integration of U.S. space operations. During times of conflict or large-scale contingencies, the JFC normally designates a "space authority" within the joint force structure to coordinate and integrate space requirements. It is important to limit the possibility of interference or redundancy between various space operations, and deconflict space activities. Assignment of the space authority is based on the missions and capabilities of the commands and organizations involved.

3-34. The Commander Army Forces (COMARFOR)/joint force land component commander (JFLCC) may be designated as space authority at the discretion of the JFC. This is most likely to happen if the Army has the preponderance of space capabilities in theater or otherwise has sufficient expertise available to justify JFC confidence, and has adequate C2 to fully coordinate space issues. The nature and duration of the overall mission are also factors when assigning the space authority. If COMARFOR/JFLCC is the designated space authority, a space support team (SST) (see JP 3-14 for a discussion of the SST) is normally assigned to support. The space authority consolidates JFC component space requirements and issues, and coordinates implementation through JFC to USSTRATCOM. The space authority coordinates space operations, integrates space capabilities, and has primary responsibility for in-theater joint space operations planning. Commander, USSTRATCOM ensures coordination and integration from the global perspective, and together with the space authority, ensures space activities are coordinated, deconflicted, integrated, and synchronized at the theater level. When acting as the space authority, COMARFOR/JFLCC exercises direct liaison with other Service space components.

ARMY SPACE COMMAND AND CONTROL

3-35. At Secretary of Defense direction, Commander, USSTRATCOM transfers designated space capabilities to the supported combatant commander, subordinate JFC, or subordinate commander. These capabilities are the forces provided by the Services to the CJCS and further allocated to USSTRATCOM, or those forces directly assigned by the Service to the component commands of USSTRATCOM. For the Army, these forces are normally forces provided via USASMDC/ARSTRAT.

3-36. The Space and Missile Defense Command Operations Center (SMDCOC) provides the USASMDC/ARSTRAT commander the means to communicate and execute command and control of USASMDC space and missile defense assets. It provides command situational awareness and maintains command asset operational status. The SMDCOC provides around-the-clock reach for space operations officers and deployed space assets.

3-37. To ensure overall synchronization of space efforts, the JFC designates a space authority to coordinate theater space operations and integrate space capabilities (per JP 3-14). Similarly, the Commanding General, USASMDC/ARSTRAT may designate an Army space coordination authority in support of the ASCC for the regional combatant commander, Army forces (ARFOR), or JFLCC and theater space authority.

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PART TWO

Tactics, Techniques, and Procedures

Like all Army operations, space operations follow the full spectrum operations process described in FM 3-0. The process is actually a cycle of planning, preparation, execution, and continuous assessment. These activities are sequential but not discrete; they overlap and recur as circumstances demand (see FM 3-0 and FM 6-0). Part Two is organized around this cycle.

Chapter 4

Planning, Preparing for, and Executing Space Operations

Planning is the means by which the commander envisions a desired outcome, lays out effective ways of achieving it, and communicates to his subordinates his vision, intent, and decisions, focusing on the results he expects to achieve (FM 3-0). Preparation is an activity of the operations process. Most preparations occur between receipt and execution of an operation order (OPORD); however, preparation begins during planning and often continues during execution. The need for responsive staff coordination among the space operations elements intensifies during execution as an operation progresses and variances from the OPORD increase. This chapter discusses planning, preparing for, and executing space operations.

SECTION I – PLANNING FOR SPACE OPERATIONS

4-1. Planning is the means by which the commander envisions a desired outcome, lays out effective ways of achieving it, and communicates to his subordinates his vision, intent, and decisions, focusing on the results he expects to achieve (FM 3-0). Commanders and staffs above company level use the military decision making process (MDMP) to plan operations. The G3 follows MDMP techniques to plan and synchronize space operations. Planning space operations requires integrating it with all the other activities and processes of the organization. Space element members synchronize their activities with the overall operation.

4-2. Integrated space operations planning requires innovation and flexibility. Some space assets, resources, and related activities require a long lead time for planning and preparation. Some elements are executed before other aspects of the overall operation. Others demand higher resolution and more

up-to-date intelligence. For some, there is a long lag between execution and assessment of their effects. Defined, but flexible, processes are used to structure space operations planning. The G3 develops space operations mission statements and concepts of support, which are the result of the operations planning process.

4-3. The space operations mission statement is a short paragraph or sentence describing what the commander wants space operations to accomplish and the purpose for accomplishing it. The G3 space element develops the initial space operations mission statement at the end of mission analysis based on the restated mission, space operations-related essential tasks, commander's intent, and commander's planning guidance. The space element develops the final mission statement after the commander approves a course of action (COA). The final mission statement includes the objectives for the approved COA.

4-4. The space operations concept of support is a clear, concise statement of where, when, and how space contributes to accomplishing the mission. It directly supports the commander's concept of operations. During COA development, the space element develops a separate concept of support for each COA the staff develops. The space operations concept of support is written in terms of space objectives and space assets, resources, and related activities.

4-5. Space operations objectives are clearly defined, obtainable aims that the commander intends to achieve using space assets, resources, and related activities. Accurate situational understanding is key to establishing space objectives. Objectives serve a function similar to that of terrain or force-oriented objectives in maneuver operations. They focus space operations on things that support the commanders' intent and concept of the operation. Space objectives usually involve tasks covering more than one space mission area. Space operations objectives are stated in terms of effects.

4-6. The G3 space element develops most space objectives concurrently with concepts of support during COA development. At the same time, the G3 develops terrain or force-oriented objectives. However, some space objectives may emerge during mission analysis. These include space objectives that are present during all operations such as maintaining SATCOM connectivity, maintaining space situational awareness, and monitoring space weather. Others may be related to specified tasks from the higher headquarters. Space objectives and tasks become part of the final space operations mission statement. The G3 space element uses them to focus the conduct of space tasks. Space operations tasks are tasks developed to support accomplishment of one or more space operations objectives. The space element develops space tasks during COA development and finalizes them during COA analysis.

4-7. With approval of a COA, the space operations concept of support for that COA becomes the space operations concept of support for the operation. During orders production, space tasks are assigned to the space element and supporting space units. The most important space-planning product is the space operations subparagraph or annex of the operation plan (OPLAN) or OPORD.

4-8. The space element also determines implied tasks. This requires identifying space-related tasks in the higher headquarters OPLAN/OPORD, developing space-related implied tasks that support accomplishing the mission, and assembling the critical asset list. All these products are refined throughout the MDMP, based on continuous assessment of the friendly and enemy situations.

4-9. The critical asset list is a list of space-related elements whose loss or functional disruption would jeopardize mission accomplishment. At the operational and strategic levels, this includes space centers of gravity. Protecting critical assets and centers of gravity is an implied task for every operation. This space critical asset list should be coordinated with the G7 to ensure no critical force capability is overlooked.

4-10. The space element compares available space operations assets and resources with tasks to identify capability shortfalls and additional resources required. The space operations product for this task is a list of assets and resources that can be employed. If the command needs additional space-related assets or resources, the space element forwards the requirements to the G3, who coordinates with higher headquarters.

SECTION II – PREPARING FOR SPACE OPERATIONS

4-11. Preparation is an activity of the operations process. Most preparations occur between receipt and execution of an operation order (OPORD); however, preparation begins during planning and often continues during execution. For example, a unit assigned a reserve or striking-force mission prepares until the commander commits the unit. When a unit executing one mission receives a warning order for a follow-on mission, it begins preparing for that mission, while executing its current mission. Because many space operations objectives and tasks require long or continuous periods, preparation often starts earlier than for other types of operations. Initial preparation for specific space operations elements may begin during peacetime, although execution is during conflict or war.

4-12. Peacetime preparation by units involves building contingency planning databases about the anticipated AO. These databases can be used for space operations input to the space estimate and to plan initial space operations.

4-13. An important element of preparation is developing and implementing the ability to coordinate among relevant units and agencies. Coordination facilitates preparation in general and is key to synchronizing forces during execution. Critical to the success of synchronized operations is the continuous exchange of information among units, including after the operations plan is approved. Coordination may be internal or external. Internal coordination occurs within the unit headquarters. The space element initiates the explicit and implicit coordinating activities within itself and with other staff sections. Much of this coordination occurs during meetings, but element members are monitoring other activities that might relate to space operations. The space element coordinates with the G3 for movement of space operations assets and resources during preparation.

4-14. External coordination includes subordinate units and higher headquarters. This coordination concerns space operations assets and resources or forces that may not be under unit control during planning. External coordination also includes coordinating with adjacent units or agencies. In space operations, adjacent refers to any organization that can affect a unit's operations. Liaison is an important coordination means. Effective liaison is through command liaison officers, and a member of the space element may be part of a liaison team. Establishing liaison early in planning supports effective coordination. Practical liaison can be achieved through personal contact between space activities.

4-15. Force protection is a continuous process executed by all commanders, regardless of mission, location, or threat. It consists of a broad set of unit specific, coordinated actions conducted to protect the force. The space element develops and initiates force protection actions during planning, but executes them mainly during preparation and execution. Space operations actions related to force protection include tasks involving all space activities. Threat assessment begins during planning and continues during preparation. Force protection measures may explicitly include space operations elements.

4-16. Resupplying, maintaining, and issuing special supplies or equipment to space operations units takes place during preparation. Repositioning logistic assets for units assigned space operations tasks also occurs during preparation. The space element coordinates with the G4 to ensure that units assigned space operations tasks receive the necessary support.

4-17. The G3 ensures that space operations-capable units made available to the force are fully integrated into the command in a posture that allows them to contribute effectively. This responsibility includes integrating support received from USASMDC/ARSTRAT.

4-18. Criteria of success are but one part of assessment. Traditional intelligence analyses and friendly reporting are still key to assessing space operations effectiveness.

SECTION III – EXECUTING SPACE OPERATIONS

4-19. During execution, a challenge faced by the space element is how to assess space operations execution and how to adjust space operations as the operation unfolds. The need for responsive staff coordination among the space operations elements intensifies during execution as an operation progresses and variances from the OPORD increase. The decentralized nature of space operations execution, combined with the multiple command levels involved, cover a wide span that the space element coordinates.

4-20. Assessment is the continuous monitoring—throughout planning, preparation, and execution—of the current situation and progress of an operation, and the evaluation of it against criteria of success to make decisions and adjustments. The space element compiles information from many sources to maintain a continuous space operations assessment. The primary objective of assessment is to determine whether space operations are achieving their objectives. As the situation changes, the space element

modifies operations to ensure they remain fully synchronized with the overall operation.

4-21. Monitoring space operations execution focuses principally on maintaining the effectiveness of space operations. The space element uses the critical assets list to monitor the status of critical friendly space activities and the status of critical space systems.

4-22. Decisionmaking during execution includes executing space operations as planned, adjusting space operations to a changing friendly situation, and adjusting space operations to unexpected adversary actions. Space operations may not be executed exactly as planned for a variety of reasons. The space element's challenge under these circumstances is to assess rapidly how changes in space operations execution affect the overall operation and to determine necessary follow-on actions.

4-23. Successful space operations execution relies on teamwork by several staff sections and organizations and rapid information exchange among them. As operations unfold, space operations objectives and tasks are modified to provide effective support.

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Appendix A

Space Input to Intelligence Preparation of the Battlespace and Space Estimate

The space element prepares two separate products, the space estimate and space-unique input to the IPB products. The space estimate is prepared as a tab to the space annex to the OPLAN while the space element provides space IPB to the G2. Both the space estimate and space IPB process are systematic, continuous methods of analyzing and documenting factors affecting space capabilities that affect the battlespace. These space-unique products present the supported commander and staff with information about the space situation that pertains to accomplishing the unit mission. These products are designed to support other staff estimates and the MDMP. The purpose of the space estimate is to consider systematically the space dimension of the battlefield. This appendix outlines the necessary content of space analysis as a tool to determine how space potentially influences the battle.

Purpose

A-1. The purpose of space input to the IPB is to provide the G2 with a highly detailed analysis of the space medium and its capabilities and effects within the battlespace. IPB is an analytical methodology to reduce uncertainties concerning the enemy and the battlespace, in three dimensions, and fuses air, space, terrain, and weather into a consolidated, coordinated assessment. IPB is the key to preparing for the next battle and, during peacetime, builds the foundational data that will be updated and enhanced continuously and simultaneously during operations.

A-2. Based on the factors of mission, enemy, terrain and weather, troops and support available, time available, civil considerations (METT-TC), staffs down to brigade level need to determine how best to integrate space capabilities and vulnerabilities into their mission analysis process. This effort supports all facets of MDMP and is the key space situation analysis tool used during the operation. The use of space systems significantly affects operations involving communications, navigation, threat warning, weather, terrain and oceans, and reconnaissance and surveillance. Throughout the spectrum of an operation (from predeployment to mission completion), the space impact on military operations is a key factor for which the commander plans. The SOO, in coordination with the rest of the battle staff, ensures that an effective space estimate process and space IPB is conducted and made available to the staff and the commander.

Space Input to the IPB process

A-3. The space element provides all space unique IPB products for integration to the G2, in accordance with FM 5-0 and FM 6-0. These space unique products are incorporated into the IPB products generated by the G2 for use in the planning, preparing, and executing of all operations. The SOO must ensure that he is in close coordination with the G2 to reduce the potential for redundant analysis.

A-4. The four steps of IPB (per FM 34-130) adequately describe the process required for the space element to provide the space IPB input. Some traditional IPB products developed by the G2 can be applied to the space estimate effort. With some adjustment, the modified combined obstacle overlay (MCOO) that addresses weather and terrain limits can be tailored to support the space estimate. The four IPB analysis steps are—

- Describe the battlefield environment.
- Describe the battlefield effects.
- Understand the threat.
- Determine threat courses of action.

STEP 1—DESCRIBE THE BATTLEFIELD ENVIRONMENT

Identification of Space Area of Interest

A-5. Step 1 begins with identification of the supported unit AO. Once the AO is identified, the area of interest (AOI) is coordinated with the G2. Based on a clear understanding of the operational commander's AO, the G2 specified AOI, and the supported unit mission, the SOO determines a separate and distinct space AOI**.** The space-specific AOI supports and complements the total G2/G3 effort and is designed to depict the relevance of space to the maneuver commander's battle. The space AOI includes the region above and adjacent to the ground AO (see figure A-1). It starts at ground level, continues through LEO, and terminates with the GEO. Satellites moving through the identified space AOI, space weather, and key terrestrial space-related locations (and associated terrestrial weather) are all considered in the space IPB input, as well as in automated ISR collection management tools. Space-related activity occurring anywhere outside of the designated space AOI (such as solar weather, space launches, and ground station activity) needs to be considered in this effort only if it directly impacts the operational mission.

Initial Examination

A-6. Once the space AOI is identified, the G3 space element begins an initial examination, in conjunction with the G2, of available intelligence and information gaps that need to be addressed. During the initial examination, the following issues may help determine the intelligence and information gaps and areas where space-based sensors may be requested:

- Adversary space capabilities database development.
- Commercial space capabilities database development.

- Blue space systems available to support the operation.
- Impact of solar and terrestrial weather on space operations.

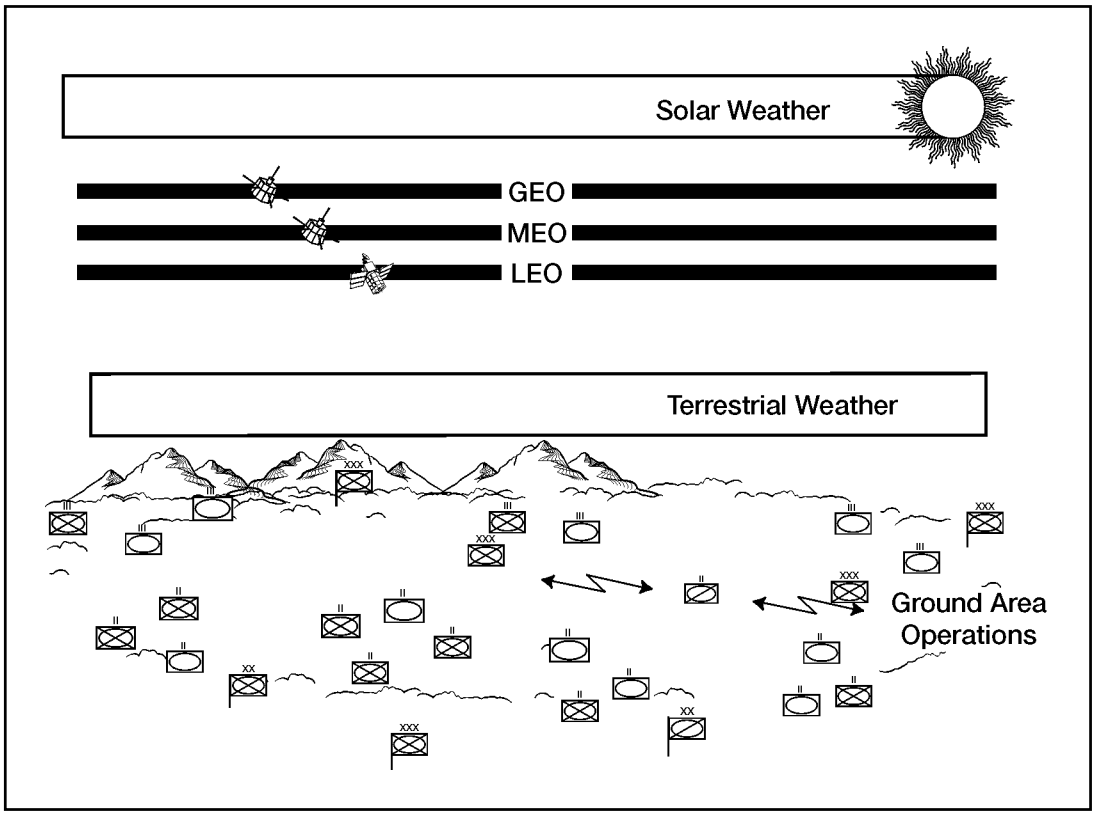

Figure A-1. Space area of interest

STEP 2—DESCRIBE THE BATTLEFIELD EFFECTS

A-7. Step 2 includes solar and terrestrial weather and terrain analysis relevant to space capabilities. Care is taken during this step to limit the focus to the weather and terrain impacts on space operations; otherwise there is duplication with the G2 effort. In fact, this step is conducted in close coordination with the G2 staff weather officer (SWO) and terrain team to ensure a complementary effort.

Impact of Solar Weather

A-8. The first task of step 2 is to examine the impact of solar weather on space operations. The space environment consists of the full range of electromagnetic radiation and charged particles (electrons and protons, which constitute solar wind) that continually flow from the sun at varying intensities. Several types of solar activity cause energetic particle streams to intensify the normal (or background) levels of solar wind. These changes in solar wind speed and density disturb the Earth's magnet field as they sweep by, creating geomagnetic and ionospheric storms. The fundamental drivers of space weather activity include solar flares (a rapid, intense variation in solar

brightness, including a release of radiation across the electromagnetic spectrum) and coronal mass ejections (huge bubbles of gas ejected from the sun over the course of several hours). These solar weather disturbances can significantly degrade selected military capabilities for periods ranging from several minutes to a few hours. The potential for space weather to disrupt friendly, civil, commercial, and adversary space systems needs to be integrated early during step 2. Table A-1 is an example of a space estimate product reflecting space weather battlefield effects.

A-9. The specific phenomena that need to be included in the solar weather analysis effort include—

- Electromagnetic radiation that may interfere with communications and radar systems during daylight hours.
- Energetic charged particles that degrade the performance of high-latitude, ground-based communications and radar systems and that disrupt or damage satellites.
- Solar wind events that cause ionospheric scintillation in the polar areas and impair or disrupt satellite communications and GPS signals.

Table A-1. Solar weather impact summary

Space WX threat	*Systems impacted*	*Problem*	*Support available*
Solar flare (X-rays)	HF communications	Shortwave fade (SWF)	SWF advisory
Solar radio bursts	Radars SATCOM	Radio frequency interface/target mask Radio frequency interface	Solar radio burst advisory
Ionospheric scintillation	SATCOM GPS	Signal fades lock loss	Scintillation forecasts and after-the-fact assessments

Impact of Terrestrial Weather

A-10. The second task of step 2 is determining the impact terrestrial weather will have on space operations. The SWO has access to the Air Force Weather Agency (AFWA) (Offutt Air Force Base [AFB], Nebraska) and to the theater specific weather support element (for example, at Shaw AFB, South Carolina, for United States Central Command [CENTCOM]) databases of terrestrial weather information for the AO. The SOO tailors the SWO product to the space analysis effort. The SOO develops a thorough understanding of the mission and effectively analyzes the linkage between terrestrial weather and space capabilities. Examples of factors related to weather analysis include—

- Terrestrial weather (such as heavy precipitation) impacting access to satellites and interfering with SATCOM.
- Cloud cover impacting collection of EO imagery and data.

- Do weather systems with extensive heavy cloud cover dominate the AO?
- How much reliance will the G-2 have on space-based EO data?

- Degradation of space-based infrared due to cloud cover. If there is a missile threat, the SOO determines if cloud cover inhibits detecting and reporting on threat missile launches.

Relation Between Terrain and Space Support

A-11. The third task of the battlefield effects analysis effort focuses on the relation between terrain and space support. All space-based ISR terrain effects are adjudicated through automated means. Additional analysis for other space-based products and services are evaluated through the basic tenets of observation, cover and concealment, obstacles, key terrain, and avenues of approach (OCOKA).

A-12. The space MCOO is the culminating product of step 2 and a combination of the MCOO developed by the G2 terrain team, the space AOI, and the space and terrestrial weather and terrain OCOKA factors discussed above. The space MCOO may be used as a stand-alone product or incorporated into the space situation template developed in step 4.

STEP 3—UNDERSTAND THE THREAT

A-13. Step 3 transitions from an environment orientation to a detailed focus on adversary capabilities. The space element coordinates with the G2 staff for this information. The desired end effect is knowledge of adversarial space forces, the doctrinal principles that indicate how these space forces are employed, recommended space high value targets (HVTs), and an initial assessment of adversarial space courses of action.

A-14. Included in step 3 is an examination, in close coordination with the G2, of key adversarial space capabilities, including civil and commercial space assets. Important factors to include in step 3 are—

- A detailed review of the adversarial space order of battle (OB) and the potential commercial space OB available to support the operations. Knowledge of the space OB is the critical first step to understanding the threat.
- An identification of space capabilities that will probably be employed by the enemy in the specific operation that the G3 space element is analyzing. These adversary space capabilities include organic space systems, third-party space support, adversary access to space via consortia, and direct adversary use of commercial space assets.
- An analysis of the following factors, regarding adversary force enhancement operations—
  - ISR. What are the space-based (organic, commercial, third-party) ISR systems available to support military operations? Does the adversary use space ISR for strategic or tactical operations? What are adversary TPED capabilities for space-based ISR? Does the adversary have the ability to receive and disseminate information in a timely manner to support the targeting process?

  - Missile warning. Most potential adversaries have no missile warning capability. However, the G3 space element should consider what threat theater ballistic and cruise missile assets are available, and the capability of friendly space-based warning systems to collect and accurately identify potential threat missile systems. The SOO does not need to analyze threat missile targeting strategies (G2 role) nor attempt to duplicate the air defense role in warning and dissemination.
  - Environmental monitoring. What space-based weather and remote sensing assets are available to support the adversary? Determine the doctrinal employment of these systems.
  - PVT. To what degree does the adversary rely on space-based navigation? What are the key adversarial capabilities that rely on PVT? How is it incorporated into critical operations?
  - SATCOM. What key military and commercial SATCOM systems does the adversary employ? What is the reliance of the adversary on SATCOM to perform effective C2?
- A review of the adversary's space control capabilities. This includes—
  - Jammers, ground-based EW, direct ascent weapons, or directed energy capabilities that may be directed against friendly space assets.
  - Friendly force space capabilities that may be targeted as part of the enemy space control strategy.
  - Analysis of potential enemy space-related vulnerabilities. Examples are enemy reliance on a single ground station, a single satellite for weather support, poor resolution, or slow TPED process for space ISR.
- A recommendation of space-related HVTs. These HVTs could be vulnerabilities uncovered by analysis or those used to support a specific friendly force mission objective. The G3 space element can develop the HVTs with the G2 staff and provide recommendations as part of the targeting process. The HVTs should be considered for potential negation operations.
- A G2 coordinated analysis of general space-related courses of action based on adversary doctrine.
  - Can the adversary adopt an aggressive space strategy for this campaign?
  - What will be the adversary defensive strategy to conserve assets?
  - How will the adversary focus on CC&D to aid in survivability of forces?
- A space-related priority intelligence requirement (PIR) that can be included in the overall list developed by the G2. If no space issue warrants a PIR, a specific information requirement (SIR) can be developed and included as a component to one of the G2-approved PIR.

STEP 4—DETERMINE THREAT COURSES OF ACTION

A-15. Step 4 of the IPB incorporates efforts from steps 1 through 3. The key tool and most important product of step 4 is the space situation template (figure A-2). The space situation template is a depiction of the space situation: the who, what, where, when, and why of the space campaign. It is an assessment and should be presented as such.

A-16. The situation template depicts how the staff believes space impacts the supported command operations. Because it includes a detailed threat analysis, the space situation template is coordinated with the staff prior to being briefed or disseminated to the commander/staff. This template is an excellent tool to depict graphically the adversary's most probable COA as it relates to the space aspects of the fight, to include the adversary's perception of how civil, commercial, and friendly satellites are employed. The space situation template is considered the culminating piece of the space estimate developed to support the mission analysis phase of MDMP. The space situation template is tailored to reflect the impact that adversary, civil, commercial, and friendly space systems have on the operational mission. The following component pieces can be included in development of the space situation template. Each of these component pieces is briefed as part of the space mission analysis to help the rest of the battle staff clearly understand the impact of space on the tactical operation. When building the space situation template, consider—

- It is a snapshot in time (for example, 301200Z). This time relates directly to a critical phase of the operation (for example, crossing the line of departure or moving from a tactical assembly area).
- It focuses on the space AOI to show the direct relation of the space AOI to the terrestrial maneuver AO.
- It depicts the general disposition of friendly and enemy maneuver forces to show supporting space operations and the relevance of space to the terrestrial battle.
- It graphically depicts space weather, and space-relevant terrestrial weather and terrain impacts (such as cloud cover that inhibits satellite EO sensor collection).
- It reflects the implications of adversary use of space (such as what satellite reconnaissance advanced notice capability the enemy possesses) and informs the timing of the CC&D strategy.

A-17. The template depicts friendly satellite systems that may be targeted by the enemy (such as CC&D) during a certain time to deceive friendly satellite ISR collection. As part of this process, the SOO provides an assessment, such as when and where the enemy will use CC&D to protect what it believes is a high priority for friendly force ISR collection. The assessment includes when and where the enemy may conduct electronic warfare to degrade friendly SATCOM effectiveness and whether the adversary understands the reliance the Army places on SATCOM to support extended range operations. The template also reflects appropriate symbology to depict this activity, such as a line from the enemy's EW system to the targeted SATCOM.

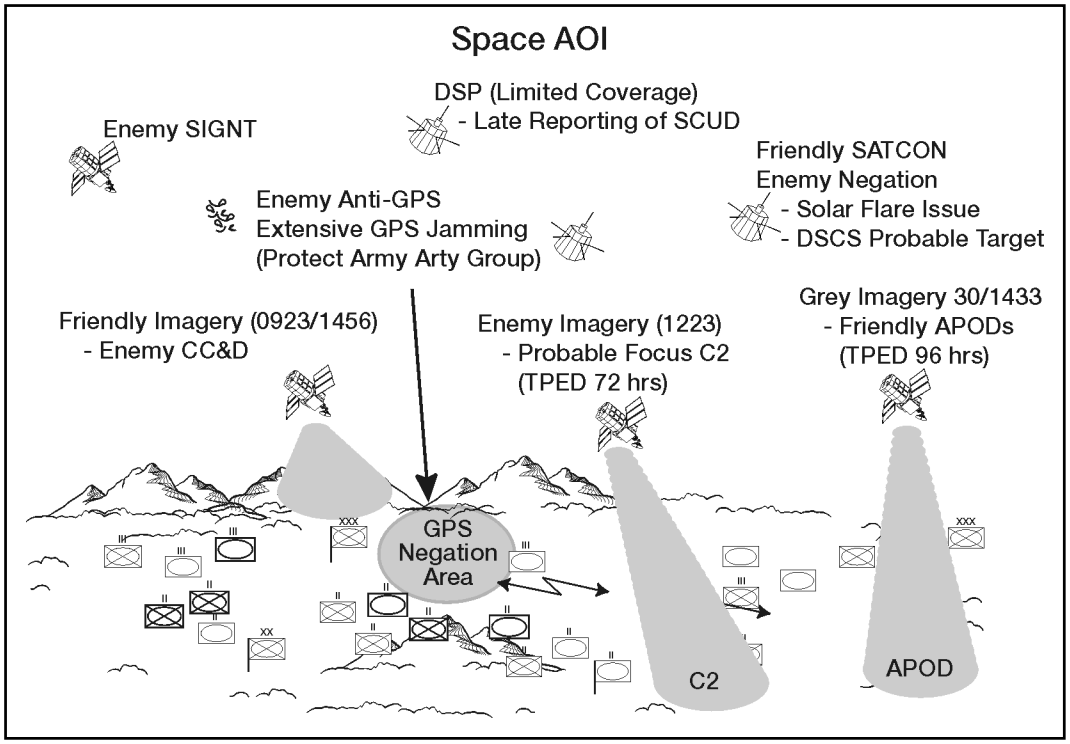

Figure A-2. Situation template

A-18. The situation template reflects an assessment of how the adversary employs space and how civil and commercial satellites affect the battlefield. This tool enables staff to project—

- The most probable adversary COA for organic, third-party, civil, and commercial space assets.
- The probable targets for adversary collection, the means (EO, radar), and the TPED process to get data to the adversary. An example might be "anticipate the adversary will use EO against corps support command because it is an HVT. The adversary's dissemination timelines support targeting fixed/semifixed facilities only."
- How shutter control regulations impact the adversary's ability to receive commercial products. What actions are being worked at higher echelons to prevent (or slow) use of commercial space by the adversary?
- Critical adversary space and associated terrestrial nodes to recommend for friendly targeting of high-payoff targets (HPTs). If the adversary has a single point of failure for receipt of satellite imagery, this could be an HPT. A key part of the space estimate effort during step 4 is the identification of enemy space-related HPTs.
- An assessment of commercial imagery available to the press and its impact on friendly force protection, deception, and maneuver

operations. These capabilities can indirectly compromise friendly force mission accomplishment.

A-19. The desired end state is that, on completion of step 4, the supported commander and staff, through the integrated G2 IPB products, have a thorough understanding of how space influences the coming operation, and the ability to be proactive. The completed space IPB will—

- Set the stage for development of the space annex to the OPLAN.
- Contribute to the G2 collection priorities and analysis efforts.
- Provide valid HVT recommendations.
- Contribute to information superiority over the adversary.
- Influence COA development and mission execution.

A-20. The space IPB input remains valid throughout the operation and should be updated and included in staff updates, as the situation dictates. Although it is an extensive undertaking, a limited manned G3 space element can produce a tailored and effective METT-TC focused space IPB input in a reasonable time.

Space Estimate

A-21. The complementary product provided by the space element is the space estimate. The space estimate is used to recommend the best use of available space capabilities.

A-22. The space estimate should specifically address the space capabilities and effects on courses of action from—

- GPS and PVT.
- BFT.
- Missile warning in coordination with air defense coordinator.
- SATCOM, in coordination with G6.
- Space control capabilities, limitations, and availability.
- Satellite operational status (figure A-3).

A-23. The space estimate should not address space-based ISR capabilities. Instead, the space element should work closely with the collection manager within the G2 to ensure that both commercial and national technical means (NTM) assets are requested appropriately.

SATELLITE OPERATIONAL STATUS

A-24. The satellite operational status depicted in figure A-3 describes the status of satellites that support (or affect) the commander's AO. This includes analysis of key commercial (grey) satellites affecting operations to the maximum extent possible. However, commercial satellite operators generally will not report satellite and payload status to third parties. Satellites may be nonoperational or partially operational for numerous reasons:

- Satellite sensor malfunction.
- Satellite maintenance, maneuvering, or repositioning.
- Space environment.
- Ground station control updating communications software or installing upgrades to satellite systems.

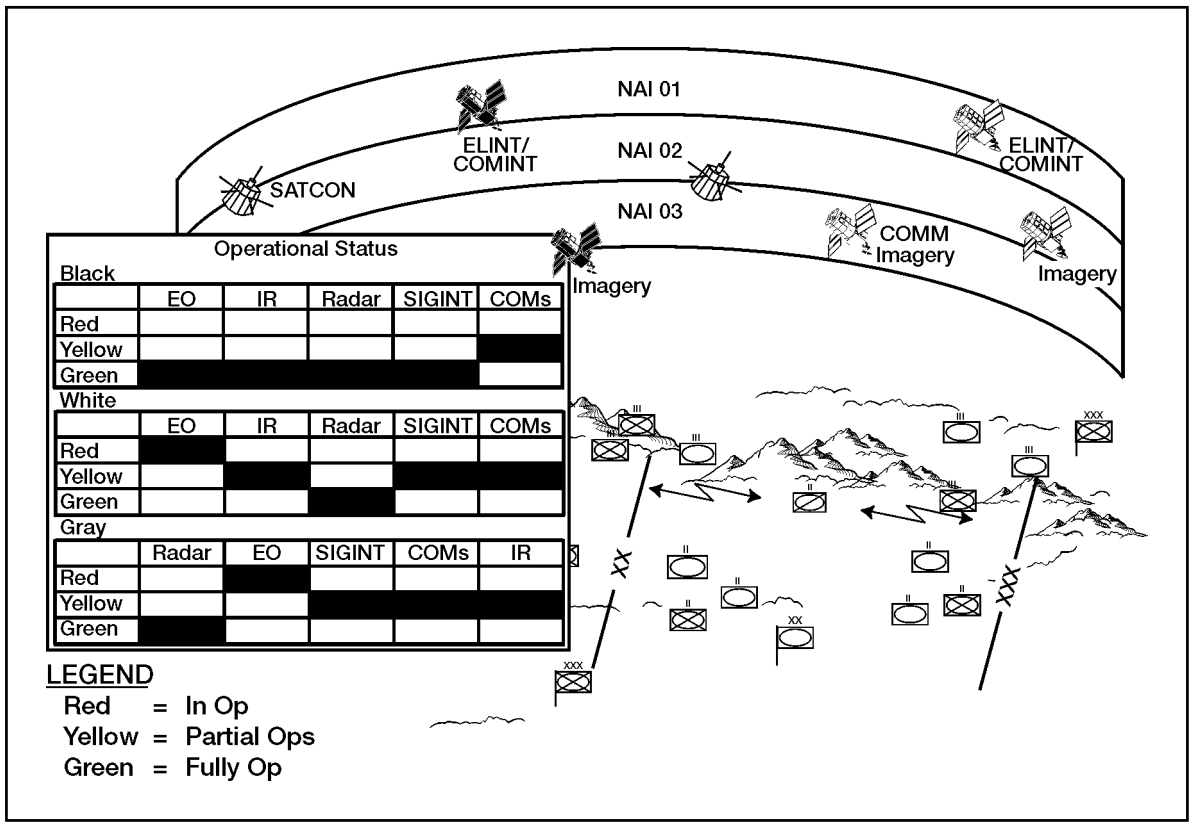

Figure A-3. Satellite operational status

SPACE DECISION SUPPORT TEMPLATE

A-25. The space decision support template (SDST) depicted in figure A-4 is used by the space element to portray the effects and support that space assets have on the battlefield. Though space is not a battlefield operating system (BOS), it is included in the SDST to highlight and clarify how to synchronize space-based products and services into the operation.

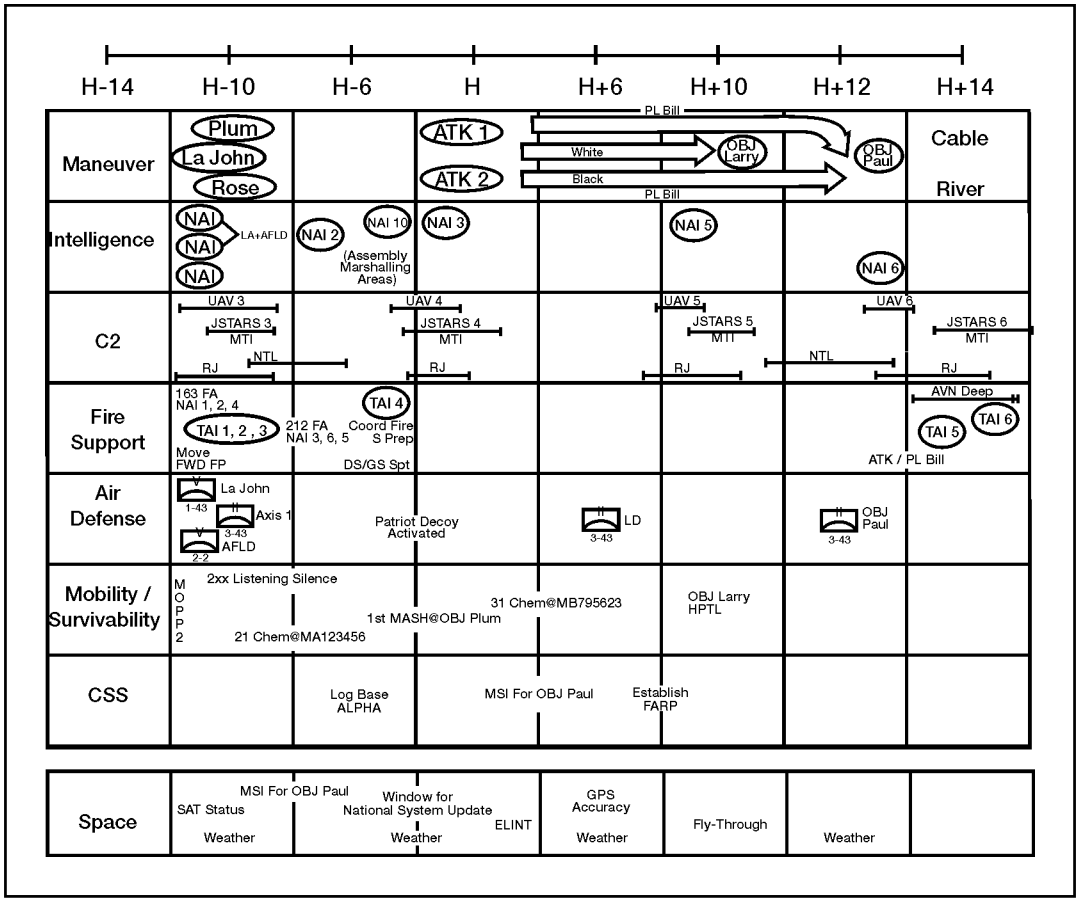

Figure A-4. Space decision support template

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Appendix B

Army Space Capabilities

The Army maintains nondeployable and deployable space support to the warfighter capabilities. These are units and teams that have routine, day-to-day support responsibilities, or are intended to support contingencies or other surge requirements. Combatant command authority (COCOM) of all these capabilities remains with the USSTRATCOM commander. Operational control (OPCON) normally remains with Commanding General, USASMDC/ARSTRAT.

SECTION I – USASMDC OPERATIONS CENTER

B-1. The SMDCOC serves as the primary operations center for USASMDC and ARSTRAT. The SMDCOC is available to Army warfighters as an Army space information center. The SMDCOC accomplishes this function by maintaining space situational awareness, exploiting space planning tools, and leveraging space expertise available within the SMDCOC, the ARSTRAT staff, ARSTRAT battalions, and the joint space community. This reach capability supports theater commanders and land component commanders who require space resources for conducting land-based operations.

B-2. The SMDCOC facilitates 24-hour-a-day, real-time command and control of ARSTRAT assets and maintains space situational awareness using global and regional communication resources. The SMDCOC maintains the current status of assigned forces, coordinates ARSTRAT mission execution, and serves as the operations information fusion center for USASMDC—the focal point for Army space operational missions, including space control, space support, force enhancement, and combat support operations.

B-3. The SMDCOC oversees and monitors the operations and utilization of ARSTRAT forces supporting space operations during peacetime, crisis, and war. The SMDCOC forwards ARSTRAT forces status to the Army operations center at the Pentagon. The SMDCOC is the conduit through which all operations orders and fragmentary order (FRAGO) taskings are passed to Army space forces from higher command authorities. The center also guides, directs, assesses, and monitors the information flow between USSTRATCOM, ARSTRAT, and subordinate ARSTRAT elements.

SECTION II – BLUE FORCE TRACKING MISSION MANAGEMENT CENTER

B-4. BFT is used to maintain situational awareness (SA) of location and movement of friendly, or "Blue Force," assets. BFT is an element of situational awareness and is often referred to as BFT/SA. Appropriately outfitted assets transmit their location to a central data fusion facility. The

location information can be correlated with other battlefield information such as mapping, terrain, and adversary positions and forwarded for inclusion in the commander's COP.

B-5. Three architectures are available to provide BFT/SA. Each uses a GPS receiver, which establishes its location and hands the data off to a transmitter. The GPS receiver and transmitter are an integrated package that can be mounted on a platform or carried by personnel. From this point, the architectures differ. The transmitter is specifically designed to radio the location information to one of three types of systems. The first is simply another nearby platform that has direct LOS access so the radio signal can be received. This platform will then be aware of the location of the transmitting asset, and may pass the information along to a central gathering point. This LOS system is limited to relatively local use and may experience outages as individual platforms lose LOS access to one another. This architecture does not involve the mission management center (MMC).

B-6. The second and third architectures are space-based; the battlefield platform transmits its location information to a satellite. In the second architecture, the satellite is a national system satellite that acts as a transponder from which the information is eventually sent back to the SB-BFT MMC. This system uses a specially designed waveform called the collection of broadcasts from remote assets (COBRA) to transmit location information from fielded assets through NTM and back to the SB-BFT MMC. SB-BFT MMC personnel correlate the location information, then pass it back to the global command and control system (GCCS) via SECRET Internet protocol router network (SIPRNET) or through a designated integrated broadcast system satellite for broadcast over all or part of the area of operations. This national system model using COBRA is the most reliable and secure of the three architectures.

B-7. The final architecture relies on commercial SATCOM systems rather than NTM. The commercial satellite hosts a transponder that sends the signal back to a ground site where a C2 system manager gathers and correlates individual platform location information. This correlated information is sent to the joint task force (JTF) headquarters and incorporated into the COP. In some cases, the SB-BFT MMC may be part of this commercial SATCOM system BFT/SA architecture.

Capabilities

B-8. The SB-BFT MMC provides warfighting combatant commands with near-real-time (less than 15 seconds) BFT data gathered by space-based systems, including NTM. This data is pushed as far forward as technically possible. It serves as actionable Blue Force location information and leads to more robust situational awareness and fratricide prevention. The SB-BFT MMC is operated by USASMDC and is located in Colorado Springs, Colorado. It is the critical BFT link between warfighters, national agencies, and a variety of dissemination architectures, and is the central point of contact for space-based BFT troubleshooting and coordination.

B-9. The SB-BFT MMC ensures requirements for use of the system, including COBRA, are properly validated; coordinates BFT collection; and accomplishes

transmission of correlated information back to the theater and relevant headquarters. The SB-BFT MMC also ensures SB-BFT (COBRA) information in the warfighter COP is accurate, timely, and actionable.

Mission Management Center Tasking

B-10. Organizations request SB-BFT MMC support through the SMDCOC. SMDCOC contact information can be gained from the FA 40 in the space element at the corps G3. USASMDC G3 will determine priority of requests but normally all requests are supported.

SECTION III – SATCOM AND SATCOM SUPPORT CENTERS

B-11. USASMDC operates three RSSCs per direction of USSTRATCOM. These centers, located in CONUS, Pacific Ocean area, and Europe, provide theater communication planners with a single point of contact for planning and managing SATCOM resources. Manned by representatives from each of the services and Defense Information Systems Agency (DISA), the RSSC is the theater SATCOM center-of-expertise for all military and commercial satellite communications serving the warfighter. USSTRATCOM operates a GSSC that serves global combatant commanders and other users.

Capabilities

B-12. RSSCs are the day-to-day operational interface with the user. All users will be assigned to an RSSC as their focal point for SATCOM planning, management, and access support. The GSSC supports global and national users not assigned to an RSSC. Current assignments are listed in table B-1. In general, the RSSCs support combatant commanders and their forces in routine, deliberate, and crisis action planning of SATCOM resources. RSSC personnel participate in planning conferences and meetings to identify and plan theater SATCOM support requirements for mission operations. The RSSCs process user satellite access requests and publish satellite access authorizations (SAAs) for approved missions.

Table B-1. RSSC support assignments

RSSC	***Supports***	
RSSC-CONUS	JFCOM CENTCOM	SOCOM SOUTHCOM
RSSC-Europe	EUCOM	
RSSC-Pacific	PACOM	
GSSC	USSTRATCOM TRANSCOM NORTHCOM	Defense agencies Other users

B-13. RSSCs perform the following day-to-day management functions for SATCOM resources in direct support of combatant command assigned theater forces and other users.

- Accept and analyze satellite access requests and develop solutions.
- Plan resource assignments; coordinate resource sharing/borrowing; publish SAAs.
- Assist combatant commander and user planners to implement networks and adjudicate usage conflicts.
- Monitor SATCOM systems status (readiness) and outage information.
- Coordinate user response to satellite anomalies.

B-14. RSSCs support combatant commander and user deliberate and crisis action planning.

- Assist combatant commander and user staffs in defining requirements and developing OPLAN/CONPLAN communication annexes.
- Perform "what if" drills, analyze scenarios, and provide assessments.
- Track resource utilization and recommend changes for optimizing resources.
- Assist combatant commander and user planners to develop theater policy and procedures.
- Provide training, technical assistance, and performance feedback to end users.

B-15. RSSCs support theater spectrum management activities.

- Assist in electromagnetic interference (EMI) response activities.
- Assist in the JF 12 process by which spectrum allocations and frequency assignments are approved.

B-16. RSSCs coordinate planning for SATCOM interfaces to the global information grid (GIG).

- Facilitate interfaces to the teleport/gateways.
- Coordinate planning with GIG service providers.

B-17. RSSCs support the GSSC in maintaining global system awareness.

- Support assessment of SATCOM support for each combatant command OPLAN.
- Monitor current SATCOM support and assess impact of system changes and anomalies on current, planned, and future operations.
- Provide data updates on SATCOM resources allocated to specific users.
- Coordinate allocation and resource sharing with other RSSCs.
- Develop contingency plans for catastrophic failure.
- Assist in system performance trend analysis.
- Assist in user performance trend identification and analysis.

B-18. RSSCs direct/coordinate SATCOM resource configuration changes with network control facilities such as WSOCs, Milstar Satellite Operations Center (MSOC), Naval Computer and Telecommunications Area Master Station (NCTAMS).

LOCATIONS

B-19. USASMDC operates RSSCs in three fixed locations, as illustrated in figure B-1. Current combatant command support assignments are also depicted.

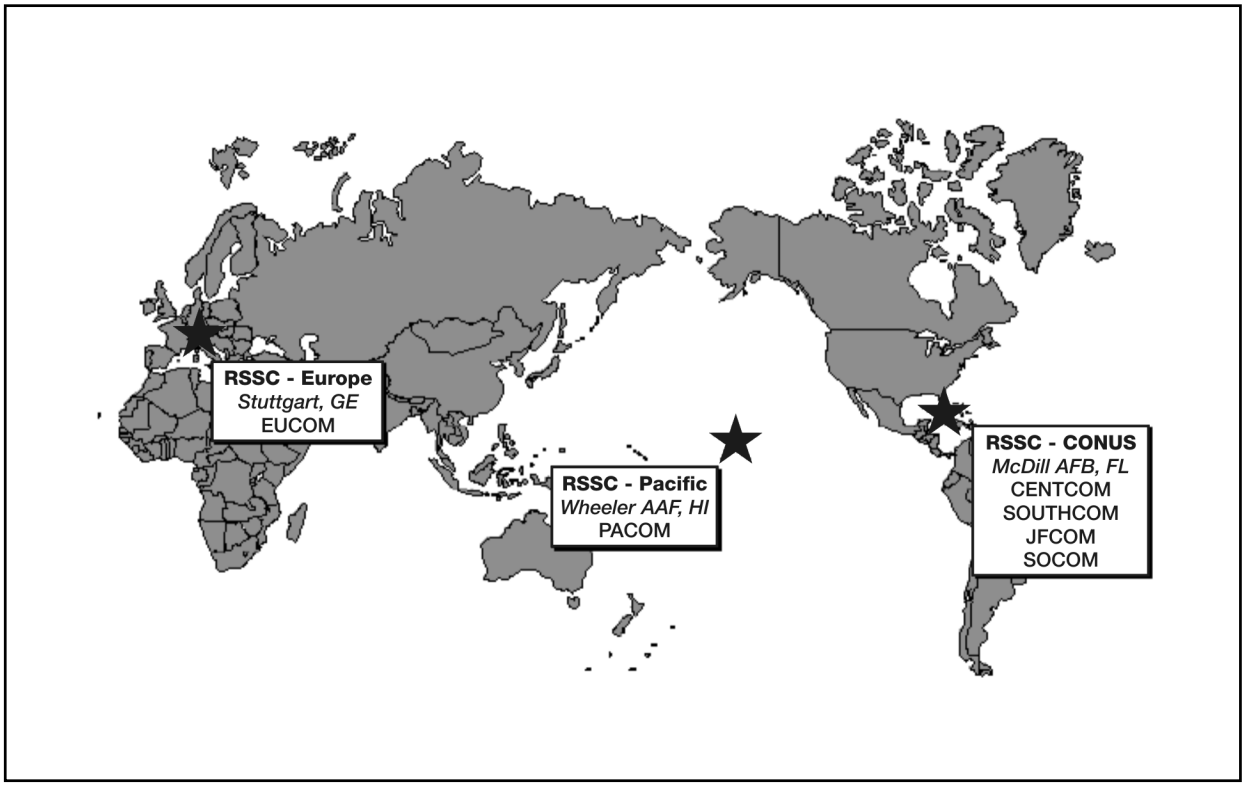

Figure B-1. RSSC locations

MANNING

B-20. The RSSCs are manned with planners from each USSTRATCOM service component and DISA who are proficient in dealing with management and control issues for their particular systems. Current manning responsibilities are as follows:

- Army (USASMDC/ARSTRAT): Wideband/SHF SATCOM (such as DSCS, WGS, and GBS).
- Navy (Naval Network Warfare Command [NNWC]/Naval Network and Space Operations Command [NNSOC]): Narrowband/UHF SATCOM (such as FLTSAT and UFO).
- Air Force Space Command (AFSPC): Protected/EHF SATCOM (such as Milstar and UFO).
- DISA: Commercial SATCOM (such as C, Ku, and mobile satellite services [MSS]).

B-21. USASMDC provides three personnel to oversee the RSSC directly. The heart of each RSSC consists of individual SATCOM spectrum planning cells manned by six to nine personnel (except for the commercial section). Figure B-2 depicts this organization. USASMDC has assigned OPCON for day-to-day operations but each service/agency has administrative control responsibilities for assigned personnel. The centers are available 24/7.

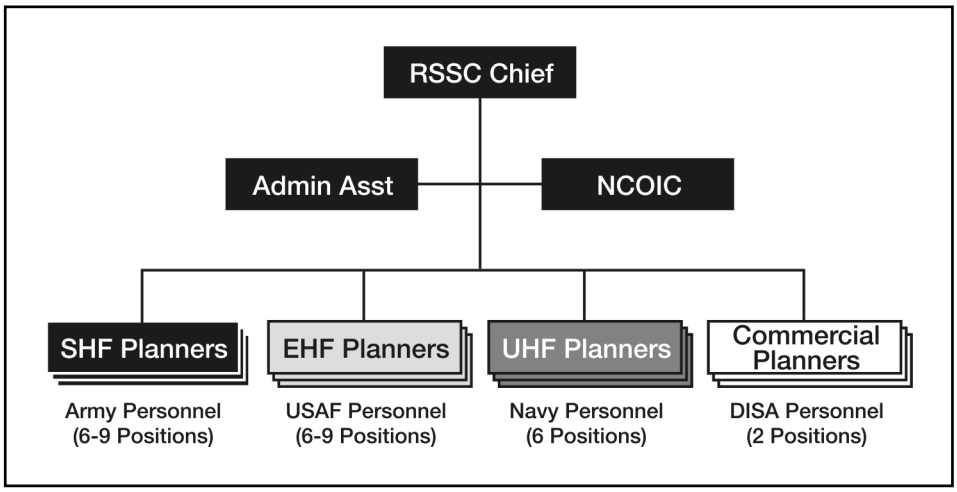

Figure B-2. RSSC manning/organization

Command and Control

B-22. USSTRATCOM designated OPCON of RSSCs resides at USASMDC. The RSSC provides direct support to the combatant command and theater forces as the focal point for all SATCOM planning matters. RSSCs also interact with the GSSC and network control organizations to coordinate and facilitate the implementation of their plans.

Regional Satellite Communications Support Center Tasking Process

B-23. The RSSCs employ standardized processes for operational management of SATCOM resources. These processes are described in the USSTRATCOM consolidated system control and operations concept (C-SCOC) and its approved system annexes. Figure B-3 outlines the primary process for satellite access. Request for additional support/products described above can be made via the appropriate combatant commander or in many cases directly to the RSSC.

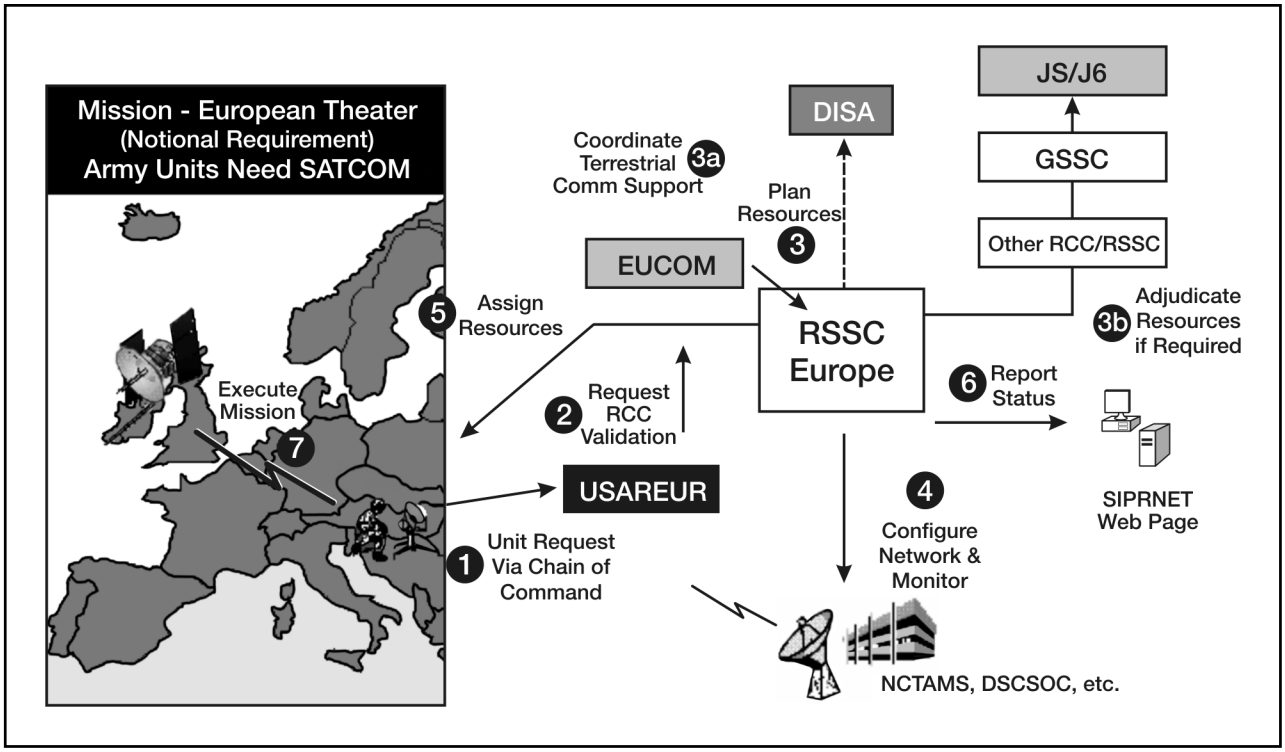

Figure B-3. Requesting SATCOM access

B-24. A unit requiring satellite access submits a satellite access request via its theater chain of command, including the theater service component, to the regional combatant commander for review and validation. For units serving global combatant commanders, such as United States Transportation Command (USTRANSCOM), submit requests via the GSSC. For new urgent requirements, submit requests to the joint staff J6 via the combatant commander.

B-25. An approved satellite access request is sent to the appropriate RSSC for analysis and planning. If sufficient resources are available, the RSSC develops a SAA, coordinates pertinent terrestrial interfaces, provides data for satellite configuration and control, and reports its status. If resources are unavailable, the request is either denied or submitted for adjudication to determine if resources can be borrowed or preempted from other users. RSSCs also continually analyze resource assignments to make optimization recommendations to combatant commanders and users.

B-26. Approved SAAs are sent to the originating unit authorizing operational access. Additionally, RSSCs direct and coordinate resource configuration directives with payload and network control centers (such as WSOCs, detailed in the next section), which implement and monitor communication plans.

B-27. Although the individual payload and network control centers have primary responsibility for monitoring and troubleshooting active networks,

RSSCs liaison with combatant commanders, users, and control centers to maintain situational awareness and respond to changing demands and requirements.

Contingency Deployment

B-28. Each RSSC can deploy an element to provide onsite SATCOM planning and management support for major or contingency operations. Potential deployment locations include supported combatant command headquarters, JTF joint/theater communications control centers (JCCC/TCCC), or supported combatant command component headquarters. This provides the theater commanders short-term, direct access to the SATCOM systems resident expert in the RSSC.

Augmentation

B-29. An RSSC may require additional support for extreme workloads during contingencies, equipment failures, or personnel losses. The RSSC receives augmentation support by another RSSC, ARSTRAT staff, or an ARSST to ensure consistent support to the operational community.

SECTION IV – WIDEBAND SATCOM OPERATIONS CENTER

B-30. WSOCs provide payload control and network control for DOD communications satellites providing SHF SATCOM for military forces. The SHF band is used to carry high volumes of communications through large terminals located around the world. The primary means for reach-back communications from in-theater headquarters to those in CONUS is via SHF communications through DSCS satellites.

B-31. The "payloads" are the radio frequency communications transponders on DSCS and soon to be launched wideband gapfiller satellites. Each transponder uses an assigned power level, frequency assignment, and antenna beam focus. Payload control is responsible for configuring and maintaining the satellite transponders for these variables at assigned levels.

B-32. Each of the DSCS satellites has a number of transponders and a very large number of ground stations communicate through the satellites. Satellite communications links go from a ground station through a satellite and back to a distant ground station, a cycle called a "hop." Multiple hops are involved in some communications links. Around the world, many communications satellites and ground stations are available, and collectively form a network. Monitoring and correcting problems such as ground station use of radio frequency signal power and bandwidth is called "network control."

Capabilities

B-33. Five WSOCs around the world provide DSCS communications payload control. Additionally, WSOCs constantly monitor the condition of assigned satellites by watching for anomalies or problematic trends on the spacecraft,

such as declining power output from solar arrays or unexpected buildup of heat in electronic components.

B-34. Network control of the DSCS is also done at the WSOC. Power and bandwidth are the commodities on the DSCS satellites, and the WSOCs ensure all users get their allocated share of these resources. WSOC personnel manage satellite resources and monitor user-compliance with joint staff-established priorities and allocations. WSOCs act as the "honest broker," implementing the rules of access, bandwidth, and frequency allocations laid out by the Joint Chiefs of Staff (JCS). Through this system, the WSOCs provide continuous worldwide support to the Commander in Chief, the JCS, the State Department, intelligence communities, the combatant commanders, and the Services in their various communications missions.

Command and Control

B-35. ARSTRAT, through the 1st Satellite Control Battalion (SATCON Battalion), provides command and control and operational direction for the WSOCs, including OPCON responsibility, while DISA provides technical direction to the WSOCs and has tactical control (TACON) responsibility.

B-36. The mission of the 1st SATCON Battalion is to provide communications network and satellite payload control of the DSCS by operating and maintaining five WSOCs and a DSCS certification facility. The five WSOCs are geographically located to provide 24-hour coverage of all assigned satellites. Each lettered company of the 1st SATCON Battalion is strategically positioned to provide command and control for one or more DSCS satellites.

Wideband Satellite Communications Operations Center Tasking Process

B-37. Each of the five WSOCs is tasked by its respective RSSC. Per this tasking, the WSOCs execute satellite payload configuration changes, thereby implementing payload and network control. The RSSCs task WSOCs after accomplishing detailed planning to allocate network communications resources properly, per configuration management requirements levied by DISA. DISA acts in part on direction from USSTRATCOM, taking combatant commander and other communications requirements from around the world and direction from the Joint Staff.

SECTION V – SPECTRAL OPERATIONS RESOURCE CENTER

B-38. The Spectral Operations Resource Center (SORC) is a USASMDC asset that provides exploitation capability of commercial and spectral data from both space and airborne sensors. Analyses and products are provided to the JFLCC down to the lowest tactical levels. Support can be provided through the supported unit S2/G2 and SOO, ARSST, USSTRATCOM support teams (SST), or the CET following doctrinal requests for information (RFI) and requirements management procedures.

B-39. The SORC is a responsive, versatile analysis and support capability, which includes a robust, fixed-site facility and a deployable capability. Deployed packages may consist of personnel with up to a three-workstation mobile production facility mounted in a vehicle.

B-40. The SORC's mission is to provide access to spectral information, products, and services and participate in activities to ensure emerging spectral information technologies and capabilities are delivered to operational and tactical forces. This is accomplished through SORC participation in the Army G2 national to theater (NTT) program for federated production of MASINT products. Tasking comes from USSTRATCOM or from operational and tactical unit S2/G2 utilizing the RFI system and the MASINT requirements system (MRS). The SORC uses the requirements management system (RMS) to request new NTM and high-resolution commercial imagery to support mission requirements.

B-41. SORC members are subject matter experts in remote sensing capabilities, to include commercial satellite data sources, tasking, and analysis. Team members provide detailed, tailored exploitation of spectral and radar data in support of operations. The SORC also creates geographic information system (GIS) data and analysis products. Finally, the SORC serves as a bridge between the research, development, and experimentation communities and military units enabling new data sources and tactics, techniques, and procedures (TTP) to be used to address military problems. The SORC can make significant contributions during the planning phase and should be included as early as possible in the MDMP.

B-42. The combination of computers and broadband communications equipment within the SORC provides high bandwidth communications and modular flexibility. The SORC has connectivity with the SMDCOC and remote sites with a broadband commercial SATCOM capability with data rates sufficient for transmitting and receiving imagery and large data files. The SORC has access to nonsecure Internet protocol routing network (NIPRNET), SIPRNET, and joint worldwide intelligence communications system (JWICS). Computers and associated software packages are capable of imagery and GIS production as well as spectral analysis. They also provide a capability for two-dimensional display and mission route simulations and three-dimensional terrain models and fly-throughs.

B-43. The SORC includes a representative from the NGA. The NGA provides geospatial intelligence in all its forms, and from whatever source—imagery, imagery intelligence, and geospatial—to ensure the knowledge foundation for planning, decisions, and action. NGA affords easy access to geospatial intelligence data for all stakeholders, creates tailored, customer-specific geospatial intelligence, provides analytic services and solutions, and shares insights.

B-44. The NGA provides support to the SORC through the NGA USSTRATCOM support team. The National Geospatial-Intelligence Agency support team (NST) is collocated with Headquarters (HQ), USSTRATCOM and component command locations (including AFSPC and ARSTRAT SORC) to conduct liaison between NGA and USSTRATCOM by facilitating the exchange of policy, procedural, and requirements management issues;

planning, programming, and budgeting issues; technical and analytical support pertaining to the exploitation of geospatial intelligence; and other activities of common interest.

B-45. NGA personnel are assigned to support geospatial intelligence requirements associated with the following work role areas:

- NGA staff officers (NSOs) are assigned to oversee areas where the geospatial intelligence function is broadly accomplished.
- Geospatial analysts (GAs) are employed at the command to assist in those areas of the geospatial intelligence function that emphasize spatial analysis of a thing or event and its symbolization and visualization.

B-46. Specific NGA analytical support to SORC—

- Enhances mission capability through project teaming efforts in the production of geospatial information products.
- Acquires and maintains NGA geospatial data sets (both standard and nonstandard) to enable an up-to-date foundation level of geospatial data on which to build SORC-generated products and information.
- Provides instruction on NGA, geospatial intelligence datasets, and appropriate data applications.
- Acts as technical liaison between SORC and NGA.
- Provides security guidance to enable proper classification markings and resolve releasibility issues to a wide variety of customers.
- Augments senior analyst expertise within the SORC on both geospatial and intelligence community matters.

Capabilities

B-47. The SORC has two areas of emphasis. The first area is the exploitation of all types of spectral imagery. This includes data from commercial, civil, and other sources. The SORC uses data that ranges from low spectral resolution four-band MSI sensors (such as Ikonos) to high spectral resolution HSI sensors (such as Hyperion). The SORC can work with data across the entire electromagnetic spectrum from the visible to the long-wave infrared (LWIR). The SORC uses these data sources to create a wide variety of products that support intelligence, topographic, and operational requirements. Examples of products created from spectral data include—

- Image maps.
- Spectral analysis.
- Spectral target detection to cue other reconnaissance assets.
- Drop-zone analysis.
- Terrain categorization/vegetation analysis.
- Change detection products.
- Three-dimensional perspectives and fly-throughs.
- Specialized products.

B-48. The SORC's second area of emphasis is the exploitation of civil and commercial imagery and data sources. This includes data from experimental satellite sensors from National Aeronautics and Space Administration (NASA) and other government agencies. It also includes working with SAR imagery from commercial satellites and local data sources such as commercial light detection and ranging (LIDAR) elevation data. Examples of products created from civil and commercial data include—

- Image maps.
- Digital elevation data.
- Terrain categorization/vegetation analysis.
- Line-of-sight analysis.
- Change detection products.
- Shaded elevation products.
- Three-dimensional perspectives and fly-throughs.
- Specialized products.

B-49. The SORC supports joint, interagency, multinational, and Army operations. The SORC acts as the conduit between organizations with spectral data and experimental satellite sensors, and the operational units that need to exploit that data. The SORC maintains relationships with, and coordinates with, commercial satellite vendors, elements of the IC (such as NGA and DIA), and other USSTRATCOM component exploitation elements (such as the Navy Remote Earth Sensing Information Center [RESIC]). The SORC provides products supporting tactical, operational, and strategic decisionmaking and operations templating.

B-50. The SORC is manned by a combination of Government employees, contractors, and military personnel (soldiers, sailors, and airmen). SORC personnel have expertise in the exploitation of panchromatic, spectral, and radar imagery. The SORC also has experience providing specialized GIS products and working with experimental, nonstandard data sources. SORC manning and equipment for deployed operations should be task organized and tailored to best support each mission, based on METT-TC. The strength of the SORC concept is its core group of subject matter experts providing tailored support to augment front-line forces. The SORC provides a comprehensive variety of force enhancement products and capabilities, primarily in support of environmental monitoring and ISR.

ENVIRONMENTAL MONITORING

B-51. The SORC is able to enhance the current capability of the topographic teams at every echelon. In addition to these enhancements, the SORC also provides unique capabilities to the supported unit topographic element. These include advanced spectral processing techniques, experience using experimental data sets, and greater access to commercial and civil imagery support. The SORC augments G2 capabilities by enabling the distribution of specialized topographic imagery products to the staff and attached elements. The SORC provides technical and production assistance to the organic and attached topographic assets and more standard products such as image maps and 3D fly-through products, which allow greater visualization of the AOR

across all battlefield operating systems. The SORC can assist with the production of other force protection products from commercial imagery that can be shared with coalition and host-nation forces with appropriate licensing.

B-52. The SORC provides tailored spectral analysis of SAR, multispectral, and hyperspectral information for change detection, material classification, and terrain/traffic analysis. Through analysis of a variety of data types, such as commercial/DOD systems, SAR, and imagery collected at different wavelengths, the SORC can determine specific ground conditions, such as vegetation type and soil moisture, enabling detailed analysis of trafficability conditions and vehicle traffic. The SORC can also assist with spectral products such as post-conflict change detections, terrain categorizations, vegetation analysis, specific ground conditions such as soil moisture, environmental disaster impacts, economic support products, and other specialized products.

INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE

B-53. The SORC enhances current capability in the G2. The SORC complements imagery analysis cells to provide additional tailored support products from commercial imagery sources, spectral data sources, and its own archive of GIS products. In support of unit intelligence requirements, the SORC responds to RFI through the exploitation of spectral data from commercial and government sources and by providing access to data from commercial imagery sources, other government agencies, and experimental platforms.

B-54. The SORC provides tailored spectral analysis of SAR, multispectral, and hyperspectral information for change detection as well as target detection and identification, and material classification:

- Through analysis of a variety of data types (such as commercial/DOD systems, synthetic aperture radar [SAR], and imagery collected at different wavelengths), the SORC can determine specific military targets, and detect and defeat camouflage and concealment efforts. An example would be assisting in the search for buried weapon caches by identifying areas with recently disturbed earth.
- In addition, SORC analysis products can support post-conflict assessment to include law of war investigations, weapon cache detection and characterization, and postbattle assessments.
- In its role as coordinator and manager of spectral production capabilities for USSTRATCOM, the SORC provides spectral products and services across the theater and throughout the joint force. The SORC is providing the nucleus for the creation of a MASINT node in support of USSTRATCOM.

REACH

B-55. The point of contact for SORC support and all forward based USASMDC/ARSTRAT elements is the SMDCOC. The SORC has organic reach capabilities that enable forward deployed forces to tap into the

complete spectrum of SORC capabilities, to include the ability to access large data files.

Command and Control

B-56. The SORC is an operational element of the USASMDC G2. The SORC fixed facility is operationally controlled and tactically controlled by the USASMDC G2. The SORC supports multiple theaters of operation based on G2 prioritization and tasking. While deployed, OPCON and TACON of SORC teams is normally assigned to the supported headquarters. The SORC responds to tasking from a deployed force (deployed Army corps, division, task force, or joint element) through the unit G2 to the USASMDC G2 requirements manager.

B-57. A deployed SORC element is normally assigned to the highest level headquarters in theater, enabling the greatest use of SORC assets. If the SORC deploys an operational team away from the fixed SORC location, the team may remain OPCON/TACON to ARSTRAT G2 through the SORC or be assigned as OPCON/TACON to a supported unit. The retention of the deployed SORC element as OPCON/TACON to SORC and ARSTRAT G2 allows complete synchronization of the entire SORC capability and TPED architecture but is normally used only in situations in which SORC is conducting operational test and evaluation of capabilities. The normal designation of deployed SORC elements is OPCON/TACON to a supported unit. This ensures that deployed SORC capabilities are leveraged and synchronized with deployed unit operations. Reach to SORC fixed activities remains in effect to provide additional capabilities as needed.

B-58. The SMDCOC provides a continuous reach capability to the SORC fixed site facility from the field.

Tasking the Spectral Operations Resource Center

B-59. Organizations can request SORC production support through their S2/G2 using the RFI/requirements system. While the RFI/requirement is processed through Coliseum or MRS, informal reach coordination with USASMDC/ARSTRAT through the supporting unit G2 can take place if the requirement is an obvious SORC requirement (cannot be accomplished by another MASINT node, the topographic team, or NGA). Supported units use the SORC imagery worksheet (available on SIPRNET) as the planning document for requesting support. The USASMDC G2 determines the priority assigned to each tasking. Requests for a deployed SORC team are sent through the USSTRATCOM global operations center with an information copy provided to the SMDCOC.

SECTION VI – COMMERCIAL EXPLOITATION TEAM

B-60. The mission of the CET is to rapidly deploy to provide directly downlinked commercial satellite imagery, commercial imagery spectral analysis, and custom mapping products to deployed ARSSTs and supported warfighters. The unit consists of seven military personnel (imagery analysts, topographic analysts, satellite operator/controllers, and system

administrators). The CET staffs and operates the mobile commercial imagery direct downlink ground station providing directly downlinked imagery to supported units. In addition to imagery, the CET also provides commercial spectral imagery analysis products and value-added geospatial information products such as image maps, perspective views, graphical overlays, and change detections. The CET is fully tailorable based on mission and support requirements and not limited to a specific configuration.

Capabilities

B-61. The CET receives and processes imagery using both the direct downlink antenna, which collects imagery directly from the imaging satellite and through "bent pipe" connectivity back to commercial vendors in CONUS. Sources for the imagery include the NGA, commercial imagery vendors, Eagle Vision II, and the ARSTRAT SORC. The CET maintains two deployment capabilities: a spectral exploitation cell—transportable (SPEC-TR), and a commercial imagery direct downlink ground station (Eagle Vision II). These capabilities can be used as stand-alone units or as a combined unit (for example, using the Eagle Vision workstations for spectral imagery analysis).

B-62. When deployed, the CET connects directly to the supported unit communications network to disseminate imagery and products. When the CET is in garrison and supporting deployed ARSSTs, the CET posts products through a page on the SORC portion of the USASMDC Web site. The CET also hosts products on the SORC EarthWhere server to allow the imagery and products to be accessed by other users.

Command and Control

B-63. The ARSTRAT 2nd Space Battalion has command and control of the active duty commercial exploitation team. The CET primarily supports ARSSTs by giving priority effort to deployed teams. The CET can function as a stand-alone unit able to support various echelons, and will be OPCON to the supported unit. The CET and ARSST coordinate with the G2 for imagery data production requirements.

Tasking Commercial Exploitation Teams

B-64. Requests for CET support are made through the corps G3 space element or through the SMDCOC. The CET responds to priority intelligence requirements submitted by the ARSST, or by the supported unit if no ARSST is assigned. Requests for new imagery collections are normally managed by the supported unit's G2/J2 collection management element.

SECTION VII – THEATER MISSILE WARNING

B-65. TMW detachments provide warning of TBM launches using joint tactical ground station (JTAGS) equipment. JTAGS are deployable, joint (Army and Navy) assets, which provide continuous in-theater processing and dissemination of TBM cueing, alerting, and early warning in support of the TES, and combatant commanders' missions. *Cueing* is reporting TBM launch, location, and velocity information to active defense weapon systems so they

can more quickly target the incoming TBM. *Alerting* is getting out a fast, initial data message to alert the theater as a whole that a TBM launched. *Early warning* means following with more accurate information and refining the initial description of the event (launch time and location, azimuth, impact time and estimated impact area).

B-66. TMW detachments deploy from 1st Space Company–TMW, of the ARSTRAT 1st Space Battalion. TMW detachments deploy so they can receive threat indications or other event data directly from DSP satellites, and quickly report to both theater and worldwide users by data (primary) and voice (secondary). With their in-theater location, TMW detachments reduce the possibility of single-point failures in long-haul communication architectures. JTAGS equipment upgrades to multimission mobile processor (M3P) equipment are underway.

Capabilities

B-67. TMW detachments provide combatant commanders a continuous 24-hour capability to receive and process in-theater, direct downlinked data from DSP sensors. The data is used to calculate high confidence estimates of TBM launch point and time, impact point and time, and associated trajectory information. The TMW detachment disseminates warning and alerting information on TBMs and static infrared events of interest throughout the theater.

B-68. A TMW detachment processes data from up to three DSP satellites to determine launch points, state vectors, and predicted ground impact points for TBMs. TMW JTAGS equipment ties directly into worldwide and theater communications systems to disseminate critical information immediately.

Command and Control

B-69. USSTRATCOM retains COCOM of TMW detachments and provides overall direction for their employment. Commanding General, USASMDC/ARSTRAT maintains OPCON of all five TMW detachments.

Tasking Theater Missile Warning Detachments

B-70. Three TMW detachments are normally forward deployed and actively support the EUCOM, PACOM, and CENTCOM theaters. Other TMW detachments deploy based on the assessed capabilities and intentions of the threat and the probability of ballistic missile employment. On implementation of a combatant commander OPLAN or tasking from JCS, or if a contingency necessitates deployment of additional TMW assets, a combatant commander or JTF commander requests allocation and deployment of a TMW detachment. The COCOM J3 makes the request to JCS, which forwards the requirement to USSTRATCOM. If appropriate, USSTRATCOM then tasks ARSTRAT.

B-71. TMW detachment deployments are preplanned and comply with time-phased force deployment data (TPFDD) airlift planning and integration methods, or by a request for forces. Qualified personnel survey potential deployment locations for theater TMW detachments to ensure satellite visibility, security, logistics, and communication connectivity support the mission.

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Appendix C

Army Space Support Teams

The ARSSTs are USASMDC assets from the Active Army, USAR and ARNG. ARSSTs rapidly deploy worldwide within 48 hours to augment corps and division space expertise, normally within the G3 section, during exercises and contingency operations, including combat operations. Their primary support is at the operational and tactical levels. ARSSTs may be assigned to support other levels in Army or non-Army units.

Capabilities

C-1. The mission of the ARSST is to deploy worldwide to provide force enhanced space support during operations and exercises. The ARSST brings with it a comprehensive variety of capabilities and products. Some are organic capabilities, ranging from subject matter expertise to specific tools such as topographic map printers. The strength of the support team concept is in its forward presence, which gives a front-line awareness of Army warfighter needs and the ability to provide fast, tailored solutions.

C-2. In coordination with the G3 space element, the ARSST provides tailored, task organized space resources to assist the supported command in the areas of SATCOM, PVT; environmental monitoring, ISR, missile warning, and other theater-tailored space information. Each team is trained and equipped to network using space information channels from many sources.

C-3. ARSSTs provide space expertise. Team members have an in-depth understanding of red, gray, and blue space orders of battle, the operational capabilities and threats imposed, and implications for land force operations. The ARSST also assists the supported command in space control planning/understanding. When the supported command is a joint task force (JTF), the ARSST can be a conduit for planning and requesting the integration of Army space control capabilities in the operation.

C-4. The ARSST facilitates joint, interagency, and multinational, as well as Army operations. ARSSTs assigned to the combined force land component commander (CFLCC) host Air Force, Navy, and Marine planners and space experts to improve multi-Service and joint operations.

C-5. In coordination with the G3 space element and the G2, ARSSTs support the space contribution to the IPB process. In coordination with the G3 space element, the ARSST supports the space estimate process. The ARSST provides space operations assessments and information to the G2, G3, G6, and other staff sections as appropriate. They, in turn, provide final staff assessments and determine impacts on communications, operations, and intelligence. The ARSST members integrate space into operations through

participation in the military decisionmaking process by developing the space operations annex and providing current space-related information. The ARSST synchronizes space support and threat information in the unit execution matrix.

C-6. Typically, soldiers who have widely varying military specialties and experiences staff the ARSST. Table C-1 shows the typical team military occupational specialty (MOS) structure. Deployed ARSST staff and equipment are task organized and tailored to best support each mission based on METT-TC. The mission and required skill sets of the ARSST changes as an operation proceeds through its various phases. ARSST member makeup is not limited to the standard team. During stability or support operations with limited threats and tactical operations, a full ARSST may not be needed. It may be possible for a single FA 40 with reliable reach and responsive support to successfully conduct all required operations. The non-FA 40 members are generally career experts in their designated fields, and have additional training to focus their skills on space. In addition, they continuously work relevant Army space issues between deployments so they are aware of the latest national, civil, commercial, and DOD space system capabilities, including user equipment and combatant commander and Army initiatives.

Table C-1. Typical ARSST composition

Title	*MOS*	*Rank*
Space operations officer	40A	O4
Space operations officer	25C	O3
Intelligence analyst	96B	E6
SATCOM systems operator	31S	E5
Topographic analyst	81T	E5
Information systems operator-analyst	74B	E4

C-7. The ARSST is a responsive, versatile space assessment and production capability in a compact, efficient package that is agile and easily sustainable. It is designed to maximize benefits of space capabilities to the warfighter while minimizing the overhead investment required of the supported unit. The ARSST is a deployable package with a minimal footprint. The equipment will fit entirely on a single high mobility multipurpose wheeled vehicle (HMMWV). The equipment package requires a 400-amp power bus and a single 787 shelter. A second HMMWV is used to transport the team and provide backup for the first. Additionally, the equipment set is C-130 air transportable. A trailer mounted tactical quiet generator and environmental control unit (ECU) provide necessary power, heating, and cooling. Computers are upgradeable and based on common hardware and software.

C-8. The combination of computers and broadband communications equipment within the ARSST provides redundant high bandwidth communications and modular flexibility. The team has connectivity between the SMDCOC and remote sites with a triple redundant space-based

communications suite. The ARSST has broadband commercial SATCOM communication capability with data rates sufficient for transmitting and receiving large imagery and data files and tactical high frequency radio communication, classified and unclassified. Computers and associated software are capable of imagery production and limited imagery assessment. They also provide a capability for two-dimensional display and mission route simulations; three-dimensional terrain models and fly-throughs; and red, gray, and blue area satellite coverage visualization.

Tasking During Full Spectrum Operations

SATCOM

C-9. The ARSST enhances current capability in the G6. It provides situational awareness on the architecture of all satellite communications to the channel level (SIPRNET, defense switched network [DSN], data circuits, and other special circuits). The ARSST provides expertise for military SATCOM constellations (UFO/FLTSAT UHF, DSCS-SHF, Milstar-EHF). It can assist in requesting activation of residual/marginal capabilities, and deconflict scheduled maintenance with critical operations. The ARSST tracks each circuit from the corps to the channel level on each communication satellite. It monitors the status of the satellites and reports scheduled and unscheduled outages. It assists in resolving issues through the constellation's controlling operations center. The ARSST also assists the supported unit, through USASMDC, with issues in interacting with the RSSC and the WSOC.

POSITION, VELOCITY, AND TIMING

C-10. The ARSST provides unique GPS reports that identify times of degraded GPS accuracy. The reports provide the relative accuracy at specific times and locations. ARSST also assists in mitigating degraded GPS accuracy and the negative impact to the mission accomplishment of deep aviation attacks, special operations forces (SOF) actions, and other operations. The ARSST coordinates the requirements for use of GPS, denial of enemy use of commercial GPS, and the necessity to counter enemy GPS jamming. USSTRATCOM provides general GPS accuracy graphics for each combatant commander AOR. ARSST products provide higher fidelity and are tailored to specific missions.

C-11. The ARSST uses software programs to predict GPS reliability, thus enabling the commander to plan for periods when GPS coverage may be less than optimal. This GPS reliability analysis is relevant for precise fires and SOF infiltration and exfiltration and could be significant for search and rescue operations. The ARSST will fully integrate accuracy information into operational planning and analysis for the space estimate. If reliability is inadequate for Army operations, the SMDCOC and USSTRATCOM are notified immediately. ARSST software tools provide the capability to monitor the status of the GPS constellation (including satellite downtimes for maintenance or problems) and graphically display this information to staff planners in the G2, G3, aviation brigade, or others. The ARSST works with

fire support personnel to determine timeframes to request GPS-enhanced theater support to optimize precision guided munition strikes.

ENVIRONMENTAL MONITORING

C-12. ARSST enhances interpretation of the impacts of space weather and solar-event driven environmental conditions through interaction with the SWO, combat weather team (CWT), and the supported Army staff. The SWO/routinely receives both terrestrial and space weather information from strategic and regional weather centers. This environmental information is often remotely sensed from space and used to help make forecasts. The SWO/CWT receives meteorological satellite (METSAT) cloud imagery, profiles, and surface weather information and applies it directly to combat operations and resource protection. The SWO/CWT use G2-provided weather effects interpretation software to determine the weather effects on operations. This includes tools to overlay METSAT imagery on the COP and enable machine-to-machine integration of weather in military decisionmaking processes throughout the command post. At lower echelons without ARSSTs, the G2 impact assessment software encompasses space weather and terrestrial weather effects. At corps, where an ARSST is assigned, the SWO/CWT receives the specification (observation) of current space weather conditions, warnings, and forecasts from the Air Force Weather Agency (AFWA). SWO/CWT provides this information to the ARSST for detailed interpretation of the space weather effects on communications and other operations disrupted by solar activity. The ARSST can help interpret AFWA space weather specifications, warnings, and forecast data. The ARSST works with the supported staff to mitigate space weather effects by adjusting plans before impacts occur or helping communicators understand that these limitations are from space weather, not equipment failure.

C-13. The ARSST enhances the current capability of corps/Army topographical teams. The ARSST has similarities to the supported unit topographical capabilities but provides unique capabilities, and has greater access to commercial and government imagery support. ARSST augments the G2 capabilities by enabling wider distribution of topographic imagery products to staff and attached elements. They provide three-dimensional fly-through products, which allow three-dimensional visualization of the AOR and near-real-time battlefield visualization across all battlefield operating systems. The ARSSTs have access to unique Army space resources that enhance imagery collection and analysis.

C-14. ARSSTs provide reach support from the SORC at ARSTRAT to leverage the capabilities in change detection assessments to identify potential enemy locations. In this process, archived imagery is merged with more recent spectral imagery, and images are compared to identify changes over time from one image to the other. The ARSST, in conjunction with the SORC, assists the G2 in identifying potential locations for enemy positions. This process enables ground forces to identify and destroy such things as hidden enemy logistic sites. The SORC and ARSST process multispectral and hyperspectral imagery. They can rectify and combine imagery having different wavelengths to highlight particular ground conditions, such as

certain types of vegetation or ground moisture content. The combination of different imagery enables a trained imagery analyst to see features not apparent in standalone imagery, such as evidence of earth excavation.

INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE

C-15. In support of unit intelligence requirements, the ARSST responds to space-related RFI, provides assessments of how the enemy will use its space systems, and provides expertise on friendly force space-based intelligence capabilities. The USASMDC G2 maintains a Web site (or similar information posting capability) that details space database information, and posts the space intelligence estimate for a given threat situation. When deployed, the ARSST accesses the G2 and the SMDCOC via SIPRNET.

C-16. The team aids the staff in making optimal use of satellite reconnaissance advance notice (SATRAN) data that provides overflight information on red and gray space systems. The ARSST uses SATRAN data and the known capabilities and limitations of the red and gray space system to portray when and where the force is most vulnerable to enemy reconnaissance.

C-17. The ARSST has the technical space system expertise to assist in the intelligence assessments of threat capabilities. The ARSST nominates targets through the effects process to include enemy satellite facilities, space launch facilities, and imagery production facilities. The teams have direct access to space intelligence agencies at the combatant commander level (USSTRATCOM).

C-18. The ARSST works with the topographic team to complement and supplement its capability. Through reach to the ARSTRAT SORC, the ARSST receives additional technical support and image products. The SORC coordinates and manages spectral production capabilities for USSTRATCOM, and provides spectral information, products, and services. Therefore, operational spectral experience is available to the theater, including analysts who can be used for joint applications.

C-19. A significant number of tactical maps are more than 15 years old. ARSSTs use controlled image base (CIB) to combine different imagery types to produce more current image map products. Satellite multispectral imagery and position information from GPS can also be used to update and supplement existing maps, enhancing their utility and accuracy. This capability is provided for specific uses, not for general mapping of the theater. These image map products are not used for targeting.

THEATER MISSILE WARNING

C-20. The ARSST provides information on the capabilities, limitations, and operational status of space-based missile-warning systems. They also provide commanders information on the ability to detect ballistic missiles beyond the range of organic ground-based assets. ARSST provides information to air defense artillery (ADA) elements on the probability of detecting specific missiles, given varied cloud heights and satellite early warning system constellation status. The ARSST serves as a point of contact to USSTRATCOM on issues concerning receiving early warning from space-

based systems. They also provide detailed information on scheduled early warning exercises to eliminate conflicts with real world operations.

SPACE CONTROL

C-21. The ARSST provides substantial space control related planning and expertise to the staff. They assist in analyzing red order of battle and the implications for unit mission accomplishment. The ARSST is knowledgeable of potential space targets (such as space system ground antennas, space data processing, distribution stations, communication links, and satellite control stations). The ARRST provides denial, disruption, deception, degradation, and destruction options in terms of analysis of targets and desired weapon effects. The ARSST assists the staff, when possible, to ensure space control surveillance, protection, prevention, and negation actions are fully integrated at both the Army and joint command levels.

REACH

C-22. The SMDCOC includes the home station operations center (HSOC) for ARSST support and all forward-based ARSTRAT space elements. The ARSST has substantial organic reach capabilities that can be augmented by supported unit communications assets.

Tasking During Stability and Support Operations

C-23. Generally, demands for SATCOM, PVT, environmental monitoring, ISR, and TMW support could remain as high in stability and support operations as in offensive and defensive operations. For example, the supporting SATCOM architecture usually remains in place for a time, and troubleshooting network problems is required. Army liaison is necessary to re-assign Army users on new nets, or prioritize which users may be bumped if communications capacities become restricted. Space-based navigation signals from GPS might not be required for targeting, but may be critical for mine clearing. Use of ISR capabilities could be significant in finding and destroying weapons depots. Guidance in adjusting space support requirements from maneuver to stability and support operations, more specifically for application in postwar reconstruction support, follows.

SATELLITE COMMUNICATIONS

C-24. The ARSST acts as a watch officer, coordinator, and facilitator with the Army, joint, or coalition communications directorate. In the beginning of stability and support operations, the team should work with the communications group and advise them of system problems that may arise from space weather, interference, or system problems that the ARSST is monitoring.

POSITION, VELOCITY, AND TIMING

C-25. The ARSST acts as the watch officer for the GPS, monitoring and reporting on the health and positions of the constellations and providing routine navigational accuracy (NAVACC) reports. During stability and support operations, it may be necessary to use GPS-guided munitions or special operations that require event-driven NAVACC reports.

ENVIRONMENTAL MONITORING

C-26. The ARSST acts as a watch officer and advisor with the space weather officer. In the beginning of stability and support operations, the team should monitor and issue warnings of space weather events and likely impacts. The team advises the communications director and SWO on space weather, its impacts, and Web sites that contain warnings and predictions of space weather activities.

INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE

C-27. There is a limited need for the ARSST to support imagery production during stability and support operations. In addition to being collocated with a topographic team, each division in theater has organic topographical sections that may already be augmented by the NST, so expertise in imagery production is already available. Nevertheless, the ARSST may provide valuable support for coordination and dissemination of commercial imagery and multispectral products.

C-28. With the end of major combat operations, SATRAN reports may not be needed. However, the ARSST maintains a thorough knowledge of U.S., adversary, and commercial satellites in use in the AOR.

THEATER MISSILE WARNING

C-29. The ARSST acts as a backup watch officer to the echelon ADE. The team acts as a coordinator between the ADE, TMW detachments, and theater space operations. Once the ADE is educated and networked with the other missile warning assets, the ARSST should "work itself out of a job."

Combat Service Support Responsibilities

C-30. The ARSST is dependent on the supported unit to which it is assigned for maintenance, transportation, supply, combat health support, field services, human resources support, religious support, and other combat service support (CSS) functions, as applicable.

C-31. Support for Army common supply items is available through the Army supply system and the Army maintenance system, outlined in AR 710-2 and AR 750-1.

C-32. Contractor logistic support (CLS) is required for ARSST-unique equipment. Reach capabilities, concerning maintenance, must be in place to work in conjunction with CLS. Employment of civilian contractors on the battlefield involves many considerations and hazards. DA Pam 715-16 and FM 100-10-2 provide guidance and doctrine for commanders and staff planners.

C-33. Equipment is sustained through corps or division assets, where possible. This includes normal maintenance, repair, and replace actions on computers and accessories, HMMWV, and 787 shelter. ARSST personnel manage software and nonstandard equipment sustainment through the SMDCOC and the USASMDC space brigade.

C-34. A continuing challenge is how to work in a coalition environment where most "SECRET US ONLY" products and information cannot be shared. ARSSTs should seek appropriate foreign disclosure training tailored to their assigned environment.

UNITED STATES ARMY SPACE AND MISSILE DEFENSE COMMAND

C-35. USASMDC is responsible for the following activities:

- Coordination of contracting activities required to support deployed ARSSTs, and interface with supported unit contracting officers.
- Coordination with vendors to provide equipment and services.
- Emergency contracting support.
- Coordination of Army space support company (ARSSC) Web sites and SIPRNET access.

SPACE BRIGADE

C-36. The space brigade is responsible for the following activities:

- Coordination of human resources support activities with the supported command.
- Security planning and assistance.
- Coordination of the military entrance processing station calendar.
- Coordination of all deployment operational and exercise participation, and the activities of the space battalion S3.
- Coordination of emergency resupply, transportation, and TPFDD requirements with USASMDC G4, as required.
- Coordination of communications and bandwidth support requirements.

1ST SPACE BATTALION

C-37. The 1st Space Battalion is responsible for the following:

- Coordination of human resources support and activities with supported command and direct support to deployed ARSST organizations.
- Emergency service support activities and coordination through the SMDCOC.
- Lead agency coordination of service support activities for deployed ARSST organizations and supported unit. Coordination for transportation, supply and service tracking, and resupply.
- Battalion motor officer coordination for maintenance support for the ARSSC HMMWV fleet.

193RD SPACE BATTALION

C-38. The 193rd Space Battalion is responsible for the following:

- Coordination of human resources support and activities with supported command and direct support to deployed ARSST organizations.

- Emergency service support activities and coordination through the SMDCOC.
- Lead agency coordination of service support activities for deployed ARSST organizations, and coordination with supported unit. Coordination for transportation, supply and service tracking, and resupply.

ARMY SPACE SUPPORT COMPANY

C-39. ARSSC is responsible for—

- Supervising and controlling detachment CSS functions and systems.
- Establishing the standing operating procedure (SOP) for CSS functions (such as maintenance, supply, and human resources).
- Coordinating CSS from the supported unit and space battalion.
- Coordinating soldier sustainment and supply for assigned personnel.

SUPPORTED UNIT

C-40. Army standard equipment found in the ARSST is maintained through the organizational support element of the supported unit and through the direct support unit (DSU) and other combat service support assets. An advance element from the 1st Space Battalion and the ARSSC coordinate support, establish maintenance accounts, and conduct other preliminary coordination prior to the arrival of the team.

C-41. Standard item maintenance support during peacetime is in accordance with established memorandums of understanding (MOUs) and interservice support agreements.

C-42. During contingency operations, the ARSST receives organizational maintenance support from the unit to which it is attached. Section personnel can perform operator and unit level maintenance on ARSST-peculiar equipment. Contractor support provides higher-echelon maintenance and coordinates it through ARSSC headquarters.

C-43. Supply support for all classes of supply from the DOD supply system during peacetime is in accordance with established MOUs. During contingency operations, an ARSST is dependent on the headquarters it supports for all classes of supply.

C-44. Each ARSST team is assigned two HMMWVs for transportation and to provide workspace when integrated into the supported unit TOC. The space brigade S4 works with the USASMDC G4 to coordinate transportation of unit vehicles and personnel to the supported unit location. The space brigade S3 works with the USASMDC G3 to integrate ARSST personnel and equipment into the supported unit TPFDD.

C-45. Reconstitution actions are based on priorities set by the commander and result in the receipt of specified available resources needed to accomplish the reconstitution mission. The ARSST company commander or team leader determines the losses in soldiers and equipment, and assesses the unit's ability to continue its mission. That information is reported to the supported

commander and to USASMDC. Physical damage assessment is the responsibility of the team chief.

C-46. Reorganization and regeneration may be executed separately, but are usually accomplished in combination, depending on current and anticipated situations, command priorities, resources, and time available. USASMDC and the supported staff coordinate logistic linkup points for replacement equipment and personnel. Standard equipment flows through DSU channels. ARSST-peculiar equipment flows through CLS channels to the linkup point. Contractor support personnel onsite assist in the reconstitution effort. Replacement personnel flow through the supported commander's G1 replacement detachment.

C-47. If sustained operational contingency operations are planned, the supported command probably provides facilities to accommodate the ARSST and its organic equipment. The gaining command provides personnel needs, such as dining facilities, living quarters, and religious and administrative support.

C-48. The ARSST requires approximately 120 square feet (10 feet by 12 feet) of space for operations. The site is normally inside, in close proximity to the G2, G3, and the deep operations coordination cell.

C-49. Under special circumstances, the ARSST deploys with a deployable rapid assembly shelter (DRASH) tent to use as a workspace shelter. The team's computers and printers must be protected from dirt, dust, and moisture as much as possible. Therefore, an outdoor work area is feasible only when no other option is available. The supported unit is expected to provide shelter for team member sleeping quarters.

C-50. The preferred source of electrical power is commercial. The minimum power requirements for the work area are two 20-amp, 110-volt, 60-Hertz circuits. Teams deploy with uninterruptible power supplies (UPS) for their organic computers. Teams also deploy with a commercial gasoline-powered generator for emergencies.

C-51. The supported unit makes the following available to the ARSST:

- Six Internet protocol (IP) addresses on the SIPRNET.
- One DSN line.
- One multiple subscriber equipment (MSE)/tri-service tactical (TRITAC) line.
- One tactical local area network (TACLAN) or tactical satellite communications interconnect module (TACSIM) (METT-TC dependent).
- Other requirements are METT-TC dependent.

Command and Control

C-52. The 1st Space Battalion provides active and reserve force teams. The 193rd Space Battalion of the Colorado National Guard also provides teams. Teams normally support the four active corps (I, III, V, XVIII), and SOCOM as well as the Third and Eighth Armies (two per Army, or one at the Army

and one at the ARFOR headquarters). Normally, specific team leaders are consistently associated with a particular corps or army while any team could be assigned to any headquarters.

C-53. While deployed the ARSST is normally OPCON and TACON to the supported headquarters. If multiple ARSSTs are deployed to the same theater, the G3 space element SOO, in coordination with the USASMDC/ARSTRAT space brigade commander, designates which ARSST is responsible for ensuring the ARSSTs coordinate activities and material. This ARSST helps establish and maintain a high-fidelity COP, MDMP, space contribution to the commander's IPB, and space estimate. This is normally the ARSST attached to the highest level headquarters in theater, but should METT-TC indicate that a different ARSST would better serve this function, the space brigade commander can designate it instead. If all ARSSTs are deployed at the division level, the space brigade commander designates the ARSST responsible for ensuring in-theater team coordination. This ARSST organizes and coordinates information from other theater ARSSTs and from reach assets, and passes appropriate information back to ARSSTs and the SMDCOC.

C-54. The Commanding General, USASMDC/ARSTRAT may designate an Army space coordinating authority. If so, responsibility to coordinate ARSST activities and material for situational awareness, MDMP, space contributions to the commander's IPB, and the space estimate could be placed with the Army space coordinating authority.

C-55. The SMDCOC provides a continuous reach capability to rapidly address space force enhancement and space control issues for deployed ARSSTs worldwide.

Tasking the Army Space Support Team

C-56. ARSST obtains support by contacting the corps G3 space element or the ARSTRAT G3 through the SMDCOC. The ARSTRAT G3 prioritizes deployment of ARSSTs according to worldwide mission issues.

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Appendix D

Space Operations Officer

This appendix discusses specific support to Army units provided by SOOs. The SOO provides space analysis and expertise, and specific products to supported units, usually at the numbered army and corps level. SOOs serve as permanently assigned staff officers, and are the space experts at the tactical and operational levels. During increased activity associated with exercises or operational deployments, an ARSST may augment the SOO.

General

D-1. The SOO is responsible for providing space-related operational support and expertise on space capabilities. The SOO integrates space force enhancement and space control operations, and supports both deliberate and crisis action planning.

D-2. Normally, one FA 40 SOO is assigned at the Army and corps staff. The primary piece of equipment the SOO employs is the space operations system, which relies on a SIPRNET backbone. The SOS provides the SOO with the necessary connectivity and analysis tools to accomplish required tasks.

D-3. The SOO is operationally aligned with the G3 and provides an organic space staff capability. The SOO routinely works in conjunction with other members of the coordinating and special staffs (such as the G2, G6, fire support element, and space weather officer). The SOO focuses on the integration of the wide range of space capabilities available to the commander. The SOO provides support to the staff to ensure they are fully cognizant of space support to provide space-based communications, PVT information, environmental monitoring, and ISR. Normally, only one SOO is assigned to the army/corps G3 staff. During wartime operations and exercises, the ARSST provides critical augmentation. The ARSST accomplishes space-related tasks and provides a 24/7 space staff capability.

D-4. The SOO is careful not to cross organizational lines when representing space-based capabilities. The coordination responsibilities discussed below as they pertain to the G2, G3, G6, and G7, are guidelines for staff interaction. The SOO does not provide unilateral answers about space capabilities that should be provided by other G-staffs who have BOS proponency. The same is true of information that should come from echelons above. In all cases, the SOO ensures that space-related actions are fully coordinated with the appropriate command and staff.

D-5. At the same time, this discipline does not cause the SOO to restrict attention to only the immediate issues of the organizational element. It is imperative that the SOO be aware of the total space picture. The SOO is

aware of space C2 elements, such as the JFC space authority and other space teams, such as the SST, adjacent unit ARSST, TMW detachments, national intelligence support team (NIST). The SOO fully understands direct liaison authority (DIRLAUTH) clearances and pursues any that are needed but not already directed. Gaining necessary situational understanding requires the SOO to network actively with a space community that will very likely be dynamic.

Space Operations Officer Primary and Supporting Tasks

D-6. The SOO is charged to—

- Provide space-based expertise and services.
- Provide space input to the MDMP.

D-7. To properly execute assigned tasks, the SOO is aware of the challenges the unit faces and is prepared to offer space solutions, when applicable. SOOs are a significant conduit for space to the warfighter, and their effectiveness can positively influence mission accomplishment.

D-8. The major SOO contribution to planning is support to the MDMP. The SOO is fully involved in the process, flow of information, and decisions in the headquarters. Additionally, the SOO works closely with the entire battle staff to ensure space support is optimized to all BOS. However, the majority of the SOO's time is focused on the G2, G3, and G6 because these staffs rely most heavily on space capabilities. Discussed below is how the SOO integrates into MDMP planning, followed by specific ways the SOO works with the G2, G3, and G6 staffs. To support the MDMP, SOOs—

- Analyze higher headquarters orders from a space perspective.
- Develop space specific specified, implied, and essential tasks.
- Develop the space estimate (see appendix A for a detailed explanation) and coordinate the estimate with other staff sections to incorporate it into the mission analysis effort.
- Recommend space-specific PIR and/or information requirements to the G2.
- Provide input to COA analysis.
- Integrate USSTRATCOM-unique capabilities in missile warning (DSP), navigation (GPS), environmental monitoring, and SATCOM capablities into staff planning.
- Ensure coordination and integration with all applicable IO cells.
- Integrate the ARSST into the MDMP planning effort.
- Analyze the potential employment of additional (other than ARSST) ARSTRAT operational capabilities.
- Write annex N (Space) to be included in the applicable plan and/or order, when a COA has been selected.

G2/SPACE OPERATIONS OFFICER STAFF COORDINATION DUTIES

D-9. Coordination with G2 includes the following:

- Ensure the G2 aerospace control element (ACE) is aware of allied, enemy, and rest-of-the-world space order of battle (USSTRATCOM, J2, JWICS, or SIPRNET home page).
- Develop the space analysis contribution to the IPB (see appendix A).
- Develop G2 space-related PIR/IR and recommend its inclusion in the collection plan.
- Maintain space situational understanding by regularly reviewing ARSTRAT G2 and USSTRATCOM J2 intelligence products. Ensure the ACE is aware of significant space intelligence data to incorporate into the ACE all source analysis effort.
- Monitor status of enemy space-related targets (user segment and ground stations, communications links to and from the satellite, and the satellites).
- Ensure the G2 staff is aware of commercial and nonthreat foreign space systems that may be utilized by the adversary. Provide space-related recommendations/requirements to the collection manager.
- Analyze effectiveness of DSP to identify threat missile activity and support BDA and situational understanding requirements. Ensure G2 is aware of DSP technical intelligence and battle space characterization capabilities.
- Provide space weather assessments and integrate space weather updates into the space estimate. Monitor status of the DMSP constellation.
- Determine and monitor vulnerabilities to supporting space-based surveillance, reconnaissance, or attack. Be familiar with the threat to U.S. systems and protect those systems by minimizing or eliminating the threat and implementing protection measures.

G3/SPACE OPERATIONS OFFICER STAFF COORDINATION DUTIES

D-10. Coordination with G3 includes the following:

- Maintain close coordination with the plans section to ensure space integration into all future planning efforts.
- Maintain close coordination with the current operations section regarding space input to staff update briefs, warning orders, FRAGOs, and so forth.
- Provide recommendations to apply military, civil, and commercial space systems and concepts for land force applications.
- Ensure the G3 understands the role of the ARSST, and integrate the ARSST into daily operations. The ARSST provides space products and support, and allows the SOO to sustain a 24/7 space staff capability.
- Monitor the effectiveness of the TES to support command TBM early warning requirements, in coordination with the ADE.

- Monitor status of friendly space systems, platforms and operations. Ensure appropriate staff elements are notified of space-related issues that may affect the operation.
- Know the space command and control network within theater, specifically, the location and mission of the entity assigned as space authority and, if assigned, the Army space coordination authority.
- Ensure BFT and GPS capabilities are optimally supporting the Army/corps and subordinate elements. Execute staff planning and training related to BFT.
- Know the capabilities and limitations of U.S. space and associated ground systems. Know what space-related support is available within theater, for example TENCAP, TMW, USSTRATCOM support teams, and NISTs.
- In coordination with Air Defense Artillery Element, ensure dissemination and warning of TBM attacks is timely and accurate. Provide staff training on capabilities and limitations of DSP and TMW.
- In concert with the G2, G6 and G7, analyze and monitor the command operations security (OPSEC) posture from a space perspective.
- In concert with the G2, G3 (fire support coordinator [FSCOORD]/IO), and G6, nominate enemy space assets for targeting, as required.
- Implement space control prevention measures to prevent the adversary from using friendly and allied systems, such as communications channels and GPS signals.
- Ensure measures are in place to protect U.S. and allied space assets, such as force protection of ground stations and antennas, and/or targeting the adversary's means of threatening U.S. assets.
- Ensure that critical ground segments of friendly space systems are designated as restricted operations zones (ROZs) in the Army airspace command and control (A2C2) element plan and are on the air defense/TMD defended asset list.
- In garrison, supervise the corps space training program and monitor the level of space capabilities training within the command.

G4/SPACE OPERATIONS OFFICER STAFF COORDINATION DUTIES

D-11. The SOO has potential responsibilities to assist the G4 in areas of—

- In-transit visibility tracking.
- Main supply route imagery.

G6/SPACE OPERATIONS OFFICER STAFF COORDINATION DUTIES

D-12. Coordination with G6 includes the following:

- Ensure the G6 staff is aware of the space weather/enemy threat to SATCOM that was developed in the space analysis for the IPB.
- Ensure G6 is aware of all service and commercial SATCOM capabilities that may contribute to unit mission accomplishment.
- Determine and recommend to the G6 SATCOM related essential elements of information.
- Ensure G6 is aware of Army SATCOM C2 organizations that contribute to operational contingency support.
- In coordination with the G3, ensure BFT systems are functioning.
- Provide status of supporting SATCOM systems, to include known deficiencies and planned outages.

G7/SPACE OPERATIONS OFFICER STAFF COORDINATION DUTIES

D-13. Coordination with G7 includes the following:

- Provide information on space-based products that could support IO requirements.
- Provide a representative to the G7.
- Include IO requirements in the space operations appendix to the operations annex.
- Coordinate IO requirements with higher headquarters for ARSTRAT and USSTRATCOM support.
- Coordinate with the G7 targeting officer to include adversary space system elements in the targeting process.
- Provide insight into the red/gray/blue space order of battle and blue space operational status.

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Appendix E

Space Support in the Employment Headquarters

The future force tactical headquarters is designed to perform tactical and operational level missions. The tactical headquarters is ARFOR/JFLCC capable without augmentation, and serves, with augmentation, as the JTF headquarters. The tactical headquarters contains an SSE, nominally consisting of two FA 40 SOOs. In peacetime or garrison operations, these space experts form an SSE within the G3 current operations section. In an operational or tactical situation, the SOOs in the SSE are in the main command post and provide or coordinate space support for other command posts. Generally, during field operations, one SOO provides space insight for planning future operations while the other supports current operations. The senior officer may adjust this support ratio, depending on METT-TC. Because of the small size of the SSE, it may be augmented by an ARSST.

E-1. The functions of the SSE at the main command post (CP) include the following:

- Provide tactical and operational space planning and support to the tactical headquarters.
- Advise on space force enhancement and space control mission areas.
- Advise on availability and use of military/civil/commercial space-based assets.
- Advise regarding the capabilities, limitations, and status of missile warning systems.
- Produce space support annex and space input to estimates/OPLANs/ FRAGOs/warning orders.
- Prepare the space estimate tab to the space support annex to the OPLAN (see appendix A).
- Support preparation of space portion of IPB and space order of battle.
- Participate in initial targeting process.
- Advise regarding space support to IO.
- Provide space support products and services.
- Synchronize space operations and effects with TAC CP 1.
- Recommend/coordinate for additional space support and force structure.
- Coordinate with higher headquarters space element.

E-2. The functions of the SSE at the TAC CP 1 include the following:

- Provide 24/7 space support to the tactical headquarters.

- Advise regarding space force enhancement mission area.
- Advise regarding space control mission area.
- Advise on BFT capabilities and limitations.
- Advise on availability and use of military/civil/commercial space-based assets.
- Advise on capabilities and limitations of threat and nonaligned space-based assets.
- Provide tactical space products and support to TAC CP 1, subordinate units of action (UAs), joint, multinational, and interagency forces.
- Participate in the targeting process.
- Provide PVT reliability data and navigation warfare advice, and coordinate GPS enhancement.
- Integrate operational headquarters and Army space unit augmentees into tactical headquarters operations.
- Assist coordinating SATCOM and ISR support.
- Monitor status of missile warning systems.
- Synchronize space operations and effects with the main CP.
- In coordination with SWO, provide weather effects analysis for tactical space operations.
- Develop and update the space portion of the COP.

Appendix F

Army Space Organizations

Army proponency for space is assigned to USASMDC, which is a MACOM. USASMDC is the Army Service component command for USSTRATCOM.

F-1. As directed by Army General Order 5, the USASMDC was assigned as a MACOM on 1 October 1997. The CG USASMDC serves as the Commander of the ARSTRAT directly supporting the Commander, USSTRATCOM. Additionally, the CG USASMDC serves as the Army specified proponent for space- and ground-based midcourse missile defense.

F-2. The CG USASMDC/ARSTRAT commands all assigned forces, operates assigned facilities, and leads the Army operational component to USSTRATCOM. The CG USASMDC/ARSTRAT responds to Commander, USSTRATCOM for operational taskings, coordinates and integrates Army space resources and requirements into USSTRATCOM plans and operations, and provides the USSTRATCOM commander an Army perspective in planning for DOD space systems. Further, the CG USASMDC/ARSTRAT is responsible for the HQ USASMDC/ARSTRAT Command General Staff; the 1st SATCON Battalion; the 1st Space Battalion; the 193rd Space Battalion (Army National Guard); the Army astronaut program at the Johnson Space Center in Houston, Texas; the Kwajalein Missile Range; and host support to USASMDC offices located in Colorado Springs, Colorado. CG USASMDC/ARSTRAT also serves as the Army representative for space issues in joint forums.

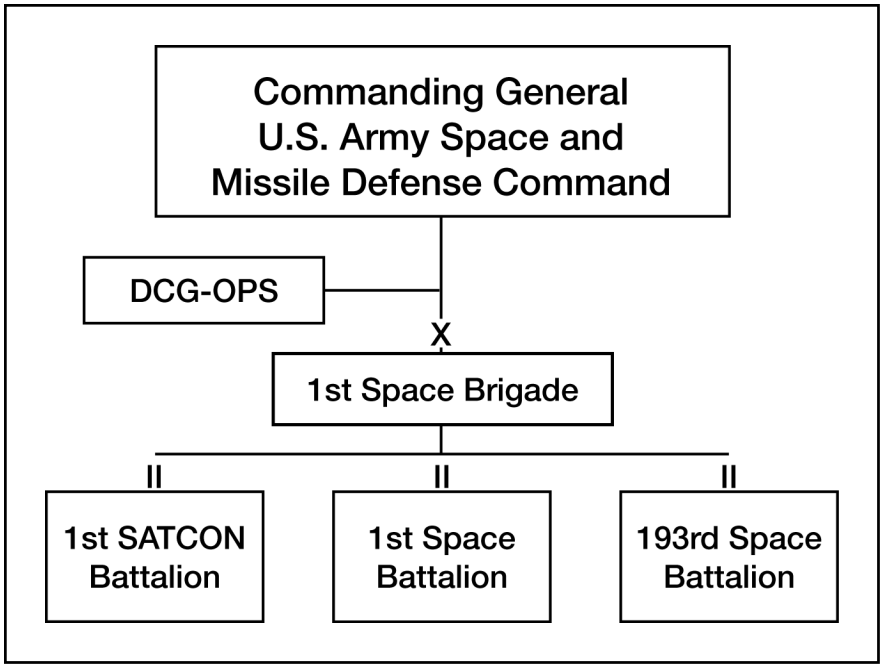

Figure F-1. USASMDC operational organization

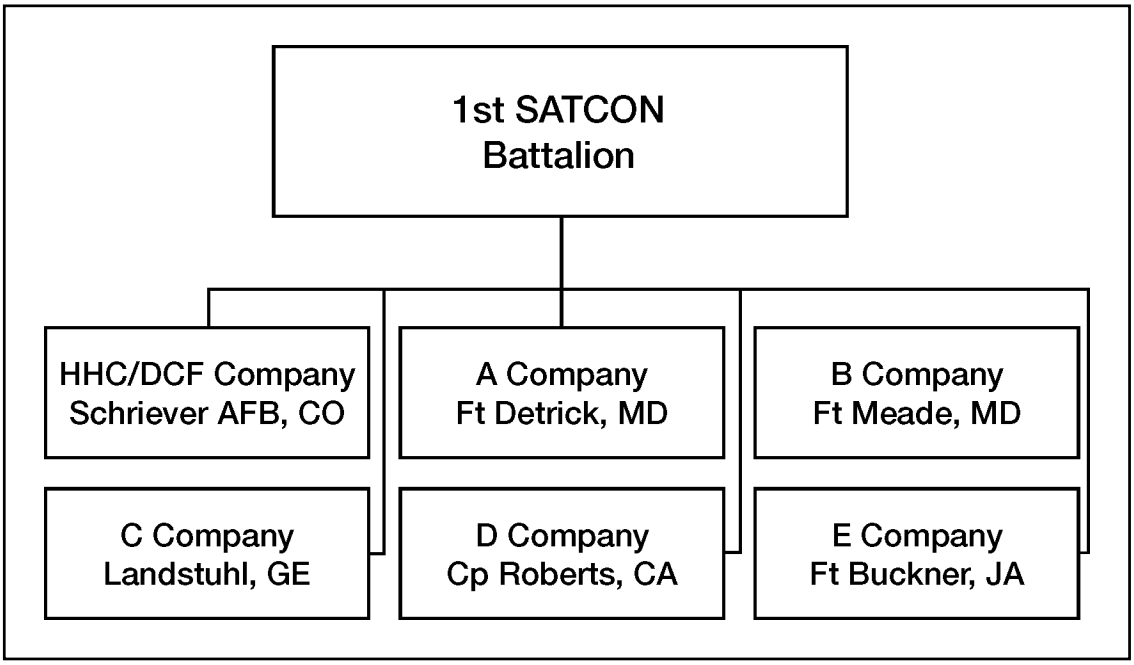

Figure F-2. 1st SATCON Battalion organization

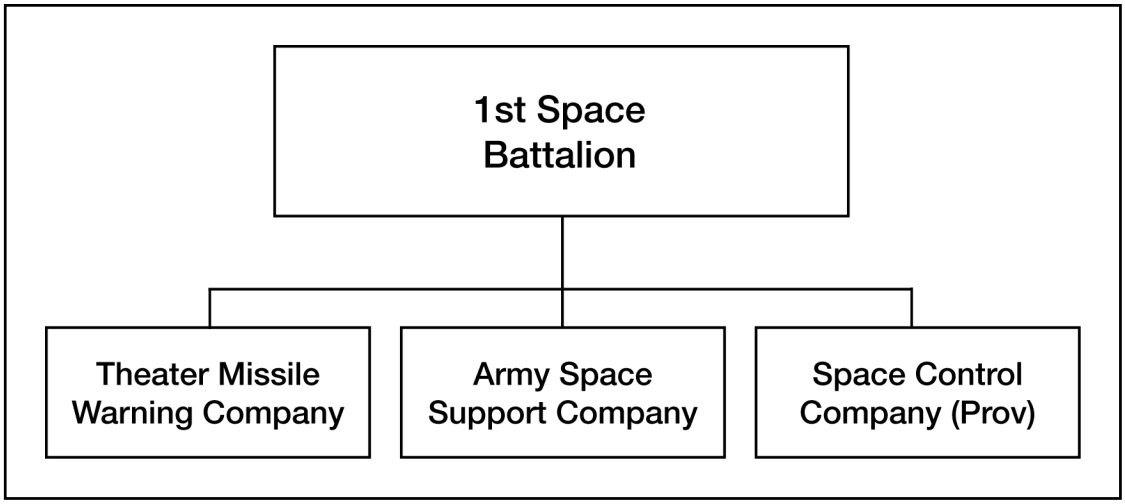

Figure F-3. 1st Space Battalion organization

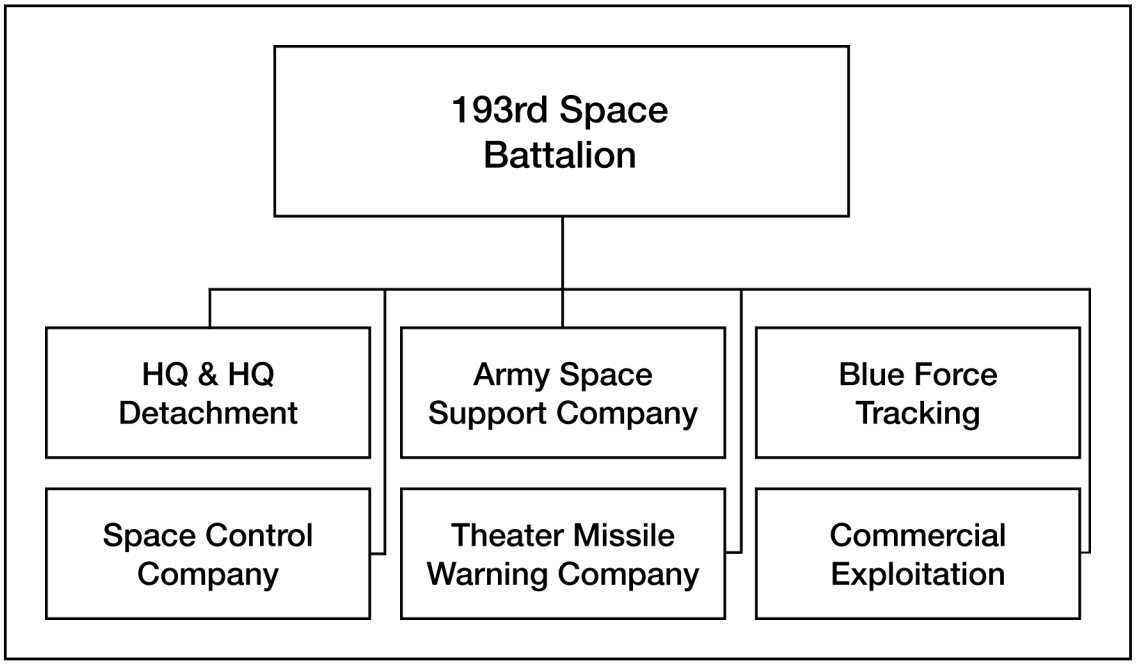

Figure F-4. 193rd Space Battalion organization

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Appendix G

Normalizing, Operationalizing, and Institutionalizing Space

The doctrine contained in this field manual aligns with higher-level doctrine from FM 1 and FM 3-0, and applicable joint publications, including JP 3-14. The intent of space doctrine at all levels is to maximize the advantage of space to U.S. warfighters. This requires that space is normalized, operationalized, and institutionalized. This appendix discusses these goals in more detail.

Normalizing Space

G-1. To ensure the maximum use of space, the Army integrates space capabilities into routine operations. The Army influences the design of future space systems to provide required warfighting capabilities and leverage technological initiatives from the other Services and commercial and civil agencies. A space-literate force identifies innovative concepts and successfully integrates capabilities into operations.

G-2. Joint space systems serve ground warfighter needs if space-based components under development incorporate appropriate Army requirements. This is a critical space-related responsibility for the Army. Urgency is driven by the near-term developmental window of opportunity that occurs many years (8 to 12 years or more) before a given space capability or improvement is deployed. By sheer number of users and dependent functional activities, operating Army elements are the greatest military users of space. The Army, therefore, focuses most of its programmatic effort on the ground user component of space systems—the user terminals.

G-3. The Air Force is the DOD executive agent for space and, together with the NRO and the Navy, leads and resources the development of most U.S. national and military space-based systems. These systems are developed and acquired to meet the requirements of all national and military users. However, cost, weight limitations, technology, support infrastructure, and treaty obligations limit space system capabilities. Therefore, the interservice and interagency competition to have their requirements recognized as a priority is very keen.

G-4. Service requirements garner joint space program priority by the substance of their analytical support and the quality of their articulation. Joint program offices reconcile service and user community requirements through a series of system and architecture "trade-offs" in a staffing process that attempts to fit the highest priority requirements to the resources, technology, and time available. Program leadership and degree of programmatic support are key influencers. The Army's challenge is to garner maximum space capability support for ground warfighters while minimizing

the Army programmatic commitment outside of its traditional role as a user, rather than provider, of space force enhancement systems. Accomplishing this takes a determined collaborative effort across all Army space stakeholders at the MACOM and Headquarters, Department of the Army Staff (ARSTAF) level. Only by placing well qualified functional area experts in key positions; orchestrating cooperative efforts across traditional functional and BOS-aligned combat development, force development, and materiel development staffs; and consistently engaging in all pertinent joint space program development efforts will the Army be certain that future space systems meet soldiers' needs, which include fully normalizing space in Army operations.

Operationalizing Space

G-5. Operationalizing space means using space-based capabilities to provide force enhancement and space control operations in near real-time. To provide ground commanders with situational knowledge throughout the battlespace requires responsive space systems to provide (or otherwise affect) information in time to influence operations.

G-6. Operationalizing space is the result of considering warfighting uses for space in a number of existing Army processes. The Army fully supports research and development and space force planning based on desired capabilities. Research and development focuses on exploitation of space. Models and simulations aid in space capability development. Army space modernization efforts focus on influencing desired capabilities to ensure joint and national systems support the mission needs of land forces.

G-7. Operationalizing space also requires educating commanders on space capabilities and limitations to allow them to successfully integrate space into planning, exercises, training, and operations. The assignment of FA 40 SOO at the joint and Army division and corps levels, along with core functional area experts with ASI 3Y (Space) and ASI 3E (TENCAP) facilitates the integration of space into planning and operations. These experts understand how space capabilities enhance all phases of operations. A combination of FA 40 and FA 34 (strategic intelligence) officers is essential to providing an accurate picture of how an adversary exploits space. Skillful employment of all available space resources helps protect U.S. forces from adversary use of space and helps establish the information superiority necessary for full-spectrum dominance.

Note: Force enhancement, space control, and other space missions are described in detail in chapter 2.

Institutionalizing Space

G-8. Institutionalizing space means making space part of the doctrinal way the Army thinks and fights. It also involves having a vision and roadmap of how the Army can best exploit space now and in the future.

G-9. Space organizations are contributing significantly to maximizing the utility of space for the warfighter. Army space-related organizations contributed significantly over the past 30 years, bringing the utility of space-based capabilities to the warfighter. Since the early 1970s, ASPO, through the Army TENCAP program, has worked with the NRO to bring national overhead capabilities to tactically deployed MI units, where the data is combined with theater airborne and terrestrial sensor data in specially designed equipment. In the late 1980s, INSCOM developed an MI space battalion specifically designed to develop expertise in exploiting the new high ground of space. Today this is the tactical exploitation system. Within the decade, the tactical exploitation system will transition to DCGS-A.

G-10. The Signal Corps provides units for SATCOM operations. USASMDC also provides space organizations. The Army is placing experienced space experts in unit and staff positions to help ensure space operations lend maximum support to the Army mission.

G-11. To further institutionalize space, space education and literacy opportunities are expanding and improving at every level of the military education system. While the Army War College and the Command and General Staff College offer space electives, more standardized instruction for all ranks is being fielded. Research libraries and the Center for Army Lessons Learned (CALL) store extensive up-to-date reference materials that allow analysis of current and historical operations and assist in the development of innovative concepts.

G-12. Education and training for the Army cadre of space professionals plus the officer intermediate level education curricula are deploying significant space expertise out into the Army.

G-13. Army doctrine incorporates space to maximize the benefits of space capabilities. The Army includes space when preparing any overarching warfighting vision, capstone concept, or operational plan. Doctrine development and space training programs, and the infrastructure to administer them, increases the institutionalizing of space in the Army.

Army Space Master Plan

G-14. The Army space master plan (ASMP) is envisioned as the roadmap for the Army's use of space. It is a key enabler to accomplish Army missions and objectives both now and into the future. It gives structure to the Army's efforts to institutionalize space activities. The biennial ASMP is the culmination of a year's effort, referred to as the Army space planning process (SP2). This process results in a space roadmap to support the Army and joint visions for transformational forces within the context of the national security space environment. It identifies doctrine, organizations, training, materiel, leadership and education, personnel, and facilities (DOTMLPF) solutions to space mission needs and helps to better integrate the space capabilities roadmap, and science and technology plans.

G-15. The ASMP provides the link between Army prioritized needed capabilities and proposed space solutions. It presents an integrated assessment of the most important Army space tasks, shortfalls, and solutions

across all space functional areas. It considers all DOD and agency solutions to Army space shortfalls. Further, it is driven by the space needs of the future and concepts (such as network-centric warfare as related to the Army's land warfare mission) and is based on the guidance and priorities contained in the Army plan.

G-16. Within the context of space mission categories provided in JP 3-14, the ASMP identifies existing and needed space capabilities that enable required Armywide capabilities. The SP2 bases the ASMP on Army coordinated priorities for maintaining and advancing its core competencies. The ASMP presents a long-term, macro-level view. The ASMP is a snapshot in time that traces the deliberate connection between Army core competencies, its use of space today, and a space roadmap. The ASMP addresses the increasing use of space capabilities across the full spectrum of potential conflict well into the future.

G-17. The ASMP results from an established process that includes not only Army space combat developers but also stakeholders from across the Army (such as Signal School, Military Intelligence School, and Maneuver Center). Its goal is to determine which space capabilities the Army should pursue to enable its six enduring capabilities. Space planners choose capabilities for their relevance to land warfighting dominance and the soldier mission. The ASMP seeks to identify those space capabilities that will affordably accomplish the five essential space operations tasks detailed in the Army space policy:

- Support situational understanding and joint battle command en route, "off the ramp," and on the move.
- Support precision maneuver, fires, and sustainment.
- Contribute to continuous information and decision superiority.
- Support increased deployability and reduced in-theater footprint.
- Protect the force during all phases of the operation.

G-18. Teams of experts explore the capability gaps precluding the Army from accomplishing these five tasks. The process begins with national- and Army-level guidance concerning what the Army needs, and proceeds through functional area analysis, functional needs analysis, and functional solutions analysis. Space planners forward for consideration by the Army proposed solutions not yet documented as validated capability needs. The planners generate timelines for phased development of new systems to ensure synchronization with other Army transformation initiatives. The ASMP captures, in one document, the capabilities needed to implement the Army space policy.

Glossary

Acronyms and Abbreviations

A2C2	Army airspace command and control
ADA	air defense artillery
ADE	air defense element
AFB	Air Force base
AFDD	Air Force doctrine document
AFSPC	Air Force Space Command
AFWA	Air Force Weather Agency
AJ	antijam
AO	area of operations
AOI	area of interest
APOD	aerial port of debarkation
AOR	area of responsibility
AR	Army regulation
ARFOR	Army forces
ARSSC	Army space support company
ARSST	Army space support team
ARSTAF	Department of the Army Staff
ARSTRAT	United States Army Strategic Command
ASCC	Army Service Component Command
ASI	additional skill indicator
ASMP	Army space master plan
ASPO	Army Space Program Office
ATACMS	Army tactical missile system
BCST	broadcast
BDA	battle damage assessment
BFT	Blue Force tracking
BMD	ballistic missile defense
BOS	battlefield operating system
C2	command and control
C4ISR	command, control, computers, communications, intelligence, surveillance, and reconnaissance
CALL	Center for Army Lessons Learned
CC&D	camouflage, concealment and deception
CCIR	commanders critical information requirements

CET	commercial exploitation team
CENTCOM	United States Central Command
CFLCC	combined forces land component commander
CG	Commanding General
CIB	controlled image base
CITO	Central Imagery Tasking Office
CJCS	Chairman of the Joint Chiefs of Staff
CJCSI	Chairman of the Joint Chiefs of Staff instruction
CLS	contractor logistic support
CMGS	consolidated mission ground station
COA	course of action
COBRA	collection of broadcasts from remote assets
COCOM	combatant command
COMARFOR	Commander Army Forces
CONUS	continental United States
COP	common operational picture
CP	command post
C-SCOC	consolidated system control and operations concept
CSS	combat service support
CWT	combat weather team
DA	Department of the Army
DCD	Directorate of Combat Development
DCG-O	Deputy Commanding General - Operations
DCGS-A	distributed common ground system – Army
DCI	Director of Central Intelligence
DDL	direct downlink
DIA	Defense Intelligence Agency
DIRLAUTH	direct liaison authority
DISA	Defense Information Systems Agency
DMSP	Defense Meteorological Satellite Program
DOD	Department of Defense
DODD	Department of Defense Directive
DOTMLPF	doctrine, organizations, training, materiel, leadership and education, personnel, and facilities
DRASH	deployable rapid assembly shelter
DSCS	Defense Satellite Communications System
DSN	defense switched network
DSP	defense support program

DSU	direct support unit
ECU	environmental control unit
EHF	Extremely high frequency
EMI	electromagnetic interference
EMPRS	en route mission planning and rehearsal system
EO	electro-optics
EUCOM	United States European Command
EW	electronic warfare
FA	functional area
FLTSAT	fleet satellite communications system
FM	field manual
FORSCOM	United States Army Forces Command
FRAGO	fragmentary order
FSCOORD	fire support coordinator
FWC	Future Warfare Center
G1	assistant chief of staff, personnel
G2	assistant chief of staff, intelligence
G3	assistant chief of staff, operations and plans
G4	assistant chief of staff, logistics
G6	assistant chief of staff, control, communications, and computer operations
G7	assistant chief of staff, information operations
GA	geospatial analyst
GBS	global broadcast system
GCCS	global command and control system
GEO	geosynchronous earth orbit
GI&S	geospatial information and services
GIG	global information grid
GIS	geographic information system
GPS	global positioning system
GSSC	global satellite communications support center
HEO	highly elliptical orbit
HMMWV	high-mobility multipurpose wheeled vehicle
HF	high frequency
HPT	high-payoff target
HQ	headquarters
HSI	hyperspectral imagery
HSOC	home station operations center

HVT	high-value target
I&W	indications and warning
IC	intelligence community
INMARSAT	international maritime satellite
INSCOM	United States Army Intelligence and Security Command
INTELSAT	International Telecommunications Satellite Organization
IO	information operations
IP	Internet protocol
IPB	intelligence preparation of the battlespace
IR	information requirements
ISR	intelligence, surveillance and reconnaissance
J2	Directorate for Intelligence
J3	Directorate for Operations
J6	Directorate for C4 Systems
JCCC	joint communications control center
JCS	Joint Chiefs of Staff
JFC	joint force commander
JFCOM	United States Joint Forces Command
JFLCC	joint force land component commander
JOpsC	joint operations concepts
JP	joint publication
JS	joint staff
JTAGS	joint tactical ground station
JTF	joint task force
JWICS	joint worldwide intelligence communications system
K	one thousand
kbps	kilobits per second
km	kilometer
LCC	land component commander
LEO	low earth orbit
LIDAR	light detection and ranging
LPD	low probability of detection
LPI	low probability of interception
LOS	line of sight
LWIR	long-wave infrared
m	meter
M3P	multimission mobile processor
MACOM	major Army command

MASINT	measurement and signature intelligence
MCOO	modified combined obstacle overlay
MCS	mission control station
MDMP	military decisionmaking process
MEO	medium earth orbit
METSAT	meteorological satellite
METT-TC	mission, enemy, terrain and weather, troops and support available, time available, civil considerations
MI	military intelligence
Milstar	military strategic and tactical relay system
MMC	mission management center
MOPP	mission-oriented protective posture
MOS	military occupational specialty
MOU	memorandum of understanding
MRS	MASINT requirements system
MSE	multiple subscriber equipment
MSI	multispectral imagery
MSOC	Milstar satellite operations center
MSS	mobile satellite services
MTI	moving target indicator
MUOS	mobile user objective system
NAVACC	navigational accuracy
NCO	noncommissioned officer
NCOIC	NCO in charge
NCTAMS	naval computer and telecommunications area master station
NETWARCOM	Naval Net Warfare Command
NGA	National Geospatial-Intelligence Agency
NIPRNET	nonsecure Internet protocol routing network
NIST	national intelligence support team
NNSOC	Naval Network and Space Operations Command
NNWC	Naval Network Warfare Command
NORTHCOM	United States Northern Command
NRO	National Reconnaissance Office
NRT	near real time
NSC	National Security Council
NSO	NGA staff officer
NSS	national security strategy
NST	National Geospatial-Intelligence Agency support team

NSTC	National Science and Technology Council
NTM	national technical means
NTT	national to theater
OB	order of battle
OBP	onboard processing
OCMC	Overhead Collection Management Center
OCOKA	observation, cover and concealment, obstacles, key terrain, and avenues of approach
OPCON	operational control
OPLAN	operation plan
OPORD	operations order
OPSEC	operations security
PACOM	United States Pacific Command
PAM	pamphlet
PDD	presidential decision directive
PIR	priority intelligence requirements
PVT	position, velocity, and timing
prov	provisional
RADARSAT	radar satellite
R&D	research and development
RCC	regional combatant commander
RESIC	Remote Earth Sensing Information Center
RFI	request for information
RMS	requirements management system
ROZ	restricted operation zone
RSOC	regional SIGINT operations center
RSSC	regional satellite communications support center
S2	intelligence staff officer
S3	operations staff officer
S4	logistics staff officer
SA	situation awareness
SAA	satellite access authorization
SAR	synthetic aperture radar
SATCOM	satellite communications
SATCON	satellite control
SATRAN	satellite reconnaissance advance notice
SB/BFT MMC	Space-Based Blue Force Tracking Mission Management Center
SDST	space decision support template

SEW	shared early warning
SHF	super-high frequency
SIGINT	signal intelligence
SIPRNET	SECRET Internet protocol router network
SIR	specific information requirement
SMDCOC	Space and Missile Defense Command Operations Center
SOF	special operations forces
SOM	SATCOM operational manager
SOO	space operations officer
SOP	standard operating procedure
SORC	Spectral Operations Resource Center
SOS	space operations system
SOCOM	United States Special Operations Command
SORC	Spectral Operations Resource Center
SOUTHCOM	United States Southern Command
SP2	Army space planning process
SSE	space support element
SSN	space surveillance network
SST	space support team
SWF	short-wave fade
SWO	staff weather officer
TAC CP	tactical command post
TACLAN	tactical local area network
TACSIM	tactical satellite communications interconnect module
TACON	tactical control
TBM	theater ballistic missile
TCCC	theater communications control center
TDL	theater downlink
TENCAP	Tactical Exploitation of National Capabilities Program
TES	theater event system
TMD	theater missile defense
TMW	theater missile warning
TOC	tactical operation center
TPED	tasking, processing, exploitation, and dissemination
TPFDD	time-phased force deployment data
TPPU	Tasking, posting, processing, and using

TRADOC	United States Army Training and Doctrine Command
TRANSCOM	United States Transportation Command
TRITAC	tri-service tactical
TT&C	telemetry, tracking, and control
TTP	tactics, techniques, and procedures
UA	unit of action
UFO	ultra-high frequency follow on
UHF	ultra-high frequency
UPS	uninterruptible power supply
U.S.	United States of America
USAREUR	United States Army, European Command
USASMDC	United States Army Space and Missile Defense Command
USSTRATCOM	United States Strategic Command
USTRANSCOM	United States Transportation Command
WGS	wideband gapfiller system
WSOC	wideband satellite communications operations center
WX	weather

Terms

combatant command

COCOM includes the authority to—

- Prescribe the chain of command within the command.
- Give authoritative direction to subordinate commands, including all aspects of military operations, joint training and logistics.
- Organize commands and forces to carry out assigned missions.
- Employ forces necessary to carry out assigned missions.
- Assign command functions to subordinate commanders.
- Coordinate and approve administration support and discipline.

Exercise authority to select subordinate commanders and combatant command staff. (Joint Pub 0-2, UNAAF, p. II-14)

geospatial information and services The concept for collection, information extraction, storage, dissemination, and exploitation of geodetic, geomagnetic, imagery (both commercial and national source), gravimetric, aeronautical, topographic, hydrographic, littoral, cultural, and toponymic data accurately referenced to a precise location on the earth's surface. These data are used for military planning, training, and operations, including navigation, mission planning, mission rehearsal, modeling, simulation, and precise targeting. Geospatial information provides the basic framework for battlespace visualization. It is information produced by multiple sources to common interoperable data standards. It may be presented in the form of printed maps, charts, and publications; in digital simulation and modeling databases; in photographic form; or in the form of digitized maps and charts or attributed centerline data. Geospatial services include tools that enable users to access and manipulate data, and also includes instruction, training, laboratory support, and guidance for the use of geospatial data. The concept is also called GI&S. (JP 2-03)

global positioning system A satellite constellation that provides highly accurate position, velocity, and timing information to users.

hyperspectral imagery Imagery derived from subdividing the electromagnetic spectrum into very narrow bandwidths. These narrow bandwidths may be combined with or subtracted from each other in various ways to form images useful in precise terrain or target analysis.

Iridium Commercial satellite based mobile telephone system.

joint force commander General term applied to a combatant commander, subunified commander, or joint task force commander authorized to exercise combatant command (command authority) or operational control over a joint force.

multispectral imagery The image of an object obtained simultaneously in a number of discrete spectral bands.

operational control	(Joint) command authority that may be exercised by commanders at any echelon at or below the level of combatant command. Operational control is inherent in combatant command (command authority) and may be delegated within the command. When forces are transferred between combatant commands, the command relationship the gaining commander will exercise (and the losing commander will relinquish) over these forces must be specified by the Secretary of Defense. Operational control is the authority to perform those functions of command over subordinate forces involving organizing and employing commands and forces, assigning tasks, designating objectives, and giving authoritative direction necessary to accomplish the mission. Operational control includes authoritative direction over all aspects of military operations and joint training necessary to accomplish the missions assigned to the command. Operational control should be exercised through the commanders of subordinate organizations. Normally this authority is exercised through subordinate joint force commanders and Service and/or functional component commanders. Operational control normally provides full authority to organize commands and forces and to employ those forces as the commander in operational control considers necessary to accomplish assigned missions; it does not, in and of itself, include authoritative direction for logistics or matters of administration, discipline, internal organization, or unit training. (JP 1-02)
panchromatic	Sensitive to all visible light colors.
RADARSAT	Canadian earth observation satellite developed to monitor environmental change and the planet's natural resources. Uses SAR.
space	A medium like the land, sea, and air within which military activities shall be conducted to achieve U.S. national security objectives. (JP 3-14)
space asset	Any individual part of a space system, including (1) equipment that is or can be placed in space (for example, a satellite or a launch vehicle) and (2) terrestrially-based equipment that directly supports space activity (for example, a satellite ground station). (JP 3-14)
space capability	(1) The ability of a space asset to accomplish a mission. (2) The ability of a terrestrial-based asset to accomplish a mission in space (such as a ground-based or airborne laser capable of negating a satellite). (JP 3-14)
space control	Combat, combat support, and combat service support operations to ensure freedom of action in space for the United States and its allies and, when directed, deny an adversary freedom of action in space. The space control mission area includes surveillance of space; protection of U.S. and friendly space systems; prevention of an adversary's ability to use space systems and services for purposes hostile to U.S. national security interests; negation of space systems and services used for purposes hostile to U.S. national security interests; and directly supporting battle management, command, control, communications, and intelligence. (JP 3-14)

space control operations (DOD) Operations that provide freedom of action in space for friendly forces while, when directed, denying it to an adversary, and include the broad aspects of protection of U.S. and U.S. allied space systems and negation of adversary space systems, prevention of adversary use of U.S. and allied space systems, and surveillance of space.

space force application Combat operations in, through, and from space to influence the course and outcome of conflict. The space force application mission area includes ballistic missile defense and force projection. (JP 3-14)

space force enhancement Combat support operations to improve the effectiveness of military forces as well as support other intelligence, civil, and commercial users. The space force enhancement mission area includes intelligence, surveillance, and reconnaissance; integrated tactical warning and attack assessment; command, control, and communications; position, velocity, time; and environmental monitoring. (JP 3-14)

space forces The space and terrestrial systems, equipment, facilities, organizations, and personnel necessary to access, use and, if directed, control space for national security. (JP 3-14)

space power The total strength of a nation's capabilities to conduct and influence activities to, in, through, and from space to achieve its objectives. (JP 3-14)

space superiority The degree of dominance in space of one force over another that permits the conduct of operations by the former and its related land, sea, air, space, and special operations forces at a given time and place without prohibitive interference by the opposing force. (JP 3-14)

space support Combat service support operations to deploy and sustain military and intelligence systems in space. The space support mission area includes launching and deploying space vehicles, maintaining and sustaining spacecraft on-orbit, and deorbiting and recovering space vehicles, if required. (JP 3-14)

space support team A team of space operations experts provided by the Commander, U.S. [Strategic] Command (or one of the space component commands and augmented by national agencies, as required) upon request of a geographic combatant commander to assist the supported commander in integrating space power into the terrestrial campaign. (JP 3-14)

synthetic aperture radar Microwave instrument on a moving platform that sends pulsed signals to Earth and processes the received reflected pulses as though they were from a much larger aperture than the actual.

tactical control May be delegated to and exercised by commanders at any echelon at or below the level of combatant command. TACON is inherent in OPCON.

It provides the authority to—

- Give direction for military operations.
- Control designated forces (such as, ground forces, aircraft sorties). (JP 0-2, UNAAF, p. III-10)

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FM 3-14 (FM 100-18)
18 May 2005

By order of the Secretary of the Army:

PETER J. SCHOOMAKER
General, United States Army
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