Joint Publication 3-14

Space Operations

06 January 2009

PREFACE

1. Scope

This publication provides joint doctrine for planning, executing, and assessing joint space operations.

2. Purpose

This publication has been prepared under the direction of the Chairman of the Joint Chiefs of Staff. It sets forth joint doctrine to govern the activities and performance of the Armed Forces of the United States in joint operations and provides the doctrinal basis for interagency coordination and for US military involvement in multinational operations. It provides military guidance for the exercise of authority by combatant commanders and other joint force commanders (JFCs) and prescribes joint doctrine for operations, education, and training. It provides military guidance for use by the Armed Forces in preparing their appropriate plans. It is not the intent of this publication to restrict the authority of the JFC from organizing the force and executing the mission in a manner the JFC deems most appropriate to ensure unity of effort in the accomplishment of the overall objective.

3. Application

a. Joint doctrine established in this publication applies to the joint staff, commanders of combatant commands, subunified commands, joint task forces, subordinate components of these commands, and the Services.

b. The guidance in this publication is authoritative; as such, this doctrine will be followed except when, in the judgment of the commander, exceptional circumstances dictate otherwise. If conflicts arise between the contents of this publication and the contents of Service publications, this publication will take precedence unless the Chairman of the Joint Chiefs of Staff, normally in coordination with the other members of the Joint Chiefs of Staff, has provided more current and specific guidance. Commanders of forces operating as part of a multinational (alliance or coalition) military command should follow multinational doctrine and procedures ratified by the United States. For doctrine and procedures not ratified by the United States, commanders should evaluate and follow the multinational command's doctrine and procedures, where applicable and consistent with US law, regulations, and doctrine.

For the Chairman of the Joint Chiefs of Staff:

STANLEY A. MCCHRYSTAL
Lieutenant General, USA
Director, Joint Staff

SUMMARY OF CHANGES
REVISION OF JOINT PUBLICATION 3-14
DATED 09 AUGUST 2002

- **Realigns space operations missions from US Space Command to US Strategic Command**

- **Discusses space operations and the principles of joint operations consistent with Joint Publication 3-0**

- **Updates missions in the space force enhancement mission area**

- **Adds rendezvous and proximity operations in the space support mission area**

- **Adds and defines offensive space control, defensive space control, and space situational awareness within the space control mission area**

- **Discusses command and control relationships of space forces**

- **Adds, defines, and discusses the space coordinating authority**

- **Provides an example of implementation of a space coordinating authority's duties**

- **Adds, updates, and outlines the responsibility of the Joint Functional Component Command for Space as well as other joint functional component commands, Service components, combat support agencies, and other agencies and organizations**

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TABLE OF CONTENTS

GLOSSARY

FIGURE

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- **Describes Fundamentals of Military Space Operations**
- **Describes Space Mission Areas**
- **Describes Command and Control of Space Forces**
- **Outlines Roles and Responsibilities**
- **Outlines Support to Planning**

Fundamentals of Military Space Operations

Space systems have increased the importance of space power to joint force commanders (JFCs) and US national interests.

The use of space capabilities by the US military has changed significantly since the first military satellites were orbited. Continuous improvements in space technology have led to the development of more advanced space systems. Space capabilities have proven to be a **significant force multiplier** when integrated across joint military operations. Military, civil, and commercial sectors of the US are **increasingly dependent** on space capabilities, and this dependence can be viewed by adversaries as a **potential vulnerability**.

Space operations ensure JFCs have the ability, flexibility, and freedom of action to take advantage of the capabilities provided by space systems.

Space has several unique characteristics that differentiate it from the air, land, and sea. Accepted international conventions do not extend a nation's geographical boundaries into Earth orbit. Therefore, nations enjoy unimpeded satellite overflight of other nations through space. Spacecraft movement is not significantly impeded by any of the Earth's surface features (such as terrain), but instead is primarily governed by orbital mechanics, thereby allowing satellites to remain in orbit for extended periods of time (i.e., years). The space environment affects the performance of both terrestrial and space systems. JFCs need to be aware of these characteristics (and the resulting operational impacts) to understand the capabilities and limitations of space forces while in support of joint operations. The special characteristics of space and the difficulty in gaining access present unique planning and operational considerations that affect friendly, adversary, and neutral space forces alike. The joint space planner must not only understand planning and operational considerations for employment of space capabilities, but must also have a firm knowledge of the threats to the use of those systems by an adversary and understand what can be done to limit an adversary's use of space capabilities while protecting friendly uses of space.

The United States must be able to protect its space assets (and when practical and appropriate, those of its allies) and deny the use of space assets by its adversaries. **Commanders** must **anticipate hostile actions** that attempt to deny friendly forces access to or use of space capabilities. They should also anticipate the **proliferation** and increasing sophistication of **space capabilities** and products with military utility that could be used by an adversary for hostile purposes. Potential adversaries no longer have to develop the infrastructure necessary to obtain space capabilities; today, the necessary capabilities may be purchased.

Space Mission Areas

Military space operations are an integral part of joint operations.

The importance of space operations is increasing due to the enabling capabilities they provide the JFC. Space capabilities are essential to overall military mission accomplishment, provide the advantages needed for success in all joint operations, and support the principles of war.

US space operations are comprised of four mission areas: **space force enhancement; space support; space control; and space force application.**

Space force enhancement operations increase joint force effectiveness of military forces.

Space force enhancement operations multiply joint force effectiveness by increasing the combat potential, operational awareness, and providing needed joint force support. There are five force enhancement functions: **intelligence, surveillance, and reconnaissance (ISR); missile warning; environmental monitoring; satellite communications; and space-based positioning, navigation, and timing.**

Space support are operations to deploy and sustain military and intelligence systems in space.

Space support includes space lift operations (launching and deploying satellites), satellite operations (maintaining, sustaining, and rendezvous and proximity operations), and reconstitution of space forces (replenishing lost or diminished satellites).

Space control ensures freedom of action in space for friendly forces, and when directed, denies an adversary the same.

Space control consists of offensive space control (OSC), defensive space control (DSC), and space situational awareness (SSA). OSC is used to deny adversary freedom of action in space and is based on negation and offensive prevention measures. DSC is used to protect space capabilities and is based on protection and defensive prevention measures. SSA involves characterizing the space capabilities operating within the terrestrial environment and space domain.

Space force application operations are combat operations in, through, and from space to influence the course and outcome of conflict by holding terrestrial targets at risk.

Space force application operations consist of attacks against terrestrial-based targets carried out by military weapons systems operating in or through space.

Command and Control of Space Forces

The JFC must ensure the integration of space capabilities into joint military operations.

Space forces are an integral part of joint military operations and, consistent with the Commander, United States Strategic Command's (CDRUSSTRATCOM's) guidance, are directed to meet the requirements of JFCs. During mission execution, CDRUSSTRATCOM will retain combatant command (command authority) of assigned space forces and where appropriate, transfer operational control or tactical control with Secretary of Defense approval, to the JFC depending upon the nature of the operation and the specific space capability. In most cases, space capabilities are available to JFC but may not deploy to the operational area.

CDRUSSTRATCOM will plan and organize day-to-day operations and publish mission-type orders for execution by components. To facilitate unity of the operational area space effort, the supported combatant commander (CCDR) or a JFC may designate a space coordinating authority (SCA). Based on the complexity and scope of operations, the JFC can either retain SCA or designate a component commander as the SCA. The JFC considers the mission, nature and duration of the operation, preponderance of space force capabilities made available; and the resident command and control capabilities (including reachback) in selecting the appropriate option. The SCA will coordinate space operations, integrate space capabilities, and have primary responsibility for joint space operations planning in the operational area. The SCA will coordinate space support of established objectives and act on behalf of the CCDR, if designated, with primary responsibility for joint space operations planning.

Each CCDR staff includes personnel who are trained to access and use products of space-based capabilities (ISR, satellite communications, etc.) to support CCDR mission requirements.

Roles and Responsibilities

The joint force achieves maximum utility from space forces when organized and employed effectively.

The Services, in accordance with Department of Defense (DOD) directives, shall integrate space capabilities and applications into all facets of their strategy, doctrine, education, training, exercises, and operations of US military forces. The Chairman of the Joint Chiefs of Staff (CJCS) is responsible for establishing a uniform system for evaluating readiness of each combatant command and combat support agency to carry out assigned missions by employing space forces, developing joint doctrine, education, and training for the operation and employment of space systems of the Armed Forces, integrating space forces and their supporting industrial base into the Joint Strategic Capabilities Plan, formulating policies for the integration of National Guard and reserve forces into joint space activities, and providing guidance to combatant commanders for planning and employment of space capabilities through the joint planning process.

Commander, United States Strategic Command ensures the most effective use of space assets.

CDRUSSTRATCOM integrates and synchronizes DOD space capabilities to ensure the most effective use of these resources. USSTRATCOM must be able to quickly plan, direct, coordinate, and control space assets and forces for daily operations, for crisis action planning, and in the event of war against the United States and/or its allies.

USSTRATCOM operates assigned space forces through Joint Functional Component Command for Space — **JFCC SPACE,** in coordination with Service component commands, USSTRATCOM functional component commands, and other agencies and organizations.

Joint Functional Component Command for Space provides support to JFCs to assist in integrating space capabilities.

Commander JFCC SPACE, as designated by CDRUSSTRATCOM, serves as the single point of contact for assigned military space operational matters, including planning, tasking, directing, and executing space operations using space forces. For space related activities, JFCC SPACE is the primary USSTRATCOM interface to supported commanders. JFCC SPACE, along with the other JFCCs, integrates space capabilities in support of the JFC.

USSTRATCOM's Service components include; Space and Missile Defense Command/US Army Forces Strategic Command, Naval Network Warfare Command, United States Marine Corps Forces, US Strategic Command, and Air Force Space Command. Although each service component has distinct missions, common responsibilities include: advocating for space requirements; providing a single service point of contact; making recommendations for the employment of space forces; providing space forces to CDRUSSTRATCOM and CCDRs; planning in support of space operations; and supporting CDRUSSTRATCOM and CCDRs with space mission area expertise and capabilities.

Planning

Joint Operations Planning

Commanders must address space operations in all types of plans and orders, at all levels of war to effectively synchronize and integrate space forces within the JOA, to counter an adversary's use of space, to maximize use of limited space assets, and consolidate operational requirements for space capabilities. CDRUSSTRATCOM, in coordination with the CJCS, must make quick decisions and have the capability to plan, direct, coordinate, and control space assets.

Coordination of space operations between staffs of the supported and supporting commanders is normally established through the designation of a SCA. The SCA will ensure the identification of operational requirements and their inclusions in the appropriate annexes. Space planners understand the unique planning and operational considerations that affect friendly, adversary, and neutral space forces, alike.

CONCLUSION

The ability to rapidly project and sustain US military capability worldwide is a basic requirement for the Armed Forces of the United States. The US military continuously deploys space assets and space forces, enhancing military capability. This publication establishes a framework for the use of space capabilities and the integration of space operations into joint military operations.

CHAPTER I
FUNDAMENTALS OF MILITARY SPACE OPERATIONS

> *"To sum it up, your Department of Defense space assets are doing extremely well. What often gets lost as we talk about our space programs is that once we get them on orbit, they tend to far outlast their design lives, and they deliver fabulous capability."*
>
> **Major General William L. Shelton**
> **Commander, Joint Functional Component Command for Space,**
> **US Strategic Command**
> **April 10, 2007**

SECTION A. MILITARY SPACE CONTRIBUTIONS TO JOINT OPERATIONS

1. General

a. This publication provides guidance for planning and conducting joint space operations. It provides space doctrine fundamentals for all joint forces; describes the military operational principles associated with support from, through, and operating in space; explains Joint Staff, combatant command, United States Strategic Command (USSTRATCOM), and USSTRATCOM functional and Service component relationships and responsibilities; and establishes a framework for the employment of space forces and space capabilities.

b. Space capabilities have proven to be a **significant force multiplier** when integrated across the range of joint military operations. To ensure effective integration, joint force commanders (JFCs) and space operators should have a **common and clear understanding** of how space forces and space capabilities contribute to joint operations and how military space operations should be integrated with other military operations to achieve United States (US) national security objectives. To achieve optimal military utility from space, commanders ensure a basic understanding of space tools and utility among all Services, integrate all necessary space capabilities with military utility (military, national, civil, commercial, and foreign), and establish a means to reasonably include those capabilities in operational planning, execution, and assessment activities.

c. US military use of space capabilities has changed significantly since military satellites were first placed in orbit. Continuous improvements in space technology have led to the development of more advanced space systems. This has changed how commanders view space capabilities.

(1) **Vulnerability.** Military, civil, and commercial sectors of the US are **increasingly dependent** on space capabilities, and this dependence is a **potential vulnerability.** The US will view purposeful interference (PI) with any element of its space systems (ground, communications, or orbital) as an infringement on its rights. When practical and authorized, the joint force will protect space capabilities of civil, commercial, and foreign systems. Commanders (CDRs) must anticipate hostile actions from state and non-state actors intended to deny friendly forces access to, or use of, space capabilities. They should also anticipate the proliferation and increasing sophistication of space capabilities and products with military utility that could be used by any adversary

for hostile purposes. Potential adversaries no longer have to develop large infrastructures to obtain or interfere with space capabilities. Today, many capabilities can be easily purchased. Options available to exert influence or prevent an adversary's access to space capabilities include diplomatic, informational, military, and economic measures.

(2) **Freedom of Action.** Permits US forces to have the freedom to take advantage of the capabilities provided by space systems at a given time and place without prohibitive interference by the opposing force. Commanders must ensure current US military capabilities remain protected and must constantly watch for the next space threat to ensure US military dominance in space utility.

(3) **Global Reach and Responsiveness.** Space-based capabilities are unique in that they are not subject to traditional air overflight restrictions and may already be in position to support operations when crises arise. However, there may be instances when the rapid surge of a capability, or the expeditious replacement of a capability, is required. In those cases, commanders should be aware that increasing capabilities of deployed space-based systems may be accomplished in hours to days, while development and deployment of replacement capabilities could take a year or more.

d. Space systems provide specialized capabilities and offer global force enhancements critical to mission success. To realize the global advantage provided by space capabilities, JFCs must understand their applications and prioritize them for best effect.

2. Space and the Principles of Joint Operations

a. National security objectives and the needs of the supported commander compel the conduct of space operations. Space forces both employ principles of joint operations and enable the application of the principles of joint operations by other joint forces.

b. Space capabilities enable the following applications of the **principles of war** in joint operations:

(1) **Objective.** The purpose of the objective is to direct military operations toward a clearly defined, decisive, and achievable goal.

(a) **Employing.** Commander, USSTRATCOM (CDRUSSTRATCOM) ensures that space objectives support, or are in alignment with, the supported commander's objectives and are included in planning.

(b) **Enabling.** Space operations provide insight into the operational environment including adversary actions and capabilities. Space forces enable continuous dissemination of supported commanders' guidance.

(2) **Offensive.** The purpose of an offensive action is to seize, retain, and exploit the initiative.

(a) **Employing.** CDRUSSTRATCOM establishes and maintains freedom of action in space by ensuring the availability of space capabilities to the joint force while, when directed, denying the opposing force the same advantage.

(b) **Enabling.** Space forces provide globally available satellite communications (SATCOM); positioning, navigation, and timing (PNT); environmental monitoring; warning systems; and intelligence, surveillance, and reconnaissance (ISR) capabilities and services. These support the joint force's efforts to seize the initiative. With in-place, space-based capabilities, the joint force is able to see first, act first, maintain the offensive, and finish decisively.

(3) **Mass.** The purpose of mass is to concentrate the effects of combat power at the most advantageous place and time to produce decisive results.

(a) **Employing.** CDRUSSTRATCOM integrates and synchronizes supporting space forces to maximize effectiveness when concentrating combat power at the proper time and place. This integration and synchronization conserves available resources, minimizes impact on nonadversaries, and maximizes the effect on the adversary.

(b) **Enabling.** Space forces support the joint forces' ability to concentrate combat power at the proper time and place by providing SATCOM to coordinate and direct forces, and PNT to synchronize operations, navigate, and guide precision munitions.

(4) **Economy of Force.** The purpose of the economy of force is to allocate minimum essential combat power to secondary efforts.

(a) **Employing.** CDRUSSTRATCOM implements apportionment and allocation prioritization guidance. Maintaining effective liaison with supported commanders enables CDRUSSTRATCOM to recommend appropriate space forces, actions, and levels of effort.

(b) **Enabling.** Space forces support JFCs in attaining information superiority, thereby reducing uncertainty and permitting reductions in the number and type of forces needed for secondary efforts. This allows commanders to concentrate forces and apply combat power at other points in the operational area. Space-based PNT enables joint force employment of precision munitions to minimize the number of weapons needed to create desired effects and minimize collateral damage.

(5) **Maneuver.** The purpose of maneuver is to place the enemy in a position of disadvantage through the flexible application of combat power.

(a) **Employing.** When necessary and feasible, CDRUSSTRATCOM directs the positioning of space forces to achieve advantage over adversaries. The employment of US space capabilities in multiple orbital regimes provides a standing position of advantage. This advantage includes freedom from overflight restrictions.

(b) **Enabling.** Space forces provide ISR, PNT, weather, and communications support to the joint force, enabling precise blue force tracking (BFT), enhancing joint force situational awareness, maneuverability, and command and control (C2) effectiveness throughout the operational area. This enables the joint force to perform precise, coordinated maneuvers with speed, confidence, and stealth even in featureless terrain or under limited visibility.

(6) **Unity of Command.** The purpose of unity of command is to ensure unity of effort under one responsible commander for every objective.

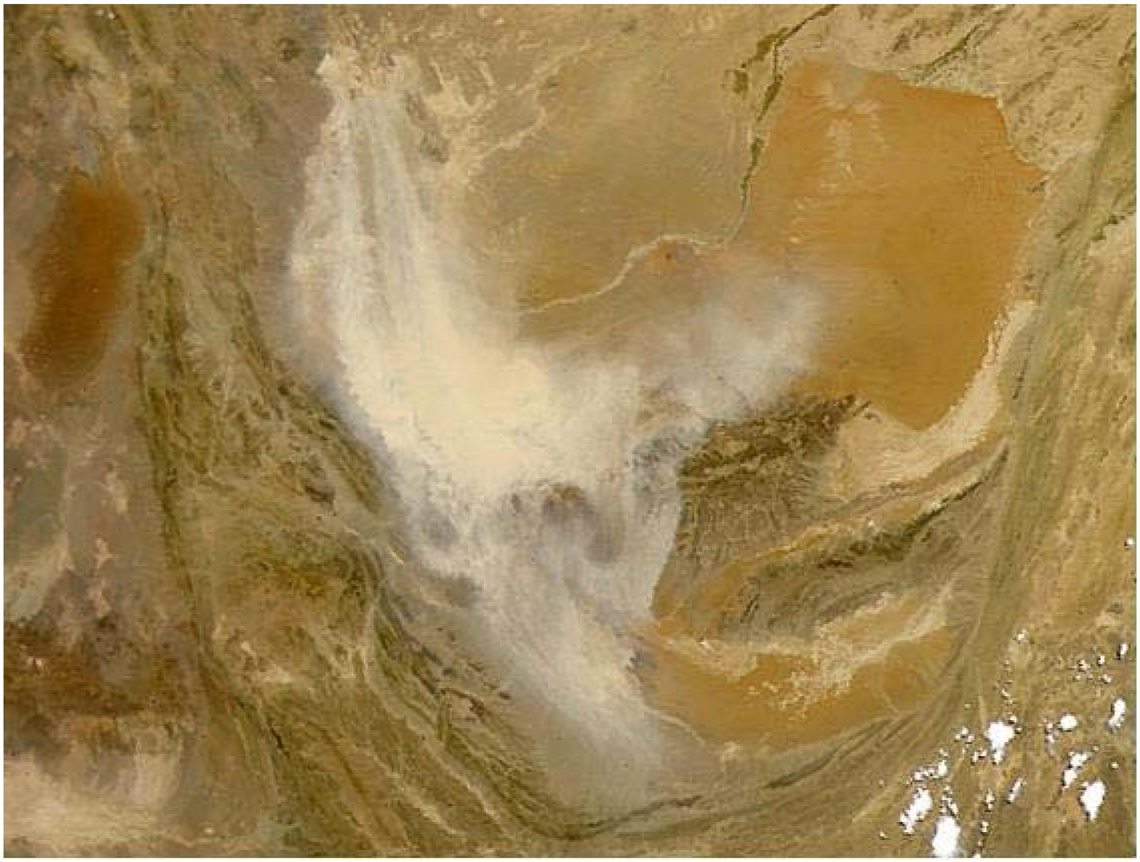
(a) **Employing.** In order to execute the responsibility to advocate, plan, and conduct space operations for national security objectives, CDRUSSTRATCOM exercises combatant command (command authority) over assigned US military space forces. CDRUSSTRATCOM normally delegates operational control (OPCON) and/or tactical control (TACON) of assigned space forces to subordinate USSTRATCOM commanders. Unless otherwise directed by the Secretary of Defense (SecDef), CDRUSSTRATCOM retains control of assigned space forces, even if they are deployed within the area of responsibility (AOR) of a geographic combatant commander (GCC). Space forces typically operate in general or direct support to other JFCs, with no reassignment of space forces or transfer of operational authorities. This allows CDRUSSTRATCOM to maintain unity of effort, not only for space forces, but across all strategic forces CDRUSSTRATCOM must integrate and employ.

(b) **Enabling.** Supported commanders identify priorities to ensure supporting commanders and agency directors have clear guidance on the supported commander's intent, integrate space capabilities into planning and operations, and consider the impact if space capabilities are unavailable. Supporting commanders then provide details of how priorities are fulfilled. CDRUSSTRATCOM provides priorities and conflict resolution guidelines in support of joint space operations.

(7) **Security.** The purpose of security is to never permit the enemy to acquire unexpected advantage.

(a) **Employing.** CDRUSSTRATCOM conducts continuous operations to establish and maintain space situational awareness (SSA), which includes assessment of the capabilities and intent of potential or actual adversaries. In turn, this supports development of defensive measures within fielded space capabilities, operational planning to defeat threats, and timely employment of available defensive measures to ensure the availability of operational space capabilities.

(b) **Enabling.** Space forces employ space-based ISR capabilities with timely, assured, and responsive C2 systems. This enhances the joint force's ability to observe areas of interest (AOIs) and increases its situational awareness. JFCs maintain



Dust Storm in Afghanistan: Space-based imagery of an operations area can enhance a commander's understanding of impacts on the operational environment.

awareness of threats to space forces in their AORs and take measures to preempt or counter those threats in order to preserve US freedom of action in, and access to, space.

(8) **Surprise.** The purpose of surprise is to strike at a time or place or in a manner for which the enemy is unprepared. Surprise is closely linked to security, since security measures are often needed to achieve the element of surprise.

(a) **Employing.** CDRUSSTRATCOM's centralization of operational space C2 capabilities, coupled with effective SSA, contributes to comprehensive assessment and speed in decision-making. This supports the ability of US forces to overwhelm adversaries' decision-making cycles achieving surprise. Effective space control operations can negate threats and adversaries' use of space.

(b) **Enabling.** Space operations provide timely intelligence collection, enhanced information sharing, and precision targeting.

(9) **Simplicity.** The purpose of simplicity is to prepare clear, uncomplicated plans and concise orders to ensure thorough understanding.

(a) **Employing.** CDRUSSTRATCOM provides authorities, intent, and guidance for space operations in orders and operational plans. This enables space forces to execute synchronized and mutually supporting operations with economy of force.

(b) **Enabling.** CDRUSSTRATCOM's guidance complements supported JFC plans and operations and provides a common understanding of required space capabilities.

c. Space capabilities also enable the following applications of **the principles of joint operations:**

(1) **Restraint.** The purpose of restraint is to limit collateral damage and prevent the unnecessary use of force. A single act could cause significant military and political consequences; therefore, the judicious use of force is necessary.

(a) **Employing.** In the conduct of space operations, CDRUSSTRATCOM observes the laws of armed conflict, standing rules of engagement, and rules for the use of force.

(b) **Enabling.** Space forces contribute to the joint force's awareness of the operational environment and munitions accuracy.

(2) **Perseverance.** The purpose of perseverance is to ensure the commitment necessary to attain the national strategic end state.

(a) **Employing.** Satellites remain in their established orbits for years after deployment, and require long-term Service commitment to ensure continued availability.

(b) **Enabling.** Space forces enable persistent insight into adversaries' actions and disposition. This helps to dissuade potential adversaries from direct military confrontation.

(3) **Legitimacy.** The purpose of legitimacy is to develop and maintain the will necessary to attain the national strategic end state. Legitimacy is based on the legality, morality, and rightness of the actions undertaken.

(a) **Employing.** Adherence to the laws of armed conflict and compliance with US-ratified legal regimes assures legitimacy in US military space operations. Legitimacy is further underscored by safe and responsible space operations.

(b) **Enabling.** Space forces help maintain high standards of accuracy in military operations (for example, precision guided munitions).

SECTION B. OPERATIONAL CONSIDERATIONS FOR SPACE

3. General

a. The importance of space operations is increasing due to the enabling capabilities they provide to the joint force. Space capabilities are vital to overall military mission accomplishment and provide the advantages needed for success in all joint operations.

(1) Space capabilities should be integrated and synchronized by the supported commander into specific joint offensive and defensive operations, campaign planning, and into their concept of operations (CONOPS), operation plans (OPLANs), and operation orders.

(2) Supported and supporting commanders coordinate, as appropriate, the deployment and employment of space forces required to accomplish the assigned mission.

(3) Space forces simultaneously support multiple users. This requires extensive coordination, planning, and the early integration of requirements and capabilities. CDRUSSTRATCOM will prioritize space capabilities and make apportionment and allocation recommendations for Department of Defense (DOD) systems in coordination with supported commanders. SecDef will determine solutions for the supported commander's needs that cannot be fulfilled by the supporting commander.

(4) Adversary knowledge of US space capabilities and the role of space assets in joint operations are formidable, and many resources are expended to constantly increase the awareness of technology and concepts of operation for current and planned space systems. At the same time, the use of space capabilities by friend and foe alike is increasing in both volume and sophistication.

b. Commanders consider the following guidelines when planning and executing military operations, and when requesting space capabilities:

(1) Understand how others, including other United States Government (USG) departments and agencies, adversaries, and neutrals, use space capabilities to support military and civilian operations (such as use of Global Positioning System (GPS) by civil aviation).

(2) Provide allies and coalition partners appropriate access to systems and information. The joint force strives to provide necessary and appropriate space-related information at the lowest appropriate security classification level. However, established procedures for disclosure of intelligence information (specifically, information on US space systems and operations) must be followed in pursuing this goal.

(3) Maintain an awareness of the space forces and their operational status.

(4) Understand how and why space capabilities are integrated across the range of military operations to include civil support operations.

(5) Maintain SSA and assess the potential impacts on space-based and ground-based systems and operations.

4. Characteristics of Space

Space is a unique environment in which to conduct military operations. Commanders in all disciplines should have a basic awareness of the fundamental advantages and disadvantages offered by space operations in order to effectively employ space capabilities.

a. **No Geographical Boundaries.** International law does not extend a nation's territorial sovereignty up to Earth orbit. Therefore, nations enjoy unimpeded satellite overflight of other nations through space. Operating from space provides line of sight (LOS) access to large areas (including remote and denied access areas), which offers advantages for communications, navigation, ISR, and meteorological and oceanographic (METOC) information.

b. **Orbital Mechanics.** Satellite orbits must follow certain orbital parameters due to physical laws. A satellite's orbit is chosen to best satisfy a satellite's mission. These orbital parameters can sometimes be changed, but will deplete fuel, which can significantly degrade the performance or lifespan of a system.

c. **Environmental Considerations**

(1) **Space Weather.** Solar flares, charged particles, cosmic rays, the Van Allen radiation belts, and other natural phenomena in space create changes that can affect communications, navigation accuracy, the performance of sensors, and cause electronic failures.

(2) **Debris.** Operational satellites are under constant threat of impact. Orbiting particulates left behind during a satellite's lifetime, debris from satellite explosions or impacts, orbiting "trash" such as rocket bodies, or natural objects such as meteoroids, can damage main operational systems.

*See Appendix H, "*Space Fundamentals,*" for additional information on space characteristics.*

CHAPTER II
SPACE MISSION AREAS

> *"What's the big difference between 25 years ago and today? I would tell you, in my opinion, that space today is embedded in combat operations."*
>
> **General C. Robert Kehler**
> **Commander, Air Force Space Command**
> **November 16, 2007**

Today, US military space operations are comprised of the following mission areas: space force enhancement, space support, space control, and space force application. This chapter summarizes the role of each mission area and how they contribute to joint operations.

SECTION A. SPACE FORCE ENHANCEMENT

1. General

Space force enhancement operations **increase joint force effectiveness** by increasing the combat potential of that force, enhancing operational awareness, and providing needed joint force support. There are five force enhancement missions: ISR, missile warning, environmental monitoring, satellite communications, and PNT. They provide a critical advantage by reducing confusion inherent in combat situations. Space force enhancement operations also afford joint commanders access to denied areas and persistence, which are important characteristics not afforded to air, land, or maritime capabilities. Space force enhancement functions are often provided by interagency organizations, commercial organizations, and consortiums.

2. Intelligence, Surveillance, and Reconnaissance

Monitoring AOIs from space helps provide information on adversary location, disposition, and intent; aids in tracking, targeting, and engaging the adversary; and provides a means to assess these actions through tactical battle damage assessment (BDA) and operational combat assessment. It also provides situational awareness, warning of attack, and feedback on how well US forces are affecting the adversary's understanding of the operational environment.

3. Missile Warning

Spaced-based and ground-based systems are crucial for timely detection and communicating warning of nuclear detonations or adversary use of ballistic missiles to US forces and US allies. The tactical warning and attack assessment information space systems are essential for the proper execution of the missile warning mission. **Tactical warning** is a notification to operational command centers that a specific threat event is occurring or has occurred. **Attack assessment** is an evaluation of information to determine the potential or actual nature and objectives of an attack for the purpose of providing information for timely decisions. The component elements that describe threat events include the country of origin, the event type and size, the country that is determined to be under attack, and the time of the event.

4. Environmental Monitoring

Space forces provide data on **meteorological, oceanographic, and space environmental factors** that might affect military operations. Additionally, 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. Imagery capabilities such as multispectral imagery (MSI) and hyperspectral imagery (HSI) can provide joint force planners with current information on sub-surface, surface, and air conditions (e.g., trafficability, beach conditions, vegetation, and land use). Knowledge of these factors allows forces to avoid adverse environmental conditions while taking advantage of other conditions to enhance operations. Such monitoring also supports joint intelligence preparation of the operational environment (JIPOE) by providing the commander with information needed to identify and analyze potential adversary courses of action (COAs).

5. Satellite Communications

Satellite communications offer many unique advantages that allow the JFC and subordinate commanders to shape the operational environment. Using military SATCOM and, in some cases, civil, commercial, and international systems, the JFC and subordinate commanders are provided a broad range of capabilities, including instant global reachback to the Global Information Grid (GIG), transmission of critical intelligence, the ability to tie sensors to shooters, and survivable communications in

Portable satellite communications deployed to the field.

austere areas with limited or no infrastructure. While JFCs are apportioned SATCOM resources for planning, the actual allocation of SATCOM resources to JFCs for operations will be determined by the CDRUSSTRATCOM as the SATCOM operational manager (SOM). See Appendix D, "Satellite Communications," for more details.

6. Space-Based Positioning, Navigation, and Timing

Space-based PNT assets provide essential, precise, and reliable information that permits joint forces to more effectively plan, train, coordinate, and execute operations. Precision timing provides the joint force the capability to synchronize operations, and enables communications capabilities such as frequency hopping and cryptological synchronization to improve communications security and effectiveness. PNT also enables precision attack from stand-off distances, thereby reducing collateral damage and allowing friendly forces to avoid threat areas. Navigation warfare (NAVWAR) ensures that friendly forces have unfettered access to PNT, while denying adversarial use of the same.

SECTION B. SPACE SUPPORT

7. General

The space support mission area includes spacelift operations (launching and deploying satellites), satellite operations (maintaining, sustaining, and rendezvous and proximity operations), and reconstitution of space forces (replenishing lost or diminished satellites).

Atlas V / Evolved Expendable Launch Vehicle

8. Spacelift Operations

a. Spacelift is the ability to deliver satellites, payloads, and material into space. Spacelift operations are conducted to deploy, sustain, augment, or reconstitute satellite constellations supporting US military operations and/or national security objectives. Spacelift operations include operationally responsive launch capabilities.

b. Many of the products which are now used by US and multinational forces (MNFs), neutral nations, and enemies are derived from capabilities provided by commercial and civil satellites, and launched aboard commercial spacelift vehicles. The linkage between commercial, civil, and military space operations is becoming increasingly commonplace, providing unique capabilities, but also presenting unique challenges.

9. Satellite Operations

a. Satellite operations are conducted to maneuver, configure, operate, and sustain on-orbit assets. Satellite operations are characterized as spacecraft and payload operations. Spacecraft operations include telemetry, tracking, and commanding (TT&C), maneuvering, monitoring state-of-health, and maintenance sub-functions. Payload operations include monitoring and commanding of the satellite payload to collect data or provide capability in the operational environment. Military satellite operations are executed through a host of satellite operations centers linked to space assets via dedicated and shared networks. Some systems utilize dedicated antennas for both mission data retrieval and routine satellite TT&C. The TT&C subsystem monitors and controls all of the other systems on the spacecraft, transmits the status of those systems to the control segment on the ground, and receives and processes instructions from the control segment. Telemetry components include sensors throughout the satellite to determine the status of various components, the transmitters and antennas to provide the data to the control segment and even the data itself. The various networks combined ensure total C2 of space resources. Additionally, as a critical and essential link between the satellite operator and joint force, and a significant contributor to SSA, satellite operations include protection mechanisms to assure access to space assets.

b. DOD satellites are monitored, sustained, and operated out of satellite operations centers under the Service components. Globally-dispersed antennas for satellite C2 provide the necessary link between the satellite operations centers and the on-orbit satellites.

10. Rendezvous and Proximity Operations

a. Rendezvous operations are specific processes where two resident space objects are intentionally brought operationally close together.

b. Proximity operations are on-orbit activities of a resident space object that deliberately and necessarily maintains a close distance from another resident space object for a specific purpose.

c. Rendezvous and proximity operations (RPO) are conducted to support mission requirements, including such on-orbit activities as assembly and servicing and include the potential to support a wide range of future US space capabilities. To minimize the risk of collision and the creation of orbital debris, all RPO activities should ensure space flight safety. RPO planners should coordinate with USSTRATCOM to confirm space flight safety procedures are in place.

11. 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.

SECTION C. SPACE CONTROL

12. General

a. Space control provides freedom of action in space for friendly forces, and when directed, denies it to an adversary. It consists of offensive space control (OSC), defensive space control (DSC), and SSA.

b. Space control enables space superiority through surveiling space and terrestrial AOIs that could impact space activities; protecting the ability to use space; preventing adversaries from exploiting US, multinational, or neutral space services and capabilities; and negating the ability of adversaries to exploit space services and capabilities.

c. These operations change in nature and intensity as the type of military operations change. OSC is used to deny adversary freedom of action in space and is based on negation and offensive prevention measures. DSC is used to protect US space capabilities and is based on protection and defensive prevention measures.

(1) **Prevention.** Measures to preclude an adversary's hostile use of US or third party space systems and services. Prevention can include diplomatic, informational, and economic measures as appropriate. Prevention measures support protection and negation measures by allowing the US to use other instruments of national power. For instance, by showing that an adversary is using a US or third-party system in a hostile manner, international pressure may be brought to bear against the adversary, thereby potentially forcing the adversary to cease its actions. The US could also present evidence of an adversary's use of a third-party system, and garner support for economic sanctions against the adversary.

(2) **Negation.** Active and offensive measures to **deceive, disrupt, deny, degrade,** or **destroy** an adversary's space capabilities. Negation includes actions against ground, data link, user, and/or space segment(s) of an adversary's space systems and services, or any other space system or service used by an adversary that is hostile to US national interests.

(3) **Protection.** Active and passive defensive measures ensure that US and friendly space systems perform as designed by overcoming an adversary's attempts to negate friendly exploitation of space, or minimize adverse effects if negation is attempted. Such measures also provide some protection from space environmental factors. Protection measures must be consistent with the criticality of the mission's

contribution to the joint force and are applied to each component of the space system, including launch, to ensure that no potential single point of failure exists. Means of protection include, but are not limited to, ground facility protection (security, covert facilities, camouflage, concealment, deception, mobility, and hardening), alternate nodes, spare satellites, link encryption, increased signal strength, adaptable waveforms, satellite radiation hardening, signal monitoring (such as monitoring SATCOM signals for electromagnetic interference [EMI], characterization of any EMI, and EMI geolocation), and space debris protection measures. Finally, attack indications could be so subtle or dispersed that, individually, an attack is not detectable.

13. Offensive Space Control

OSC is defined as those offensive operations to prevent an adversary's hostile use of US/third-party space capabilities or negate an adversary's space capabilities. OSC entails the negation of enemy space capabilities through denial, deception, disruption, degradation, or destruction. Adversaries – both state and non-state actors – will exploit increased access to space-based capabilities. Hence, it is incumbent on the US military to negate the adversaries' use of those space capabilities that affect the safety and well-being of US, allied, and coalition forces. OSC actions may target an adversary's space-related capabilities, forces, information links, and space capabilities supporting those forces, using both destructive and nondestructive means.

14. Defensive Space Control

a. DSC is defined as those operations conducted to preserve the ability to exploit space capabilities via active and passive actions. DSC includes defensive operations that prevent adversaries from exploiting US or third-party space capabilities. These actions protect friendly space capabilities from attack, interference, or unintentional hazards. Although focused on responding to man-made threats, such as GPS and SATCOM jammers, DSC actions may also safeguard assets from unintentional hazards such as space debris, radio frequency (RF) interference, and other naturally occurring phenomenon such as radiation.

b. DSC attempts to preserve US access to, and use of, space by employing all means available to react to events affecting US and allied space capabilities. A robust DSC capability influences adversaries' perceptions of US space capabilities and makes them less confident of success in interfering with those capabilities. DSC is built on several elements including capabilities to detect and characterize an attack, ability to attribute an attack to an adversary, ability to defeat the attack, and the ability to operate through or deter an attack.

c. The USG considers PI with its space systems as an infringement on its rights. PI consists of deliberate actions taken to deny or disrupt a space system, service, or capability. The Purposeful Interference Response Team (PIRT) has been established to meet the threats posed by PI. The PIRT is led by DOD through USSTRATCOM and brings together representatives from the USG to include the Department of State, the intelligence community (IC), and the Federal Communications Commission. The PIRT is designed to provide a single point of entry to report PI, provide an interagency forum to evaluate the impact on US national interests, and provide options to resolve them.

15. Space Situational Awareness

a. **SSA is fundamental to conducting space operations.** It is a key component for space control because it is the enabler, or foundation, for accomplishing all other space control tasks. SSA involves characterizing, as completely as necessary, the space capabilities operating within the terrestrial environment and the space domain. It includes components of ISR; environmental monitoring, analysis, and reporting; and warning functions. SSA leverages space surveillance, collection, and processing of space intelligence data; synthesis of the status of US and cooperative satellite systems; collection of US, allied, and coalition space readiness; and analysis of the space domain. It also incorporates the use of intelligence sources to provide insight into adversary use of space capabilities and their threats to our space capabilities while in turn contributing to the JFC's ability to understand enemy intent.

b. SSA supports the following key objectives:

(1) **Ensure space operations and spaceflight safety.** SSA provides the infrastructure that ensures that US space operators understand the conditions that could adversely impact successful space operations and spaceflight safety (i.e., collision avoidance).

(2) **Implement international treaties and agreements.** SSA is a means by which compliance, via attribution, can be verified and by which violations can be detected.

(3) **Protect space capabilities.** The ability of the US 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 US support during times of peace, crisis, and conflict.

(4) **Protect military operations and national interests.** SSA supports and enhances military operations.

c. **Components of space situational awareness** include:

(1) **Intelligence.** For SSA, intelligence provides the characterization and analysis of foreign (adversary and third-party) space capabilities, to include adversary or third party use of US, or commercial space capabilities to their advantage and intent. Characterization includes, but is not limited to, how forces and assets operate, their impact upon military operations, and their vulnerabilities and strengths. Intelligence analysis of all elements of space systems is required to determine threats and vulnerabilities of foreign space capabilities. It primarily supports the characterization and

analysis of space capabilities in preparation for targeting or protection. Reliable, timely, and accurate intelligence also supports assessment.

(2) **Surveillance.** Space surveillance is the systematic and continuous observation and information collection on all man-made objects orbiting the Earth. Surveillance contributes to orbital safety, indications and warning of space events, initial indications of where threats may be located, and assessment. Space events include satellite maneuvers, anticipated and unanticipated launches, reentries, and mission-impacting space weather. Surveillance data, for example, is used to produce the satellite catalog — the fused product that provides the location of on-orbit satellites as well as man-made space debris. Information from the satellite catalog is used by predictive orbital analysis tools to anticipate satellite threats and mission opportunities for friendly, adversary, and third party-assets.

(3) **Reconnaissance.** Reconnaissance provides the detailed characterization of a specific object needed to analyze and assess the operational environment. Space reconnaissance supports targeting and post-strike assessment. Reconnaissance data, for example, may come from an unmanned aircraft system (UAS) providing visual images of a mobile satellite ground station to aid in the planning of a strike against that ground station. Assets that perform reconnaissance may also conduct surveillance.

(4) **Environmental Monitoring.** Environmental monitoring includes the characterization, analysis, and prediction of space weather (e.g., solar conditions), terrestrial weather near important ground nodes, and natural phenomena (e.g., interplanetary objects, such as meteoroids and asteroids) in space. This environmental information must be accurate and timely to protect space systems and support space control planning and execution. Predictions of natural environmental effects should be synchronized with military commanders' COAs to enhance military effectiveness. Environmental monitoring, analysis, and prediction are critical in space control and space force enhancement operations. Natural phenomena, such as solar activity and lightning, can interfere with space systems. Operators must be able to differentiate between natural phenomena interference and an intentional attack on a space system in order to formulate an appropriate response.

(5) **Space Common Operational Picture.** The space common operational picture (COP) is a subset of the overall COP that aggregates information about space and terrestrial weather that could impact space systems; the blue space picture showing US, allied, and civilian space capabilities; the red/grey space picture showing adversary and neutral space capabilities; and space debris tracking. SSA provides the relevant space information needed in planning, execution, and assessment. Combining multiple sources of information into a COP is essential for SSA. Likewise, C2 and reporting processes enhance SSA by providing feedback on the status/readiness of forces and insight on how integrated space capabilities are contributing to military operations. Fusion of SSA information occurs at several levels, but is crucial at the C2 nodes. Multiple C2 nodes will often require SSA information, making unity of effort for SSA activities essential. Figure II-1 provides a summary of the space COP.

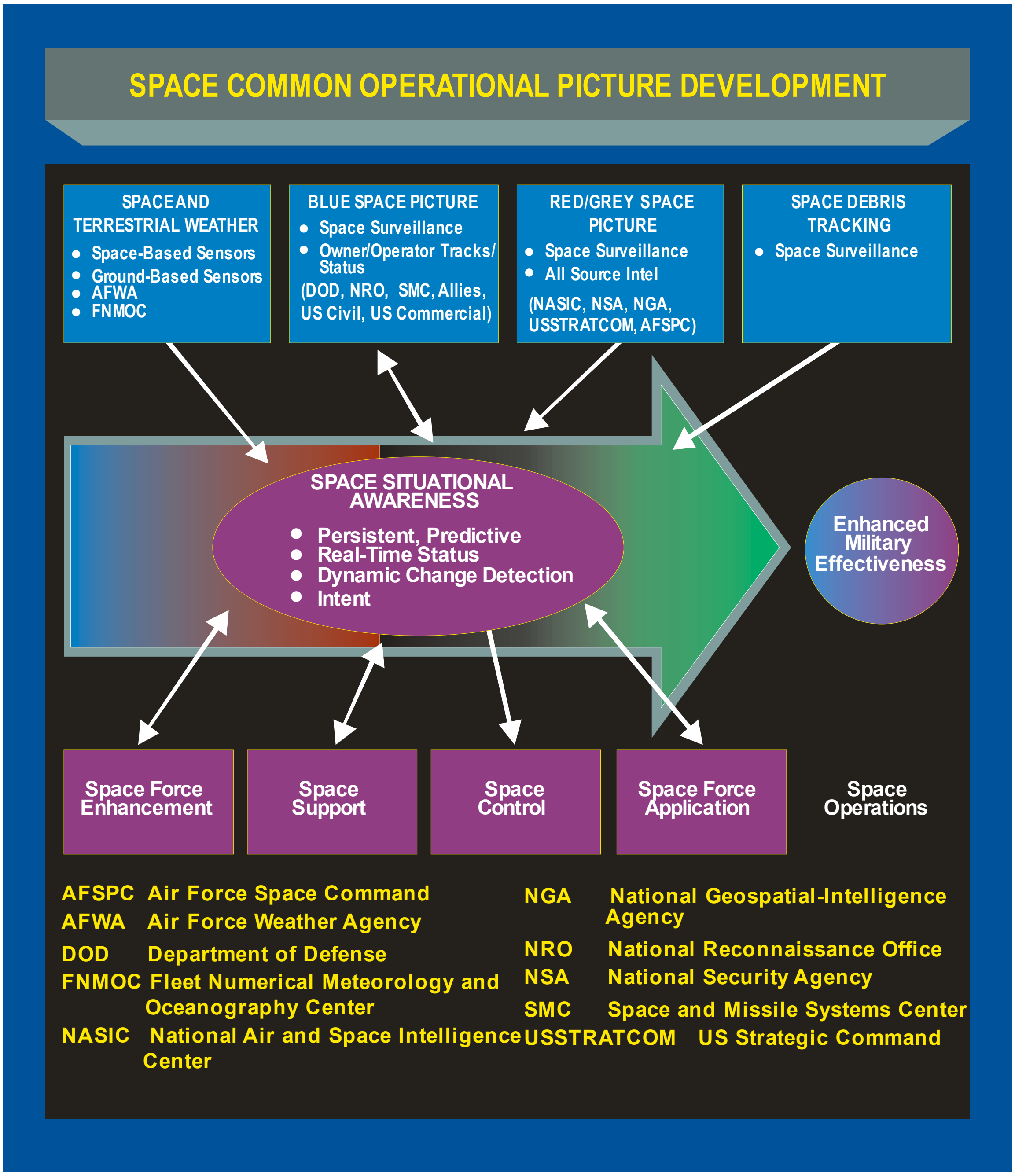


Figure II-1. Space Common Operational Picture Development

d. The overall SSA of the US can benefit from cooperation with non-USG satellite operators by gaining insight into commercial and foreign systems' status, mission capabilities, maneuver plans, and knowing who to call in case of a potential conflict with a USG satellite, etc.

SECTION D. SPACE FORCE APPLICATION

16. Space Force Application

DOD policy defines space force application as combat operations in, through, and from space to influence the course and outcome of conflict by holding terrestrial targets at risk. This mission area is incorporated into national space policy as well. Specific responsibilities can be found in DOD Instruction (DODI) 3100.13, *Space Force Application.*

CHAPTER III
COMMAND AND CONTROL OF SPACE FORCES

> *"It is through space that our troops and our leadership monitor the battlefield and communicate with each other."*
>
> **Secretary of Defense Robert M. Gates**
> **Offutt Air Force Base, Nebraska**
> **October 17, 2007**

1. General

Command relationships are defined by the Global Force Management Implementation Guidance, and described in Joint Publication (JP) 1, *Doctrine for the Armed Forces of the United States*. Applied to space forces, they establish and maintain unity of command, effort, and purpose in achieving joint force and national security objectives. CDRUSSTRATCOM advocates, plans, and executes military space operations and has the responsibility to prioritize, deconflict, integrate, and synchronize military space operations for current and planned joint operations.

2. Command Relationships

a. Joint space forces are an integral part of military operations, and command relationships are crucial for ensuring timely and effective employment. CDRUSSTRATCOM has the United Command Plan (UCP)-assigned role to conduct space operations. CDRUSSTRATCOM has designated the CDR, Joint Functional Component Command for Space (JFCC SPACE) to manage day-to-day space operations. The CDR JFCC SPACE is the focal point for military space operations, and has been delegated the following from CDRUSSTRATCOM:

(1) Coordinating authority for planning and execution of space operations by designated space forces.

(2) OPCON of designated space and missile warning forces under CDRUSSTRATCOM.

(3) Management of the theater event system (TES) that provides theater ballistic missile warning to all GCCs.

b. Space capabilities provide global communications PNT services, environmental monitoring, space-based ISR, and warning services to combatant commanders (CCDRs), Services, and agencies. Normally, space forces supporting multiple CCDRs remain assigned or attached to USSTRATCOM. In the past, command of satellites and space systems supporting multiple CCDRs have not been transferred to a CCDR. However, there may be a need during operations for command of these resources to be transferred to a CCDR.

3. Responsibilities

CCDRs:

a. Provide their prioritized space requirements to CDRUSSTRATCOM.

b. Establish specific joint force guidance and objectives for space operations. This guidance is integrated into appropriate OPLANs and their annexes.

c. Specify OSC and DSC objectives to be met, and provide guidance for the employment of C2, communications systems, intelligence, logistics, and attack operations. This guidance should be reflected in appropriate OPLANs and their annexes. The component commanders jointly conduct operations under the guidance and in support of the objectives of the CCDR.

d. May designate a space coordinating authority (SCA) and delegate appropriate authorities for planning, integrating, and coordinating space operations within the operational area.

4. Space Coordinating Authority

a. A supported JFC normally designates an SCA to coordinate joint space operations and integrate space capabilities. Based on the complexity and scope of operations, the JFC can either retain SCA or designate a component commander as the SCA. The JFC considers the mission, nature, and duration of the operation; preponderance of space force capabilities made available; and resident C2 capabilities (including reachback) in selecting the appropriate option. The SCA is responsible for coordinating and integrating space capabilities in the operational area, and has primary responsibility for joint space operations planning, to include ascertaining space requirements within the joint force.

b. 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. Following coordination, a prioritized list of recommended space requirements based on joint force objectives is provided to the JFC. Upon JFC approval, the list is submitted to the CCDR for coordination with CDRUSSTRATCOM. To ensure prompt and timely support, CDRUSSTRATCOM may approve direct liaison authorized as appropriate. This does not restrict CCDR Service component commands from communicating requirements directly to their counterpart USSTRATCOM Service component commander. However, SCAs keep their respective commanders apprised of all such coordination activities to ensure that space activities are coordinated, deconflicted, integrated, and synchronized. SCAs at subordinate commands, if designated, will accomplish the same requirements for submission to the combatant command SCA as directed. Summarizing, the SCA's roles and responsibilities include:

(1) Coordinating, integrating, and synchronizing space capabilities in the operational area.

(2) Planning space operations and ensuring inputs from the staff and components are incorporated.

(3) Maintaining situational awareness of theater space operations, and coordinating with the combatant command SCA or CDR JFCC SPACE to integrate theater space operations into global space operations.

(4) Providing consolidated space requirements through the JFC for coordination as required.

5. Role of Non-Department of Defense Capabilities

a. CCDRs have requirements that cannot always be provided by DOD space capabilities alone. Accordingly, DOD's reliance on non-DOD space systems continues to grow. DOD space capabilities can be supplemented through civil, commercial, international, allied, and other USG agency capabilities. Required capabilities that can be fulfilled by non-DOD assets include communications, imagery, environmental monitoring, and Earth resource information.

b. USSTRATCOM or other organizations will coordinate the appropriate assets to fulfill the required capabilities sought by the CCDR.

c. The National Aeronautics and Space Administration (NASA) may provide launch facilities and environmental Earth science products that may have applicability to joint operations. The National Oceanic and Atmospheric Administration (NOAA), under the Department of Commerce (DOC), provides weather information through the polar operational environment satellite (POES) system, geostationary operational environment satellites, and Defense Meteorological Satellite Program (DMSP), as well as locating distress alerts via the search and rescue satellite-aided tracking (SARSAT) system. Additionally, commercial satellite programs such as Automatic Identification System and Long Range Identification and Tracking contribute to homeland security through global tracking of shipping traffic. The capabilities that many non-DOD agencies provide to joint forces are discussed in greater detail in Chapter IV, "Roles and Responsibilities."

d. Satellite systems are increasingly becoming national assets. Multiple agencies have combined separate programs to resource an interagency capability. As an example, the National Polar-orbiting Operational Environmental Satellite System (NPOESS) combines existing orbiting satellite systems, NOAA POES and DOD DMSP, under a single national program. NPOESS collects and disseminates data on Earth's weather, atmosphere, oceans, and land environments for the DOC, DOD, and NASA. These polar-orbiting satellites are able to monitor the entire planet, thereby providing a wealth of environmental knowledge to joint forces and several agencies.

The designated space coordinating authority (SCA) should consider, as a best practice, establishing a jointly manned space element, with the appropriate joint command relationship, to aid the SCA in the execution of day-to-day responsibilities. All Services provide some level of support to the designated SCA to create synergy in space planning. All Services and operational units in the operational area should be afforded consideration in planning for space operations.

For example, in Operation IRAQI FREEDOM, the Commander, US Central Command designated the joint forces air component commander as the SCA. The Army and Air Force have provided support to the US Central Command SCA, creating a level of synergy in space planning. However, since there is no Navy representation on the SCA staff, the SCA provides direct space support to the lead carrier strike group (CSG) in theater. The CSG commander requires direct liaison authorized in order to interact with the SCA at the operational level, for support to all tactical level maritime units.

CHAPTER IV
ROLES AND RESPONSIBILITIES

1. General

The joint force achieves maximum utility from space forces when they are organized and employed effectively. While some command and support relationships are enduring, others may vary for operations of different scopes and purposes. The joint force allocates space forces in the joint operations planning process.

SECTION A. THE CHAIRMAN OF THE JOINT CHIEFS OF STAFF AND COMBATANT COMMANDERS

2. The Chairman of the Joint Chiefs of Staff

The Chairman of the Joint Chiefs of Staff (CJCS) will:

a. Establish a uniform system for evaluating readiness of each combatant command and combat support agency (CSA) to employ space forces to carry out assigned missions.

b. Develop joint doctrine for the operation and employment of space capabilities of the Armed Forces, and formulate policies for joint space training and military education of the Armed Forces.

c. Integrate space forces and their supporting industrial base into the Joint Strategic Capabilities Plan, and formulate policies for the integration of National Guard and reserve forces into space activities.

d. Provide guidance to CCDRs for planning and employment of space capabilities through the joint operation planning process.

3. Combatant Commanders

CCDRs also play a key role in space operations. Accordingly, they will:

a. Consider space capabilities when selecting alternatives to satisfy mission needs, as well as develop and articulate military requirements for space and space-related capabilities.

b. Provide prioritized theater space requirements to CDRUSSTRATCOM.

c. Integrate space services and capabilities into OPLANs, concept plans (CONPLANs), campaign plans, theater guidance, and objectives, and plan for the employment of space capabilities within their AOR.

d. Use staff elements and component commands to plan, monitor, advise, coordinate, and execute space operations within their AOR.

e. Provide input to the Joint Staff for evaluations of the preparedness of their combatant command to carry out assigned missions by employing space capabilities.

f. Coordinate on operation and campaign plans and provide supporting plans as directed by the CJCS.

g. Plan for and provide force protection for space forces deployed and operating in their AOR.

SECTION B. UNITED STATES STRATEGIC COMMAND AND COMPONENTS

4. General

a. CDRUSSTRATCOM is charged with the missions of global strike, space operations, information operations (IO), missile warning, and integrated missile defense. With regards to the UCP-assigned space mission, the CDRUSSTRATCOM will advocate for desired capabilities, and plan and conduct space operations to include:

(1) Providing warning and assessment of space attack.

(2) Serving as the single point of contact for military space operational matters, except as otherwise directed.

(3) Providing military representation to US national agencies, international agencies, and commercial entities for military matters related to space operations as directed and in coordination with the CJCS and other CCDRs.

(4) Coordinating and conducting space campaign planning.

(5) Serving as the DOD Manager for Human Space Flight Support Operations.

(6) Setting protection and survivability requirements for space capabilities.

(7) Supporting the SSA requirements of the Director for National Intelligence and conducting SSA for the USG; commercial space capabilities and services used for national and homeland security purposes; civil space capabilities and operations, particularly human space flight activities; and, as appropriate, commercial and foreign space entities.

(8) Planning for the protection of national, civil, and commercial space capabilities used for national security and homeland security purposes, or as designated by the President.

b. CDRUSSTRATCOM:

(1) Plans, integrates, coordinates, and develops desired characteristics and capabilities for global missile defense operations and support for missile defense.

*For more information on missile warning and defense see Appendix B, "*Missile Warning,*" and JP 3-01,* Countering Air and Missile Threats.

(2) Plans, integrates, and coordinates DOD global network operations by directing GIG operations and defense. Within the GIG, space-based capabilities and services play a key role.

(3) In coordination with the CJCS quickly plans, directs, coordinates, and controls assigned space assets and forces for daily operations and crisis action planning in the event of military action against the US and/or its allies. In addition, USSTRATCOM provides warning to US national leaders of attacks against US space assets worldwide. USSTRATCOM executes these warning responsibilities through JFCC SPACE and its Joint Space Operations Center (JSPOC).

(4) USSTRATCOM performs the functions, roles, and responsibilities of the Strategic Missile Warning Functional Manager's Office (FMO) and the Theater Missile Warning FMO that are collectively responsible for the management and oversight of the missile warning mission.

5. Joint Functional Component Command for Space

a. **Commander, Joint Functional Component Command for Space.** CDR JFCC SPACE, as designated by CDRUSSTRATCOM, serves as the single point of contact for assigned military space operational matters, including planning, tasking, directing, and executing space operations using assigned space forces. For space related activities, JFCC SPACE is the primary USSTRATCOM interface to supported commanders. The goal of JFCC SPACE is to provide unity of command and unity of effort in the unimpeded delivery of joint space capabilities to supported commanders and, when directed, to deny the benefits of space to adversaries. JFCC SPACE responsibilities are reflected in the pertinent USSTRATCOM directives and/or orders. Currently, these responsibilities include:

(1) Plan and conduct space operations (force enhancement, space control, space support [excluding spacelift], and force application [excluding intercontinental ballistic missiles {ICBMs}]).

(2) Conduct operational-level C2 of assigned forces. Report operations in direct support of other combatant commands to CDRUSSTRATCOM via the Global Operations Center. Provide continuous situational awareness of assigned forces engaged in ongoing space operations.

(3) Maintain a space COP as the operational manager for SSA. Ensure the common space picture is available to all authorized users and space mission partners to facilitate their planning, decision-making, and situational awareness. Maintain an operational picture of the blue force space order of battle.

(4) Synchronize USSTRATCOM space operations with the National Reconnaissance Office (NRO) to develop shared SSA and jointly execute DSC.

(5) Execute safety of flight and constellation management operations in accordance with CONPLAN 8035 and provide USSTRATCOM with situational awareness of any operational implications or impact to other combatant command AORs, to include any space vehicle repositioning that would impact CCDRs. Coordinate with Joint Task Force – Global Network Operations (JTF-GNO) to conduct global SATCOM operations.

(6) As CDRUSSTRATCOM's SCA, establish relationships and coordinate joint space operations with designated SCAs at each combatant command.

(7) On behalf of CDRUSSTRATCOM, conduct operations in support of CDRUSSTRATCOM duties as DOD manager for human space flight support in compliance with headquarters (HQ) USSTRATCOM direction, to include any changes in mission or operational impacts.

(8) Perform RF deconfliction and laser clearinghouse operations for all applicable DOD operations.

(9) Provide warning and assessment of attack on space systems to CDRUSSTRATCOM and other combatant commands. Coordinate time sensitive analysis with HQ USSTRATCOM J-2 (intelligence directorate of a joint staff) and national intelligence agencies to provide indications and warning of attack on space assets.

(10) Conduct the USSTRATCOM mission of providing missile warning to other combatant commands, allies, and others as directed.

(11) Conduct integrated NAVWAR operations by providing global and GCC-specific space-borne and space-enabled NAVWAR capabilities.

(12) Support HQ USSTRATCOM advocacy, identification, and assessment of current and future space requirements of combatant commands.

(13) Plan, task, integrate, C2, and execute joint space operations in accordance with timing and tempo as established by CDRUSSTRATCOM, and, when in support, other CCDRs and allies, and other organizations as appropriate.

b. **Joint Space Operations Center.** The mission of the JSPOC is to provide CDR JFCC SPACE with agile and responsive C2 capabilities to conduct space operations on a 24/7 basis. The JSPOC is built around an air and space operations center adapted specifically for space missions and global operations and provides reachback to CCDRs' SCAs. The JSPOC:

(1) Provides operational-level space C2 support to CDR JFCC SPACE.

(2) Provides SSA and maintains the single integrated space picture that is shared with CCDRs and appropriate SSA users.

(3) Plans, directs, controls, integrates, and assesses space operations on behalf of CDRUSSTRATCOM and CDR JFCC SPACE.

(4) Supports the intertheater responsibilities of CDR JFCC SPACE and coordinates with theater SCAs.

(5) Develops COAs, plans, and executes military space operations.

(6) Provides day-to-day operations with JSPOC crews in place to monitor day-to-day events. When a space-related incident or contingency requiring enhanced space support occurs, the JSPOC assesses the situation and notifies the appropriate operations centers within USSTRATCOM and the National Military Command Center, as necessary.

6. Other US Strategic Command Functional Components

a. **Joint Task Force-Global Network Operations.** The JTF-GNO directs the operation and defense of the GIG to ensure timely and secure net-centric capabilities in support of DOD's full range of warfighting and intelligence missions. CDR JTF-GNO is the supported commander for SATCOM, a key component of the GIG and GIG defense. Specific roles and responsibilities include:

(1) Planning, coordinating, and overseeing or directing SATCOM network and payload reconfiguration plans for assigned users.

(2) Developing COAs for GIG-related operations which include SATCOM operations in support of USSTRATCOM and national-level objectives as required to support net-centric warfare operations.

(3) Performing operational functions and activities of the SOM, including day-to-day operations, management, and coordination with the strategic functions and activities of the SOM as performed by the strategic SATCOM manager.

(4) Serving as the supported commander for EMI resolution.

(5) Providing full support to maintain availability and reliability of critical DOD SATCOM systems.

(6) Serving as liaison between USSTRATCOM, Defense Information Systems Agency (DISA), and DOD customers for SATCOM-related issues.

(7) Providing technical input to, and participating in, reviews and recommendations of best practices for Military Strategic and Tactical Relay System DOD use of commercial SATCOM.

(8) Ensuring the global network operations (NETOPS) center, through the global SATCOM support center, theater NETOPS centers, satellite C2 centers, and other supporting elements, such as the regional SATCOM support centers (RSSCs), provide timely SATCOM status, and rapidly resolve outages or other problems.

(9) Directing all operational and tactical SATCOM functions and tasks.

For more information on JTF-GNO roles and responsibilities related to NETOPS, including SATCOM, see JP 6-0, Joint Communications System.

b. **Joint Functional Component Command for Intelligence, Surveillance, and Reconnaissance.** Joint Functional Component Command for Intelligence, Surveillance, and Reconnaissance (JFCC ISR) plans, coordinates, and integrates defense global ISR strategies into combatant command planning and operations. JFCC ISR formulates recommendations to integrate global ISR capabilities associated with the missions and requirements of DOD ISR assets in coordination with the combatant command, the Defense Intelligence Operations Coordination Center (DIOCC), and CDRUSSTRATCOM. In coordination with the combatant commands, JFCC ISR provides personnel and resources in direct support of the combatant command joint intelligence operations centers.

(1) JFCC ISR plans, integrates, and coordinates ISR activities in support of DOD's strategic and global operations. The JFCC ISR AOI extends worldwide, from underwater to space and overlays, but does not affect other AORs assigned to combatant commands.

(2) JFCC ISR coordinates with multiple agencies which operate or use space capabilities, including the Defense Intelligence Agency (DIA), National Geospatial-Intelligence Agency (NGA), National Security Agency/Central Security Service (NSA/CSS), NRO, US Joint Forces Command (USJFCOM), the military Services, and other mission partners. Specific roles and responsibilities of JFCC ISR in relation to space operations include:

(a) Developing and maintaining a global COP of ISR which is shared in real time with JFCC SPACE, USSTRATCOM and other combatant commands, and JFCs via the GIG.

(b) Supporting CDRUSSTRATCOM's development of COAs and options to mitigate consequent risks and gaps.

(c) Assessing, identifying, and defining gaps, shortfalls, priorities, and redundancies of ISR capabilities.

(d) Integrating ISR special activities in support of combatant command requirements.

For more information on JFCC ISR roles and responsibilities related to intelligence, see JP 2-0, Joint Intelligence.

c. **Joint Functional Component Command for Network Warfare.** The Joint Functional Component Command for Network Warfare (JFCC NW) is responsible for planning, integration, coordination, execution, force management, and capability management of the cyber warfare mission in support of the joint force, as directed by CDRUSSTRATCOM. It also provides situational awareness of opportunities to attack adversaries, and exercises OPCON and TACON of cyberspace forces and capabilities as directed. Space links and nodes may be incorporated in JFCC NW operations to ensure coordination and deconfliction of desired objectives.

d. **Joint Functional Component Command for Integrated Missile Defense.** The Joint Functional Component Command for Integrated Missile Defense is responsible for integrated missile defense planning and operational support to include operational and tactical level plan development, force execution, and day-to-day management of assigned and attached missile defense forces.

For more information on missile defense, see JP 3-01, Countering Air and Missile Threats.

e. **Joint Functional Component Command for Global Strike.** The Joint Functional Component Command for Global Strike provides planning and force management in order to deter attacks against the US, its territories, possessions, and bases, and when directed, defeat adversaries through decisive joint global strike.

SECTION C. SERVICE COMPONENT OPERATIONS

7. General

USSTRATCOM operates assigned and attached space forces through JFCC SPACE, in coordination with Service component commands and their operations centers, including Space and Missile Defense Command/US Army Forces Strategic Command (SMDC/ARSTRAT), Naval Network Warfare Command (NETWARCOM), United States Marine Corps Forces, United States Strategic Command (MARFORSTRAT), and Air Force Space Command (AFSPC). These Service components have distinct space missions. Common responsibilities of each of the Service components are: advocating for space requirements within their respective Services, providing a single point of contact for access to Service resources and capabilities, making recommendations to USSTRATCOM on appropriate employment of Service forces, providing assigned space forces to CDRUSSTRATCOM and CCDRs as directed, assisting in planning in support of space operations and assigned tasking, and supporting CDRUSSTRATCOM and other CCDRs with space mission area expertise and advocacy of desired capabilities as requested.

8. Army Component

a. SMDC/ARSTRAT provides planning, integration, control, and coordination of Army forces and capabilities in support of USSTRATCOM missions. While SMDC/ARSTRAT is the Army proponent for space, high altitude, and ground–based midcourse defense (GMD) the US Army Signal Center is responsible for SATCOM force integration and life-cycle management of all Army SATCOM user equipment, and the US Army Intelligence Center is responsible for space-based ISR force integration and life cycle management of related user equipment. Successful integration of space capabilities into Army operations results in some space capabilities being executed outside SMDC/ARSTRAT.

b. SMDC/ARSTRAT contains two brigades. One provides space support, space force enhancement, and space control operations; the other provides space force application operations.

(1) SMDC/ARSTRAT provides advanced geospatial intelligence, BFT, ballistic missile warning by deploying joint tactical ground stations, space expertise with Army space support teams, commercial satellite imagery products through commercial exploitation teams, and communication transmissions and satellite payload control of the wideband satellite constellation that includes Defense Satellite Communications System (DSCS) and Wideband Global Satellite Communications (WGS).

(2) In its role of missile defense, SMDC/ARSTRAT provides GMD to dissuade, deter, and defeat ballistic missile attacks.

(3) SMDC/ARSTRAT has OPCON/administrative control of the three RSSCs. A RSSC may support multiple CCDRs.

c. The Army also integrates space capabilities at the army, corps, division, and fires brigade levels using space support elements (SSEs). SSEs organic space experts resident on the HQ staff, are an integral part of the staff and are directly involved in the staff planning process from the beginning. The element is responsible for identifying opportunities to employ space force enhancement, or space control, and then coordinating for the required support. When deployed, the SSE establishes and maintains contact with the SCA. It also coordinates with the SCA on procedures for space support requests and reachback support. The SSE participates in the conduct of mission analysis to determine which space-based capabilities are applicable to the particular operation and then coordinates and makes recommendations for the allocation and use of space services and capabilities. The mission analysis performed by the SSE forms the basis of the staff's space running estimate, as well as annex N (Space Operations), for all orders and plans.

9. Marine Corps Component

a. MARFORSTRAT, as the United States Marine Corps (USMC) Service component to USSTRATCOM, represents USMC capabilities and space interests. Marine Corps requirements for space exploitation and space force enhancement are supported through MARFORSTRAT. MARFORSTRAT brings resident knowledge and access to Marine Corps capabilities that can support USSTRATCOM mission areas and advises CDRUSSTRATCOM on proper employment and support of USMC forces. During planning and execution, MARFORSTRAT informs the CDRUSSTRATCOM of changes in space capabilities that would significantly affect operational capabilities or mission sustainment. MARFORSTRAT assists in developing operation plans and provides necessary force data to support all assigned missions to include contingency or crisis action planning.

b. MARFORSTRAT also directly supports subordinate functional components and Service component commanders on the proper employment of USMC forces and capabilities, assists in developing operational and exercise plans, and provides necessary force data to support all assigned missions, including the space mission through the Marine Corps space cadre. MARFORSTRAT provides support to facilitate planning, operations, and exercises for space through established policy and joint employment of assets to Marine Corps forces.

10. Navy Component

a. NETWARCOM is assigned to USSTRATCOM and functionally serves as the Navy's central operational authority for space, networks, and IO in support of maritime forces afloat and ashore. Commander, NETWARCOM is responsible for operating assigned space systems as an integral element of network operations and associated space control activities, and providing space expertise, support, products, and services, as required.

b. NETWARCOM Maritime Operations Center (MOC) provides planners and space reachback for maritime forces and coordinates with other space operations entities, including space operations officers on strike group staffs, on joint force maritime component commander staffs, or maritime HQ with MOCs responsibilities include:

(1) Developing space effects packages (naval space plan for maritime forces) and providing space products in support of combat plans to satisfy strike group and forward deployed and theater maritime forces' requirements derived in the planning process.

(2) Providing SSA for maritime forces.

(3) Synchronizing with the fleet MOCs to provide operational assessment of maritime operations to facilitate translation of the maritime operator's space needs and ensure delivery of critical space capabilities.

c. Naval Satellite Operations Center (NAVSOC), administratively and operationally assigned under NETWARCOM, is responsible for operating, managing, and maintaining assigned satellite systems to provide reliable space-based services in direct support of Navy and joint forces. NAVSOC's missions include the tracking, telemetry, and control operations of:

(1) Ultrahigh frequency (UHF) follow-on satellite system and fleet satellite constellations that provide the military UHF narrowband voice and data communications.

(2) Polar extremely high frequency (EHF) satellites.

(3) Navy Ionospheric Monitoring System satellites that support upper ionospheric research.

(4) Mobile User Objective System satellites that provide global SATCOM narrowband connectivity.

11. Air Force Component

a. AFSPC serves as the Air Force Service component to USSTRATCOM for space and ICBMs. Its mission is to organize, train, and equip Air Force space forces providing space control, force application, force enhancement, and space support to the JFC. AFSPC accomplishes its mission through two numbered air forces (NAFs) and a center which oversees space launch and on-orbit checkout. These NAFs provide operational space forces for space control, ballistic missile warning, PNT, communications, spacelift, satellite control operations capabilities, and the Nation's ICBM force. Commander, AFSPC provides strategic planning and develops CONOPS to support strategic-level operations.

b. The Commander, AFSPC presents a component numbered air force (C-NAF) to USSTRATCOM. This C-NAF exercises operational and tactical-level responsibilities of the Service component commander, as delegated by the AFSPC commander, to include operating space capabilities, and presentation, generation, readiness, and sustainment of Air Force space forces assigned to CDRUSSTRATCOM. This C-NAF commander performs Service operational needs identification and prioritization, and supports Service-component aspects of crisis and contingency planning and integration for global and theater objectives.

c. AFSPC is responsible for services, facilities, and range control for the conduct of DOD, NASA, and commercial launches. Through control of DOD satellites, it provides continuous global coverage, operations for essential in-theater secure communications, environmental monitoring, and navigational data for joint operations and threat warning.

AFSPC also operates ground-based radar to monitor ballistic missile launches around the world and guard against surprise attack. AFSPC assures access to space by providing launch and range operations for a variety of launch vehicles including the Evolved Expendable Launch Vehicle.

d. AFSPC operates the Air Force Satellite Control Network (AFSCN) which supports national security (defense and intelligence) satellites during launch and early orbit periods and is used to analyze anomalies affecting orbiting satellites. For particular constellations, AFSCN provides routine control functions and operates a few satellite constellations with a dedicated control network.

e. The director of space forces (DIRSPACEFOR) is a senior Air Force officer with broad space expertise and theater familiarity, normally nominated by Commander AFSPC and approved by the commander, Air Force forces (COMAFFOR). AFSPC ensures DIRSPACEFORs are qualified to perform their responsibilities, and the COMAFFOR provides theater-specific information and orientation. The DIRSPACEFOR facilitates coordination, planning, execution, and assessment of Air Force space operations for the COMAFFOR to include providing support for joint space operations to the SCA. The COMAFFOR can also direct the DIRSPACEFOR to support the SCA by providing advice on Air Force space forces. When the COMAFFOR serves as the joint force air component commander and is designated the SCA, the DIRSPACEFOR typically accomplishes the day-to-day duties assigned to the SCA.

12. Theater Support

Services assign space operators to various joint and Service echelons. JFCs may assign space experts to the joint component commanders' staffs. JFCs and their components request space services and capabilities early in the planning process to ensure effective and efficient use of space assets. Each GCC has a network of space operators, resident on staffs at multiple echelons, who serve as theater advisors for space capabilities (national, military, civil, commercial, and foreign). These individuals concentrate primarily on working the detailed activities of theater space operations in support of the SCA in developing, collecting, and prioritizing space requirements. Several DOD and national agencies deploy theater support teams that can provide additional space services and capabilities.

SECTION D. SPACE-RELATED SUPPORT TO THE JOINT FORCE

13. Combat Support Agencies

The joint force uses DOD space capabilities supplemented by national, civil, commercial, and foreign partners. The CCDR's staff element is responsible for a specific function which works through its channels to the correct CSA (e.g., DISA, NGA, NSA/CSS, or DIA) to obtain the needed support or products. Information from other defense agencies or USG organizations (e.g., NRO, NOAA) is available through established procedures. The SCA can work with or through USSTRATCOM to establish additional support.

a. **Defense Information Systems Agency.** DISA provides services and support in a wide range of missions, including communications, C2, information assurance, and GIG services, and plays a key role in ensuring that US capability to operate in space is maintained. The Director, DISA, responsibilities include:

(1) Providing forces to JTF-GNO, under the direction of USSTRATCOM, to direct the operations and defense of the GIG.

(2) Acquiring commercial communications services, including commercial satellite network assets for DOD.

(3) Defining system performance criteria for military satellite communications (MILSATCOM) systems, identifying areas of deficiency, and recommending corrective actions as appropriate.

(4) Assists USSTRATCOM with information assurance for SATCOM services.

(5) Providing MILSATCOM technical support, to include representation to international and North Atlantic Treaty Organization (NATO) forums.

For additional information, see Department of Defense directive (DODD) 5105.19, Defense Information Systems Agency (DISA).

b. **National Geospatial-Intelligence Agency.** NGA provides geospatial intelligence in support of national security objectives. Geospatial intelligence is the exploitation and analysis of imagery and geospatial information to describe, assess, and visually depict physical features and geographically referenced activities on the Earth. Information collected and processed by NGA is tailored for customer-specific solutions. By giving customers ready access to geospatial intelligence, NGA provides support to civilian and military leaders, and contributes to the state of readiness of US military forces. NGA also contributes to humanitarian efforts such as tracking floods and fires, and in peacekeeping. NGA is a member of the US IC and a DOD CSA. NGA operates major facilities in the St. Louis, Missouri and Washington, D.C. areas, and fields support teams worldwide. The joint force contacts NGA Source for support.

(1) NGA operates under Title 10, US Code (USC), Section 442 and Title 50, USC, Section 404e as well as the guidance of National Security Presidential Directive (NSPD) 27, *US Commercial Remote Sensing Policy*. Under this NSPD, the NGA is charged with effective implementation of key responsibilities for commercial remote sensing from space with respect to national security and foreign policy.

(2) NGA is also the functional manager for the National System for Geospatial Intelligence (NSG). NSG integrates technology, policies, capabilities, and doctrine

necessary to conduct geospatial intelligence in a multi-intelligence environment. NGA provides geospatial intelligence to support senior national decision makers, and helps plan and prosecute military objectives. NGA's strategy supports operational readiness through a set of geospatial foundation data. These may include controlled imagery, digital elevation data, and selected feature information which can be rapidly augmented and fused with other spatially referenced information such as intelligence, weather, and logistics data. The result is an integrated, digital view of the mission area.

c. **National Security Agency/Central Security Service.** NSA/CSS is a unified organization structured to provide for the signals intelligence (SIGINT) mission of the US. The Director, National Security Agency/Chief, Central Security Service (DIRNSA/CHCSS) acts as the principal SIGINT advisor to SecDef, the Director, National Intelligence, and the Joint Chiefs of Staff. The DIRNSA/CHCSS, under the authority delegated to him by the SecDef, exercises SIGINT operational control over US SIGINT operations. Specifically, the NSA/CSS also coordinates closely with the Central Intelligence Agency and DIA, who are responsible for human intelligence (HUMINT), the NGA for imagery intelligence (IMINT), and the DIA for measurement and signature intelligence (MASINT). NSA/CSS's SIGINT mission helps protect the nation by providing information in the form of SIGINT products and services that enable national-level decision makers to make informed decisions and operate successfully. DIRNSA also provides information assurance advice and assistance regarding national security information and information systems to the USG departments and agencies, and serves as the National Manager for National Security Telecommunications and Information Systems Security. The joint force contacts the Overhead Collection Management Center for support.

d. **Defense Intelligence Agency.** DIA provides intelligence support in a variety of missions, including, but not limited to, all-source military analysis, measures and MASINT, HUMINT, counterintelligence, IO, personnel recovery, peacekeeping and coalition support, indications and warning, targeting, BDA, collection management, and intelligence support to operations planning.

(1) DIA's core space-related functions include:

(a) Coordinating DOD and national technical collection policy with agencies having policy responsibilities for those systems.

(b) Facilitating and overseeing the processing, exploitation, and dissemination of tailored and timely MASINT in order to help the joint force and national customers.

(c) Acting as the senior defense intelligence collection representatives and primary combatant command advocate for MASINT and technical collection capabilities.

(d) Characterizing the environment, threats, and challenges, and defining technical and operational capabilities in support of DOD and IC planning.

(e) DIA conducts evaluations and assessments on space based collection capabilities supporting the DOD Intelligence Information System Enterprise.

(2) **Defense Intelligence Operations Coordination Center.** The DIOCC plans, coordinates, and integrates full-spectrum defense intelligence operations and capabilities in support of the combatant commands to satisfy the priorities of DOD and the Nation. DIOCC is the DOD-level lead organization for intelligence operations. The DIOCC formulates recommendations for the SecDef through the CJCS to realign defense intelligence resources in response to existing and emergent combatant command operational requirements.

(3) **Missile and Space Intelligence Center.** The Missile and Space Intelligence Center (MSIC) is an element of DIA that produces finished, all-source scientific and technical intelligence in support of the combatant commands, force planners, and policy makers. It develops and disseminates scientific and technical intelligence on foreign threat systems, including guided missile systems, directed energy weapons, selected space programs or systems, and related command, control, and communications in support of operationally deployed forces and the materiel acquisition process. MSIC also develops and distributes digital simulations of threat weapon systems and provides threat simulation support to force developers and operational forces.

(4) **Defense Special Missile and Aerospace Center (DEFSMAC).** DEFSMAC is a collaborative DIA and National Security Agency (NSA) activity that provides tasking, technical support, analysis, and reporting for various DIA and NSA intelligence activities.

For additional information, see JP 2-01, Joint and National Intelligence Support To Military Operations*, and DODD 5105.21,* Defense Intelligence Agency.

14. Other Agencies and Organizations

a. **National Reconnaissance Office.** NRO is a joint organization engaged in the research and development, acquisition, launch, and operation of overhead reconnaissance systems necessary to meet the needs of the intelligence community and of DOD. NRO conducts other activities as directed by the SecDef or the Director of National Intelligence.

(1) NRO responsibilities include support to intelligence and warning, monitoring arms control agreements, and crisis support to the planning and conduct of military operations. The NRO accomplishes its mission by building and operating reconnaissance satellites and associated communications systems. The NRO liaison officers and theater support representatives located with each of the combatant commands serve as direct links to NRO for the CCDRs and their staffs.

(2) DIA is the overall coordinator of NRO support for DOD, which it manages with on-line systems. IMINT requirements are tasked through NGA, SIGINT requirements through NSA, and MASINT requirements through DIA. The basic reference for obtaining support is the *Joint Tactical Exploitation of National Systems Manual.*

For additional information, see JP 2-01, Joint and National Intelligence Support To Military Operations.

b. **National Air and Space Intelligence Center.** The National Air and Space Intelligence Center (NASIC) is the principal agency for assessing the foreign air and space threat. NASIC can provide deployed forces with unique capabilities for aerospace intelligence for DOD operational commands, research and development centers, weapon acquisition agencies, and national planners and policymakers.

c. **National Oceanic and Atmospheric Administration.** A component of DOC, NOAA provides many products with commercial, civil, interagency, and defense applications.

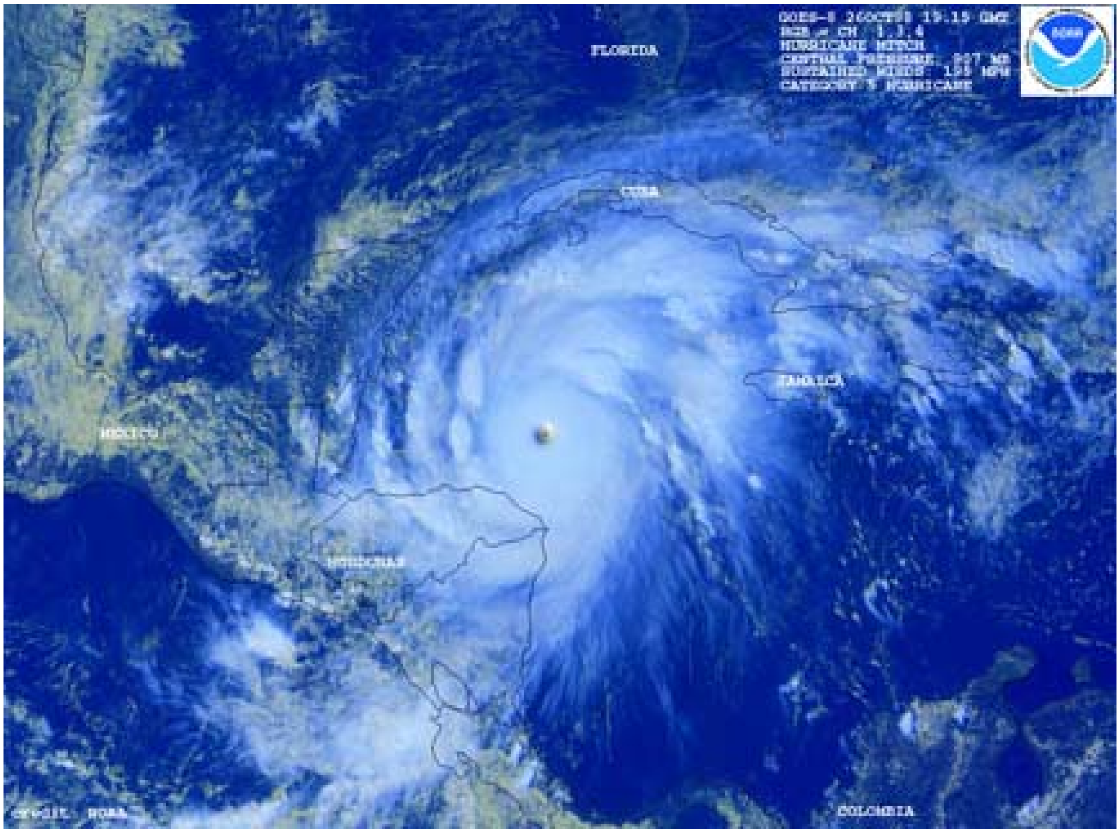
(1) NOAA has many programs and products with military applications, including:

(a) Operational Significant Event Imagery (OSEI) — broadcast, print, and Web-quality imagery created by the OSEI team of particularly significant or newsworthy environmental events which are visible in available satellite data. These events include dust storms, fires, floods, icebergs, ocean events, severe weather, hurricanes, and other events, each of which can impact military operations.

(b) National Geophysical Data Center — receives and archives Earth observations from space to include data from DMSP, a DOD program operated by NOAA, by agreement between DOD, DOC, and NASA. The DMSP constellation comprises several near polar-orbiting, as well as sun-synchronous satellites, monitoring the METOC and solar-terrestrial physics environments.

(2) NOAA operates the Space Weather Prediction Center (SWPC) as part of the National Weather Service. SWPC is operated by NOAA and supports the Nation's civil and civilian space weather customer base. In addition, SWPC partners with the Air Force Weather Agency (AFWA) space weather production center to provide support to DOD. AFWA is the point of contact for all DOD and intelligence community space weather support. The two organizations work together to provide real-time monitoring and forecasting of solar and near-Earth space weather events that impact military operations. AFWA leverages SWPC's research and technique development capabilities to improve space weather support to military operations.

(3) NOAA's operational environmental satellite system is composed of geostationary operational environmental satellites for short-range warning and



Geostationary Operational Environmental Satellite imagery

"nowcasting," and POES for longer term forecasting. Both kinds of satellites are necessary for providing a complete global weather monitoring system. The satellites also carry additional instruments which are used to support aviation safety and maritime/shipping safety which can impact military operations.

(4) NOAA also operates SARSAT which is a global search and rescue (SAR) system that detects and locates distress signals from emergency beacons carried by mariners, aviators, and land-based users and then relays this information to SAR authorities around the world. SARSAT's global-reach is designed to primarily support civilian users; however, the system also supports military units particularly in non-combat/peacetime operations. DOD use of the SARSAT system is promulgated by Directive Type Memorandum *08-021, DOD Use of the Civil Search and Rescue Satellite-aided Tracking (SARSAT) System for Support to Personnel Recovery*.

15. Commercial Space Operations

a. The commercialization of space supports a growing demand for technologies, services, and products which are commonplace in households, businesses, agencies, and governments on a global scale. Users of space-based products enjoy a wide range of products and services, including global positioning data, satellite radio, direct-to-home television, and even imagery-based products. Businesses and governments at all levels benefit from commercial space operations. Agriculture, fisheries, and geophysical services are among industries that benefit. Emerging services, such as space-based transportation and space-based tourism, are no longer out of reach. Due to the demand for space-based products and services, the USG has established policy to foster the use of US commercial space capabilities around the globe. These capabilities include:

(1) **Commercial Satellite Communications.** Commercial satellite communications are a critical part of US military operations, and planning should include protection of these services. DISA is the only authorized provider of commercial SATCOM for DOD.

See JP 6-0, Joint Communications System*, for more information.*

(2) **Remote Sensing.** Commercial satellites provide remote sensing information. Meteorological satellites and various weather agencies provide additional and redundant capability to US systems. Additionally, many scientific and experimental satellites contribute information on the space environment and terrestrial monitoring. See Appendix C, "Space-Based Environmental Monitoring Capability," for more information.

(3) **Positioning, Navigation, and Timing.** US space-based PNT capabilities are, by national policy, dual military-civilian use. GPS is the PNT system of choice for US and international applications such as commercial shipping, safety of life, timing of commerce activities, and commercial aviation. Though operated by the United Sates Air Force (USAF), GPS is available to commercial and civilian users. The US is committed to improving current GPS capabilities to enhance today's PNT capabilities. See Appendix E, "Space-Based Positioning, Navigation, and Timing," for more information.

(4) **Commercial Satellite Imagery.** Space-based imagery provided by commercial entities has become an important capability for civil and military operations. Commercial satellites provide electro-optical, infrared, and synthetic aperture radar imaging. Companies can provide imagery, cartography, basic analysis, vessel tracking data, and much more. The joint force obtains these products through NGA Source just like they would for products from US capabilities. The benefits of these products are that they are usually easily obtainable, they free up national systems for higher priority tasks, they can have high resolution and high revisit rates, and they are fairly inexpensive. Because they are unclassified, US forces often share these products with coalition and host-nation (HN) members.

b. Commercial satellites present capabilities that military commanders may draw on to support planning, operations, and even morale and welfare of the fighting force. However, commercial space operations present unique challenges. Although commercial space capabilities may provide services, they lack assured access and timeliness because capabilities used by US forces are also used by adversaries. Military commanders may request satellite "surge" capabilities while providing civil support during natural disasters, yet commercial vendors may require long lead time and multiyear leasing to gain access to a capability. Finally, using commercial satellites for military operations presents additional legal issues which must be considered.

c. Even though these challenges exist, military use of commercial capabilities has dramatically increased due to requirements surpassing MILSATCOM resources. To help meet the increased demand, many commercial satellite product vendors have established government services and solutions branches within their organizations to coordinate usage requirements with DOD and other USG agencies. Although these relationships may be largely transparent to military field commanders, the products they request may be eventually fulfilled by a commercial application. In any case, requests for space-based products and services follow standard channels through established procedures.

16. Multinational Space Operations

a. The NATO Alliance has integrated several space capabilities and established offices which coordinate specific programs for NATO. Supreme Headquarters Allied Powers Europe oversees most programs, such as coordinating with USSTRATCOM for the shared early warning system and theater missile defense. The NATO Consultation, Command and Control Board overseas the Consultation, Command and Control Agency which is responsible for NATO's commercial space imagery and SATCOM programs.

b. For most other nations, the civilian and commercial segments dominate space operations. Therefore, civilian space agencies have often taken the leadership role for space. Agencies such as the European Space Agency, the Japan Aerospace Exploration Agency, France's Centre National d'Estudes Spatiales, and the Indian Space Research Organization often issue national policies and strategies in which military space operations may not be addressed. There are allied space operations centers, such as the European Union Satellite Centre, the British National Space Centre, and several others, but they are not typically part of military forces. However, there may be agreements and procedures in place for them to support military operations.

c. US forces rely extensively on foreign environmental satellite capabilities to augment DMSP data. Foreign geostationary environmental satellite data is essential for military operations in Europe and Asia, and in the western-Pacific and Indian Oceans. Additionally, foreign POES information is being incorporated into the NPOESS constellation to assist in meeting DOD environmental satellite requirements.

d. **Space Integration into MNF Operations.** Allied or coalition forces will have many of the same requirements for space services and capabilities as do US forces However, US foreign disclosure policy will dictate the nature and scope of disclosure and release of space-derived products to multinational partners. Commercial imagery products are normally unclassified and will be of great benefit to other MNFs. Weather data is also readily available to share, as is GPS navigation support. Of special importance is the provision for missile warning and defense against attack from theater ballistic missiles. USSTRATCOM is responsible, as part of an interagency process and in coordination with GCCs, for assisting in development of missile warning architectures and providing this information to MNFs in a process called shared early warning (SEW).

See JP 3-16, Multinational Operations*, for additional information.*

CHAPTER V
PLANNING

> *"The staff's effort during planning focuses on developing effective plans and orders and helping the commander make related decisions. The staff does this by integrating situation specific information with sound doctrine and technical competence."*
>
> **Joint Publication 5-0, *Joint Operation Planning***

1. General

a. Commanders address space operations in all types of plans and orders, at all levels of war. Additionally, plans must address how to effectively integrate capabilities, counter an adversary's use of space, maximize use of limited space assets, and to consolidate operational requirements for space capabilities.

(1) The GCC may request CDRUSSTRATCOM's assistance in integrating space forces, capabilities, and considerations into each phase of campaign and major operation plans.

(2) Joint force planners incorporate space forces and capabilities into the basic plan and the applicable annexes (e.g., A, B, C, H, J, K, L, M, N, S, and V, at a minimum).

(3) During mission analysis, planners assist the CCDR to identify specified, implied, and essential tasks for space forces. Additionally, the capabilities of the adversary, including their ability to impact our space forces and their use of space capabilities, are considered in JIPOE. Finally, military planners identify those space forces and capabilities that are potential adversary or friendly centers of gravity (COGs), or are critical parts of COGs.

(4) In staff estimates, the planners examine their functional specialties to identify the role and contributions of space forces in the various phases of the campaign. During preparation of the commander's estimate, space forces and capabilities are war gamed along with land, maritime, air, and special operations forces to allow the CCDR to make an informed decision. Additionally, the JFC must adequately plan for operations without certain space forces or capabilities. Planners should consult space or functional experts to discern which capabilities will not be available during the operation.

(5) The completed plan should describe how space supports or is employed to accomplish the commander's stated objectives, how the adversary employs its space forces, the process and procedures through which additional support will be requested, and finally, how the commander will execute the plan in the event of the loss of space capabilities.

(6) Space forces can also be used to support or conduct flexible deterrent options (FDOs). Conducting a theater ballistic missile defense exercise with US allies is one possible FDO if the CCDR is facing a ballistic missile threat. Another FDO could be to publish, in the world media, high-resolution images from commercial satellites and

other systems to clearly demonstrate the adversary's preparations for war and to raise public awareness.

(7) **Annex N (Space Operations)** provides detailed information on space forces and their capabilities that the supported commander can use throughout the campaign. The format for annex N is found in Chairman of the Joint Chiefs of Staff Manual (CJCSM) 3122.03C, *Joint Operation Planning and Execution System Volume II, Planning Formats*. Annex N directly relates to those space capabilities included in other places such as annex A (Task Organization), annex B, (Intelligence), appendix 3 (Information Operations) to annex C (Operations), annex H (Meteorological and Oceanographic Operations), annex K (Communications Systems), annex L (Environmental Considerations), annex M (Geospatial Information and Services), annex S (Special Technical Operations), and annex V (Interagency Coordination).

b. **Coordination.** Coordination of space operations between the staffs of the supported and supporting commanders is normally established through the designation of an SCA. The designated SCA coordinates the identification of operational requirements and their inclusion in the appropriate annex. The result of this process is a supportable, valid statement of requirements that can be used by the supporting commander.

(1) During coordination, the operational requirements are evaluated to identify shortfalls in capability, appropriate use of space forces, compliance with national policy, and feasibility of mission success.

(2) When shortfalls or other limitations are identified, they are forwarded to the SecDef via the CJCS for further coordination, resolution, adjudication, and apportionment.

c. **Supporting Plans.** USSTRATCOM components develop supporting plans as required. Consideration is given to, and balanced with, requirements of all supported joint force space users.

(1) The Joint Staff evaluates requirements based on priority of use, alternative solutions, impact of loss, and SecDef or CJCS guidance. The review and approval of the supporting plan are the responsibility of the supported commander.

(2) If the supporting commander cannot meet the supported commander's requirements because of planning commitments previously granted to other commanders or agencies, the CJCS or the SecDef will adjudicate and resolve the conflicting requirements.

2. Operational Art and Design

a. Since operational art integrates ends, ways, and means across the levels of war, operational art and design should be considered when planning space operations at all levels. Space forces and capabilities can support or enable operational art and design.

They are a means to achieve the required end, or a way to support or enable other means to achieve the required end. As such, space forces and capabilities must be considered equally with forces and capabilities in other domains.

For additional information on operational art and design, see JP 3-0, Joint Operations, *and JP 5-0*, Joint Operation Planning.

b. Operational design is characterized by the following fundamental elements:

(1) **Termination.** Knowing when to terminate military operations and how to preserve achieved advantages is a component of strategy and operational art and design. Space-based ISR supports the JFC's general situational awareness by enabling understanding of when to terminate operations. Space-based ISR can also persistently monitor situations in support of stability operations or treaty obligations.

(2) **End State and Objectives.** Once the termination criteria are established, operational design continues with development of the military strategic objectives which comprise the military end state conditions. Since space operations are usually in support of other operations, the end state is not usually space specific.

(3) **Effects.** Identifying desired and undesired effects within the operational environment connects military strategic and operational objectives to tactical tasks. Determining specific desired and undesired effects in relation to space operations can help commanders and their staffs gain a common picture and shared understanding of the operational environment that promotes unified action.

(4) **Centers of Gravity.** The essence of operational art lies in being able to mass the effects of combat power against the enemy's sources of power in order to destroy or neutralize them. COGs are those characteristics, capabilities, or locations from which a military force derives its freedom of action, physical strength, or will to fight. Given our dependency on space capabilities, space should be considered a COG for the JFC. Space assets are also important in helping to identify enemy COGs.

(5) **Decisive Points.** By correctly identifying and controlling decisive points, a commander can gain a marked advantage over the enemy and greatly influence the outcome of an action. For example, decisive points for the assured access to space are launch complexes and ground stations.

(6) **Direct vs. Indirect.** In theory, direct attacks against enemy COGs is the most direct path to victory. However, where direct attack means attacking into an opponent's strength, JFCs should seek an indirect approach. If space-enabled C2 is an adversary's COG, then OSC is an example of a direct approach against the space component of the adversary's C2 COG. If public support for military operations is an adversary's COG, then the use of SATCOM to deliver IO messages is an example of an indirect approach against an adversary's COG.

(7) **Lines of Operations.** As JFCs visualize the design of the operation they may use multiple lines of operations. Generally, lines of operations describe the linkage of various actions on nodes and/or decisive points with an operational or strategic objective. In as much as space operations support most operations, lines of operations may be a factor during space planning.

(8) **Operational Reach.** Operational reach is the duration and distance across which a unit can successfully employ military capabilities. Since national boundaries do not extend into space, satellites may provide the most timely access to denied areas.

(9) **Simultaneity and Depth.** The intent of simultaneity and depth is to bring both military and nonmilitary power to bear concurrently across the tactical, operational, and strategic levels of war, to overwhelm the adversary across multiple domains, thus disrupting the opponent's decision cycle causing failure of their moral and physical cohesion. PNT and SATCOM enable precision operations on a global scale and can be optimized to provide capabilities anywhere within a theater, or within multiple theaters. Additionally, space force enhancement contributes to the establishment and maintenance of a space COP, which is critical to carrying out simultaneity and depth in joint operations.

(10) **Timing and Tempo.** The joint force should conduct operations at a tempo and time that best exploits friendly capabilities and inhibits the enemy. With proper timing, JFCs can dominate the action, remain unpredictable, and operate beyond the enemy's ability to react. For instance, the employment of OSC capabilities against adversary communications can inhibit the enemy's timing and tempo.

(11) **Forces and Functions.** Commanders and planners design campaigns and operations that focus on defeating either enemy forces or functions, or a combination of both. Space control focuses on disrupting enemy functions while enhancing our own (see JP 3-0, *Joint Operations*, for a discussion of joint functions).

(12) **Leverage.** Leverage is gaining, maintaining, and exploiting advantages in combat power across all domains and the information environment. Space capabilities enable JFCs to see the entire operational theater and provide the opportunity for the JFC to exploit advantages when detected. Reachback helps reduce the required footprint within a theater and leverages unique centers of expertise (e.g., JSPOC).

(13) **Balance.** Balance is the appropriate mix of forces and capabilities within the joint force, and the nature and timing of operations conducted. The intent is to maintain friendly balance while disrupting the enemy's. The employment of ground-based radars and space-based infrared sensors for missile warning is an example of balance. The joint force also deploys space forces into theater while relying on reachback for certain tasks reliant on special infrastructure. In this way, the overall placement of space capabilities is balanced to support an operation. Conversely, the JFC should not be completely dependent on space forces or capabilities to meet a particular

operational requirement, and should have alternatives available in case of the loss or disruption of space capabilities within the AOR.

(14) **Anticipation.** JFCs should remain alert for the unexpected and for opportunities to exploit the situation. Space-borne ISR fused into the COP supports the JFC's overall situational awareness and improves his ability to exploit unexpected opportunities. The predictive attributes of SSA are key to the anticipation of threats to space systems. A JFC anticipates and plans for the loss of space systems or capabilities through regular exercises.

(15) **Synergy.** Synergy involves integrating and synchronizing operations in a manner that applies force from different dimensions to shock, disrupt, and defeat opponents. JFCs seek combinations of forces and actions to achieve concentration in various domains and the information environment, all culminating in achieving the assigned military objective(s) in the shortest time possible and with minimal casualties. Planners need to consider how space operations can be integrated into all aspects of the planning process. Space planners also need to understand how different types of space systems and capabilities can be employed together to produce enhanced effectiveness.

(16) **Culmination.** Culmination has both an offensive and defensive application. In the offense, the culmination occurs at the point in time and space at which an attacker's combat power no longer exceeds that of the defender. A defender reaches culmination when the defending force no longer has the capability to go on the counteroffensive or defend successfully. Attacking an enemy's C2 structure through OSC operations can reduce their combat power and lead to earlier culmination. Conversely, loss of critical space capabilities could lead to unanticipated early culmination for the JFC.

(17) **Arranging Operations.** JFCs must determine the best arrangement in the execution of operations. This arrangement will often be a combination of simultaneous and sequential operations to achieve the desired end state quickly and at the least cost in personnel and other resources. When best to employ space capabilities, particularly during offensive operations, is a key concern for the JFC. Space-based sensors can provide details of geography of the operational area, thereby supporting planning and arranging of operations. In phasing operations, planners should consider the footprint, visibility, and signal strength of available space-based capabilities (e.g., GPS accuracy, overhead non-imaging infrared).

For additional information on the elements of operational design, see JP 3-0, Joint Operations *and JP 5-0,* Joint Operation Planning.

3. Key Planning Considerations

a. Space presents unique planning and operational considerations that affect friendly, adversary, and neutral space forces alike. Numerous resource and legal considerations impact planning and affect mission success. The space planner understands planning and operational considerations for employment of space capabilities, and has a firm knowledge of the threats to the use of those systems by an adversary. The space planner must understand what can be done to limit an adversary's use of space capabilities and how to protect our own use of space. Finally, a planner understands how space capabilities relate to and support capabilities and operations in other domains.

b. **Global Access.** The fact that there are no geographical boundaries or physical obstructions in space gives military forces **global access** and **extensive advantage.**

(1) A single satellite in a low Earth polar orbit can overfly any location on the Earth's surface within a 24-hour period. However, basic **orbital mechanics** limit the time some satellites can remain over a particular geographic area. The amount of time that a terrestrial user will be within a satellite's direct field of view will vary from minutes to years, depending on the satellite orbit type and the field of view of the satellite sensor/antenna (see Appendix H, "Space Fundamentals," for a more in-depth discussion of orbit types and considerations).

(2) With a sufficient number of satellites in appropriate orbits, it is possible to maintain continuous LOS of, and have access to, any points on the surface of the Earth.

(3) Global access is one of the key advantages that space capabilities offer. Most spacecraft can serve multiple CCDRs and/or users around the world simultaneously (e.g., missile warning satellites).

(4) Despite such global access, however, terrestrial obstructions can affect or limit observations of some points on the Earth from space.

c. **Persistence.** Satellites in an equatorial, circular orbit with an orbital period of 24 hours are called geostationary. A geostationary orbit allows the satellite to remain over the same area of the Earth 24 hours a day, providing continuous access to a given terrestrial AOI. However, geostationary orbits do not permit good views of high latitude regions. Polar or highly inclined orbits are needed to view these regions, at the cost of reduced dwell time over a given AOI. Because orbits are easily determined, short dwell times and intermittent coverage by a given satellite may provide an adversary significant windows of opportunity for unobserved activity. Therefore, most satellite surveillance systems must consist of multiple satellites or be supplemented by other sensors if continuous surveillance of an area is desired.

d. **Limitations** on the operating lifetime of a satellite include the following:

(1) The design life of the satellite.

(2) Maintenance Considerations. Physical maintenance cannot currently be performed on most satellites on orbit. Maintenance is conducted daily using digital

commands transmitted via the RF spectrum. Satellite maintenance relies on the use of redundant systems, robust design, and alternative subsystems configurations.

(3) The amount of **fuel** carried for changing or maintaining the spacecraft's desired orbit and altitude. Satellite orbital maneuvers may be costly in terms of fuel expended. Although some satellite maneuvers can happen quickly (e.g., station keeping), the ability to move a geosynchronous satellite over another part of the Earth may require weeks to months to perform. Whatever the case, satellite maneuvers requiring the use of fuel could shorten the overall useful life of the satellite.

(4) The type of orbit used by the spacecraft.

(5) Space Weather. Unexpectedly large or frequent space weather events could shorten a satellite's planned life either by a significant single event or an increased rate of degradation to instruments and systems.

e. **Predictable Orbits.** A satellite's motion or orbital location is predictable, allowing for warning of satellite overflight, maintaining situational awareness, and tracking the location of objects in space. However, there are several forces at work that slowly degrade the prediction accuracy of a satellite's location. These forces will cause a satellite's orbit to slowly change. A satellite may use propulsive forces to maneuver and change its orbit, making the orbit hard to predict to anyone but the organization initiating the maneuver. However, maneuvering may come at a high cost in terms of on-board fuel, a limited resource. These motion predictions (satellite ephemeris) become less accurate over time and require periodic updates on a daily to weekly basis.

f. **Space capabilities may be vulnerable.** Space capabilities are subject to the effects of space weather, including Sun spot activity. Additionally, ground-to-satellite links are susceptible to jamming, and C2 facilities are subject to attack. Launch facilities must be protected to ensure access to space so that force replenishment may be accomplished. Some space capabilities may also be subject to exploitation, such as an adversary using commercial GPS receivers for navigation. Knowledge of an adversary's OSC and exploitation capabilities will allow a joint space planner to develop appropriate responses.

g. **Resource Considerations.** Long lead times to replenish/replace space assets may result in less than adequate space assets to meet a commander's requirements.

(1) Current launch programs take 40-150 days to generate and launch, provided that all hardware, including payload, is available at the launch site. Payload availability, prelaunch processing, positioning, and on-orbit checkout are factors that can significantly lengthen the time from call-up to operating on-orbit.

(2) Some forces can perform multiple missions. For example, some missile warning sites perform a secondary mission of space surveillance and missile defense.

(3) Multiple DOD organizations apportion space capabilities according to established and validated priorities which allow the greatest total mission assurance for the joint force. While there are numerous satellites capable of supporting a requirement, higher priority requirements will be satisfied first.

(4) Users may be preempted based on priority. Competition for bandwidth, priorities for tasking, and similar constraints, combined with satellite physical access to specific locations, impact availability of space capabilities.

h. **Timing Considerations.** SATCOM is heavily dependent on precise timing capabilities. Precise time enables information throughput by increasing the effective use of the bandwidth, and allows for the frequency hopping and cryptographic functions inherent in some communications systems.

(1) According to Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 6130.01D, *2007 CJCS Master Positioning, Navigation, and Timing Plan (MPNTP)*, GPS time is the standard for DOD. However, the vulnerabilities of GPS warrant that communication systems have a back-up capability to acquire timing information.

(2) Cryptologic systems and capabilities rely on precise time for synchronization of encrypted communications and information systems. Many communications networks use frequency hopping to improve security and increase resistance to jamming. Therefore, it is essential that planners allow for redundant timing capabilities in the event GPS is denied or degraded. See CJCSI 6130.01D for additional information on DOD's precise timing policy.

i. **Legal Considerations.** The joint force complies with US policy and laws, as well as US-ratified treaties and international law, when planning space operations. Legal advisors participate in all stages of space operations planning and execution in order to ensure compliance with applicable legal considerations. Although some uses of space are prohibited, there are relatively few legal restrictions on the use of space for military purposes. The US is committed to the exploration and use of outer space by all nations for peaceful purposes, and for the benefit of all humanity. Consistent with this principle, "peaceful purposes" allow US defense and intelligence-related activities in pursuit of national interests.

(1) Some contracts and consortium agreements could prohibit certain space assets from being used for military purposes. For example, certain corporate agreements prohibit using SATCOM for military operations.

(2) The law of armed conflict and certain treaties, acts, and conventions, as they pertain to the use of force, regulation of the means and methods of warfighting, and protection of civilians, must be complied with when conducting space control and space force application operations.

(a) **Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 1967.** The "Outer Space Treaty" provides that every activity in outer space must be carried out in accordance with international law, including the United Nations (UN) Charter, which recognizes the inherent right of self-defense. All nations are free to use and explore outer space, no nation may appropriate any part of outer space, and every activity in outer space must be carried out with due regard to the corresponding interests of other nations. No nuclear weapon or other weapon of mass destruction may be placed in orbit around the Earth, installed on the Moon or on any other celestial body, or otherwise stationed in outer space. A limited range of military activities, such as establishing bases, weapons testing, and the conduct of military maneuvers, are also prohibited on celestial bodies, to include the Moon.

(b) **Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques, 1977.** This convention prohibits military or other hostile use of environmental modification techniques as a means of destruction, damage, or injury to the environment (including outer space) if such use has widespread, long-lasting, or severe effects.

(c) **Other Space Treaties.** Other major treaties pertaining to space are the 1968 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (The Rescue and Return Agreement), the 1972 Convention on the International Liability for Damage Caused by Space Objects (Liability Convention) and the Convention on Registration of Objects Launched into Outer Space (Registration Convention) of 1974. The Rescue and Return Agreement obligates nations that have ratified this treaty to cooperate in the rescue and return of distressed personnel of a spacecraft and, upon request of the launching authority, to take those measures it deems practicable to return space objects of other nations that come to Earth within its territory. The Liability Convention provides a system for assessing liability for damage caused by space objects. Generally, a nation is responsible for direct damage caused by a space object to objects on the ground or to aircraft in flight. Damage caused to other space objects, on the other hand, will only lead to liability if one party can establish fault on the part of the other party. Finally, the Registration Convention requires nations to notify the UN “as soon as practicable” after an object has been launched into outer space, providing certain descriptive information, to include orbital parameters and a general statement of the purpose of the space object.

(d) **Noninterference with National or Multinational Technical Means of Verification.** Various arms control treaties prohibit “interference” with national or multinational technical means of verification (NTM); i.e., the array of intelligence-gathering capabilities that can be operated from outside the territory of the observed nation in order to monitor the treaty compliance, to include photoreconnaissance satellites and space-based sensors. The 1992 Treaty on Conventional Armed Forces in Europe extended application of what was once a bilateral precept to all NATO and former Warsaw Pact countries, so that the prohibition on interference with NTM now applies to 30 countries.

(e) **Frequency Spectrum Management.** The International Telecommunications Union manages the assignment of orbital positions in the geosynchronous belt and coordinates the use of the RF spectrum with all member countries. Individual countries have sovereignty over frequency usage within their borders. The users of any spectrum dependent device, to include space systems, must obtain host nation approval to operate those devices in country. Users must obtain frequency clearance from the National Telecommunications and Information Agency when operating within US territory through their service frequency management office. In addition to frequency clearance, users must get landing rights from the host nation when operating outside of US territory. These are coordinated through the geographic combatant commands' joint frequency management office.

(3) In some cases, national policy dictates that space-based capabilities are made available to civilian users. The USG is committed to providing GPS to users worldwide as a space-based navigation capability of choice. JFCs should be aware of this commitment and factor it into NAVWAR planning and operation plans.

j. **Multinational Space Operations**

(1) Space capabilities have become increasingly important to operations for all nations and nongovernmental organizations. Access to commercial space services has enabled even the smallest of nations to use GPS, commercial space imagery, SATCOM, and other services. Space capabilities are being used across the range of military operations by our allied and coalition partners and have become a critical enabler for civil and military operations. The US has the predominance of military space capability; however, many nations are pursuing their own space capabilities. Small satellites also present a very affordable option for many nations. As other nations begin to provide, and have access to, their own (or commercial) space capabilities, the US must integrate them into multinational operations.

(2) Most nations do not have military space forces and only limited (if any) military space systems. They rely on dual-use satellites and leverage commercial space assets. It is critical to integrate and coordinate the requirements for various national space capabilities, and to work releasability issues of US space capabilities in multinational operations. Command and control and support relationships should be established among US forces, various partner space centers, and multinational space organizations.

(3) Space is addressed in NATO's Bi-Lateral Strategic Command Functional Planning Guide for Space Operations (NATO Restricted document), and provides guidance for space integration in the operational planning process.

4. Control and Coordinating Measures

a. Control and coordinating measures are used by JFCs to provide deconfliction between assets and missions, to maximize efficient and effective use of limited assets, and to provide effective C2 of forces and assets within a defined area. For most DOD space operations, control and coordinating measures are primarily accomplished through the space tasking cycle, and through specific products which are derived during the tasking cycle. For operations conducted in theater, and/or through JFCC SPACE, the space operations directive gives visibility into the efforts of subordinate units assigned to a JFC (or via JFCC SPACE). The joint space tasking order (JSTO) tasks units with specific missions. See Figure V-1.

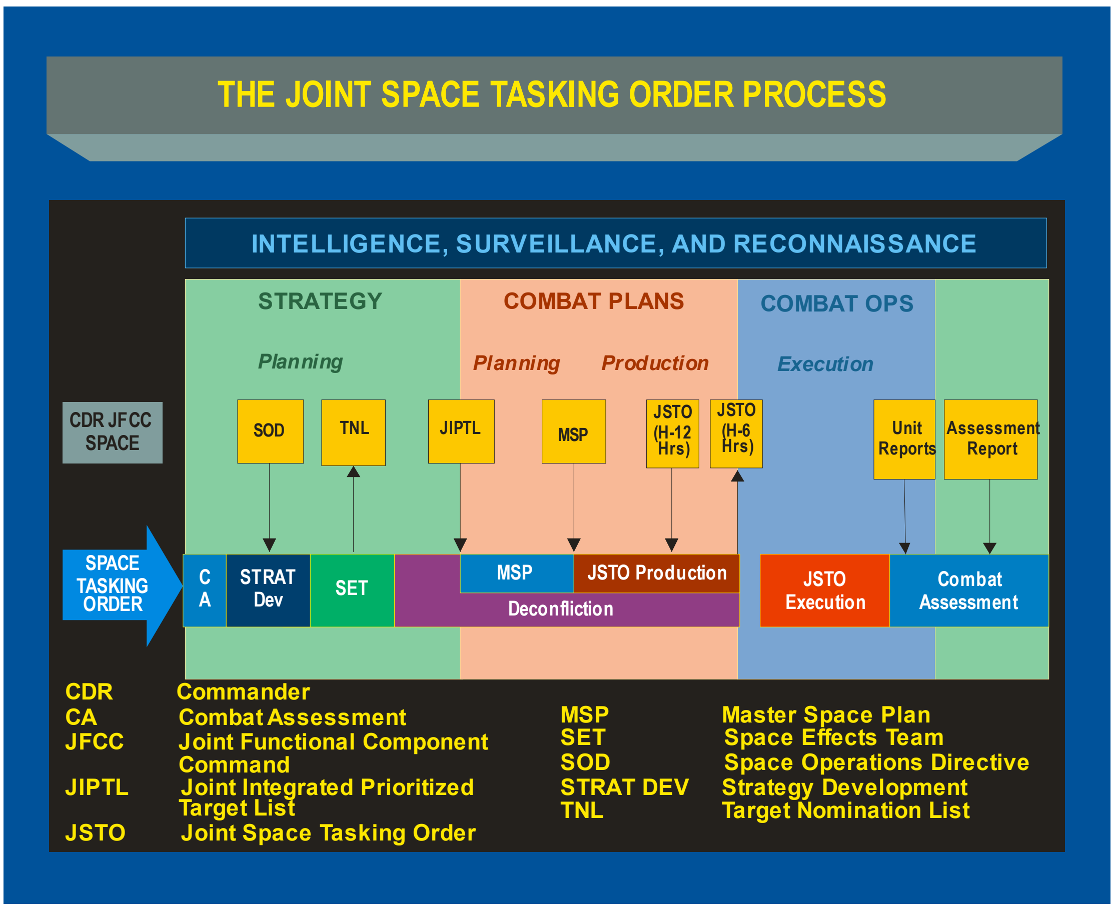


Figure V-1. The Joint Space Tasking Order Process

b. The JSTO development process does not account for missions performed by non-DOD space assets or those limited space forces assigned to a GCC, thereby creating potential conflicts between DOD and non-DOD agencies. It is then incumbent upon the GCCs and JFCC SPACE to coordinate as required to minimize conflicts. To this end, CDRUSSTRATCOM authorized JFCC SPACE to directly liaison with other DOD and non-DOD agencies to help deconflict space operations.

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APPENDIX A
SPACE-BASED INTELLIGENCE, SURVEILLANCE, AND RECONNAISSANCE

1. Overview

Space-based ISR is a part of the synchronization and integration of sensors, assets, and processing, exploitation, and dissemination systems for collection of data and information on an object or in an AOI on a persistent, event driven, or scheduled basis. The JFC and the components have access to space capabilities which can collect diverse military, diplomatic, and economic information that can be valuable for planning and execution across the range of military operations. Specifically, information can be collected, processed, exploited, and disseminated on such diverse subjects as indications and warning (to include ballistic missile launch), targeting analysis, friendly COA development, adversary capability assessment, BDA, or characterization of the operational environment.

2. Application

a. **Intelligence.** The product resulting from the collection, processing, integration, evaluation, analysis, and interpretation of available information concerning foreign nations, hostile or potentially hostile forces or elements, or areas of actual or potential operations. Space systems contribute to the development of intelligence through surveillance and reconnaissance activities.

b. **Surveillance.** Space systems can provide commanders with systematic observation of aerospace, surface, or subsurface areas, places, persons, or things by visual, electronic, photographic, or other means that provide commanders with situational awareness within a given area. Surveillance from space does not imply that a single satellite or capability must be continuously collecting. Satellites that are able to provide a snapshot in time can be augmented by additional capabilities collecting in the same or even different areas of the electromagnetic spectrum. There will be short gaps in collection (minutes or a few hours), but capabilities will be concentrating on a target, which, over time, constitutes surveillance. These "following" capabilities can continue collecting on a target as the previous satellite moves out of the area of access in its orbit. Several satellites in low and medium Earth orbits can provide coverage of targets on the order of minutes. Geosynchronous satellites can provide surveillance because their orbits allow them to have continuous access to large portions of the Earth. Collection from geosynchronous systems may, by necessity, be prioritized based on area of the world and where within the electromagnetic spectrum it can be tasked to collect. In many instances, the number of requirements levied against a system may also necessitate a prioritization of collection. Satellites may also be a contributor to an overall surveillance effort consisting of space, terrestrial, and airborne systems that together provide continuity in surveillance when space systems alone do not have continuous access or are unavailable. The JSPOC maintains the satellite catalog based upon a global network surveiling on-orbit objects. This database is used to provide overflight warning to supported commanders. This database is also used for flight safety to inform satellite operators when satellites are in the path of other man-made orbiting objects.

c. **Reconnaissance.** Reconnaissance is a mission undertaken to obtain, by visual observation or other detection methods, information about activities and resources of an enemy or adversary, or to secure data concerning the meteorological, hydrographic, or geographic characteristics of a particular area. Single low and medium Earth-orbiting systems, or architectures that provide limited numbers of low or medium orbital systems, are well suited to the reconnaissance mission. Generally, their access to specific targets are limited in time based on their orbit such that data collected will be a "snapshot" of events in the portion of the electromagnetic spectrum where they can collect. Geosynchronous or geostationary satellites are capable of performing reconnaissance from space as well, focusing their collection efforts on a target or region for a relatively short amount of time before focusing on another area.

3. Advantages

a. The prime advantage of space-based ISR capabilities is their potential to provide systematic and focused coverage of AOIs, sometimes without detection, from sanction.

b. Often, the product of a space or terrestrial capability can enhance accuracy and shorten reaction times to the user by cueing another space system to survey an AOI. Likewise, a space-based capability may be used to cue a terrestrial-based system for more precise location, discrimination, and targeting.

c. ISR systems also enhance planning capabilities by providing updated information regarding terrain and adversary force dispositions. Space-based imagery, in particular, supports the full range of military intelligence activities including indications and warning, current intelligence, order of battle, scientific and technical intelligence assessments, targeting, and combat assessments. Imagery is also used to conduct mission planning and rehearsal.

For additional information on space based intelligence support, see JP 2-0, Joint Intelligence *and the other joint intelligence series JPs*.

4. Limitations

In addition to the access limitations and a predictable overflight schedule dictated by the satellite orbit, satellite systems may be affected by a variety of atmospheric disturbances such as fog, smoke, electrical storms, and precipitation and clouds, which affect the ability of imaging systems to detect adversary activity, missile launches, and battle damage. Other limiting factors include: priority conflicts; tasking, processing, exploitation, and dissemination limitations; and low numbers of assets.

5. Support Procedures

a. There are a number of national, military, and nonmilitary space capabilities that can be used individually or in combination to provide the information required by the

JFC. The support request procedures for products and information are dependent on the individual system.

See JP 2-01, Joint and National Intelligence Support to Military Operations*, for additional information on national imagery sensors and capabilities.*

b. **National and DOD ISR Support.** National ISR systems provide direct support to the President. The information provided by these systems is used by senior government leaders to make strategic political or military decisions, and is also of great utility to the JFC. Information from national systems is provided to the JFC by direct and indirect feeds in addition to Service component tactical exploitation of national capabilities programs and Distributed Common Ground System elements. Requests for ISR support should go through the combatant command or joint force J-2 and the J-2 collection manager. Additional sources of information and assistance include the liaison officer or support team assigned from the appropriate national or DOD intelligence agencies.

c. **Nonmilitary and Commercial Imagery Support.** National and USG civil imagery satellites provide most of the imagery support to joint operations. However, nonmilitary space surveillance systems (including commercial and allied space capabilities) may augment DOD space systems, enhancing surveillance and reconnaissance coverage of the Earth.

(1) Commercial electro-optical imaging satellites are capable of providing large area, mid-to-high resolution images with a revisit time from 8 to 15 days; others are capable of high-resolution imagery with a revisit time of 3 days. Recent increases in the number and quality of commercial imagery satellites provide a valuable opportunity to augment national systems with panchromatic, multispectral, and radar imagery products. All commercial imagery is requested through the NGA.

(2) The greatest limitation of commercial imagery is a lack of understanding in how to use the available systems. Commercial imagery timelines are not adequate to fulfill most stated theater collection requirements with revisit times between 3 and 15 days. Lengthy revisit times and competition will dictate how long a request for imagery takes to fill, and could take up to a year. In times of conflict, these capabilities could provide an advantage to adversaries, since the sale of information from these systems is often not restricted. The sale of commercial imagery to non-USG customers may be interrupted (i.e., “shutter control”) via the procedures contained in CJCSM 3219.01A, *Interruption of Remote Sensing Space System Data Collection and Distribution During Periods of National Security Crisis*.

(3) NGA is the sole DOD action agency for all purchases of commercial and foreign government-owned imagery-related remote sensing data by DOD components. To support this, NGA has established contracts with all major commercial imagery vendors.

(4) Before commercial products can be relied upon for targeting and accurate geolocations, they should be verified by NGA. NGA provides this service on a case-by-case basis. Requests for these services must be validated by the appropriate geospatial information and services (GI&S) staff agency at the combatant command or Service component before being forwarded to NGA. Commercial imagery resolution and timeliness may not be adequate to satisfy specific needs.

d. **Geospatial Information and Services Support.** Joint forces receive current and accurate GI&S products from NGA based on satellite imagery. In addition, NGA can provide supplemental updates to military forces on port conditions, river stages, recent urban construction, vegetation analysis, ice coverage, and oceanographic features. Space-based imagery can provide current information on terrain, surface moisture conditions, oceanic subsurface conditions, beach conditions, and vegetation that permit identification of avenues of approach, specific ingress and egress routes, and other mission parameters to assist in the JIPOE.

(1) Currently, the major source for geospatial data is visible-spectrum imagery provided by national intelligence systems. Imagery provides a detailed overhead view of the area that is analyzed to identify natural and man-made features. Stereo imagery provides elevation data and improved identification of features. Ephemeris and altitude data that accompanies the imagery allows for the precise geodetic positioning of the image and mensuration of features.

(2) Panchromatic, MSI, and HSI are contributing sources of data for the development and update of GI&S. Satellite systems are vital for providing GI&S data because of their global coverage and periodic updates.

(3) During a crisis, it is important to understand that geospatial information producers are in direct competition with intelligence activities for national collection systems. In some cases, this competition could be mitigated by the use of civil and commercial imagery sources as discussed above.

See JP 2-03, Geospatial Intelligence Support to Joint Operations*, for additional information.*

APPENDIX B
MISSILE WARNING

1. Overview

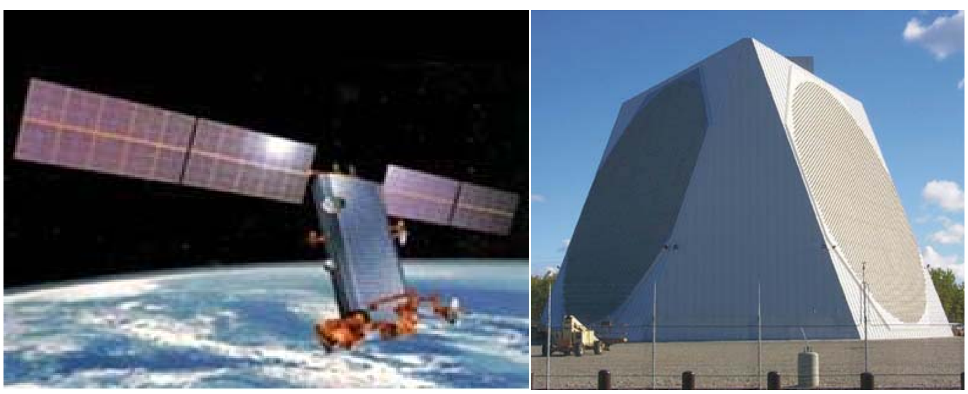
Space forces significantly contribute to the ability to provide warning of ballistic missile launches. Voice and data warning information is relayed to the joint force in near-real-time to support tactical decision making and provide executable data to the missile defense network to counter the threat.

2. Application

a. There are two missile warning missions: strategic and theater. Both use a mix of space-based and terrestrial sensors. Strategic missile warning is the notification to national leaders of a missile attack against North America, as well as attacks against allied and coalition partners. Theater missile warning is the notification to geographic combatant commands, allied and coalition partners, and forward deployed personnel.

(1) A well-organized missile warning system structure allows commanders to maximize detection and warning of inbound ballistic missiles, thereby ensuring effective passive defense, active defense, and attack operations.

(2) Missile warning systems process raw sensor data into missile warning reports and disseminate the information to users globally. Missile warning consists of multiple ground and space-based systems located worldwide.



Space-based and terrestrial sensors play a role in missile detection and warning.

b. **Strategic Missile Warning.** Space-based sensors, such as Defense Support Program and space-based infrared system, usually provide the first level of immediate missile detection. The satellite sensors also accomplish nuclear detonation detection. Ground-based radars provide follow-on information on launches and confirmation of strategic attack. A majority of the day-to-day mission is space surveillance; however, the radar is always scanning the horizon for incoming missiles. These ground-based radar systems include: ballistic missile early warning system, phased array warning system, and the Perimeter Acquisition Radar Attack Characterization System. Upgraded early warning radars are multi-mission radars supporting the missile warning, space surveillance, and the missile defense missions. There is no room for error in strategic missile warning, therefore, all information provided must be timely, accurate, and unambiguous.

For information on performance criteria for missile warning, see CJCSI 6210.02B, Information and Operational Architecture of the Integrated Tactical Warning and Attack Assessment System.

c. **Theater Missile Warning.** Because the reaction time for theater forces to respond to incoming missiles is relatively short, GCCs have adopted a strategy known as "assured" warning. This strategy weighs accepting potentially false reports against the time required to obtain unambiguous reports. Under this strategy, the GCCs have elected to receive quicker launch notifications understanding the warning could be ambiguous.

(1) A well-organized missile warning system structure allows commanders to maximize detection and warning of inbound ballistic missiles, thereby enabling effective passive defense, active defense, and attack operations.

(2) Theater missile warning elements process raw sensor data from satellite systems, form that data into missile warning reports, and disseminate the information to theater users. Missile warning elements consist of multiple US ground and in-theater units.

d. **Requests for Theater Missile Warning.** A JFC should forward requests for theater missile warning to CDRUSSTRATCOM via approved procedures. (See figure B-1.)

(1) When requesting support from missile warning elements, users should clearly state their requirements and applicable objectives as appropriate. Requests should include specific threat assessment, location and type of threat, duration of support requested, primary and secondary communications media preferred for reporting, false reporting tolerance, and levels and units within the command structure to which the warning data and information will be provided.

(2) Upon receiving a request, CDRUSSTRATCOM will assess its ability to provide support based on the assets assigned to the command. Once the command has determined a COA, it will provide that feedback through the SCA of the supported command.

e. **Missile Warning Exercise Support**

(1) **Exercise Design.** The TES elements will use operational hardware, software, and procedures to the maximum extent possible for exercises. For each exercise requiring TES support, USSTRATCOM will determine, after taking into account the requirements of the requesting agency, if the TES processor elements or a simulation device will support the exercise. USSTRATCOM will provide the Missile Warning Center, theater, and all participating TES elements, or simulation organizations with the

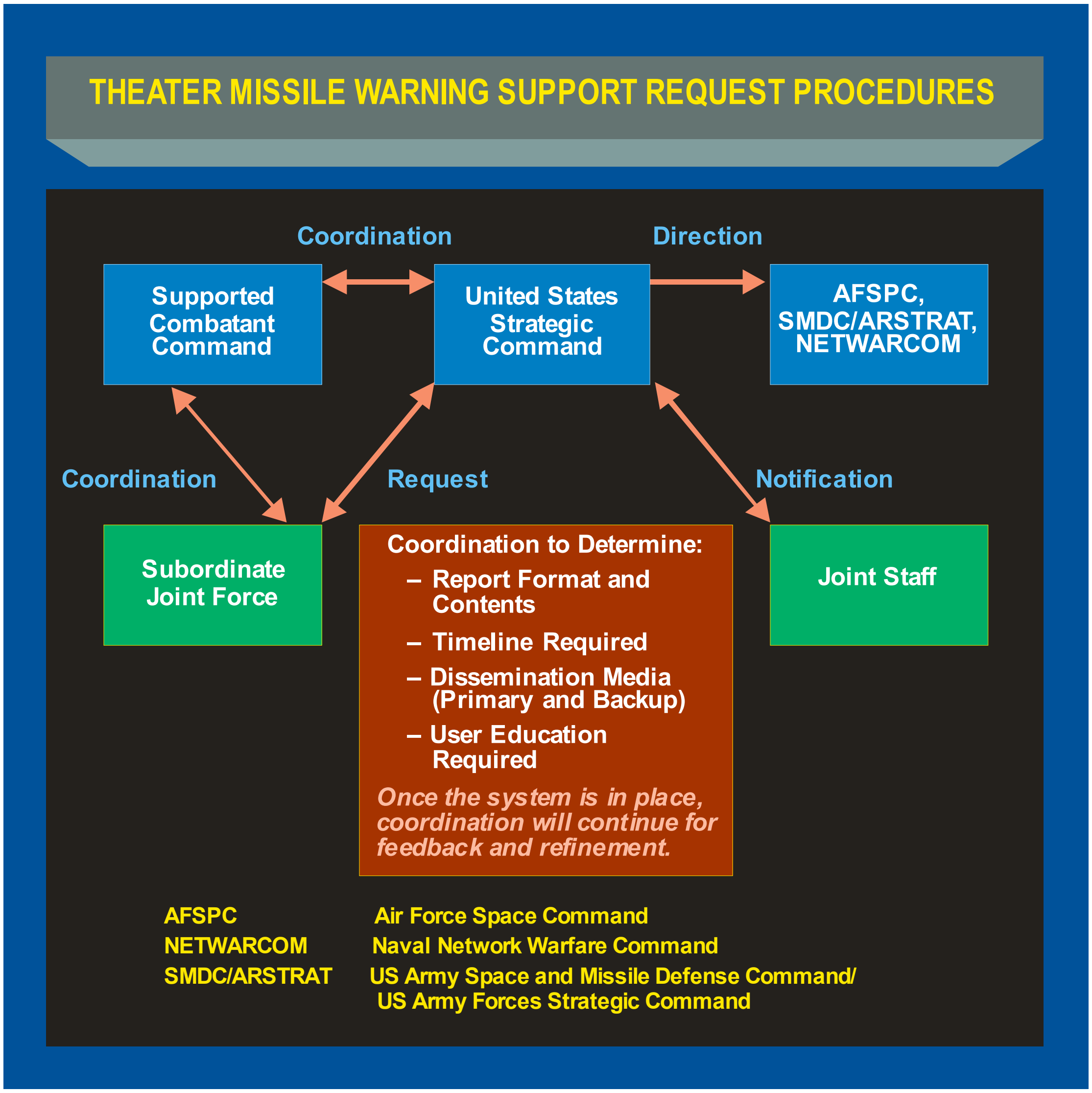


Figure B-1. Theater Missile Warning Support Request Procedures

missile launch scenario, the voice reporting architecture, and templates (if different from real-world).

(2) **Exercise Coordination.** Coordination with USSTRATCOM is required prior to TES elements or simulation systems injecting exercise traffic. Request for TES exercise support must be submitted to USSTRATCOM via a consolidated exercise support request. USSTRATCOM will review and approve exceptions on a case-by-case basis, and is responsible to ensure that a users message is released announcing the exercise specifics.

(3) Dissemination of exercise data over the Integrated Broadcast Service requires separate approval and coordination.

(4) The TES elements must keep exercise and real-world data separate and clearly defined.

f. **Shared Early Warning.** The US exchanges missile detection and warning information with its allies and coalition partners. The objective of SEW is the continuous exchange of missile early warning information derived from US missile early warning sensors and, when available, from the sensors of the SEW partner. Information on missile launches is provided on a near real time basis. This information can take the form of data, voice warning, or both. The objective of SEW is to enhance regional stability by providing theater ballistic missile warning to CCDRs, sponsored partner countries, and NATO allies. Regional CCDRs will recommend/sponsor SEW partner countries. DOD policy is to provide continuous, near-real-time, theater ballistic missile early warning information on regional launches that is of the same high quality and timeliness as the launch warning that would be made available to US Forces if operating in the same area at the same time. Currently, the SEW system provides both messages and voice warning to partner countries.

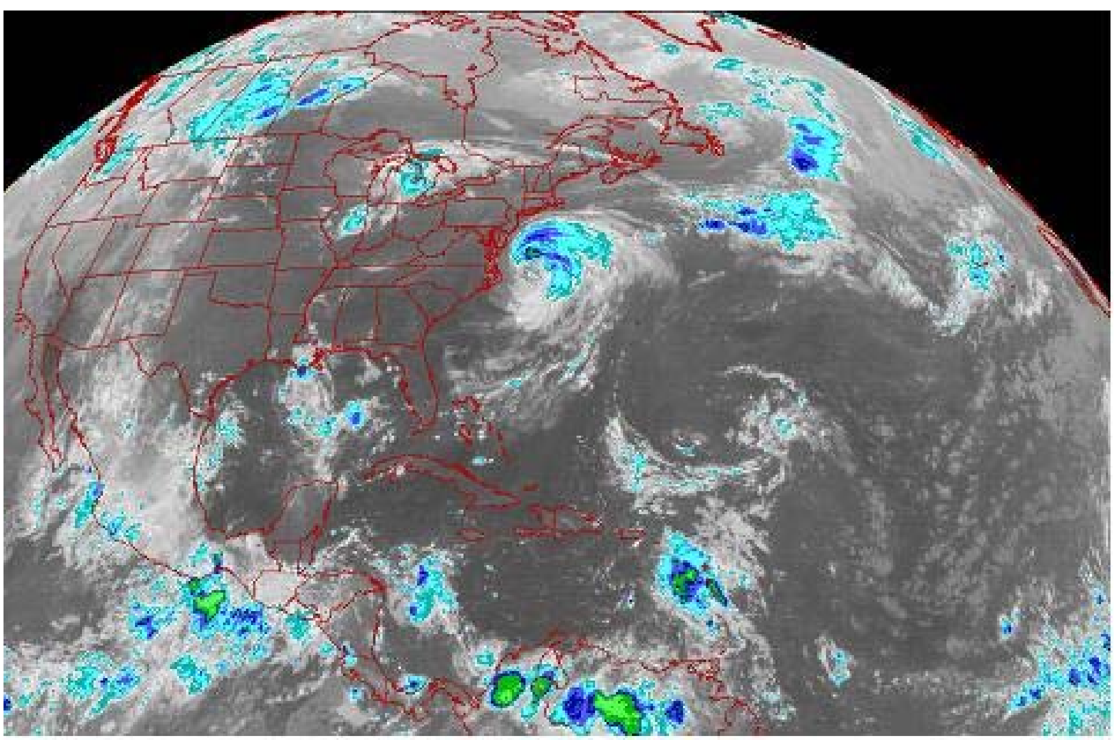
APPENDIX C
SPACE-BASED ENVIRONMENTAL MONITORING CAPABILITY

1. Overview

METOC support from space is critical to the development of forecasts and assessments of environmental impacts on both friendly and adversary military operations. Environmental monitoring satellites, which typically use sun-synchronous, geosynchronous and Lagrangian orbits (see Appendix H, "Space Fundamentals," for additional information about orbits), as well as some intelligence satellites, provide terrestrial and space environmental monitoring for joint forces. Environmental monitoring information includes data provided by non-DOD satellites, such as NOAA weather and NASA research satellites, which are used by AFWA and Fleet Numerical Meteorology and Oceanography Center (FNMOC) to support joint forces and Services.

2. Application

a. **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. This information helps commanders assess the environmental impacts on both friendly and adversary forces alike and helps to complete operational preparation of the environment. 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.



Meteorological information from space sensors is a critical factor in planning and executing joint operations.

b. **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.

c. **Space Environment.** Environmental data from the space domain must be available to integrate into SSA information to form a space COP. This enables joint forces to determine the impact of environmental factors on both adversary and friendly space and weapons systems.

3. Advantages

a. A prime advantage of environmental satellites is their ability to gather data regarding remote or hostile areas, where little or no data can be obtained via surface reporting stations. For example, space-based environmental data is critical over most oceanic regions, where data can otherwise be very sparse.

b. Environmental satellites typically gather data in the visual, infrared, and microwave spectral bands. Infrared sensors provide images that are based on the thermal characteristics of atmospheric features, such as clouds, and Earth features, such as land masses and water bodies. This data can be used to calculate the altitude of cloud tops and ground or water surface temperatures.

c. Thermal and visible images together provide the coverage and extent of clouds at various levels, as well as other physical features such as ice fields and snow. Current microwave sensors are used to measure or infer sea surface winds (direction and speed), ground moisture, rainfall rates, ice characteristics, atmospheric temperatures, and water vapor profiles.

d. Space-based monitoring of the space domain provides the ability to detect and mitigate the impacts of space weather on satellites, manned spaceflight, and communications to, from, and through space. Detection of solar events and measurement of the radiation environment allow operators to protect resources and deduce likely causes of spacecraft anomalies.

4. Limitations

a. Polar-orbiting satellites have periodic revisit rates over the target area, and therefore have a limited time over target for observations. However, these satellites provide global coverage and high-resolution data at all latitudes.

b. Geosynchronous satellites provide lower resolution images, but maintain a constant view of their coverage area. The image quality of geosynchronous satellites degrades as distance and angle from the point directly under the satellite increases. Coverage at polar latitudes is poor or nonexistent. US owned and operated geostationary environmental satellites are focused on the western hemisphere (the continental US, eastern Pacific, and western Atlantic). Foreign national capabilities are used for the remainder of the globe.

c. Some METOC parameters needed by forecasters for operational support, including heights of cloud bases and visibility restrictions, cannot be accurately determined from environmental satellites. Data from several sources, including surface observations, upper air soundings, and satellite data, are combined to determine these parameters.

d. Due to the magnitude of the space domain, space-based capabilities are limited in their ability to characterize the space environment in all areas, thereby creating gaps in complete situational awareness.

5. Support Procedures

a. METOC support to joint operations is critical to a JFC's awareness of the operational environment during all types of joint operations and across the full range of military operations. This support is normally provided by METOC forces assigned to one or more of the participating components. When two or more units are involved in a joint operation, coordination of their support is normally accomplished by the joint METOC coordination cell. See JP 3-59, *Meteorological and Oceanographic Operations*, for more information on the organization of METOC forces.

b. METOC satellite system data is supplied to AFWA, FNMOC, and the Naval Oceanographic Office. These central facilities provide users with real-time and stored environmental satellite cloud imagery, processed products, and satellite information incorporated into other environmental products. Another source of environmental satellite system information for joint operations is direct downlink of environmental satellite data from fixed and deployed mobile ground- and ship-based tactical data processing terminals within the operational area.

c. AFWA is responsible for collecting, processing, and providing space environmental data products to the joint force.

d. Weather satellite system data is distributed via the GIG.

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APPENDIX D
SATELLITE COMMUNICATIONS

1. Overview

SATCOM — military, commercial, foreign, and civil — provides global coverage which affords the US and allied national and military leaders with a means to maintain strategic situational awareness and a means to convey their intent to the operational commander responsible for conducting joint operations in a specific area (see Figure D-1). SATCOM also provides critical connectivity for tactical maneuver forces whose rapid movement and nonlinear deployments take them beyond LOS communication.

2. Application

a. SATCOM collectively provides an essential element of national and DOD communications worldwide. They allow for information transfer from the highest levels of government to the theater tactical level for all matters to include operations, logistics, intelligence, personnel, and diplomacy.

(1) It supports a variety of media, from television to interactive computer to digitized voice.

(2) To a user, the satellite is transparent because it is only a space-based communications relay. The frequency band and waveform of a signal influences the throughput capacity and the degree of protection and survivability provided to the communications system (anti-jam [AJ], anti-scintillation, low probability of intercept [LPI], and low probability of detection [LPD] capabilities).

(3) The frequency bands over which current MILSATCOM operate are:

(a) UHF for narrowband communications.

(b) Super-high frequency (SHF) for wideband communications.

(c) EHF for both wideband and protected band (protected band is defined as bandwidth that is specifically protected using satellite hardening techniques against solar/nuclear radiation, in addition to using communications security techniques and transmission security techniques). These frequencies are specifically used to permit transmission through the atmosphere without refraction back to Earth or significant loss due to atmospheric absorption.

b. **Narrowband SATCOM** systems support secure voice and data transmission at relatively low data rates for both mobile and fixed users by providing access on a single dedicated channel or demand assigned multiple access channel.

(1) Narrowband communications traditionally support requirements such as emergency action message dissemination between the SecDef and CCDRs, force

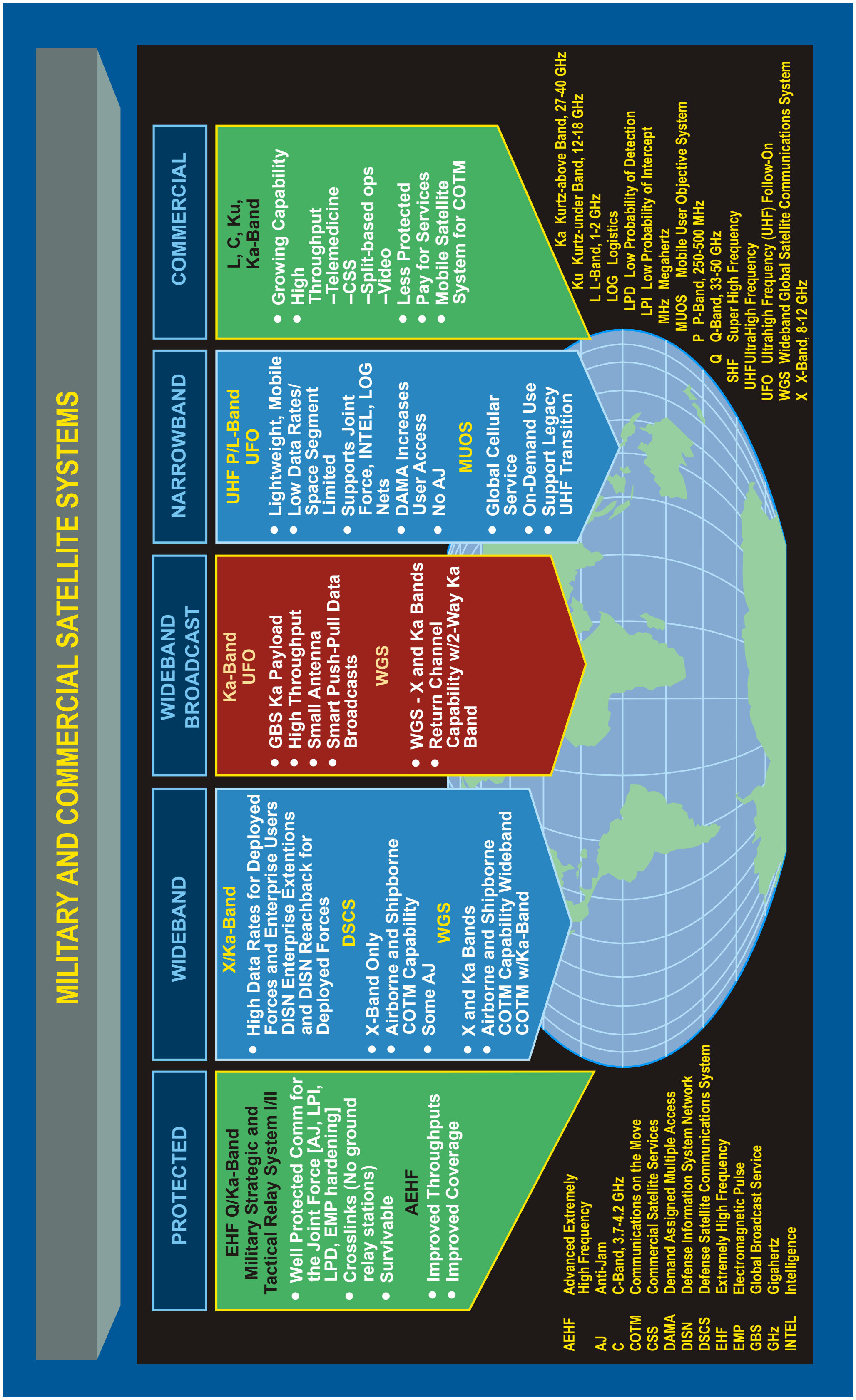

Figure D-1. Military and Commercial Satellite Systems

direction messages, tactical C2, low data rate broadcasts, and force report-back message transmission and reception.

(2) Narrowband systems support highly mobile, tactical users. Compact terminal equipment and directional and omnidirectional antennas allow deployed joint forces to quickly and efficiently exchange both voice and data communications.

(3) Narrowband systems include mobile and fixed terminals installed in air, sea, and ground platforms; command centers and command posts; and missile launch control facilities.

(4) Narrowband communications use UHF frequencies that allow excellent transmission quality through all types of terrestrial weather to small, tactical terminals; however, UHF frequencies can be totally disrupted by ionospheric scintillation. Additionally, the bandwidth itself is limited and therefore can only achieve data rates in the kilobits-per-second range.

c. **Wideband SATCOM** supports multichannel, secure voice, and high data-rate communications for C2, crisis management, and intelligence data transfer.

(1) Wideband communications support a range of government, strategic, and tactical users:

(a) White House Communications Agency.

(b) Uniformed Services, US Department of State.

(c) Joint Staff, CCDRs.

(d) Joint task force, coalition forces, mobile units, UAS.

(2) Wideband SATCOM provides Defense Information Services Network common user information transport and allows the JFC to reach back to other portions of the GIG. It also supports services (e.g., Non-Secure Internet Protocol Router Network [NIPRNET], SECRET Internet Protocol Router Network [SIPRNET], and Joint Worldwide Intelligence Communications System).

(3) Wideband communication tactical terminals support exercises and the deployed operations requirements of tactical forces for high-capacity, multichannel communications aboard ships and aircraft, as well as in support of ground forces.

d. **Protected SATCOM** supports survivable voice and data communications not normally found on other systems.

(1) Protected SATCOM throughput is less than wideband. In a hostile environment where a wideband system could be degraded, protected SATCOM will allow survivable communication, but at a reduced data rate.

(2) Protected SATCOM characteristics, such as narrow beamwidths and the use of spread spectrum and frequency hopping technology, provide capabilities such as AJ, scintillation-resistance, LPI, and LPD. Due to these unique capabilities, the use of the protected SATCOM frequency band has often been reserved for the most critical strategic forces and C2 systems. However, DSCS access also provides these enhanced capabilities through select satellite ground terminals.

(3) Protected SATCOM also permits the use of smaller antennas that increase its mobility, enabling wider use of manpack, submarine, airborne, and other mobile terminals. Because of spot beam power considerations, use of smaller antennas will have a limiting effect on the number of simultaneous users within the satellite's footprint.

e. **Commercial Capabilities.** Commercial SATCOM offers another venue to satisfy DOD's rapidly growing information needs. Some wideband services and personal communications services (e.g., satellite phones) are examples of current commercial SATCOM support to strategic and tactical mobile users. Commercial systems currently support much of DOD's predictable, wideband, and fixed SATCOM needs when MILSATCOM is not available. Leasing commercial services also affords faster access to advanced capabilities and services than traditional government research, development, and acquisition programs. However, in an environment where both the US and its potential adversaries will have almost equivalent access to the same advanced technologies and commercial services, sustaining military advantage may largely rest on the US ability to integrate those technologies and commercial services into its force structure faster and more effectively than the adversary can.

3. Advantages

The inherent capabilities of satellite systems provide significant advantages over other communications systems.

a. **Global Coverage.** Collectively, SATCOM systems provide global coverage. If required, satellites can provide focused capacity in areas of special interest.

b. **Real-Time Over-the-Horizon Transmission of Voice and Data.** Like other communications media, most SATCOM systems provide real-time connectivity for both voice and data, but unlike other communications media above high frequency, SATCOM can provide over-the-horizon voice and data transmission.

c. **Data Relay.** SATCOM links preclude the need for long terrestrial communications links. Furthermore, SATCOM enables US forces to communicate without substantial terrestrial communications architecture.

d. **Flexibility.** Satellite systems allow global coverage and inter-linking between frequency bands and systems, and certain systems are able to provide a relatively LPD. Flexibility gives the JFC a great deal of latitude in mixing and matching satellite systems to meet specific operational requirements. Directional antennas afford LPD; wide bandwidths allow higher data rates; ground stations permit cross patching; and satellite positions make global coverage available.

e. **Support to Mobile Forces.** SATCOM systems can provide the communications required by mobile forces operating over wide areas. This is especially true for those forces that require dynamic C2 when they are on the move.

4. Limitations

SATCOM has the following limitations:

a. **Limited Capacity.** Requirements for SATCOM service worldwide exceed the capacity of current MILSATCOM systems. Through partnering, the DOD supplements SATCOM capabilities with commercial, international, and civil systems.

(1) MILSATCOM systems support the SecDef, CJCS, national and DOD agencies, and CCDRs worldwide. Due to the number of SATCOM users, the priority of use, and the criticality of information carried over these systems, oversight through requirement validation and adjudication is required at the DOD, Joint Staff, and CDRUSSTRATCOM levels.

(2) Identified requirements are carefully scrutinized through a validation process, starting with a USSTRATCOM-led assessment, with capacity eventually being allocated based on priority and availability.

(3) Within their allocated capacity, CCDRs manage, direct, and control individual networks supporting component air, land, maritime, space, and special operations forces.

See USSTRATCOM Strategic Instruction (SI) 714-4, Consolidated Satellite Communications (SATCOM) Management Policies and Procedures (C-SMPP), *for additional information on the SATCOM request validation process.*

b. **Orbital Considerations.** Most DOD communications satellites are in geostationary orbits over the equatorial plane where they appear to be stationary over a point on the Earth's equator. Due to the orbital mechanics of having to be over the equator, high-latitude and polar coverage is limited. See Appendix H, "Space Fundamentals" for a description of geostationary orbits.

(1) A constellation of three geostationary communications satellites equally spaced, or nearly so, can provide near-total Earth coverage between 65 degrees north and south latitude. However, due to signals becoming weak at the edges of coverage,

MILSATCOM generally employs a constellation of four satellites to provide adequate worldwide coverage between 65 degrees north and south latitude.

(2) In general, a mix of geosynchronous and polar satellites is required for full global coverage. A mixture of satellites in low-altitude, mid-altitude, or highly elliptical orbits can also provide global coverage; however, this requires a greater number of satellites in the constellation to accomplish.

c. **Frequency Constraints.** Except in forcible entry situations, the terminal segments associated with space systems are subject to the same HN and National Telecommunications Information Agency frequency clearance processes as terrestrial radio systems. In addition, frequency bleed-over among antennas must be considered when configuring ground segments (e.g., antenna farms), to ensure self-imposed interference is avoided.

d. **Terminal and Antenna Size.** Because antenna size, frequency, bandwidth, and data rate capacity are interrelated, commanders often must compromise either information flow rate or mobility.

(1) Generally, the higher the frequency (e.g., SHF, EHF), the wider the available signal bandwidth (hertz) and the higher the data rate (bits per second) capacity. Similarly, within these frequency bands, the larger the antenna size, the greater the data throughput, but the smaller a SATCOM terminal's mobility. However, small terminals and antennas are required to minimize the impacts on tactical force mobility and ensure that the many different platforms of the supported forces are suitably integrated in the operational, physical, power, and electromagnetic environments. Hand-held and/or man-pack, maritime, and airborne platforms have especially demanding constraints.

(2) Lower frequency systems have narrower signal bandwidth and lower data rate capacity. This narrower bandwidth allows generally smaller antenna sizes.

e. **Susceptibility to Jamming and Interference.** All radio receivers, including satellite systems, are susceptible to jamming and interference. Unintentional interference can be as harmful to SATCOM operations as deliberate jamming. Mandatory jamming and interference processes for all JFCs, Services, and agencies are contained in SI 714-5, *Space System Electromagnetic Interference (EMI) Resolution Procedures.*

(1) Narrowband satellites are the most susceptible to both jamming and intercept due to their narrower bandwidth, large antenna beamwidth, and low power. While most commercial satellites have no protection against jamming, some transponders installed on military UHF satellites have limited resistance through different modulation schemes and frequency hopping techniques.

(2) Military wideband systems operate at higher frequencies, smaller antenna beamwidths, and wider bandwidth. This allows the incorporation of more effective modulation schemes that provide a higher degree of jam resistance.

(3) Military protected systems afford even greater protection through the different techniques possible with wider available bandwidth.

f. **Constellation Reconfiguration.** While the ability to move satellites to reconfigure constellations may be an advantage, there are also significant disadvantages to repositioning satellites.

(1) Most communications satellites currently in service are positioned to provide communications connectivity to a large number of users. Moving any of the primary satellites to a new satellite region could disrupt communications connectivity for this population, and could impair their ability to accomplish their missions. Movement of satellites requires extensive coordination with multiple agencies. The process to move communications satellites is defined in SI 714-4.

(2) Repositioning satellites can take weeks and can consume a significant amount of on-board, station-keeping fuel, thereby reducing the operational life of the satellite.

(3) To offset this limitation, JFCs must identify their SATCOM requirements through the Joint Staff SATCOM Database (SDB) according to CJCSI 6250.01C, *Satellite Communications* by following the defined process of submissions through the appropriate combatant command. SATCOM is incorporated into operation plans as described in SI 714-4.

g. **Solar Activity.** Increased solar activity can disrupt SATCOM for short periods of time. In extreme cases, this can cause communications outages.

(1) The detection of solar flares can be used to forecast solar effects, thereby minimizing the disruption of communications by using workarounds.

(2) Sun activity mostly affects small receivers in the Arctic and tropical regions as well as the UHF frequency band.

(3) All SATCOM is susceptible to solar activity.

h. **Interference Due to Precipitation.** SATCOM in the Ku- and Ka- bands, and EHF systems, are particularly affected by precipitation (the higher the frequency, the greater the effect). Precipitation not only degrades the signal but, if heavy enough, can cause a complete outage. While the percentage of time a system will not be available due to precipitation is small, this is an operational constraint which must be considered during planning or operations.

i. **Sun Conjunctions.** Sun conjunctions (in this context, when a satellite is aligned between the Earth and Sun) cause communications disruptions and outages. Since their time and duration can be predicted, such events can be planned for and the impact on operations minimized.

j. **Considerations for Military Use of Commercial SATCOM Systems.** Access to commercial SATCOM systems raises several issues which must be considered:

(1) Communications are not protected.

(2) Potential competition for access with other customers, including adversaries.

(3) Non-US ownership or control of commercial SATCOM services outside the borders of the United States.

(4) The potential inability to quickly access commercial SATCOM capacity in many areas to which the military could deploy (often on a short notice).

(5) Access and availability to commercial services are based on contractual terms which could be terminated at times not convenient to the military.

(6) Potential for commercial SATCOM unencrypted TT&C links and lack of vendor ability to identify, geolocate, and support DOD jamming or interference response.

k. **National Systems for Communications.** In some cases, specialized DOD communications needs can be met through national systems. As with MILSATCOM systems, these assets may be highly subscribed, and therefore require careful coordination and planning with national systems operators before military use can be ensured.

5. Support Procedures

The SATCOM requirements process is defined in CJCSI 6250.01C, Satellite Communications*. A summary of the process is provided below.*

a. **Requirements Process.** The ultimate objective for SATCOM management is to provide the right users SATCOM resources when and where needed, in accordance with operational priorities. DOD needs to continually assess the SATCOM systems' effectiveness in pursuit of this objective.

(1) The CJCS, CCDRs, Services, and DOD agencies are all key stakeholders with military SATCOM requirements. CDRUSSTRATCOM, per the UCP, serves as the advocate for DOD operational SATCOM matters, representing the DOD SATCOM community by coordinating and orchestrating consolidated user positions with combatant commands, Services, and agencies.

(2) Each CCDR will consolidate, validate, and prioritize all requests for use of SATCOM systems within their AOR.

(3) CCDRs and Services will validate their requirements and submit them to the Joint SATCOM Panel, co-chaired by the Joint Staff and USSTRATCOM.

(4) DOD agencies will validate and submit requirements in support of their agency mission and/or function to the Joint SATCOM Panel, co-chaired by the Joint Staff and USSTRATCOM.

(5) Assistant Secretary of Defense (Networks and Information Integration) is responsible for non-DOD and federal agency requirements.

b. **Format.** SATCOM requirements for user connectivity will be submitted via the SDB Management Tool or via DISA Form 772, *SDB Requirement Request Form.* Current and future requirements will be submitted with the format described in the DISA-published SDB Management Tool user guide.

c. **Prioritization.** CCDRs, Services, and agencies review each requirement to ensure that it is valid, has a clear operational concept, identifies the operational needs and missions supported, and provides a mission impact if not satisfied. The requirements are then prioritized by category as prescribed and documented in CJCSI 6250.01C, *Satellite Communications*.

d. **Submission.** All SATCOM (military and commercial) requirements are submitted to the Joint Staff through the joint SATCOM panel administrator (JSPA) at DISA who administers the SDB.

e. **Future Requirements.** Future connectivity requirements are satisfied through ongoing changes to strategy, doctrine, forces, weapon systems, or changes in technology. The SDB consolidates future SATCOM requirements to assist planners in determining future SATCOM capabilities, trends, architectures, and acquisition strategies.

f. **SATCOM Access.** Access is requested via the SATCOM allocation process described in SI 714-4.

g. **Adjudication.** Per CJCSI 6250.01C, *Satellite Communications,* the CJCS has final adjudication authority for competing DOD SATCOM access requirements that cannot be resolved by CDRUSSTRATCOM.

h. **Urgent Requirements.** For urgent requirements not documented in the SDB, a request is submitted to USSTRATCOM, with information copies to JSPA. Urgent requirements can be submitted by CCDRs, Services, and DOD agencies, but they must be validated as an operational necessity. The request must contain justification for urgent processing. For urgent requirements, the Joint Staff can grant a 30-day waiver for SDB approval.

See JP 6-0, Joint Communications System, *for keystone communications doctrine.*

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APPENDIX E
SPACE-BASED POSITIONING, NAVIGATION, AND TIMING

1. Overview

a. Space-based PNT systems, in combination with terminal units, support strategic, operational, and tactical missions by providing the joint force with essential and precise three-dimensional position capability navigation options, and a highly accurate time reference. US military forces use GPS for their space-based PNT information.

b. In conducting joint military operations, it is essential that PNT services be available with the highest possible confidence. PNT services must meet or exceed JFC mission requirements. Any information that makes reference to time must be able to provide that time in terms of the standard temporal reference defined by Coordinated Universal Time (UTC) as maintained by the US Naval Observatory (USNO) master clock, which is the standard for all military systems.

c. GPS satellites broadcast navigation information on a continuous basis. The transmission has two levels of service — a standard positioning service (SPS) and a precise positioning service (PPS). The positioning code in each permits very precise matching of receiver-generated and satellite-generated waveforms, hence, precise measurement of the distance to each satellite.

(1) **SPS**, which utilizes the coarse acquisition code, is the unencrypted civilian positioning and timing service that is provided to all GPS users.

(2) **PPS** is a more accurate, military positioning, velocity, and timing service available to authorized encrypted users (US military and some allies) on a worldwide basis with limited AJ capabilities. Access to PPS is controlled by use of cryptography (encryption keys loaded in the terminal units).

d. **DOD Policy for Precise Positioning Service.** In 2005, Congress directed that all DOD aircraft, ships, combat vehicles, and indirect-fire weapon systems must be equipped with a GPS receiver. However, certain federal civil agencies, allies, and coalition members are also authorized use of the PPS through department-level special agreements. GPS policy is included in the DOD GPS Security Policy, DODD 4650.05, *Positioning, Navigation, and Timing*, and CJCSI 6130.01D, *2007 CJCS Master Positioning, Navigation, and Timing Plan (MPNTP);* each require all DOD assets to use a common precise time: UTC (USNO), and a common precise celestial reference frame (provided by USNO).

(1) GPS PPS and inertial navigation systems are the only authorized PNT sources for all military operations. Exceptions to this policy are approved according to the MPNTP.

(2) GPS is the primary source of PNT information for the DOD. Civil capabilities are permitted for use in peacetime operations when the use of the system does not jeopardize the ability to accomplish the US military mission.

(3) All DOD combatant users must acquire, train with, and use GPS PPS systems in accordance with the DOD GPS Security Policy and the MPNTP.

2. Application

GPS plays a key role in military operations in all four domains (land, sea, air, and space), and is likely to do so well into the future. Capabilities are increasing across the space, control, and user segments (see Figure E-1).

a. **Operations on Land.** The inherent precision of GPS allows precise site surveys, emplacement of artillery, target acquisition, and location. GPS establishes a "common reference grid" within the operational area, enables a "common time," helps establish "common direction," and facilitates synchronized operations. Some of the benefits of using GPS include:

(1) Mine fields and obstacles can be accurately surveyed, emplaced, and recorded.

(2) The accuracy of artillery fire is improved through precise gun emplacement, precision gun laying, precision observer location, a reduction in adversary target location error, and precision guided artillery and mortar rounds.

(3) Armored units can travel "buttoned-up" and still maintain highly accurate position awareness.

(4) Exact location and navigation information helps logistic support by expediting resupply efforts. The precise information also supports the timely and efficient evacuation of wounded personnel to aid stations.

(5) Enables BFT.

(6) Enables all weather air support.

b. **Operations at Sea**

(1) Ships and submarines can precisely plot their position, thereby allowing safe port operations and navigation through restricted waters.

(2) Coastlines can be accurately surveyed by using a combination of laser range finding and highly accurate position information.

(3) Mines can be laid and precisely plotted for friendly force avoidance and safe, efficient retrieval.

(4) Rendezvous at sea, sea rescue, and other operations that require precise tracking can be facilitated using space-based PNT support.

THE GLOBAL POSITIONING SYSTEM SPACE, CONTROL, AND USER SEGMENTS

SPACE SEGMENT

Legacy (Block IIA/IIR)	Modernized (Block IIR-M)	Modernized (Block IIF)
• Basic GPS • C/A Civil Signal (L1C/A) • Std Pos Service • Precise Pos Service – L1 & L2 P(Y) Nav • NDS	• 2nd Civil Signal (L2C) • M-Code Signals (L1M, L2M) • Flex AJ Power (+7dB)	• 3rd Civil Signal (L5)

CONTROL SEGMENT

Legacy	Upgraded (AEP)	Modernized (OCX V1)
• TT&C • L1 & L2 Monitoring	• IIR-M IIF TT&C • WAGE, AII, LADO • SAASM • New MCS/AMCS	• New Architecture • Signal Monitoring • M-Code

USER SEGMENT

Legacy	Upgraded	Modernized
• PLGR	• DAGR • GAS-1 • CSEL • MAGR2K • ADAP • GB-GRAM	• MGUE • MUE • MSR

IIA	Block II A
IIF	Block II Follow-On
IIR	BlockII Replenishment
IIR-M	Block II Replenishment -- Modernized
AJ	Anti-Jam
ADAP	Advanced Digital Antenna Production
AEP	Architectural Evolution Program
AII	Accuracy Improvement Initiative
AMCS	Alternate Master Control Station
C/A	Coarse Acquisition
CSEL	Combat Survivor/Evader Location
DAGR	Defense Advanced GPS Receiver
dB	decibel
GAS-1	GPS Antenna System
GB-GRAM	Ground-Based GPS Receiver Application Module
GPS	Global Positioning System
L1M	M-Code on the L1 frequency
L2C	Civil Signal on the L2 frequency
L2M	M-Code on the L2 frequency
LADO	Launch and Early Orbit, Anomaly Resolution, and Disposal Operations
M-Code	Military Code
MAGR/2K	Miniaturized Airborne GPS Receiver (2000)
MCS	Master Control Station
MGUE	Military GPS User Equipment
MSR	Modernized Space Receiver
MUE	Modernized User Equipment
NDS	Nuclear Detonation Detection System
OCX	Operational Control Segment
P(Y)	Precise Code
PLGR	Precision Lightweight GPS ReceiverSAASM Selective Availability Anti-Spoofing Module
TT&C	Telemetry, Tracking, and Commanding
WAGE	Wide Area GPS Enhancement

Figure E-1. The Global Positioning System Space, Control, and User Segments

c. **Operations in the Air**

(1) Information on PNT enhances airdrop, air refueling, search and rescue, reconnaissance, terminal approach and recovery, low-level navigation, targeting, and precision weapons delivery.

(2) Air corridors for friendly return-to-force procedures can be set with greater accuracy, and aircraft have a greater capability to safely follow these corridors.

(3) Nontraditional ISR and dynamic targeting enables near-real-time reallocation of airborne firepower.

d. **Operations in Space.** The GPS navigation service provides exact positioning to other satellites to enable their "position autonomy." The same service enables "orbital rendezvous" between space systems (e.g., space docking for the space shuttle). It also provides precise time to communications satellites and to systems in geosynchronous orbits. New launch vehicles rely upon GPS position and derived velocity information to aid in determining attitude orientation.

3. Advantages

Advantages of GPS include:

a. **Accuracy.** The GPS constellation provides continuous global service. Accuracy of the service is provided by the type of receiver used, the number of satellites in view, and the geometric configuration of those satellites.

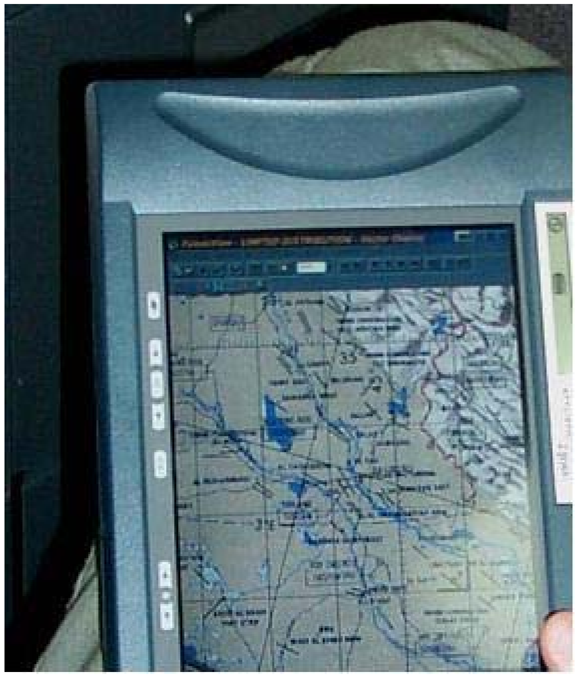
b. **Accessibility.** Because GPS equipment is passive, it is capable of providing continuous real-time information. Any authorized user with a keyed PPS receiver has access to the most precise PNT information. However, commercial user equipment cannot receive and process the PPS information and is limited to the SPS signal.

c. **Graceful Degradation.** Each GPS satellite can store information on board for up to 60 days. In the event the GPS constellation cannot be updated, accuracy will gradually degrade. The rate of degradation is very slow in the first few days but increases with time. This allows GPS to be used for several days even if the update capabilities are interrupted.

d. **Common Grid.** The default navigation grid used by the GPS is the World Geodetic System 1984 (WGS-84). WGS-84 can be easily converted to any grid reference using the terminal device.

e. **Jamming.** Space-based navigation systems (e.g., GPS) are resistant to some types of jamming. The use of GPS encryption (like a more robust military code [M-Code]) and nulling antennas/filters, as well as the correct placement of GPS receivers on various platforms, improves jamming resistance. Tactical measures employed by joint forces decrease vulnerability from ground-based jamming (such as placing a hand-held receiver at the bottom of a foxhole).

f. **Anti-Spoofing (A/S).** With the precise capability provided by the GPS, a logical concern is that an adversary could generate false signals to mislead an authorized user with respect to position or timing information. A/S technology is designed to mitigate receiver confusion that could be caused by intentionally misleading transmissions.



Global Positioning System information enables situational awareness.

4. Limitations

Limitations of GPS include:

a. Adversary exploitation of the SPS can reduce the US military advantage. Commercial GPS receivers are vulnerable to jamming.

b. Jamming GPS can adversely affect civil and first responder operations, as well as joint military operations within a geographic area. The stronger the jammer, the larger the affected area. CCDRs and their subordinate JFCs must factor potential GPS jamming into their electronic warfare (EW) plan. Consideration must also be given to friendly interference, which is mitigated via the joint restricted frequency list. Coordination procedures for this list are detailed in JP 3-13.1, *Electronic Warfare*.

c. Signals from at least four satellites are required to build a three-dimensional position and navigation picture (only one signal is needed for timing). Units relying on hand-held GPS receivers in areas of dense vegetation or steep terrain may have diminished GPS capabilities due to the lack of LOS reception of GPS signals.

d. GPS navigation signals are also affected by ionospheric scintillation, tropospheric errors, and signal multipath issues. Receivers capable of two frequency (i.e., some combination of L1, L2, and/or L5) reception minimize errors.

e. Denial of the GPS "navigation" signal may have a direct negative impact on joint systems that have nothing to do with "navigation". This is particularly true for communications systems that rely on GPS timing.

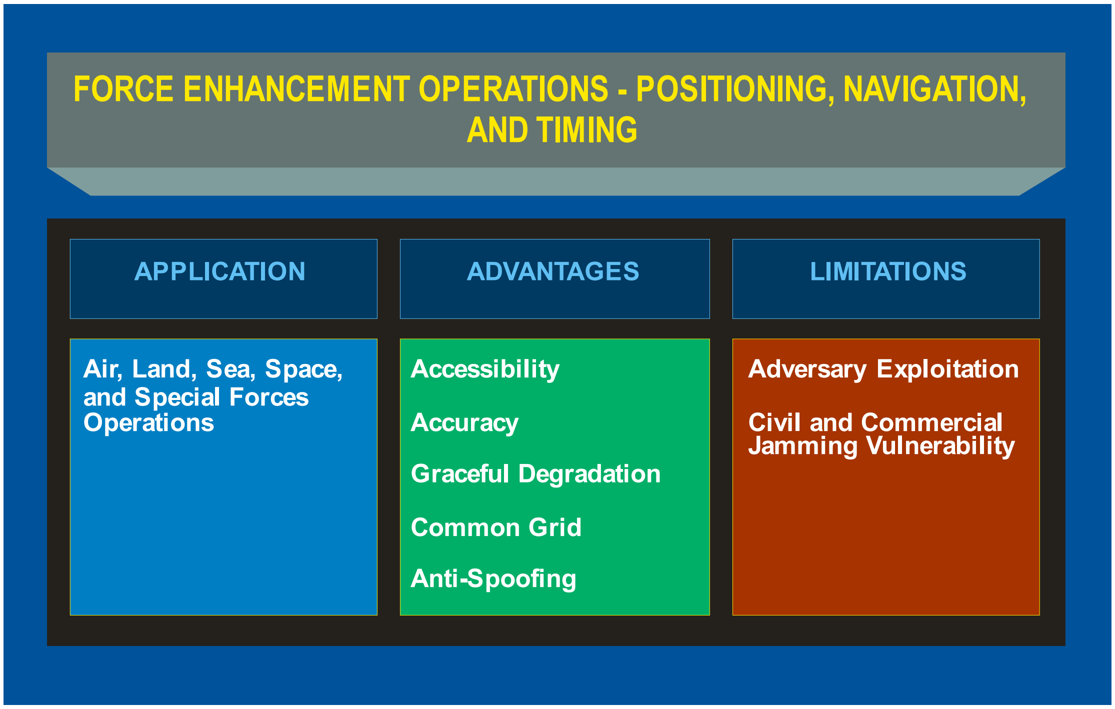


Figure E-2. Force Enhancement Operations — Positioning, Navigation, and Timing

APPENDIX F
SPACE SUPPORT TO INFORMATION OPERATIONS

1. Information Operations

a. **IO** is the integrated employment of the core capabilities of EW, computer network operations (CNO), psychological operations (PSYOP), military deception (MILDEC), and operations security (OPSEC), in concert with specified supporting and related capabilities, to influence, disrupt, corrupt, or usurp adversarial human and automated decision making while protecting our own.

b. Commanders should plan to fully integrate IO into their operations, to include how space-based capabilities can support IO. It is vital that IO and space representatives coordinate their efforts through an IO cell. The IO cell brings all capabilities, to include special technical operations, into the planning cycle to ensure the commander's objectives are achieved. Planners need to **coordinate and synchronize space control with IO plans** to include which desired effects can be created by space forces or IO capabilities. Effective synchronization will prevent negative impacts to IO plans.

c. Successful IO relies on global communication, reachback support, timing, and global synchronization. IO planners should coordinate with the SCA to cue space assets to recognize key events or triggers to initiate IO-specific plans or allow time to develop alternate COAs.

2. Space Support to Information Operations

a. **General.** Space forces have active and passive capabilities (collecting, controlling, exploiting, and protecting information) that can support joint force efforts to conduct influence operations, EW, and network operations.

(1) Space assets provide global persistence that provides indications and warnings of adversary operations.

(2) Space assets provide the venue to synchronize the joint efforts and enable maintenance of operational legitimacy and perseverance.

(3) Space planners need to be integrally involved in the IO planning process as a member of the IO cell to ensure that redundant links and appropriate bandwidth are available to accomplish rapid and reliable global communication.

(4) Space-based capabilities support IO personnel in the field by providing two-way secure communications in remote areas, imagery of an operational area, position and navigation information, ISR, and weather, terrain, and environmental monitoring.

b. **Intelligence Support to Information Operations.** Intelligence, a key enabler of IO, is greatly enhanced through space-based capabilities. Understanding space enabled characteristics of the information environment is critical in developing offensive and defensive options to influence, protect, and deny information. Space-based imagery products, SIGINT capabilities, and positioning and navigation capabilities are vital in the JIPOE process.

For detailed guidance on intelligence requirements supporting IO, see JP 3-13, Information Operations*.*

c. **Assessment of Information Operations. Space assets can provide valuable assessment data** that support measures of effectiveness (MOEs) or measures of performance (MOPs). MOE/MOP standards should be communicated to the SCA to coordinate the tasking of space assets to collect in support of MOEs/MOPs. IO planners need to communicate with the SCA or designated space planner to translate IO MOEs/MOPs into required space support tasking. Examples include:

(1) PSYOP planners could assess if delivered messages are being transmitted to adversary forces.

(2) MILDEC planners could assess if adversary sensors have detected deception maneuvers and are reacting to that deception in the anticipated manner.

(3) Space assets can support BDA efforts feeding into MOEs for EW operations.

(4) SIGINT data can discern if a specific emitter that was previously targeted has returned to operational status and needs to be reattacked.

d. **Support to Core Information Operations Capabilities**

(1) **Electronic Warfare.** Space assets collect space-based intelligence data that, once analyzed, enables our forces to reprogram EW systems, locate adversary integrated air defense system locations, and map the critical links and nodes. Space-based capabilities also provide intelligence and information on adversarial NAVWAR capabilities targeting friendly PNT. SIGINT data is utilized for discovering emitters that are either operating out of recognized parameters or have changed location. The speed at which these changes can be recognized and delivered to either EW planners for targeting or to the joint Electronic Warfare Integrated Reprogramming agencies, directly affects survival of joint forces. Space planners should coordinate with the electronic warfare coordination center to ensure processes are in place to accomplish these functions.

(2) **Operations Security and Military Deception.** Space operations personnel can support OPSEC and MILDEC efforts by providing adversary space order of battle information, including orbital paths and satellite coverage areas. Using this information, planners can select optimum times to conduct their own operations (e.g., increasing chance that deception maneuvers are visible to adversary space assets), or determining when their own operations are at risk from an adversary's space-based sensors. Space imagery also provides valuable information for friendly forces to assess the OPSEC posture (i.e., observability) of their operations and infrastructure. Secure space

communications links increase the global secure bandwidth. Ubiquitous secure communications enhance the ability of friendly forces to protect sensitive (even if not classified) voice and data transmissions, thereby practicing good OPSEC.

(3) **Psychological Operations.** Space assets provide message delivery vehicles for PSYOP message dissemination. SSA can assist PSYOP planners in choosing the delivery vehicle for selected messages by providing exact coverage area and times of commercial satellites and the capabilities of those satellites to broadcast either by radio, television, or Internet. Linking that information with the target audience will enhance the effectiveness of PSYOP.

(4) **Computer Network Operations.** CNO is comprised of three related areas; computer network attack (CNA), computer network defense (CND), and computer network exploitation. Real-time monitoring and analysis provides status of the overhead GIG components. This assessment can determine if GIG interruptions are caused from deliberate attack and may trigger CND response actions and/or CNA since jamming may not affect the satellite itself but is directed at the information dissemination management/content staging that uses the GIG. The analysis can also provide predictions of environmentally induced interruptions of service allowing development of alternate paths to ensure uninterrupted GIG capability.

See JP 3-13, Information Operations*, for additional details on information operations.*

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APPENDIX G
OPERATIONALLY RESPONSIVE SPACE

1. Overview

a. Per Deputy Secretary of Defense Memorandum dated 9 July 2007, **operationally responsive space (ORS)** is defined as "assured space power focused on timely satisfaction of JFCs' needs." ORS balances the requirement to meet JFC urgent space needs with the requirement to satisfy other users' needs. ORS also provides the "capacity to respond to unexpected loss or degradation of selected capabilities, and/or provide timely availability of tailored or new capabilities" (per NSPD-40). Strategic or long-term needs are not a primary focus of ORS.

b. **Establishing Needs.** The CDRUSSTRATCOM provides operational oversight for all ORS activities consistent with the UCP and other applicable authorities. This includes collecting, prioritizing, and managing identified joint force needs, and operating ORS capabilities to meet those needs.

c. **Capability Development.** The ORS Office is a joint organization that reports to the DOD Executive Agent for Space To ensure a range of possibilities are available for consideration when responsive space capabilities are required, the IC, DOD, and national security space mission partners will collaborate in ongoing efforts to leverage existing systems and to provide responsive, actionable, near-real-time information to users. The ORS Office will also expedite development and fielding of capabilities by leveraging national security space-wide technology and operational capabilities, and provide integration and technical support to other Service and government agency activities.

2. Application

a. ORS missions support USSTRATCOM space mission areas of space force enhancement, space control, and space support by providing timely, responsive space capabilities when needed.

b. To accomplish these missions, ORS capabilities are implemented in a three-tiered approach:

(1) Tier-1 uses existing or on-station capabilities to create highly responsive space effects through the employment, modification, and revised application of these space capabilities. The targeted timeframe for the application of Tier-1 solutions is immediately-to-days from the time the need is identified. Tier-1 solutions focus on existing ground and space systems, operations, and procedures. Although mission or system utilization analysis may be needed, Tier-1 solutions will not typically involve the design, engineering, or fabrication of new materiel items.

(2) If all possible Tier-1 options have been evaluated and no Tier-1 solution can respond to the need, a Tier-2 solution will be considered. Tier-2 solutions will utilize field-ready capabilities or deploy new or additional capabilities that are field-ready. The

targeted timeframe for delivering usable Tier-2 solutions is days-to-weeks from the time the JFC need is established. Tier-2 solutions focus on achieving responsive exploitation, augmentation, or reconstitution of space force enhancement or space control capabilities through rapid assembly, integration, testing, and deployment of affordable small satellites.

(3) There may be cases where an expressed need cannot be addressed through existing capabilities (Tier-1) or through rapid deployment of field-ready capabilities (Tier-2). In such events, ORS efforts must focus on the rapid development and deployment of a new capability (Tier-3). Once developed, Tier-3 capabilities will be responsively deployed and employed in the same manner as Tier-2 assets. The targeted timeframe for the presentation of an operational Tier-3 capability is months-to-1 year of the established JFC need. Meeting this challenging timeline cannot be accomplished unless the amount of new development involved is very limited.

c. To develop capabilities, ORS leverages existing technology and capabilities to maximize their benefits. This includes exploring non-space options as well as other material and nonmaterial solutions.

3. Advantages

ORS helps to synchronize and integrate space capabilities in time and purpose with the employment of other forces by a JFC. Advantages of ORS include:

a. Rapid presentation of new or enhanced space capabilities in response to JFC needs. These capabilities will be operational within one year of that need.

b. Rapidly adapt or augment existing space capabilities when needed to expand operational capability.

c. Rapidly reconstitute or replenish critical space capabilities to preserve operational capability, providing the JFC assured, persistent space power.

4. Limitations

Limitations of ORS include:

a. Shortened timelines will challenge every aspect of the development and deployment process and increase risk.

b. Congressionally-mandated cost ceilings will require well-defined JFC needs. In turn, these will drive "just-enough" developmental approaches.

APPENDIX H
SPACE FUNDAMENTALS

1. General

a. Space is a domain enabling many joint force-essential capabilities. These capabilities derive from exploitation of the unique characteristics of space, among which include a global perspective and lack of overflight restrictions, as well as the speed and persistence afforded by satellites.

(1) **Global Perspective.** Space has been labeled "the ultimate high ground" for good reason. Even low earth orbit (LEO) satellites, which are relatively close to Earth's surface (altitudes from roughly one hundred miles to a few hundred miles), have fields of view spanning hundreds of miles. At greater distances, geosynchronous Earth orbit (GEO) satellites can view slightly over one-third of the Earth at once. At this range, only three evenly-positioned GEO satellites are needed to provide almost complete global communications coverage (regions near the North and South Poles cannot be covered by GEO satellites due to reasons discussed below). Thus, space affords a global vantage point from which to assess several considerations, from tactical to strategic levels.

(2) **Lack of Overflight Restrictions.** Unlike the international rules for overflight of state aircraft, under which nations may prevent—using force, if needed—aircraft overflight, currently there are no international overflight restrictions regarding overflight by other nations' satellites. Thus, space provides unhindered access to points spanning the globe. It is this unhindered capability of ISR, communications, and navigation, coupled with the ability to traverse the globe in very short periods that provide capabilities unrivaled by other domains.

(3) **Speed and Persistence.** Satellites travel at incredible rates of speed and, unlike aircraft, do not require constant propulsion to remain in orbit. These factors enable satellites not only to cover vast amounts of ground in very short periods of time, but also to provide continuous operation and coverage. Often, a satellite's life span is limited only by the reliability of its on-board systems and the quantity of propellant available for station keeping and additional maneuvers.

b. All of these unique aspects make space a very desirable domain within which to operate. However, space also has many peculiar characteristics which must be appreciated by joint forces to plan and operate effectively.

2. Unique Characteristics of Space

While physical laws on land, in the water, or in the air are directly observable and commonly understood at a fundamental level, the physics of Earth-orbiting objects—"satellites"—within the vacuum of space is more difficult to observe and understand. The unique attributes of space have profound implications for the inherent capabilities and limitations that derive from them. Consequently, though a comprehensive discussion of orbital mechanics is neither possible nor desirable within this publication, certain basic precepts must be understood to leverage space power effectively.

a. **Gravitational Forces Predominate.** Due to the Earth's gravitational field, satellites orbiting the Earth are in a constant state of falling toward the Earth's center. At the same time, the satellite is hurtling at extremely high speeds in a direction near-horizontal to the Earth's surface. On average, the Earth's surface curves downward 5 meters for every 8 kilometers traveled horizontally. Consequently, if a satellite is to stay in a simple circular LEO, it must traverse 8 kilometers of the Earth's surface in the time required to fall 5 meters towards the Earth's center. In essence, the Earth's surface will curve away at a rate proportional to the rate the satellite is falling and the satellite will never actually hit the Earth. The horizontal speed required to achieve this circular, LEO is roughly 17,500 miles per hour. The speeds required for orbit insertion and the rates at which a satellite falls to Earth are dependent on the altitude and shape of the orbit in question.

b. **Orbits Are Fixed in Space.** With the exception of a few external forces (see "perturbations" discussion below), orbits do not move.. That is, a given satellite's orbit is fixed in space, while the Earth rotates beneath the orbit and while the satellite itself traces around the orbit (Figure H-1). This phenomenon results from the satellite's *angular momentum*. A gyroscope illustrates the effects of angular momentum on a much smaller scale. When holding a spinning gyroscope, it is difficult to twist in various directions. The inertia, or resistance to positional change is the effect of the gyroscope's angular momentum. Satellites' high altitudes (and thus great radial distances from Earth's center) and very high velocities mean satellites have tremendous angular momenta, implying extremely large inertias and thus orbital planes that are very resistant to movement. Therefore, they are not easily repositioned.

c. **Satellites Are Not Very Maneuverable.** Contrary to popular, but misleading, conceptions about maneuvering in space, satellites cannot maneuver much, if at all, because

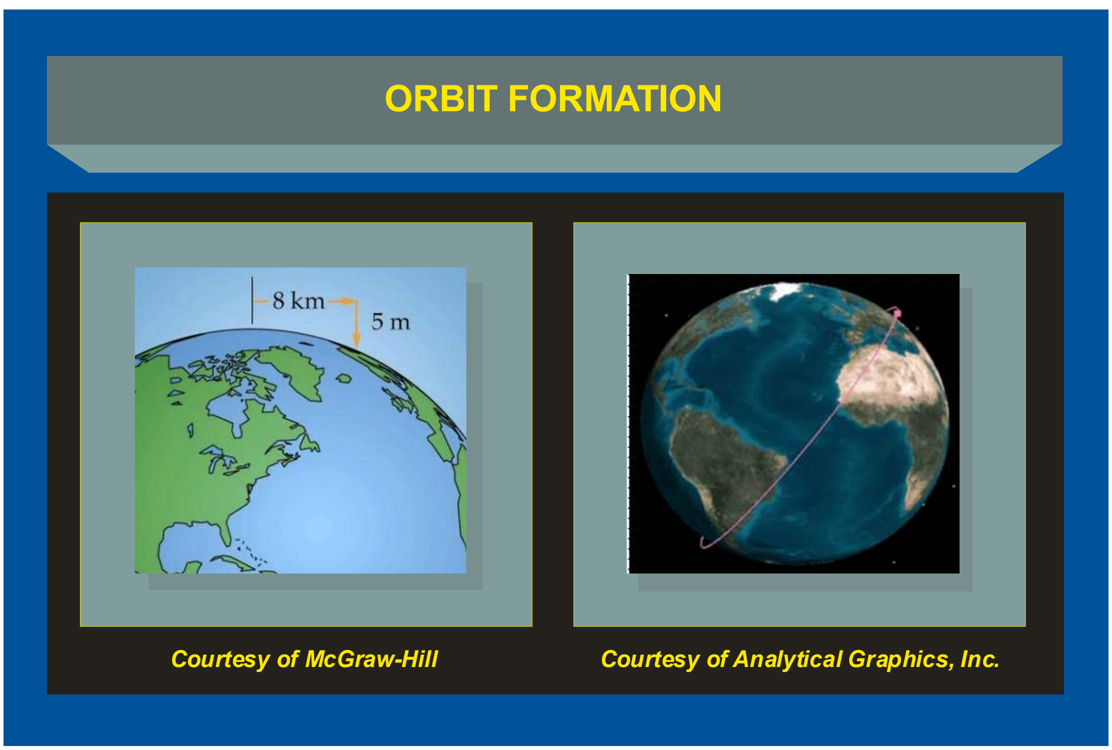

Figure H-1. Orbit Formation

of the effects of angular momentum. Maneuvering, such as changing an orbit's size or inclination, costs fuel and can severely limit the life of a satellite. As an example, if a space shuttle used every bit of on board fuel to change its orbital plane, the maximum plane change it could effect would amount to no more than two and a half degrees. A more important inference drawn from these limits is that satellites cannot "hover" over a given point on Earth, nor can they "bend" their orbital planes to maneuver to a specified point. Thus, a satellite's arrival over a particular point on the Earth depends almost wholly upon the passage of time, as the Earth rotates through the plane of the satellite's orbit, and the satellite orbits around the Earth.

d. **Orbital Planes Must Pass Through Earth's Center.** Gravity is the predominate force, continuously pulling the satellite toward Earth's center. Because of this phenomenon, any orbit traced by a satellite must be within a plane that passes through the center of the Earth. Practically, this means orbits cannot be designed to be "offset" or "overhead" (e.g., a "halo" orbit over the North Pole) to one side or another from the Earth: each orbit *must* encircle the Earth.

e. **"Perturbations" Can Change an Orbit.** Certain external forces can change the parameters of an orbit, producing an exception to the general rule that orbits are fixed in space. These forces are generally known as "perturbations," because they perturb, or alter, the orbit. These include atmospheric drag (atmospheric particles exist even at very high altitudes, albeit in very low concentrations); gravitational pull of the Sun, Moon, and other planets; variations in the Earth's gravitational field, resulting in orbital plane changes and other effects; solar pressure from the Sun's radiation; and interactions between solar radiation and the Earth's magnetic field. Perturbations have significant impacts on planning considerations. For example, contrary to popularly-held notions about satellite tracking, no country has the ability to continuously track every satellite orbiting Earth. However, if a satellite's position is known at several points, predictive models using basic laws of physics can be used to calculate the satellite's future position. Unfortunately, orbital perturbations can degrade the accuracy of those models. Generally, the lower a satellite's altitude, the shorter the accuracy duration of a given model, and consequently the greater the need for up-to-date prediction data (see paragraph 3, *"Operational Considerations").*

f. **Certain Orbits Have Special Characteristics.** Certain orbits have features that seemingly violate the general rules discussed above. On closer examination, however, these apparent exceptions are seen nonetheless to follow the general rules.

(1) **Geosynchronous/Geostationary.** Geosynchronous satellites track in their orbit around the Earth at the same rate at which the Earth rotates upon its axis – they are synchronized to the Earth's rotation. If placed directly over the equator, to a ground-based observer, a satellite in such an orbit appears to "hover" a little over 22,000 statute miles above that point. However, the satellite is actually moving very fast, in pace with Earth's rotation. This special, but very common, type of geosynchronous orbit is called geostationary because it appears stationary above Earth. GEO orbits allow constant LOS with a given, very large (slightly over one-third of the Earth) footprint, and thus lend themselves readily to gross environmental imagery (i.e., tens-of-square-miles pixel sizes) and global communications. An exception occurs near the poles, where communication

with high north or south latitudes (roughly 75 degrees or greater) is not possible because of a lack of LOS with the satellite.

(2) **Sun-Synchronous.** Natural perturbations will cause satellite orbits to change over time and mission planners can use this effect to their advantage. Such is the case with sun-synchronous orbits (See Figure H-2). A cross-section of the Earth is about 44 kilometers wider at the equator than at the poles. This causes an orbital perturbation, known as the "J2 effect," to alter the orientation of an orbital plane. By incorporating the J2 effect and carefully selecting the inclination of the orbit, a satellite can be placed in an orbital plane that shifts by slightly less than one degree per day to the east. The result is when the satellite passes over a given point, it will do so with the same sun angle (hence the label, sun-synchronous). This does not imply that a sun-synchronous satellite passes over the same point every day, only that when the satellite does pass over a given point along its ground track, it will have the same sun angle, and thus, the Sun shadows cast by features on the Earth's surface will not change. These types of orbits are particularly useful for reconnaissance and weather applications, where maintaining a constant viewing condition is critical (e.g., height determination, change detection).

(3) **Highly Elliptical Orbit.** A highly elliptical orbit (HEO), as its name implies, is a very flat, oval-shaped orbit. The usefulness of such orbits derives from the fact that satellites close to Earth travel quickly, and those further away travel slowly. At their most distant points form Earth, satellites in HEO orbits can be over 25,000 miles away. The relatively slow satellite speeds at these points combined with long orbit tracks provide HEO

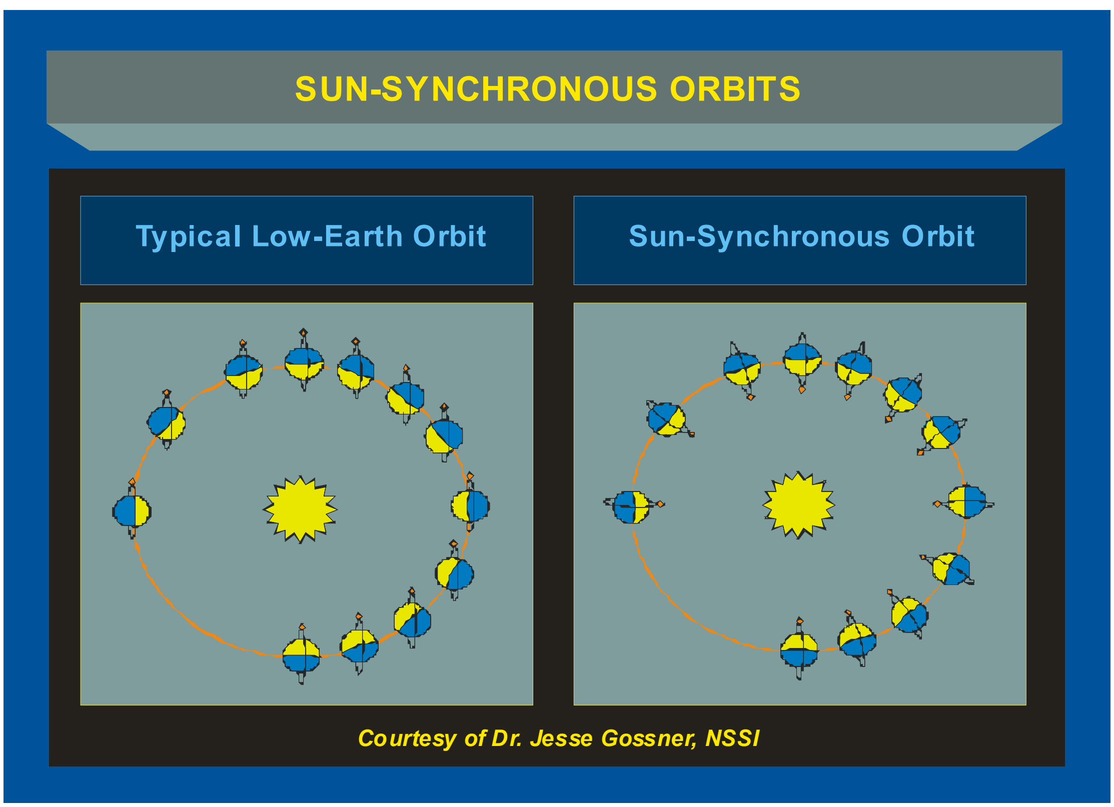

Figure H-2. Sun-Synchronous Orbits

satellites long dwell times at these distance points, again giving the appearance that satellites in these orbits "hover" for a time being. Such orbits are normally inclined so that these long dwell times occur over high-latitude points on Earth, ideally suiting them for communication satellites serving high-latitude locales (e.g., Russia, Scandanavia, Canada). Although many types of HEO orbits are possible, the most useful is termed a *Molniya* orbit (from the Russian word for "lightning," so named because of the dramatic speed of the satellite as it passes close to Earth). This type of orbit, inclined at 63.4 degrees, maintains perigee in the Southern hemisphere so that it dwells in the Northern hemisphere for nearly 11 hours of its 12-hour period. Three satellites set in phased Molniya orbits could thus provide continuous Northern-tier coverage. Other applications include weather and ISR. A variety of commonly used orbit types and their parameters are described in Figure H-3.

g. **One Satellite Often Is Not Enough.** No "one-size-fits-all" satellite exists for every application. Even satellites perfectly optimized for a particular mission may lack the required coverage for that mission. In such cases, a *constellation*—multiple satellites performing a single mission—is used to provide increased coverage or timeliness to meet

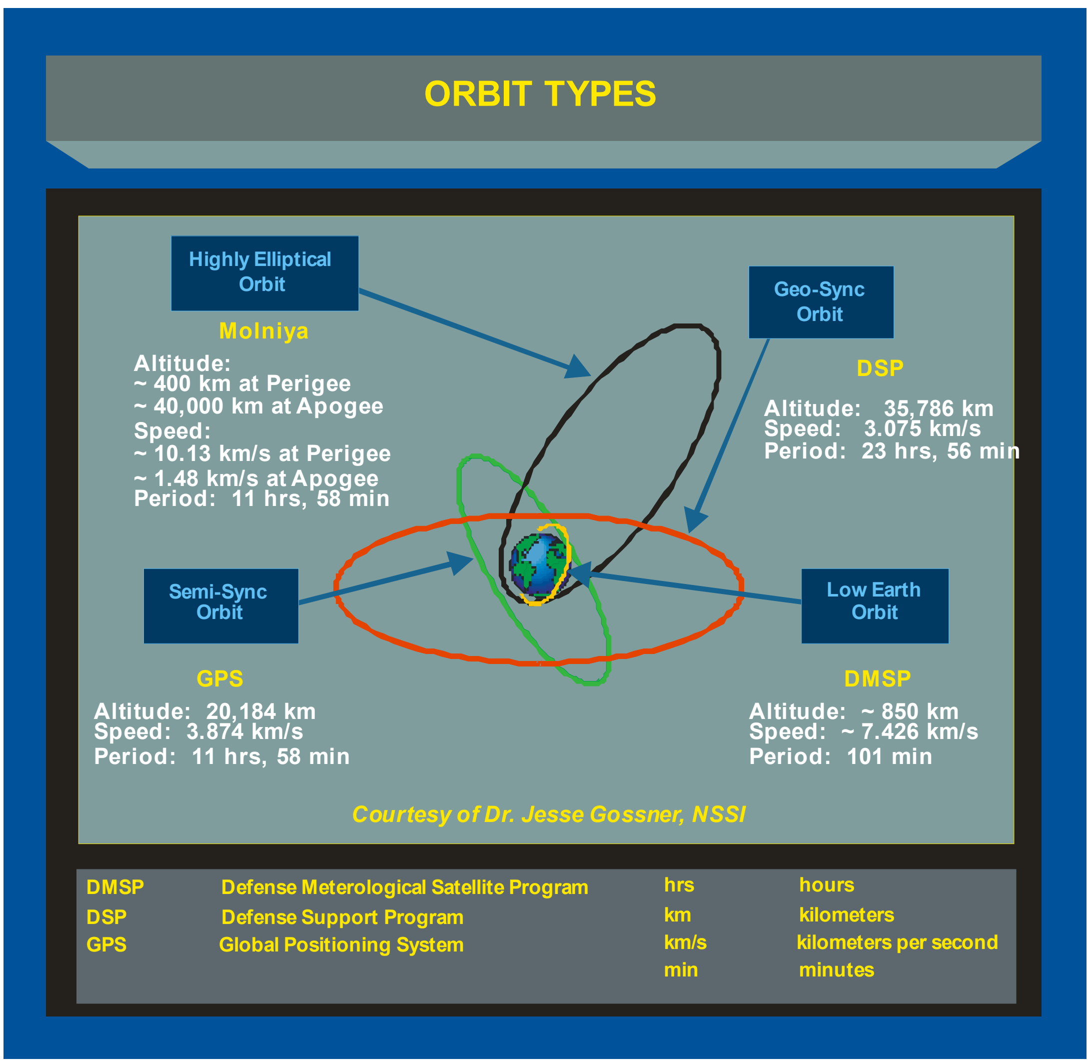

Figure H-3. Orbit Types

mission requirements. For example, navigation constellations (such as GPS) are designed to ensure that signals from at least four satellites can be simultaneously received at any location on the ground, enabling three-dimensional position fixing unavailable using only a single GPS satellite. Other examples include communications constellations, which are designed to ensure continuous connectivity between both ends of the communications link. To provide truly global coverage, such systems may include both equatorial and polar components. A final example includes weather and reconnaissance systems, which typically require constellations that combine both high and low altitude components. This construct provides a capability to combine wide-area, low-resolution coverage with limited field-of-view, high-resolution coverage to provide a complete weather picture. Regardless of configuration, constellations are designed to optimize mission components across multiple satellites so that overall mission requirements are met.

3. Operational Considerations

The unique characteristics of space drive important operational considerations that must be weighed when planning to provide space services and capabilites to the joint force:

a. **Revisit Rates.** "Revisit rate" refers to the interval between successive passes of a satellite over the same point on the Earth. Revisit rates are dependent on the geometry of the orbit itself, as well as its period *(*the time required for a satellite to complete one orbit). The larger the orbit, the longer the period will be. For example, typical LEO periods average from 90 minutes to a few hours. During this time, the Earth will continue to rotate on its axis beneath the orbit. Thus, by the time the satellite completes one orbit, its track over the Earth has shifted appreciably. Revisit rates for some satellites are as much as several days, while other satellites have much shorter revisit rates, depending on the orbit. In the extreme, GEO satellites have no revisit rate, since these satellites constantly maintain LOS with particular sectors of the Earth.

b. **Access Windows.** "Access window" refers to the amount of time a given satellite will be able to maintain LOS geometry with a fixed point on Earth's surface. With the exception of satellites in GEO and HEO orbits, a satellite cannot dwell over a fixed point for any prolonged length of time. The closer a satellite is to the Earth's surface, the faster it will travel, and the smaller the field of view available to that satellite. LEO satellites, for example, can maintain sensor contact and/or communications with a fixed point for only about 10 to 15 minutes. Access times and fields of view for other satellites increase proportionally to increasing satellite altitudes. Just as knowledge of friendly access windows ensures timely satellite contact, knowledge of enemy access windows helps in planning appropriate counter-tactics.

c. **Currency of Predictive Data.** Parameters describing a given satellite's position in space are derived from various sensors' observations of the satellite's azimuth, elevation, and range. These position "snap shots" are used to predict future satellite locations. Generally, the lower a satellite's orbital altitude, the shorter the time window within which a given prediction will remain accurate, because aggregate perturbation impacts (such as atmospheric drag) increase in severity with decreasing altitude. Consequently, for satellites in LEO orbits, predictive models usually cannot provide accuracy within required tolerances beyond roughly one or two days. For the field-deployed joint force, this fact drives the need to ensure data sets are as current as possible for all orbits, increasing in importance for orbits closest to Earth.

d. **Electromagnetic Interference.** Every capability leveraged from space derives from the electromagnetic spectrum, whether the capability enables ISR, communications, or navigation. All of these capabilities are thus subject to disturbances known as ***electromagnetic interference***. EMI can be natural or man-made. An example of natural EMI derives from effects caused by Earth's ionosphere. This outer region of Earth's atmosphere is nothing more than a "soup" of atomic particles and electrons that acts as random noise within the electromagnetic spectrum. However, this is not a uniform region. The Sun's electromagnetic energy and the Earth's magnetic field interact in complex ways to strengthen or weaken this interference, with both global and local impacts. Understanding and predicting these impacts help to mitigate their effect through preparation (e.g., selecting different operating frequencies, boosting power, timing transmissions to occur during periods of minimum interference). This understanding also helps in space control, where employment of capabilities can be masked by, and/or attributed to, environmental impacts. An example of man-made EMI is drawn from jamming, where a stronger electromagnetic signal is used to overpower a weaker signal. Knowledge of the space domain and of threat capabilities can help mitigate both natural and man-made EMI.

e. **Lack of Serviceability.** Space assets normally are not serviceable after launch (the Hubble and space station being the exceptions). This means that their ability to change functions, recover from failures or attacks, or maneuver is based almost entirely on the design of the system at the time of deployment (some software uploads may be possible). This limits flexibility compared to terrestrial assets which can be serviced, repaired, or upgraded. Lack of serviceability puts tighter constraints on the operational C2 since some requests can reduce the asset lifetime – for example, too much fuel expenditure or too much battery depletion during eclipses.

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APPENDIX J
REFERENCES

The development of JP 3-14 is based upon the following primary references:

1. Federal Law

a. Title 10, US Code.

b. Goldwater-Nichols Department of Defense Reorganization Act of 1986.

2. Strategy and Policy Documents

a. *The National Security Strategy of the United States.*

b. *The National Defense Strategy of the United States.*

c. *National Military Strategy.*

d. NSPD-27, *US Commercial Remote Sensing Policy.*

e. NSPD-39, *US Space-Based Positioning, Navigation, and Timing Policy.*

f. NSPD-40, *US Space Transportation Policy.*

g. NSPD-49, *National Space Policy.*

h. National Cryptologic Doctrine 2-1.

i. National Cryptologic Doctrine 3-0.

j. Unified Command Plan (UCP).

3. Office of the Secretary of Defense Guidance

a. Deputy Secretary of Defense memorandum, *Operationally Responsive Space.*

b. Report to Congressional Defense Committees, *DOD Plan for Operationally Responsive Space.*

c. DOD Global Positioning System Security Policy.

4. Department of Defense

a. DODD 3100.10, *Space Policy.*

b. DODD 5100.1, *Functions of Department of Defense and Its Major Components.*

c. DODD 5105.19, *Defense Information Systems Agency (DISA).*

d. DODD 5105.60, *National Imagery and Mapping Agency (NIMA)*.

e. DODI 3100.12, *Space Support.*

f. DODI S-3100.13, *Space Force Application.*

g. DODI S-3100.14, *Space Force Enhancement.*

h. DODI S-3100.15, *Space Control.*

5. Chairman of the Joint Chiefs of Staff

a. CJCSI 3110.01F, *Joint Strategic Capabilities Plan (JSCP)*.

b. CJCSI 6130.01D, *2007 CJCS Master Positioning, Navigation, and Timing Plan (MPNTP)*.

c. CJCSI 6250.01C, *Satellite Communications.*

d. CJCSI 8910.01A, *Joint Blue Force Situational Awareness Operations Guidance.*

e. CJCSM 3122.01A, *Joint Operation Planning and Execution System (JOPES) Volume I, Planning Policies and Procedures.*

f. CJCSM 3122.03C, *Joint Operation Planning and Execution System (JOPES) Volume II, Planning Formats.*

g. CJCSM 3219.01A, *Interruption of Remote Sensing Space Systems Data Collection and Distribution During Periods of National Security Crisis.*

6. Joint Publications

a. JP 1, *Doctrine for the Armed Forces of the United States.*

b. JP 1-02, *Department of Defense Dictionary of Military and Associated Terms.*

c. JP 2-01, *Joint and National Intelligence Support to Military Operations.*

d. JP 2-01.3, *Joint Intelligence Preparation of the Operational Environment.*

e. JP 2-03, *Geospatial Intelligence Support to Joint Operations*.

f. JP 3-0, *Joint Operations.*

g. JP 3-01, *Countering Air and Missile Threats.*

h. JP 3-05, *Doctrine for Joint Special Operations.*

i. JP 3-08, *Interagency, Intergovernmental Organization, and Nongovernmental Organization Coordination During Joint Operations, Volume I.*

j. JP 3-13, *Information Operations.*

k. JP 3-13.1, *Electronic Warfare.*

l. JP 3-16, *Multinational Operations.*

m. JP 3-27, *Homeland Defense.*

n. JP 3-30, *Command and Control for Joint Air Operations.*

o. JP 3-59, *Meteorological and Oceanographic Operations.*

p. JP 3-60, *Joint Targeting.*

q. JP 4-0, *Joint Logistics.*

r. JP 5-0, *Joint Operation Planning.*

s. JP 6-0, *Joint Communications System.*

7. International Law

a. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 1967.

b. Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques, 1977.

c. Charter of the United Nations, 1945.

8. Service Publications

a. Air Force Doctrine Document 2-2, *Space Operations.*

b. AR 115-11, *Geospatial Information and Services.*

c. Field Manual 3-14, *Space Support to Army Operations.*

d. OPNAVINST 5400.43, *Navy Space Policy Implementation.*

9. Supporting Documents

a. Blue Force Tracking Report to Congress.

b. CDRUSSTRATCOM CONPLAN 8035 (Change 2).

c. CDRUSSTRATCOM Operational Directive for JFCC SPACE.

d. CDRUSSTRATCOM, Strategic Command Directive 505-3, *Space Support to Joint Force Commander or Designated Space Coordinating Authority.*

e. CDRUSSTRATCOM, Strategic Command Instruction 534-5, *Space-Based Joint Blue Force Situational Awareness Support to Combatant Commands and Allies.*

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g. Industrial College of the Armed Forces/National Defense University, Space Industry Study.

h. SD 714-02, SATCOM System Expert (SSE) Responsibilities.

i. SI 714-03, Satellite Communications (SATCOM) Support Center (SSC) Management.

j. SI 714-04, Consolidated Satellite Communications (SATCOM) Management Policies and Procedures (C-SMPP).

k. SI 714-05, Space System Electromagnetic Interference (EMI) Resolution Procedures.

APPENDIX K
ADMINISTRATIVE INSTRUCTIONS

1. User Comments

Users in the field are highly encouraged to submit comments on this publication to: Commander, United States Joint Forces Command, Joint Warfighting Center, ATTN: Joint Doctrine Group, 116 Lake View Parkway, Suffolk, VA 23435-2697. These comments should address content (accuracy, usefulness, consistency, and organization), writing, and appearance.

2. Authorship

The lead agent for this publication is the United States Strategic Command. The Joint Staff doctrine sponsors for this publication are the Director for Operations (J-3) and the Director for Operational Plans and Joint Force Development (J-7).

3. Supersession

This publication supersedes JP 3-14, 9 August 2002, *Joint Doctrine for Space Operations*.

4. Change Recommendations

a. Recommendations for urgent changes to this publication should be submitted:

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d. CD-ROM. Upon request of a JDCC member, the Joint Staff J-7 will produce and deliver one CD-ROM with current joint publications.

GLOSSARY

PART I — ABBREVIATIONS AND ACRONYMS

AFSCN	Air Force Satellite Control Network
AFSPC	Air Force Space Command
AFWA	Air Force Weather Agency
AJ	anti-jam
AOI	area of interest
AOR	area of responsibility
A/S	anti-spoofing
BDA	battle damage assessment
BFT	blue force tracking
C2	command and control
CCDR	combatant commander
CDR	commander
CDRUSSTRATCOM	Commander, United States Strategic Command
CHCSS	Chief, Central Security Service
CJCS	Chairman of the Joint Chiefs of Staff
CJCSI	Chairman of the Joint Chiefs of Staff instruction
CJCSM	Chairman of the Joint Chiefs of Staff manual
CNA	computer network attack
C-NAF	component numbered air force
CND	computer network defense
CNO	computer network operations
COA	course of action
COG	center of gravity
COMAFFOR	commander, Air Force forces
CONOPS	concept of operations
CONPLAN	concept plan
COP	common operational picture
CSA	combat support agency
DEFSMAC	Defense Special Missile and Aerospace Center
DIA	Defense Intelligence Agency
DIOCC	Defense Intelligence Operations Coordination Center
DIRNSA	Director, National Security Agency
DIRSPACEFOR	director of space forces (USAF)
DISA	Defense Information Systems Agency
DMSP	Defense Meteorological Satellite Program
DOC	Department of Commerce
DOD	Department of Defense
DODD	Department of Defense directive
DODI	Department of Defense instruction
DSC	defensive space control
DSCS	Defense Satellite Communications System

EHF	extremely high frequency
EMI	electromagnetic interference
EW	electronic warfare
FDO	flexible deterrent option
FMO	functional manager office
FNMOC	Fleet Numerical Meteorology and Oceanography Center
GCC	geographic combatant commander
GEO	geosynchronous Earth orbit
GI&S	geospatial information and services
GIG	Global Information Grid
GMD	ground-based midcourse defense
GPS	Global Positioning System
HEO	highly elliptical orbit
HN	host nation
HQ	headquarters
HSI	hyperspectral imagery
HUMINT	human intelligence
IC	intelligence community
ICBM	intercontinental ballistic missile
IMINT	imagery intelligence
IO	information operations
ISR	intelligence, surveillance, and reconnaissance
J-2	intelligence directorate of a joint staff
JFC	joint force commander
JFCC ISR	Joint Functional Component Command for Intelligence, Surveillance, and Reconnaissance
JFCC NW	Joint Functional Component Command for Network Warfare
JFCC SPACE	Joint Functional Component Command for Space
JIPOE	joint intelligence preparation of the operational environment
JP	joint publication
JSPA	joint satellite communications (SATCOM) panel administrator
JSPOC	Joint Space Operations Center
JSTO	joint space tasking order
JTF-GNO	Joint Task Force - Global Network Operations
LEO	low Earth orbit
LOS	line of sight
LPD	low probability of detection

LPI	low probability of intercept
MARFORSTRAT	United States Marine Corps Forces, United States Strategic Command
MASINT	measurement and signature intelligence
METOC	meteorological and oceanographic
MILDEC	military deception
MILSATCOM	military satellite communications
MNF	multinational force
MOC	maritime operations center
MOE	measure of effectiveness
MOP	measure of performance
MPNTP	Master Positioning Navigation and Timing Plan
MSI	multispectral imagery
MSIC	Missile and Space Intelligence Center
NAF	numbered air force
NASA	National Aeronautics and Space Administration
NASIC	National Air and Space Intelligence Center
NATO	North Atlantic Treaty Organization
NAVSOC	Naval Satellite Operations Center
NAVWAR	navigation warfare
NETOPS	network operations
NETWARCOM	Naval Network Warfare Command
NGA	National Geospatial-Intelligence Agency
NIPRNET	Non-Secure Internet Protocol Router Network
NOAA	National Oceanic and Atmospheric Administration
NPOESS	National Polar-orbiting Operational Environmental Satellite System
NRO	National Reconnaissance Office
NSA	National Security Agency
NSA/CSS	National Security Agency/Central Security Service
NSG	National System for Geospatial Intelligence
NSPD	national security Presidential directive
NTM	national or multinational technical means of verification
OPCON	operational control
OPLAN	operation plan
OPSEC	operations security
ORS	operationally responsive space
OSC	offensive space control
OSEI	operational significant event imagery
PI	purposeful interference
PIRT	Purposeful Interference Response Team
PNT	positioning, navigation, and timing

POES	polar operational environment satellite
PPS	precise positioning service
PSYOP	psychological operations
RF	radio frequency
RPO	rendezvous and proximity operations
RSSC	regional satellite communications (SATCOM) support center
SAR	search and rescue
SARSAT	search and rescue satellite-aided tracking
SATCOM	satellite communications
SCA	space coordinating authority
SDB	Satellite Communications Database
SecDef	Secretary of Defense
SEW	shared early warning
SHF	super-high frequency
SI	United States Strategic Command strategic instruction
SIGINT	signals intelligence
SIPRNET	SECRET Internet Protocol Router Network
SMDC/ARSTRAT	United States Army Space and Missile Defense Command/United States Army Forces Strategic Command
SOM	satellite communications operational manager
SPS	standard positioning service
SSA	space situational awareness
SSE	space support element
SWPC	Space Weather Prediction Center
TACON	tactical control
TES	theater event system
TT&C	telemetry, tracking, and commanding
UAS	unmanned aircraft system
UCP	Unified Command Plan
UHF	ultrahigh frequency
UN	United Nations
US	United States
USAF	United States Air Force
USC	United States Code
USG	United States Government
USJFCOM	United States Joint Forces Command
USMC	United States Marine Corps
USNO	United States Naval Observatory
USSTRATCOM	United States Strategic Command
UTC	Coordinated Universal Time

WGS	Wideband Global Satellite Communications (SATCOM)
WGS-84	World Geodetic System 1984

PART II — TERMS AND DEFINITIONS

Unless otherwise annotated, this publication is the proponent for all terms and definitions found in the glossary. Upon approval, JP 1-02, *Department of Defense Dictionary of Military and Associated Terms*, will reflect this publication as the source document for these terms and definitions.

Army space support team. A team of space operations experts provided by the Commander, US Army Forces Strategic Command upon request of an Army component commander or a geographic combatant commander to assist the supported commander in integrating space power into the terrestrial operation or campaign. Also called ARSST. (This term and its definition modify the existing term "space support team" and its definition and are approved for inclusion in JP 1-02.)

attack assessment. An evaluation of information to determine the potential or actual nature and objectives of an attack for the purpose of providing information for timely decisions. (JP 1-02. SOURCE: JP 3-14)

ballistic missile early warning system. An electronic system for providing detection and early warning of attack by enemy intercontinental ballistic missiles. Also called BMEWS. (JP 1-02. SOURCE: JP 3-14)

blue force tracking. Employment of techniques to actively or passively identify or track US, allied, or coalition forces for the purpose of providing the combatant commander enhanced situational awareness and reducing fratricide. Also called BFT. (Approved for inclusion in JP 1-02.)

constellation. A number of like satellites that are part of a system. Satellites in a constellation generally have a similar orbit. For example, the Global Positioning System constellation consists of 24 satellites distributed in six orbital planes with similar eccentricities, altitudes, and inclinations. (JP 1-02. SOURCE: JP 3-14)

deception. Those measures designed to mislead the enemy by manipulation, distortion, or falsification of evidence to induce the enemy to react in a manner prejudicial to the enemy's interests. (JP 1-02. SOURCE: JP 3-13.4)

Defense Satellite Communications System. Geosynchronous military communications satellites that provide high data rate communications for military forces, diplomatic corps, and the White House. The Defense Satellite Communications System provides long-haul super-high frequency 7/8 gigahertz voice and high data rate communications for fixed and transportable terminals, and extends mobile service to a limited number of ships and aircraft. Also called DSCS. (JP 1-02. SOURCE: JP 3-14)

Defense Support Program. Satellites that provide early warning of missile launches; the first line of defense against missile attack against North America. Also called DSP. (JP 1-02. SOURCE: JP 3-14)

defensive space control. Operations 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. (Approved for inclusion in JP 1-02.)

geospatial information and services. The collection, information extraction, storage, dissemination, and exploitation of geodetic, geomagnetic, imagery (both commercial and national source), gravimetric, aeronautical, topographic, hydrographic, littoral, cultural, and toponymic data accurately referenced to a precise location on the Earth's surface. Geospatial services include tools that enable users to access and manipulate data, and also include instruction, training, laboratory support, and guidance for the use of geospatial data. Also called GI&S. (JP 1-02. SOURCE: JP 2-03)

geospatial intelligence. 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 1-02. SOURCE: JP 2-03)

Global Positioning System. 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. (This term and its definition modify the existing term "global positioning system" and its definition and are approved for inclusion in JP 1-02.)

latitude band. None. (Approved for removal from JP 1-02.)

link element. None. (Approved for removal from JP 1-02.)

multispectral imagery. The image of an object obtained simultaneously in a number of discrete spectral bands. Also called MSI. (This term and its definition modify the existing term "multi-spectral imagery" and its definition and are approved for inclusion in JP 1-02.)

negation. Measures to deceive, disrupt, deny, degrade, or destroy an adversary's space systems and services or any other space system or service used by an adversary that is hostile to US national interests. See also space control. (JP 1-02. SOURCE: JP 3-14)

offensive space control. Those operations to prevent an adversary's hostile use of US/third party space capabilities and services or negate (disrupt, deny, degrade, deceive, or destroy) an adversary's space capabilities. (Approved for inclusion in JP 1-02.)

period. The time it takes for a satellite to complete one orbit around the earth. (This term and its definition modify the existing term and its definition and are approved for inclusion in JP 1-02.)

polar orbit. A satellite orbit in which the satellite passes over the North and South Poles on each orbit, and eventually passes over all points on the earth. The angle of inclination between the equator and a polar orbit is 90 degrees. (JP 1-02. SOURCE: JP 3-14)

prevention. 1. The security procedures undertaken by the public and private sectors in order to discourage terrorist acts. (JP 3-07.2) 2. In space usage, measures to preclude an adversary's hostile use of United States or third-party space systems and services. Prevention can include diplomatic, economic, and political measures. See also space control. (JP 3-14) (This term and its definition modify the existing term and its definition and are approved for inclusion in JP 1-02.)

protection. 1. Preservation of the effectiveness and survivability of mission-related military and nonmilitary personnel, equipment, facilities, information, and infrastructure deployed or located within or outside the boundaries of a given operational area. (JP 3-0) 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) (This term and its definition modify the existing term and its definition and are approved for inclusion in JP 1-02.)

proximity operations. In space operations, on-orbit activities of a resident space object that deliberately and necessarily maintains a close distance from another resident space object for a specific purpose. Two objects in space that pass each other by natural orbital mechanics (e.g., routine orbital conjunctions or close approaches) or Department of Defense space systems which are designated to utilize cluster or formation flight to maintain required proximity to provide required system functionality do not fall within this definition. (Approved for inclusion in JP 1-02.)

purposeful interference. In space operations, deliberate actions taken to deny or disrupt a space system, service, or capability. Purposeful interference threats include but are not limited to: mission uplink or downlink interference; command uplink interference; telemetry downlink jamming; positioning jamming; unauthorized access; information insertion; and signal probing. Also called PI. (Approved for inclusion in JP 1-02.)

space asset. Any individual part of a space system as follows. (1) Equipment that is or can be placed in space (e.g., a satellite or a launch vehicle). (2) Terrestrially-based equipment that directly supports space activity (e.g., a satellite ground station). (JP 1-02. SOURCE: JP 3-14)

space capability. 1. The ability of a space asset to accomplish a mission. 2. The ability of a terrestrial-based asset to accomplish a mission in space (e.g., a ground-based or airborne laser capable of negating a satellite). (JP 1-02. SOURCE: JP 3-14)

space control. Operations to ensure freedom of action in space for the US and its allies and, when directed, deny an adversary freedom of action in space. The space control mission area includes: operations conducted to protect friendly space capabilities from attack, interference, or unintentional hazards (defensive space control); operations to deny an adversary's use of space capabilities (offensive space control); supported by the requisite current and predictive knowledge of the space environment and the operational environment upon which space operations depend (space situational awareness). (This term and its definition modify the existing term and its definition and are approved for inclusion in JP 1-02.)

space coordinating authority. A commander responsible for coordinating joint space operations and integrating space capabilities in the operational area. Also called SCA. (Approved for inclusion in JP 1-02.)

space-faring nation. None. (Approved for removal from JP 1-02.)

space force application. Combat operations in, through, and from space to influence the course and outcome of conflict by holding terrestrial targets at risk. The space force application mission area includes ballistic missile defense and force projection. (This term and its definition modify the existing term and its definition and are approved for inclusion in JP 1-02.)

space force enhancement. Combat support operations and force-multiplying capabilities delivered from space systems to improve the effectiveness of military forces as well as support other intelligence, civil, and commercial users. The space force enhancement mission area includes: intelligence, surveillance, and reconnaissance; integrated tactical warning and attack assessment; command, control, and communications; positioning, navigation, and timing; and environmental monitoring. (This term and its definition modify the existing term and its definition and are approved for inclusion in JP 1-02.)

space forces. The space and terrestrial systems, equipment, facilities, organizations, and personnel necessary to access, use and, if directed, control space for national security. (JP 1-02. SOURCE: JP 3-14)

space power. The total strength of a nation's capabilities to conduct and influence activities to, in, through, and from space to achieve its objectives. (JP 1-02. SOURCE: JP 3-14)

space sensor. An instrument or mechanical device mounted on a space platform or space vehicle for collecting information or detecting activity or conditions either in space or in a terrestrial medium. (JP 1-02. SOURCE: JP 3-14)

space situational awareness. The requisite current and predictive knowledge of the space environment and the operational environment upon which space operations depend – including physical, virtual, and human domains – as well as all factors, activities, and events of friendly and adversary space forces across the spectrum of conflict. (Approved for inclusion in JP 1-02.)

space superiority. The degree of dominance in space of one force over another that permits the conduct of operations by the former and its related land, maritime, air, space, and special operations forces at a given time and place without prohibitive interference by the opposing force. (This term and its definition modify the existing term and its definition and are approved for inclusion in JP 1-02.)

space support. Operations to deploy and sustain military and intelligence systems in space. The space support mission area includes launching and deploying space vehicles, maintaining and sustaining spacecraft on-orbit, rendezvous and proximity operations, disposing of (including deorbiting and recovering) space capabilities, and reconstitution of space forces, if required. (This term and its definition modify the existing term and its definition and are approved for inclusion in JP 1-02.)

space surveillance. The observation of space and of the activities occurring in space. This mission is normally accomplished with the aid of ground-based radars and electro-optical sensors. This term is separate and distinct from the intelligence collection mission conducted by space-based sensors which surveil terrestrial activity. See also space control. (JP 1-02. SOURCE: JP 3-14)

space systems. All of the devices and organizations forming the space network. These consist of: spacecraft; mission packages(s); ground stations; data links among spacecraft, mission or user terminals, which may include initial reception, processing, and exploitation; launch systems; and directly related supporting infrastructure, including space surveillance and battle management and/or command and control. (This term and its definition modify the existing term and its definition and are approved for inclusion in JP 1-02.)

space weather. The conditions and phenomena in space and specifically in the near-Earth environment that may affect space assets or space operations. Space weather may impact spacecraft and ground-based systems. Space weather is influenced by phenomena such as solar flare activity, ionospheric variability, energetic particle events, and geophysical events. (This term and its definition modify the existing term and its definition and are approved for inclusion in JP 1-02.)

sun-synchronous orbit. An orbit in which the satellite's orbital plane is at a fixed orientation to the sun, i.e., the orbit precesses about the earth at the same rate that the earth orbits the sun. It has the characteristics of maintaining similar sun angles along its ground trace for all orbits, and typically has an inclination from 96 to 98 degrees, depending on the orbit altitude and orbit shape (eccentricity). (JP 1-02. SOURCE: JP 3-14)

synchronous orbit. None. (Upon approval of this revision, this term and its definition will be deleted from JP 1-02.)

terrestrial environment. The Earth's land area, including its man-made and natural surface and sub-surface features, and its interfaces and interactions with the atmosphere and the oceans. (This term and its definition modify the existing term and its definition and are approved for inclusion in JP 1-02.)

theater event system. Architecture for reporting theater ballistic missile events, composed of three independent processing and reporting elements: the joint tactical ground stations, tactical detection and reporting, and the space-based infrared system mission control station. Also called TES. (This term and its definition modify the existing term "tactical event system" and its definition and are approved for inclusion in JP 1-02.)

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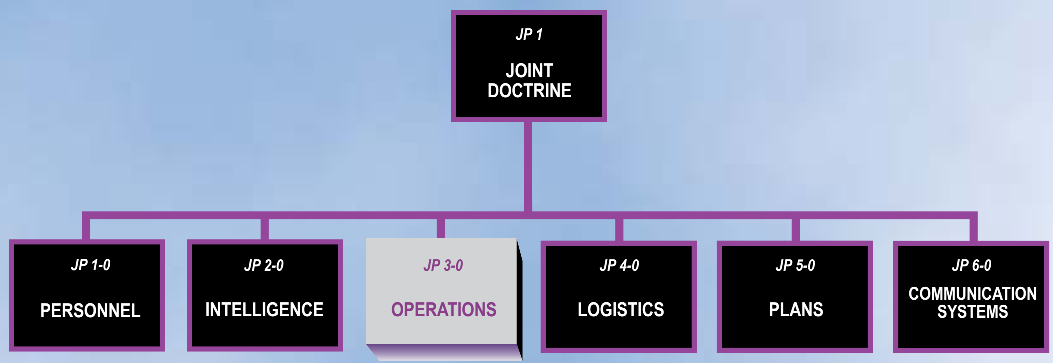

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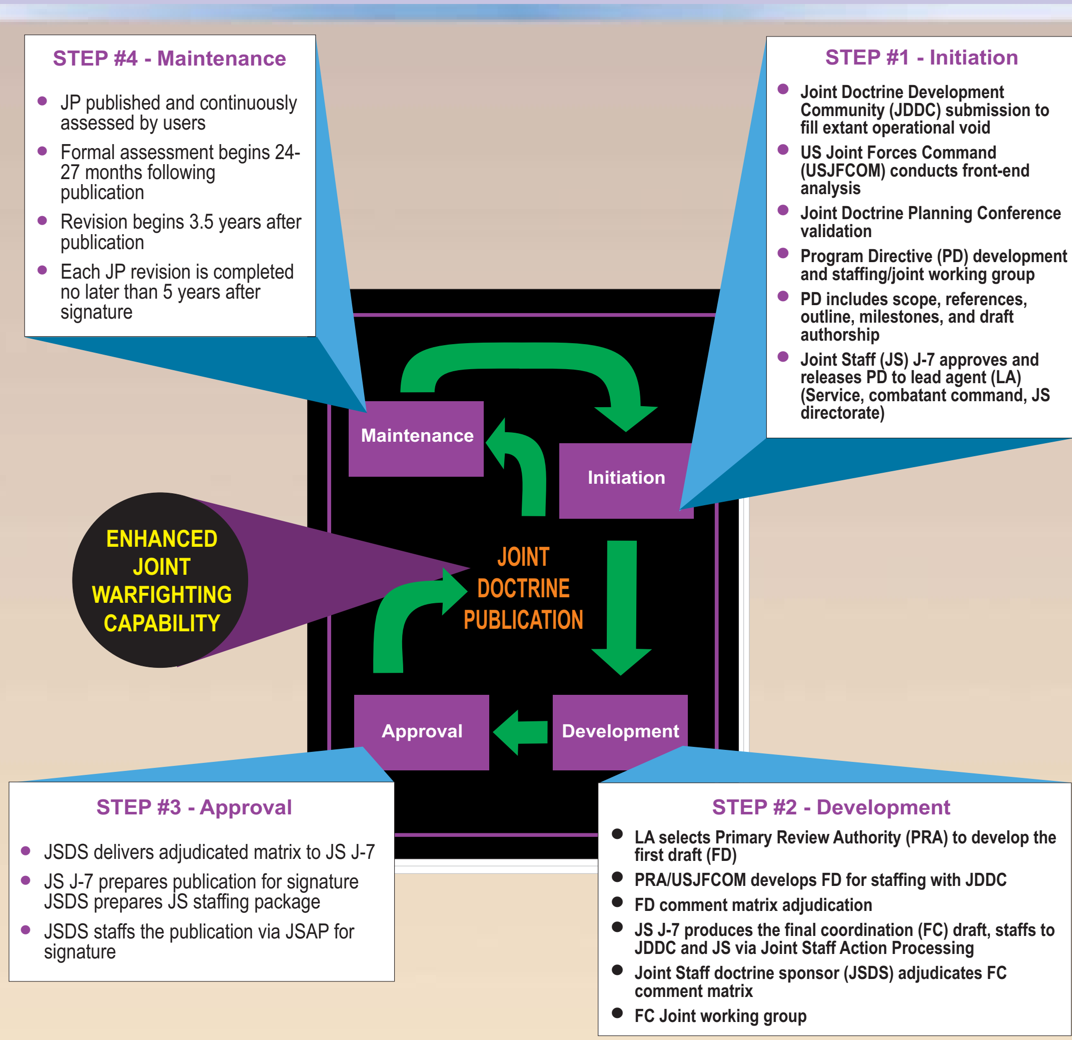

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