FM 3-14

ARMY SPACE OPERATIONS

AUGUST 2014

Headquarters Department of the Army

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FM 3-14, C2

Change 2
No. 3-14

Headquarters
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Washington, DC, 13 February 2018

Army Space Operations

1. Change 2 to FM 3-14, 19 August 2014 clarifies the full form meaning of D3SOE.

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v thru vi	**v** thru vi
Glossary-1 thru Glossary-4	Glossary-1 thru Glossary-4
References-1 thru References-2	References-1 thru References-2

2. A double bar (| |) on the outside margin marks changed material.

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FM 3-14, C2
13 February 2018

By Order of the Secretary of the Army:

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General, United States Army
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Army Space Operations

1. Change 1 to FM 3-14, 19 August 2014 adds discussion on D3SOE to clarify it meaning and application.

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No. 3-14

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Army Space Operations

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Preface

FM 3-14, *Army Space Operations*, provides an overview of space operations in the Army and is consistent and compatible with joint doctrine. FM 3-14 links Army space operations doctrine to joint space operations doctrine as expressed in JP 3-14, *Space Operations* and other joint doctrinal publications. This FM establishes guidance for employing space and space-based systems and capabilities to support United States (U.S.) Army land warfighting dominance. It provides a general overview of overhead support to Army operations, reviews national guidance and direction, and outlines selected unique space-related Army capabilities. The doctrine in this manual documents Army thought for the best use of space capabilities. This manual also contains tactics and procedures outlining how to plan, integrate, and execute Army space operations.

The principal audience for FM 3-14 is all members of the Army profession, including Army commanders and staffs to assist the planning and incorporation of space capabilities to operations. It will aid Army and joint force commanders in planning and executing cohesive joint operations throughout the entire operational environment. Commanders and staffs of Army headquarters serving as joint task force or multinational headquarters should also refer to applicable joint or multinational doctrine concerning the range of military operations and joint or multinational forces. Trainers and educators throughout the Army will also use this manual.

Commanders, staffs, and subordinates ensure their decisions and actions comply with applicable U.S., international, and in some cases, host-nation laws and regulations. Commanders at all levels ensure their Soldiers operate in accordance with the law of war and the rules of engagement (see FM 27-10).

FM 3-14 uses joint terms where applicable. Selected joint and Army terms and definitions appear in both the glossary and the text. Terms for which FM 3-14 is the proponent publication (the authority) are marked with an asterisk (*) in the glossary. Definitions for which FM 3-14 is the proponent publication are boldfaced in the text. For other definitions shown in the text, the term is italicized and the number of the proponent publication follows the definition.

FM 3-14 applies to the Active Army, Army National Guard/Army National Guard of the United States, and United States Army Reserve unless otherwise stated.

The proponent of FM 3-14 is the United States Army Space and Missile Defense Command/Army Forces Strategic Command (USASMDC/ARSTRAT). The preparing agency is the USASMDC Future Warfare Center-Directorate of Training and Doctrine (USASMDC FWC-DOTD). Send comments and recommendations on a DA Form 2028 (Recommended Changes to Publications and Blank Forms) to Director, Directorate of Training and Doctrine, Headquarters USASMDC/ARSTRAT ATTN: SMDC-FW-D (FM 3-14), 1330 Inverness Drive, Suite 440, Colorado Springs, Colorado 80910; by e-mail to usarmy.peterson.smdc.list.smdc-doctrine@mail.mil; or submit an electronic DA Form 2028.

Introduction

Space is a warfighting domain with different characteristics from air, land, sea, and cyberspace domains. Space is identified as one of the Global Commons as defined in the National Military Strategy of the United States of America. Army space operations enable Army and joint warfighting, and use of space capabilities is an inherently joint venture. The need for the Army to accomplish space operations is firmly established in national and Service level policies. Moreover, this FM is rooted in Army operations and consistent with Joint doctrine. Space capabilities and the space domain provide a global perspective as satellites allow routine access to denied areas of the Earth.

The space environment is harsh and the distances involved are vast, but it offers unique advantages that make it worthwhile to overcome the adversities of the operational environment. To that end, the space environment continues to become more congested, contested, and competitive. The uses of space are many, applications vary, and space-enabled capabilities are constantly evolving. It is important that Soldiers continue to look to the future with responsiveness, adaptability, and flexibility toward how space enables the Army's warfighting functions in the conduct of unified land operations.

Army space operations includes all aspects of the employment of specialized Army space forces but also the spectrum of activities associated to the planning, preparation, integration and execution support required to ensure synchronized and effective space-based capabilities from all sources are available to support dominant land operations as part of Unified Action. Army space operations are heavily influenced by understanding the constraints, limitations, and operational needs of the land component users with regard to those space-based capabilities.

The Army depends on space capabilities to enable and enhance unified land operations. Virtually every Army operation relies on space capabilities to some degree to enhance the effectiveness of combat forces. Space capabilities enable the Army to communicate, navigate, target the enemy, and protect forces.

The principles that successfully guide unified land operations are applicable to the space domain. The Army uses space-based capabilities to support its dominance in unified land operations. Space operations are critical to the range of military operations as many space capabilities are embedded in Army operations. The space mission areas form the framework for how space supports the Army warfighting functions, and operations conducted through decisive operations.

FM 3-14 contains eight chapters and an Annex:

Chapter 1 contains material that identifies how Army Space operations are framed by national and Army level space policies. Section II discusses the space domain and operations in the space operational environment.

Chapter 2 identifies the mission command of space forces.

Chapter 3 identifies the five space mission areas and uses them as the operational foundation of Army space capabilities. Section II identifies how Army space contributes to and directly supports the Army's Warfighting Functions.

Chapter 4 identifies space operations in Unified Land Operations.

Chapter 5 discusses planning, preparing, and executing the space mission within the Operations Process.

Chapter 6 discusses Army space capabilities.

Chapter 7 identifies and describes the Space Support Elements.

Chapter 8 identifies space input to the intelligence preparation of the battlefield (IPB), and developing the Space Estimate.

Appendix A identifies Annex N - Space Operations to a base operations order, its relationship to other annexes, its content, and the template for preparing Annex N.

Based on current doctrinal changes, certain terms for which FM 3-14 is proponent have been added for purposes of this manual. The glossary contains acronyms and defined terms. See introductory table-1 for specific term changes.

Introductory table-1. New Army terms

Term	Remarks
denied, degraded, and disrupted space operational environment	New definition.

Summary of Changes

FM 3-14 has changed substantially from the previous version dated 6 January 2010. The current manual highlights the critical support Army space operations play in joint operations, links space operations with the warfighting functions, and aligns it to the Unified Land Operations framework. The entire document has been reorganized, but a summary of changes is below.

- Adds a section on Joint and Army dependency on space operations.
- Adds text on Army Strategic Space Plan.
- Adds a definition for space domain and includes material on the operational environment.
- Adds additional text on operating in space and characteristics of satellite orbit types.
- Adds text on commercial imagery; deletes references to Commercial Imagery Team and CIT.
- Adds text on Tactical Exploitation of National Capabilities and Commercial Imagery.
- Adds a new chapter on mission command of Army space forces. It addresses major command relationships, space coordinating authority, and the director of space forces roles and responsibilities as they relate to Army space operations.
- Adds Space Situational Awareness as a fifth space mission and updates the four existing mission areas area to align with recent joint doctrine changes.
- Adds a section that identifies how Army space operations supports each warfighting function and includes a summary chart that crosswalks the space mission areas to the support provided to each warfighting function.
- Updates existing text to frame space operations against Unified Land Operations.
- Adds additional text on the operations process and separates *Executing and Assessing Space Operations* into two separate sections.
- Adds additional material on friendly force tracking and its mission management center.
- Updates the space situation template to reflect a more robust portrayal of space operations.
- Adds Appendix A (Annex N - Space Operations) which is dedicated entirely to Annex N to a base operations order.

Summary of Change 1

- Adds definition and supporting information on denied, degraded, and disrupted space operational environment D3SOE.

Summary of Change 2

- Changes 'or' to 'and' in the full form of D3SOE in the Introduction and in the Glossary.

Chapter 1

Army Space Operations

"Army space forces contribute to the Joint Force and the Army's ability to be adaptive, versatile, and agile to meet tomorrow's security challenges. Simply put, space capabilities are critical elements to the Army's ability to see, shoot, move, and communicate."

Lieutenant General David L. Mann
former Commanding General, USASMDC/ARSTRAT
Senate Armed Services Committee Statement
12 March 2014

The Army uses space-based capabilities to support its dominance in decisive actions. Space is a critical element of Army operations. Moreover, the need for the U.S. Army to accomplish space-enabled operations are firmly established in policy and practice; in fact, many space capabilities are well integrated into Army operations. The space mission areas are critical components of offensive, defensive, stability or defense support of civil authority (DSCA) operations. Army space operations enable Army and joint warfighting. The use of space capabilities is an inherently joint venture.

This chapter describes how Army Space operations directly support and contribute to joint operations and the Army's Warfighting Functions. It also describes how Army space operations help enable the tenets of unified land operations.

SECTION I – OPERATIONAL DEPENDENCY ON SPACE

JOINT DEPENDENCY ON SPACE

1-1. Space operations are inherently joint in nature. Space capabilities have been used to enhance both peacetime and wartime effectiveness of joint forces for nearly four decades and have proven to be a significant force multiplier when integrated across the range of joint military operations.

1-2. JP 3-14, *Space Operations,* 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 Army manages long-haul military satellite communications (SATCOM), and 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 each component has a unique role to play in providing space capabilities, and the capabilities provided by one service are integrated into the planning and operations of all services.

1-3. Space forces and space capabilities contribute to joint operations and are integrated with all military operations to achieve U.S. national security objectives. To achieve optimal military utility from space, commanders must:

- Ensure a basic practical and relevant understanding of space tools and utility exists among all services;
- Require end-to-end lifecycle integration of space capabilities with military utility into all policies and procedures; and
- Include these space capabilities in operational planning, execution, and assessment activities.

ARMY'S DEPENDENCY ON SPACE

1-4. This FM is rooted in basic Army and joint doctrine that is characteristically progressive and evolving. Space is a warfighting domain with different characteristics from land, sea, air, and cyberspace domains. The Army depends on space operations to effectively execute unified land operations. Every Army warfighting function relies on space contributions to some degree to enhance the effectiveness of our combat forces. Space capabilities enable the Army to communicate, navigate, accurately target the enemy, protect, and sustain our forces.

1-5. The U.S. Army is one the largest consumers of space-based capabilities within Department of Defense (DOD). The Army depends on Army space forces (personnel, organizations, space and terrestrial systems, equipment, and facilities), to ensure full access to all current and future space capability in order to fight and survive on today's area of operations. The Army must leverage the capabilities of space assets. Consistent with the inherent right of self-defense, the Army must deter others from interference and attack, defend our space systems, and contribute to the defense of multinational space systems. If deterrence fails, the Army must defeat efforts to attack its space assets. This must be done while operating in a global information environment against any threats. Consequently, the Army space capabilities must provide continuous, secure, global communications, space situational awareness, space control, and space force enhancement to Army and joint warfighters from strategic to tactical levels.

1-6. In a memo to the Army Service component commands titled *Unified Quest 2010 (UQ2010) Results and Implementation*, 27 July 2010, the Commander of Army Training and Doctrine Command stated, "The Army must prepare to fight in denied, degraded, and disrupted space operational environment (D3SOE)." In enclosure 6 of the memo, denied, degraded, and disrupted space operational environment is expanded upon.

> *Army forces no longer treat space systems as enablers, they depend on them as essential tools that cut across every warfighting function. As Army requirements, space capabilities, and access to space have grown in importance, Army forces have gained greater confidence in those systems and have acknowledged them as crucial to land combat operations.*
>
> *Adversaries are actively seeking ways to degrade space capabilities, and the demand for bandwidth is expected to outstrip supply. The threat to cyberspace operations, and the cyber connections to space create vulnerabilities that make both domains exploitable by adversaries. Fully functional space, cyber, and network capabilities means greater operational adaptability, but degraded space and network capabilities may seriously test the limits of operational adaptability.*
>
> General Martin Dempsey
> Commander, Training and Doctrine Command
> Memo to Army Service component commands, 27 July 2010

1-7. Commanders at all echelons and in all disciplines must understand the fundamental principles and advantages space operations bring to their mission areas, and the disadvantages associated with not utilizing and or misunderstanding space-enabled operations. Space operations bring essential tools that possess unique capabilities to influence and enhance each of the warfighting functions as employed in unified land operations.

1-8. Soldiers should have a basic understanding of how space contributes to Army operations, and Army unit commander must have a common and clear understanding of the space resources available that contribute to mission operations and how best to utilize those assets. This basic understanding is echoed at the joint level.

To facilitate effective integration, joint force commanders and their staffs should have a common and clear understanding of how space forces contribute to joint operations and how military space operations should be integrated with other military operations to achieve U.S. national security objectives.

JP 3-14

THE ARMY PROFESSIONAL

1-9. Army Doctrine Reference Publication (ADRP) 1, states the Army professional is a member of the Army profession who meets the Army's certification criteria of competence, character, and commitment. The space professional is a member of the Army profession who embraces professional and ethical behavior and values-based decision making.

1-10. It is the responsibilities of all commanders and leaders, as stewards of the Army Profession to:

- Establish and sustain a positive ethical command climate;
- Be moral exemplars;
- Professionally develop their subordinates' competence and character; and
- Set unit standards, discipline, and accountability of all Soldiers - especially commanders.

SECTION II – SPACE COMPONENT OF NATIONAL SECURITY POLICY

1-11. Historically, the policy of the U.S. 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 capabilities and should be carefully and purposefully developed, as appropriate by each Service, to help provide a balanced overall capability for full-spectrum dominance. These national-level policies and joint directives have a direct bearing on Army space operations in support of unified land operations.

NATIONAL SPACE POLICY

1-12. The National Space Policy issued in June 2010 commits the U.S. space program to a leadership role in the world. The U.S. will use space to preserve peace and protect national security, civil, and commercial interests. The 2010 policy reaffirms and enhances many of the goals of the previous policy while deemphasizing the unhindered U.S. access to space for defense of U.S. interests in space. The specific goals of the National Space Policy that support Army operations are:

- Expand international cooperation on mutually beneficial space activities to: broaden and extend the benefits of space; further the peaceful use of space; and enhance collection and partnership in sharing of space-derived information;
- Strengthen stability in space through: domestic and international measures to promote safe and responsible operations in space; improved information collection and sharing for space object collision avoidance; protection of critical space systems and supporting infrastructures, with special attention to the critical interdependence of space and information systems; and strengthening measures to mitigate orbital debris;
- Increase assurance and resilience of mission-essential functions enabled by commercial, civil, scientific, and national security spacecraft and supporting infrastructure against disruption, degradation, and destruction, whether from environmental, mechanical, electronic, or hostile causes; and
- Improve space-based Earth and solar observation capabilities needed to conduct science, forecast terrestrial and near-Earth space weather, monitor climate and global change, manage natural resources, and support disaster response and recovery.

1-13. The policy identifies a set of guidelines that apply to all federal departments and agencies and sector guidelines for activities conducted in the three distinct but independent sectors of commercial, civil space, and national security (space activities of the DOD and intelligence community). The U.S. will conduct those space activities deemed necessary for national security. Per National Security Space Guidelines, the Secretary of Defense and the Director of National Intelligence oversee these activities. Some prominent national security space activities supporting Army operations include:

- Develop, acquire, and operate space systems and supporting information systems and networks to support U.S. national security and enable defense and intelligence operations during times of peace, crisis, and conflict;
- Ensure cost-effective survivability of space capabilities, including supporting information systems and networks, commensurate with their planned use, the consequences of lost or degraded capability, the threat, and the availability of other means to perform the mission;
- Develop and implement plans, procedures, techniques, and capabilities necessary to assure critical national security space-enabled missions. Options for mission assurance may include rapid restoration of space assets and leveraging allied, foreign, and or commercial space and non-space capabilities to help perform the mission;
- Maintain and integrate space surveillance, intelligence, and other information to develop accurate and timely space situational awareness (SSA). SSA information shall be used to support national and homeland security, civil space agencies, human space flight activities, and commercial and foreign space operations; and
- Develop and apply advanced technologies and capabilities that respond to changes to the threat environment.

1-14. The National Space Policy has specific guidelines for DOD where the Secretary of Defense shall:

- Be responsible, with support from the Director of National Intelligence, for the development, acquisition, operation, maintenance, and modernization of SSA capabilities;
- Develop capabilities, plans, and options to deter, defend against, and, if necessary, defeat efforts to interfere with or attack U.S. or allied space systems;
- Maintain the capabilities to execute the space support, force enhancement, space control, and force application missions; and
- Provide, as launch agent for both the defense and intelligence sectors, reliable, affordable, and timely space access for national security purposes.

1-15. DOD space mission area activities contribute to U.S. national security by:

- Providing support for the U.S.' 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; and
- Supporting the activities of national policy makers, the intelligence community, the President of the U.S., Secretary of Defense, combatant commander, military Services, other federal officials, other government agencies, and continuity of government operations.

DOD SPACE POLICY

1-16. Department of Defense directive (DODD) 3100.10, *Space Policy* implements the National Space Policy and assigns responsibilities for space and space-related activities. This directive states the primary DOD goal is to provide operational space force capabilities to ensure the U.S. has the space power to

achieve its national security objectives in accordance with the U.S. National Security Strategy. Additionally the U.S. National Military Strategy recognizes space as one of the global commons and notes that our ability to project power from the global commons may be at risk. The space domain is critical for Army operations, yet becoming increasingly more vulnerable to malicious actions that create a D3SOE. The space environment is continuously becoming more congested, contested, and competitive. 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.

1-17. In accordance with DODD 3100.10, *Space Policy*, Department of Defense instruction (DODI) 3100.12, *Space Support*, DODI S-3100.13, *Space Force Application*, DODI S-3100.14, *Space Force Enhancement*, and DODI S-3100.15, *Space Control*, the Services shall integrate space capabilities and applications into all facets of their strategy, doctrine, education, training, exercises, and operations of U.S. military forces.

ARMY SPACE POLICY

1-18. According to Army Regulation (AR) 900-1, The Army will integrate space capabilities across the force, provide needed space capabilities and support, and develop capabilities needed to provide space effects in support of Army requirements. In order to do so, the Army must:

- Ensure the Army and CCDRs can utilize space capabilities in the most effective manner.
- Maintain a trained and ready cadre to execute space operations.
- Ensure necessary space force structure and systems are developed and acquired.
- Actively participate in defining space-related capability needs in coordination with the joint community.

1-19. The Army Space Policy clearly recognizes the Army's dependency on space capabilities and continuing commitment to space. The Army's three broad space policy objectives are:

- Provide space capabilities and support.
- Integrate space capabilities across the force.
- Develop space requirements and capabilities.

1-20. The Army Space Policy confirms the Army's access to, and use of, space capabilities is essential to operational success. Army space-related activities enhance operational support to operating forces and contribute to successful execution of Army missions.

1-21. The National Space Policy, DOD space policy, and Army Space Policy reflect the criticality of space for current and future U.S. military operations. Space is already an integral part of Army operations and continues to contribute to increasing Army and joint land warfighting dominance.

ARMY STRATEGIC SPACE PLAN

1-22. The purpose of the Army Strategic Space Plan is to create an overarching Army strategy that synchronizes Service functions in support of the Army missions The Secretary of the Army and the Chief of Staff of the Army approved the Army Strategic Space Plan on 23 May 2011.

> *For the effective execution of unified land operations, the Army depends on capabilities from space-based systems such as global positioning satellites, communication satellites, weather satellites, and intelligence collection platforms.*
>
> Army Strategic Space Plan

1-23. The Army space vision is assured access to resilient and relevant space-enabled capabilities to ensure Army operational and generating forces can conduct a variety of unified land operations around the world.

1-24. The Army space principles guide the Army's space strategy. They link the priorities presented in National and DOD guidance to facilitate integration with sister Services and other organizations. These principles are derived from existing relevant polices and directives as they pertain to the space mission areas:

- Enable the Army's enduring mission: Provide requisite space-enabled capabilities in support of current contingency operations as well as the Army's future transformation efforts when and where needed.
- Leverage joint interoperability and interdependency: Establish joint synchronization and maintain enduring relationships to advance effective use of responsive, timely, and assured National, international, and commercial space-based products and services; provide Army forces in support joint space operations.
- Network enterprise and or multi-domain approach: Employ a resilient architecture to help assure the delivery of critical capabilities across multiple domains and seamlessly integrate these activities into the Army.

1-25. The Army Strategic Space Plan is consistent with national, DOD, and Army policy. It establishes functional lines of effort to achieve the strategic space goals. The functional lines of effort align with the space mission areas and are prioritized to support tactical operations.

SECTION III – SPACE OPERATIONS OVERVIEW

SPACE DOMAIN

1-26. The Army's ability to capitalize on and protect space systems with space control, and attack enemy capabilities being used for purposes hostile to the U.S. Army, yields military power and contributes to U.S. military space superiority. Space superiority is the degree of dominance in space of one force over another. It permits the conduct of operations at a given time and place without prohibitive interference by the opposing force. The purpose of space superiority is to secure the freedom to take advantage of the capabilities provided by space systems at a given time and place without interference by opposing forces.

1-27. The space domain optimizes the high ground, which optimizes the use of space-enabled functions such as information collection, early warning, environmental monitoring, SATCOM, and positioning, navigation, and timing (PNT). Activities in the space domain enable freedom of action for operations in all other domains, and operations in the other domains can create effects in and through the space domain. Operations in the space domain grant significant operational advantage in order to achieve U.S. national policy and military objectives. Operations in all domains are positively impacted by maintaining assured access to the space domain.

1-28. The *space domain* is the area above the altitude where atmospheric effects on airborne objects become negligible. Like the air, land, and maritime domains, space is a physical domain within which military, civil, and commercial activities are conducted to achieve U.S. national security objective. According to JP 3-59, the *space environment* is the environment corresponding to the space domain, where electromagnetic radiation, charged particles, and electric and magnetic fields are the dominant physical influences, and that encompasses the Earth's ionosphere and magnetosphere, interplanetary space, and the solar atmosphere.

1-29. The Space domain supports all domains. It is separate but interdependent with the air, land, and sea domains; it is interconnected with the cyberspace domain. Operations in all domains, including space, rely on space for real-time or near real-time communications. The relationship between the space domain and the cyber domain is unique in that many space operations depend on cyberspace, and a critical portion of cyberspace is enabled by the space domain and can only be provided via space operations. Cyberspace provides the means by which space mission control and transmission of space sensor data are conducted. This interrelationship is critical and the linkages must be addressed during all phases of military planning and operations to ensure synergy between space and cyberspace.

1-30. The Army continually incorporates existing and emerging space domain capabilities to further improve the effectiveness of its operations. The Army executes space operations and contributes to establishing and maintaining space superiority consistent with unified land operations needs.

1-31. The Army leverages space capabilities to accomplish a wide variety of missions. Space-based and space-enabled communications, PNT, environmental monitoring, surveillance, reconnaissance, space control, and missile warning support are robust capabilities that continue to be necessities for success on the area of operations. They enhance situational awareness, information related capabilities, cyber electromagnetic activities, and aid high-tempo, noncontiguous, dispersed, and decentralized operations.

1-32. *Space forces* are the space and terrestrial systems, equipment, facilities, organizations, and personnel necessary to access, use, and control space for national security (JP 3-14). Other personnel are directly involved in routinely using space-based capabilities but are not considered space forces per the definition in JP 3-14. For example, SATCOM equipment operators in a brigade combat team or intelligence personnel who use space services who task and operate sensors and sensor feeds are not considered as part of the space force. For command purposes, JP 3-14 indicates that DOD space forces "…are directed by United States Strategic Command component commanders…." However, not all Army space forces are under the command of United States Strategic Command (USSTRATCOM) component commanders. As an example, Army space support teams (ARSST) assigned to USASMDC/ARSTRAT, or under the operational control of a combatant command, but are still considered Army space forces.

OPERATING IN SPACE

1-33. Space is the ultimate high ground and gives land forces the advantage of a global, persistent perspective of the strategic, operational, and tactical situation. Space systems consist of satellites on orbit, ground stations, launch bases, and the communications links and capabilities. Space hosts communications transponders, observation posts for surveillance and reconnaissance, transmitters broadcasting location and exact time information, sensors for weather and other environmental data, and sensors that can warn of enemy actions.

1-34. Space is a domain like land, sea, air, and cyberspace within which military activities are conducted to achieve U.S. national security objectives. Space begins above the atmosphere of the Earth and extends infinitely outward. The U.S. does not formally recognize a lower limit to space. However, space is considered to be the region around the Earth with little atmosphere, where satellites are placed in orbit. Space operations are those enabling operations that create or present opportunities to employ space capabilities to enhance the warfighting potential of the U.S. military and multinational partners. Space operations are generally supported by satellites in orbits around the Earth. Space is interrelated with the other domains and properly integrating these complex functions with the other military activities is critical for successful operations.

1-35. The 1967 Outer Space Treaty, officially known as *Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies* dictates satellites in orbit must be allowed free passage over countries. Nations cannot claim the space directly above them as their own, as they do with airspace. This allows the U.S., other countries, and commercial entities to orbit satellites that freely traverse or occupy positions while in space over other countries.

1-36. Space-based resources provide freedom of action, global reach, responsiveness, insights in an anti-access, area of denial arena, and are not constrained by geographic borders of otherwise geographically denied regions. Satellites are well suited for reconnaissance and surveillance, imagery, mapping, and intelligence operations because of the access they provide. However, operations in the space environment are bound by other constraints such as the laws of physics, international law, and policies that have a unique set of vulnerabilities.

1-37. Space-based platforms provide unique capabilities across all operational missions. The unique operating parameters of sensors on space-based platforms are a function of orbit characteristics, not the sensors. For example, space-based platforms may have frequent revisit rates or long dwell times.

1-38. Satellite orbits are generally grouped into categories defined by their altitude above the Earth and by the shape of their orbits. The four orbits are graphically represented in figure 1-1 on page 1-9.

- Low Earth orbit – up to 1,000 miles above the surface of the Earth. Satellites in this orbit are close to the Earth but moving quickly relative to the ground. A special category is the polar orbit, which is a low Earth orbit inclined approximately 90 degrees from the equatorial plane so the satellite orbits over the Earth's poles. Satellites in polar orbits can view the entire surface of the Earth over the course of several orbital passes as the Earth rotates. Satellites in low Earth orbit are the well-suited for:
  - Surveillance and reconnaissance;
  - Weather collection; and
  - Manned space missions.
- Medium Earth orbit – any orbital asset above low Earth orbit and below geosynchronous Earth orbit, but is most frequently associated with a distance of approximately 12,000 miles above the surface of the Earth. Commercial satellite providers have begun to explore medium Earth orbit alternatives that can provide wideband SATCOM with low latency and high capacity. This orbit is used mostly for PNT satellites.
- Geosynchronous Earth orbit – approximately 22,300 miles above the Earth and orbits the Earth once every 24 hour with the rotation of the Earth. Satellites in a geostationary orbit appear to be stationary relative to the surface of the Earth. Satellites in geosynchronous Earth orbit are the well-suited for:
  - Communications;
  - Weather collection;
  - Surveillance and reconnaissance; and
  - Missile-warning.
- Highly elliptical orbit. These orbits are oval-shaped with the Earth near one end inside the oval. In highly elliptical orbits, the satellite's altitude typically ranges from 600 miles above the Earth at perigee (point of closest approach), to 24,000 miles at apogee (point of farthest from the Earth) where it has a long dwell time over a large area similar in size to geosynchronous Earth orbit. The highly elliptical orbit is inclined from the equatorial plane so the total effect is that the satellite spends the majority of its time over higher latitudes that geosynchronous Earth orbits do not have coverage. Satellites in highly elliptical orbit are the well-suited for:
  - Communication over high northern or southern latitudes;
  - Scientific missions; and
  - Surveillance and reconnaissance.

1-39. For perspective, if the Earth were represented by a basketball, most low Earth orbits would be within one inch of the surface of the basketball. Global Positioning System (GPS) satellites in medium Earth orbit would be 14.5 inches above the ball, and satellites in a geosynchronous Earth orbit would be 27 inches above the ball. Important aspects of satellite utility come to light in this example and are highlighted in table 1-1 on page 1-9.

1-40. Except for those in a geostationary orbit, 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, hub-spoke, mesh, and point-to-point communications.

1-41. While unfettered access from high and relatively safe Earth orbits provides a tremendous advantage for information collection, 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 highly elliptical orbit yields a long dwell time but lacks global access, while a low Earth orbit provides global access but a short dwell time. Generally, only minor changes to orbits are made after initial spacecraft insertion.

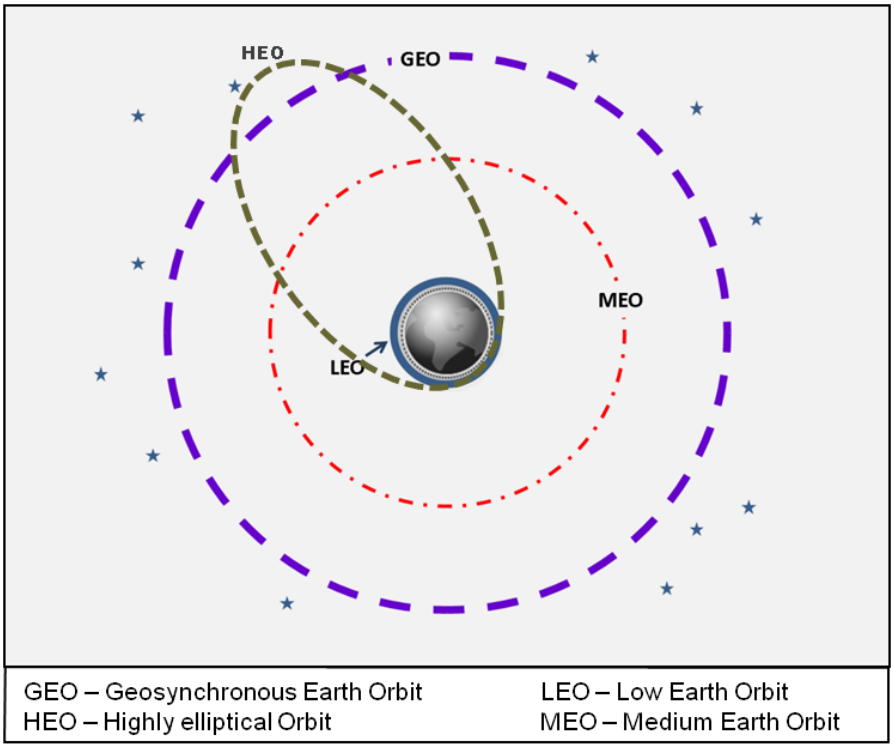

Figure 1-1: Illustration of basic Earth orbits

Table 1-1. Characteristics of satellite orbit types

Type	*Description*	*Advantages*	*Disadvantages*	*Uses*
Low Earth Orbit	• Roughly circular • Up to ~1,000 miles above Earth's surface	• Near Earth - high resolution and signal strength	• Small coverage area over Earth surface • Limited time over Earth's surface	• Surveillance • Reconnaissance • Weather collection • Manned space
Medium Earth Orbit	• Roughly circular • Between ~1,000-22,000 miles above Earth's surface	• Stable orbit • Less signal latency	• Highest radiation level environment	• Position, navigation, and timing • Communication
Geo-synchronous Earth Orbit	• Roughly circular • ~23,000 miles above Earth's surface	• Continuous coverage over specific area • Coverage nearly hemispheric	• Far from Earth - resolution and signal limitations • Easier to jam • Signal latency	• Communication • Surveillance • Reconnaissance • Weather collection • Missile warning
Highly Elliptical Orbit	• Oval shaped • ~ 600 miles at perigee (closest to Earth) • ~24,000 miles at apogee (farthest from Earth)	• Long dwell time over a large area • Coverage of high North or South latitudes	• Continuous coverage requires multiple satellites	• Communication over high North or South latitudes • Scientific • Surveillance • Reconnaissance

1-42. A related limitation is predictability. The position of satellites in low Earth orbit can be accurately predicted; therefore, predictions of satellite locations based on current orbit characteristics can be made weeks in advance. This predictability makes space-based information collection susceptible to camouflage, denial, and deception. Space operator can use this information to their benefits when dealing with enemy capabilities, and not considering its limitation could lead to unanticipated results. In addition to these limitations, information collection spacecraft are high-demand, low-density assets and cannot satisfy all information requests. It is the responsibility of space professionals to ensure this information is known by the staff during mission planning.

1-43. In-place orbiting space assets are quite responsive to the operating forces' needs. However, if the assets are not in place before the conflict or operation begins, it is unlikely more assets will become available within the time required to support the operations. It often takes weeks to move satellites from one orbital location to another, and this movement can deplete limited propellant and shorten the satellite's operational life. Propellant expenditure rates directly impact satellite life expectancy. When propellant is used for significant orbital changes or maneuvers, it is no longer available for station keeping, resulting in decreased mission life. Moving satellites can also affect several theaters' access to the limited resource. Currently, launching new satellites can take years and the additional months required for on-orbit checkout makes launching new satellites to augment a theater impractical for short-term needs.

1-44. When a satellite is tasked to provide data, whether its purpose is to update PNT, collect information, or provide communications, a task command is sent to the appropriate asset through a ground station. Once the task is processed, data is disseminated through a variety of means, dependent on the sensor employed, support architecture, and required product. The three methods include direct downlink, theater downlink, and reachback. Table 1-2 provides an overview of the three different methods and some common characteristics.

Table 1-2. Methods of dissemination

Method	*Description*	*Advantages*	*Disadvantages*	*Use*
Direct downlink	Spacecraft collects data, uses onboard processing, and immediately disseminates information in near real time to multiple terrestrial receivers.	• Near real time • Limited ability for adversaries to manipulate raw data	• Limited ability for intended users to manipulate raw data	• Position, navigation, and timing • Missile warning • Beyond line of sight communication
Theater downlink	Aircraft like the Joint Surveillance Target Attack Radar System disseminates information in near real time to ground station or satellite with the sole duty of relaying data to designated receivers.	• Timely • Near-continuous access • Higher bandwidth	• Requires additional spacecraft • Reduced ability to manipulate raw data • Multiple hops	• COP • FFT • Non-line of sight communication
Reachback	Data is transmitted to a consolidated mission station where it is processed and disseminated to the forward users.	• Data processing is consolidated • Users receive finished product	• Not as timely • Multiple hops • Operational and tactical sites with limited bandwidth	• COP • FFT • Battle damage assessment • Imagery
COP – common operational picture		FFT – friendly force tracking		

COMMERCIAL IMAGERY

1-45. Unclassified commercial satellite imagery is used by U.S. forces, other government agencies, and multinational partners in the combatant commander's area of responsibility to enhance knowledge of the environment within the operational area. Soldiers with commercial imagery requirements should initially contact and utilize their command elements in place such as Expeditionary Military Intelligence Brigade, Geospatial Production Cell, unit intelligence staff officer (commonly referred to as S-2) or assistant chief of staff for intelligence (G-2). Soldiers should also be mindful of operations security when describing requirements and mission needs to their command elements as well as the Army Geospatial Center and mission partners. Users that do not have access to Joint Worldwide Intelligence Communications System, or the local geospatial unit, can contact the Army Geospatial Center Imagery Office via email at dll-agc-aio@usace.army.mil.

Note: For specific details on commercial imagery requirements see ATP 2-22.7, *Geospatial Intelligence*.

1-46. Army Geospatial Center Imagery Office provides expertise on the National System for geointelligence tasking, collection, processing, exploitation, and dissemination cycle, most specifically through fulfillment of collection management services for users requiring new commercial imagery collections or unfunded/unlicensed archived imagery requirements. The Army Geospatial Center Imagery Office collaborates directly with the Army Departmental Requirements Office, National Geospatial-Intelligence Agency Source Directorate & National Geospatial-Intelligence Agency St. Louis, the United States Geological Survey and various commercial satellite/aerial digital imagery vendors to provide requested imagery availability information, data acquisition, data processing, and administrative coordination. Additional Army Geospatial Center Imagery Office services include an online repository of selected commercial imagery pertaining to terrain & urban analysis and water resources operations, and assistance to users with existing commercial imagery research, acquisition, and dissemination needs if they do not have access to NGA resources.

1-47. Commercial imagery provides direct support for DSCA. The ARSSTs and Army space coordination elements (ASCE) rely on unclassified commercial space imagery for a wide variety of reasons during planning and real-time operations. ARSSTs and ASCEs may receive unclassified commercial imagery using direct downlink capabilities that are available to deployed Soldiers.

TACTICAL EXPLOITATION OF NATIONAL CAPABILITY

1-48. Army Tactical Exploitation of National Capabilities (TENCAP) program delivers unique capability as the Army's lead activity to influence, leverage, and integrate the national intelligence enterprise to benefit the Army through the space-enabled capabilities.

1-49. Army TENCAP evolved from a U.S. Army recognition that national overhead systems developed for the National Command Authorities had potential to support Army forces with space-enabled capabilities at the tactical level. Throughout the early and mid-1970s the Army explored the tactical applicability of national systems to corps level operations and began developing and fielding tools needed to leverage those systems. The office created to do this, under the auspices of the Deputy Chief of Staff for Operations (now the Army assistant chief of staff, operations), became the U.S. Army TENCAP Program by Army Chief of Staff Directive in May 1975.

1-50. The Army's TENCAP Program is managed by Program Executive Office for Intelligence, Electronic Warfare, and Sensors and is directed by a general officer steering group chaired by the Assistant Secretary of the Army for Acquisition, Logistics, and Technology, Military Deputy, Army G-2, and Army G-8. Selected Department of the Army headquarters principal staff, the Army Capabilities Integration Center, and the Intelligence Center of Excellence round-out a general officer steering group membership.

1-51. The TENCAP mission is fivefold:

- Conduct cross-agency systems engineering to leverage national capabilities for Army purposes;

- Understand and influence National technologies and architectures;
- Provide core engineering expertise across the national and theater intelligence, surveillance, and reconnaissance (ISR) layers to integrate national capabilities within Army space, terrestrial, and foundation layers;
- Be the Army's technical interface to the National Reconnaissance Office; and
- Leverage the Intelligence Community's investment in overhead technologies, and transition applicable technologies to the Army to satisfy validated Army requirements.

Note: For specific details see the *Joint Tactical Exploitation of National Systems Manual*.

THE OPERATIONAL ENVIRONMENT

1-52. An operational environment is a composite of the conditions, circumstances, and influences that affect the employment of capabilities and bear on the decisions of the commander (JP 3-0). An operational environment includes physical areas (air, land, maritime, and space domains) and the information environment, which includes the cyberspace domain. An operational environment for any specific operation not only includes isolated conditions of interacting variables that exist within a specific area of operations, but also interconnected influences from a global or regional perspective, such as the political and economic influences that impact conditions and operations.

Note. The operational environment in which a unit conducts operations should not be confused with training environments created by the commander for local training.

1-53. Analysis of the broad aspects of the space operational environment in terms of the operational variables provides relevant information that senior commanders use to understand, visualize, and describe the operational environment. The operational variables are political, military, economic, social, information, infrastructure, physical environment, and time. Upon receipt of a warning order or mission, Army commanders filter relevant information and narrow their focus to six mission variables. The mission variables are mission, enemy, terrain and weather, troops and support available, time available, and civil considerations. These variables are used by space operators during analysis and to facilitate understanding. (See ADRP 3-0).

DENIED, DEGRADED, AND DISRUPTED SPACE OPERATIONAL ENVIRONMENT

1-54. Army and joint operations are dependent on space-based capabilities delivered to the other domains via the electromagnetic spectrum. The threat to Army and joint operations from a contested operational environment may create vulnerabilities which makes contesting space capabilities attractive to adversaries and enemies. Army space operations must remain responsive and flexible to commanders' needs and stay agile in response to adversary and enemy efforts to place joint forces in a contested operational environment.

1-55. Army forces must be prepared to conduct operations in a contested operational environment. *Denied, degraded, and disrupted space operational environment* is a composite of those conditions and influences in which space-enabled capabilities have been impaired by hostile threats or non-hostile means. Adversaries may attempt to create one or multiple effects against U.S. and allied forces. The use of denied, degraded, and disrupted are consistent with JP 3-14. For the purpose of this document, the use of these terms are clarified as denied—temporary total elimination of the use of space capabilities, effects, or associated linkages; degraded—permanent impairment (either partial or total) of the use of space capabilities, effects, or associated linkages usually with physical damage; or disrupted—a temporary impairment that weakens or diminishes the use of space capabilities, effects, or associated linkages upon which the Army, joint forces, and allies depend. D3SOE includes both threats and hazards.

- A *threat* is a fundamental part of an overall operational environment for any operation. A threat is any combination of actors, entities, or forces that have the capability and intent to harm

United States forces, United States national interests, or the homeland (ADRP 3-0). Threats may include individuals, groups of individuals (organized or not organized), paramilitary or military forces, nation-states, or national alliances and their actions. A threat may cause a D3SOE by attacking a physical asset or using electromagnetic interference.

- A *hazard* is a condition with the potential to cause injury, illness, or death of personnel; damage to or loss of equipment or property; or mission degradation (JP 3-33). Hazards are not strictly viewed as threats. They are usually predictable and preventable, and may be reduced through effective risk management efforts. Natural phenomena may create hazardous conditions which cause damage, destroy life and vital resources, or prevent mission accomplishment. Naturally occurring environmental factors are hazards which may negatively impact the electromagnetic spectrum and must be considered during the planning process.

1-56. D3SOE applies to physical assets and electromagnetic interference which may impair space-enabled capabilities. D3SOE focuses on identifying adversaries' actions to deny, degrade, or disrupt U.S. and allied space capabilities, effects, or associated linkages necessary to protect against those actions. Some threats which may contribute to a D3SOE include physical damage; signal jamming; signal spoofing; electronic interference with space-related assets, ground control nodes, control link, or on-orbit segments; and disabling or deceiving user equipment. The most likely risk to the tactical Army is signal jamming and spoofing directed against the ground user SATCOM and PNT linkages.

1-57. D3SOE is the Army space operations portion of the larger contested electromagnetic spectrum environment and the area which Army space forces operate. A contested operational environment may affect operations in any one, any combination, or all five domains, and may impact active and passive measures. A contested environment applies to a wide variety of operations, including, but not limited to space operations, cyberspace, electronic warfare, ballistic missile warning, space and terrestrial weather, lethal and non-lethal fires, and many intelligence disciplines such as signals, geospatial, measurement and signature, and technical intelligence. Operating within a contested environment has the potential to severely impact operations in the mission command, movement and maneuver, fires, intelligence, sustainment, and protection warfighting functions. Army unit are dependent upon the electromagnetic spectrum for mission operations. Mission critical systems operate in the radio, microwave, infrared, ultraviolet, and x-ray portions of the spectrum.

1-58. Commanders and staffs must understand how current and potential threats and hazards affect their forces. Threats and hazards must be analyzed during the initial planning phase. They must be continually identified, monitored, assessed, and revised to identify vulnerabilities throughout mission operations as they adapt and change over time. It helps the commander visualize potential impacts on operations when they understand both threats and hazards.

1-59. Adversaries are constantly seeking ways to create D3SOE effects and use them to their advantage. The threat to Army and joint operations from D3SOE may create vulnerabilities which may make electromagnetic interference or physical attack against space capabilities look attractive to adversaries. The U.S. Army depends on Soldiers to understand unit equipment, capabilities, limitations, and tactics, techniques, and procedures to fight through a D3SOE. Army space capabilities and effects contribute to successful unified land operations.

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Chapter 2

Mission Command of Space Forces

"The Army 'requires access to space capabilities to exercise effective mission command and support combatant commanders.' "

The U.S. Army Capstone Concept
19 December 2012

The Army is committed to the effective employment of all available space-related resources as space offers unique advantages so great, it is clearly worthwhile to overcome the characteristic difficulties of the space environment. Mission command of space forces and assets must be thoroughly defined, understood, and well coordinated to maximize space resource utilization. Refer to JP 3-14, *Space Operations* for more information.

ARMY-JOINT SPACE OPERATIONS RELATIONSHIPS

2-1. JP 3-14 lays the foundation of joint space doctrine by establishing principles for the integrated employment of space capabilities. It also recognizes the Service components have both common and distinct space missions. Each Service component contributes to an integrated whole that is synchronized by the joint force headquarters. Space forces both employ principles of joint operations and enable the application of the principles of joint operations by other joint forces. All Army space operations flow from and support the joint force commanders 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, ADP 3-0).

2-2. Common responsibilities of each of the Service components are advocating for space requirements within their respective Services; providing a single service point of contact for access to Service resources and capabilities; making recommendations to Commander, USSTRATCOM on appropriate employment of Service forces; providing assigned space forces to Commander, USSTRATCOM and combatant commanders as directed; assisting in planning in support of space operations and assigned tasking; and supporting Commander, USSTRATCOM and other combatant commanders with space mission area expertise and advocacy of desired capabilities as requested.

2-3. Service components have distinctly unique roles to play in providing space capabilities. The space-specific, distinctly Army roles are identified in JP 3-14, but are summarized below:

- Conduct space operations and provides planning, integration, control and coordination of Army forces and capabilities in support of USSTRATCOM missions;
- Provides friendly force tracking (FFT);

  Provide ballistic missile warning from deployed joint tactical ground station (JTAGS);
- Provide space expertise with ARSSTs;
- Conduct SATCOM planning by regional satellite communications support centers (RSSC);
- Conduct communication transmissions and satellite payload control of the wideband satellite constellations, and support to SSA; and
- Designated by Commander, USSTRATCOM as the consolidated SATCOM system expert for wideband, military ultrahigh frequency (UHF), and the specific SATCOM system expert for the Wideband Global Satellite Communications (WGS), the Global Broadcast Service, and Mobile Users Objective System.

2-4. In the case of USASMDC/ARSTRAT, in its role as the Army Service component command to USSTRATCOM as directed by the Forces For Unified Commands section of the Global Force Management Implementation Guidance, or when requested by a combatant commander and validated by the Joint Staff and USSTRATCOM, USASMDC/ARSTRAT provides space forces through the 1st Space Brigade (further detail is provided in Chapter 6). As a member of the Army's National-to-Theater geospatial intelligence federation, USASMDC/ARSTRAT's G-2, geospatial intelligence division is tasked by the Army G-2 to provide full-spectrum geospatial intelligence support to USSTRATCOM, United States Northern Command, and United States Transportation Command. Additionally, it also provides overhead persistent infrared (OPIR) analysis support to United States European Command and United States Africa Command. The Army provides space capabilities to the modular force through the space support element (SSE) organic to army, corps, division, special forces groups, fires brigade, and other organizations with emerging requirements. The Army also provides space capabilities that do not require deployed teams. These are detailed in chapter six and seven.

USSTRATCOM

2-5. The Unified Command Plan establishes USSTRATCOM as the functional unified command with overall responsibility for military space operations. Joint functional component command (JFCC) for Space (JFCC SPACE) is a component of USSTRATCOM and is the focal point for military space operations and is responsible for executing day-to-day, integrated space operations to deliver theater and global effects in support of national and combatant commander objectives. JFCC SPACE coordinates space operational-level planning, integration, and coordination to ensure unity of effort in support of military and national security operations and support to civil authorities. Commander, JFCC SPACE executes space operation taskings through the Joint Space Operations Center. Army space teams and elements use coordinate on a daily basis with JFCC SPACE.

2-6. Commander, USSTRATCOM has operational authority for all SATCOM on-orbit assets, control systems, and SATCOM terminal infrastructure. Commander, JFCC SPACE, as the supported commander for SATCOM, performs functions and activities of the SATCOM operational manager, including oversight, management, and control of SATCOM resources. USSTRATCOM has delegated day-to-day operation of DOD-owned SATCOM resources to Commander, JFCC SPACE and or the applicable SATCOM system experts assigned by USSTRATCOM to provide authorized users with global SATCOM support for operations and evolving requirements.

SPACE COORDINATING AUTHORITY

2-7. The space coordinating authority (SCA) is a commander or individual assigned responsibility for planning, integrating, and coordinating space operations support in the operational area. The SCA will coordinate space support of established objectives and act on behalf of the combatant commander, if designated, with primary responsibility for joint space operations planning. SCA is not a person, but rather an authority imparted upon a commander or individual to coordinate space efforts within the area of responsibility. Based on the complexity and scope of operations, the joint force commander can either remain SCA or designate a component commander, or other individual, as the SCA. The commander with SCA is responsible for coordinating joint space operations and integrating space capabilities in an operational area. The joint force commander may retain responsibility as the SCA or may designate a component commander as the SCA. The joint force commander may consider a variety of variables to include, but not limited to, the mission, nature, and space force capabilities when selecting to remain or delegate SCA, and to whom to delegate this authority.

> *The SCA has primary responsibility for joint space operations planning, to include ascertaining space requirements within the joint force. The SCA gathers operational requirements that may be satisfied by space capabilities and facilitates the use of established processes by joint force staffs to plan and conduct space operations.*

A supported joint force commander (when delegated space coordinating authority from the Geographic Combatant Commander) integrates space capabilities and coordinates joint space operations in the operational area.

JP 3-14

2-8. The commander or individual with SCA gathers operational requirements that may be satisfied by space capabilities and facilitates the use of established processes by joint force staffs to plan and conduct space operations. The commander or individual with SCA's roles and responsibilities include:

- Coordinating, integrating, and synchronizing space capabilities in the operational area;
- Planning space operations;
- Maintaining SSA of theater space operations, and coordinating with the individual with combatant command SCA or Commander, JFCC SPACE to integrate theater space operations into global space operations; and
- Providing consolidated space requirements through the joint force commander for coordination.

2-9. If SCA is not delegated to the Army, the joint force land component commander SSE advocates for land component space forces and space support. In this case, it is entirely appropriate for the Army Service component command SSE to provide an officer to augment the organization with SCA as part of a joint manning document.

SPACE COORDINATION IN A JOINT ENVIRONMENT

2-10. JP 3-14 outlines general strategic and operational situations for joint space operations. Due to the nature of space resources, changes to satellite tasking to support one theater can affect other theaters. Therefore, day-to-day mission command and satellite control is accomplished from a strategic perspective. Commander, USSTRATCOM is responsible for conducting joint space operations, and coordinating and conducting space planning through the joint planning process in support of the national military strategy. USSTRATCOM assigns appropriate command relationships for space operations to the component commanders; components maintain this strategic perspective in their space planning and operations. Commander, USSTRATCOM ensures coordination and integration from the global perspective, and together with the SCA, ensures space activities are coordinated, deconflicted, integrated, and synchronized at the theater level.

2-11. In joint operations, the joint force commander may designate a commander or individual with SCA and delegate to the SCA appropriate responsibility to conduct space planning, integrate space capabilities, and coordinate joint space operations within the operational area, to include ascertaining space requirements within the joint force. It is important to limit the possibility of interference or redundancy between various space operations, and to deconflict space activities. The joint force commander may retain SCA or designate a component commander with SCA. The joint force commander considers the mission, nature, and duration of the operation; preponderance of space force capabilities made available; and resident command and control capabilities (including reachback) in selecting the appropriate option.

2-12. The commander, Air Force forces, is the Service component commander for Air Force space forces. The functional component commander is usually the joint force air component commander in-theater. The joint force commander normally delegates SCA to the joint force air component commander to coordinate joint space operations and integrate theater and global space capabilities and effects. The commander, Air Force forces is normally dual-hatted as the joint force air component commander. The commander, Air Force forces and joint force air component commander are well suited to coordinate space operations because of their ability to exercise control of space forces, theater-wide perspective, and expertise on staff.

2-13. The joint force land component commander may be delegated SCA at the discretion of the joint force commander. 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 joint force commander confidence, and has adequate mission command to fully coordinate space issues. The nature and duration of the overall mission are also factors when assigning SCA to a commander. If joint force land component commander is

designated with SCA, that headquarters should request appropriate Army, Joint, and Service space augmentation in order to perform the functions required to support the execution of SCA. The commander with SCA consolidates joint force commander component space requirements and issues, and coordinates implementation through joint force commander to USSTRATCOM. When delegated SCA, the joint force land component commander may exercise direct liaison with other Service space components if authorized.

DIRECTOR OF SPACE FORCES

2-14. A director of space forces (DIRSPACEFOR) is assigned to the commander, Air Force forces staff and serves as the senior space advisor to integrate space capabilities and effects. If the commander, Air Force forces or joint force air component commander is delegated SCA, the DIRSPACEFOR will normally execute SCA responsibilities on behalf of the commander, Air Force forces or joint force air component commander. While each combatant commander may have a DIRSPACEFOR, United States Central Command is the only combatant commander with a standing DIRSPACEFOR with a formal agreement to utilize an Army functional area 40 (FA40) space professional as the Deputy DIRSPACEFOR. When an Army FA40 is serving as the United States Central Command Deputy DIRSPACEFOR, the individual is assigned to USASMDC/ARSTRAT with duty at Air Force Central Command.

2-15. The DIRSPACEFOR is responsible for:

- Integration of space force enhancement, space control operations, and planning in joint operations on behalf of the combined force air component commander when acting as SCA;
- Oversee day-to-day functions of the DIRSPACEFOR staff and accomplish assigned duties of SCA;
- Provide the combined force air component commander and key staff counsel and training in space operations;
- Assist with planning and executing theater space operations and applying space capabilities throughout the joint targeting cycle;
- Assist in coordinating tailored space support for operations throughout the area of responsibility;
- Work directly for the combined force air component commander as special staff providing advice on space capabilities and employment;
- Ensure continuity of operations, focus, operational stability, and unity of command with multiple rotations of joint space personnel across the area of responsibility;
- Conduct deliberate planning for contingency operations and exercises, and validate process;
- Provide reachback support for all forward deployed space forces from all Services in area of responsibility;
- Interact with multiservice space professionals within the combined air and space operations center; and
- Provide insight and participate in special technical operations planning, as required.

2-16. During larger standing operations and in crisis planning and execution, the theater SCA function is supported with appropriate manning for staff support based upon the nature of the pending contingency. The manpower and expertise requirements will be reflected in the final approved joint manning document for that headquarters along with an identification of a responsible Service to fill the position. In most cases where the SCA is delegated to the Commander, Air Force forces with an assigned DIRSPACEFOR to support those functions, the Deputy DIRSPACEFOR is normally sourced as an Army space officer, as established in operations. An Army Deputy DIRSPACEFOR supports all the joint functions of the DIRSPACEFOR, can represent specific land component space-related needs and issues to the theater SCA for resolution. An Army Deputy DIRSPACEFOR also acts as an intermediary between DIRSPACEFOR staff and Army SSEs, ARSSTs, ASCE, JTAGS detachments, space situational awareness planning teams (SSAPT), and space control detachments.

USASMDC/ARSTRAT

2-17. The mission of USASMDC/ARSTRAT is to conduct space and missile defense operations and provide planning, integration, control, and coordination of Army forces and capabilities in support of USSTRATCOM missions; serve as the Army specified proponent for space, high altitude, and ground-based midcourse defense; and conduct mission-related research and development in support of Army Title 10 responsibilities.

2-18. Per AR 10-87, *Army Commands, Army Service Component Commands, and Direct Reporting Units* USASMDC/ARSTRAT is an operational level Army force designated by the Secretary of the Army as Army Service component command to USSTRATCOM. USASMDC/ARSTRAT exercises administrative control authority and responsibilities on behalf of the Secretary of the Army over Army forces assigned to USSTRATCOM and operational control over forces delegated by Commander, USSTRATCOM.

2-19. Per AR 5-22, *The Army Force Modernization Proponent System,* USASMDC/ARSTRAT is designated as the force modernization proponents for space. The Army force modernization proponent system is the process of managing change within the Army. It is the strategic-level process for interaction between the Department of the Army and force modernization proponents used to transform the Army. Proponent responsibilities are defined below:

- Execute force management responsibilities which include doctrine, organization, training, materiel, leadership and education, personnel, and facilities (DOTMLPF) and policy changes for their particular function or branch.
- Ensure DOTMLPF actions are coordinated with Army commands, Army Service component commands, direct reporting units, field operating agencies, headquarter Department of the Army staff, and others, as required.

2-20. USASMDC/ARSTRAT, as the Army Service component commander to USSTRATCOM, is the Army space force provider for combatant commanders. They execute mission command for USASMDC/ARSTRAT space forces that are not operational control or tactical control to combatant commander organizations. USASMDC/ARSTRAT provides existing and emerging Army space capabilities to U.S. forces and allies to deliver decisive combat power on the area of operations. USASMDC/ARSTRAT plans and executes continuous military space operations and sustains assigned units supporting USSTRATCOM (see figure 2-1 on page 2-6). USASMDC/ARSTRAT supports all USSTRATCOM space-related operational mission areas and is the focal point for the employment and integration of USASMDC/ARSTRAT space forces into global, national, and military operations. USASMDC/ARSTRAT supports Army and USSTRATCOM policies, objectives, and land component commander operation plans.

2-21. The Commander, USASMDC/ARSTRAT, serves as the Army integrator for global missile defense systems, and commands USASMDC/ARSTRAT. The Commander, USASMDC/ARSTRAT also commands JFCC for Integrated missile defense because of the roles and responsibilities as the Army specified proponent for ground-based midcourse defense system.

2-22. The Commander, USASMDC/ARSTRAT is also the personnel developer for FA40s per AR 600-3, *The Army Personnel Development System*, and serves as the Army focal point and lead agent for implementation of Army space cadre efforts; these functions are executed by the Army Space Personnel Development Office.

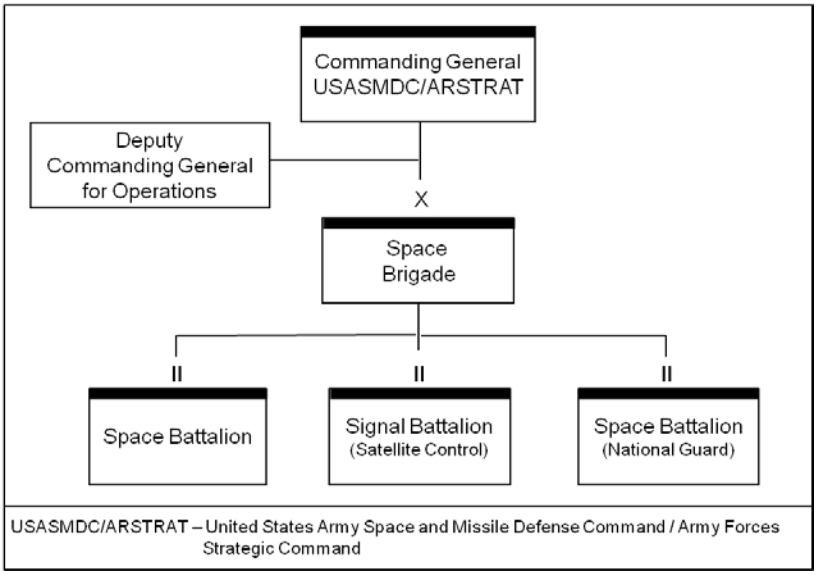

Figure 2-1. USASMDC/ARSTRAT operating forces

ARMY SPACE CADRE

2-23. The Army has been involved in space-related operations for over five decades with Army signal corps Soldiers involved in SATCOM and military intelligence involved with space-based systems. While those activities certainly continue, the Army space cadre is directly involved in space operations in support of Army operations throughout DOD, joint, and Service space activities. Since the beginning of the 21st century, Army space operations have grown to include all aspects of space operations that support the Army core competencies, all warfighting functions, and operations. In the Secretary of Defense Memorandum titled *National Security Space Management and Organization*, 18 October 2001, the Secretary of Defense directed the Army to develop "a cadre of space qualified professionals comprised of military and civilian personnel in sufficient quantities to represent their military departments and DOD agency's interests in space requirements, acquisition, and operations." DODD 3100.16, *DOD Management of Space Professional Development*. Describes the processes for managing space professional development.

2-24. Army space operations are founded on the depth and breadth of knowledge of the Army space operations officer. The Army space cadre is comprised of Soldiers and Army civilians identified as either space professionals or space enablers. Space professionals are military and civilian career space specialists, whose principal duties include planning, developing, resourcing, acquiring, integrating, or operating space forces, concepts, applications, or capabilities in accordance with DODD 3100.10 and JP 3-14. Space enablers are military and civilian career space specialists assigned to positions whose primary career field is not space, but who perform unique tasks or require skills to apply space capabilities. Space enabler positions may be in operations, such as ARSST, ASCE, SSA, and JTAGS operators, or they may be support staff such as command staff members, USASMDC/ARSTRAT operations center, FFT mission management center (MMC) members, and designated Battle-lab Soldiers and civilians. Additionally, some signal, military intelligence, and logistic positions are also designated as space enablers.

2-25. Army space operations are conducted by knowledgeable, well educated Army space cadre. Army space operations officers are designated from nearly every branch within the Army. This experience gives the FA40 community a broad level of understanding of Army operations. Every FA40 is educated to bring detailed knowledge of all aspects of space operations to military operations, including SSA, Space Control, information collection, early warning, environmental monitoring, SATCOM, PNT, and electromagnetic interference.

2-26. Army space cadre professionals support Army and joint space operations across all space mission areas. Refer to chapter 3 for definitions and overview of the five space mission areas.

ARMY, CORPS, AND DIVISION SPACE STAFF

2-27. Theater Armies, field armies, corps, and divisions headquarters have organic SSE for planning, integration, coordination of space capabilities, and to conduct mission command of space forces. The Army, corps, and division movement and maneuver cells have SSEs comprised of FA40 space operations officers. In special forces groups and fires brigades, a single FA40 officer is assigned to the operations staff officer.

2-28. The primary function of the SSE is to synchronize space mission area activities throughout the operations process using effective mission command to maximizing the positive impact of space-based capabilities for the commanders needs. The SSE is responsible for maintaining SSA and updating the space protion of the common operational picture (COP). SSE members coordinate space operations objectives and tasks with their counterparts at higher and lower echelons. The SSE serves as the primary mission command element within the staffs for space operations. They may also work alternative compensatory control measures and special technical operations, as directed.

COORDINATION OF ARMY SPACE OPERATIONS

2-29. The corps may serve as the warfighting headquarters in the role of a joint task force or land component to a joint task force. The corps serving as a joint task force is the focal point for the planning and execution of space operations. The joint task force coordinates with the theater commander having SCA, which is commonly the joint force air component commander. The theater army will normally be responsible for the Title 10 role of providing trained and ready land forces to the combatant commander as well as the executor of reception, staging, onward movement, and integration of land forces for a theater commander. Figure 2-2 on page 2-8 depicts these mission command relationships at a high level. In certain short-term contingency situations, the Army Service component command staff can deploy a contingency command post, which serves as a joint task force until either the short-term contingency ends or a follow-on headquarters takes over. Divisions may serve as subordinate headquarters to the joint task force headquarters if the scale and scope of the mission allows, or as subordinate headquarters to the joint task force and execute mission command over brigade combat teams and functional brigades, such as fires, sustainment, and surveillance brigades.

2-30. Army space forces are normally provided to Commander, USSTRATCOM via USASMDC/ARSTRAT.

2-31. The joint force commander may request an ASCE to provide Army space operations expertise via a request for forces. Upon validation of the request for forces, a Chairman of the Joint Chiefs of Staff deployment execution order will be sent to USSTRATCOM. USSTRATCOM may task USASMDC/ARSTRAT to provide the forces. If tasked, the Commander, USASMDC/ARSTRAT will designate an ASCE to provide Army space operations expertise and coordination support to the battlefield coordination detachment staff. The ASCE is discussed in greater detail in chapter 6.

2-32. If an ASCE is requested, then the ASCE may perform the following functions:

- Provides Army space representation and support to the commander with SCA;
- Assists the SSEs in ensuring Army space equities are recognized and incorporated into joint space operations;
- Assists in the joint space planning process and development of the space priorities; and
- Coordinates space operations through the Army battlefield coordination detachment.

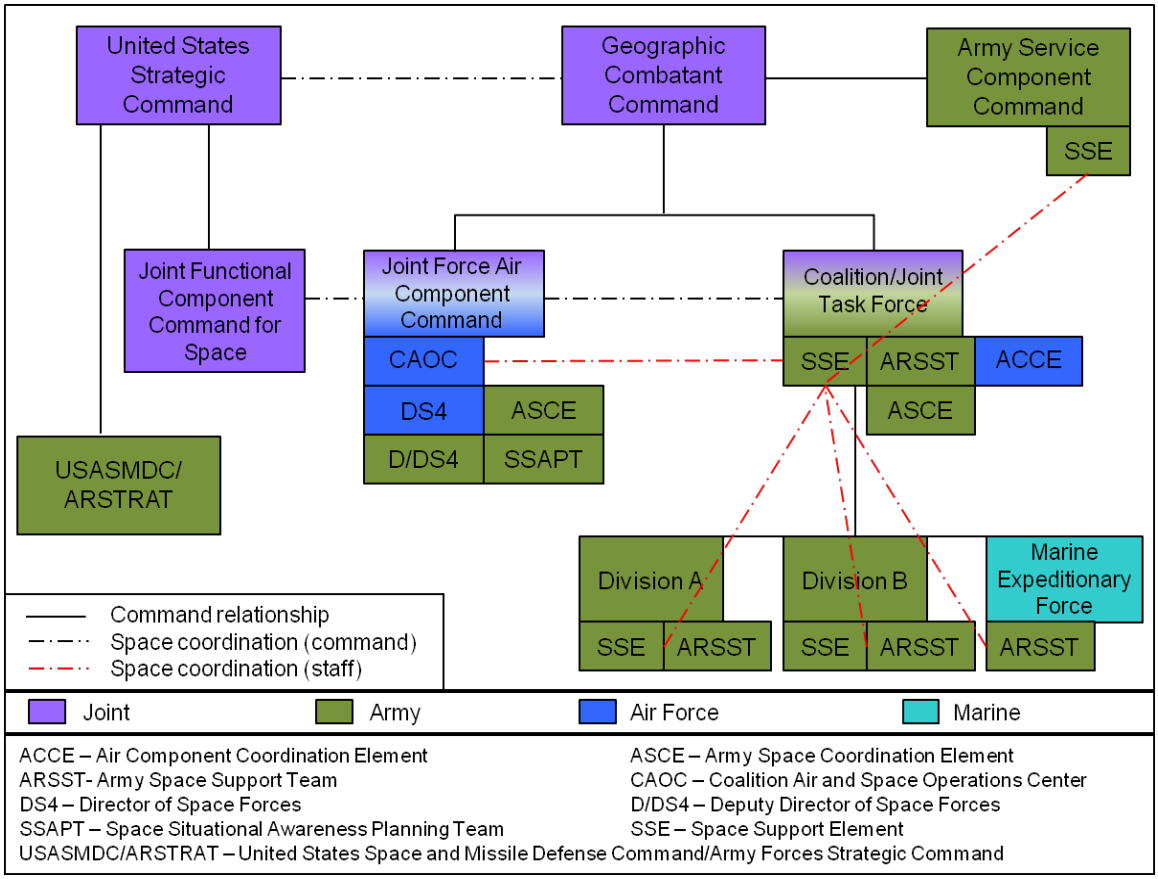

Figure 2-2. Army space coordination relationships to Coalition & Joint Task Force

2-33. The USASMDC/ARSTRAT operations center provides the USASMDC/ARSTRAT commander the means to communicate and execute mission command of USASMDC/ARSTRAT space and missile defense assets. It provides command situational awareness and maintains command asset operational status. The USASMDC/ARSTRAT operations center provides around-the-clock reachback for space operations officers and deployed space assets.

Chapter 3

Space Mission Areas and Army Warfighting Functions

"Fully integrated [space] capabilities will provide depth, persistence, and reach capabilities for commanders at the strategic, operational, and tactical levels. Assured space systems and well-trained and experienced space professionals significantly reduce the fog, friction, and uncertainty of warfare."

Lieutenant General (retired) Richard B. Formica
former Commander, USASMDC/ARSTRAT
Senate Armed Services Committee Statement
11 May 2011

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 space-related assets and operations that surround the world. The framework used to organize the many space functions are the space mission areas. The Army categorizes space missions into five primary mission areas consistent with JP 3-14.

SECTION I – SPACE MISSION AREAS OVERVIEW

3-1. Space operations are categorized into the five space mission areas of SSA, space control, space force enhancement, space support, and space force application. SSA is a key component for space operations because it builds the foundation for accomplishing all other space mission areas as graphically illustrated in figure 3-1 on page 3-2. The definitions of the five space mission areas are included in JP 3-14, but are summarized below.

- SSA is the requisite current and predictive knowledge of the space environment and the operational environment upon which space operations depend. SSA involves characterizing, as completely as necessary, the space capabilities operating within the terrestrial environment and the space domain. SSA is fundamental to conducting space operations.
- Space control consists of offensive space control and defensive space control and supports freedom of action in space for friendly forces, and when necessary, defeats adversary efforts that interfere with or attack U.S. or allied space systems and negates adversary space capabilities.
- Space force enhancement operations increase joint force effectiveness by increasing the combat potential of that force, enhancing operational awareness, and providing critical joint force support. Space force enhancement is composed of ISR, missile warning, environmental monitoring, SATCOM, and PNT.
- The space support mission area includes the essential capabilities, functions, activities, and tasks necessary to operate and sustain all elements of space forces throughout the range of military operations. It is composed of spacelift, satellite operations, and reconstitution of space forces.
- Space force application is combat operations in, through, and from space to influence the course and outcome of conflict by holding terrestrial targets at risk. This mission area includes ballistic missile defense and force projection capabilities such as intercontinental ballistic missiles. The space force application mission area is codified into national space policy.

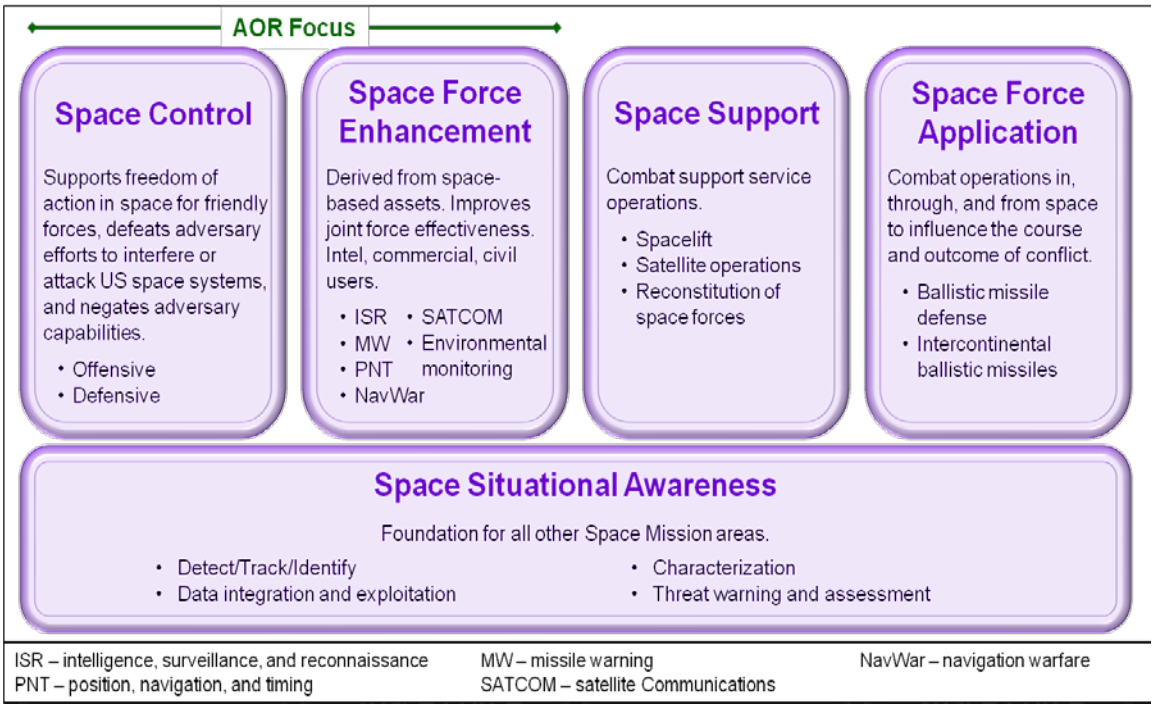

Figure 3-1. Space mission areas and relationship

SPACE SITUATIONAL AWARENESS

3-2. SSA is fundamental to conducting space operations because it is the foundation for all other space mission areas as it involves characterizing space capabilities, operating within the land domain and space domain, and integrating analysis of information collections that contribute to the joint force commanders ability to understand enemy intent. The four functional capabilities of SSA are: detect, track, identify; threat warning and assessment; characterization; and data integration and exploitation. SSA involves characterization, analysis, and prediction, as completely as necessary, of the space capabilities operating within the space domain, land domain, and natural phenomena.

3-3. SSA requires in-depth knowledge of the space domain, understanding of the operational environment, intelligence on all non U.S. space systems, correlation of effects to the cause, and proper distribution and sharing of SSA information. Processes for distributing, sharing, and integrating SSA are described in the USSTRATCOM Strategic Instruction (SI) 534-03, *Sharing Space Situational Awareness Information*. SSA supports these four key objectives.

- Ensure space operations and spaceflight safety. SSA provides the infrastructure that ensures that U.S. space operators understand the conditions that could adversely impact successful space operations and spaceflight safety, such as collision avoidance.
- Implement international treaties and agreements. SSA is a means by which compliance, via attribution, can be verified and by which violations can be detected.
- Protect space capabilities. The ability of the U.S. to monitor all space activity enables protection of space capabilities, helps deter others from initiating attacks against space and terrestrial capabilities, and assures allies of continuing U.S. support during times of peace, crisis, and conflict.
- Protect military operations and national interests. SSA supports and enhances military operations.

3-4. SSA operations are continuous to ensure the current and future locations of all space-based and terrestrial space systems are known with reliable accuracy. SSA is fundamental to combined arms

maneuver and wide area security because it characterizes space capabilities and integrates information collections analysis that contribute to the Army's ability to understand and react to an enemy intent.

3-5. Detect, Track, Identify. The ability to search, discover, track, maintain custody of space objects and events, distinguish objects from others, and recognize objects as belonging to certain types, missions. The primary role of detect, track, identify is in support of safety of flight and support of offensive space control and defensive space control missions. This capability is required to provide the operations center data for creation of a COP and presentation to the decision makers. The joint force commander benefits through comprehensive knowledge of inventory of space objects, events, and status, which may affect the user's missions.

3-6. Threat Warning and Assessment. The ability to predict and differentiate between potential or actual attacks, space weather environment effects, and space system anomalies, as well as provide timely friendly force status. Threat warning and assessment's primary role is in direct support of offensive space control and defensive space control and relies heavily on detect, track, identify, characterization, and data integration and exploitation. This capability is required to provide the joint force commander with an assessment of events related to all aspects of space capabilities which includes the space segment, ground segment and communications link, as well as advanced warning of potential events of threats and their impacts to space capabilities or other capabilities dependent on space. These threat warnings and assessments may also contribute to or serve as indications and warnings of other potential events or threats, which might affect non-space capabilities and or non-DOD capabilities and services.

3-7. Characterization. The ability to determine strategy, tactics, intent, and activity, including characteristics and operating parameters of all space capabilities (ground, link, space) and threats posed by those capabilities. This provides the joint force commander, and other decision makers, with the knowledge and confidence to make assessments of space capabilities, objects, and events, which may affect the mission. Characterization of blue assets is necessary to support blue system anomaly resolution, establish baselines for evaluating enemy space object surveillance and identification capabilities, enemy concept of operations, and supports indications and warning development.

3-8. Data Integration and Exploitation. The ability to fuse, correlate and integrate multi-source data into a tailorable COP and enable decision making for the entire set of space operations missions. This capability enhances the other three functional capabilities of SSA and provides the ability to identify, correlate, and integrate multiple sources of data and information and to provide SSA services. These enhancements support higher confidence and more responsive course of action (COA) for space and non-space forces. Data Integration and Exploitation should provide the information technology capability to:

- Search and discover better sources of data and information across multiple organizations, missions, and security levels;
- Rapidly integrate that data into real time SSA operations centers;
- Identify to the operator or commander the discovery and context of changes as they occur;
- Retrieve, process, and store data according to its use, such as real time or routine operations, training, rehearsal, or research;
- Provide user-centric displays tailored to needs and access levels; and
- Provide these functions via operator-centric displays and tools that permit autonomous or manual execution as well as reminders and status of pending or ongoing tasks such as blue force status.

3-9. The result of data integration and exploitation is seamless fusion of space information into the COP. This provides the relevant space information needed in planning, assessment, and execution by fusing multiple sources of information from the space mission areas and placing it into one cohesive picture. The space portion of the COP aggregates information about ground and on-orbit space systems, space and terrestrial weather that could impact both space systems and mission operations, and space debris tracking. It includes blue space picture which includes space-related friendly, allied, and civilian capabilities, red space picture which shows enemy capabilities, and grey space picture which shows neutral space capabilities.

3-10. SSA provides the commander the ability to identify the space capabilities available and impacts to operations in the local area. It also provides insight into enemy space capabilities and their threats to U.S. space capabilities. Understanding enemy intent is critical to every operation. SSA operations are continually ongoing to ensure the current and future locations of all satellites are known with reliable accuracy. Friendly forces may be warned when enemy space-based information collection assets will be in position to view and record friendly force activities. SSA supports assured communications which are critical for friendly PNT, FFT, and SATCOM capabilities to assess unwanted intrusions, attacks, interference, or unintentional hazards, and safeguards targeting and fires assets from unintentional hazards such as radio frequency interference and other naturally occurring phenomenon.

3-11. FFT systems provide the commander the ability to track small unit patrols and teams that are often intermingled with the local populace. Integrating the FFT information into the theater COP is of great importance if a friendly force unit needs to be reinforced or removed from a difficult situation. FFT systems provide the exact location information necessary to track units, and thus contribute to effective mission command, situational understanding, personnel recovery, and fratricide avoidance.

SPACE CONTROL

3-12. The foundation of space control operations is SSA. Space control operations ensure freedom of action in space for the U.S. and its allies and defeat efforts to interfere with or attack U.S. or multinational space systems. Space control is comprised of offensive space control and defensive space control. Offensive space control operations are based on prevention and negation measures whereas defensive space control operations are conducted to preserve the ability to exploit space capabilities via active and passive actions, while protecting friendly space capabilities from attack, interference, or unintentional hazards.

3-13. Offensive space control are measures taken for prevention of an enemy's hostile use of U.S. or third-party space capabilities or offensive operations to negate an enemy's space capabilities used to interfere with or attack U.S. and multinational space systems. Offensive space control entails the negation of enemy space capabilities through deception, disruption, denial, degradation, or destruction actions. State and non-state adversaries will exploit the increased access to space-based capabilities to support their operations. Consequently, the importance of space capabilities in military operations makes it crucial for the U.S. to prevent or negate enemy efforts that interfere with or attack U.S. and multinational space capabilities. Offensive space control actions target an enemy's space-related capabilities and forces, using both lethal and nonlethal means. Offensive space control operations support U.S. national security actions taken to negate attacks against U.S. and friendly space assets.

- Prevention measures preclude an enemy's hostile use of U.S. or third party space systems or services to support their operations. Prevention is normally accomplished through diplomatic, informational, military, and economic measures, as appropriate.
- Negation is active defensive and offensive measures to deceive, disrupt, degrade, deny, or destroy an enemy's space capabilities. Measures include actions against ground, data link, user, and or space segments to negate enemy's space systems, or to thwart hostile interference with or attacks on U.S. and multinational space systems.

3-14. Defensive space control is defined as those operations conducted to preserve the ability to exploit space capabilities via active and passive actions. These actions protect friendly SATCOM and other space capabilities from attack, interference, unauthorized intrusions, or unintentional hazards. Although defensive space control is focused on responding to man-made threats, such as GPS and SATCOM jammers, defensive space control actions also safeguard assets from unintentional hazards such as space debris, radio frequency interference, and other naturally occurring phenomenon such as radiation. A robust defensive space control capability influences enemies' perceptions of U.S. space capabilities and makes them less confident of success in interfering with those capabilities. Friendly forces may be warned when enemy space-based reconnaissance and surveillance assets will be in a position to view and record U.S. activity. Forces can then use camouflage, concealment, and deception techniques, if necessary, to protect themselves. This is an example of defensive space control enabled by SSA.

3-15. Defensive space control measures include operations that protect U.S. or third-party space capabilities from adversaries' attacks. Defensive space control preserves U.S. access to, and use of, space by employing all means available to react to events affecting U.S. and multinational space capabilities. Defensive space control is built on several elements including capabilities to detect and characterize an attack, ability to attribute an attack to an enemy, ability to defeat the attack, and the ability to operate through or deter an attack (JP 3-14). Defensive space control is consistent with the inherent right of self-defense, deters others from interference and attack, defends our space systems, contributes to the defense of multinational space systems, and if deterrence fails, defeats efforts to attack them.

3-16. Although focused on responding to man-made threats that can affect either terrestrial or space-based systems such as GPS and SATCOM jammers, defensive space control actions may also safeguard assets from unintentional hazards such as space debris, radio frequency interference, and other naturally occurring phenomena such as radiation and weather. Space control provides encryption and protection of vital communications and information collection links necessary to support the force during normal and denied, degraded, and disrupted space operational environment. Protection of U.S. assets from adversarial exploitation protects the commander's ability to communicate and navigate in a challenged environment. Passive defensive space control protection measures such as encryption and electronic hardening of GPS receivers to preclude electromagnetic interference ensure Army forces can receive GPS information in a contested environment. Active defensive space control protection actions such as geo-locating jamming sources assist Army forces to find, fix, and destroy jammers.

3-17. Space control can be used to deny communications and propaganda tools, such as satellite television and satellite radio, to enemy leadership. Space surveillance systems monitor the status of enemy and commercial satellite operations to determine potential threats to friendly forces. Space control ensures combined arms maneuver freedom of action for U.S. forces and allies, and when directed, defeat efforts to interfere with or attack U.S. and multinational space systems.

3-18. According to ADRP 3-0, combat power has eight elements: leadership, information, mission command, movement and maneuver, intelligence, fires, sustainment, and protection. Information enables commanders at all levels to make informed decisions on how best to apply combat power. Ultimately, this creates opportunities to achieve definitive results. Space control operations help ensure information is available at all times throughout the range of military operations. Knowledge management enables commanders to make informed, timely decisions despite the uncertainty of operations. Information management helps commanders make and disseminate effective decisions faster than the enemy. Every operation requires complementary tasks of information related capabilities that affect the commander's intent and concept of operations. Every operation also requires cyber electromagnetic activities. Coupled with space control, these activities ensure information availability, protection, and delivery as well as a means to deny, degrade, or disrupt the enemy's use of its command and control systems and other cyber capabilities. Commanders use information and a mission command system to understand, visualize, describe, direct, lead and assess operations.

Note: For more information on information operations, refer to FM 3-13, *Information Operations*.

SPACE FORCE ENHANCEMENT

3-19. The Army relies on space-based capabilities and systems, such as global positioning, communication, weather satellites, and intelligence collection platforms. These systems are critical enablers used by the corps to plan, communicate, navigate, maneuver, maintain situational awareness, engage the enemy, provide missile warning, protect, and sustain forces. Space-enabled capabilities are ubiquitous, required, and regularly used by every element of the joint force. Planning and coordination of space support with national, Service, joint, and theater resources takes place through liaison with space professionals. The corps becomes the principal integrator of space capabilities in support of the land component. The corps staff employs its organic SSE within the main command post. The SSE coordinates directly with the joint

SCA, normally the joint force air component commander, for support by space-based systems to meet corps requirements.

3-20. Space force enhancement functions increase force effectiveness across the range of military operations through improved SSA, increased efficiency with which units employ fires, and other capabilities, as required. Space force enhancement is composed of ISR, missile warning which is divided into missile tracking and launch detection, environmental monitoring, SATCOM, and PNT. Space force enhancement operations afford commanders near-persistent access to denied areas, which is an important characteristic not always afforded to air, land, or maritime capabilities.

3-21. Space force enhancement components are often provided by other Services, civil agencies, and commercial and foreign entities. Units plan, coordinate, and integrate space force enhancement functions into their operations through organic coordinating staffs. SSEs or other attached space forces provide space support to organizational staff as directed by the unit commander. Users should be aware of the vulnerabilities associated with using civil, commercial, or foreign space systems.

ISR

3-22. Space-based capabilities are well suited for information collection missions. The use of satellite systems for imaging and information collection missions is optimal as they allow the U.S. access to otherwise denied areas. Space-based information collection systems are a crucial enabler supporting all Army operations. Army access to overhead information collection is provided through established intelligence channels, and the U.S. Army Intelligence Center is responsible for space-based reconnaissance and surveillance force integration and life-cycle management of related user equipment.

3-23. Space-based information collection complements air and ground based information collection. Surveillance from space enables the forces to overcome terrestrial line of sight restrictions and affords coverage of virtually the entire area of interest. In some cases, such as forced entry, the only early surveillance available will be from space-based assets. Space-based sensors can provide multispectral imagery, hyperspectral imagery, electro-optical data, infrared data, and other various capabilities that are of value to the supported Army commander. The Army leverages space-based collection through the submission of requests for collection through the joint collection management process. Additional information on the joint collection management process is contained within JP 2-0.

3-24. When a requirement is designated for collection, a tasking is sent to the appropriate asset through a ground station. Once collected, data is disseminated to the original requester through a variety of means, dependent on the sensor employed, the classification of the data, and the maturity of the theater intelligence support architecture. These methods include direct downlink, theater downlink, and reachback and are summarized in table 1-2 on page 1-11.

3-25. Space-based information collection systems are vital to shaping and entry phases and operations in non-contiguous areas. Theater downlink and direct downlink is fundamental to timely, assured, and responsive support to the ground maneuver force.

3-26. As with any information collection asset, the capabilities and limitations should be considered. Space-based collection assets operate within established orbital paths. Changing the orbit requires time and the use of a limited propellant supply. Space-based assets are also susceptible to threat denial and deception practices.

3-27. Space-based surveillance activities enable the commander to plan for troop placement and maintain an understanding of enemy activities that may negatively or otherwise impact operations. The information gathered through the use of space-based capabilities supports the development of intelligence that supports mission success, and other actions that may influence the commander's current and future operational decisions. In-theater downlink capabilities provide timely assured access to information collection products, as well as provide responsive support to the ground maneuver force requests for information. Imagery products provide planners with current information on subsurface, surface, and air conditions such as traffic-ability, beach conditions, vegetation, and land use that the commander can assess for impacts to the unit's movement and maneuver capabilities. Capabilities include using space-based assets for battle

damage assessment, strategic warning, monitoring for force buildups, and precision location of enemy forces.

ENVIRONMENTAL MONITORING

3-28. Weather influences military forces as those forces attempt to account for it during the planning, preparation, execution, and assessing of operations. Weather data is part of the information collection that is required by commanders and staffs when planning, preparing, executing, and assessing combat operations. The results from analyzing weather data, identifying potential weather effects, and assessing the impact of weather on systems, tactics, and operations provide vital information for commanders to optimally employ their forces.

3-29. Knowledge and understanding of operational effects presented by the space environment are increasingly more relevant within the IPB process. Historically, analysis of the space environment focused on solar and lunar predictions and their effects on tides and illumination. As our understanding of space weather has increased, military considerations for space weather conditions and the implications on operations have increased as well. Space weather events may adversely affect PNT, surveillance and reconnaissance missions, as well as terrestrial- and space-based SATCOM capabilities. Net-centric operations rely extensively on continuously available SATCOM; understanding the influences of space weather events on all communication requirements allow commanders to work mitigation efforts for predicted periods of reduced availability.

3-30. Adverse space weather can impact satellites, communications links, and ground stations which have a cascading effect on Army ground operations. Knowledge of these factors allows forces to mitigate adverse environmental conditions while taking advantage of favorable conditions elsewhere to enhance operations. Such monitoring also supports IPB by providing the commander with information needed to identify and analyze potential enemy COAs.

3-31. Space capabilities provide data that forms the basis for forecasts, alerts, and warnings for the space environment that may negatively impact space assets and space operations. These space-based environmental monitoring capabilities provide the ability to forecast and warn operating forces of degraded SATCOM and GPS signals due to ionospheric disturbances from space weather.

3-32. Operational planners must focus mission analysis over widespread, geographically diverse area. For military applications, weather forecast information must be tailored to support operations that range from small surgical strikes to theater-wide operations. Terrestrial weather, space weather, or both may significantly impact both friendly and threat operations.

3-33. Space weather has become an important facet in SATCOM, which is a common means of communication. Although it is impossible to prevent phenomena produced by the sun from affecting communications and navigation systems, forecasting adverse effects on space and terrestrial resources will give commanders increased SSA during planning, preparation and execution of combat missions. For example, the Enhanced Position Location Reporting System provides brigade combat teams with the ability to enhance control and communications capabilities by supporting mission command requirements for SATCOM, PNT, reporting and friendly identification. Any space weather impacts on SATCOM may have an adverse affect on brigade combat team operations and mission success.

3-34. Space-based meteorological systems provide timely and accurate weather, details on environmental conditions, and space environment data. Current technologies provide the commander a clear understanding of the environmental impacts on operations throughout the depth of the operational area. Space-based environmental monitoring benefits for planning support to operations include:

- Detect terrestrial weather throughout the area of responsibility;
- Timely receipt and access of weather observations from remote locations;
- Detect space weather to forecast potential effects and understand actual effects on communications and space-based assets;

- Detect soil moisture content which can support assessments of trafficability such as unrestricted, restricted, and severely restricted terrain based on recent precipitation and analysis of soil type;
- Vegetation and materials analysis has important benefits to counterinsurgency and law enforcement operations, as well as effects on crop yield and production;
- Detect obscurants and differentiate between dust, smoke, fog, oil mist, and so forth;
- Detect ionospheric disturbances, such as scintillation, which can impact UHF SATCOM and GPS reliability;
- Detect changes in activity in a given area which can be especially beneficial supporting counterdrug, law enforcement, detecting and monitoring environmental damage, and disaster relief; and
- Increasing overall understanding of the area of responsibility by using multispectral imagery.

3-35. Terrestrial weather can impact space-based surveillance and reconnaissance. Clouds, heavy rain, and sand storms, for example, can affect imagery. Time of day and lighting conditions may affect electro-optical imagery quality. Additionally, severe weather around the mission ground station can impact data reception. JP 3-14 further identifies impacts of weather on space capabilities.

- Weather. The terrestrial and space environment can adversely impact a wide range of space systems and missions. Space-derived meteorological information is crucial to understanding and reacting to the effects of the environment on both space and terrestrial operations. The environment affects almost all aspects of operations. A few examples are: mission timing, route selection, target and weapon selection, mode of weapon delivery, communications, reconnaissance, and surveillance.
- Space Environment. Space capabilities provide data that forms the basis for forecasts, alerts, and warning for space environment that may negatively impact space assets, space operations and their terrestrial users.
- Oceanography. Knowledge of the location and characteristics of oceanographic features, such as sea heights, sea surface ice, currents, fronts, and eddies, is essential to all maritime forces. It is especially critical for undersea warfare operations and can be used by commanders to avoid submarine or maritime mine threats. This knowledge can also be used to concentrate forces in an area where an adversary is most likely to be operating to optimize search and rescue operations at sea, and to help determine optimum locations for amphibious landings. Meteorological and Oceanographic processes are described in the USSTRATCOM SI 541-01, *Meteorology and Oceanography Operations*.

3-36. The Army receives weather support from the Air Force and it receives topographic support through Army geospatial information and services assets. Space-based capabilities, received from systems such as the geostationary operational environmental satellites and Defense Meteorological Satellite Program, can provide data on environmental factors that may affect military operations. Imagery capabilities such as multispectral imagery and hyperspectral imagery can provide planners with current information on sub-surface, surface, and air conditions such as trafficability, beach conditions, vegetation, and land use.

Note: For additional details see USSTRATCOM SI 322-01, *Geospatial Information and Services Requirements Program*.

MISSILE WARNING

3-37. Missile warning is comprised of launch detection and missile tracking components. Both launch detection and missile tracking require space-based and ground-based systems to process raw sensor data into missile warning reports. Missile warning reports are transmitted to commanders regarding detection and predicted impact point location for their decision making. Reports are also transmitted to air defense assets to allow these systems to respond to the attack.

3-38. Missile tracking uses all available ground- and space-based system data to provide senior leaders and allies the requisite timely warning and characterization of ballistic missile events. Missile Tracking

includes launch, mid-course tracking, terminal phase re-entry, launch and impact prediction, nuclear detonations to support threat and non-threat determination, and follow-on decision making.

3-39. Launch detection sensors provide real time and post-launch analysis to determine orbital characteristics and potential conjunctions with other objects in space. Launch detection data is used to evaluate events that could directly or indirectly threaten U.S. or multinational space assets. Similar to missile warning, this data is analyzed to determine potential impacts on assets so timely warnings and recommendations for suitable countermeasures can be made. Detection of space launches is accomplished for both domestic and foreign launches. Launch detection information on domestic launches is used to support the characterization of nominal and anomalous space launch events.

3-40. Air and missile defense (AMD) mission command nodes use missile warning to cue active and passive defenses against incoming enemy ballistic missiles. Active defense includes use of Army missiles to destroy enemy ballistic missiles before they impact their targets as well as cueing other land, air, and sea-based missile defense sensors. Passive defenses include warning affected troops and populations to take protective measures. Missile warning sensors are hosted on platforms in space, in the air, and on the ground. The Space-Based Infrared System (SBIRS), and the legacy Defense Support Program satellites, provides space-based missile warning platforms. SBIRS and Defense Support Program satellites host OPIR sensors that detect infrared energy from sources such as missiles during powered flight. Data from SBIRS satellites is transmitted to the SBIRS Mission Control Station and the theater event system (TES) element of missile warning.

3-41. The TES has two unclassified components. The first is the SBIRS Mission Control Station. It is a high confidence operational system that provides assured missile warning to operating forces worldwide. The SBIRS Mission Control Station monitors all major regional conflict areas and potential hot spots simultaneously by fusing SBIRS, Defense Support Program legacy satellites, and other data sources into a cohesive picture.

3-42. The second unclassified component of TES is theater missile warning (TMW) detachments, which operate the JTAGS. These stations are strategically forward-stationed worldwide and receive data directly from SBIRS and Defense Support Program satellites in their fields of view. TMW detachments provide direct downlink, processing, and dissemination of ballistic missile warning information. TMW detachments identify missile launch points, trajectory, and locations where warheads are likely to impact. TMW detachments are located to optimize warning data receipt and missile warning dissemination. Chapter 6, Section I discusses TMW detachments in greater detail.

3-43. Space-based missile detection capabilities assist the unit commander by providing early warning of enemy ballistic missile launches via the TES reporting. TES support the missile defense operational elements of active defense, passive defense, attack operations and operations management, mission command, control, communications and computers, and intelligence. The TES broadcasts data to forward units where the AMD section or element coordinates warning distribution to subordinate units and allies. The TES warning supports mission command, fires, and maneuver operations.

- Identification of missile type (supporting passive defense). This may help determine the appropriate chemical, biological, radiological, and nuclear protection measures (for example, if the missile is capable of carrying a chemical, biological, radiological, or nuclear warhead) and if maneuver units need to go to a higher mission-oriented protective posture level.
- Predicted impact point and time (supporting passive defense). The TES warns 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 and active defense. The commander may employ combat maneuver forces and fires to attack mobile launch systems, their support areas, and installations. The commander may also employ fires to attack incoming ballistic missiles.

3-44. Information provided by OPIR supports strategic and TMW. OPIR systems support technical intelligence provided to combatant commands, force planners, and policy makers. It contributes to

scientific and technical intelligence on foreign threat systems, selected space programs or systems, and supports materiel acquisition. This information supports commanders in executing their intelligence warfighting function in a near real time manner, and influences his decision making process through the provision of a more complete COP.

3-45. To help influence theater activity, space-based ballistic missile detection capabilities assist the unit commander by providing early warning of enemy launches. The scope and advertised capabilities of the missile warning systems aids in deterring the enemy from conducting such activities. This helps unit commanders assess the current and future risk, and gives the commander the ability to shape and influence the current engagement as well as help develop teams with joint, interagency, and multinational partner capacity.

3-46. The U.S. also exchanges missile detection and warning information with its allies and multinational partners. Shared early warning allows U.S. forces to provide missile warning to civilian populations of foreign partners, or neutral parties. The objective of shared early warning is the continuous exchange of missile early warning information derived from U.S. missile early warning sensors to allow partners or neutral parties to take protective measures that could help stabilize political and military situations as well as help protect noncombatants. 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.

SATCOM

3-47. SATCOM offers many unique features to the operating forces and figure 3-2 illustrates some of these features. Using a global network of joint military and commercial communication satellites, operating forces at all levels of command can overcome limited infrastructure, execute reachback operations, enable two-way flow of data to critical nodes, provide support to special users, and increase overall command and control effectiveness. Further, SATCOM provides critical connectivity for maneuvering forces whose rapid movement and deployments in non-contiguous areas take them beyond available line of sight communication networks.

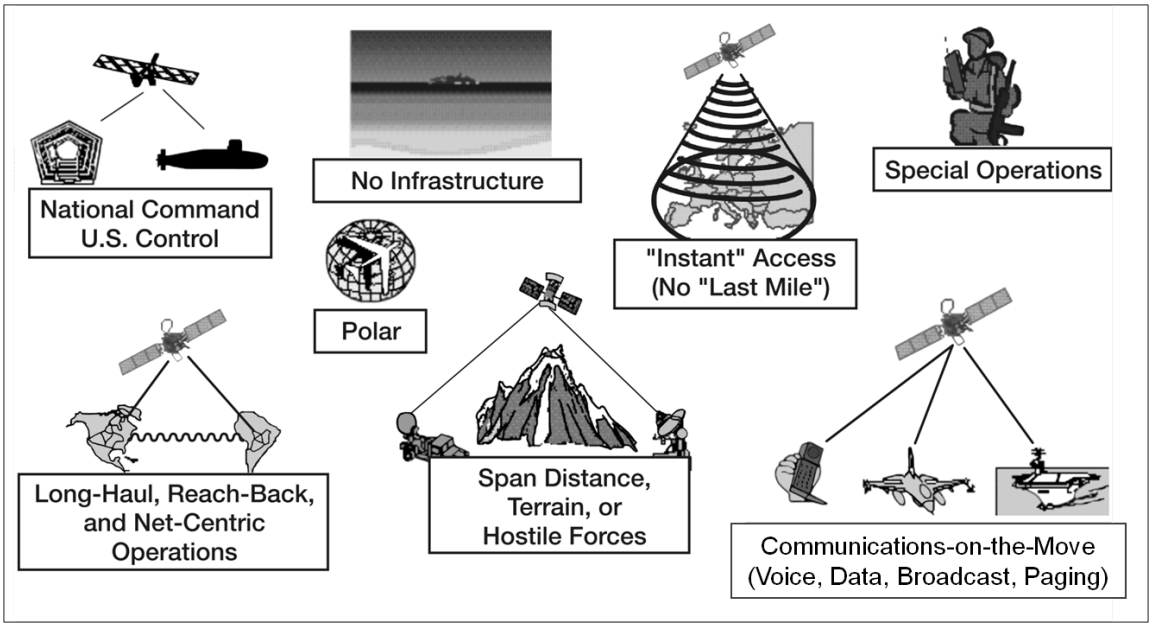

Figure 3-2. Key SATCOM features

3-48. SATCOM collectively provides an essential element of national and DOD communications worldwide. It allows information transfer from the highest levels of government to the theater and tactical level for all matters, to include operations, sustainment, intelligence, personnel, and diplomacy. SATCOM

supports a variety of media, including voice, data, and video services. The satellites' functionality is generally transparent to the user; they do not create information, but they serve as a transport medium.

3-49. Space-enabled capabilities, such as direct sensor-to-shooter SATCOM provide updated targeting information and intelligence updates in near real time. The sensor-to-shooter links enables improved situational awareness, allowing Soldiers to assess fire control techniques and effectiveness. SATCOM capabilities facilitate transition of data such as position, operational status, equipment, aircraft conditions, transit data, maintenance diagnostics, and prognostics.

3-50. Military SATCOM uses a range of frequencies to meet SATCOM requirements at all levels of conflict. UHF and super-high frequency (SHF) lend themselves to supporting SATCOM in benign and contested environments, whereas, extremely high frequency (EHF) lends itself to providing greater protection in the highly contested to nuclear environments. Systems such as ultrahigh frequency follow-on (UFO) and Mobile Users Objective System that primarily use UHF frequencies are referred to as narrowband SATCOM systems. Systems such as Defense Satellite Communications System (DSCS) and WGS operating in the SHF and EHF bands where the bandwidth is primarily used for large capacity are referred to as wideband SATCOM systems. Systems such as Milstar and Advanced EHF using SHF and EHF bands and are specifically designed to use the bandwidth to counter electromagnetic interference events and work through nuclear scintillated environments are referred to as protected band SATCOM systems. The frequency band of a signal influences the throughput capacity and the degree of protection provided to the communications system, such as anti-jam, low probability of interception, and low probability of detection capabilities. Table 3-1 summarizes these general attributes.

Table 3-1. SATCOM attributes

Frequency Spectra	***Applicable Bands***	***Advantages***	***Limitations***
UHF .3-3 GHz	Military UHF, L, S	• Small terminals, low power • Economical • Flexible, highly mobile • Penetrates foliage	• Vulnerable to nuclear events • Susceptible to jamming, interference, scintillation • Low capacity, crowded spectrum • Access is limited
SHF 3-30 GHz	S, C, X Ku, K, Ka	• More bandwidth and channel available • Global connectivity • Flexibility in routing • Greater protection features • Less vulnerability to nuclear blackout or scintillation	• Limited frequency allocation • Susceptible to jamming • Ground terminals are larger, more complex, and expensive
EHF 30-300 GHz	Ka, V, W	• Extensive bandwidth • Uncrowded spectrum • Jam resistant • Small equipment • Least vulnerability to nuclear blackout or scintillation	• Technologically immature • Susceptible to rain and atmospheric attenuation • Expensive to outfit • Ground terminals are large, complex, and expensive
EHF – extremely high frequency SHF – super-high frequency		GHz – gigahertz UHF – ultrahigh frequency	

SATCOM Systems

3-51. The Army employs a combination of military and commercial systems to support its requirements. All Army forces require narrowband, wideband, commercial and protected SATCOM for rapid transport of

voice and data between the lowest tactical level and headquarters at all echelons. The capability to move operational information provides increased situational awareness, enables commanders the opportunity to conduct decentralized operations, and extends joint capabilities to the tactical level.

3-52. SATCOM capabilities provide to the Army, corps, and division the following:

- Near real time information from sensor to shooter;
- Direct downlink of space-based reconnaissance and surveillance sensors into Army TENCAP systems in support of both situational understanding and targeting;
- Advanced geospatial intelligence to enable operations and defeat enemy camouflage, concealment and deception;
- Missile warning indications provided from OPIR assets may also support to area of operation surveillance by detecting the infrared signatures of enemy theater ballistic missiles, surface-to-air missiles, and multiple rocket launcher systems to support timely combat assessments; and
- Commercial space imagery to supplement national sources, providing additional imagery to support planning, theater security cooperation, combat assessment, situational awareness, and cartography.

DOD Narrowband SATCOM Systems

3-53. These systems support secure voice and data transmission at relatively low data rates for mobile and fixed users. In particular, these systems primarily support highly mobile, tactical users. Compact terminal equipment and omni-directional antennas allow deployed forces to conduct tactical mission command and quickly exchange both voice and data communications. These systems, which include UFO and Mobile Users Objective System, operate in the L, S, and Ka frequency bands.

3-54. Mobile Users Objective System has cellular-like capabilities that will increase DOD narrowband capacity and access nearly ten-fold. Mobile Users Objective System will allow the soldier to connect directly to Defense Information Systems Network services such as to Defense Switched Network, Nonsecure Internet Protocol Router Network, and SECRET Internet Protocol Router Network (SIPRNET).

3-55. Mobile Users Objective System is part of the military narrowband SATCOM component of the emerging DOD architecture. The primary purpose of Mobile Users Objective System is to provide worldwide, point-to-point, beyond line of sight, communication to multi-Service organizations with fixed and mobile terminal users. Its primary user community is the tactical level force on land, sea, and air that is typically on-the-move and beyond line of sight, operates in irregular terrain environments, and has small mobile terminals.

DOD Wideband SATCOM Systems

3-56. These systems support multichannel, secure voice, and high data-rate communications for mission command, 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 operating forces for high-capacity, multichannel communications aboard ships and aircraft as well as in support of ground forces. These systems typically operate in the wideband and protected frequency band and examples include DSCS, WGS, and Global Broadcast Service.

DOD Protected SATCOM Systems

3-57. These systems support survivable voice and data communications not normally found on other systems. Its unique characteristics, such as its narrow beam width and use of spread spectrum and frequency hopping, give it attributes such as anti-jam and scintillation-resistance along with low probability of interception or detection. Because of these capabilities, use of the protected SATCOM has often been associated with the most critical strategic forces and mission command systems, but these capabilities are also in demand by tactical and special forces that require anti-jam and low probability of interception or

detection for the completion of their missions. These systems typically operate in the EHF frequency. Examples include Milstar, Advanced EHF, and EHF packages on UFO satellites.

Commercial SATCOM Systems

3-58. Commercial SATCOM offers greater capacity that can be exploited to meet and augment the Army's rapidly growing information needs. Some wideband services and personal communications services such as fixed satellite service and mobile satellite service are examples of current commercial SATCOM support to strategic and tactical mobile users. Fixed satellite service provides invaluable airborne support to current military operations. Mobile Satellite Service uses Iridium and Inmarsat services to compliment military SATCOM narrowband services to provide highly mobile communications. Additionally, commercial systems are advantageous to support much of the Army's predictable, wideband fixed SATCOM needs. Leasing commercial services is costly, but may afford the Army faster access to advanced commercial technologies than traditional government research, development, and acquisition programs. However, in an environment where both the Army 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 enemy. These systems typically operate in the L-, C-, X-, Ku-, and Ka-band frequencies.

3-59. In accordance with Chairman of the Joint Chiefs of Staff instruction (CJCSI) 6250.01E, *Satellite Communications*, Army units seeking to employ commercial SATCOM must follow all specified procedures to include satellite access requests, appropriate reports, and satellite database numbers for each commercial satellite network. In accordance with AR 25-13, *Army Telecommunications and Unified Capabilities*, Army units must obtain commercial SATCOM services through the U.S. Army Network Enterprise Technology Command and the Defense Information Systems Agency (DISA), and must report their arrangements and expenditures for commercial satellite services to the headquarters, Department of the Army chief information officer or assistant chief of staff for signal (G-6) office. Satellite provisions obtained through DISA include terms and conditions for resolution and mitigation of electromagnetic interference and other anomalies in commercial satellite systems.

3-60. Army communicators need to be cognizant of the unpredictable threat environment when choosing to use commercial SATCOM. To ensure DOD receives ready assured access to commercial services when and where needed, leases for those services must be procured in the early stages of a contested environment or before the spectrum becomes too congested. Access and availability to commercial services are based on the terms of the lease or contract. Experience shows that commercial satellite services 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

3-61. There are two primary SATCOM processes: the requirements process and the access process. The Joint Staff administers the requirements process, which formally documents user needs for SATCOM as a precondition for satellite access. USSTRATCOM, as the DOD SATCOM operational manager, has responsibility for the satellite database process, which validates combatant commands and agencies requirement for SATCOM resources. These processes are further detailed in CJCSI 6250.01E and USSTRATCOM SI 714-04, *Consolidated Satellite Communications Management Policies and Procedures*.

Army SATCOM Support

3-62. USASMDC/ARSTRAT operates four RSSCs, as directed by USSTRATCOM. The RSSCs plan and manage regional SATCOM support to the operating forces. They are multi-service and multi-agency organizations managed by USASMDC/ARSTRAT, and provide a single point of contact for narrowband, wideband, protected band, and commercial SATCOM support. JFCC SPACE provides joint forces with global SATCOM system status, maintains situational awareness for SATCOM planned and current operations, and supports satellite anomaly and electromagnetic interference resolution and management.

Resolution processes are described in the USSTRATCOM SI 714-05, *Satellite Communications Electro-Magnetic Interference Resolution Procedures*. See Chapter 6, Section V, for a detailed discussion of the RSSC and its capabilities.

3-63. The 53rd Signal Battalion satellite control (SATCON) provides satellite transmission, payload control, and electromagnetic interference detection of the WGS and DSCS, by operating and maintaining five wideband satellite communications operations centers (WSOC) and a DSCS certification facility. See Chapter 6, Section V for a detailed description of the WSOC and its capabilities.

3-64. Global Network Operations and Security Center. The Army global network operations and security center provides situational awareness and reporting for the Army LandWarNet. It includes the SATCOM transport layer which provides end-to-end communication services for applications within a layered architecture of network components. In this capacity, the Army global network operations and security center monitors the performance and operation of SATCOM ground terminals in support of the Army's regional communications requirements. By assessing bandwidth, utilization, environmental factors, throughput, performance, and planned and unplanned outages, they provide on-demand operational situational awareness of Army SATCOM communications in order to determine system availability and integrity.

POSITIONING, NAVIGATION, AND TIMING

3-65. The 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. Public law (Title 10, Chapter 136, §2281) and national policy, states GPS is designated for dual military-civilian use. The GPS system is operated and controlled by the Air Force. Each GPS satellite broadcasts a continuous signal. Coded signals from the satellites are broadcast so properly equipped users with direct line of sight 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 receiver equipment can calculate three-dimensional position and time. With the proper equipment, users can calculate position, velocity, navigation information, and time. Receivers are available for use in land vehicles, aircraft, spacecraft, and ships, as well as for dismounted Soldiers.

3-66. GPS provides continuous navigation services, including:

- Three-dimensional position information (latitude, longitude, and altitude) accurate to 5 meters;
- Velocity within a fraction of a mile per hour;
- Precise time within a few ten-billionths of a second;
- Passive all-weather operations; and
- Support to an unlimited number of users and areas.

3-67. Only DOD-approved PNT systems such as inertial navigation systems and GPS precise positioning service shall be used for Army operations. Users must be aware that civil GPS receivers do not offer the same performance or protection that military receivers provide. However, in order to provide the best anti-jam protection, military receivers must be loaded with the latest communications security key and powered on outside of any jamming environment. All DOD combatant users must acquire, train with, and use GPS precise positioning service systems in accordance with the DODD 4650.05, *Positioning, Navigation, and Timing* and CJCSI 6130.01F, *CJCS Master Position, Navigation, and Timing Plan*.

3-68. GPS systems enhance navigational accuracy, which is particularly useful in featureless or obscured terrain. They allow precise maneuver without sighting specific geographic features. Soldiers can rendezvous to join or support other troops using GPS waypoints. GPS is a passive system; therefore, a Soldier can receive and use the signal without emitting a signal that might compromise location.

3-69. Sometimes GPS equipment is enhanced with extremely accurate data concerning the GPS satellite to reduce ranging errors. GPS signals can be received and the calculations made in a highly dynamic environment, so the GPS signal receive and processing equipment can be used in precision-guided munitions as a means to increase their accuracy.

3-70. The use of satellite-based navigation is widespread not only for position information, but also for weapon system applications. 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, the Global Positioning System Multiple Launch Rocket System, and Excalibur 155 millimeter artillery ammunition, are a few examples of munitions that use GPS for guidance. The GPS components in missiles and projectiles enable in-flight corrections that significantly improve accuracy over previous munitions using only inertial guidance. Positional accuracy of the GPS navigational signal is dependent on various types of errors, some of which are environmental and some of which are user induced.

3-71. 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. This facilitates target destruction with smaller or fewer munitions while reducing collateral damage. This leads to reducing munitions transport requirements and more stable unit stocking levels. It also enables strikes in direct support of combat action to be executed closer to friendly positions. Employment of GPS-aided munitions can assist in reducing fratricide and collateral damage. GPS-aided delivery also allows for smaller warheads, thus increasing the range of the weapon.

3-72. Offensive and defensive operations are enabled through precision navigation aids and through networked mission command, control, and communications capabilities that depend on timing signals from the GPS transmission. The GPS signal with its positioning information can be used in stability operations to maintain a distance buffer between opposing forces in a truce or stand-down situation. Providing both parties 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 line. Surveying demarcation lines and marking them with GPS-surveyed locations allows forces with GPS receivers to avoid inadvertently crossing these lines.

3-73. FFT capabilities allow the commander to track friendly forces and subordinate elements to help avoiding fratricide incidents while maintaining a high operations tempo. The majority of FFT devices rely on space-based components to maintain critical links associated with tactical navigation operations. The primary information technology application for situational understanding and mission command at tactical command posts is joint battle command–platform, which uses FFT to share GPS-enabled situational awareness information among command posts at tactical echelons. GPS generated PNT data used by FFT devices, tagging, tracking and locating devices, and personnel recovery devices supports tracking of vehicles and personnel; enabling more accurate area of operations situational awareness and enhancing awareness of deployed forces.

3-74. Although GPS provides these advantages, the GPS signal is susceptible to jamming and electromagnetic interference because the signal is relatively weak, the electromagnetic environment is contested, and GPS operates on a limited number of frequencies that cannot be changed.

SPACE SUPPORT

3-75. Space support consists of spacelift operations, satellite operations, and reconstitution of space forces. All are designed to deploy, operate, and sustain military and intelligence systems in space. A brief description of each follows.

- Spacelift. Spacelift is the ability to deliver satellites, payloads, and material into space. Range operations are a key enabler of spacelift operations and include the capability to provide assured, responsive access to space safely and reliably.
- Satellite Operations. Satellite operations are characterized as spacecraft operations, payload operations, or rendezvous and proximity operations. Payload operations include monitoring and commanding of the satellite payload to collect data or provide capability in the operational environment. For example, the 53rd Signal Battalion (SATCON) conducts payload operations when it provides communications transmission control and satellite payload control of DOD wideband constellations. Spacecraft operations include telemetry, tracking, and commanding, satellite maneuvering, monitoring state-of-health, and maintenance satellite sub-functions. Rendezvous and proximity operations are specific processes where two resident space objects are intentionally brought close together. Servicing of space assets requires the capability to rendezvous, conduct close proximity operations, and or dock with the space asset.
- Reconstitution of Space Forces. Reconstitution refers to plans and operations for replenishing lost or diminished space capabilities. This includes repositioning, reconfiguring unaffected and surviving assets, augmenting capabilities with civil and commercial capabilities, and replacing lost assets.

3-76. Army space operations play a critical role in operating space systems and reconstitution of space forces. Additionally, the Army conducts space support in the form of satellite transmission and payload control of the DSCS and WGS constellations for DOD use. Army space operations maintains a backup control capability through its WSOCs for the Air Force Satellite Control Network common user equipment.

3-77. Space Support contributes to both combined arms maneuver and wide area security through payload operations by ensuring secure SATCOM is available for use when needed. Combined arms maneuver and wide area security are more efficient because of the enhanced mission command enabled by active payload management and communications transmission control.

SPACE FORCE APPLICATION

3-78. Space force application consists of attacks against terrestrial-based targets carried out by military weapons systems operating in or through space. The space force application mission area includes ballistic missile defense and force projection such as intercontinental ballistic missiles. The ground-based midcourse defense ballistic missile defense system is the space force application weapon system provided to the joint force by the Army. The Army depends upon space-based assets to provide missile warning cue and tracking data as a predecessor to missile defense.

3-79. Space force application contributes to combined arms maneuver through the protection provided by an umbrella of a multi-tiered missile defense system to protect localized, point defenses in theater from short range ballistic missiles and homeland defense from intercontinental ballistic missiles. The same multi-tiered missile defense system enables combined arms maneuver by providing freedom to maneuver.

Note: For more information on ballistic missile defense as it relates to space force application, refer to FM 3-27, *Army Global Ballistic Missile Defense Operations*.

SECTION II – SPACE CONTRIBUTION TO ARMY WARFIGHTING FUNCTIONS

3-80. Operations conducted in the space domain are a significant force multiplier because of their cross domain connectivity and the asymmetric advantage they provide. Due to accessibility of space assets, space operations are integral to successfully conducting of wide area security and combined arms maneuver. Commanders apply combat power through one or a combination of warfighting functions using leadership and information to fulfill the core competencies.

The Army depends on capabilities from space-based systems such as global positioning satellites, communication satellites, weather satellites, and intelligence collection

platforms. These systems enable the Army to communicate, navigate, develop situational awareness, target the enemy, protect, and sustain its forces. Most [space-based] services are seamlessly integrated into weapon systems and support processes to an extent that Soldiers are frequently unaware of the space connection.

Army Strategic Space Plan

3-81. Army space operations are founded on the depth and breadth of knowledge of the Army space operations officer, space cadre, and space enablers. These FA40 space professionals are the core of the Army space cadre and designated from nearly every branch within the Army, which gives the space operations community a broad level of understanding of Army operations. Every FA40 brings detailed knowledge of space operations, including SSA, space control, and space force enhancement, space force applications, and space support. In addition to FA40s, the Army has other space cadre members serving in positions that bring space capabilities to Army operations. The Army space cadre develops, plans, acquires, and operates space and missile defense systems and capabilities to fulfill mission requirements.

The Army's warfighting functions, weapons, and battle systems are vitally dependent on space. We must fully leverage allied, national, and joint space capabilities to enable our warfighting functions and provide space support to all ground component forces.

2013 Army Strategic Planning Guidance

3-82. According to ADP 3-0, *Unified Land Operations*, the definition of a warfighting function is, "a group of tasks and systems (people, organizations, information, and processes) united by a common purpose that commanders use to accomplish missions." The Army's warfighting functions are fundamentally linked to the joint functions.

3-83. The Army warfighting functions are enhanced by the five space mission areas. It is within the framework of these five space mission areas that space operations are identified for each of the Army's warfighting functions.

3-84. Within the Army, ISR and environmental monitoring are intelligence functions and are executed under the authority and oversight of the headquarters, Department of the Army G-2. Space operations enable intelligence operations, but are also dependent upon intelligence to provide reconnaissance, surveillance, and intelligence products.

3-85. All Services contribute to and use the body of knowledge that resides within the five space mission areas. Some space mission area functions are the responsibility of other Services and Agencies, but are require to support Army operations and contribute to the success of Army missions. Army space operations may receive space-related intelligence and environmental monitoring products directly from the JFCC SPACE, other Services, or through Army intelligence channels.

MISSION COMMAND

3-86. As the Army's philosophy of command, mission command emphasizes that command is essentially a human endeavor. This fundamental philosophy of command places people, rather than technology or systems, at the center. Under this philosophy, commanders drive the operations process through the activities of understand, visualize, describe, direct, lead, and assess. They develop teams, both within their own organizations and with joint, interagency, and multinational partners. Commanders influence audiences, inside and outside their organizations. According to ADP 6-0, the six principles of mission command are:

- Build cohesive teams through mutual trust;
- Create shared understanding;
- Provide a clear commander's intent;
- Exercise disciplined initiative;
- Use mission orders; and
- Accept prudent risk.

3-87. Army space operations that uniquely support mission command contribute to developing a shared understanding of the operational environment that helps build cohesive teams. A large percentage of the intelligence required to make mission command decisions for employment of ground forces are obtained from space-based reconnaissance and surveillance assets. SATCOM provides secure, integrated communications to all echelons to ensure mission orders and commander's intent are clearly and securely conveyed to all Soldiers. The space portion of a COP provides situational awareness, supports shared understanding, and supports control of forces by empowering subordinate leaders to be granted greater freedom of action and independence to facilitate initiative and agility to accomplish commander's overall intent. Space professionals form the SSE, who are organic to, and thoroughly integrated into Army, corps, and division headquarters. The SSEs support mission command and ensure space systems vulnerabilities are assessed for risks to mission execution. Army space operations are integrated through the mission command warfighting function to complement and reinforce the other five warfighting functions.

Note: Refer to ADP 6-0 for discussions on the mission command warfighting function.

MOVEMENT AND MANEUVER

3-88. The *movement and maneuver warfighting function* is the related tasks and systems that move and employ forces to achieve a position of relative advantage over the enemy and other threats (ADRP 3-0). Direct fire and close combat are inherent in maneuver. This function includes tasks associated with force projection related to gaining a positional advantage over the enemy. The tasks of the *movement and maneuver warfighting function* are:

- Deploy;
- Move;
- Maneuver;
- Employ direct fires;
- Occupy an area;
- Conduct mobility and countermobility operations;
- Conduct reconnaissance and surveillance; and
- Employ area of operations obscuration.

3-89. Army space operations that uniquely support movement and maneuver warfighting function provides the units with the capabilities that enable rapid movement by providing a positional advantage to the friendly forces. Various space domain mission areas are used to facilitate the decision making process for movement and maneuver. SATCOM enables communications on the move; GPS provides enhanced navigational accuracy in featureless or obscured operational environments and provides accurate location and timings critical to tactical missions. Space-based environmental monitoring provides the commander with information that may affect military operations, enabling forces to take advantage of adverse environmental conditions, or avoid situations negatively impacting their ability to maneuver. The use of FFT capabilities adds a level of fidelity useful to the commander when making decisions impacting movement and maneuver.

Note: Refer to ADP 3-0 for discussions on the movement and maneuver warfighting function.

INTELLIGENCE

3-90. The *intelligence warfighting function* is the related tasks and systems that facilitate understanding the enemy, terrain, and civil considerations (ADRP 3-0). This warfighting function includes understanding threats, adversaries, and weather. It synchronizes information collection with the primary tactical tasks of reconnaissance, surveillance, security, and intelligence operations. Intelligence is driven by commanders and is more than just collection. Developing intelligence is a continuous process that involves analyzing information from all sources and conducting operations to develop the situation. The four tasks of the *intelligence warfighting function* are:

- Intelligence support to force generation;
- Intelligence support to situational understanding;
- Collect information; and
- Intelligence support to targeting and information capabilities.

3-91. Army space operations that uniquely support the intelligence warfighting function include space-based sensors providing critical input for the production of intelligence. Space-based sensors are uniquely positioned to gather information concerning relevant operational environment, as well as provide positional relationship of threat forces during operations. SATCOM provides the link for direct communications and dissemination of intelligence products.

Note: Refer to ADP 2-0 for discussions on the intelligence warfighting function.

FIRES

3-92. The *fires warfighting function* is the related task and systems that provide collective and coordinated use of Army indirect fires, joint fires, and AMD through the targeting process in accordance with JP 2-0, *Joint Intelligence*, and ATP 2-19.4, *Brigade Combat Teams Intelligence Techniques*. The three tasks of the *fires warfighting function* are:

- Deliver fires;
- Integrate all forms of Army, joint, and multinational fires; and
- Conduct targeting.

3-93. Army space operations that uniquely support the fires warfighting function include space-based services provide robust and reliable geolocation and communications capabilities. GPS supports precision targeting. SATCOM enables real time communications between commanders and forces to enable immediate redirection of fires over extended distances to shape the operations.

Note: Refer to ADP 3-09 for discussions on the fires warfighting function.

SUSTAINMENT

3-94. The *sustainment warfighting function* is the related tasks and systems that provide support and services to ensure freedom of action, extend operational reach, and prolong endurance. The endurance of Army forces is primarily a function of their sustainment. Sustainment determines the depth and duration of Army operations. It is essential to retaining and exploiting the initiative. The three major elements of the *sustainment warfighting function* are:

- Logistics – planning and execution of the movement and support of forces;
- Personnel services – sustainment functions that staff and fund the force; and
- Health service support – medical, dental, hospitalization, behavior health, and suspected chemical, biological, radiological, and nuclear treatment.

3-95. Army space operations that uniquely support the sustainment warfighting function include facilitating real time logistics data transfer and visibility for an expeditionary Army. Long-haul SATCOM has made it possible to conduct nearly instantaneous control of the operational force with the ability to reach worldwide, prolonging endurance through efficient communications. Exact location information helps logistic support by expediting resupply efforts and also supports the timely and efficient evacuation of wounded personnel to aid stations. Space-based resources are crucial during entry and shaping phases and operations. SATCOM linking theaters is fundamental to timely assured and responsive support to the sustainment force.

Note: Refer to ADP 4-0 for discussions on the sustainment warfighting function.

PROTECTION

3-96. The *protection warfighting function* is the related tasks and systems that preserve the force so the commander can apply maximum combat power to accomplish the mission. Preserving the force includes protecting personnel (friendly, combatants, and noncombatants) and physical assets of the United States, host-nation, and multinational military and civilian partners. The four tasks directly supported by space operations are:

- Conduct operational area security;
- Employ safety techniques;
- Implement operations security; and
- Provide intelligence support to security.

3-97. Army space operations that uniquely support the protection warfighting function support freedom of action in all domains preserving the commander's freedom of action and protecting the forces. The use of GPS and FFT, tagging, tracking and locating devices, and personnel recovery devices supports tracking of vehicles and personnel on the area of operations; enabling protection through situational awareness. With situational understanding, commanders have information necessary to respond to given situations such as personnel recovery operations. SATCOM provides the ability to transport data to all levels of command, expands the area of operations, and improves situational awareness for the commanders.

Note: Refer to ADP 3-37 for discussions on the protection warfighting function.

3-98. Table 3-2 below, and continued on page 3-21, provides a crosswalk of space mission areas that support each warfighting function.

Table 3-2. Space to warfighting function crosswalk

	Mission Command	Movement and Maneuver	Intelligence[1]	Fires	Sustainment	Protection
Space Situational Awareness Mission Area						
Space situational awareness	• Common operational picture • Characterization	• Common operational picture • Characterization	• Common operational picture • Characterization	• Common operational picture • Characterization	• Common operational picture	• Common operational picture
Space Control Mission Area						
Space Control	• Offensive • Defensive	• Offensive • Defensive	• Offensive • Defensive	• Offensive • Defensive	• Defensive	• Offensive • Defensive
Space Force Enhancement Mission Area						
ISR	• Geospatial Info • Situational awareness • Imagery • Terrain	• Geospatial Info • Situational awareness • Imagery • Terrain	• Geospatial, measures, and signal intelligence • Terrain	• Battle damage assessment • Terrain	Not applicable	• Geospatial Info • Situational awareness Imagery • Terrain
Missile Warning	• Missile launch and impact • Ballistic missile warning	• Predicted Impact points	• OPIR • Operational area awareness	• Missile launch cueing	Not applicable	• Predicted impact • Ballistic missile warning

Table 3-2. Space to warfighting function crosswalk (continued)

	Mission Command	Movement and Maneuver	Intelligence[1]	Fires	Sustainment	Protection
Environmental Monitoring	• Weather	• Operational planning • Imagery • Mobility	• Weather	• Operational planning • Imagery • Mobility	• Operational planning	Not applicable
SATCOM	• BLOS comms • NLOS comms • Reachback	• BLOS comms • NLOS comms	• Reachback • Reach forward	• BLOS comms • NLOS comms	• BLOS comms • NLOS comms	• BLOS comms • NLOS comms
Position, navigation, and timing	• FFT • JBCP with FFT • Critical timing	• FFT • JBCP with FFT • Position, navigation, and timing	• FFT • JBCP with FFT	• Precision targeting • NLOS Fires • JBCP with FFT	• FFT • JBCP with FFT • In-transit Visibility	• FFT • JBCP with FFT

1. Space operations enable certain capabilities within the Intelligence warfighting function operations, but Space operations are also dependent upon Army Intelligence to provide reconnaissance, surveillance, and intelligence products and information.

BLOS – beyond line of sight
FFT – friendly force tracking
JBCP – joint battle command platform
NLOS – non-line of sight
OPIR – overhead persistent infrared
SATCOM – satellite communications
ISR – intelligence, surveillance, and reconnaissance

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Chapter 4

Space Operations in Unified Land Operations

"The Army is dependent on space capabilities to execute Unified Land Operations in support of the nation's objectives."

Lieutenant General David L. Mann
Commanding General, USASMDC/ARSTRAT
Senate Armed Services Committee Statement
12 March 2014

In all operational environments, the initiative of Army leaders, agility of Army units, depth of Army resources, and versatility of Soldiers combine to allow Army forces to conduct unified land 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.

4-1. This section provides examples of how unified land operations are tied to space. Unified land operations describe how the Army seizes, retains, and exploits the initiative to gain and maintain a position of relative advantage in sustained land operations through simultaneous offensive, defensive, and stability operations in order to prevent or deter conflict, prevail in war, and create the conditions for favorable conflict resolution. Unified land operations are the Army's operational concepts and the Army's contribution to unified action. Unified action is the synchronization, coordination, and or integration of the activities of governmental and nongovernmental entities with military operations to achieve unity of effort (ADP 3-0).

4-2. Effective use of space capabilities is essential to the conduct of successful Army unified land 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 operations in a non-contiguous area of operations can be created based on increased understanding. Commanders can project attacking forces on multiple axes throughout the area of operations, thus enabling commanders to focus combat power at decisive points.

4-3. Space operations cover the entire spectrum of activities from launching, controlling, and maintaining satellites, to leveraging space capabilities and defeating efforts to interfere with or attack U.S. and multinational space systems. Space operations also include facilitating the use of space assets and enabling Soldiers to apply space capabilities to Army unified land operations.

SPACE OPERATIONS ENHANCE UNIFIED LAND OPERATIONS

4-4. Army space operations contribute to U.S. land warfighting dominance. Army space operations are land centric. The joint space mission areas form the basis for leveraging space capabilities to enhance Army unified land operations. The Army is not solely responsible for any of these mission areas, but relies on joint and national partners, as well as commercial providers, to achieve full benefits from space capabilities.

4-5. The prerequisite to exploiting space for U.S. advantage is the same as in other realms of warfare: control the domain of operations. Landpower 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. The Army cannot exploit space without being able to ensure freedom of action

in space for friendly forces and, when directed, limit or deny an enemy's ability to control space for hostile purposes.

4-6. Controlling space for security purposes is similar to 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 is impractical to control all of them all of the time; the same is true of satellites in space.

4-7. The Army requires maximum control of particular space assets at particular times; this requires the ability to exercise control of organic space assets at any time that they are not committed to supporting higher priority missions. It is important to understand that this is different from exercising control over all space assets all of the time. The Army may need to establish access to space relevant to area of operations during specific periods, coinciding with preparation or execution of unified land operations, and at other times take no offensive space control actions. SSA and space control protection are continuous processes and are always at work. Space control is a necessity for the land force to exercise the Army's will at decisive points in support of joint operations. ADRP 3-0, *Unified Land Operations*, contains Army doctrine concerning decisive points in operational design.

4-8. Accordingly, it is essential to control decisive points or exercise control during specific, limited periods. These decisive points may include friendly or enemy space systems. When the joint force does this, it establishes space superiority, which is the space equivalent to air, land, and sea superiority. Having space superiority maximizes the contribution space can make to unified operations.

4-9. Having established space superiority 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 decisive action 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 mission command and enabled, in part, by integrated space systems.

4-10. To accomplish these tasks, space-based capabilities and services should provide assured, responsive, and timely support all the way down to the tactical level commander, and must be fully integrated with other area of operation systems, to include space, air, and terrestrial-based systems. Space-based capabilities and resources are integrated components of transparent processes and products provided to unified operating forces.

4-11. Integrating civil, commercial, and foreign space assets may be vital to mission accomplishment. Similarly, integration of space operations, signals, computers, communications, intelligence capabilities, and the other warfighting functions, whether they are space-based or space-enabled, is the responsibility of the respective commander. The most effective solutions are not found by creating duplicative layers, but in purposeful integration of existing missions.

4-12. Multinational forces will have many of the same requirements for space support as do U.S. forces. Sharing of intelligence products with multinational forces is controlled according to intelligence and foreign disclosure guidelines. Commercial imagery products are normally unclassified and will be of great benefit to other multinational forces. Weather data is also readily available to share, as is GPS navigation support.

FOUNDATION OF UNIFIED LAND OPERATIONS

4-13. The foundation of unified land operations is built on initiative, decisive action, the Army core competencies, and mission command. They are linked to achieve the commander's intent and desired end state.

INITIATIVE

4-14. All Army operations aim to seize, retain, and exploit the initiative and achieve decisive results. Space-enabled intelligence capabilities greatly facilitate the Army's ability to seize, retain, and exploit the initiative to limit enemy achievement of objectives, reverse enemy success, and lead towards eventual success. These capabilities include strategic warning through intelligence, monitoring for force buildups and precisely locating enemy force elements through information collection, providing targeting information to Army and joint fires, and finding optimum staging areas and lines of communication through information collection.

DECISIVE ACTION

4-15. Unified land operations are the Army's operational concept. This concept is based on the central idea that Army units seize, retain, and exploit the initiative to gain a position of relative advantage over the enemy. This is accomplished through decisive action – the simultaneous combination of offensive, defensive, and stability tasks or DSCA that set the conditions for favorable conflict resolution. (ADRP 3-0). In conducting decisive action in unified land 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 and differ based on echelon, time, and location.

4-16. Space-enabled capabilities such as Army mission command systems provide en route planning, communication, and intelligence updates and enables situational awareness during movement to an objective. This allows Soldiers to exploit optimum routes, access points, and fire control techniques to engage the enemy with appropriate force from the initial contact.

4-17. All deployed units may find terrestrial communications infrastructure has been damaged to the point that landline and line of sight communications lack assured access. Landline communications in other countries may not be compatible with Army systems for secure communications. Military and commercial SATCOM provide means of ensuring reliable and secure communications with subordinate and adjacent units as well as other government agencies. The requirement to communicate with civil authorities and other agencies makes the combination of commercial and military SATCOM very valuable.

4-18. Transitioning or balancing between types of operations normally requires adjustments in the space force enhancement needs. Space contributions to stability and DSCA 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 stability operations.

4-19. The Army's core competencies provide the means for balancing the application of the combat power elements within the tactical actions and tasks. Combined arms maneuver and wide area security define what the Army provides to the joint force commander, but they are not tasks; rather they are specific missions designed to defeat or destroy enemy forces and protect civilians, troops, and infrastructure. In general terms, combined arms maneuver is appropriate when attempting to defeat or destroy the enemy, while wide area security is more appropriate for stability operations.

4-20. Army space operations are particularly well suited to make significant contributions to decisive action operations. The five space mission areas are necessary to ensure the Army's core competencies can be carried out.

- SSA is fundamental to combined arms maneuver and wide area security because it characterizes space capabilities and integrates information collections analysis that contribute to the Army's ability to understand and react to an enemy intent.
- Space Control ensures combined arms maneuver freedom of action for U.S. forces and allies, and when directed, defeat efforts to interfere with or attack U.S. and multinational space systems.

- Space force enhancement functions increase force effectiveness across the range of military operations and are critical enablers used by the Army to plan, communicate, navigate, maneuver, maintain situational awareness, engage the enemy, employ fires, provide missile warning and ballistic missile defense, protect, and sustain forces.
- Space Support contributes to both core competencies through payload operations by ensuring secure SATCOM is available for use when needed. Combined arms maneuver and wide area security are more efficient because of the enhanced mission command enabled by active payload management and communications transmission control.
- Space force application contributes to combined arms maneuver through the protection provided by an umbrella of a multi-tiered missile defense system to protect localized, point defenses in theater from short range ballistic missiles and homeland defense from intercontinental ballistic missiles. The same multi-tiered missile defense system enables combined arms maneuver by providing freedom to maneuver.

OFFENSIVE AND DEFENSIVE TASKS

4-21. Space contributions to offensive and defensive tasks include many elements. These elements include Space Control, information collection, early warning, environmental monitoring, SATCOM, and PNT. The capabilities provided by space-enabled systems significantly enhance both offensive and defensive operations.

4-22. SATCOM allows the commander to exercise effective mission command away from the command post for missions that require beyond line of sight or command on the move. The location of the commander has historically been constrained by limited communications capabilities. Mobile SATCOM enables the commander to receive a clear COP of the operations and remain at the best location to assess and control the situation. Mobile SATCOM is especially useful during exploitation or pursuit, where units move swiftly and cover significant distances. In both offensive and defensive operations, SATCOM facilitates split-based operations, linking commanders and staffs with forward deployed forces.

STABILITY OPERATIONS

4-23. Space assets provide important contributions to effective employment and success of stability operations. Stability operations take place outside the U.S. Past and present stability operations such as those conducted in Bosnia-Herzegovina, Kosovo, Haiti, Iraq, Afghanistan, and other locations have demonstrated the need to implement timely and effective space capabilities. This also holds true when conducting noncombat operations.

DSCA TASKS

4-24. DSCA is the support provided by U.S. Federal military forces, DOD civilians, DOD contract personnel, DOD component assets, and National Guard forces (when the Secretary of Defense, in coordination with the governors of the affected states, elects and requests to use those forces in Title 32, United States Code, status) in response to requests for assistance from civil authorities for domestic emergencies, law enforcement support, and other domestic activities, or from qualifying entities for special events. DSCA is provided under the framework provided in the U.S. National Response Plan, ADP 3-28, *Defense Support of Civil Authorities*. While DOD's support of civil authorities focus is on preparation and response, DOD may provide critical support to U.S. civil authorities in all areas of the DSCA framework. Civil authorities are defined as those elected and appointed officers and employees who constitute the government of the U.S., the governments of the 50 states, the District of Columbia, the Commonwealth of Puerto Rico, U.S. possessions and territories, and political subdivisions thereof (JP 3-28, *Defense Support of Civil Authorities*). DSCA tasks take place in the U.S. and are organized by emergency support functions rather than warfighting functions.

Note: For more information on civil support, refer to ATP 3-28.1/MCWP 3-36.2/NTTP 3-57.2/AFTTP 3-2.67, *Multi-Service Tactics, Techniques, and Procedures for Defense Support of Civil Authorities*.

4-25. USSTRATCOM has tasked USASMDC/ARSTRAT to provide ARSST, SATCOM planners, and geospatial intelligence support for DSCA missions, when requested. Although space operations are not confined by geographical boarders, DSCA missions are strictly limited to operations conducted within the U.S., its territories, and political subdivisions. Space-based capabilities are essential to the conduct of DSCA missions. Space-derived products provide civil authorities imagery products for planning and cooperation in DSCA operations. Commercial and civil space-based products are used for disaster relief support, incident management, and damage assessment. Imagery can be combined with manmade and natural hazard models along with other relevant data, such as population densities, first responder assets, schools, medical treatment facilities, and lines of communication. Such products provide situational awareness of what has occurred, where it happened, and what is in the affected area. They enable effects assessments that enhance the military decision-making process (MDMP) and help commanders and first responders visualize the situation.

4-26. Products derived from space-based assets provide situational awareness and understanding of what has occurred, where it occurred, what is in the affected area, and trending and forecast analysis for potential evacuation operations. Space-based products enable assessments that enhance the MDMP and help first responders, civil leadership, and DSCA commanders visualize the situation. Space-based weather satellites allow the early identification of hurricanes and enable military planners to stage Soldiers and relief supplies based on forecast landfall time and location. Many natural disasters, such as hurricanes, tornadoes and earthquakes, may severely disrupt the electrical grid and destroy critical infrastructure rendering the impact zone much like an austere theater. Accordingly, SATCOM and space-enabled FFT offer tremendous advantages during DSCA operations. Additionally, multispectral imagery systems may contribute to the support of law enforcement agencies in the counter-drug mission area. Army space forces support to response efforts for hurricanes Katrina and Rita have demonstrated the utility of space force enhancement to disaster relief and national emergency response.

4-27. In DSCA operations, GPS-aided devices may be used to determine or record precise locations of streets, buildings, casualties, damaged property, emergency service resources, and disaster relief resources in order to protect life and reduce property losses.

4-28. When the information collection activities constitute intelligence or intelligence support operations undertaken within the homeland, these activities must comply with the intelligence oversight provisions outlined in AR 381-10, *U.S. Army Intelligence Activities.* If intelligence in DSCA missions is not involved, but U.S. persons or persons not affiliated with the DOD are identified or identifiable through image or likeness capture, then sensitive information rules may apply pursuant to AR 380-13, *Acquisition and Storage of Information Concerning Non-Affiliated Persons and Organizations.* Always consult with the local intelligence oversight officer or supporting office of the staff Judge Advocate before undertaking information collection operations in the homeland to ensure regulatory compliance. Proper use memorandums will be required for the collection and use of imagery products from national systems conducted within the homeland and its territories.

Note: For more information on DSCA, refer to ADRP 3-28, *Defense Support of Civil Authorities.*

TENETS OF UNIFIED LAND OPERATIONS

4-29. 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 command and control. According to ADP 3-0, Army operations are characterized by flexibility, integration, lethality, adaptability, depth, and

synchronization. Space capabilities enhance these attributes from the strategic to tactical levels. Space-based capabilities are adaptable; they are and will continue to be particularly valuable in remote and austere theaters with insufficient or unreliable infrastructure. Joint capabilities provide a seamless space-to-soldier infrastructure linking terrestrial air- and space-based sensors, networks that provide situational awareness, and mission command capabilities. Space systems enable the U.S. and multinational forces to operate with full integration in a more efficient and effective manner.

4-30. ADP 3-0 details the Army's unified land operations. Army forces combine offensive, defensive, and stability or DSCA operations simultaneously as part of an interdependent joint force to seize, retain, and exploit the initiative, accepting prudent risk to create opportunities to achieve decisive results. They employ synchronized action, lethal and nonlethal, proportional to the mission and informed by a thorough understanding of all variables of an operational environment.

FLEXIBILITY

4-31. Required to achieve tactical, operational, and strategic success in spite of adversity. The Army provides long-haul SATCOM critical to mission command through the WGS and DSCS constellations to enable flexibility. It also provides this support through integration with other space systems, such as commercial SATCOM, Milstar, and UFO. Interoperability between command elements across joint and multinational forces fosters collaboration and is a necessity the Army will continue to use and develop. These long-haul SATCOM support flexibility in operations through the communication of real time information and support improved situational understanding. Flexible space planning allows units to quickly adapt to changing operations and SSA supports rapid, flexible responses.

INTEGRATION

4-32. Army space operations are most successful when they are integrated across the full range of joint military operations as part of a larger joint, interagency, and frequently multinational effort. Each Service component has a unique role to play in providing space capabilities, and the capabilities provided by one service are used and integrated into the planning and operations of all Services. Army space operations use Army's unique space capabilities to complement those of their joint, interagency, and multinational partners. It is this shared purpose and understanding through collaboration with all Services and other elements of the friendly forces that makes space operations a force multiplier.

LETHALITY

4-33. The U.S. Army is the world's premier land fighting force. The Army's ability to meet operational objectives and hold territory hinges not only on Soldiers and firepower, but also on space capabilities such as comprehensive SSA that can support the synchronization of lethal effects. Gaining and maintaining early, accurate, and comprehensive knowledge of the evolving operational environment is facilitated by indigenous Army capabilities to access information streams made available by national and DOD assets. The ability to sort and fuse information and provide rapid dissemination to area of operation planners and commanders also improves their situational awareness of the evolving operational environment. This is facilitated by synoptic or wide-area graphics of the area of operations as well as detailed information features, both of which can be provided partly through space-based information collection and environmental monitoring resources.

ADAPTABILITY

4-34. Reflects a quality that Army leaders and forces exhibit through their ability to rapidly adapt their thinking, their formations, and their employment techniques to each specific situation they face. Space operations help Army leaders to better understand the operating environment through near real time communications and space-based information collection. Space operations may be used to help deprive the enemy of the ability to adapt by disrupting communications and forcing the enemy to continually react to U.S. operations. The Army may also use space control to negate enemy space-based information streams.

Supporting friendly communications and information while disrupting the enemy of their information networks, if necessary, is essential to facilitate continuous assessments necessary to seize, retain, and exploit the initiative based on relevant understanding of the specific situation.

DEPTH

4-35. The extension of operations in space, time, or purpose. Space-based assets help find and identify enemy reserves, command and control nodes, logistics, and other capabilities both in an out of direct contact with friendly forces and can help prevent effective employment of those assets. Space-based assets detect adverse space weather that can impact satellites, communications links, and ground stations which may have a cascading effect on Army ground operations. Knowledge of these potential impacts assists a commander in building operational depth by using these environmental factors to take advantage of favorable and unfavorable conditions to achieve the most decisive results. Space assets also assist the commander in operating in depth by providing continuous reconnaissance and real time communications to manage an operational tempo that is favorable to U.S. forces.

SYNCHRONIZATION

4-36. The arrangement of military actions in time, space, and purpose to produce maximum relative combat power at a decisive place and time (JP 2-0). It is the ability to execute multiple related and mutually supporting tasks in different locations at the same time, producing greater effects than executing each in isolation, and is enabled by space capabilities. Success in controlling and defending land, people, and natural resources requires maximizing situational understanding through force synchronization. Space-enabled capabilities make major contributions to that understanding. The Army keeps pace with current and changing situations in part through the use of imagery, environmental monitoring data from meteorological satellites, space-enabled in-theater communications between Army units, and reachback to multiple global analysis resources to ensure all forces are synchronized and operating from a common reference.

RISK MANAGEMENT

4-37. Risk management is the Army‘s primary decision-making process for identifying hazards and controlling risks across the range of military operations, Army missions, functions, operations, and activities. Army leaders take prudent risks and make risk decisions based on informed judgment and intuition. Failure to include space-related information during mission assessment may lead to an inaccurate risk assessment for the mission. Risk management is a function of the probability of an event occurring and the severity of the event expressed in terms of the degree to which the incident affects combat power or mission capability.

4-38. Some space-related risk management items to consider during any mission execution risk assessment should include, but not be limited to, SATCOM availability and security, PNT accuracy for fires, and identification of space-based and terrestrial weather and the impacts on land operations.

Note: For more information on the risk management, refer to ATP 5-19, *Risk Management.*

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Chapter 5

Planning, Preparing, Executing, and Assessing Space Operations

"The Army is evolving from a position of simply exploiting strategic space-based capabilities to one where the Army is fully engaged in the planning, development, and use of theater-focused operational and tactical space applications."

Lieutenant General (retired) Richard B. Formica
former Commander, USASMDC/ARSTRAT
Senate Armed Services Committee Statement
12 March 2012

The operations process describes the activities performed by any military unit to accomplish a mission (See ADRP 5-0). Army space organizations follow the operations process to conduct space operations, the same way maneuver units do to conduct their operations. This chapter discusses how space operations are incorporated into the operations process.

PLANNING FOR SPACE OPERATIONS

5-1. Planning is the art and science of understanding a situation, envisioning a desired future, and laying out effective ways of bringing about that future (ADP 5-0). It results in a plan or order that communicates the commander's intent, understanding, and visualization of the operation to subordinates, focusing on desired results. During the plan activity, the supported unit performs the MDMP, developing a plan or order that lays out the schemes of support for space that support the concept of operations. Commanders and staffs use Annex N – Space Operations to describe how space operations support the concept of operations described in the base plan or order. The space operations officer develops Annex N which is used to coordinate early with the staff. Coordination includes the G-2, assistant chief of staff for operations (G-3), G-6, fires officer, and the special technical operations personnel to synchronize efforts and avoid duplication of information. While the assistant chief of staff for intelligence may want to produce and include the enemy space assessment portion in Annex B – Intelligence, there are products space professionals may uniquely contribute. The space operations officer requests the space order of battle through the Joint Space Operations Center prior to deployment. Since space operations is inherently joint in nature, the space operations officer should be familiar with joint operational planning methodologies as described in JP 5-0, *Joint Operation Planning*.

Note: For more information on the operations process, refer to ADP 5-0 and ADRP 5-0, *The Operations Process*.

5-2. Methodologies that assist commanders and staffs to plan operations using the operations process include Army design methodology, the MDMP, and troop leading procedures. The Chief of Staff manages or coordinates the staff's planning efforts. Planning space operations requires integrating it with all the other planning activities and processes of the organization. SSE and ARSST members synchronize their activities with the overall operation.

5-3. Conducting space operations requires synchronization of comprehensive DOD, Service, and in some cases, foreign nation efforts that are specifically designed to use and employ space products and services in support of military operations and training. This effort is usually continuous and may surge to support military requirements that will require the integration of the capabilities and complex coordination requirements. The commander uses the operations process to recognize what needs to be done and the mission command process is used to ensure that appropriate actions are taken. Combatant commanders serve as a primary mechanism for implementing space operations, through USSTRATCOM. Through the joint operation planning process, commanders and staffs apply operational art to operational design to provide the conceptual framework that underpins theater plans to achieve the national security objectives stated in the National Space Strategy. The theater plan is the primary vehicle for designing, organizing, integrating, assessing, and setting conditions for unified action in a region and setting conditions for space operations and military operational plans.

5-4. The MDMP is an iterative planning methodology to understand the situation and mission, develop a COA, and produce an operation plan or order (ADRP 5-0). The MDMP comprises seven steps:

- Receipt of mission;
- Mission analysis;
- COA development;
- COA analysis (war game);
- COA comparison;
- COA approval; and
- Orders production, dissemination, and transition.

5-5. The SSE develops the space operations mission statement and concept of space operations, emphasizing aspects of the base plan that require space support and that may affect space capabilities. Some space assets, resources, and related activities require a long lead time for planning and preparation. Some space operations are executed before other aspects of the overall operation. Defined, but flexible, processes are used to structure space operations planning. The SSE identifies space activities required to support the operation or that impact it, including all SSA, space force enhancement, space control, and enemy space activities.

5-6. Receipt of the mission. Planning begins at receipt or anticipation of a mission or when circumstances indicate the need to create a new plan, even in the absence of guidance from higher headquarters (for example, changed circumstances render the current plan irrelevant and dictate a new concept of operations). The SSE proceeds with analysis and assessment of the relevant aspects of the operational environment within the area of operations, emphasizing space environment, friendly, enemy, and neutral space capabilities. Based on the commander's guidance, planning includes formulating one or more supportable space operations COAs to accomplish the mission.

5-7. Mission analysis. The SSE updates the existing space operations estimate (see Chapter 8, Section II), or prepares a new one. Other actions may include:

- Review higher HQs and Joint space plans and annexes;
- Develop commander's intent for space;
- Recommend commanders' critical information requirements and essential elements of friendly information related to space;
- Assisting the G-2 in identifying and analyzing enemy space capabilities and friendly information collection capabilities; and
- Provide G-3 with likely impacts from space weather on friendly and enemy space capabilities regarding PNT, SATCOM, missile warning, and environmental monitoring.

5-8. COA development. The SSE begins COA development by estimating the relative combat power of friendly and enemy space assets, including commercially contracted assets and space situational awareness, space control, space support, and space force application assets, if applicable. SSEs should integrate their

assessment of force ratio into the overall estimate. As the staff develops COA options, the SSE explores friendly space-related activities required to support the operation. These activities may include:

- Plan and integrate degraded space operations impacts and mitigation into COAs and Annex N (Space Operations);
- Identifying methods for providing multinational forces non-encrypted GPS capabilities;
- Updating space weather impacts to COAs;
- Determine where space control assets are needed to protect friendly use of space;
- Assisting the G-2 in analyzing and wargaming enemy COAs for the use of space;
- Assist G-6 in determining SATCOM constellation status and impacts on COAs; and
- Comparing friendly and enemy space capabilities and shortfalls.

5-9. COA analysis. The SSE participates in the COA Analysis or war game. Actions may include:

- Identifying risks to space operations associated with each COA;
- Assist the G-2 in analyzing and wargaming enemy COAs for the use of space;
- Identifying new requirements for space-related activities;
- Refining space input to the commanders' critical information requirements; and
- Assisting the G-2 in identifying enemy space high payoff targets.

5-10. COA comparison. The SSE members analyze and evaluate the advantages and disadvantages of each COA from the space operations perspective, considering all applicable JP 3-14 space mission areas. Depending on the degree of space-related activities affecting the mission, SSEs may use their own matrix to compare COAs, or may integrate space operations input along the elements of combat power or other decision matrix system the staff uses.

5-11. While the SSE participates in the COA development, analysis, and comparisons, the two principle roles the SSE has in the COA process is:

- Provide input on which COA is *most* supportable from a space perspective; and
- Determine how space can *best* support each of the COAs.

5-12. COA approval and orders production. The SSE prepares Annex N (Space Operations) in accordance with Army procedures for orders production.

5-13. Weather influences military forces and those forces should attempt to account for it during the planning. Weather information is part of the intelligence required by commanders and staffs when planning for combat operations. The planning results from analyzing weather data, identifying potential weather effects, and assessing the impact of weather on systems, tactics, and operations provide vital information for commanders to optimally employ their forces.

5-14. Planners must focus mission analysis over a widespread, geographically diverse area. For military planning, weather forecast information must be tailored to support operations that range from small surgical strikes to theater-wide operations. Terrestrial weather, space weather, or both may significantly impact both friendly and threat operations. Factoring these aspects into the planning process may significantly reduce and mitigate mission risk.

5-15. Forecasting adverse effects on space and terrestrial resources will give commanders increased SSA during planning of combat missions. Some of the more common effects from solar activity that should be considered during all phases of planning include:

- Solar and lunar effects on tides and illumination;
- Solar flares may disturb the ionosphere, which impedes high-frequency radio and navigation systems, often causing isolated, widespread, and occasionally total communications losses;
- Geomagnetic storms create disturbances in the geomagnetic field due to the solar wind which may affect power systems, spacecraft operations, radio signal propagation, and PNT errors;
- Solar radiation storms from solar flares greatly increase the radiation count, which creates a radiation hazard to SATCOM, satellite operations, and terrestrial communications systems;

- As solar radiation increases the density of the ionosphere with energized particles, GPS operations may be adversely affected. As the signals from the GPS satellites pass through the varying density of the ionosphere, the signals are affected and cause a propagation delay in the GPS signal that may result in PNT errors; and
- Sun fades and Sun outages. The sun produces radiation in all radio frequency bands. As the Earth goes through spring and fall equinox, the sun may be positioned directly behind a SATCOM satellite and may overpower the satellites ability to close a link on the Earth as the sun's radio frequency energy directly impacts on the ground antenna.

PREPARING FOR SPACE OPERATIONS

5-16. Preparation consists of those activities performed by units and Soldiers to improve their ability to execute an operation (ADP 5-0). Preparation creates conditions that improve friendly forces' opportunities for success. It requires commander, staff, unit, and Soldier actions to ensure the force is trained, equipped, and ready to execute operations. Preparation activities help commanders, staffs, and Soldiers understand a situation and their roles in upcoming operations.

5-17. The SSE routinely works with other members of the coordinating and special staffs such as the intelligence cell, signal operations, network operations, movement and maneuver cell, AMD section, fires cell, and staff weather office element. The SSE focuses on the integration of the wide range of space capabilities across all warfighting functions. The SSE educates members of the staff to ensure they are fully aware of space capabilities, limitations, and vulnerabilities that pertain to the various warfighting functions.

5-18. Mission success depends as much on preparation as on planning. Higher headquarters may develop the best of plans; however, plans serve little purpose if subordinates do not receive them in time. Subordinates need enough time to understand plans well enough to execute them. Subordinates develop their own plans and preparations for an operation. After they fully comprehend the plan, subordinate leaders rehearse key portions of it and ensure Soldiers and equipment are positioned and ready to execute the operation.

5-19. Peacetime preparation by units involves building contingency planning databases about the anticipated area of operations. These databases can be used for space operations input to the space estimate and to plan initial space operations.

5-20. An important element of preparation is developing and implementing the ability to coordinate among relevant units and agencies. The SSE initiates the explicit and implicit coordinating activities within itself and with other staff sections. Much of this coordination occurs during meetings and working groups, but SSE members are monitoring other activities that might relate to space operations.

5-21. 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 SSE 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 organizations.

5-22. The protection warfighting function 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 SSE develops and initiates protection actions during planning, but executes them mainly during preparation and execution. Space operations actions related to protection include tasks involving all space activities. Threat assessment begins during planning and continues during preparation. Protection measures may explicitly include space operations elements.

5-23. 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 SSE coordinates with the assistant chief of staff, logistics sustainment section to ensure that units assigned space operations tasks receive the necessary support.

EXECUTING SPACE OPERATIONS

5-24. 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.

5-25. Monitoring space operations execution focuses principally on maintaining the effectiveness of space operations. The SSE uses the critical assets list to monitor the status of critical friendly space activities and the status of critical terrestrial, aerial, and space-based systems.

5-26. During execution, the SSE assesses space operations execution and how to adjust space operations as the operation unfolds. The need for responsive staff coordination among the SSEs and headquarters and units with space-related tasks intensifies during execution as an operation progresses and variances from the operations order increase. The decentralized nature of space operations execution, combined with the multiple command levels involved, entail a wide span of coordination for the SSE.

5-27. Decision making during execution includes executing space operations as planned, adjusting space operations to a changing friendly situation, and adjusting space operations to unexpected enemy actions. Space operations may not be executed exactly as planned for a variety of reasons. The SSE's challenge under adverse circumstances is to rapidly assess how changes in space operations execution affect the overall operation and to determine necessary follow-on actions.

ASSESSING SPACE OPERATIONS

5-28. Assessment is continuously monitoring and evaluating the current situation and the progress of an operation. SSEs and space forces continually assess operations by using measures of effectiveness (measure of effectiveness is a criterion used to assess changes in system behavior, capability, or operational environment) and measures of performance (measure of performance is a criterion used to assess friendly actions that is tied to measuring task accomplishment) (ADP/ADRP 5-0). Measures of performance helps answer questions such as: Was the action taken? Or Were the tasks completed to standard? A measure of performance confirms or denies that a task has been properly performed.

- Examples of measures of effectiveness may include the following:
  - Has solar activity impacted GPS and precision navigation;
  - Ability of electromagnetic interference resolution processes to resolve SATCOM or GPS electromagnetic interference in a timely manner; and
  - Timeliness of receipt of commercial satellite imagery products;
- Examples of measures of performance include the following:
  - Success or failure of FFT infrastructure to enable the COP;
  - Have mitigation measures enable uninterrupted operations; and
  - Have the missile warning alerts provided sufficient accuracy and time to take protective measures.

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Chapter 6

Army Space Organizations and Capabilities

The Army maintains non-deployable and deployable organizations and capabilities to provide space force enhancement, space support, space control, and space situational awareness to operating forces. These are units and teams that have routine, day-to-day support responsibilities, or are intended to support contingencies or other surge requirements.

SECTION I – THE SPACE BRIGADE

SPACE BRIGADE

6-1. The 1st Space Brigade is the primary USASMDC/ARSTRAT space force provider. The 1st Space Brigade is a multi-component organization comprised of regular Army, Army Reserve, and Army National Guard Soldiers through a training readiness oversight relationship. The space brigade exercises mission command over its subordinate space battalions and the 53rd Signal Battalion (SATCON). Space units are organized in a cellular manner, utilizing a building-block approach to field or adjust capabilities incrementally as Army requirements change and resourcing becomes available.

6-2. The 1st Space Brigade's mission is to conduct continuous, global space support, space force enhancement, and space control operations that support USSTRATCOM and supported combatant commanders and enable the delivery of decisive combat power. To accomplish this mission, the 1st Space Brigade coordinates with combatant commanders, Army Service component commands, and SSEs, as required, to execute space operations, deploy combat ready Army space forces, perform theater space operations, and conduct space control planning, coordination, integration, and execution in support of the combatant commander's priorities. The 1st Space Brigade performs the following functions, as requested:

- Provides theater-of-operations level Army space force enhancement, space control, space situational awareness, and space support forces and capabilities;
- Provides tailored Army space forces to assist SSEs as required;
- Provides tailored Army space forces to assist units without organic SSEs such as theater sustainment commands, joint task forces and Marine forces;
- Deploys a scalable, tailorable ASCE to assist battlefield coordination detachment staff in planning space operations;
- Deploys SSAPT and tactical SSAPTs to provide in-theater liaison and planning support for space control operations at the geographical combatant commander level and at tactical headquarters;
- Provides select sustainment functions for Army space forces;
- Conducts pre-deployment planning for Army space forces and supported units;
- Provides recommendations to USASMDC/ARSTRAT on the most effective and efficient employment of space brigade forces;
- Manages commercial service and maintenance contracts for unique, low-density or one of a kind type of equipment;

- Conducts regular Army and Reserve Component integration; and
- Provides brigade space planners forward to JFCC SPACE to support space control planning.

6-3. USASMDC/ARSTRAT has the 1st Space Brigade which consists of two battalions and they also have training and readiness oversight of a third battalion. A multi-component Army space battalion provides TMW, space control, and space force enhancement to operating forces. The 53rd Signal Battalion (SATCON) provides continuous wideband SATCOM transmission and satellite payload control of DOD wideband constellations. The space brigade also has training and readiness oversight over the National Guard battalion for Title 10 mobilizations and demobilizations that provide TMW, space control, and space force enhancement to operating forces. The Army National Guard space battalion specializes in Title 10 DSCA and Title 32 National Guard civil support. The dashed line in figure 6-1 indicates training and readiness oversight.

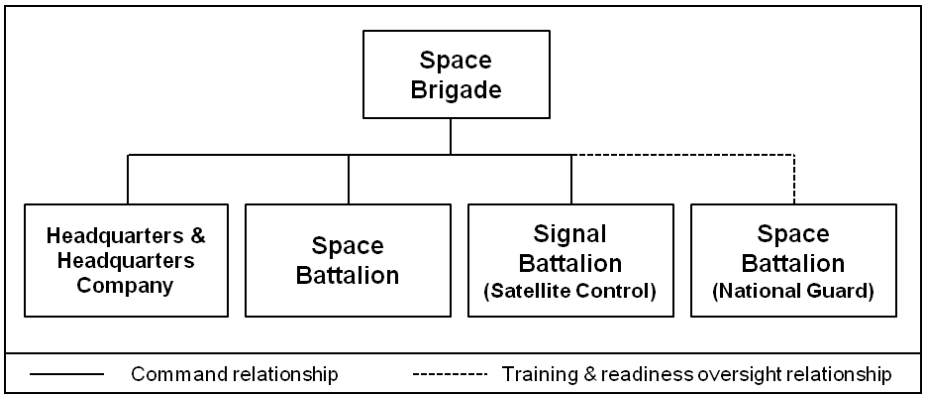

Figure 6-1. 1st Space Brigade organization

6-4. As a matter of DOD policy, training and readiness oversight authority includes:

- Providing guidance to Service component commanders on operational requirements and priorities to be addressed in military department training and readiness programs;
- Commenting on Service component program recommendations and budget requests;
- Coordinating and approving participation by assigned Reserve Component forces in joint exercises and other joint training when on active duty for training or performing inactive duty for training;
- Obtaining and reviewing readiness and inspection reports on assigned Reserve Component forces; and
- Coordinating and reviewing mobilization plans (including post-mobilization training activities and deployability validation procedures) developed for assigned Reserve Component.

SPACE BRIGADE HEADQUARTERS

6-5. The brigade headquarters is the dedicated mission command headquarters for 1st Space Brigade forces that provide focus for their tactical and operational mission accomplishment, and provides (or coordinates) logistic and administrative support. When requested by the combatant commander, Army Service component command, or SSE, and directed by USASMDC/ARSTRAT, the brigade deploys a scalable support package, often referred to as an ASCE into a theater to provide mission command for Army space forces, general Army space support to forces, and direct space support to the joint force commander.

6-6. The headquarters and headquarters company is multi-component and consists of the command group, the coordinating staff, and the special staffs. See the headquarters and headquarters company organization in figure 6-2.

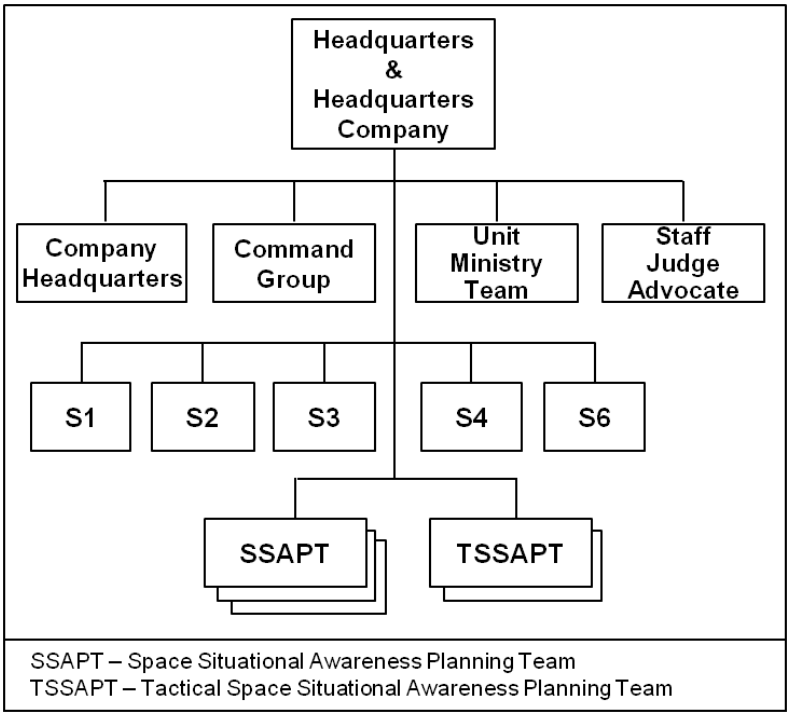

Figure 6-2. Space Brigade headquarters and headquarters company

ASCE

6-7. 1st Space Brigade forms tailored space support packages known as ASCEs, and deploys them when directed based on the factors of mission variables. The size and composition of the ASCE is dependent on the missions required to be performed in-theater. The ASCE is tailorable which depends on the degree of involvement of Space capabilities in-theater, Army requirements, and operational control or tactical control relationships. The ASCE draws its personnel from those staff elements within the headquarters and headquarters company as needed. If there is an in-theater requirement for space-specific personnel management, elements of the brigade personnel section would be included in the ASCE. The primary headquarters element responsible for preparing and training the ASCE is the brigade operations section.

6-8. The 1st Space Brigade's deployable elements, in coordination with combatant commander, Army Service component command, and SSE, plan, synchronize, coordinate, and prioritize space operations support to military operations. This capability allows these elements to augment Army headquarters SSEs or battlefield coordination detachments and submit land component space needs to the SCA. When the Theater Army is not assigned as a joint force land component commander and a corps is designated as the primary warfighting headquarters the ASCE support packages will be adjusted. The functions of these tailored space support packages continues to evolve as deployment missions are assessed. The following is a list of responsibilities for the ASCE:

- The ASCE is normally attached to the joint force land component commander or Army Service component command and may perform the following functions on arrival in a theater of operations. When directed by the senior Army space officer in theater, augments the SSE or becomes the joint force land component commanders space planning cell if there is no organic SSE. An ASCE integrates into the gaining headquarters joint operations staff to plan space operations;
- Assists the division, corps, and Army headquarters SSEs in ensuring Army space equities are recognized and incorporated into the SCA concept of space operations and execution support;
- Assists in the joint space planning process and development of the space priorities;

- Recommends and coordinates space-related capabilities and receives guidance and priorities from the Army Service component command or joint force land component commander;
- Assists in the joint space planning process and development of the space priorities of effort and support;
- Assists in the planning, coordination, and synchronization of joint space control operations with joint force air component commander and the air and space operations center, as required;
- Coordinates space operations with the Army battlefield coordination detachment, Army air and missile defense command, and joint force land component commander for land component space requirements;
- Provides Army space representation and support to the SCA, JFCC SPACE, the fires and effects coordination cell, and the Air Force air and space expeditionary task force when necessary;
- Serves as the principal Army advocate to the SCA and the joint warfighting space expeditionary force; and
- Supports the joint SCA when directed and in coordination with other Service components.

SSAPTs

6-9. SSAPTs provide planning information and expertise on Army space control capabilities in order to coordinate effects, timing, and tempo with centralized operational space capabilities. The specific missions and capabilities of SSAPTs assets are generally classified and require controlled access to mission programs. Space control planning and controlling is limited to a small group of personnel who are granted access to specific programs.

6-10. SSAPTs operate at the combatant commander level, integrating into the headquarters responsible for planning and executing space control operations which is normally the headquarters where designated SCA resides. When deployed in a joint environment, SSAPTs augment joint space control coordination elements where they provide Army and joint headquarters staffs with the expertise on Army space control capabilities.

6-11. As required, the 1st Space Brigade headquarters may deploy up to three, three-person SSAPTs to support commands exercising operational control of space control systems and capabilities. The three SSAPTs provide for rotational depth in one theater, but may support three separate theaters simultaneously if no rotational capability is required. Some of the functions performed by SSAPTs are:

- Assist operations in mission command of space control systems;
- Assist combined air and space operations center in developing space control plans, which includes developing the space control portion of the space tasking order;
- Support Integrated joint special technical operations planning and operations; and
- Update space tasking order to account for emerging targets or operational changes.

6-12. Tactical SSAPTs are employed when space control planning and expertise are required at a tactical headquarters such as a corps, joint task force, or Marine expeditionary force. The brigade may deploy up to two, two-person tactical SSAPTs to support a tactical headquarters in planning for and coordinating the periodic application of space control capabilities. The team's link to the tactical headquarters is through the SSE or ARSST if there is no SSE. Some of the function performed by tactical SSAPTs are:

- Assist tactical-level headquarters in developing space control plans;
- Requesting space control capabilities from theater; and
- Coordinating application of space control effects.

SPACE BATTALIONS

6-13. The mission of a space battalion is to plan, coordinate, integrate, and synchronize execution of space force enhancement functions. The battalion headquarters provides mission command, services, support, and staff assistance for line companies and the headquarters company. The space battalion also has training and

readiness oversight over its Army Reserve companies and detachments for Title 10 mobilizations and demobilizations. Space battalions typically perform the following space force enhancement functions:

- Provide and integrate continuous assured theater ballistic missile warning, combined early warning, and characterization of the operational environment into operations;
- Provide SSA, space assets, and space products through the ARSSTs and SSA Company; and
- Provide low-density, high-demand capabilities such as ARSSTs.

6-14. The space battalion is designed to have mission command over following types of units:

- TMW space companies;
- Army space support companies; and
- Army space control detachments.

6-15. Space battalions are cellular in nature, meaning that the number and type of subordinate space companies is variable. It has mission command of two to five subordinate space companies. The organization is shown in figure 6-3.

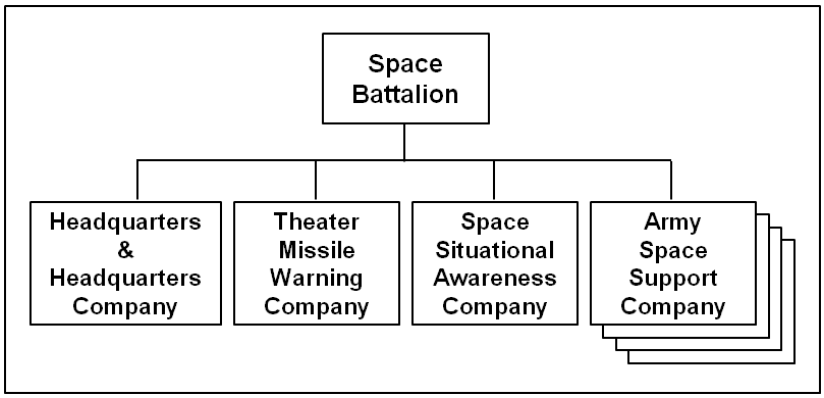

Figure 6-3. Space battalion organization

SPACE COMPANY (TMW)

6-16. The TMW space company provides space-based ballistic missile warning to a combatant commander and reports on other infrared events. These support the passive defense, active defense, and attack operation pillars of theater missile defense and contribute to the theater commander's operational environment awareness.

6-17. The company, like the space battalion, is cellular in nature, meaning that the number of subordinate TMW detachments varies between 3-5 detachments. It is comprised of a headquarters section (including a training and evaluation section) and 3-5 subordinate TMW detachments, all forward-stationed. Each detachment operates one TMW system known as JTAGS. A typical organization is shown in figure 6-4 on page 6-6.

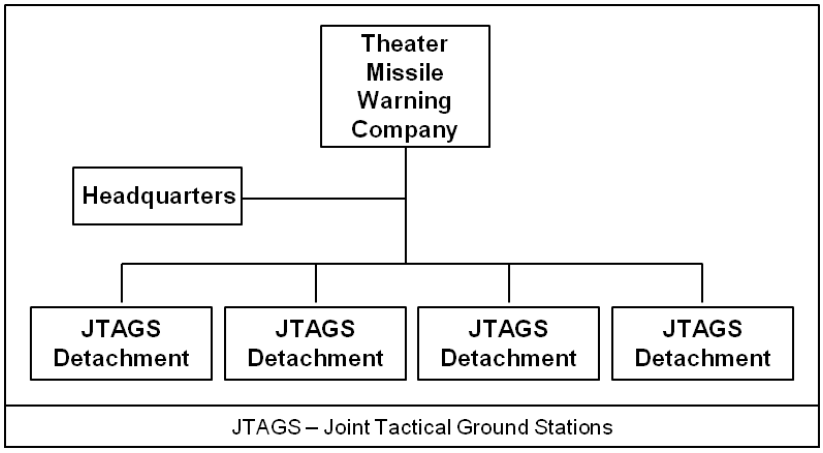

Figure 6-4. TMW space company organization

SPACE SITUATIONAL AWARENESS COMPANY

6-18. The mission of the SSA company is to provide trained and operationally ready SSA detachments to combatant commands. The SSA company coordinates services and mission support for assigned elements. The SSA company conducts mission command of subordinated detachments and maintains operational oversight of deployed elements to ensure they maintain situational awareness and provide updates to the COP.

6-19. The SSA companies provide training, certification, mission command, and supervision of up to seven subordinate Space Detachment–Electronic (SATCOM), known as E-Dets, and reachback operational support for deployed unit.

6-20. The mission of the Space Detachment–Electronic (SATCOM) is to deploy globally, on orders, and conduct ground mobile surveillance and assessment of space systems in support of military and civil operations. Each Space Detachment–Electronic (SATCOM) plans and conducts system diagnostic monitoring, vulnerability assessments, data integrity studies, and quality control in support of U.S. military SATCOM using the Mobile Integrated Ground Suite or other capabilities. A typical SSA company organization is shown in figure 6-5.

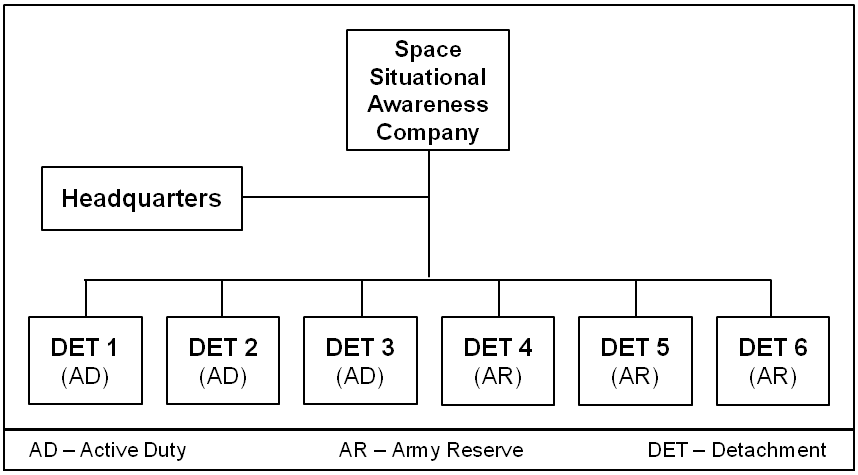

Figure 6-5. SSA company organization

ARMY SPACE SUPPORT COMPANY

6-21. The mission of space support companies are to organize, train, and equip ARSSTs to deploy globally to plan, coordinate, and analyze space force enhancement and SSA in support of military and civil operations. Space support companies are organized with a variable number of ARSSTs, but generally do not exceed ten per company. The organization enables the rapid deployment of ARSSTs to provide space force enhancement analysis, space-based commercial satellite imagery, space control coordination, characterization of the operational environment, and to inject USASMDC/ARSTRAT emerging capabilities into the fight. A generic example of a space support company is shown in figure 6-6.

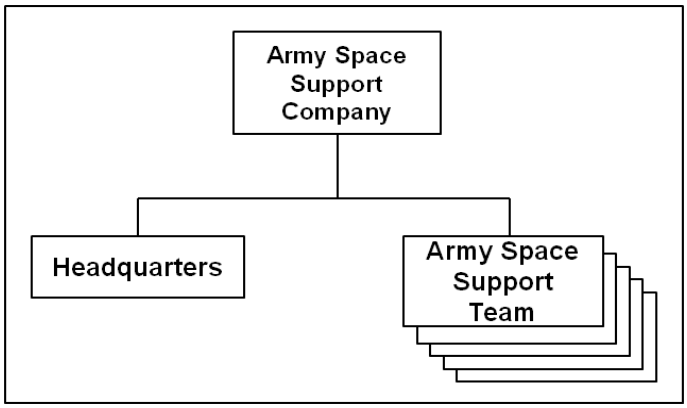

Figure 6-6. Army space support company organization

ARSSTs

6-22. ARSSTs provide situational awareness of space capabilities, space assets, and space products and their impact on operations. The company provides divisions, corps, joint task force, Marine expeditionary force, Theater Sustainment Command, and Army Service component command headquarters a six-Soldier space force enhancement analysis team, comprising two officers and four enlisted Soldiers, each having unique space-related skills, knowledge, and abilities. ARSST organization is shown in figure 6-7.

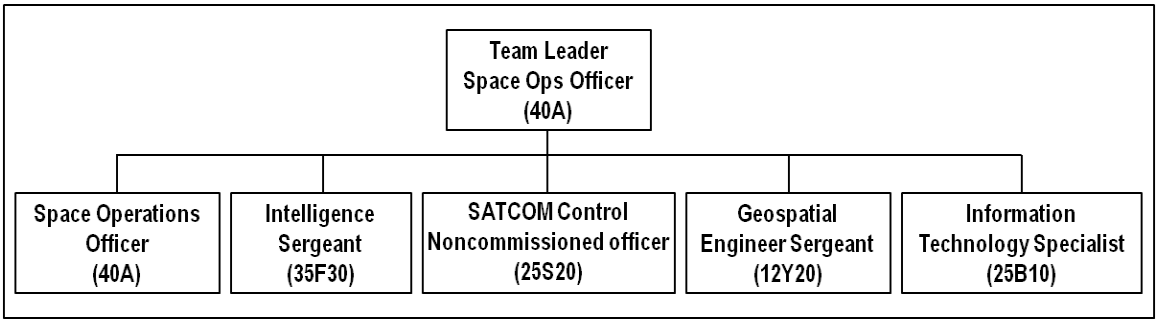

Figure 6-7. Army space support team organization

6-23. ARSSTs plan, coordinate, and analyze the space force enhancement areas. The ability to provide space input to the IPB is a significant value-added to the MDMP. ARSST prepare and train for unified land operations supporting all operations.

6-24. In the absence of (or in support of) an SSE, ARSSTs provide a daily space update to the commander and staff and track the daily status of all space systems available to the commander in a specific area of responsibility or joint operating area.

6-25. In absence of (or in support of) an SSE, ARSSTs work with supported commands to determine systems that use GPS and what level of accuracy they desire for those systems. ARSSTs can alert the command when the GPS accuracy falls below established tolerances.

6-26. ARSSTs assist the G-2 or intelligence staff officer with IPB effort to analyze the mission variables in the operational environment by helping to assess the operational impacts of space weather. ARSSTs use space weather forecasts from Air Force Weather Agency to assess forecasted impacts of space weather on space assets, terrestrial communications, and impacts of terrestrial weather space-based sensors. By interpreting the Air Force Weather Agency forecast against space and land component system capabilities and limitations, ARSSTs are able to identify potential impacts to space systems and terrestrial communication systems and disseminate that information to the affected parties, commander, and staff.

6-27. ARSSTs are equipped with Distributed Common Ground System-Army (DCGS-A) workstations, which are replacing the space operations system workstations. Teams also utilize other equipment that provides space forces with reachback capability when integrated into the supported units' unclassified and classified communication and information networks. The DCGS-A workstations are certified by the Army program office and have approval to operate certificates for use on any Army network. The DCGS-A workstations are equipped with approved space-unique applications to conduct space analysis, space force enhancement, and space planning to support Army and joint missions. Other equipment the ARSSTs use includes printers, plotters, telephone communications, network attached storage devices, and communications systems for DCGS-A workstations. To conduct and develop mission products, ARSSTS utilize equipment and communications networks to download a variety of files and datasets that typically range in the multi-gigabyte file sizes.

53RD SIGNAL BATTALION (SATELLITE CONTROL)

6-28. The mission of the 53rd Signal Battalion (SATCON) is to provide satellite transmission and payload control of the DSCS and WGS constellations for the President of the U.S., the Secretary of Defense, and joint commands by operating and maintaining five WSOCs and a DSCS certification facility. The 53rd Signal Battalion (SATCON) enables various users, including the President of the U.S., DOD components, national agencies, and joint commands, to access and use the essential wideband SATCOM.

6-29. The mission of the 53rd Signal Battalion (SATCON) is to provide global wideband payload control, transmissions control, and defensive space control ensuring the DOD wideband satellite constellations' continuous support to peacetime, contingency, surge, and crisis action plans supporting DOD, U.S. government agencies, and allied partners by sustaining, operating, and maintaining five global WSOC and a DSCS Certification Facility. The 53rd Signal Battalion (SATCON) also provides global defensive space control supporting USSTRATCOMs ability to assure access of DOD leased commercial satellite transmission paths of interest. The 53rd Signal Battalion (SATCON) enables various users, including the President of the U.S., DOD components, national agencies, and joint commands, to access and use the essential wideband SATCOM, to include the DSCS and WGS constellations. Figure 6-8 shows the organization of the 53rd Signal Battalion (SATCON).

6-30. SATCON line companies operate each WSOC. The WSOC is the focal point for conducting satellite command and telemetry functions, transmission monitoring functions, and Earth terminal control functions for DSCS and WGS satellites. Responsibilities include controlling terminal access, maintaining operational databases, responding to transmission anomalies and alarms, evaluating the quality of communication links, and the implementation of restoral plans on a 24-hour basis. Capabilities include transmission control, payload control, defensive space control, Eagle Sentry, and platform control. WSOCs are further described in Section V of chapter 6.

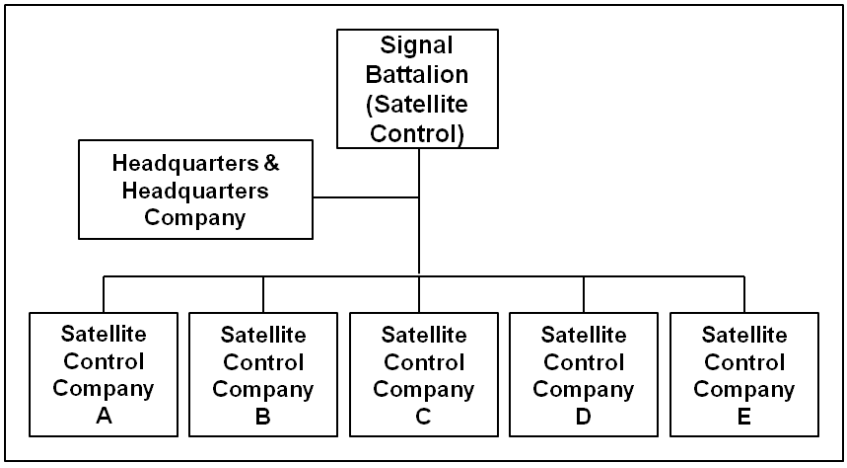

Figure 6-8. Signal battalion (satellite control) organization

SECTION II – USASMDC/ARSTRAT OPERATIONS CENTER

6-31. The USASMDC/ARSTRAT operations center provides continuous, responsive, Army space-related reachback for all combatant commands, Army Service component command, and deployed and forward stationed space forces. The operations center accomplishes this function by leveraging Army space expertise available within the USASMDC/ARSTRAT staff and 1st Space Brigade.

6-32. The operations center maintains continuous situational awareness of the operational capabilities of all deployed and forward stationed subordinate commands ensuring uninterrupted mission execution and support to Soldiers. It maintains communications with USSTRATCOM global operations center, USSTRATCOM's JFCC operation centers, and the U.S. Army operations center on all Army operational space missions. It monitors developing world situations and intelligence to anticipate potential Army space mission requirements and or support.

6-33. The operations center serves as the USASMDC/ARSTRAT information fusion center for all ongoing operations. It also serves as the incoming and outgoing distribution center for all orders and official message traffic. The operations center analyzes all orders from higher headquarters, identifying specified and implied tasks, and then distributes to the appropriate staff directorate for action. It also distributes, monitors execution, and maintains all USASMDC/ARSTRAT internal orders.

SECTION III – FRIENDLY FORCE TRACKING

FFT ROLES AND RESPONSIBILITIES

6-34. CJCSI 3910.01B, *Friendly Force Tracking Operation Guidance,* tasks USSTRATCOM to provide continuous FFT data services and capability development support to combatant commanders, agencies, allies, and multinational partners. Commander, USSTRATCOM, through USSTRATCOM SI 534-05, *Friendly Force Tracking Operations Guidance (Space and Satellite Operations),* has delegated the execution of its FFT responsibilities and tasks to its Army Service component command, USASMDC/ARSTRAT. The joint, interagency and multinational nature of this assigned mission is unique and requires the command to work across the broad FFT community of interest to execute these responsibilities in addressing user needs and accomplishing essential tasks that enable data sharing and integrated operations.

6-35. USASMDC/ARSTRAT's space expertise, established integrator roles, and stakeholder relationships provide value in successfully executing this information-centric assignment. USASMDC/ARSTRAT satisfies FFT mission responsibilities by equipping, staffing, and operating the FFT MMC. The MMC

ensures requirements for use of the system are properly validated; coordinates FFT collection, processes FFT messages for COP integration and accomplishes the dissemination of FFT information back to user designated destinations. The MMC ensures all information delivered to the COP is accurate, timely and actionable. USASMDC/ARSTRAT determines the priority of user support requests and endeavors to support all valid operational needs. USASMDC/ARSTRAT provides FFT research, development, testing, and integration capabilities support through the joint FFT division. The joint FFT Division executes capabilities development tasks using engineering, test, and network support expertise and by maintaining and operating a FFT test bed to provide direct support to the MMC and general support to other authorized users.

6-36. 6-36. As FFT continues to evolve and more systems and devices are deployed globally, the critical need for data interoperability across security domains and mission command systems continues to increase. Accordingly, FFT roles include:

- Execution of other position location information related data services such as tagging, tracking, and locating support;
- FFT system expertise for advice in planning, information assurance, device procurement and management, data owner guidance, and COP integration;
- Development of FFT data integration capabilities consistent with network enabled mission command modernization;
- Emergency message alerting and notification;
- Deliberate planning assistance in support of operational plans and concept plans for FFT activities;
- Operations and limited exercise and demonstration support to include troubleshooting, subject matter expert support, testing and limited training; and
- Analyzing and developing solutions to satisfy requests for FFT support.

FFT CAPABILITIES AND SUPPORT

6-37. To support assigned FFT responsibilities USASMDC/ARSTRAT staffs, equips, and operates the MMC for organizations and users that require these services and support. It is the critical FFT link between operating forces, national agencies, and a variety of dissemination architectures. The MMC is the central point of contact for FFT troubleshooting and coordination.

6-38. The MMC is a operations center with global reach that leverages the Department of Defense information networks to provide tailored FFT data translation, cross-domain data transfer, and data dissemination services for authorized users. Users require these services to be interoperable and support integrated COP display. The MMC and operating staff provide subject matter expertise to verify new system requirements, coordinate FFT data collection, and accomplish the transmission of information back to strategic, operational, and tactical levels. The MMC gets the right data to the right user in the right format, and ensures the FFT information transmitted for use in COP is accurate, timely, and actionable.

6-39. FFT data is used to improve situational awareness by providing the location and movement of force assets equipped with devices that transmit their position location information. Typically, FFT data is transmitted between devices and systems using one or a combination of several communications methods. These methods include line of sight or beyond line of sight, which include commercial and or national technical means SATCOM systems where most FFT devices and systems leverage the coverage and beyond line of sight capabilities of SATCOM. FFT devices typically use an embedded GPS receiver to establish its location. Then they repackage the date, time, and location information, and transmit it to a data processing node using established communications infrastructure. The information is routed from the data processing node directly to a COP or through the MMC for further processing and dissemination. A graphic illustration of the FFT data flow is in figure 6-9 on page 6-11.

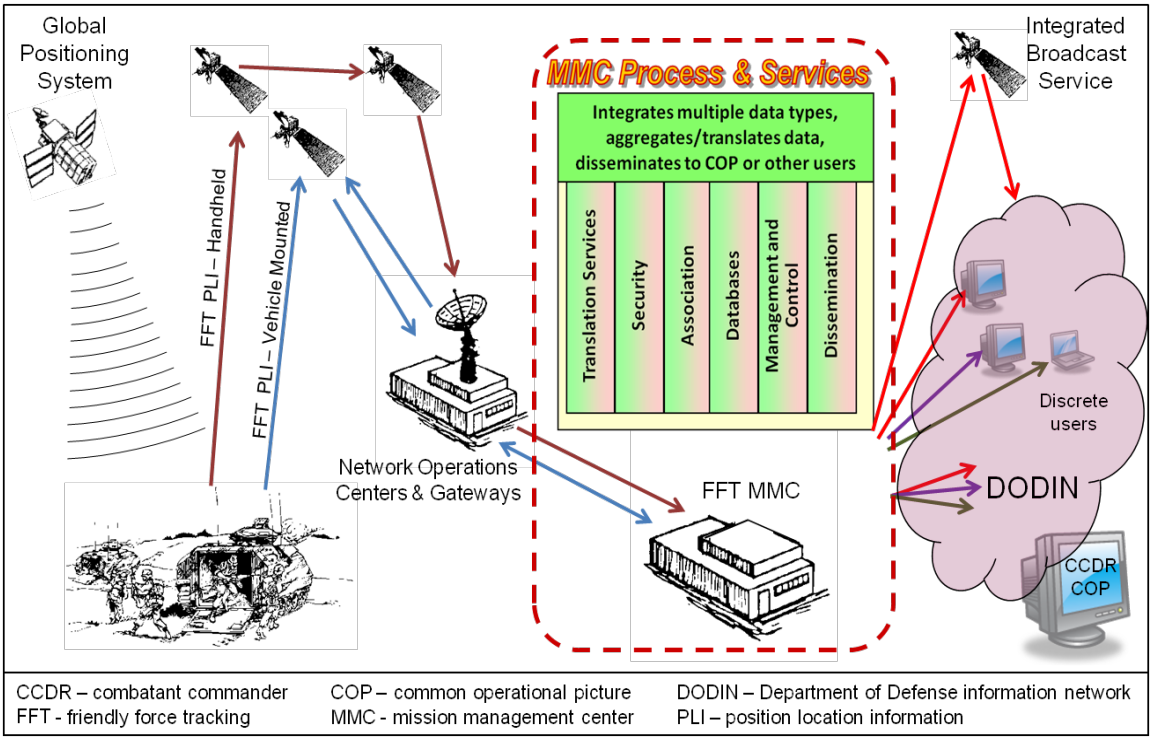

Figure 6-9. FFT data flow overview

6-40. Line of sight communications. The receiving platform collects and passes position location information along to a central gathering point. The line of sight system is limited to relatively local use and may experience outages as individual platforms lose line of sight access to one another.

6-41. Commercial SATCOM. Some commercial satellites host a transceiver that collects and sends the signal back to a ground site where a mission command system manager gathers individual platform location information. This information is sent to the user's headquarters and incorporated into their COP. In most cases, the MMC provides translation, cross domain transfer, and dissemination of position location information data to a Global Command Control System via SIPRNET or through a designated Integrated Broadcast Service satellite for broadcast over all or part of the area of operations.

6-42. National technical means relies on national satellites and the MMC. The area of operation platform transmits its location information to a national satellite that acts as a transceiver. The national satellite sends the location information to the MMC. MMC personnel translate location information and pass it to Global Command Control System via SIPRNET or through a designated Integrated Broadcast Service satellite for broadcast over all or part of the area of operations.

6-43. The mission support intent is to responsively deliver FFT capabilities that provide authorized users with timely, accurate, and secure information to improve their situational awareness. These capabilities are provided to meet data sharing and dissemination needs to enable FFT systems to interoperate with other systems and feed common mission command systems and COP. USASMDC/ARSTRAT is committed to protection of FFT data as required by the data owner and will ensure all connections within the Command's network meet DOD or U.S. government accreditation standards and regulations.

SECTION IV – GEOSPATIAL INTELLIGENCE DIVISION

6-44. The USASMDC/ARSTRAT G-2 geospatial intelligence division is a member of the Army's National-to-Theater geospatial intelligence program that provides geospatial intelligence services and products to combatant commands and their subordinate joint forces worldwide. The National-to-Theater

program, under the operational direction of headquarters U.S. Army Intelligence and Security Command, conducts federated production of all varieties of geospatial intelligence products but specializes in advanced geospatial intelligence production using non-literal analysis of imagery data obtained from commercial and National sources in the visible and non-visible areas of the electromagnetic spectrum.

6-45. This division conducts analysis of both airborne and satellite imagery including synthetic aperture radar, panchromatic, multispectral imagery, hyperspectral imagery, thermal, full motion video, OPIR, and light detection and ranging imagery. This division also creates detailed geospatial information services and mapping data.

6-46. The USASMDC/ARSTRAT G-2 geospatial intelligence division is located at Peterson Air Force base. As a member of the U.S. Army National-to-Theater geospatial intelligence federation, it provides full-spectrum geospatial intelligence support to USSTRATCOM, United States Northern Command, and United States Transportation Command. Additionally, the geospatial intelligence division is the Army's node for producing OPIR products in support of United States European Command and United States Africa Command.

6-47. The Army National-to-Theater program is functionally managed by the headquarters, Department of the Army G-2 and consists of headquarters, Department of the Army G-2 staff, U.S. Army Intelligence and Security Command units, and the USASMDC/ARSTRAT geospatial intelligence division. As a distributive federation, these elements provide reinforcing support to each other, when necessary.

6-48. Requests for USASMDC/ARSTRAT geospatial intelligence division and National-to-Theater support and access to its products are available through the Army geospatial intelligence enterprise tasking, collection, processing, exploitation, and dissemination service web portal on both Joint Worldwide Intelligence Communications System and SIPRNET.

SECTION V – SATELLITE COMMUNICATIONS

REGIONAL SATELLITE COMMUNICATIONS SUPPORT CENTER

6-49. USASMDC/ARSTRAT operates four RSSCs per the directions of USSTRATCOM. The RSSCs provide theater communication planners with a single point of contact for satellite access planning management of SATCOM resources. Staffed by representatives from Department of the Army, Department of the Air Force, Depart of the Navy, and DISA, the RSSC is the theater center of expertise for all military and commercial SATCOM serving the operating forces. RSSC duties and responsibilities are described in USSTRATCOM SI 714-03, *Satellite Communications Support Center Management*.

SATCOM SYSTEM EXPERTS

6-50. USSTRATCOM designated USASMDC/ARSTRAT as the military narrowband consolidated SATCOM system expert and the specific Mobile Users Objective System SATCOM system expert. These responsibilities include the manning of the RSSCs for narrowband planning and managing the increased resources for payload operations management and transmission control, as well as the responsibility to certify all terminals that will be used across the narrowband satellite payload.

6-51. USSTRATCOM designated USASMDC/ARSTRAT as the military wideband consolidated SATCOM system expert and the specific WGS and Global Broadcast Service SATCOM support expert. These responsibilities include the operational payload management of an increased constellation and the development and sustainment of control architecture for the increased WGS payloads on-orbit.

6-52. SATCOM system experts and consolidated SATCOM system expert have detailed knowledge of assigned system and spectrum, as well as provide technical, operational, and engineering support to USSTRATCOM. SATCOM system expert duties and responsibilities are described in USSTRATCOM SI 714-02, *Satellite Communications System Expert and Consolidated Satellite Communications System Expert Responsibilities*. Specific duties include:

- Advocate user requirements;
- Operationally advise PMs;
- Develop policy and procedures;
- Assist transition planning;
- Provide continuous, 24 hour per day operational support;
- Ensure integrated spectrum operations; and
- Provide RSSC manning.

6-53. USASMDC/ARSTRAT staffs a wideband SATCOM watch office and a narrowband SATCOM watch office out of the USASMDC/ARSTRAT operations center. Narrowband and wideband watch officers continuous, 24 hour per day operational support to all SATCOM users. Watch officers are charged with reachback support for any issues relating to SATCOM usage.

6-54. The RSSC commercial spectrum works with the customer and DISA's defense information technology contracting organization which contracts for commercial SATCOM service.

RSSC CAPABILITIES

6-55. RSSCs are the day-to-day operational interface with the user. All users are assigned to an RSSC as their focal point for SATCOM planning, management, and access support. Locations of the four fixed RSSCs and current combatant command support assignments are depicted in figure 6-10. 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 appropriate working groups to identify and plan theater SATCOM support requirements for mission operations. RSSCs process user satellite access requests and publish satellite access authorizations for approved missions.

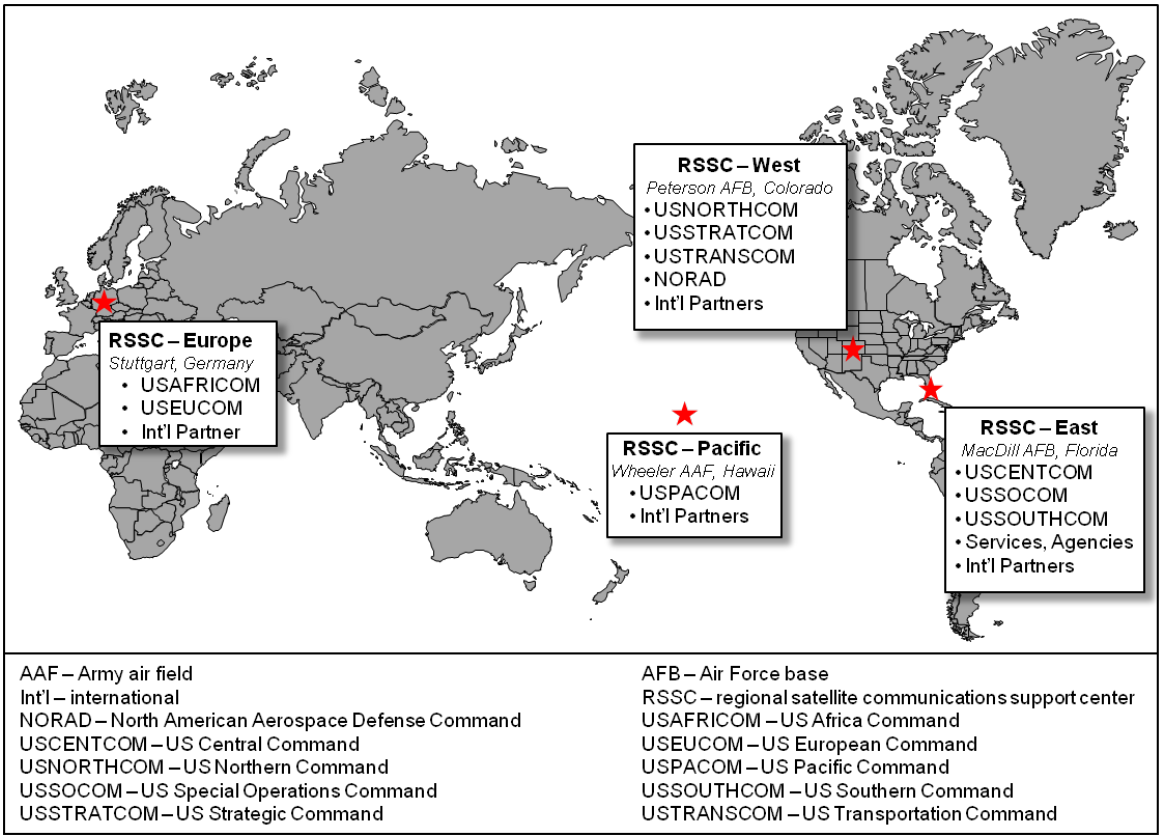

Figure 6-10. RSSC locations and support assignments

6-56. RSSCs perform the following day-to-day management functions for SATCOM resources in direct support of combatant commander assigned theater forces and other users:

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

6-57. RSSCs support combatant commander and user deliberate and crisis action planning:

- Assist combatant commander and user staffs in defining requirements and developing operation plans, contingency plans, and 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; and
- Provide training, technical assistance, and performance feedback to end users.

6-58. RSSCs support to theater spectrum management activities:

- Assist in SATCOM restoral actions in response to electromagnetic interference or anomalous conditions; and
- Assist in the joint force intelligence processes by which spectrum allocations and frequency assignments are approved.

6-59. RSSCs coordinate planning for SATCOM interfaces to the Department of Defense information networks:

- Facilitate interfaces to the gateways; and
- Coordinate planning with DISA field offices contingency and exercises branch for Department of Defense information networks access.

6-60. RSSCs support JFCC SPACE in maintaining global situational awareness:

- Support assessment of SATCOM support for each combatant command operation plans;
- 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; and
- Assist in user performance trend identification and analysis.

6-61. RSSCs direct and coordinate SATCOM resource configuration changes with transmission control facilities such as WSOCs, Milstar satellite operations center, and the naval computer and telecommunications area master station.

RSSC STAFFING

6-62. The RSSCs are staff elements of headquarters USASMDC/ARSTRAT. The RSSCs provide direct support to the combatant command and theater forces as the focal point for all SATCOM planning matters. RSSCs interact with each other, consolidated – SATCOM systems expert, JFCC SPACE, spectrum specific global watch officers, and Service unique satellite command and control centers to coordinate and facilitate the implementation of their plans.

6-63. USASMDC/ARSTRAT provides key management personnel for each RSSC, which includes a director, operations noncommissioned officer, and administrative assistant. Furthermore, each RSSC consists of individual SATCOM spectrum planning cells staffed by respective Service or agency as depicted in figure 6-11. USASMDC/ARSTRAT is assigned management responsibilities for day-to-day operations but each Service and or agency has administrative control responsibilities for their respective assigned personnel. The RSSCs conduct operations a continuous, 24-hour basis.

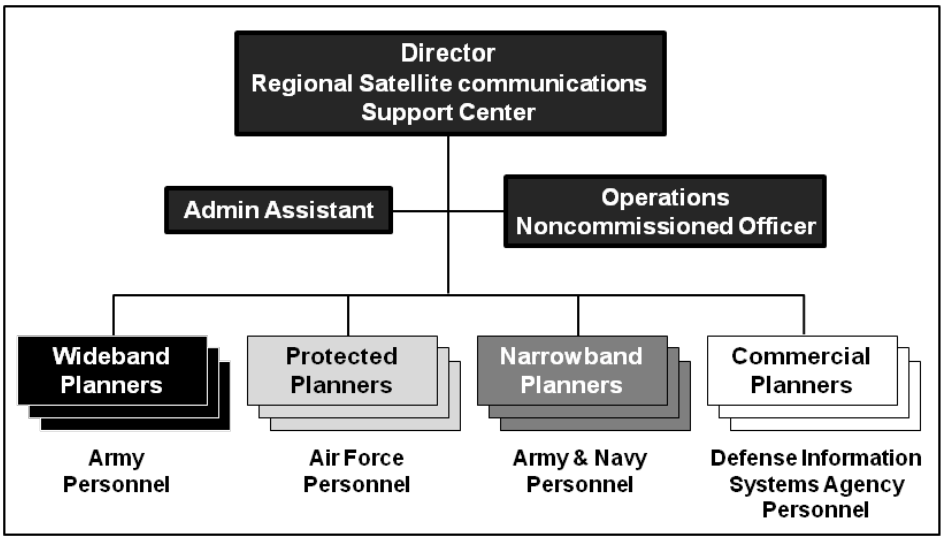

Figure 6-11. RSSC staffing and organization

6-64. The RSSCs are staffed with planners from each USSTRATCOM service component and DISA. The planners are proficient in dealing with management and control issues for their particular systems. Current staffing responsibilities are identified below.

- Army (USASMDC/ARSTRAT): Wideband and or SHF SATCOM such as DSCS, WGS, and Global Broadcast Service and narrowband and UHF SATCOM such as Mobile Users Objective System.
- Navy (Naval Fleet Cyber Command): Narrowband and legacy UHF SATCOM such as Fleet SATCOM and UFO.
- Air Force Space Command: Protected and Advanced EHF SATCOM such as Milstar, Advanced EHF, and selected EHF payloads on UFO.
- DISA: Commercial SATCOM such as C, Ku, Ka, X band fixed, and mobile satellite services.

RSSC TASKING PROCESS

6-65. The RSSCs employ standardized processes for operational management of SATCOM resources. These processes are described in the USSTRATCOM SI 714-04. Figure 6-12 on page 6-16 outlines the primary process for requesting SATCOM access. Request for additional support and products described above can be made via the appropriate combatant commander or in many cases directly to the RSSC.

6-66. A unit requiring satellite access submits a satellite access request via its theater chain of command, including the theater Service component, to the combatant commander communications directorate, Service, or Agency for review and validation.

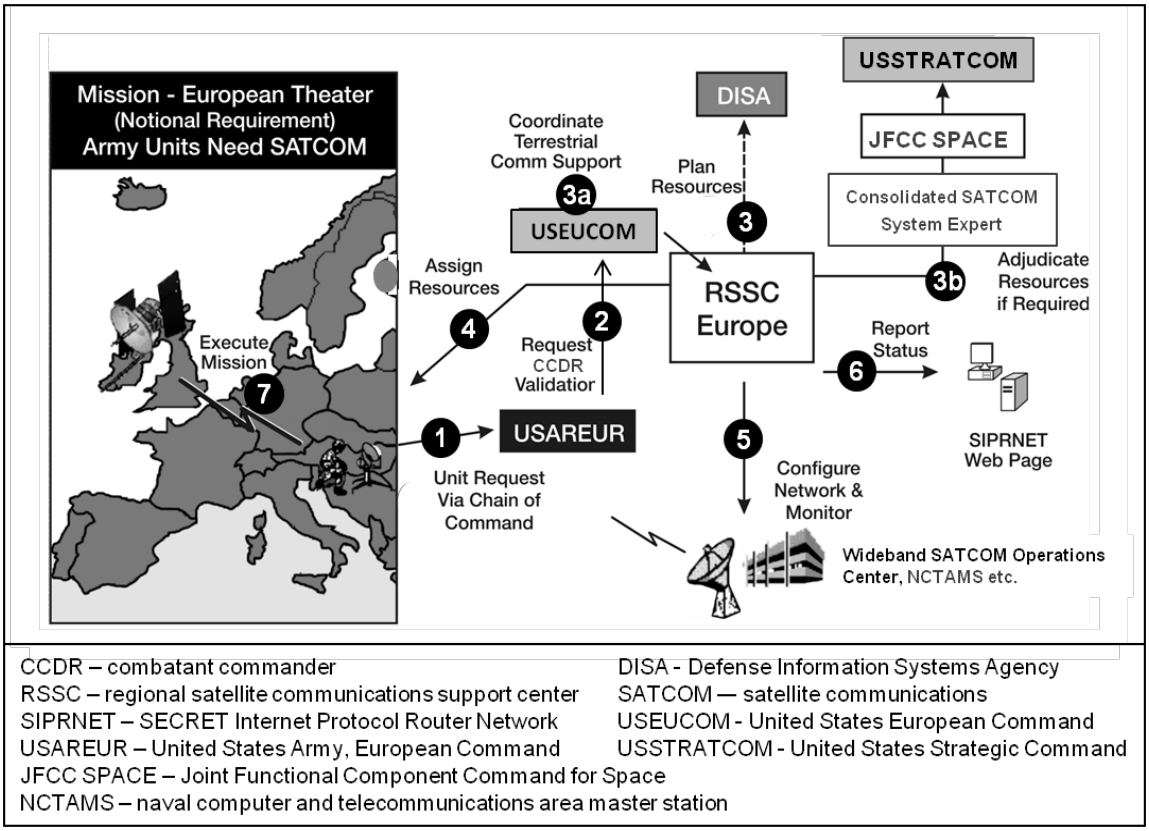

Figure 6-12. Requesting SATCOM access

6-67. A validated satellite access request is sent to the appropriate RSSC for analysis and planning. If sufficient resources are available, the RSSC develops a satellite access authorization, coordinates pertinent terrestrial interfaces, provides data for satellite configuration and control, and reports its status. If resources are unavailable, the request is denied and sent to the combatant commander communications directorate 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.

6-68. Approved satellite access authorizations are sent to the originating unit authorizing operational access. Additionally, RSSCs direct and coordinate resource configuration directives with satellite operations centers (such as WSOCs, detailed below), which implement and monitor communication plans.

6-69. Although the individual satellite operations centers have primary responsibility for monitoring and troubleshooting active networks, RSSCs liaise with combatant commanders, consolidated SATCOM system experts, users, and control centers to maintain situational awareness and respond to changing demands and requirements.

6-70. RSSC Contingency Deployment. 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, joint task force, joint or theater communications control centers, or supported combatant command component headquarters. This provides the theater commanders short-term, direct access to the resident SATCOM planner in the RSSC.

6-71. RSSC Augmentation. An RSSC may require additional support for extreme workloads during contingencies, equipment failures, or personnel losses. The RSSC receives augmentation support from another RSSC or USASMDC/ARSTRAT G-6 staff to ensure consistent support to operational forces.

WIDEBAND SATCOM OPERATIONS CENTER

6-72. WSOCs provide satellite payload and transmission control for DOD communications satellites providing wideband SATCOM for military forces. Strategic wideband SATCOM is used to carry high volumes of communications through large terminals located around the world. The primary means for reachback communications from in-theater headquarters to those in continental U.S. is via wideband SATCOM through DSCS and WGS satellites.

6-73. The WGS program has established international partnerships with Australia, Canada, New Zealand, Denmark, Luxembourg, and the Netherlands. International memorandums of understanding allow these countries to provide funding to support the acquisition of additional WGS spacecraft in return for a percentage use of the WGS constellation.

6-74. The WSOCs are the focal point for:

- Conducting payload command and telemetry functions;
- Transmissions monitoring functions; and
- Strategic and tactical terminal control functions for DSCS and WGS satellites.

6-75. WSOC responsibilities include:

- Controlling terminal access;
- Maintaining operational databases;
- Responding to transmission anomalies and alarms;
- Monitoring the health and status of the spacecraft;
- Monitoring for unauthorized users and electromagnetic interference;
- Evaluating the quality of communication links and the implementation of restoral plans on a 24-hour basis; and
- Reporting SSA information.

WSOC MISSION COMMAND

6-76. USASMDC/ARSTRAT, through the 53rd Signal Battalion (SATCON), provides mission command and operational direction for the WSOCs, including operational control responsibility. The Wideband consolidated SATCOM system expert provides technical direction and the RSSCs provide satellite authorizations for the communications payload direction to the WSOCs.

6-77. The five WSOCs are geographically located to provide continuous, 24-hour coverage of all assigned satellites. Each company of the 53rd Signal Battalion (SATCON) is strategically positioned to provide mission command for one or more DSCS and WGS satellites. Figure 6-13 on page 6-18 provides an illustration of the battalion's mission, which includes transmission control, assured access, and payload control.

WSOC CAPABILITIES

6-78. Five geographically dispersed WSOCs provide DSCS and WGS communications payload control. The 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. Additionally, three WSOCs operate the Eagle Sentry mission in support of interference detection, spectrum monitoring, and integrated geo-location capabilities. All WSOCs perform interference detection and spectrum monitoring.

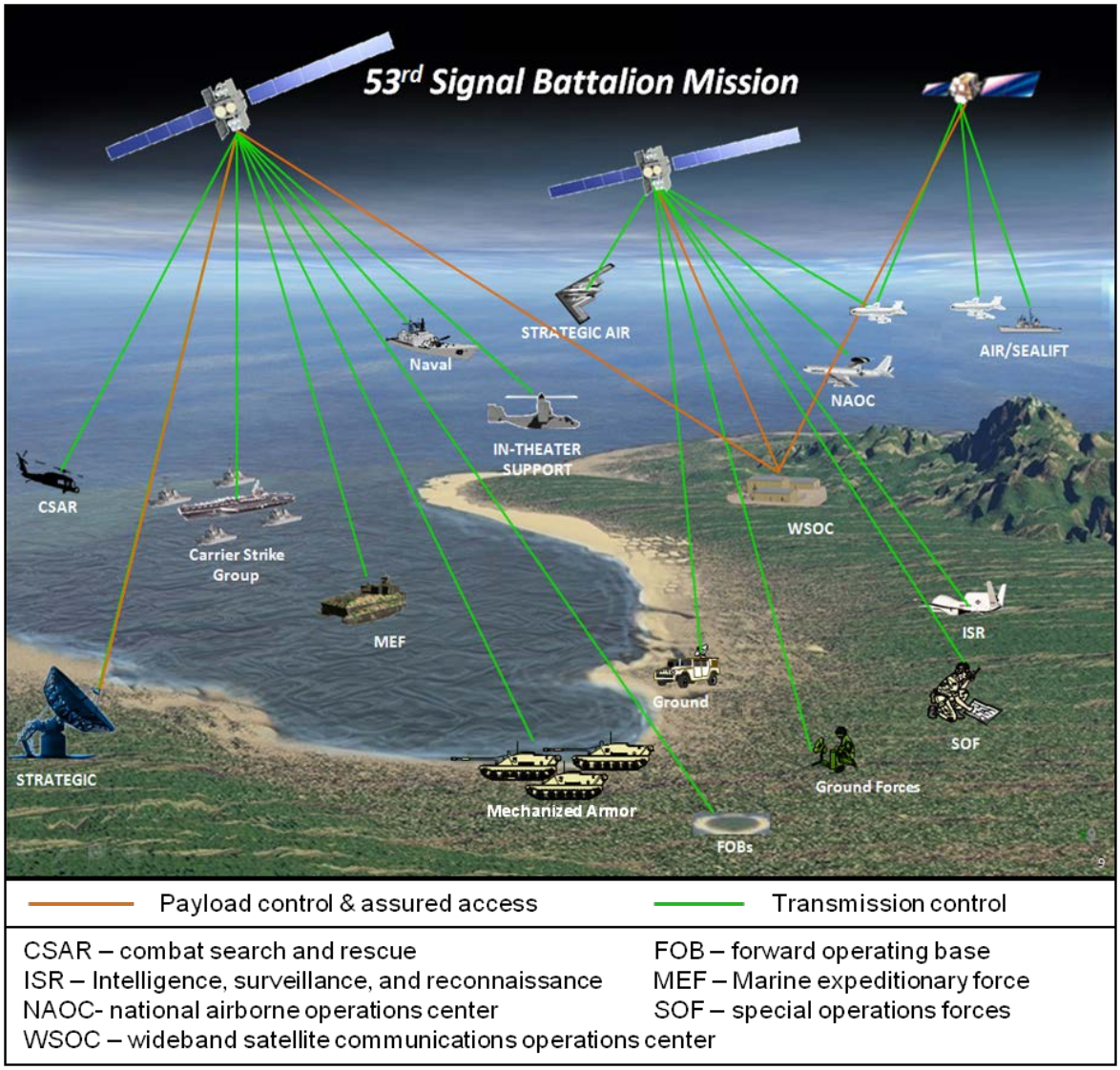

Figure 6-13. 53rd Signal Battalion (SATCON) mission overview

6-79. WSOCs also conduct transmission control. The WSOCs ensure users do not exceed their allocated share of power and bandwidth resources. WSOC personnel manage satellite resources and monitor user's compliance with established directives and resource allocations. The WSOCs implement the rules of access, bandwidth, and frequency allocations. Through this system, the WSOCs provide continuous worldwide support to the President of the U.S., the Joint Chiefs of Staff, the State Department, intelligence communities, the combatant commanders, Services, and international partners in their various communications missions.

6-80. WSOC Tasking Process. The WSOCs are tasked by the appropriate RSSC to execute satellite payload configuration changes, thereby implementing payload and transmission control. Upon detailed allocation planning for SATCOM resources, the RSSCs task the appropriate WSOC in accordance with configuration management requirements levied by the wideband consolidated SATCOM system expert. The wideband consolidated SATCOM system expert acts in part on direction from JFCC SPACE and USSTRATCOM, taking into consideration combatant commander and other communications requirements from around the world and direction from the Joint Staff in accordance with CJCSI 6250.01E.

Chapter 7

Space Support Elements

The Army deploys specialized Army Space Support Teams to support Army corps and divisions, other Services, Joint task forces, and multinational forces.

Lieutenant General David L. Mann
Commanding General, USASMDC/ARSTRAT
Senate Armed Services Committee Statement
12 March 2014

This chapter discusses specific roles and functions of SSEs in the Army, corps, and divisions. The SSE is the commander's primary advisor on space operations. The SSE plans, integrates, and coordinates space force enhancement across all warfighting functions. The SSE plans, integrates, and coordinates space control and SSA activities. The SSE provides space analysis and expertise, and specific products to the staff and subordinate units. An ARSST may augment the SSE under certain circumstances, such as when the headquarters is serving as the joint forces land component command or joint task force headquarters, or when the number of subordinate units requiring space support exceeds the capacity of the SSE to support.

ARMY HEADQUARTERS SSE

7-1. The Army Service component command SSE mission is to provide enhanced Army space support to the combatant commander and Title 10 support to Army space forces deployed in the Army Service component command's area of operations. The Army Service component command SSE is assigned to the G-3, and provides organic space operations planning, support, and integration for the commander, staff, assigned and attached subordinate units. The Army Service component command SSE supports all combatant commander space-related operational missions by properly planning and coordinating with all Army space forces supporting the theater commander. The SSE is responsible to provide recommendations for space-based support, forces, and interfaces required to support Army operations in a joint operations area. The senior Army space operations officer in the Army Service component command is the primary space staff advisor to the Army Service component commander. The SSE will coordinate any space augmentation requirements prior to deployment and ensure the augmentation is troop listed and deploys with the Army Service component command. The SSE provides the following functions and capabilities:

- Provide space-based expertise, services, and training where applicable;
- Provide space input and develop the space portion of the MDMP;
- Develop the space estimate;
- Recommend space-specific priority intelligence requirements to the G-2;
- Ensure G-6 awareness of SATCOM capabilities;
- Provide support to information related capabilities;
- Integrate USSTRATCOM-unique capabilities for missile warning, PNT, environmental monitoring, and SATCOM capabilities into staff planning; and
- Be prepared to perform special technical operations duties and responsibilities, as directed.

7-2. In Army and joint organizations, the senior FA40 may be designated as the command's chief for special technical operations. When directed to fill this position as an additional responsibility, duties

include managing billets for the command, oversight of special technical operations planning, exercises, operations, and inspections.

7-3. The SSE routinely works with other members of the coordinating and special staffs such as the intelligence cell, signal operations, network operations, movement and maneuver cell, AMD section, fires cell, and staff weather office element. The SSE focuses on the integration of the wide range of space capabilities across all warfighting functions. The SSE educates members of the staff to ensure they are fully aware of space capabilities, limitations, and vulnerabilities that pertain to the various warfighting functions. The SSE may request ARSSTs to provide space support capabilities required for theater-level subordinate commands.

7-4. The SSE's primary analytical tool is the DCGS-A workstation with Army approved space-unique and space-related applications, which may connect to the SIPRNET. The analytical tools on the DCGS-A workstations provide the SSE with the necessary equipment to accomplish their required tasks.

CORPS AND DIVISION SSE

7-5. If the corps commander is designated as the joint force land component commander and SCA is delegated to this commander, the SSE within the corps supports the joint force land component commander with planning and operations in the role as the SCA. When the requirements of serving as the SCA exceed the capabilities of the corps, the corps SSE may be augmented by a tailored space support package from the 1st Space Brigade, an SSAPT, an ARSST or joint organizations to enable this functionality.

7-6. The corps is the principal integrator of space capabilities in support of unified land operations, and headquarters each contain an SSE. The Army relies on space-based capabilities such as PNT, SATCOM, missile warning, environmental monitoring of the space environment, and information collection. These capabilities are critical enablers used by the corps and division to plan, communicate, navigate and maneuver, maintain situational awareness, engage the enemy, provide missile warning, and protect and sustain forces.

7-7. Within the division staff, the SSE is organic to the movement and maneuver cell in the current operations section. The SSE provides, plans, coordinates, and integrates space force enhancements and space control for corps, division, and subordinate units. The SSE performs the day-to-day staff functions required to execute SCA, should the commander be so designated. The SSE coordinates directly with the joint SCA, normally the joint force air component commander, for support by space-based systems to meet corps requirements. An SSE may be augmented by an ARSST.

7-8. The corps mission command structure has four design requirements. The corps serves as the Army component and senior Army headquarters for all Army forces assigned to the combatant commander. Depending on the scope of the mission, the corps headquarters can serve as a joint task force or joint force land component commander with the appropriate joint augmentation. It can function as an intermediate tactical headquarters in a major combat operation. Each corps contains an SSE in the movement and maneuver cell. For operational space planning, all land component coordination runs up to the corps headquarters. If serving as a joint task force or joint force land component commander headquarters, the SSE should consider requesting ARSST augmentation.

7-9. The primary tactical warfighting headquarters is the division. The primary task of the division headquarters is to direct the operations of its subordinate brigade combat teams and supporting brigades. The division contains the resources needed to be an Army forces headquarters during the conduct of a crisis response or limited contingency operations without additional Army augmentation, but requires substantial augmentation to serve as a joint task force or joint force land component commander headquarters. Each division contains an SSE in the movement and maneuver cell. Due to the small size of the division SSE, it requires augmentation to perform 24-hour operations if serving as a joint task force, joint force land component commander, or Army forces headquarters. When the number of subordinate brigades exceeds the capacity of the SSE to provide effective support, augmentation by an ARSST should be requested.

7-10. The division headquarters is a modular mission command organization capable of directing decisive operations. The Army builds expeditionary force packages around the division headquarters. As the Army's primary warfighting headquarters, the division conducts decisive, shaping, and sustaining operations that translate operational-level goals into tactical action.

7-11. As in the Army Service component command, the corps or division SSE routinely works with other members of the coordinating and special staffs to integrate space capabilities across all warfighting functions.

INTERNAL COORDINATION RESPONSIBILITIES AND TASKS

STAFF COORDINATION, RESPONSIBILITIES, AND TASKS

7-12. The coordination responsibilities discussed below as they pertain to the intelligence cell, movement and maneuver cell, and G-6 are guidelines for staff interaction at the theater Army and corps level. At the corps these staff sections are the intelligence cell, movement and maneuver cell, and G-6. At the division level these staff sections are: the intelligence cell, movement and maneuver cell, G-6 and network operations. The SSE does not provide unilateral answers about space capabilities that should be provided by other command staffs who have warfighting function proponency. In all cases, the SSE coordinates all space-related actions with the appropriate command and staff.

7-13. The SSE maintains awareness of the total space picture and has in-depth understanding of the space mission command elements, such as the joint force commander with SCA and its supporting staff. The SSE maintains contact with other space teams, such as the subordinate unit SSEs, ARSSTs, and TMW detachments, as well as other teams such as national intelligence support teams and sister Service space capabilities. The SSE pursues any direct liaison authority clearances that are needed but not already directed. Gaining necessary situational understanding requires the SSE to network actively with a space community that will very likely be dynamic and different from theater to theater.

7-14. The SSE is charged to:

- Develop space requirements;
- Maintain the space portion of the COP;
- Plan, integrate, and coordinate space force enhancement, SSA, and space control capabilities;
- Provide space-based expertise and services; and
- Provide space input to the MDMP.

7-15. To properly execute assigned tasks, the SSE maintains awareness of the challenges the unit faces and is prepared to offer potential space solutions, when applicable.

7-16. The major contribution of the SSE to planning is support to the MDMP and development of Annex N (Space Operations) to the base order. Commanders and staffs use Annex N (Space Operations) to describe how space operations support the concept of operations described in the base plan or order. The SSE is fully involved in the process, flow of information, and decisions in the headquarters. Additionally, the SSE works closely with the entire staff to ensure space support is optimized to all warfighting functions. However, the majority of the SSE's time is focused on the intelligence cell, movement and maneuver cell, and G-6 section at the Theater Army level (or equivalent staff sections at corps and division) because these staffs rely most heavily on space capabilities. Discussed below is how the SSE integrates into MDMP planning, followed by specific ways the SSE works with the coordinating staff elements. Refer back to the planning section of chapter 5for how SSEs support the MDMP.

G-2, INTELLIGENCE CELL

7-17. SSE coordination with intelligence cell includes the following:

- Develop the space analysis contribution to the IPB (see Chapter 8, Section I);
- Assist Intelligence cell with development of space-related priority intelligence requirements information and recommend its inclusion in the collection plan;
- Assist Intelligence Cell with incorporating space capabilities into personnel recovery and combat search and rescue plans, operation drills, and operations;
- Maintain the space portion of the COP by regularly reviewing space products. Ensure the analytical control element is aware of significant space data to incorporate into the all source analysis effort;
- Provide space-related requirements to the collection manager;
- Analyze effectiveness of missile warning architecture to identify threat missile activity and support battle damage assessment and situational awareness requirements. Ensure Intelligence Cell staff is aware of missile warning constellation technical intelligence and battle space characterization capabilities;
- Provide space environment assessments and integrate space environment updates into the space estimate;
- Determine and monitor vulnerabilities to supporting space-based surveillance, reconnaissance, or attack; and
- Apprise the Intelligence Cell of ongoing or available space control protection measures.

G-3, MOVEMENT AND MANEUVER CELL OR FIRES AND EFFECTS CELL

7-18. SSE coordination with movement and maneuver cell includes the following:

- Monitor status of friendly space systems, platforms and operations to maintain that portion of the COP. Ensure appropriate staff elements are able to access the space portion of the COP for space-related issues that may affect the operation;
- Maintain close coordination with the staff 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, and fragmentary orders;
- Provide recommendations to apply military, civil, and commercial space systems and concepts for land force applications;
- Brief the movement and maneuver cell on the capabilities and roles of the ARSST, and integrate the ARSST into daily operations. The ARSST provides space products and support, and allows the SSE to sustain continuous space duty staff capability;
- Coordinate for space control protection;
- Coordinate for SATCOM electromagnetic interference resolution, GPS electromagnetic interference resolution, and PNT augmentation to support operations;
- Coordinate with the knowledge management section to ensure GPS capabilities, to include FFT, are optimally supporting the Army, corps, or division, and subordinate elements;
- Provide information on the capabilities and limitations of U.S. space and associated ground systems. Assist in ensuring space-related support is available within theater, such as TMW and GPS;
- In concert with the intelligence cell, G-6 section, signal operations, network operations, analyze and monitor the command operations security posture from a space perspective;
- In concert with the intelligence cell, movement and maneuver cell, fire support coordinator, and G-6, nominate enemy space assets for targeting, as required;
- Ensure space capabilities are fully integrated into unmanned aerial systems;

- Implement space control prevention measures to prevent the enemy from using friendly and foreign systems, such as communications channels and GPS signals; and
- Ensure that critical ground segments of friendly space systems are designated as restricted operations zones in the airspace command and control element plan and are on the air defense or theater missile defense defended asset list.

7-19. SSE coordination with the plans cell includes the following:

- Upon receipt of mission, provide space-based capabilities and products to the planning staff during the MDMP by:
  - Analyze higher headquarters mission and commander's intent from a space perspective;
  - Develop the space estimate by coordinating with other cells and elements during mission analysis. The space estimate will specifically address the capabilities and effects on operations of GPS and PNT; FFT; missile warning, in coordination with the AMD Section; SATCOM, in accordance with the G-6 section, signal operations, network operations planner; space control capabilities, limitations, and asset availability; and satellite operational status;
  - Recommend space-specific commanders' critical information requirements, priority intelligence requirements, friendly forces information requirements, and essential elements of friendly information;
  - Provide space input to COA analysis; and
  - Integrate national level asset capabilities into staff planning, to include: ballistic missile warning, PNT, environmental monitoring, and SATCOM capabilities;
- Integrate the ARSST with the MDMP planning effort, if applicable;
- Coordinate with the personnel recovery and combat search and rescue cell to optimize GPS for these missions;
- Analyze the potential employment of additional (other than ARSST) USASMDC/ARSTRAT operational capabilities; and
- Write Annex N (Space Operations) for the operation plans and orders after a COA is selected and approved.

G-3, INFORMATION OPERATIONS ELEMENT

7-20. SSE coordination with G-3 Section, information operations, includes the following:

- Provide information on space-based products that could support information related capabilities requirements;
- Provide a representative to information related capabilities working groups;
- Include information related capabilities requirements in the space operations appendix to Annex N (Space Operations);
- Coordinate information related capabilities requirements with higher headquarters SSEs;
- Coordinate with the G-3 to include enemy space system elements in the targeting process; and
- Provide insight into the friendly, enemy, and rest-of-world space orders of battle and friendly space operational status.

CHIEF OF SUSTAINMENT

7-21. SSE coordination with the assistant chief of staff, logistic sustainment section includes the following:

- Provide an understanding of in-transit visibility tracking architectures;
- Provide an understanding of FFT architectures supporting sustainment;

- Provide GPS navigational accuracy predictions in support of precision sustainment; and
- In concert with the geospatial cell, enable assistant chief of staff, logistic sustainment section to request and receive main supply route space-based imagery.

G-6, SIGNAL OPERATIONS

7-22. SSE coordination with G-6 section, signal operations, network operations includes the following:

- Through the COP, provide environmental impacts on SATCOM and from enemy threat to SATCOM and terrestrial communications;
- Through the COP, provide awareness of all military and commercial SATCOM capabilities that may contribute to unit mission accomplishment;
- Through the COP, provide status of supporting SATCOM systems, to include known deficiencies and announced service interruptions and unannounced service interruptions;
- Coordinate for space control protection; assist the G-6 section, signal operations, and network operations in developing space control protection priorities;
- Coordinate for SATCOM and GPS electromagnetic interference resolution;
- Determine and recommend to the G-6 section, signal operations, and network operations SATCOM related essential elements of information;
- Ensure G-6 section, signal operations, and network operations is aware of Army SATCOM mission command organizations that contribute to operational contingency support;
- Provide information on the space coordination network within theater, specifically, the location and mission of the entity delegated SCA and ASCE, if applicable;
- In coordination with the movement and maneuver cell and knowledge management section, provide information on tracking such as FFT systems architecture to support G-6 section, signal operations, or network operations troubleshooting; and
- In coordination with the G-2, G-3, facility engineer, and knowledge manager, plan the various hardware and software platform integrations of supporting space forces such as ARSSTs, into the supported unit's communication and information networks.

ASSISTANT CHIEF OF STAFF, CIVIL AFFAIRS, CIVIL AFFAIRS ELEMENT

7-23. SSE coordination with assistant chief of staff for civil affairs, civil affairs section includes the following:

- Provide information on space-based products that could support civil-military requirements; and
- Include civil-military operations requirements in the space operations appendix to the civil military operations annex.

AMD SECTION OR ELEMENT

7-24. The SSE must not attempt to duplicate the air defense role in warning and dissemination. Coordination with the AMD section or element includes the following:

- Through the COP, advise the AMD section or element on the status of TES elements' effectiveness and ability to support command theater ballistic missile early warning requirements; and
- Ensure dissemination and warning of theater ballistic missile attacks is timely and accurate. Provide staff training on capabilities and limitations of the OPIR constellation and other TMW assets.

EXTERNAL COORDINATION RESPONSIBILITIES AND TASKS

7-25. The space command and control and technical channels may be different in every theater of operations; therefore, this section is intended to provide general guidelines for SSEs to conduct coordination with units, forces, and agencies external to the Army chain of command.

7-26. SSEs maintain connectivity with other SSEs and various worldwide operations and analysis centers. These include, but are not limited to:

- The Joint Space Operations Center;
- The GPS operations center;
- USASMDC/ARSTRAT operations center;
- The commander delegated SCA staff;
- The ASCE, if one is present;
- Higher echelon SSEs;
- Adjacent SSEs;
- Army components and Service components from adjacent Services with space expertise;
- Lower echelon SSEs; and
- ARSSTs supporting units without SSEs.

7-27. Space Support Request. The senior space officer with SCA may establish a space support request procedure for creating, submitting, prioritizing, and synchronizing requests for space force enhancement, SSA, space control services, products, and effects. SSEs should forward space support requests to the appropriate addressee, normally the staff supporting the commander delegated SCA. SSEs should handle space support requests in the following manner:

- Resolve space support requests at the lowest echelon possible;
- Coordinate space requirements with higher headquarters SSEs;
- Satisfy space operations requirements with organic capabilities if possible; and
- Space support requests may eventually reach the Joint Space Operations Center and be further disseminated to other space related units or agencies.

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Chapter 8

Space Products

The three separate products the SSE prepares are the space-unique inputs to the IPB, the space estimate, and Annex N – Space Operations. The space estimate is prepared as a tab to the Annex N to the operation plans, while the SSE provides space input to the intelligence cell's IPB activity. Both the space estimate and space input to IPB process are systematic, continuous methods of analyzing and documenting factors affecting space capabilities that affect the operational environment. 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 estimates and the MDMP. The purpose of the space estimate is to consider systematically the space dimension of the area of operation. This chapter outlines the necessary content of space analysis as a tool to identify how space influences the operations.

SECTION I – SPACE INPUT TO IPB

PURPOSE

8-1. The purpose of space input to the IPB is to provide the intelligence cell and other staff elements, with a highly detailed analysis of the space domain and its capabilities and effects within the operational environment. IPB is an analytical methodology to reduce uncertainties concerning the enemy and the operational environment, in three dimensions, and fuses air, space, terrain, and weather into a consolidated, coordinated assessment. IPB is the key to preparing for the next engagement and, during peacetime, builds the foundational data that will be updated and enhanced continuously and simultaneously during operations.

8-2. An enemy's access to space and or space control capabilities can generate effects that impact across the levels of war. Space input to IPB conducted at the maneuver unit level to support combat operations needs to be a highly focused effort directly impacting the mission or operations that leverages the results of the JFCC SPACE space IPB production program. This multi-agency intelligence production effort is designed to augment a combatant command's joint IPB tailored to assessing enemy usage of space and space control systems with predictive courses of action. The space IPB process executed at JFCC SPACE is a continuous all-source intelligence production effort tailored to support combatant commander contingency plans and operation plans in existence.

8-3. The SSE should coordinate through the intelligence cell for access to existing JFCC SPACE IPB products during mission analysis. If the SSE's area of responsibility doesn't have an available space IPB product, or if further tailoring is necessary, the SSE should submit an intelligence requirement through the collections manager to JFCC SPACE. The SSE and intelligence cell should review the joint space IPB to understand the enemy's use of the space domain, space order of battle, and space control courses of action to integrate into the unit IPB process. Based on the intelligence cell's limited capacity to focus on the space domain, the SSE should lead the space threat analysis effort, which will eventually be incorporated into the overall intelligence estimate.

8-4. Based on mission variables, 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 may significantly affect operations involving communications, navigation, threat warning, weather monitoring, reconnaissance, and surveillance. Throughout all phases of an operation (from pre-deployment

to mission completion), the space impact on military operations is a key factor for which the commander plans. The SSE, in coordination with the rest of the staff, conducts the space estimate process and space input to IPB, and makes the products available to the staff and the commander.

SPACE INPUT TO THE IPB PROCESS

8-5. The SSE provides all space unique IPB products for integration to the intelligence cell. These space unique products are incorporated into the IPB products generated by the intelligence cell for use in the planning, preparing, and executing of all operations. The SSE coordinates closely with the intelligence cell to reduce the potential for redundant analysis.

8-6. The four steps of IPB (per ATP 2-01.3, *Intelligence Preparation of the Battlefield/Battlespace*) adequately describe the process required for the SSE to provide the space input to IPB. However, as part of the overall mission analysis effort, step 4 also supports the space estimate with linkage to the army warfighting functions. This is done because the SSE must evaluate the overall capability of the threat to attack or degrade U.S. space operations, and this needs to be reflected in graphic format as part of the space IPB. The four IPB analysis steps are:

- Describe the operational environment;
- Describe the environmental effects on operations;
- Evaluate the threat; and
- Determine threat courses of action.

STEP 1—DEFINE THE OPERATIONAL ENVIRONMENT

Identification of Space Area of Interest

8-7. Step 1 begins with identification of the supported unit area of operations. Once the area of operations is identified, the area of interest is coordinated with the intelligence cell. Based on a clear understanding of the operational commander's area of operations, the intelligence cell specified area of interest, and the supported unit mission, the SSE determines a separate and distinct space area of interest. The space portion of the area of interest supports and complements the total intelligence cell and movement and maneuver cell effort and is designed to depict the relevance of space to the maneuver commander's engagement.

8-8. The space portion of the area of interest includes the region above and adjacent to the ground portion of the area of operations as illustrated in figure 8-1. The SSE may further subdivide the space area of interest in named area of interests that roughly correspond to low, medium, and highly elliptical Earth orbits. It starts at ground level, continues through low Earth orbit, and terminates with the geosynchronous Earth orbit and above. Satellites moving through the identified space area of interest, space weather, and key terrestrial space-related locations (and associated terrestrial weather) are all considered in the space input to IPB. Space-related activity occurring anywhere outside of the designated space area of interest (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. Identification of the space area of interest should help answer questions, such as:

- What is the status and capabilities of U.S. satellites to support the mission?
- Is the satellite orbit conducive to support operations within the area of operations?

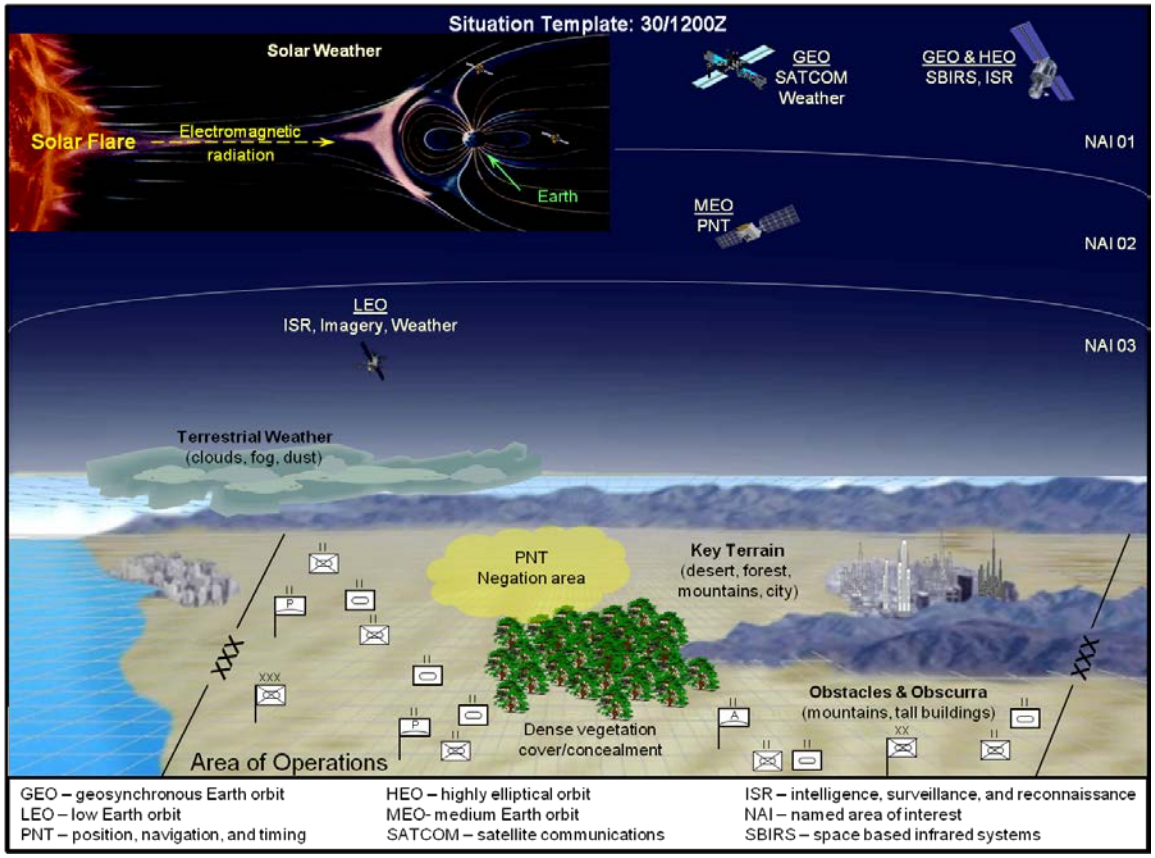

Figure 8-1. Situation template with space area of interest

Initial Examination

8-9. Once the space area of interest is identified, the SSE begins an initial examination, in conjunction with the other staff elements, of available information and knowledge gaps that need to be addressed. During the initial examination, the following issues may help determine the information and knowledge gaps and areas where space-based sensors may be requested:

- Impact of solar and terrestrial weather on space operations;
- Initial assessment of enemy space capabilities;
- Initial assessment of commercial space, and how it may impact both enemy and friendly operations; and
- The operational status of friendly space systems, availability, and importance to mission accomplishment.

STEP 2—DESCRIBE THE ENVIRONMENTAL EFFECTS ON OPERATIONS

8-10. 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 intelligence cell effort. In fact, this step is conducted in close coordination with the intelligence cell staff weather officer and terrain team to ensure a complementary effort.

Impact of Solar Weather

8-11. 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 magnetic 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 may potentially degrade both commercial and military capabilities for periods ranging from several minutes to a few hours to more extreme impacts such as loss of system performance. In extreme circumstances, solar weather may cause a loss of system performance. The potential for solar weather to disrupt friendly, civil, commercial, and enemy space systems needs to be integrated early during step 2. Table 8-1 is a summary of a space estimate product reflecting the space weather effects in an area of operation.

Table 8-1. Solar weather impact summary

Space Weather Threat	*Systems impacted*	*Effects*	*Support available*
Solar flare (X-rays)	• High frequency communications	• Shortwave fade	• Shortwave fade advisory
Solar radio bursts	• Radars • Ultrahigh frequency satellite communications	• Frequency interface • Target mask	• Solar radio burst advisory
Ionospheric scintillation	• Ultrahigh frequency satellite communications • Global Positioning System	• Signal fade • Loss of signal lock	• Scintillation forecast • Post event assessment

8-12. 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; and
- Solar wind events that cause ionospheric scintillation in the polar areas and impair or disrupt SATCOM and GPS signals.

Impact of Terrestrial Weather

8-13. The second task of step 2 is determining the impact terrestrial weather will have on space operations. The staff weather officer has access to the Air Force Weather Agency and to the theater specific weather support element databases of terrestrial weather information for the area of operations. The SSE tailors the staff weather officer product to the space analysis effort. For example, the impact on space capabilities will be considerably different during monsoon season in parts of the United States Pacific Command area of responsibility when compared to the stable, high pressure weather conditions which are common over much of the United States Central Command area of responsibility. The SSE develops a thorough understanding of the mission and effectively analyzes the linkage between terrestrial weather and space capabilities.

8-14. Some factors related to weather analysis include:

- Terrestrial weather, such as heavy precipitation, can interfere with SATCOM reception; particularly when operating in frequencies of 10 GHz and higher-KU band (upper level SHF) and above EHF;
- Cloud cover impacting collection of electro-optical imagery and data;
  - Interference with electro-optical, multispectral imagery, and infrared collection;
  - The high moisture content in cloud cover can hinder the infrared detection capability of missile warning sensors; and
- Degradation of space-based infrared due to cloud cover. If there is a missile threat, the SSE determines if cloud cover inhibits detecting and reporting on threat missile launches.

Relation Between Terrain and Space Support

8-15. The third task of the area of operation effects analysis effort focuses on the relation between terrain and space support. It must be understood that while terrestrial impacts are typically addressed in other sections of the IPB, the SSE must consider terrain impacts on the space information chain. For example, in restrictive terrain, line of sight issues may restrict access to space systems and result in degraded operations. Analysis for space-based products and services may be evaluated automatically or through observation and fields of fire, avenues of approach, key terrain, obstacles, and cover and concealment. Some examples of how terrain impacts space are identified below.

- Mountainous terrain may impede the basic line of sight between a satellite and a ground terminal or receiver (primarily SATCOM and GPS). Communication satellites in a geosynchronous orbit with inclinations may move the satellite in and out of the line of site of a receiver due to their figure eight ground trace. Mountains and buildings may also affect GPS accuracy. GPS signals from a satellite may experience multi-pathing, which occurs when the signal is reflected off a mountains or buildings on the way to a receiver. The timing of the GPS signal is affected which affects the accuracy of the receiver. Though this should only be a minor problem for navigation, it has the potential for a greater impact on GPS guided munitions.
- Information collections systems may also be impacted by terrain as off-center imagery collection may be blocked by mountains and tall buildings. If this happens, the satellite cannot take an image to complete its mission until another revisit provides a better angle.
- Vegetation may also be a consideration when conducting the space related terrain analysis. Dense jungles may require a higher reliance on UHF communications, GPS signal reception may be impeded, and panchromatic imagery will only provide a black and white image of the top of the forests with no penetration. However, multispectral imagery may be able to detect changes in vegetation (destroying, modifying, camouflage) that indicate enemy activity.

STEP 3 – EVALUATE THE THREAT

8-16. Step 3 transitions from an orientation on the environment as a whole to a detailed focus on enemy capabilities. The SSE coordinates with the intelligence cell 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, and an initial assessment of adversarial space courses of action.

8-17. In step 3 of the IPB process, the SSE will coordinate with the intelligence cell for an examination of key enemy space capabilities including use of civil and commercial space assets. The SSE needs to ensure the intelligence cell understands the resulting intelligence products are important and will provide support to the intelligence cell as requested. Important factors to include in step are below.

- Assist the intelligence cell in developing information requirements for intelligence support to space operations.
- A detailed review of the adversarial space threat characteristics and the potential commercial space threat characteristics available to support enemy operations. Knowledge of the space

threat characteristics is the necessary first step to understanding the threat. As part of this initial analysis, the SSE needs to consider enemy counter-space capabilities.

- An identification of space capabilities that will probably be employed by the enemy in the specific operation that the SSE is analyzing. These enemy space capabilities include organic space systems, third-party space support, enemy access to space via consortia, and direct enemy use of commercial space assets.
- An analysis of the following factors, regarding enemy force enhancement operations:
  - Reconnaissance and surveillance. What are the near-space and space-based (organic, commercial, third-party) information collection systems available to support military operations? Does the enemy use space reconnaissance and surveillance for strategic or tactical operations? What are enemy tasking, collection, processing, exploitation, and dissemination capabilities for space-based reconnaissance and surveillance? Does the enemy 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 SSE should consider what threat 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 SSE does not need to analyze threat missile targeting strategies (intelligence cell 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 enemy? Determine the doctrinal employment of these systems.
  - PNT. To what degree does the enemy rely on space-based PNT? What are the key adversarial capabilities that rely on PNT? How is it incorporated into critical operations?
  - SATCOM. What key military and commercial SATCOM systems does the enemy employ? What is the reliance of the enemy on SATCOM to perform effective mission control?
- A review of the enemy's space control capabilities, which includes:
  - Jammers, ground-based electronic warfare, 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 to include satellites, data links, and ground control segments; and
  - 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 tasking, collection, processing, exploitation, and dissemination process for space surveillance and reconnaissance.
- A recommendation of space-related high-value targets. These high-value targets could be vulnerabilities uncovered by analysis or those used to support a specific friendly force mission objective. The SSE should assist the movement and maneuver cell in developing the targeting strategy for nominating high-value targets as part of the targeting process to provide space targeting focus to the Intelligence Cell staff. The high-value targets should be considered for potential negation operations.
- An analysis of general space-related COAs based on enemy doctrine, accessibility to space assets, and the enemy's operational objectives. Examples include:
  - What type of space capabilities will be most relied upon, such as information collection, SATCOM, and or PNT; and
  - How the enemy will attempt to attack friendly space assets and or protect their forces from U.S. space operations.

STEP 4—DETERMINE THREAT COURSES OF ACTION

8-18. 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 (refer back to figure 8-1 on page 8-3). The space situation

template is a depiction of the space situation: the who, what, where, when, and why of the space operations in support of the plan. It is an assessment and should be presented as such.

8-19. The situation template depicts how the staff believes space impacts the supported command operations. The SSE coordinates with the intelligence cell or staff for this information. 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 and staff. This template is an excellent tool to depict graphically the enemy's most probable COA as it relates to the space aspects of the fight, to include the enemy's perception of how civil, commercial, and friendly satellites are employed. The space situation template can be an important contribution to both the intelligence and the space estimates. The space situation template is tailored to reflect the impact that enemy, civil, and commercial space systems have on the operational mission. The space situation template is the culminating piece of the space estimate developed to support the mission analysis phase of MDMP. 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 staff clearly understand the impact of space on the tactical operation. When building the space situation template, consider the following:

- It is a snapshot in time (for example, 301200Z), and must be continually updated;
- It focuses on the space portion of the area of interest to show the direct relation of the space area of interest to the terrestrial maneuver area of operations;
- It depicts the general disposition of friendly and enemy maneuver forces to show the relevance of space capabilities to operations; and
- It reflects key enemy space capabilities; space related targets the enemy may attack, and other actions the enemy may take related to space.

8-20. The space situation template depicts friendly satellite systems that may be targeted by the enemy through uses such as SATCOM jamming or the use of camouflage, concealment and deception to deceive friendly space-based assets. The intelligence cell is a key contributor to this process to ensure enemy space intent and capabilities are accurately assessed in relation to the overall enemy operational objectives. The assessment includes when and where the enemy may conduct counter-space operations to degrade friendly satellites effectiveness, and whether the enemy understands the reliance the Army places on key space capabilities like SATCOM to support extended range operations. The template reflects appropriate symbology to depict this activity, such as a line from the enemy's electronic warfare system to the targeted SATCOM. The SSE will assist the intelligence cell with technical knowledge of enemy space systems and capabilities as required.

8-21. The situation template enables staff to project the most probable enemy space COA for organic, third-party, civil, and commercial space assets, such as:

- Attempts to deceive information collections during satellite over-flight through the use of deceptive activity such as troop movement, muster, decoys, and mock ups;
- Threatened use of weapons of mass destruction;
- The probable targets for enemy collection, the means (electro-optical, radar), and the tasking, collection, processing, exploitation, and dissemination process to get data to the enemy. An example might be to anticipate the enemy will use electro-optical against a headquarters because it is a high-value target. The enemy's dissemination timelines support targeting fixed or semi-fixed facilities only; and
- Critical enemy space and associated terrestrial nodes to recommend for friendly targeting of high payoff targets. If the enemy has a single point of failure for receipt of satellite imagery, this could be a high payoff target. A key part of the space estimate effort during step 4 is the identification of enemy space-related high payoff targets.

- Attempt to jam SATCOM, or GPS to protect from precision guided munitions;
- Use commercial SATCOM for regime survival, propaganda, or command and control;

8-22. The desired end state is that, on completion of step 4, the supported commander and staffs have a thorough understanding of how space influences the coming operation, and the ability to be proactive. The completed space input to IPB will:

- Set the stage for development of the Annex N (Space Operations) to the operation plans;
- Contribute to the development of the intelligence cells' Annex B, collection priorities, and intelligence estimates;
- Provide valid high-value target recommendations;
- Contribute to information superiority over the enemy; and
- Influence COA development and mission execution.

8-23. The space IPB remains valid throughout the operation and should be updated and included in staff updates, as the situation dictates. Although it is an extensive undertaking, the intelligence cell, in coordination with the SSE, will produce tailored and effective mission variable focused space IPB input in a reasonable time.

SECTION II – SPACE ESTIMATE

8-24. The space estimate is a complementary product of the space input to the IPB and is provided by the SSE. It is used to recommend the best use of available space capabilities and must be accomplished in close coordination with the commander and staff elements as part of the overall planning process. The space estimate must be regularly updated to stay current with ongoing operations.

8-25. The space estimate should not address space-based information collection capabilities. The SSE should coordinate all intelligence requirements through the G-2. The format and content of the space estimate includes the following:

- Describe the area of operation environment or space area of interest. This can be derived from the information compiled during steps one and two of space IPB;
- Assess enemy space capabilities may be derived from steps three and four of space IPB and is conducted in close coordination with the intelligence cell;
- Evaluate friendly space force capabilities;
  - Define essential, specified, and implied space tasks;
  - Define space capabilities strengths and vulnerabilities;
  - Identify operational status and relative importance of each space force enhancement function;
  - Identify space control capabilities status, relevance, and possible employment options;
  - Compare current mission requirements versus existing space capabilities' ability to support the operation; and
  - Identify additional space forces which may be necessary for the operation.
- The SSE, in coordination with the staff elements, conducts COA analysis;
  - Describe how space capabilities can support each of the identified friendly force COAs in terms such as suitability, feasibility, and completeness;
  - Identify how space force enhancement capabilities will affect each COA;
  - Identify the space control strategy for each COA; and
  - The SSE recommends which COA is most supportable from a space perspective. The most supportable COA is the one where the space architecture is most capable and best suited to support. It is not necessarily the COA that is most dependent upon space.

- Identify space related assumptions;
- Key members of the staff the SSE must coordinate with are:
  - G-2 for space intelligence, threat; and information collection issues;
  - G-3 for support to operations and the commander's intent;
  - G-6 for SATCOM, FFT, and GPS;
  - Air defense cell for missile warning; and
  - Staff weather officer for space and terrestrial weather.

8-26. Table 3-2, *Space to warfighting function crosswalk* (refer back to page 3-20 and 3-21) is a key summary tool to assist the key conclusions found in the space estimate. Information in the table:

- Reflects space strengths, concerns, and vulnerabilities when relating space support to a given warfighting functions. For example, PNT is important to all the warfighting functions, but it may be vulnerable to jamming;
- Shows the space linkage to the Army warfighting functions by mission area or function;
- May be tailored to meet the preferences of the SSE and or supported staff; and
- May be shared with the commander and the rest of staff, and provides a snapshot of how space capabilities support operational mission accomplishment.

SATELLITE OPERATIONAL STATUS

8-27. The satellite operational status describes the status of satellites that support (or affect) the commander's area of operations. This includes analysis of key commercial satellites affecting operations to the maximum extent possible. Commercial satellite operators are obligated to provide responsive satellite capabilities to the Army or DOD users who pay for the services, and provide relevant status information through the appropriate channels. Satellites may be partially operational or nonoperational for a variety of reasons that include, but is not limited to:

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

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Appendix A

Annex N – Space Operations

The SSE is responsible to prepare Annex N, Space Operations to an operations order. This appendix provides a format for Annex N (Space Operations) in Army plans and orders. The format for the annex can be modified to meet the requirements of the base order and operations. This chapter also includes an example information collection plan.

A-1. Annex N (Space Operations) provides fundamental considerations, detailed information, and instructions on space forces and capabilities to the base operation plans or order that the supported commander can use throughout the operation. Annex N is used to coordinate early with the staff, to include the G-2, G-6, air defense artillery officer, and the special technical operations cell to synchronize efforts and avoid duplication of information. Annex N is the primary annex for space operations, but space may also be found in other annexes. Planners should consider the integration of space operations into Annexes A (Task Organization), B (Intelligence), C (Operations), D (Fires), E (Protection), G (Engineer), H (Signal), J (Public Affairs), L (Information Collection), S (Special Technical Operations), and V (Interagency Coordination) as well as others when applicable. While the G-2 is responsible for producing a space threat portion in the intelligence estimate to Annex B, the SSE may contribute to this product such as providing impacts of space weather on operations. The SSE is responsible for preparing Annex N to the operation plans or operation order. Commanders and staffs use Annex N to describe how space operations support the concept of operations described in the base plan or order.

A-2. Annex N uses the standard five-paragraph operations order format and contains the information indicated in figure Appendix-1 on pages A-2 thru A-5. All references in the content, such as Appendix 2 (Operation Overlay) to Annex refer to the base plan or order.

Note: Refer to FM 6-0, *Commander and Staff Organization and Operations* for additional guidance on formatting and procedures. FM 6-0 is the source document for Annex N. FM 6-0 takes precedence over FM 3-14 for any discrepancies that may arise.

[CLASSIFICATION]

Place the classification at the top and bottom of every page of the attachments. Place the classification marking at the front of each paragraph and subparagraph in parentheses. Refer to AR 380-5 for classification and release marking instructions.

Copy ## of ## copies
Issuing headquarters
Place of issue
Date-time group of signature
Message reference number

Include heading if attachment is distributed separately from the base order or higher-level attachment.

ANNEX N (SPACE OPERATIONS) TO OPERATION PLAN (OPLAN)/OPERATION ORDER (OPORD) [number] [(code name)]—[issuing headquarters] [(classification of title)]

(U) References: *List documents essential to understanding the attachment.*

a. *List maps and charts first. Map entries include series number, country, sheet names, or numbers, edition, and scale.*

b. *List other references in subparagraphs labeled as shown.*

c. *Doctrinal references for space operations include FM 3-14, FM 6-0, JP 3-14, and U.S. National Space Policy.*

(U) Time Zone Used Throughout the Order: *Write the time zone established in the base plan or order.*

1. (U) Situation. *Include information affecting space operations that paragraph 1 of the OPLAN or OPORD does not cover or that needs expansion.*

a. (U) Area of Interest. *Describe the area of interest as it relates to space operations. Refer to Annex B (Intelligence) as required.*

b. (U) Area of Operations. *Refer to Appendix 2 (Operation Overlay) to Annex C (Operations).*

(1) (U) Terrain. *Describe the aspects of terrain that impact space operations such as terrain masking. Refer to Annex B (Intelligence) as required.*

(2) (U) Weather. *Describe the aspects of space and terrestrial weather that impact space operations. Refer to Annex B (Intelligence) as required.*

c. (U) Enemy Forces. *List known locations and activities of enemy space capable assets and units. List enemy space capabilities that can impact friendly operations. State expected enemy courses of action and employment of enemy and commercial space assets. Refer to Annex B (Intelligence) as required.*

d. (U) Friendly Forces. *Outline the higher headquarters' plan for space operations and space support teams including but not limited to space support elements, Army space support teams, and an organic space weapons officer. List designation, location, and outline of plans of higher, adjacent, and other space operations-related assets that support or impact the issuing headquarters or require coordination and additional support. For example, the space coordinating authority and specified processes established for the area of responsibility.*

[page number]
[CLASSIFICATION]

Figure Appendix-1. Sample Annex N (Space Operations) format

[CLASSIFICATION]

ANNEX N (SPACE OPERATIONS) TO OPLAN/OPORD [number] [(code name)]—[issuing headquarters] [(classification of title)]

e. (U) Interagency, Intergovernmental, and Nongovernmental Organizations. *Identify and describe other organizations in the area of operations that may impact the conduct of space operations or implementation of space-specific equipment, tactics, and capabilities. Consider all multinational, civil, and nongovernmental organizations such as civilian relief agencies and other customers and providers of space-based capabilities. Refer to Annex V (Interagency Coordination) as required.*

f. (U) Civil Considerations. *Describe the aspects of the civil situation that impact space operations. Refer to Annex B (Intelligence) and Annex K (Civil Affairs Operations) as required.*

g. (U) Attachments and Detachments. *List units attached or detached only as necessary to clarify task organization. Refer to Annex A (Task Organization) as required.*

h. (U) Assumptions. *List space operations-specific assumptions that support the annex development.*

2. (U) Mission. *State the mission of space operations in support of the base plan or order.*

3. (U) Execution.

a. (U) Scheme of Space Operations. *Describe how space capabilities support the commander's intent and concept of operations. Establish the priorities of space support to units for each phase of the operation. For example, electromagnetic interference resolution and defended asset list. Also address unique space reliances or vulnerabilities related to unit systems and capabilities. Refer to Annex C (Operations) as required.*

(1) (U) Space Force Enhancement. *Identify space activities required to support the operation plan, including the following specific areas as applicable:*

(a) (U) Satellite Communication. *Describe the space operations communications plan. Ensure defensive space priorities for satellite communication links are established and coordinated based on operational priorities. Refer to Annex H (Signal) as required.*

(b) (U) Remote Sensing/Environmental Monitoring. *Identify and list meteorological, oceanographic, geodetic, and other environmental support information provided by space assets that affect space, air, surface, or subsurface activities and assets. Refer to Annex G (Engineer) as required.*

(c) (U) Position, Navigation, and Timing. *Provide navigational capabilities that would aid the transit of ships, aircraft, personnel, or ground vehicles and determine the course and distance traveled or position location. Provide Global Positioning System (GPS) accuracy to support GPS-aided munitions.*

(d) (U) Information Collection. *Provide information pertaining to friendly and enemy forces in or external to the operational areas that would aid in operations and force positioning. Refer to Annex L (Information Collection) as required.*

(e) (U) Theater Missile Warning. *Provide information on the notification of enemy ballistic missile or space-weapon attacks evaluated from available sensor and sources and the possible affect on the operational area. Provide notification of friendly ballistic missile launches and the impacts on the operational areas that would require early warning of affected friendly forces and an estimated point of impact for each launch. Establish provisions, in coordination with the air defense artillery officer, to disseminate information quickly throughout the operational areas. Refer to Annex B (Intelligence), Annex D (Fires), and Annex E (Protection) as required.*

[page number]
[CLASSIFICATION]

Figure Appendix-1. Sample Annex N (Space Operations) format (continued)

[CLASSIFICATION]

ANNEX N (SPACE OPERATIONS) TO OPLAN/OPORD [number] [(code name)]—[issuing headquarters] [(classification of title)]

(2) (U) Space Control. *Provide information on space-related activities, whether performed by space, air, or surface assets that ensure friendly forces and deny enemy forces the unrestricted use of space and space assets. Identify targetable enemy assets and limitations of targeting. Address all capabilities and effects related to offensive or defensive space control and space situational awareness [understanding] requirements.*

(3) (U) Nuclear Detonation. *Provide information on the notification of detected nuclear detonations that might affect the operation and require evaluation as to yield and location. Refer to Annex B (Intelligence) as required.*

(4) (U) Cyber Electromagnetic Activities. *Integrate cyber electromagnetic activities to optimally synchronize their effects. Refer to Annex C (Operations) as required.*

(5) (U) Special Technical Programs. *Provide information on the organization and synchronization of the integrated Army and integrated joint special technical operations and alternate compensatory control measures plans in support of the commander's objectives. Refer to Annex S (Special Technical Operations) as required*.

(6) (U) Mission Command. *Provide information and an assessment on friendly space reliance upon satellite communications, missile warning, and network architectures. Determine how organic unit systems and equipment rely upon these communications paths (architectures).*

b. (U) Tasks to Subordinate Units. *List space tasks assigned to specific subordinate units not contained in the base plan or order. Refer to any tasks in base order.*

c. (U) Coordinating Instructions. *List only instructions applicable to two or more subordinate units not covered in the base plan or order. Document coordination and reachback support requests in accordance with space coordinating authority guidance such as "Space Coordinating Plans" and other directives for the area of responsibility; include unique equipment sustainment and technical points of contact.*

4. (U) Sustainment. *Identify priorities of sustainment for space operations key tasks and specify additional instructions as required. Refer to Annex F (Sustainment) as required.*

a. (U) Logistics. *Identify unique sustainment requirements, procedures, and guidance to support space operations teams and operations. Specify procedures for specialized technical logistics support from external organizations as necessary. Use subparagraphs to identify priorities and specific instructions for space operations logistic support. Refer to Annex F (Sustainment) and Annex P (Host-Nation Support) as required.*

b. (U) Personnel. *Use subparagraphs to identify priorities and specific instructions for human resources support, financial management, legal support, and religious support. Refer to Annex F (Sustainment) as required.*

c. (U) Health System Support. *Identify availability, priorities, and instructions for medical care. Refer to Annex F (Sustainment) as required*.

[page number]
[CLASSIFICATION]

Figure Appendix-1. Sample Annex N (Space Operations) format (continued)

[CLASSIFICATION]

ANNEX N (SPACE OPERATIONS) TO OPLAN/OPORD [number] [(code name)]—[issuing headquarters] [(classification of title)]

5. (U) Command and Signal.

a. (U) Command.

(1) (U) Location of the Commander and Key Leaders. *State the location of the commander and key space leaders such as the space coordinating authority, director of space forces, Joint Space Operations Center, electronic warfare officers, and other key reachback leaders.*

(2) (U) Succession of Command. *State the succession of command if not covered in the unit's standard operating procedures.*

(3) (U) Liaison Requirements. *State the space liaison requirements not covered in the unit's standard operating procedures, such as air component coordination element or multinational space officers.*

b. (U) Control.

(1) (U) Command Posts. *Describe the employment of space command, control, and functional chains including their location and contact information.*

(2) (U) Reports. *List space related reports not covered in standard operating procedures. Refer to any space coordinating authority concept of operations or guidance and Annex R (Reports) as required.*

c. (U) Signal. *Address any space-specific communications requirements such as secure chat communications applications. These often require a lengthy approval process to tunnel through existing networks and should be specified well in advance. Refer to Annex H (Signal) as required.*

ACKNOWLEDGE: *Include only if attachment is distributed separately from the base order*.

[Commander's last name]
[Commander's rank]

The commander or authorized representative signs the original copy. If the representative signs the original, add the phrase "For the Commander." The signed copy is the historical copy and remains in the headquarters' files.

OFFICIAL:

[Authenticator's name]
[Authenticator's position]

Use only if the commander does not sign the original attachment. If the commander signs the original, no further authentication is required. If the commander does not sign the signature of the preparing staff officer requires authentication and only the last name and rank of the commander appear in the signature block.

ATTACHMENTS: *List lower-level attachments (appendixes, tabs, and exhibits).*

DISTRIBUTION: *Show only if distributed separately from the base order or higher-level attachment.*

[page number]
[CLASSIFICATION]

Figure Appendix-1. Sample Annex N (Space Operations) format (continued)

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Source Notes

This section lists sources by page number. Where material appears in a paragraph, it lists both the page number and paragraph number.

1-1 "Army space forces contribute to the Joint Force and …". *Senate Armed Services Committee Statement, March 2014*. Available at: http://www.armed-services.senate.gov/imo/media/doc/Mann_03-12-14.pdf

1-2 "The Army must prepare to fight in denied, degraded, and disrupted space operational environment." *TRADOC Commander memorandum to Army Service component command titled Unified Quest 2010 (UQ2010) Results and Implementation*, 27 July 2010.

1-2 "Army forces no longer treat space systems as enablers, …". *Enclosure 6 to TRADOC Commander memorandum to Army Service component command titled Unified Quest 2010 (UQ2010) Results and Implementation*, 27 July 2010.

1-3 "To facilitate effective integration, joint …". *JP 3-14, Space Operations.* Available at: https://jdeis.js.mil/jdeis/index.jsp?pindex=2

1-5 "The U.S. Army is one of the largest users of space-based …". *AR 900-1, Army Space Policy*. Available at: http://www.apd.army.mil/AdminPubs/browse_reg4.asp

1-5 "For the effective execution of unified land operations, the Army depends …". *Army Strategic Space Plan*, 23 May 2011. Available from Army G-3/5/7, Strategic Plans and Policy Directorate (Attention: DAMO-SSS, 400 Army Pentagon, 2D337, Washington, DC 20310).

2-1 "The Army 'requires access to space capabilities to …". TRADOC Pamphlet 525-3-0, *The U.S. Army Capstone Concept*. Available at: http://www.tradoc.army.mil/tpubs/pams/tp525-3-0.pdf

2-3 "The SCA has primary responsibility for joint space operations …". *JP 3-14, Space Operations*. Available at: https://jdeis.js.mil/jdeis/index.jsp?pindex=2

2-6 "a cadre of space qualified professionals comprised of military and civilian…". *Secretary of Defense Memorandum titled National Security Space Management and Organization*, 18 October 2001.

3-1 "Fully integrated [space] capabilities will provide depth, …" *Senate Armed Services Committee Statement, May 2011*. Available at: http://www.smdc.army.mil/CG/SpaceWrittenTestimonytotheSASC-StrategicForcesSubcommittee11May11.pdf

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3-17 "a group of tasks and systems (people, organizations, information, …". ADP 3-0, *Unified Land Operations*. Available at: http://armypubs.army.mil/doctrine/ADP_1.html

3-17 "We must fully leverage allied, national, and joint space …". *2013 Army Strategic Planning Guidance*. Available at: http://usarmy.vo.llnwd.net/e2/rv5_downloads/info/references/army_strategic_planning_guidance.pdf

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5-1 "The Army is evolving from a position of simply exploiting …" *Senate Armed Services Committee Statement, May 2011*. Available at: http://www.smdc.army.mil/CG/2012/LTGFormica2013SASCSFSpaceWrittenStatement.pdf

7-1 "The Army deploys specialized Army Space Support Teams to support …" *Senate Armed Services Committee Statement, March 2014*. Available at: http://www.armed-services.senate.gov/imo/media/doc/ Mann_03-12-14.pdf

GLOSSARY

The glossary lists acronyms and abbreviations and terms with Army or joint definitions, and other selected terms. Where Army and joint definitions are different, (Army) follows the term. Terms for which FM 3-14 is the proponent (authority) manual are marked with an asterisk (*). The proponent manual for other terms is listed in parentheses after the definition.

SECTION I – ACRONYMS AND ABBREVIATIONS

ADP	Army doctrine publication
ADRP	Army doctrine reference publication
AMD	air and missile defense
AR	Army regulation
ARSST	Army space support team
ASCE	Army space coordination element
ATP	Army techniques publication
CJCSI	Chairman of the Joint Chiefs of Staff instruction
COA	course of action
COP	common operational picture
D3SOE	denied, degraded, and disrupted space operational environment
DCGS-A	Distributed Common Ground System-Army
DIRSPACEFOR	director of space forces (USAF)
DISA	Defense Information Systems Agency
DOD	Department of Defense
DODD	Department of Defense directive
DODI	Department of Defense instruction
DOTMLPF	doctrine, organization, training, materiel, leadership and education, personnel, and facilities
DSCA	defense support of civil authorities
DSCS	Defense Satellite Communications System
EHF	extremely high frequency
FA40	functional area 40 (space professional)
FFT	friendly force tracking
FM	field manual
G-2	assistant chief of staff, intelligence
G-3	assistant chief of staff, operations
G-6	assistant chief of staff, signal
GPS	Global Positioning System
IPB	Intelligence preparation of the battlefield

ISR	intelligence, surveillance, and reconnaissance
JFCC	joint functional component command
JP	joint publication
JTAGS	joint tactical ground station (Army)
MDMP	military decision-making process
MMC	mission management center
OPIR	overhead persistent infrared
OPLAN	operation plan
OPORD	operation order
PNT	positioning, navigation, and timing
RSSC	regional satellite communications support center
SATCOM	satellite communications
SATCON	satellite control
SBIRS	Space-Based Infrared System
SCA	space coordinating authority
SHF	super-high frequency
SIPRNET	SECRET Internet Protocol Router Network
SSA	space situational awareness
SSAPT	space situational awareness planning team
SSE	space support element
TENCAP	tactical exploitation of national capabilities
TES	theater event system
TMW	theater missile warning
UFO	ultrahigh frequency follow-on
UHF	ultrahigh frequency
U.S.	United States
USASMDC/ARSTRAT	United States Army Space and Missile Defense Command/Army Forces Strategic Command
USSTRATCOM	United States Strategic Command
WGS	Wideband Global Satellite Communications
WSOC	wideband satellite communications operations center

SECTION II – TERMS

defense support of civil authorities

(DOD) Support provided by U.S. Federal military forces, Department of Defense civilians, Department of Defense contract personnel, Department of Defense component assets, and National Guard forces (when the Secretary of Defense, in coordination with the governors of the affected states, elects and requests to use those forces in Title 32, United States Code, status) in response to requests for assistance from civil authorities for domestic emergencies, law enforcement support, and other domestic activities, or from qualifying entities for special events. Also called DSCA. Also known as civil support. (DODD 3025.18).

***denied, degraded, and disrupted space operational environment**
A composite of those conditions and influences in which space-enabled capabilities have been impaired by hostile threats or non-hostile means. Also called D3SOE.

friendly force tracking
(DOD) A system that provides commanders and forces with location information about friendly and hostile military forces. Also called FFT. (JP 3-14).

geospatial information and services
(DOD) The collection, information extraction, storage, dissemination, and exploitation of geodetic, geomagnetic, imagery, gravimetric, aeronautical, topographic, hydrographic, littoral, cultural, and toponymic data accurately referenced to a precise location on the Earth's surface. Also called GI&S. (JP 2-03).

geospatial intelligence
(DOD) The exploitation and analysis of imagery and geospatial information to describe, assess, and visually depict physical features and geographically referenced activities on the Earth. Geospatial Intelligence consists of imagery, imagery intelligence, and geospatial information. Also called GEOINT. (JP 2-03).

global positioning system
(DOD) A satellite-based radio navigation system operated by the Department of Defense to provide all military, civil, and commercial users with precise positioning, navigation, and timing. Also called GPS. (JP 3-14).

multispectral imagery
(DOD) The image of an object obtained simultaneously in a number of discrete spectral bands. Also called MSI. (JP 3-14).

negation
(DOD) In space operations, active and offensive measures to deceive, disrupt, degrade, deny, or destroy space capabilities being used to interfere with or attack Unites States/allied systems. See also space control. (JP 3-14).

prevention
(DOD) In space usage, measures to preclude an adversary's hostile use of United States or third-party space systems and services. See also space control. (JP 3-14).

protection
(DOD) 2. In space usage, active and passive defensive measures to ensure that United States and friendly space systems perform as designed by seeking to overcome an adversary's attempts to negate them and to minimize damage if negation is attempted. (JP 3-14).

regional satellite communications support center
(DOD) United States Strategic Command operational element responsible for providing the operational communications planners with a point of contact for accessing and managing satellite communications resources. Also called RSSC. (JP 3-14).

space asset
(DOD) Equipment that is an individual part of a space system, which is or can be placed in space or directly supports space activity terrestrially. (JP 3-14).

space capability
(DOD) 1. The ability of a space asset to accomplish a mission. 2. The ability of a terrestrial-based asset to accomplish a mission in or through space. See also space asset. (JP 3-14).

space coordinating authority
(DOD) A commander or individual assigned responsibility for planning, integrating, and coordinating space operations support in the operational area. Also called SCA. (JP 3-14).

space environment
(DOD) The environment corresponding to the space domain, where electromagnetic radiation, charged particles, and electric and magnetic fields are the dominant physical influences, and that encompasses the earth's ionosphere and magnetosphere, interplanetary space, and the solar atmosphere. (JP 3-59).

space forces
(DOD) 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
(DOD) 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
(DOD) The degree of dominance in space of one force over another that permits the conduct of its operations at a given time and place without prohibitive interference from space-based threats. (JP 3-14).

theater event system
(DOD) Architecture for reporting ballistic missile events, composed of three independent processing and reporting elements: the joint tactical ground station, tactical detection and reporting, and the space-based infrared system mission control station. Also called TES. (JP 3-14).

training and readiness oversight
(DOD) The authority that combatant commanders may exercise over assigned Reserve Component forces when not on active duty or when on active duty for training. (JP 1).

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These documents must be available to the intended users of this publication.

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DOD Dictionary of Military and Associated Terms, August 2017.

RELATED PUBLICATIONS

These documents contain relevant supplemental information.

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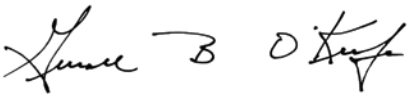

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