Joint Publication 3-14

Space Operations

10 April 2018

PREFACE

1. Scope

This publication provides joint doctrine to plan, execute, and assess joint space operations.

2. Purpose

This publication has been prepared under the direction of the Chairman of the Joint Chiefs of Staff (CJCS). It sets forth joint doctrine to govern the activities and performance of the Armed Forces of the United States in joint operations, and it provides considerations for military interaction with governmental and nongovernmental agencies, multinational forces, and other interorganizational partners. It provides military guidance for the exercise of authority by combatant commanders and other joint force commanders (JFCs), and prescribes joint doctrine for operations and training. It provides military guidance for use by the Armed Forces in preparing and executing their plans and orders. 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 objectives.

3. Application

a. Joint doctrine established in this publication applies to the Joint Staff, commanders of combatant commands, subordinate unified commands, joint task forces, subordinate components of these commands, the Services, and combat support agencies.

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 CJCS, 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 US, 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:

KEVIN D. SCOTT
Vice Admiral, USN
Director, Joint Force Development

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SUMMARY OF CHANGES
REVISION OF JOINT PUBLICATION 3-14
DATED 29 MAY 2013

- **Aligns space capabilities with the seven joint functions in accordance with Joint Publication 3-0, *Joint Operations.***
- **Establishes a new type of operational area called a space joint operating area.**
- **Clarifies supported/supporting relationships.**
- **Identifies warfighter access to space capabilities and effects.**
- **Introduces a threat section that details several natural and man-made threats to space operations and introduces the threat mitigation concept of space mission assurance.**
- **Clarifies the definition of space coordinating authority; the term can now refer to an authority or to the individual who holds that authority.**
- **Adds a description of the space domain and space superiority.**
- **Deletes the space mission area taxonomy to be consistent with current space operations.**
- **Elaborates on the planning and execution of space operations to include the joint space tasking order process.**
- **Removes several appendices and incorporates relevant material into the main text.**
- **Updates several naming conventions.**
- **Expands Service-specific contributions to space operations.**
- **Includes updates to be consistent with national policy, Department of Defense issuances, and other joint publications.**

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TABLE OF CONTENTS

EXECUTIVE SUMMARY
COMMANDER'S OVERVIEW

- **Describes joint space operations and threats in the space domain**
- **Details associated space capabilities**
- **Aligns space capabilities with the seven joint functions**
- **Describes the space joint operating area**
- **Discusses command and control of joint space operations**
- **Provides planning and assessment considerations**

Overview of Joint Space Operations

Space is no longer utilized by only the most technologically advanced countries.

Over the past half century, continuous improvements in technology, technology transfers, and globalization of services have led to the development and proliferation of advanced space systems across the commercial, civil, and military sectors. Operations in the space domain are increasingly contested, degraded, and operationally limited.

2017 National Security Strategy

"The United States considers unfettered access to and freedom to operate in space to be a vital interest. Any harmful interference with or an attack upon critical components of our space architecture that directly affects this vital US interest will be met with a deliberate response at a time, place, manner, and domain of our choosing." Sustained space access is vital to the collective security of the US and its allies. The *National Security Strategy* recognizes that "collective action is needed to assure access to the shared spaces [such as] space—where the dangerous behaviors of some threaten us all."

Space Domain

The space domain is the area above the altitude where atmospheric effects on airborne objects become negligible. Like the air, land, and maritime domains, space is a physical domain within which

military, civil, and commercial activities are conducted. The relationship between space and cyberspace is unique in that many space operations depend on cyberspace, and a critical portion of cyberspace can only be provided via space operations.

Benefits From Access to Space

Space assets provide combatant commanders (CCDRs) with near-worldwide coverage and access to otherwise denied areas. There are several distinct advantages to using space for operational purposes. These include freedom of action, overflight, and global perspective and responsiveness.

Dependencies

Military planners may need to coordinate additional support with non-Department of Defense (DOD) civil, commercial, and foreign organizations. The joint force is becoming increasingly dependent on the use of commercial space systems to provide communications; tagging, tracking, and locating; and other support.

Threat to Space Operations

Space is a naturally hazardous environment and is increasingly congested, contested, and competitive. Natural threats to satellites include solar activity, radiation belts, and natural orbital debris. Man-made threats can be both unintentional (e.g., satellite debris or electromagnetic interference) or intentional (e.g., jamming, lasing, cyberspace attacks, and antisatellite weapons). Nations are also developing, and in some cases demonstrating, disruptive and destructive space capabilities.

Orbital Characteristics of Space

Orbit types and parameters are generally selected to provide the greatest benefit for the least cost, based on the purpose and capabilities of the satellite. The four most common orbit types used by the military are geosynchronous Earth orbit, highly elliptical orbit, medium Earth orbit, and low Earth orbit.

Environment Considerations

Apart from the threat of meteoroids and cosmic rays, almost all natural hazards to space capabilities come from the Sun. Operational satellites are under constant threat of impact. Orbiting particulates left behind during a satellite's lifetime, debris from satellite explosions or impacts, trash such as rocket

bodies, and natural objects such as meteoroids may damage operational systems.

Space Operations and the Joint Functions

Space Operations and Associated Capabilities

A discussion of space capabilities and a common baseline for all elements of the joint force is provided here to better enable joint planning and facilitate effective joint military operations.

- Space situational awareness (SSA) is dependent on integrating space surveillance, collection, and processing; environmental monitoring; status of US and cooperative satellite systems; understanding of US and multinational space readiness; and analysis of the space domain.
- Space control employs offensive space control and defensive space control operations to ensure freedom of action in space.
- Military users depend on assured positioning, navigation, and timing systems for precise and accurate geolocation, navigation, and time reference services.
- Significant advantages of space-based intelligence collection capabilities are their coverage over denied areas where little or no data can be obtained from ground, maritime, or airborne sensors and their mission longevity.
- Satellite communications (SATCOM) systems inherently facilitate beyond line of sight connectivity.
- Terrestrial and space environmental monitoring support to joint operations gives the joint force commander (JFC) awareness of the operational environment (OE).
- The missile warning mission uses a mix of space-based and terrestrial sensors.
- Nuclear detonation detection capabilities provide a persistent, global, and integrated sensor capability.
- Spacelift is the ability to deliver payloads into space.
- Satellite operations are characterized as spacecraft and payload operations.

Joint Functions

Joint functions are related capabilities and activities grouped together to help JFCs integrate, synchronize, and direct joint operations. Functions that are common to joint operations at all levels of warfare fall into seven basic groups: command and control (C2), intelligence, fires, movement and maneuver, protection, sustainment, and information.

Command and Control

A large percentage of the intelligence required to make decisions for employment of forces is obtained from space-based intelligence collection assets. SSA assists C2 by characterizing the space environment, including the ground and link segment. SSA provides insight into an adversary's employment of space systems.

Intelligence

Space-based assets complement non-space-based intelligence sources by providing decision makers with timely, accurate data for information that can create a decisive advantage across all phases of conflict.

Fires

Fires function includes space control operations that create a desired effect on enemy space systems in multiple domains.

Movement and Maneuver

Movement and maneuver includes the deployment, repositioning, or re-orientation of on-orbit assets and terrestrial space forces.

Protection

Protection in space operations includes all measures taken to ensure friendly space systems perform as designed by overcoming attempts to deny or manipulate them.

Sustainment

Space operations sustainment is achieved through spacelift, satellite operations, space force reconstitution, and maintenance of a force of space operations personnel.

Information

Space supports the flow of information and decision making.

Command and Control of Joint Space Operations

Space Coordinating Authority

Space coordinating authority (SCA) is a specific type of coordinating authority delegated to a commander or a designated individual for coordinating specific

space functions and activities. The SCA requests and integrates theater-specific space operations and capabilities.

Commander, United States Strategic Command

Commander, United States Strategic Command (CDRUSSTRATCOM), exercises combatant command (command authority) over assigned space forces and assets to ensure availability of space capabilities to the joint warfighter. CDRUSSTRATCOM delegated tactical control of assigned space units to the Joint Force Space Component Commander (JFSCC). CDRUSSTRATCOM has delegated SCA to the JFSCC to plan space operations in operational-level support of United States Strategic Command's (USSTRATCOM's) Unified Command Plan responsibilities.

Joint Force Space Component Commander

USSTRATCOM is the only combatant command (CCMD) with a space component. The JFSCC coordinates, plans, integrates, synchronizes, executes, and assesses space operations, as directed by CDRUSSTRATCOM, and facilitates unified action for joint space operations.

Services

The US Air Force conducts space operations to achieve space superiority for the US as a Service core competency.

The US Army provides SATCOM; conducts satellite operations, space control operations, space support, and missile defense operations; and provides planning, integration, control, and coordination of Army space forces, capabilities, and effects.

The US Marine Corps integrates space capabilities for use in decentralized combined arms operations.

Commander, Fleet Cyber Command, serves as the United States Navy (USN) central operational authority for USN networks and space.

Combatant Commander

CCDRs have the authority to utilize assigned or attached space forces to best accomplish their assigned mission. Space operations personnel directly supporting a specific CCDR from day to day are usually limited in number; therefore, the

CCDR may request additional support from USSTRATCOM if required by the mission.

National Reconnaissance Office

The National Reconnaissance Office (NRO) is responsible for research and development; acquisition, launch, deployment, and operation of overhead systems; and related data processing facilities to collect intelligence and information to support national and departmental missions and other United States Government (USG) needs. NRO activities support warning intelligence, monitoring of arms control agreements, access to denied areas, and the planning and execution of military operations. The NRO provides direct support to the CCMD joint intelligence operations centers.

Space Coordinating Authority

SCA within a joint force helps coordinate joint space operations and integrates space capabilities and effects that support the CCDRs.

Planning and Assessment of Joint Space Operations

Joint Space Operations Planning Overview

It is constrained by physical attributes (i.e., orbital dynamics), the multiplicity of actors (DOD; intelligence community; other USG departments and agencies; allied, commercial, and foreign partners), and C2 relationships. Space forces typically support multiple CCDRs and the joint functions simultaneously and throughout multiple OEs.

Key Planning Considerations

Planning considerations for space operations include:

National Space Policy, DOD Space Policy, global reach, satellite constellations, and persistence.

Assessment is a continuous process

USSTRATCOM is the lead DOD organization for conducting the space functional campaign plan operations assessment. Other CCMDs support space operations assessment by providing any requested data to help assess mission success or failure.

CONCLUSION

This publication provides doctrine for joint space operations.

CHAPTER I
OVERVIEW OF JOINT SPACE OPERATIONS

"We must assume future war on earth will extend into space. We will need to 'fight through' attacks on our space assets and capabilities and continue to provide the space support our warfighters need and have come to expect."

Deputy Secretary of Defense Robert O. Work, 15 September 2015

1. General

a. Over the past half century, continuous improvements in technology, technology transfers, and globalization of services have led to the development and proliferation of advanced space systems across the commercial, civil, and military sectors. Space is no longer utilized by only the most technologically advanced countries; people worldwide rely on services provided by, or dependent upon, space assets. Operations in the space domain are increasingly contested, degraded, and operationally limited. Space capabilities underpin infrastructures and services for activities such as commerce, agriculture, humanitarian- and disaster-relief efforts, financial transactions, social networks, and national defense. The *2017 National Security Strategy* (NSS) recognizes the benefits that space provides for security, economics, and society: "The United States considers unfettered access to and freedom to operate in space to be a vital interest. Any harmful interference with or an attack upon critical components of our space architecture that directly affects this vital US interest will be met with a deliberate response at a time, place, manner, and domain of our choosing." Accordingly, national security interests and objectives require combatant commanders (CCDRs) to integrate space capabilities, defense, and expertise across all joint operations. The significant benefits gained by the joint force's access to, and utilization of, the space domain directly affect how others view and use this domain.

b. Others have their own advanced space programs or have the ability to access space through third parties. Several nations continue to make significant advances in offensive space control (OSC) capabilities, intending to challenge US and allied use of space. Both developing states and non-state actors can increase their influence in regional or global events by purchasing (or leasing) desired space capabilities, products, and applications with little effort or expenditure.

c. The continued growth of government, academic, commercial, and foreign space activities adds a layer of complexity to joint space operations. The mounting orbital clutter complicates the forensics and attribution of unusual spacecraft activity. Access to space is vital to the collective security of the US and its allies. The Department of Defense (DOD) space policy is centered to deter adversaries, defend against threats, and pursue resilient space architectures that contribute to achieving space mission assurance and objectives. Further, the US must sustain the ability to attribute malicious or irresponsible actions that jeopardize the viability of space for all. Sustained space access is vital to the collective security of the US and its allies. The NSS recognizes that "collective action is needed to assure access to the shared spaces [such as] space—where the dangerous behaviors of some threaten us all." Additionally, both the *2010 National Space Policy* and the *2011 National Security Space Strategy* include

key goals of strengthening stability in space through domestic and international measures that promote safe and responsible space operations. Whereas earlier space operations integration efforts focused primarily on providing capability from space to support terrestrial forces, the focus now includes the equally demanding and more complex task of assuring and defending our space capabilities against the aggressive space activities of others. The joint force must be capable of not only continuing to integrate military space operations as part of joint operations, but also be capable of defending the space assets that are critical enablers of joint operations. Integration and synchronization of space capabilities into joint operations, planning, concepts of operations (CONOPSs), operation plans (OPLANs), and operation orders enable higher probability of success at lower risk to the US.

d. The US must be prepared to conduct unified action across the full range of its collective resources and options—diplomatic, informational, military, and economic—in both the public and private space sectors. To achieve unity of effort, when planning and executing military operations or requesting space capabilities, commanders should understand how other United States Government (USG) departments and agencies, partner and third-party/neutral nations, international organizations, nongovernmental organizations (NGOs), and adversaries use space capabilities to enable their operations.

2. Space Domain

a. The space domain is the area above the altitude where atmospheric effects on airborne objects become negligible. Like the air, land, and maritime domains, space is a physical domain within which military, civil, and commercial activities are conducted. The relationship between space and cyberspace is unique in that many space operations depend on cyberspace, and a critical portion of cyberspace can only be provided via space operations.

(1) Proper planning of military operations in space enables activities such as intelligence collection; early warning; environmental monitoring; satellite communications (SATCOM); and positioning, navigation, and timing (PNT). Activities conducted in the space domain support freedom of action throughout the operational environment (OE), and operations in other domains may create effects in the space domain.

(2) Space operations are those operations impacting or directly utilizing space-based assets to enhance the potential of the US and multinational partners. DOD space forces are the space and terrestrial systems, equipment, facilities, organizations, and personnel, or combination thereof, necessary to conduct space operations. Space systems consist of three related segments: ground, link, and space.

(a) The ground segment consists of ground-based facilities and equipment supporting command and control (C2) of space segment resources, as well as ground-based processing equipment, Earth terminals or user equipment, space situational awareness (SSA) sensors, and the interconnectivity between the facilities in which this equipment is housed.

(b) The link segment consists of signals connecting ground and space segments through the electromagnetic spectrum (EMS). This normally includes telemetry, tracking, and commanding (TT&C) signals necessary for controlling the spacecraft and may also include

satellite payload signals such as the SATCOM signal, enabling communication between points on the ground, or the PNT signal, enabling navigation.

(c) The space segment involves the operational spacecraft within the space joint operating area (SJOA), which lies in the space domain.

b. The SJOA extends the existing doctrinal operational area framework to the space domain. As with other operational areas, when deliberate fires (i.e., electromagnetic or directed energy) are directed into or out of the SJOA, they should be coordinated between the affected combatant commands (CCMDs). By honoring the boundaries of the SJOA, CCDRs help to preserve SSA, spacecraft life span, and space system performance. This, in turn, facilitates freedom of action in space and improves space support to terrestrial operations. It is important to note that missile defense operations transiting though the SJOA are not pre-coordinated due to the short-/no-notice self-defense actions required to defeat enemy ballistic missile attacks.

c. **Unity of Effort**

(1) Synergy throughout the OE is a prerequisite for effective joint operations. Every joint operation requires synchronization of capabilities throughout the OE to support the commander's intent and CONOPS. Space capabilities must be thoroughly integrated into every aspect of joint planning long before operations begin. Lack of integration increases the fog and friction of war.

(2) Joint forces rely on space assets and capabilities such as PNT; SSA; intelligence, surveillance, and reconnaissance (ISR); and SATCOM. Similar to the air, land, and maritime domains, space is a distinct domain with its own physical attributes. As with the littorals, the air and space domains also have a transitional region as the Earth's atmosphere and effects of gravity taper at increasing altitudes. Similar to air, land, and maritime operations and assets, space operations and assets are interconnected with cyberspace through the EMS.

(3) While space operations and cyberspace operations (CO) are distinct, operations in space enable many CO and space systems' control segments require use of cyberspace. Cyberspace provides a means for satellite control and spacecraft data transport. The Department of Defense information network (DODIN) end-to-end connectivity and security under CO treats SATCOM payloads like a communications transport medium, much like copper wire, microwave links, or fiber optics do in other physical domains. The transport layer is critical, and the linkages must be addressed during all phases of military planning and operations to ensure cyberspace concerns are met.

d. **Space Control**

(1) US space forces conduct space control operations to ensure freedom of action in space for the US and its allies and, when directed, to deny an adversary freedom of action in space. The purpose of these operations is to achieve space superiority.

(2) **Space Superiority.** Space superiority is the degree of control in space of one force over any others that permits the conduct of its operations at a given time and place without prohibitive interference from terrestrial and space-based threats. The purpose and value of

space superiority is to provide the freedom of action to apply space capabilities in the pursuit and defense of national security interests. The US ability to capitalize on and protect space systems, and to counter enemy capabilities, contributes to US space superiority. To establish and maintain space superiority, commanders require resilient space capabilities, with forces that have the skill and the experience to operate and defend their space systems across the range of military operations and to deny the same to the opposing force. Commanders should ensure their forces understand how to access space capabilities and determine whether the capabilities are continuously available or know when special authorization and coordination are required. The use of offensive and defensive operations in multiple portions of the OE may be necessary to maintain space superiority. To maintain space superiority, joint forces must have SSA and the knowledge, training, resources, and authorities needed to defend our ability to use space. This includes being prepared to prevent the threat from exploiting space against the US and its allies and partners. Commander, United States Strategic Command (CDRUSSTRATCOM), is responsible for establishing space superiority and may request specific contributions from other CCDRs.

3. Benefits From Access To Space

a. Space operations support and enable the joint force to conduct operations. These capabilities come from the unique characteristics of space, including a global perspective and lack of overflight restrictions, as well as the rapid revisit times provided by low Earth orbit (LEO) spacecraft and the persistence afforded by geosynchronous satellites. Space assets provide CCDRs with near-worldwide coverage and access to otherwise denied areas. Commanders should account for specific space characteristics to plan and operate effectively.

b. There are several distinct advantages to using space for operational purposes. Despite the challenges stemming from a competitive space domain, these advantages are commonly applicable to space operations, whether military, civil, or commercial.

(1) **Freedom of Action.** Since the beginning of the Space Age, the US has led the world in space capability and capacity, thereby achieving overmatch in space and significant freedom of action. However, competition from adversaries is beginning to limit US freedom of action.

(2) **Overflight.** International law does not extend a nation's territorial boundaries into space. Unlike the rules for aircraft overflight, there are no overflight restrictions for spacecraft in outer space. Therefore, space-faring nations benefit from unrestricted space overflight. This characteristic makes space-based ISR, remote sensing, SATCOM, and PNT more responsive than terrestrial alternatives.

(3) **Global Perspective, Responsiveness, and Users**

(a) **Global Perspective.** Space has been characterized as "the ultimate high ground." Orbiting the Earth in 90 minutes, LEO satellites have fields of view spanning hundreds of miles. Geosynchronous Earth orbit (GEO) satellites can view approximately one-third of the Earth's surface area. The space domain affords a global vantage point

from which to assess large swaths of the land, maritime, and air domains for strategic, operational, and tactical level applications.

(b) **Responsiveness.** Space operations provide the ability to surge some types of capabilities, such as communications or ISR, on much faster timescales than ground-based or airborne capabilities. As priorities change, some space resources can be rapidly reallocated to the areas where they are needed most. As an example, in the event of increased operating tempo or loss of a satellite, available SATCOM bandwidth can be quickly reallocated to meet the highest-priority requirements. Such retaskings may result in a degradation of system performance and/or life span.

(c) **Multi-User Capacity.** Space operations typically support multiple users and, in some cases, such as PNT, can provide service to an unlimited number of users. Joint warfighters can have access to shared space-generated effects nearly anywhere on the globe, in near real time.

(4) **Speed, Reach, and Persistence.** A spacecraft's orbital parameters (e.g., velocity, distance, and inclination) enable satellites not only to overfly vast areas in very short periods, but also to enable continuous operation, creating effects at great distances, with persistent coverage.

4. Dependencies

a. Space operations and resources are inherent in, and often technologically integrated with, joint- and Service-specific platforms. Effectively using space capabilities to best contribute to the achievement of a joint force commander's (JFC's) objectives, commanders and their staffs require a clear and common understanding of space operations and resources and of how they integrate with joint military operations. When properly planned and coordinated, space capabilities enable and support unified action through each of the seven joint functions. Depending on the complexity and scale of an operation or mission, and/or the capacity of a particular DOD space system, military planners may need to coordinate additional support with non-DOD civil, commercial, and foreign organizations.

(1) **Space Partnerships.** Leveraging capabilities of allies and partners provides greater strength, resiliency, and flexibility to space operations and complicates our adversary's decision making. Security cooperation encompasses all DOD interactions with foreign security establishments to build security relationships that promote specific US security interests, develop allied and friendly military and security capabilities for self-defense and multinational operations, and provide US forces with peacetime and contingency access to allies and partner nations (see Joint Publication [JP] 3-20, *Security Cooperation*). Joint, interagency, and multinational space operations build partner capacity with responsible nations, international organizations, NGOs, and commercial owner/operators by providing a common understanding of space operations and identifying the importance of capable space partners for current and future multinational operations.

(2) The joint force should communicate space-related information at the lowest appropriate security classification level and with the broadest releasability, consistent with policy, to our allies and international partners. However, established procedures for disclosure of intelligence and other relevant classified information on US space systems and operations must be followed.

(3) The joint force is becoming increasingly dependent on the use of commercial space systems to provide communications; tagging, tracking, and locating; and other support. Examples include integration of commercial personal locator beacons in military common operational pictures (COPs) to support multinational partners, leasing SATCOM bandwidth, and contracting for commercial imagery. Although there may be additional risks associated with using commercial services, these should be balanced against the potential benefits, including support to coalition partners and the effectiveness of maintaining a surge capacity without procuring larger and more expensive DOD satellite constellations.

b. **EMS.** Space-based assets utilize the EMS for transmitting and receiving signals. The electromagnetic frequency bands that space-based systems use have finite capacity, and therefore, it is vital the US achieve the required level of EMS control to ensure freedom of action for space assets.

5. Threat to Space Operations

a. **General.** Space is a naturally hazardous environment and is increasingly congested, contested, and competitive. Space assets face many threats, both natural and man-made. Natural threats to satellites include solar activity, radiation belts, and natural orbital debris. Man-made threats can be both unintentional (e.g., satellite debris or electromagnetic interference [EMI]) or intentional (e.g., jamming, lasing, cyberspace attacks, and antisatellite [ASAT] weapons). Nations are also developing, and in some cases demonstrating, disruptive and destructive space capabilities.

b. **The Natural Environment.** The natural terrestrial and space environment can impact space systems and services. For example, terrestrial weather, such as high winds, clouds, and rain, can affect launch, SATCOM, and overhead persistent infrared (OPIR) missile warning capabilities. Natural space environment effects include, but are not limited to, meteor impacts on satellites and solar and ionospheric EMI with space surveillance radars, missile warning radars, and communication links. Nations are developing, and in some cases demonstrating, disruptive and destructive counterspace capabilities.

c. **Man-Made Threats.** Man-made threats can be physical or electromagnetic. They are further classified as intentional or unintentional, and it is vital to be able to differentiate between the two. Unintentional man-made physical threats include orbital congestion and debris fields. A direct-ascent ASAT missile is an intentional physical threat. Ground-to-satellite links are susceptible to electromagnetic jamming and unintentional EMI. Electromagnetic jamming is the deliberate radiation, reradiation, or reflection of electromagnetic energy for the purpose of preventing or reducing an enemy's effective use of the EMS and with the intent of degrading or neutralizing the enemy's combat capability.

Unintentional interference may be just as harmful to space operations as deliberate jamming but may drive a very different response. Mandatory jamming and interference resolution processes are contained in Chairman of the Joint Chiefs of Staff Manual (CJCSM) 3320.02, *Joint Spectrum Interference Resolution (JSIR) Procedures.*

d. **Threats**

(1) Threats possess varying levels of knowledge of US space capabilities and their role in joint operations and continually expend resources to maintain awareness of US doctrine, technology, and CONOPS for space operations and related systems—current and future. Additionally, they are developing, testing, and fielding capabilities in an attempt to deny the US the advantages gained from space. Our adversaries' progress in space technology not only threatens the space environment and our space assets but could potentially deny us an advantage if we lose space superiority. The US mitigates risks and threats through understanding of threat space capabilities and by planning and conducting defensive and offensive operations.

(2) CDRUSSTRATCOM conducts operations to establish and maintain SSA, which includes detection, characterization, and assessment of the capabilities and intent of our adversaries. This assessment identifies potential threats and enables the timely development and employment of countermeasures to ensure the availability of friendly space capabilities. JFC plans and operations should account for threats to space capabilities that enhance the effectiveness of their forces and, in coordination with United States Strategic Command (USSTRATCOM), should take measures to preempt or counter those threats to preserve US freedom of action in, and access to, space. Effective space operations counter adversary efforts to interfere with or attack US or allied space systems.

(3) When developing plans and strategic estimates, commanders and staffs should consider the possibility of hostile actions from both state and non-state actors' intent on denying or disrupting friendly forces' use of space capabilities. Ground segment assets such as C2 facilities are vulnerable to physical attack and cyberspace attack. The space segment may be vulnerable to attacks from ASAT weapons, exoatmospheric nuclear detonations, directed energy weapons, and interference from laser blinding.

(4) JFCs and staffs should also anticipate increasing sophistication and proliferation of adversarial space capabilities. While adversaries continue to improve their indigenous space capabilities, they no longer have to develop large infrastructures to obtain space capabilities. Today, many such capabilities exist and may be readily acquired on the open market. Classified intelligence estimates provide further discussion of threats.

e. **Space Mission Assurance.** Regardless of the threat origin (natural or man-made), there are several methods to provide space mission assurance. These methods can be grouped in three categories of measures: defensive operations, reconstitution, and resilience.

(1) **Defensive Operations** are activities undertaken to neutralize or reduce the effectiveness of hostile action against US, allied, and partner space systems. They reduce

the likelihood that a threat will be able to mount a successful attack on US space architectures and, to a certain extent, are independent of the space mission defended. This type of capability or operation might include disrupting a threat's targeting or attacking of space systems. Synchronized and systematic maneuvers of on-orbit assets to confuse and overwhelm an enemy's targeting system, and active measures to deceive, degrade, or destroy targeting systems are examples of defensive operations. Defensive operations also include a space object surveillance and identification capability that provides warning and characterization of the attack, as well as blue force C2 capabilities to execute the defense.

(2) **Reconstitution** consists of actions taken to restore functionality to an acceptable level for a particular mission, operation, or contingency after severe degradation. It includes launching additional satellites or bringing additional ground stations, new signals, and spectrum into play to bolster the ability to provide the capabilities and capacity required for mission success. Reconstitution involves adding back capability or capacity through additional assets or links.

(3) **Resilience** is the ability of an architecture to support the functions necessary for mission success with higher probability; shorter periods of reduced capability; and across a wider range of scenarios, conditions, and threats, in spite of hostile action or adverse conditions. Resilience may leverage cross-domain or alternative government, commercial, or international capabilities. Unlike defensive operations and reconstitution, resilience is an internally focused characteristic of an architecture. This is contrasted with reconstitution and defensive operations, which are external to the architecture, although architectural decisions would affect the ability to reconstitute that architecture or employ defensive operations to defend it. Resilient capabilities are achievable through one or a combination of the following methodologies:

(a) **Disaggregation** is the separation of dissimilar capabilities into separate platforms or payloads. An example of this would be separating tactical and strategic protected SATCOM. Further, disaggregation can also apply in other cases to reduce the complexity of systems, making it easier to implement other resilience characteristics. In this respect, disaggregation is a means to an end, not bolstering resilience directly, but allowing it to occur more readily.

(b) **Distribution** is utilizing a number of nodes, working together, to perform the same mission or functions as a single node. For example, the Global Positioning System (GPS) is a distributed system. No individual satellite, or ground monitoring site, is fundamental to assuring PNT in any one specific location. Losing a single node, satellite, or ground station begins to reduce the accuracy of the system and, with enough losses, the availability of the system. However, the highly resilient nature of the distributed GPS architecture allows for more gradual degradation and presents an adversary the problem of far larger number of targets than if the system relied on a singular node.

(c) **Diversification** is contributing to the same mission in multiple ways, using different platforms; different orbits; or systems and capabilities of commercial, civil, or international partners. Systems or architectures that are flexible or adaptable for use in support of a variety of mission sets are also examples of diversification. Again using PNT

as an example, the diverse nature of space-based PNT systems can be used to assure warfighters have access to at least one space-based PNT capability, even if a primary means is denied. A similar dynamic arises for other systems with vast commercial and international participation (communication and ISR). Diversification coupled with other approaches (proliferation and deception) can create resilient architectures. Moreover, since diversification could include the use of alternative, non-USG systems, it can increase resilience with lower investments than some other techniques.

(d) **Protection** comprises active and passive measures to ensure space systems provide the required quantity and quality of mission support in any operating environment or condition. This includes traditional steps, such as EMI protection and nuclear hardening, and can be extended to maneuverability and other ASAT countermeasures. It also includes efforts to characterize and attribute effects, which enables satellite operators to restore satellite functions, capabilities, or capacity.

(e) **Proliferation** is deploying larger numbers of the same platforms, payloads, or systems of the same types to perform the same mission. Examples include deploying a larger number of Wideband Global SATCOM satellites in the constellation and increasing the number of downlink and data processing facilities. The resilience benefits of such efforts could be magnified if proliferation efforts were coupled with other complementary resilience measures. For example, proliferation could be joined with diversification and protection through use of commercial systems that complement and provide alternatives to military satellite communications and through development of protected tactical waveforms for communications on those commercial systems.

(f) **Deception** is considered by commanders of space assets, in their planning for space operations, to ensure the survival and resilience of their space mission. Deception in space operations is typically designed to confuse or mislead a threat with respect to the location, capability, operational status, mission type, and/or robustness of a national security system or payload. If deception measures are successful, an adversary will not attack a given system or capability. Given the physics of space operations, deception is likely a critical element of any space-system resilience effort.

f. **Deterrence.** Adversaries are deterred from attacking space assets when they believe the existence of a credible threat of unacceptable counteraction and/or believe the cost of action outweighs the perceived benefits. Displaying the resources and resolve to implement responses to an attack using all appropriate instruments of national power could cause an adversary to believe the cost of the attack is not worth the benefit. This type of cost imposition is dependent on timely attribution—the ability to quickly and definitively identify the enemy responsible for the attack. On the other side of the cost-benefit equation, protective measures and resilient architectures that enable the delivery of space capabilities can reduce the potential advantages gained by an adversary. Both sides of the deterrence cost-benefit equation are positively influenced through space partnerships, which improve resilience by incorporating partner-provided capabilities and increase the potential cost to an adversary when an attack on one partner is seen as an attack on all.

6. Orbital Characteristics of Space

a. **Orbital Characteristics.** Spacecraft orbits follow parameters according to the laws of physics. Orbit types and parameters are generally selected to provide the greatest benefit for the least cost, based on the purpose and capabilities of the satellite.

b. The four most common orbit types used by the military are GEO, highly elliptical orbit (HEO), medium Earth orbit (MEO), and LEO.

(1) GEO satellites are synchronized to the Earth's rotation, orbiting at the same rate at which the Earth rotates upon its axis. GEO traces a figure eight (i.e., orbital ground-trace) over the ground; the higher the inclination, the larger the ground trace. A geostationary orbit is a special type of GEO placed directly over the equator so a satellite appears at a fixed point in the sky to observers on the ground. GEO allows constant line of sight (LOS) observations within a very large footprint covering slightly over one-third of the globe. A GEO footprint roughly extends to 70 degrees of latitude; higher latitudes fall outside the footprint. GEO is ideal for worldwide communications, surveillance, reconnaissance, observing large-scale weather patterns, and missile warning.

(2) HEO takes the shape of a long ellipse. At their most distant points from Earth (the satellite's apogee), satellites in HEO may be over 25,000 miles away. On the other side of the elliptical orbit, the satellite's closest point of approach (called perigee) could be only a few hundred miles above the Earth's surface. HEO provides very long dwell times near apogee. Satellites in HEO are normally highly inclined, so the long dwell times occur over high latitudes, providing coverage over northern Russia, Scandinavia, Canada, and the Arctic Ocean. HEO dwell times in the northern or southern hemisphere (depending on inclination) are nearly 10 hours of a 12-hour-long orbit. Two satellites set in phased orbits can provide continuous high-latitude coverage, filling the polar coverage gaps of GEO satellites. HEOs are ideally suited for communications, scientific, surveillance, and weather missions over higher latitudes.

(3) MEO has no formal altitude but is considered to include those orbits between LEO and GEO. A semi-synchronous orbit is a special case that repeats an identical ground trace after two revolutions, each taking just under 12 hours. Semi-synchronous orbits are classified as MEO when they are nearly circular. When highly eccentric, they are classified as HEO. The most well-known constellation that uses MEO is the GPS constellation, but this type of orbit may also be used for communications.

(4) Objects in LEO are relatively close to the Earth, so they may use less powerful transmitters for communications and achieve higher resolution imagery with similar-sized apertures compared to objects in higher orbits. LEOs have the disadvantage of only being in the view of a ground user or station for the short period when overhead. Continuous coverage requires a constellation of satellites spaced evenly around the several orbital planes. The average time to orbit the Earth is approximately 90-100 minutes. LEO is ideal for ISR, environmental monitoring, and small communications satellites. Science instrument payloads and manned space-flight missions also frequently use these orbits. A brief synopsis of the characteristics for each orbit type is in Figure I-1.

c. All commanders need to have a basic awareness of the fundamental advantages offered by space operations to effectively employ space capabilities. In certain circumstances, authorized commanders may have satellite operators change a satellite's orbital parameters to meet mission requirements. When doing so, the commander must understand this will deplete fuel, which may significantly degrade the performance and/or life span of a system.

7. Environment Considerations

The space environment is a significant limiting factor influencing every aspect of a satellite's size, weight, and power, which affect the performance and life span of any operational spacecraft.

a. **Space Weather.** Apart from the threat of meteoroids and cosmic rays, almost all natural hazards to space capabilities come from the Sun. The various phenomena resulting from the Sun's activity are collectively termed "space weather" and manifest as solar flares, increased electromagnetic noise, ionosphere interference, or prolonged impact by energetic

Orbit Type and Characteristics

Type	Description	Advantages	Disadvantages	Applications
Geosynchronous Earth orbit	Roughly circular ~23,000 miles above Earth's surface	Continuous coverage over specific area Coverage nearly hemispheric	Far from Earth - resolution and signal limitations Easier to jam signal latency	Communication Surveillance Reconnaissance Weather collection Missile warning
Highly elliptical orbit	Long ellipse ~600 miles at perigee (closest to Earth) ~25,000 miles at apogee (farthest from Earth)	Long dwell time over a large area Coverage of high North or South latitudes	Continuous coverage requires multiple satellites	Communication over high North or South latitudes Scientific Surveillance Reconnaissance Missile warning
Medium Earth orbit	Roughly circular Between ~1,000-22,000 miles above Earth's surface	Stable orbit Less signal latency	Highest radiation level environment	Positioning, navigation, and timing Communication
Low Earth orbit	Roughly circular Up to ~1,000 miles above Earth's surface	Near Earth - high resolution and signal strength	Small coverage area over Earth surface Limited coverage windows for any specific geographic region	Surveillance Reconnaissance Weather collection Manned space flight Communications

Figure I-1. Orbit Type and Characteristics

charged particles. Charged particles, cosmic rays, the Van Allen radiation belts, and other natural phenomena in space may affect communications, navigation accuracy, and sensor performance and may even cause electronic failure.

b. **Debris.** Operational satellites are under constant threat of impact. Orbiting particulates left behind during a satellite's lifetime, debris from satellite explosions or impacts, trash such as rocket bodies, and natural objects such as meteoroids may damage operational systems. Further complicating this problem is that much of the debris is too small to track with current sensor capabilities.

(1) **Debris Dispersal.** Generally, if an object detaches from an orbiting body, no matter its size, it will initially follow the same orbit. Debris may take weeks, months, or even years to separate from its source. Even clouds of objects, created by explosive events, will only slowly disperse once the initial explosion is complete. Depending on altitude and velocity, such objects may remain in a stable orbit for tens or even hundreds of years.

(2) **Cascading Collisions.** The preferential use of certain orbits compounds the collision risk by concentrating large numbers of objects in discrete bands. Congestion in space is a well-recognized problem. The National Aeronautics and Space Administration (NASA) estimates there are approximately 500,000 orbiting objects between 1 and 10 centimeters in size. As the orbital space around the Earth becomes more congested, a small collision may create a chain reaction of collisions, creating debris that renders some orbits unusable for centuries.

(3) **Collision avoidance** involves maneuvering spacecraft to avoid a collision of space objects against an impending hazard to the safety of astronauts or the space vehicle. Such actions may shorten the overall operational life span of the spacecraft. Nearly a decade after China's 2007 ASAT weapon test, approximately 3,000 discrete pieces of debris remain in orbit. This debris field has required satellite operators to conduct collision-avoidance maneuvers for spaceflight safety.

CHAPTER II
SPACE OPERATIONS AND THE JOINT FUNCTIONS

"We have to, as a country and as a joint military, get our heads around how we would fight through a war that started on earth, but bled into space."

Secretary of the Air Force Deborah Lee James
September 2015

1. General

Joint functions are related capabilities and activities grouped together to help JFCs integrate, synchronize, and direct joint operations. A function is a group of tasks and systems (people, organization, information, and processes) united by a common purpose commanders use to accomplish missions. In determining the correct C2 relationships for space operations, commanders must consider what decisions have to be made; by whom; under what circumstances; and how to aggregate capacity, capability, and situational awareness at the correct levels. Functions that are common to joint operations at all levels of warfare fall into seven basic groups: C2, intelligence, fires, movement and maneuver, protection, sustainment, and information. Due to the complexities of the OE, and the required integration and coordination between elements of the joint force, a shared understanding of selected aspects of specific space capabilities is essential to foster and enhance unified action. Section A, "Space Operations and Associated Capabilities," provides a discussion of space capabilities and a common baseline for all elements of the joint force to better enable joint planning and facilitate effective joint military operations. Section B, "Joint Functions," provides a description of how each of these capabilities contributes to the JFC's ability to execute each of the joint functions.

SECTION A. SPACE OPERATIONS AND ASSOCIATED CAPABILITIES

2. Space Situational Awareness

a. Situational awareness is fundamental to conducting space operations. SSA is the requisite foundational, current, and predictive knowledge and characterization of space objects and the OE upon which space operations depend – including physical, virtual, information and human dimensions – as well as all factors, activities, and events of all entities conducting, or preparing to conduct, space operations. Space surveillance assets include a mix of space-based and earth-based sensors. SSA is dependent on integrating space surveillance, collection, and processing; environmental monitoring; status of US and cooperative satellite systems; understanding of US and multinational space readiness; and analysis of the space domain. SSA must incorporate understanding of the space capabilities and intent of those that pose a threat to our space operations and space capabilities.

b. The Joint Space Operations Center (JSPOC) provides a COP to the Joint Force Space Component Commander (JFSCC) to enable broad, shared awareness of the JFSCC's critical information requirements, status of forces, SSA, and the full range of military activities arranged in time, space, and purpose.

3. Space Control

a. Space control employs OSC and defensive space control (DSC) operations to ensure freedom of action in space and, when directed, defeat efforts to interfere with or attack US or allied space systems. Space control plans and capabilities use a broad range of response options to provide continued, sustainable use of space. Space control contributes to space deterrence by employing a variety of measures to assure the use of space, attribute enemy attacks, and consistent with the right to self-defense, target threat space capabilities.

b. **OSC.** OSC operations consist of offensive operations conducted for space negation, where negation involves measures deceive, disrupt, degrade, deny, or destroy space systems or services. Adversaries, both state and non-state actors, will exploit the availability of space-based capabilities to support their operations. In keeping with the principles of joint operations, this makes it incumbent on the US to deny adversaries the ability to utilize space capabilities and services. OSC actions targeting an enemy's space-related capabilities and forces could employ reversible and/or nonreversible means.

(1) **Deceive.** Measures designed to mislead an adversary by manipulation, distortion, or falsification of evidence or information into a system to induce the adversary to react in a manner prejudicial to their interests.

(2) **Disrupt.** Measures designed to **temporarily impair** an adversary's use or access of a system for a period, usually without physical damage to the affected system.

(3) **Deny.** Measures designed to **temporarily eliminate** an adversary's use, access, or operation of a system for a period, usually without physical damage to the affected system.

(4) **Degrade.** Measures designed to **permanently impair** (either partially or totally) the adversary's use of a system, usually with some physical damage to the affected system.

(5) **Destroy.** Measures designed to **permanently eliminate** the adversary's use of a system, usually with physical damage to the affected system.

c. **DSC.** DSC operations consist of all active and passive measures taken to protect friendly space capabilities from attack, interference, or unintentional hazards. DSC safeguards assets from unintentional hazards such as direct or indirect attack, space debris, radio frequency interference, and naturally occurring phenomenon such as radiation. DSC measures can apply to defense of any segment of a space system—space, link, or ground.

(1) Successful DSC operations include the ability to preempt and suppress attacks. DSC capabilities should be integrated with SSA elements that provide the ability to detect, characterize, and attribute an attack to an enemy. A robust DSC capability influences enemies' perceptions of US space capabilities and makes them less confident of success in interfering with those capabilities.

(2) DSC contributes to space deterrence by employing a variety of measures that help assure the use of space and, consistent with the inherent right of self-defense, defend our space systems and contribute to the defense of allied/partner space systems.

(3) Active space defense consists of those actions taken to neutralize imminent space control threats to friendly space forces and space capabilities.

(4) Passive space defense consists of all measures (except active space defense measures) taken to minimize the effectiveness of on-orbit and terrestrial threats to friendly space forces and friendly space capabilities. Passive space defense measures could include camouflage, concealment, and deception; evasion; dispersal of space systems; and hardening of space system links and nodes.

d. **Navigation Warfare (NAVWAR)**

(1) NAVWAR is deliberate offensive and defensive actions to assure friendly use and prevent adversary use of PNT information through coordinated employment of space, cyberspace, and electronic warfare (EW) capabilities. NAVWAR is further enabled by supporting activities such as ISR and EMS management.

(2) At the operational level, a JFC may gain a desired advantage by integrating diverse capabilities to create NAVWAR effects. Integrated offensive and defensive NAVWAR activities ensure friendly PNT information use is unimpeded while simultaneously denying the threat's use of PNT information. When formulating NAVWAR courses of action (COAs), JFCs must understand the tradeoffs between NAVWAR effects and potential degradation to friendly forces and civil, commercial, and scientific users (as stipulated by US national space-based PNT policy).

For additional information about NAVWAR, see JP 3-13.1, Electronic Warfare, *and JP 3-12,* Cyberspace Operations.

4. Positioning, Navigation, and Timing

a. Military users depend on assured PNT systems for precise and accurate geo-location, navigation, and time reference services. PNT information, whether from space-based global navigation satellite systems (GNSSs), such as GPS, or non-GNSS sources, is mission-essential for virtually every modern weapons system. For decades, GPS provided the global community largely uncontested access to space-based PNT services. Because of its constant availability, free access, high accuracy, and modest cost of user equipment (i.e., GPS receivers), other nations' military forces integrated GPS into their tactics, techniques, and procedures (TTP). The international community is acutely aware of their dependence on, and consequent vulnerability from, GPS. For this reason, other GNSSs are in various stages of development. The increasing availability of non-US-based GNSSs means adversaries may leverage GPS while it provides an operational advantage, then attempt to deny US and allies GPS through jamming, while preserving their own PNT capabilities via other systems. The US must protect assured PNT through the synergy of cyberspace, space, and EW operations.

b. GPS provides two levels of positioning services. The standard positioning service is available to all users through the broadcast of an unencrypted signal. The precise positioning service, used by DOD, authorized government agencies, and some US allies, leverages an encrypted code broadcast over two frequencies. Precise positioning service users retain a significant advantage over standard positioning service users due to the relative robustness of the encrypted signal and the ability to correct for environmental conditions by accessing two frequencies. Newer military GPS receivers incorporate an architecture (both hardware and software) that safeguards classified GPS cryptographic keys and algorithms and protects signals from exploitation.

For additional information on PNT, see Department of Defense Instruction (DODI) 4650.08, Positioning, Navigation, and Timing (PNT) and Navigation Warfare (NAVWAR).

5. Intelligence, Surveillance, Reconnaissance

a. Space-based intelligence collection synchronizes and integrates sensors, assets, and systems for gathering data and information on an object or in an area of interest (AOI) on a persistent, event-driven, or scheduled basis. Space-based ISR, which includes OPIR, tasking, and collection, is conducted by an organization's intelligence collection manager to ensure integrated, synchronized, and deconflicted operations of high-demand assets. This includes warning (to include ballistic missile activity), targeting analysis, threat capability assessment, situational awareness, battle damage assessment (BDA), and characterization of the OE. Space-based intelligence collection supports the President and USG departments and agencies (e.g., National Geospatial-Intelligence Agency [NGA], National Security Agency [NSA], and DOD). The CCMDs and the components have access to space capabilities that can collect diverse military, diplomatic, and economic information for planning and execution across the range of military operations and to the intelligence derived and developed from the data collected.

b. Significant advantages of space-based collection capabilities are their coverage over denied areas where little or no data can be obtained from ground, maritime, or airborne sensors and their mission longevity. While able to provide worldwide coverage, demands on individual space-based systems often exceed their capacity, and their associated orbit requirements may limit the ability to meet operational requirements. Space-based ISR systems are operated by military, nonmilitary, and intelligence community (IC) organizations. International cooperation in military space-based intelligence collection systems with allies and other partners contributes to US national security objectives by improving resiliency and interoperability, supporting multinational operations, and building partnership capacity and capability.

c. Often, the product of a space or terrestrial capability can enhance intelligence accuracy and shorten reaction time by cueing another space system to survey an AOI. Likewise, a space-based capability may cue a terrestrial-based system on a noninterference basis for more precise location, discrimination, and targeting.

d. ISR capabilities also enhance planning by providing updated information regarding terrain and adversary force dispositions. Space-based imagery, in particular, supports

military intelligence activities, including warning, current intelligence, order of battle, scientific and technical intelligence assessments, targeting and combat assessments, and mission planning and rehearsal. Commanders should be aware, adversaries may have access to similar capabilities to employ against US forces.

6. Satellite Communications

a. SATCOM systems inherently facilitate beyond LOS connectivity. Depending on its configuration, a robust SATCOM architecture provides either worldwide coverage (non-polar) or global coverage (includes poles). This provides national and strategic leadership with a means to maintain situational awareness and convey their intent to the operational commanders responsible for conducting joint operations. SATCOM also provides critical connectivity for tactical maneuver forces and disadvantaged users whose rapid movement and geographically dispersed deployments remove them from direct access to terrestrial communications infrastructures. SATCOM systems provide voice and data connectivity that facilitates C2, survivable communications for Presidential support, nuclear C2, and intelligence.

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

(1) **Global Coverage.** Collectively, SATCOM systems provide global coverage. If required, satellites can focus capacity in areas of special interest.

(2) **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. Unlike other communications media, SATCOM can provide global voice and data transmission such as the tracking of force disposition and status.

(3) **Independence from Terrestrial Communications Architecture.** Some SATCOM links preclude the need for long terrestrial communications links. Furthermore, these specific SATCOM links enable US forces to communicate without the need for physical connectivity or terrestrial LOS communication over relay infrastructure.

(4) **Flexibility.** Satellite systems allow global coverage and interlinking between frequency bands and systems, and certain systems are able to provide a relatively low probability of detection (LPD). Flexibility gives the JFC a great deal of latitude in mixing and matching satellite systems to meet specific operational requirements. Selected waveforms and directional antennas afford LPD, wide bandwidths allow higher data rates, ground stations permit cross patching, and satellite positions make global coverage available.

(5) **Support to Mobile Forces.** SATCOM systems can provide the communications required by mobile forces operating over wide areas.

7. Environmental Monitoring

a. **Terrestrial Environmental Monitoring.** Terrestrial environmental monitoring provides information on meteorological and oceanographic (METOC) factors in the

maritime, land, and air domains that affect military operations. Space-based environmental sensing supports the development of METOC forecasts and assessments of environmental impacts on both friendly and threat military systems and operations. Environmental monitoring information includes data provided by non-DOD satellites, such as National Oceanic and Atmospheric Administration (NOAA) operational weather and NASA research satellites, as well as foreign satellites such as the European and Japanese geostationary weather satellites. This information is used by the 557th Weather Wing, the Fleet Numerical Meteorology and Oceanography Center, and the Naval Oceanographic Office to support joint forces and Services, as well as by individual forecasters in the field, supporting local units. A prime advantage of environmental satellites is their ability to gather data in remote or hostile areas, where little or no data is available via surface reporting stations. For example, space-based environmental data is critical over most oceanic regions, where terrestrially observed data is often sparse.

b. **Space Environmental Monitoring.** Space environmental monitoring provides data that supports forecasts, alerts, and warnings for the space environment that may affect space assets, space operations, and their terrestrial users. 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.

c. **Environmental Monitoring Support.** Environmental monitoring support to joint operations gives the JFC awareness of the OE. 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.*

8. Missile Warning

a. The missile warning mission uses a mix of space-based and terrestrial sensors. Missile warning supports the warning mission executed by North American Aerospace Defense Command to notify national leaders of a missile attack against North America, as well as attacks against multinational partners (via shared early warning [SEW]) in other geographic regions. It also includes notification to geographic CCMDs, multinational partners, and forward-deployed personnel of missile attack, and the assessment of a missile attack if the applicable CCMD or multinational partner is unable to do so. Collectively, space-based sensors provide continuous coverage of all CCMD areas of responsibility (AORs). These persistent, overhead satellite sensors are linked via multiple missile warning/defense data processing and dissemination systems to CCDRs and subordinate forces. This theater system takes advantage of direct downlinks, key protected SATCOM, and tactical communications systems. The theater-event system architecture enables rapid dissemination of missile-event warning messages to warfighters, thereby enabling effective passive defense, active defense, and offensive operations.

b. Space-based sensors, such as Defense Support Program, Space-Based Infrared System, and IC sensors, usually provide the first indication of a missile launch. Ground-based radars provide follow-on information on launches and confirmation of strategic attack. These ground-based radar systems include the following: Ballistic Missile Early Warning System, Perimeter Acquisition Vehicle Entry 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 missile defense missions. There is no room for error in missile warning; therefore, all information provided must be timely, accurate, and unambiguous.

For information on performance criteria for missile warning, see Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 6210.02, (U) Information and Operational Architecture of the Integrated Tactical Warning and Attack Assessment System.

9. Nuclear Detonation Detection

Nuclear detonation detection capabilities provide a persistent, global, and integrated sensor capability to provide surveillance coverage of critical regions of the globe and provide warning and assessment recommendations to the President, Secretary of Defense (SecDef), and CCDRs, indicating place, height of burst, and yield of nuclear detonations. Space-based systems, ground-based systems, correlation center C2 systems, and CCDR/national leadership decision-support systems support time-critical event conferencing. These systems provide allies and senior leaders the requisite timely warning and characterization of nuclear detonations to support threat/non-threat determination and follow-on decision making. In countering weapons of mass destruction (WMD), detection of nuclear detonations can be used to help identify proliferators.

10. Spacelift

Spacelift is the ability to deliver payloads (satellites or other materials) into space. Assured access to space includes spacelift operations and range operations. Air Force Space Command (AFSPC) conducts these operations as a Service function that supports other Services and the joint force.

a. Spacelift operations deploy, sustain, augment, or reconstitute satellite constellations supporting US military operations, national security objectives, and/or commercial customers. DOD procures commercial services for spacelift, a practice that supports National Space Policy. Space launches are usually planned several years in advance and executed in accordance with the established space launch manifest. Planners should account for the long lead times involved with the manifest scheduling process.

b. Range operations are critical to spacelift operations and provide assured, responsive access to space with an emphasis on public safety. Space ranges provide launch campaign support, pre-launch testing, launch traffic control, and scheduling services for spacelift operations. Launch ranges may also be responsible for planning and execution of space launch vehicle and spacecraft recovery operations.

11. Satellite Operations

Satellite operations maneuver, configure, operate, and sustain on-orbit assets. In a conflict, satellite operations are critical to the C2, movement and maneuver, protection, and sustainment of space assets. Similarly, all of the space capabilities addressed in this section that contribute to the joint functions require satellite operations to support the JFC successfully.

a. Satellite operations are characterized as spacecraft and payload operations. Spacecraft operations include TT&C, maneuvering, monitoring state-of-health, and maintenance sub-functions. TT&C is the process of monitoring spacecraft systems, transmitting the status of those systems to the control segment on the ground, and receiving and processing instructions from the control segment. Payload operations include monitoring and commanding of the satellite payload to collect data or provide capability in the OE. Satellite operations centers, linked to on-orbit assets via dedicated and shared networks, execute satellite operations. Some systems utilize dedicated antennas for both mission data retrieval and routine satellite TT&C. 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 ensure access to space assets.

b. Service component satellite operation centers monitor, sustain, and operate DOD satellites. Globally dispersed antennas (i.e., those of the Air Force Satellite Control Network, the Naval Satellite Control Network, the wideband SATCOM operations centers, NASA networks, National Reconnaissance Office [NRO], and GPS ground antennas) provide the necessary links between the satellite operations centers and satellites to execute spacecraft and payload operations.

c. Rendezvous and proximity operations (RPO) are specific processes where two resident space objects are intentionally brought close together. Servicing of space assets requires the capability to rendezvous, conduct close proximity operations, and/or dock with the space asset. On-orbit servicing capabilities enable inspection, repair, replacement, and/or upgrade of spacecraft subsystem components and replenishment of spacecraft consumables (e.g., fuels, fluids, cryogens). RPO may also be used to provide information on spacecraft events. RPO planners should coordinate with the JFSCC to confirm space flight safety procedures are in place, to minimize risk of collision and creation of orbital debris.

For more information on RPO activities, planners should consult CJCSI 3920.01, (U) Procedures for Space Rendezvous and Proximity Operations.

SECTION B. JOINT FUNCTIONS

12. Command and Control

a. In military operations, the JFC provides operational vision, guidance, and direction to the joint force. C2 encompasses the exercise of authority and direction by a commander, over assigned and attached forces, to accomplish the mission. The C2 function supports an efficient decision-making process. Enabled by timely intelligence, effective C2

provides the ability to make decisions, communicate orders, and execute operations more rapidly and effectively than the adversary. This decreases risk and allows the commander more control and decision time over the timing and tempo of operations.

b. **Space Capabilities Contribution to C2 for Joint Operations.** C2 of space forces is covered in detail in Chapter III, "Command and Control of Joint Space Operations," with the focus of this section on how space operations are part of, enable, and support the C2 of joint operations.

(1) Space-based intelligence collection assets support C2 by providing information used to develop a shared understanding of the threat. A large percentage of the intelligence required to make decisions for employment of forces is obtained from space-based intelligence collection assets.

(2) SSA assists C2 by characterizing the space environment, including the ground and link segment. SSA provides insight into an adversary's employment of space systems. It helps commanders understand threats that could deny friendly space capabilities in their operational areas and warns commanders when a threat would have satellite overhead visibility of friendly operations.

(3) SATCOM provides secure, integrated communications to ensure plans and orders are conveyed to all forces. The precision, speed, and interoperability with which these systems operate improve access to the information, thereby establishing and reinforcing a common perspective of the OE. Data on a COP is often provided by SATCOM. The COP provides situational awareness, supports shared understanding, and supports control of forces by empowering subordinate leaders to gain greater information and independence to facilitate initiative and agility to accomplish the commander's overall intent. In addition to the COP, SATCOM supports friendly force tracking (FFT), provided by integrating ISR, PNT, and SATCOM-enabled information systems that give the joint force the disposition and status of US forces and multinational forces (MNFs). It also facilitates the communication of the COP throughout the command and allows the user to input and share other operationally relevant information, to include the location, status, and progress of threats, obstacles, and other hazards.

(4) PNT enables multiple C2 network linkages by providing highly accurate timing signals.

(5) Missile warning is an essential part of the capabilities commanders use to characterize the OE. Missile warning provides critical battlefield information such as enemy launches. OPIR capabilities provide commanders information on activities and at speeds not otherwise available through ground, airborne, or maritime assets. For example, OPIR provides data allowing rapid battle damage indications to assist in BDA.

c. **Space Operations, Capabilities, and Effects Supporting Joint Operations.** Space operations continuously support joint operations in the other domains. This persistent integration via technology and existing processes is largely transparent. However, additional space operations may be relevant to joint operations. In these

instances, joint forces have multiple avenues to request and access space capabilities beyond what is in use daily. Several categories of space operations and functionally trained space personnel are available to help the CCMD request and integrate these additional space capabilities in joint operations. Of these space operations subject matter experts (SMEs), those assigned to serve in positions at geographic CCMDs and other major operational-level combat organizations are trained and in place to directly assist their respective CCMD or joint force with the daily execution of space coordinating authority (SCA) and operational planning for the inclusion of applicable additional space capabilities in the joint mission. These space operations personnel include the director of space forces (DIRSPACEFOR) and comprise teams such as combat operations division space cells within air operations centers' (AOCs') organizational structure. Others include United States Air Force (USAF) weapons officers, who serve as space planners or in other operational headquarters' roles, and other space professionals trained to serve as members of the commander's team in every AOR. The numbers and locations of these space professionals vary, depending on the particular theater or organizations involved, and are subject to the requirements of the CCMD. The United States Navy (USN) has the space support working group (SSWG) at the maritime operations center (MOC) and a space operations officer embarked on a carrier strike group. They have reachback capability to the Naval Network Warfare Command and Navy information operations (IO) commands. The Army will have a space support element (SSE) or an Army space support team (ARSST) at Army, corps, and division levels. The United States Marine Corps (USMC) has space operations officers assigned to the Marine expeditionary forces (MEFs), located within the operations directorate and the Marine information groups. They have reachback capability to Marine Corps Forces Strategic Command and other space support organizations and may be augmented with an SSE or ARSST, as required. The joint special operations task force will have a space cell. These SMEs are trained to plan, facilitate, and help coordinate joint force access to relevant additional space capabilities in their respective theater of assignment.

(1) If the component needs meteorological, oceanographic, or space weather products, the unit METOC/weather officer will be the central point of contact (POC). The METOC/weather officer has reachback support from organizations such as the fleet weather centers, Naval Oceanographic Office, 557th Weather Wing, the Fleet Numerical Meteorology and Oceanography Center, and the JSPOC.

(2) If SATCOM support is required for a mission, the unit/organization submits a satellite access request to the CCMD communications systems directorate or Service for validation and for action by the applicable regional satellite communications support center.

(3) If the component needs ISR or OPIR support or technical intelligence, the request for information (RFI) will go to the appropriate intelligence directorate to request the appropriate information. Intelligence personnel, in turn, have reachback capabilities to the OPIR Outreach Desk, national capabilities, or commercial imagery to fulfill the RFI.

(4) Because the air component often has the preponderance of space forces, the geographic combatant commander (GCC) normally delegates SCA to the joint force air

component commander (JFACC) (if established). In turn, the JFACC normally tasks a senior SME, typically the DIRSPACEFOR (if the commander, Air Force forces [COMAFFOR], is the JFACC), to execute the daily actions associated with SCA. Many space capabilities are pre-integrated into weapons systems and processes (e.g., PNT signal processing from GPS satellites). However, DIRSPACEFOR and other space operations personnel (e.g., AOC combat operations division space cell, space planner[s] in the combat plans division) plan and integrate additional joint space operations and capabilities. Requests for such capabilities (e.g., tailored PNT operations OSC, DSC, satellite reconnaissance advanced notice, launch detection and missile tracking, or SSA products) are typically submitted to the JSPOC via a space support request, which is processed through the DIRSPACEFOR and theater combat operations division space cell.

(5) A supported JFC (when delegated SCA from the GCC) integrates space capabilities and coordinates joint space operations in the designated operational area. The SCA for an operational area will coordinate space support requirements through the CCMD-level SCA.

(6) Components responsible for integrating space capabilities into planning and operations for a joint force will normally coordinate their requirements for space effects with USSTRATCOM's JFSCC.

13. Intelligence

a. The intelligence function supports shared understanding by providing integrated, evaluated, analyzed, and interpreted information concerning foreign nations, hostile or potentially hostile forces or elements, or areas of actual or potential operations. Space-based assets complement non-space-based intelligence sources by providing decision makers with timely, accurate data for information that can create a decisive advantage across all phases of conflict. Space operations may be both producers and consumers of intelligence. For example, SSA information on foreign activities in space, such as adversary satellite maneuvers, contributes indicators for potential terrestrial activities. Space control operations depend on warning data from the IC to counter threats and protect friendly systems.

b. **Joint Intelligence Support and SSA.** Joint intelligence is fundamental to SSA functions, which include detect/track/identify, integrated tactical warning, and attack assessment and characterization. Operations in space demand multi-source intelligence and continuous coordination with the IC. In turn, space operations, such as SSA functions, produce intelligence information on the space environment (e.g., spacecraft locations and activities, such as maneuvers and re-entries). Data and information supporting SSA comes from a number of sources. Currently the dominant source of intelligence required for SSA is from IC sources (e.g., intelligence on foreign launches [missiles, space, and ASAT weapons], foreign threat systems, foreign space systems and their status). Timely and up-to-date knowledge of all national and foreign space systems is required to complete the SSA information needed for space control operations, conducting space operations for joint mission operations, and protecting, defending, and sustaining space systems. For example, changes to the OE are evaluated for potential threats. Every spacecraft and ballistic missile

launch is detected, characterized, and assessed. Spacecraft maneuvers are processed to identify and address potential aggressive actions or future collisions. Multiple events are considered in a broader context to identify coordinated operations. Rapid identification of change combined with intelligence allows threat determination and enables protection and defense of space systems.

c. Similar to the challenges with cyberspace attacks, forensics in the space domain can be difficult; multi-source intelligence is crucial in this regard. Intelligence supports the understanding of threat actions and intentions, which in turn facilitates the development of COAs and appropriate responses. Intelligence capabilities must provide indicators of attacks across the continuum of enemy offensive capabilities with sufficient warning time to enable defensive measures. Warfighters' understanding of the natural environment is supported by environmental monitoring systems and organizations. Environmental awareness enables warfighters, especially space operators, to assess and mitigate potential weather phenomena and other natural environmental impacts on spacecraft communications (e.g., spacecraft charging and EMI). Knowledge of the environment supports DSC characterization and attribution processing by helping to differentiate between natural environmental sources of space system and ground system anomalies and deliberate hostile activities against our space operations and capabilities.

d. Persistent surveillance of threat space systems facilitates prediction of threat behavior and formulation and execution of preemptive activities to deter or forestall an anticipated threat's COA. It can provide information on the threat's space operations that may be precursors to, or complementary to, terrestrial activities. For these reasons, SSA data is valuable to the IC and joint force. The IC can assist planners and effectively predict outcomes that involve space systems when enemies choose to target space capabilities. For example, SSA provides the joint warfighters with knowledge of when threat image intelligence and signals intelligence (SIGINT) spacecraft are overhead, allowing warfighters to manage emissions and reduce the effectiveness of the threat's collections. Enemy activity, especially in an antiaccess, area denial scenario, might commence in or expand into space and cyberspace. Early activities in space and cyberspace inform JFCs of enemy capability, commitment, and intent.

e. **Joint Intelligence and Space Control.** Space control operations rely on intelligence from the IC. Intelligence may warn of impending attacks on US, ally, and partner spacecraft, allowing defensive posturing and assisting with attribution and characterization. Intelligence helps planners and operators identify obstacles. DSC operations protect space systems from attack through a process that includes deterrence, detection, characterization, and attribution and operating through and defeating the attack. As with warnings in other domains, the IC may detect precursor activities and should provide timely assessments to space operators and planners in synchronization with the operations and planning cycle. Space control operations require timely and accurate intelligence to avoid friendly fire, collateral damage, and other unintended secondary effects. Intelligence support to these operations includes SSA data; frequency spectrum usage; enemy force distribution; and target nominations, observations, and assessments.

f. The JSPOC provides information to complement IC-provided intelligence by disseminating warnings and activities that space operators detect or are addressing. Timely sharing of unusual indications and activities between the JFSCC and the IC with CCMDs improve the broader operational understanding of a conflict. Space operators are trained to detect SATCOM interference. The Joint Spectrum Interference Request Online is the designated reporting mechanism for suspected interference. The SATCOM system experts will evaluate reported EMI to characterize it and coordinate EMI management actions with the SATCOM EMI cell for disposition. Determining a threat's intent is challenging due to the dynamic nature of space operations. Precise, timely, and accurate information is always limited. Threats may attempt to degrade SSA and seek to disrupt space operations, such as space control activities, as part of broader operations. As space systems extend operational reach and agility, threats might include countering these capabilities in their efforts to create operational time and space. Combating an enemy's operation requires full intelligence support and sharing. Warning of a cyberspace attack against space systems requires special attention as the overlap of space and cyberspace provides an effective avenue to attack space systems.

14. Fires

a. Per JP 3-0, *Joint Operations,* the use of fires entails the use of weapon systems or other actions to create specific lethal or nonlethal effects on a target. In space operations, the fires function includes space control operations that create a desired effect on enemy space systems in multiple domains. This effort includes terrestrial fires to defend space operations and assets. A capability for, or employment of, fires may deter threats and/or contain and de-escalate a crisis. Planners should consider fires during flexible deterrent option and flexible response option planning and execution. Staffs should vet and manage fires involving or affecting space operations via the same systems and processes as conventional fires, thereby maximizing integration and synchronization.

For further guidance, refer to JP 3-0, Joint Operations, *and CJCSM 3122.07,* (U) Integrated Joint Special Technical Operations (IJSTO) Supplement to Joint Operation Planning and Execution System (JOPES) Volume I (Planning Policies and Procedures).

b. Targets can be nominated by any CCMD through their respective target nomination processes. The USSTRATCOM Joint Fires Element synchronizes supported joint fires for targets with other CCMDs and interagency partners through the USSTRATCOM Joint Targeting Coordination Board and manages the targeting cycle. Target nominations are validated in accordance with the law of war, with particular attention to legal considerations, collateral damage mitigation, and prevention of friendly fire. Target sets will likely have linkages and overlap throughout the OE.

For additional targeting guidance, refer to JP 3-60, Joint Targeting.

c. Space operations support air, land, maritime, and cyberspace fires through intelligence, PNT, and communications capabilities. Use of space-based PNT capabilities significantly reduces collateral damage and friendly fire, as many types of guided munitions and FFT devices use space-based PNT. SATCOM provides data flow

to and from widely geographically dispersed forces conducting fires in austere environments.

15. Movement and Maneuver

a. Movement and maneuver encompasses the disposition of joint forces to conduct operations by securing positional advantages before or during combat operations and by exploiting tactical success to achieve operational and strategic objectives. This function includes moving or deploying forces into an operational area and maneuvering them to operational depths for offensive and defensive purposes.

b. In space operations, this includes the deployment, repositioning, or re-orientation of on-orbit assets and terrestrial space forces. These movements may support service optimization, protection from environmental hazards, passive defense from threats, or the positioning of assets to enable active defense or offensive measures. Changing the position or operating frequency of space assets and forces can make them more difficult to target. Space force movement and maneuver occurs in each of the three space-system segments: space, link, and ground.

c. **Movement and Maneuver in the Space Segment.** This segment includes moving or deploying forces into an operational area and maneuvering them to operational locations for offensive and defensive purposes. From a space operations perspective, maneuvering most often involves the movement of a spacecraft from one orbit with its inherent characteristics (period, shape, orientation) to another unique orbit. Spacelift operations also constitute a form of maneuver and are conducted to deploy, sustain, augment, reconstitute, or protect satellite constellations for US military operations and/or national security objectives.

d. **Movement and Maneuver in the Link (Control) Segment.** Movement and maneuver in the EMS, the link (control) segment, includes changing frequencies, shifting users to other satellites (whether commercial or military), frequency hopping, moving spot beams, altering beam shape, changing modulation schemes, crosslinking (communications from one satellite to another), and cross-banding (the ability to cross from one band of the EMS to another band via the satellite). The purpose is to secure an advantage in the EMS before or during combat operations to ensure timely exchange of mission-essential information. Movement and maneuver can also exploit alternate communications paths, like fiber, or theater communication architectures such as LOS or airborne relay.

e. **Movement and Maneuver in the Ground Segment.** Movement and maneuver in the ground segment refers to units on the ground communicating to the satellites (for operational purposes or for TT&C) and to deployable space capabilities (SSA and space control). For units that provide TT&C, deployable mobile systems and alternate backup locations provide redundancy by moving to geographically dispersed locations, should primary locations become disabled.

f. **Space Operations and Movement and Maneuver in Terrestrial Operations.** CCDR decision-making process for movement and maneuver is influenced by various

space capabilities. SATCOM enables communications on the move; PNT provides enhanced navigational accuracy in featureless or obscured OEs and provides accurate location and timings critical to tactical missions. Environmental monitoring provides the commander with information that may affect military operations, enabling forces to take advantage of adverse environmental conditions or avoid situations negatively impacting their ability to maneuver. The use of FFT capabilities adds a level of fidelity useful to the commander when making decisions impacting movement and maneuver. SSA provides times when adversary space-based intelligence collection systems are less likely to detect movement and maneuver, enabling covert movement of troops. SSA also provides for awareness/detection of adversary jamming activity and facilitates maneuver in the EMS.

16. Protection

a. Protection is the 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.

b. Protection in space operations includes all measures taken to ensure friendly space systems perform as designed by overcoming attempts to deny or manipulate them. Protection includes all measures to passively neutralize or mitigate threats and man-made and/or environmental hazards, to include enemy attack, terrestrial weather, space weather, on-orbit conjunctions, and non-hostile EMI. Protection of space capabilities is critical to every weapons system that is enabled by space. Passive defense measures make friendly forces, systems, and facilities resilient by increasing the difficulty to locate, strike, and destroy them. Equally important is the application of technology and procedures to reduce the risk of friendly fire. Finally, emergency management and response reduce the loss of personnel and capabilities caused by accidents, health threats, and natural disasters.

c. Commanders should protect critical space systems and supporting infrastructure and take steps to assure availability of space-enabled, mission-essential functions by developing techniques, measures, and relationships to maintain continuity of services. 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.

d. **Protecting the Space Segment.** Threats to the space segment (spacecraft) include space object surveillance and identification networks, direct-ascent ASAT missiles, orbital ASAT systems, directed energy, jammers, and nuclear detonation. Possible countermeasures to these threats include maneuver, materiel hardening, filters, shutters, redundant components, backup systems, TTP development, and active defense capabilities that can create lethal and/or nonlethal effects.

e. **Protecting the Link Segment.** Threats to the link segment include uplink and downlink jamming as well as CO. Countermeasures can range from increasing transmission power to enhancing cybersecurity. Mandatory jamming and interference resolution processes for all commanders, Services, and agencies are contained in CJCSM 3320.02, *Joint Spectrum Interference Resolution (JSIR) Procedures.*

f. **Protecting the Ground Segment.** Threats to the ground segment include physical attack, cyberspace attack, and sabotage. Countermeasures include optimizing the location of a system, maximizing force protection, providing mobile capabilities, hardening the ground segment, redundancy, backup systems, and robust defensive CO.

g. **Space Operations and Protecting Joint Operations**

(1) Missile warning capabilities employ a space segment to assist in protecting joint forces by providing early warning capabilities. Space-based systems, ground-based systems, correlation center C2 systems, and CCDR/national leadership decision support systems support time-critical event conferencing. Reference JP 3-01, *Countering Air and Missile Threats,* for further discussion of air and missile defense.

(2) Space forces utilize space-based intelligence collection capabilities with timely, assured, and responsive systems to contribute to C2. This enhances the joint force's ability to observe AOIs and increases joint force situational awareness. GCCs maintain awareness of threats to space assets and forces in their operational areas and take measures to preempt or counter those threats to preserve US freedom of action.

(3) Space operations support air, land, maritime, and cyberspace fires through PNT and communications capabilities. SATCOM provides data flow to and from widely geographically dispersed forces conducting fires in austere environments. PNT and SATCOM enable increased operational tempo, dispersion, and concentration of forces, thereby increasing force survivability and maximizing surprise and unity of effort.

(4) Space-based environmental monitoring provides awareness and status of severe weather events which may impact the safety of friendly forces or their ability to effectively conduct military operations.

(5) SSA provides the joint force with timely notification of adversary space-based reconnaissance of friendly forces. Overflight warning reporting provides sufficient warning to allow recipients time to respond to a potential threat by employing cover, concealment, or cessation of activity until the threat has passed. This knowledge is critical to the commanders' planning and timing of military maneuvers and covert operations.

17. Sustainment

a. Sustainment is the provision of logistics and personnel services required to maintain and prolong operations until successful mission accomplishment and redeployment of the force.

b. **Sustainment Support to Space Operations.** Space operations sustainment is achieved through spacelift, satellite operations, space force reconstitution, and maintenance of a force of space operations personnel. Spacelift includes rockets, launch facilities, and ground personnel capable of placing satellites on orbit. Satellite operations maintain spacecraft in optimum orbits and in good mechanical health to ensure data streams continue uninterrupted to CCMDs. Space force reconstitution historically refers to plans and operations conducted to replenish lost or diminished space capabilities. This is usually

done through repositioning, reconfiguring, and augmenting satellites. Replenishment operations may have to address catastrophic situations such as an extensive attack via cyberspace, multiple ASAT weapons, exoatmospheric nuclear detonations, and cascading collisions causing second- and third-order fragmentations, rendering entire orbits unusable for years.

c. **Space Operations and Joint Sustainment.** PNT, ISR, SATCOM, and environmental monitoring support joint sustainment. Space-based environmental monitoring information provides regional weather, sea states, and terrain and ground stability and supports delivery of supplies and personnel. SATCOM supports logistics and communications networks and links supporting the COP. Space-based intelligence collection and environmental monitoring provide information for logistics route planning, timing, delivery methods, and locations. Space-based global navigation satellite systems (e.g., GPS, Galileo) provide PNT to civil and military users worldwide.

d. **Operationally Responsive Space (ORS).** An additional means for potentially replenishing the force is through ORS. ORS contributes to the development of low-cost, rapid reaction payloads, buses, launch, and launch-control capabilities, to fulfill joint military operational requirements for on-demand space support and reconstitution. ORS provides a means to synchronize and integrate space capabilities in time and purpose with the employment of other forces by the JFC. 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 National Security Presidential Directive [NSPD]-40, *US Space Transportation Policy*). In doing so, ORS balances the requirement to meet JFC urgent space needs with the need to innovate when adapting space capabilities to changing requirements. Strategic or long-term needs are not a primary focus of ORS.

18. Information

The information function helps commanders and staffs understand and leverage the pervasive nature of information, its military uses, and its application during all military operations. This function provides JFCs the ability to integrate the generation and preservation of friendly information, while leveraging the inherent informational aspects of all military activities to achieve the commander's objectives and attain the end state. The information function encompasses the management and application of information and its deliberate integration with other joint functions to influence relevant-actor perceptions, behavior, action or inaction, and human and automated decision making. Space operations and the employment of information-related activities are mutually reinforcing. Space supports the flow of information and decision making. It may also serve as an information-related activity essential to the delivery of specific information in the information environment. Conversely, information-related activities can generate effects that support achievement of space superiority.

For a more detailed discussion of joint functions, see JP 3-0, Joint Operations.

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CHAPTER III
COMMAND AND CONTROL OF JOINT SPACE OPERATIONS

"And the fog of war will not easily clear in that fight, because future adversaries will employ new tools as well, exploiting any cyber[space] and space vulnerabilities they can find and try to negate our advantages in those domains."

Admiral James A. Winnefeld, Jr. Vice Chairman, Joint Chiefs of Staff
October 2013

1. General

Clearly defined command relationships are crucial for ensuring timely and effective execution of space operations in support of CCDR objectives. CDRUSSTRATCOM advocates, plans, and executes military space operations and has the responsibility of prioritizing, deconflicting, integrating, and synchronizing military space operations with current and planned joint operations. SCA is a specific type of coordinating authority delegated to a commander or a designated individual for coordinating specific space functions and activities. The SCA requests and integrates theater-specific space operations and capabilities. Common understanding of command relationships is essential to the conduct of effective joint space operations throughout the OE.

2. Commander, United States Strategic Command

a. CDRUSSTRATCOM exercises combatant command (command authority) over assigned space forces and assets to ensure availability of space capabilities to the joint warfighter. CDRUSSTRATCOM delegated tactical control (TACON) of assigned space units to the JFSCC.

b. **JFSCC.** USSTRATCOM is the only CCMD with a space component. The JFSCC coordinates, plans, integrates, synchronizes, executes, and assesses space operations, as directed by CDRUSSTRATCOM, and facilitates unified action for joint space operations. CDRUSSTRATCOM has delegated SCA to the JFSCC to plan space operations in operational-level support of USSTRATCOM's Unified Command Plan responsibilities.

(1) **JSPOC.** On behalf of the JFSCC, the JSPOC:

(a) Ensures optimization and availability of critical space services to support global users.

(b) Conducts operational-level space C2 support for assigned missions on behalf of the JFSCC.

(c) Provides oversight of strategic missile warning and theater-level support to inform the space COP that is shared with CCDRs.

(d) Plans, directs, controls, integrates, and assesses space operations on behalf of CDRUSSTRATCOM and the JFSCC.

(e) Provides theater reachback to facilitate coordination and support to theater SCAs.

(f) Exercises C2 of military space operations.

(g) Conducts day-to-day operations, as directed by the JFSCC. When a space-related incident or contingency requires additional space capabilities to fulfill joint functions, the JSPOC assesses the situation, coordinates with the affected CCDR, and notifies the appropriate operations centers within USSTRATCOM and the National Military Command Center, as necessary.

(h) Conducts day-to-day operations as the primary sensor manager for missile warning sensors, ensuring effective coverage to provide timely, accurate, and continuous warning of impending threats.

(2) **National Space Defense Center.** Integrates DOD, multiple agencies, and IC personnel and authorities (as granted by Title 50, United States Code [USC]) to enable unified space defense. The National Space Defense Center executes mission orders received from the joint space tasking order (JSTO) and NRO space tasking order.

(3) **Joint Navigation Warfare Center (JNWC).** The JNWC plans, tasks, integrates, provides C2, and supports integrated NAVWAR worldwide. C2 is conducted day-to-day, through reachback capabilities and deployable SMEs, in support of CCDRs. Assistance is provided via the JNWC NAVWAR support cell, coordination cells, and deployable theater coordination cells. CCDR requests for NAVWAR capabilities are supported by USSTRATCOM components after deconfliction and prioritization of ongoing missions.

(4) **Missile Warning Center (MWC).** The MWC coordinates, plans, and executes worldwide missile, nuclear detonation, and space re-entry event detection to provide timely, accurate, and unambiguous strategic warning in support of the US and Canada. CDRUSSTRATCOM, through the MWC and a network of satellite and ground sensors, provides timely, accurate, and continuous detection and warning of impending ballistic missile threats at the strategic and theater levels and warning and attack assessment on space assets. The MWC also performs a backup role of sensor manager to the JSPOC.

(5) **Joint OPIR Planning Center.** The Joint OPIR Planning Center is a joint endeavor between USSTRATCOM, the JFSCC, and NGA. The OPIR Planning Center develops integrated OPIR collection and exploitation strategies and plans for OPIR sensors (both IC and DOD sensors) in support of missile warning, missile defense, awareness of the OE, technical intelligence, and civil/environmental mission areas.

(6) **SATCOM Integrated Operations Environment.** The SATCOM integrated operations environment is the key coordination point for the SATCOM enterprise, synchronizing and integrating cross spectrum and multi-domain information, orchestrating communications restoration, and delivering actionable options to the JFSCC.

(7) **Air Force Space Aggressors.** On behalf of the JFSCC and in support of CCMDs, the space aggressor squadrons prepare joint forces and multinational partners to fight in and through contested space environments through analysis, teaching, and replication of realistic, relevant, and integrated space threats.

For more information on space support, see Appendix A, "Additional Space Support Related to the Joint Force."

3. Services

a. The USAF conducts space operations to achieve space superiority for the US as a Service core competency. The USAF has space operations units, ranging from detachments and squadrons to a numbered air force (14th Air Force), with an AOC and a major command (AFSPC). The USAF integrates and optimizes space operations and capabilities for theater-level joint operations through its specially trained space operators, who are assigned to Service and joint billets at all echelons and integrated in key CCMD operational and planning elements. These space operations personnel include senior leaders whose space operations backgrounds enable them to lead and advise as DIRSPACEFORs, as well as space operators serving as operational planners and/or deployed for AOR-specific space operations. The DIRSPACEFOR is a senior USAF leader with depth and breadth of space operations expertise and familiarity with theater-level operations and processes. AFSPC ensures senior leaders selected as DIRSPACEFORs receive the latest information and guidance on space operations and resources and coordination processes pertinent to AOR operations. The COMAFFOR also provides theater-specific guidance and orientation. The DIRSPACEFOR and space operators integrated in COMAFFOR and/or JFC staffs advise and facilitate coordination, planning, execution, and assessment of space operations and COAs for the COMAFFOR. They may also oversee and facilitate tasks required for the execution of the JFC's SCA. The COMAFFOR can also direct the DIRSPACEFOR to provide senior leader advice on USAF space operations and forces concerning AOR operations. When the COMAFFOR serves as the JFACC, the DIRSPACEFOR may be tasked to guide and advise the COMAFFOR/JFACC's staffs in accomplishing routine responsibilities and to lead day-to-day activities such as joint space working groups. Space cells, space planners, and space operations-focused operational planning teams typically accomplish the day-to-day duties associated with coordination of space operations.

b. The US Army conducts space operations and leverages capabilities for joint land operations to integrate space capabilities across all echelons and all joint functions. The Army provides SATCOM; conducts satellite operations, space control operations, space support, and missile defense operations; and provides planning, integration, control, and coordination of Army space forces, capabilities, and effects. The US Army Space and Missile Defense Command/Army Forces Strategic Command is the Army Service component command to USSTRATCOM for space forces and provides these space capabilities:

(1) Conducts satellite operations, including transmissions control, payload control, EMI detection, and protection mechanisms to ensure access for all military

SATCOM users through five dispersed, wideband SATCOM operations centers. They operate four multi-Service, multi-agency, regional satellite communications support centers to provide theater communication planners with a single POC for satellite access planning of military narrowband, wideband, protected band, and commercial SATCOM support.

(2) Acts as the consolidated SATCOM system expert for all military ultrahigh frequency SATCOM to provide active payload management, ensure nominal operations of satellites transmission and payloads, and provide support to all military SATCOM users.

(3) Provides space-based missile detection capabilities, providing warning of enemy ballistic missile launches via the joint tactical ground station, which receives direct downlink OPIR data and then processes and disseminates ballistic missile warning notification to joint forces and Tier 1 command centers. Transportable ground radars are strategically located to provide warning and threat characterization in support of US homeland defense and theater ballistic missile defense.

(4) Integrates SATCOM and PNT to provide continuous FFT to CCDRs, agencies, allies, and multinational partners. FFT improves situational awareness by providing the location and movement of force assets equipped with devices that transmit position location information to the theater COP. The FFT mission management center ensures all information delivered to theater COP is accurate, timely, and actionable. The center ensures complete system operations for emergency message alerting, notification, and execution of position location capabilities such as tagging, tracking, and locating.

(5) Uses SSEs at the Army, corps, and division echelons, as well as special forces groups. SSEs are directly involved in headquarters staff planning and targeting processes and coordinate with the commander or SCA on procedures for space support requests and reachback support. SSEs develop COAs and integrate space assets to meet commander's intent. They identify the utility of employing space capabilities, coordinate those capabilities through the commander or SCA, and integrate them into current and future joint operations. ARSSTs support SSEs, normally at the Army and corps levels, when additional staff capacity or particular mission area expertise is required, and assist units without organic SSEs such as theater sustainment commands, joint task forces, and MEFs.

c. The USMC integrates space capabilities for use in decentralized combined arms operations, providing strategic agility and tactical flexibility over their adversary during the various forms of operations conducted by a Marine air-ground task force (MAGTF). The USMC has a limited number of dedicated space officers serving in various Service and joint billets. These billets include dedicated operational space billets assigned to an MEF, located within the operation directorate of the staff and the MEF information group. These officers are directly involved in the planning and execution of MAGTF operations by integrating space-based capabilities and effects via coordination with the theater SCA. Historically, the USMC often receives additional space support from ARSSTs and SSE assets when assigned to a joint force land component, and from the

MOCs, SSWGs, and/or Naval Network Warfare Command space directorate, when assigned to a joint force maritime component. The USMC continues to develop its space cadre to provide support to plan, train, and operate for the MAGTF and joint force.

d. The USN conducts space operations and has the ability to contribute to the achievement of space superiority for Commander, Fleet Cyber Command (COMFLTCYBERCOM). COMFLTCYBERCOM serves as the USN central operational authority for USN networks, cryptology, SIGINT, IO, cyberspace, EW, and space. Commander, Tenth Fleet, serves as the numbered fleet commander for Fleet Cyber Command and exercises operational control (OPCON) of assigned Navy forces. The Navy Network Warfare Command is designated to execute tactical-level C2 to direct, operate, maintain, and secure Navy communications and network systems for DODIN and to leverage joint space capabilities for Navy and joint operations as assigned by Commander, Tenth Fleet.

(1) The USN integrates space capabilities through the Navy component commanders' and fleet commanders' MOCs. MOCs support all assigned operational missions and provide C2 of assigned forces and employment recommendations to the respective CCDR. Within the MOC, the SSWG provides support to all warfare areas, planning teams, and decision forums where space systems and services impact operations. The SSWG coordinates with the SCA (or designated representative) as required and ensures space-based capabilities and vulnerabilities are included in all planning.

(2) The USN is DOD's lead Service for narrowband SATCOM, performing satellite operations from the Naval Satellite Operations Center. The Naval Satellite Operations Center operates, manages, and maintains three satellite constellations and ground systems, to include the Naval Satellite Control Network. These provide enduring global space support, in direct support of USN forces, the joint warfighter, and interagency partners.

4. Combatant Commander

a. CCDRs have the authority to utilize assigned or attached space forces to best accomplish their assigned mission. Space operations personnel directly supporting a specific CCDR from day to day are usually limited in number; therefore, the CCDR may request additional support from USSTRATCOM if required by the mission. The CCDR assigns responsibilities, establishes appropriate command relationships, and establishes coordinating instructions (e.g., for the execution of SCA).

b. CCMDs have Service-assigned space operations staff at multiple echelons to serve as theater space advisors and integrators of space capabilities. CCDRs may assign space experts to their component staffs. JFCs and their components request space operations and capabilities specific to their mission during the planning process to ensure sufficient space capabilities are available to accomplish objectives. Each Service uses different means to provide space expertise to satisfy the CCMD Service component's space requirements. Many factors will determine the amount of space capability required

for the JFC, most notably the type of operation, sophistication, and level of threats, and JFC organic capabilities to accomplish the mission. Space professionals and forces can be requested by the JFC through the request for forces (RFF) and time-phased force and deployment data (TPFDD) processes. OPCON or TACON of JFC-attached space expertise and forces will be coordinated between the JFC and CDRUSSTRATCOM and is typically documented in a SecDef order. USSTRATCOM will coordinate JFC support to conduct operations for mitigation or elimination of adversary threats to space systems. In these cases, CDRUSSTRATCOM would typically be the supported commander for protection of friendly space operations and capabilities (e.g., a terrestrial-based threat to space capabilities), while the CCDR would be the supported commander for all other terrestrial operations. Synchronizing the unique capabilities and limitations of the DOD space force is critical to achieving unity of effort. To that end, DOD space forces need to be integrated alongside the other instruments of national power to forge unity of effort through a whole-of-government approach to meet US national security objectives.

5. The National Reconnaissance Office

a. The NRO is a DOD agency and a member of the IC. The Director, National Reconnaissance Office, reports to both the Director of National Intelligence (DNI) and SecDef. The NRO is responsible for research and development; acquisition, launch, deployment, and operation of overhead systems; and related data processing facilities to collect intelligence and information to support national and departmental missions and other USG needs. NRO activities support warning intelligence, monitoring of arms control agreements, access to denied areas, and the planning and execution of military operations. The NRO provides direct support to the CCMD joint intelligence operations centers.

b. The NRO executes its core operational functions (space operations, enterprise information technology management operations, and facilities and infrastructure operations) via the NRO Operations Center.

6. Space Coordinating Authority

a. The SCA within a joint force helps coordinate joint space operations and integrates space capabilities and effects that support the CCDRs. SCA is a specific type of coordinating authority delegated to a commander or a designated individual for coordinating specific space functions and activities. A commander (when delegated SCA from the CCDR) integrates space capabilities and coordinates joint space operations in the operational area. Based on the complexity and scope of operations, the CCDR can either retain SCA or delegate it to a component commander (or other individual). In selecting the appropriate option, the GCC considers the mission, nature, and duration of the operation; preponderance of space force capabilities made available; and resident C2 capabilities (including reachback). The commander or designated individual with SCA has responsibility for joint space operations and participating in the joint planning process, to include ascertaining space requirements within the joint force.

b. The individual with SCA gathers operational space capabilities requirements and facilitates the use of established joint force staff processes to plan and conduct space operations within the context of joint operations. The JFC develops and provides a prioritized list of space support requests based on joint force objectives. Examples of typical space requirements include requests for space forces (e.g., deployed space forces), requests for space capabilities (e.g., support to personnel recovery operations), and requests for implementation of specific command relationships. Once approved by the CCDR, the list is coordinated through the SCA. However, individuals exercising SCA keep their respective commanders apprised of all such coordination activities to ensure space activities are coordinated, deconflicted, integrated, and synchronized. In summation, the SCA:

(1) Coordinates space capabilities to support joint functions.

(2) Plans, coordinates, and synchronizes space operations in the operational area and ensures inputs from the JFC's organizations are incorporated.

(3) Consolidates space requirements and provides the operational requirements to the JFSCC.

(4) Leads coordination for space-related target development, vetting, and validation to the JFC's target nomination list.

(5) Submits RFFs and TPFDD requests through the CCDR to the Joint Staff for joint space professionals to augment a JFC's staff during crisis escalation or CONOPS activation.

(6) Directs RFIs for ISR or SATCOM to the intelligence directorate of the joint staff and communications systems directorate of the joint staff, respectively.

7. Supported and Supporting Command Relationships

a. SecDef establishes support relationships among CCDRs for the planning and execution of joint operations. A supported CCDR requests capabilities, tasks supporting DOD components, coordinates with the appropriate USG departments and agencies, and develops a plan to achieve the objective. Supporting CCDRs provide the requested capabilities, as approved by SecDef, to assist the supported CCDR to accomplish missions requiring additional resources.

b. USSTRATCOM provides both direct and general support to CCMDs for space operations. However, a GCC may require TACON or OPCON of specified space forces for an operation, based on situation or mission parameters. GCCs have the following responsibilities:

(1) Establish specific joint force guidance and objectives for space operations. This guidance is integrated into appropriate plans and orders.

(2) Specify space control objectives and provide guidance for the employment of C2 systems, communications systems, intelligence, and logistics. This guidance should be reflected in appropriate plans and orders.

(3) Use SCA and other authorities to plan, integrate, and coordinate space operations within the AOR and between CCMDs.

(4) Protect space operations and capabilities operating within their AORs.

c. JP 3-09, *Joint Fire Support,* describes fire support coordination requirements. One such requirement dictates that units do not fire across operational area boundaries unless the fires are coordinated with the adjacent unit. Additionally, when electromagnetic or directed energy fires affect an adjacent unit, coordination with that unit is essential. Consequently, with the exception of missile defense operations to defeat enemy ballistic missile attacks in their AOR, actions and fires that have the potential to generate unintended effects in the SJOA should be coordinated between the executing CCDR and CDRUSSTRATCOM.

8. Liaison

Effective coordination is vital to facilitate integration of space operations and capabilities across the joint force. Space professionals on Service and joint functional component staffs ensure JFCs and their staffs have a common understanding of space operations and how they should be integrated with other military operations to achieve unity of effort and meet US national security objectives. The SCA may require additional liaison with other organizations such as joint force headquarters, major subordinate commands, and MNFs.

9. Control and Coordination Measures

a. CDRUSSTRATCOM is usually the supported commander for space operations. CDRUSSTRATCOM integrates, synchronizes, and coordinates joint space operations globally. CDRUSSTRATCOM coordinates with other commanders, space operators, and agencies for protection priorities, target priorities, effects, and timing. For most DOD space operations, control and coordinating measures are primarily accomplished through applicable guidance from higher headquarters (HHQ), CDRUSSTRATCOM, and the JFSCC.

(1) The JFSCC normally exercises TACON over space forces made available for tasking. Unless otherwise specified, other commanders, as well as directors of other USG organizations, retain control over their personnel. This requires close coordination between the JFSCC and the commanders and/or directors to synchronize space operations.

(2) The responsible CCDRs coordinate and establish support relationships between the JFSCC and CCMD components to facilitate space operations.

b. **Coordination Measures**

(1) USSTRATCOM components, CCMDs, and organizations supporting military operations within the SJOA maintain shared SSA to the greatest extent possible through the JFSCC and coordinate (except for established GCC exceptions) with CDRUSSTRATCOM when utilizing capabilities in, from, or through the SJOA.

(2) CDRUSSTRATCOM coordinates with supported CCDRs to determine requirements to prioritize and synchronize space operations.

10. Homeland Defense and Defense Support of Civil Authorities

Space operations are vital to effective homeland defense and defense support of civil authorities. US Northern Command and US Pacific Command provide forces, including space operations and personnel, for both. For more information, see JP 3-27, *Homeland Defense,* and JP 3-28, *Defense Support of Civil Authorities*.

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CHAPTER IV
PLANNING AND ASSESSMENT OF JOINT SPACE OPERATIONS

"No combatant commander can do it all. It requires us all to work together, as part of our whole-of-government effort, so that we can provide the nation with the requisite capability for our national security."

Admiral Cecil D. Haney Commander, United States Strategic Command
March 24, 2015

SECTION A. PLANNING

1. Joint Space Operations Planning Overview

a. The space operations planning environment is complex. Space capabilities must be thoroughly integrated into every aspect of joint planning long before operations begin and be executed in such a way as to ensure security and defense of prioritized assets. It is constrained by physical attributes (i.e., orbital dynamics), the multiplicity of actors (DOD; IC, other USG departments and agencies; allied, commercial, and foreign partners), and C2 relationships. Space forces typically support multiple CCDRs and the joint functions simultaneously and throughout multiple OEs.

b. At the strategic level, planners provide space capabilities in concert with US national security priorities and are directed toward achieving national security goals and objectives. In addition to planning for joint space operations, DOD space planners also consider the ongoing interaction with other USG departments and agencies, allies, and the commercial sector. Planners coordinate and cooperate to ensure strategic-level DOD planning is consistent with, and supports the requirements of, these organizations as they conduct their respective national security tasks. Additionally, strategic planners must understand space capabilities from other government organizations, allies, academia, and the commercial sector and the processes required to integrate those capabilities to support joint space operations. Strategic-level planners anticipate changes in the OE and advocate for responses to those changes years before they are required, because of the long lead-time to place satellites on orbit. Coordination with non-DOD organizations for unity of effort and synchronization of requirements is essential to space operations planning. Finally, strategic planners support CCDRs and the Joint Staff through the global force management process in determining how to balance limited global space capability in a contested space environment.

c. Operational-level planners translate JFC objectives into supporting actions and effects. Throughout this process, space planners must balance operational-level requirements to support the current terrestrial operation with strategic-level requirements to preserve space capabilities for other times and places. In recognition of this need for balance and of the growing threat to spacecraft, commanders and their staffs should plan for degraded space operations. A clear articulation of minimum essential space capability by phase promotes the appropriate balance and provides a well-defined roadmap for collaboration between operational space units.

d. If direct liaison is authorized, operational space units may coordinate directly with counterparts, POCs, and users at various levels, performing their units' portion of space operations effectively, within the broader context of global operations. This tactical integration is governed by established procedures and results in the responsive decentralized execution of space operations supporting joint, multinational, and interagency operations around the globe. This dynamic, real-time coordination and provisioning of space operations and capability is executed within the structures of operational and strategic plans.

e. Direct and rapid feedback on space operations effects from operators throughout the OE is critical for the planning of space operations at all levels, especially in a contested environment. Feedback from operational users ensures space operations are timely and accurate as part of the joint fight. User feedback often serves as the first indication of space assets being targeted.

2. Joint Planning Process

a. Commanders coordinate space operations through plans and orders at all levels of warfare. Plans should address how, when, and where to effectively perform space missions, integrate space capabilities with other systems, maximize use of limited space assets, protect and defend space assets, consolidate operational requirements for space capabilities, and, as directed, counter an adversary's use of space and space operations.

b. During mission analysis, planners identify specified, implied, and essential tasks for space forces. Additionally, the threat's capabilities, including their ability to impact our space forces and their use of space capabilities, are considered in joint intelligence preparation of the operational environment (JIPOE). Finally, military planners identify those space forces and capabilities that are the threat or friendly centers of gravity.

(1) **CDRUSSTRATCOM.** CDRUSSTRATCOM leads DOD space operations planning, ensures planning supports, and is synchronized with CCMD plans. CDRUSSTRATCOM ensures space plans support national policy and strategy objectives. CDRUSSTRATCOM plans for the defense and protection of the SJOA and the creation of space effects. The JFSCC is responsible for conducting space operations to defend the SJOA and for creating theater and global space effects on behalf of CDRUSSTRATCOM. JFSCC support plans translate CDRUSSTRATCOM numbered plans into executable operation plans.

(2) **Other CCDRs.** The GCCs and other functional CCDRs should synchronize joint planning and, with CDRUSSTRATCOM's assistance, integrate space operators and planners, capabilities, and considerations into campaign plans and OPLANs. Space planners at CCMDs, and their components, develop objectives for space operations that enable the supported JFC's mission. These planners also coordinate their objectives with USSTRATCOM's plans and campaign objectives to develop a cohesive, integrated, and synchronized product. They will coordinate with other space experts (e.g., field representatives, liaisons) in theater planning.

See JP 5-0, Joint Planning, *for further details.*

(3) **Integration of Non-DOD Capabilities.** Non-DOD space capabilities provide a significant contribution to joint operations. Entities and organizations providing such capabilities interact with terrestrial forces at the tactical-through-strategic levels, through established procedures, but usually do not subscribe to DOD planning constructs. Joint planners should consider and document non-DOD capabilities in major OPLANs through interorganizational cooperation.

3. Key Planning Considerations

a. Planners consider HHQ planning directives and strategic guidance; the commander's initial planning guidance, which may include a description of the OE; a definition of the problem; the operational approach; initial intent; and the JIPOE. Command relationships and authorities for space assets and units require special consideration, as they may vary from traditional relationships and authorities, as detailed in Chapter III, "Command and Control of Joint Space Operations."

For information on understanding HHQ planning directives, strategic guidance, and commander's intent, see JP 5-0, Joint Planning.

b. Additional planning considerations for space operations include:

(1) **National Space Policy.** This policy provides governing principles for the US approach to operations in the space domain. In some cases, national policy dictates provision of military space capabilities for use by civilian users. For example, the USG is committed to minimizing impact to peaceful civil use of GPS outside of operational areas. JFCs should be aware of this commitment and factor this constraint into operational planning.

(2) **DOD Space Policy.** DOD space-related activities are designed to deter aggression, promote stability and responsible use of space, integrate space capabilities, and improve mission assurance.

See Department of Defense Directive (DODD) 3100.10, Space Policy.

(3) **Global Reach.** The orbital motion and high altitude of space systems offer an outstanding vantage point to serve CCDRs in multiple AORs around the world. Satellite constellations employing communication relay and cross-links provide near-instantaneous connectivity around the world.

(4) **Persistence.** Persistent access provides predictable coverage of an AOI. Geosynchronous orbits provide continuous access to approximately one third of the Earth's surface. HEO and MEO systems provide significant dwell time for satellites; constellations of a relatively small number of satellites in these orbits can provide global persistent access. However, because coverage patterns of such systems can be easily determined, any gaps may provide a threat with a predictable window of opportunity to perform unobserved activity. Most space-based intelligence collection capabilities consist of multiple satellites operating in concert, or supplemented by other sensors, when continuous surveillance of an area is desired.

(5) **Space and Terrestrial Weather.** Planners should consider the impact of space and terrestrial weather on space systems and identify the environmental limitations of those space systems. These impacts may include temporary disruption or denial of signals, anomalous or spurious information, or even permanent degradation of spacecraft capability. Terrestrial weather can degrade the effectiveness of electro-optical, space-based sensors; interfere with ground-based, electro-optical system ability to conduct SSA; and impede higher-frequency SATCOM uplink/downlink signals during moisture-producing storms. Planners must consider space and terrestrial weather effects when developing collection and contingency plans.

(6) **Integration of Space Operations with Other Operations.** Rarely are space operations conducted independently of other joint operations. Planners need to remain cognizant of the ways operations in space affect, or have the likelihood to impact, concurrent joint operations on land, at sea, in the air, and/or within the information environment. Likewise, traditional military planners should recognize and understand the full scope of warfighters' ubiquitous reliance on space operations to enable mission success.

c. Space planners also consider the following when planning space operations:

(1) **Resource Considerations.** Space assets may provide high-demand, low-density capabilities that may be called on to support multiple GCCs in multiple AORs simultaneously. In addition, these capabilities may also be providing global support to national priorities and to shaping operations and peacetime users. Additionally, planners must consider the limited options available to space operators when systems experience malfunctions or require on-orbit maneuvers.

(a) Planners should consider the multi-mission nature of many space systems. For example, some missile warning sites provide a secondary capability of space surveillance. Finding creative methods of exploiting existing systems for potential secondary uses may alleviate gaps in resources.

(b) Space capabilities are apportioned and allocated according to established and validated priorities allowing the most effective and efficient use for the joint force.

(c) CJCSI 6250.01, *Satellite Communications,* describes the priority and precedence for SATCOM.

(d) Design intricacies and constrained launch schedules result in long lead-times to replenish or replace space assets if lost, destroyed, or inoperable. Planners should recognize this and incorporate it into branch plans accordingly, recognizing that resources may be unavailable for the duration of a specific operation or campaign. Planners should identify critical nodes and alternate capabilities to allow for mitigation of a loss of capability.

(e) Planners and operators must also consider the limited power and propellant resources available to orbiting spacecraft. On-orbit maneuvering and high-

power demands may reduce the life span of a spacecraft, possibly decreasing availability of a valuable capability during future operations.

(f) Operational contract support is the process of planning for and obtaining supplies, services, and construction from commercial sources in support of joint operations. DOD increasingly relies on contractors to perform various functions and tasks, some of which are not organic capabilities found in the active or reserve forces structure. Many of the commercial sources that support space operations are high-demand and low-density; therefore, planners need to consider procurement lead-time as they conduct their requirements-development planning.

d. Legal Considerations

(1) Space activities and operations must comply with the law of war and any other applicable treaties or international agreements to which the US is a party, with all applicable domestic law and policy, and with any applicable host nation laws. Legal counsel participates during all stages of space operations planning and execution, assessing compliance with applicable legal requirements and providing guidance, as required.

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

(3) **Multinational Space Operations.** Space capabilities are increasingly important to all nations and many NGOs for socioeconomic stability. Even the smallest of nations uses commercial space imagery, SATCOM, and other services to improve quality of life and for national security. Our multinational partners use space capabilities across the range of military operations, and joint planners at all levels should consider their capability when planning operations. Multinational partners and commercial services can provide significant contributions to space operations and should be included when planning and executing operations. This support is generally provided directly to the requesting CCMD.

4. Joint Targeting

a. Joint targeting is a fundamental task of the fires function that encompasses many disciplines and requires participation from all joint force staff elements and components, to include space planners. Every target has distinct value and is identified by multiple means relative to the OE. Space assets, and the warfighters who control those assets, must be an integral part of the targeting process to understand objectives and the space capabilities required to support those objectives. This ensures target development and selection are based on the supported commander's desired end state.

b. Planners must understand the targeting process to maximize space effects by ensuring space requirements are receiving full consideration. The Services have space operational planning POCs, which include the geographic CCMD SCAs, USAF DIRSPACEFORs, AOCs' combat plans division space planners, Army SSE, Marine Corps space operations officer, and Navy SSWG. Collectively, they must understand the CCMD

planning process and nominate targets into the CCMD targeting cycle, as necessary. Further, they serve as the conduit of information to USSTRATCOM to nominate candidate targets in support of the GCC's mission.

For more information on the process of selecting and prioritizing targets and matching the appropriate response to them, see JP 3-60, Joint Targeting.

5. Plans and Orders

a. Specific to space operations, the JFSCC produces plans/orders for the management of assigned space forces through the JSTO. The JSTO and special instructions (SPINS) direct space forces, assign tasks to meet joint force operational objectives, and synchronize space operations with other CCMD operations (see Figure IV-1).

b. The operational planning cycle includes inputs into the joint targeting cycle, as depicted in Figure IV-1. For more information on the joint targeting cycle, see JP 3-0, *Joint Operations,* and JP 3-60, *Joint Targeting.* The space operations directive captures the JFSCC's guidance and intent. The space operations directive conveys prioritization and apportionment guidance focused on the applicable execution period. This is then used to form the master space plan. The master space plan is used to allocate resources to each desired effect and serves as the source to generate unit tasking and coordination within the JSTO and SPINS. The JSTO tasks execution and the SPINS provide amplifying guidance.

(1) The planning process may significantly compress during a crisis or to support major combat operations. In periods of conflict, the JSTO cycle may compress from a 30-day production cycle to synchronize with the supported GCC's air tasking order cycle.

(2) The JSTO transmits the JFSCC's guidance and priorities for a short-duration timeframe, assigns tasks to meet operational objectives, and, when required, synchronizes and integrates JFSCC activities with other CCMD operations.

SECTION B. ASSESSMENT

6. Joint Space Operation Assessment Overview

a. Assessment, as discussed in JP 5-0, *Joint Planning,* is a continuous process that measures the overall effectiveness of employing joint force capabilities during military operations and the expected effectiveness of plans against contingencies as the OE changes. Operation assessment supports decision making by measuring the progress toward accomplishing a task, creating an effect, achieving an objective, or attaining a military end state.

b. The assessment of space operations should measure their effectiveness. The space operations assessment should nest within the larger operational assessment of the supported commander. When space operations constitute the main operation, the assessment should provide feedback to the JFSCC concerning the effectiveness of the space operations in achieving the required objectives or attaining the end state.

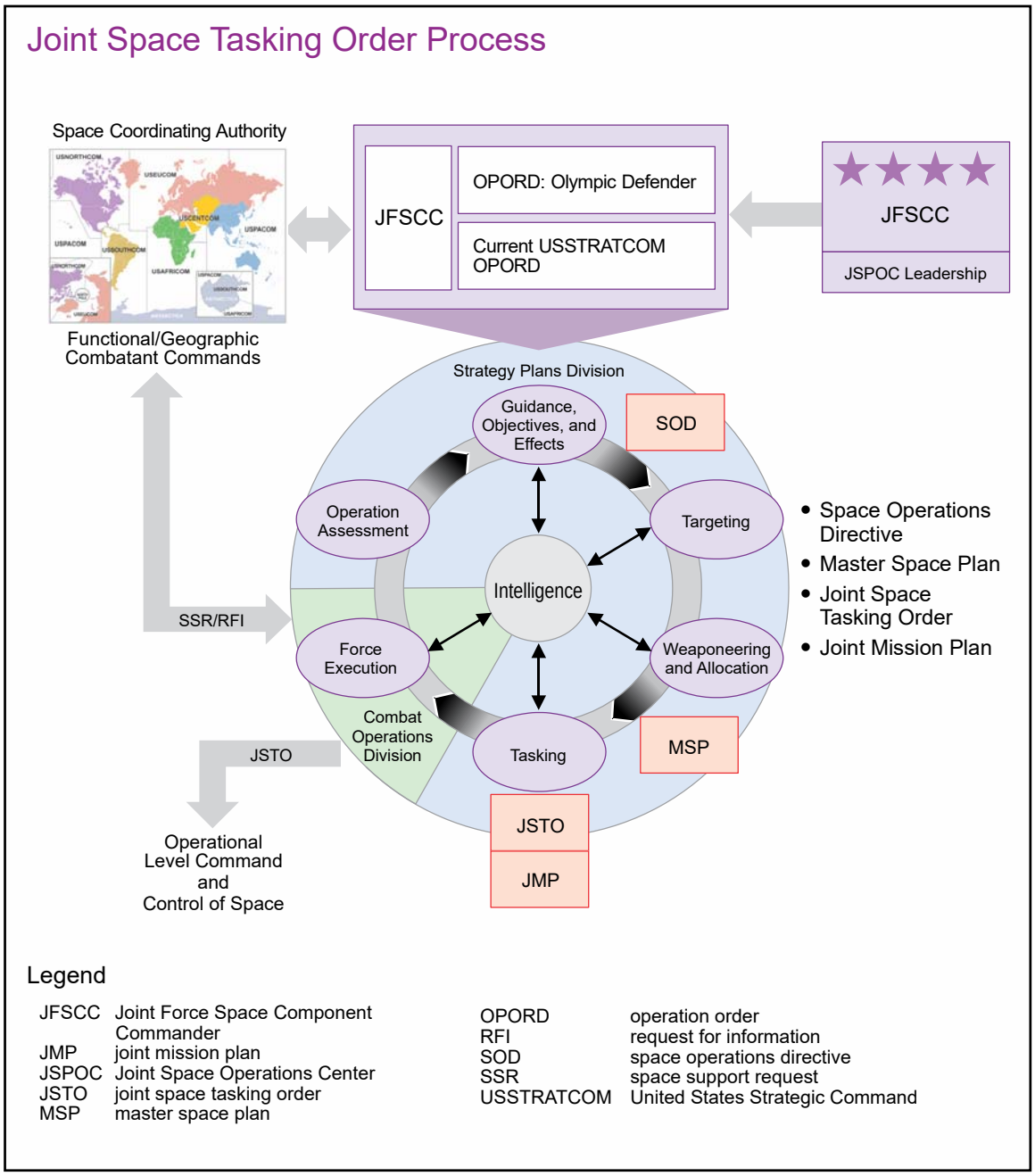

Figure IV-1. Joint Space Tasking Order Process

c. USSTRATCOM is the lead DOD organization for conducting the space functional campaign plan operations assessment. Other CCMDs support space operations assessment by providing any requested data to help assess mission success or failure. A collaborative effort across DOD in supporting space operations assessment makes the process efficient and the products timely and effective for the joint force.

d. Assessment involves deliberately comparing forecasted outcomes to actual events to determine the overall effectiveness of force employment. In general, space operation assessments should answer two questions:

(1) Are the correct space operations being conducted?

(2) Are the space operations being conducted effectively?

e. During the planning process for space operations, operation assessment can inform the JFSCC's decision concerning the best way to employ limited resources in support of military operations. As specific space tasks are identified in planning, specific measures of performance (MOPs) and/or measures of effectiveness (MOEs) should also be identified to assess each space task. Figure IV-2 shows an example of an MOP and MOE for a space operations task.

f. Space tasks may change from phase to phase of an operation, based on the required space support. All military operations will require some level of space support, to include electromagnetic, PNT, SATCOM, and SSA. Each item of space support should have the appropriate MOP or MOE developed to provide a means to assess the space operation task. As space operations progress, the assessment of the MOPs and MOEs for space tasks will guide the decision to adapt plans and resources for future space operations in support of achieving the required objectives.

g. For multinational operations, the assessment process for space support should nest within the larger operation assessment process. Assessors should tie all partner nations' space support to specific space tasks and the appropriate MOP and/or MOE developed for the assessment process.

For more information on assessment, see JP 5-0, Joint Planning.

Example Space Operations Task	
Objective	Support the joint force commander in command and control of military operations.
Task	Provide uninterrupted military satellite communications (MILSATCOM) worldwide.
Measure of performance	Percent of MILSATCOM availability in the theater of operations every 24-hour period.
Measure of effectiveness	MILSATCOM availability supports US military operations success.

Figure IV-2. Example Space Operations Task

APPENDIX A
ADDITIONAL SPACE SUPPORT RELATED TO THE JOINT FORCE

1. General

a. DOD space operations and capabilities cannot always satisfy CCDRs' requirements. National, foreign, civil, and commercial capabilities supplement DOD space capabilities, and the utilization of non-DOD space systems to meet requirements continues to grow. When requested, USSTRATCOM supports integration of DOD and non-DOD operations (e.g., CONOPS, TTP) to satisfy the supported CCDR's objectives.

b. By leveraging non-DOD capabilities, CCDRs can mitigate the consequences of lost, degraded, or limited DOD space capability and capacity, improving the joint forces' ability to operate in a degraded environment and/or with finite resources. Options include leveraging multinational, foreign, and/or commercial space and non-space capabilities, as well as use of hosted payloads on a mix of USG, commercial, and multinational platforms in different orbits.

c. Other USG departments and agencies acquire and operate space systems that are not under CDRUSSTRATCOM authority. CDRUSSTRATCOM seeks to facilitate unity of effort between the DOD and the IC by increasing information sharing across USG space operations, where and when appropriate, and will establish relationships with those USG departments and agencies as required. While USSTRATCOM and NRO operations utilize separate chains of command, the JFSCC and the NRO Mission Operations Directorate coordinate to ensure unity of effort and information sharing to synchronize DOD and IC space activities. NASA has launch facilities and environmental Earth science products potentially applicable to joint operations. NOAA, under the Department of Commerce (DOC), provides METOC information through the Polar-orbiting operational environmental satellites and the geostationary operational environmental satellites, data sharing and partnerships with foreign countries' systems, and other environmental monitoring systems. NOAA is able to locate distress alerts via the search and rescue satellite-aided tracking (SARSAT) system. Additionally, civil satellite programs such as automatic identification system and long-range identification and tracking contribute to homeland security through global tracking of shipping traffic.

2. Combat Support Agencies

a. The joint force uses DOD space capabilities supplemented by national, civil, and commercial partners. In most cases, the CCDR's staff requests support from the combat support agencies (CSAs). The SCA can work with or through USSTRATCOM to establish additional support.

b. The **Defense Information Systems Agency (DISA)** provides services and support for a wide range of missions, including communications, C2, cybersecurity, and DODIN services, and plays a key role in ensuring US capability to operate in space is maintained. The Director, DISA:

(1) Acquires commercial communications services, including commercial satellite network assets for DOD.

(2) Assists USSTRATCOM with cybersecurity for SATCOM services.

(3) Provides teleport or gateway sites to support capacity in space.

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

c. **NGA.** The NGA supports US national security objectives by providing timely, relevant, and accurate geospatial intelligence (GEOINT) to DOD, the IC, and other USG departments and agencies; conducting other intelligence-related activities essential for US national security; preparing and distributing maps, charts, books, and geodetic products; designing, developing, operating, and maintaining systems related to the processing and dissemination of GEOINT; and providing GEOINT in support of the combat objectives of the Armed Forces of the United States. The NGA is a DOD agency, a designated CSA, and an element of the IC.

(1) The NGA Director serves as the DOD GEOINT mission manager for all acquisition or exchange of commercial and foreign government-owned, imagery-related, remote sensing data for DOD. NGA also serves as the DOD lead for terrain environment modeling and simulation, coordinating with DOD modeling and simulation activities related to the geospatial aspects of natural and man-made features across the Earth, the atmosphere, and near-Earth space. As the DOD lead for GEOINT standards, NGA prescribes standards. NGA produces timely, relevant, and accurate GEOINT for the joint force. NGA manages satellite collection requirements and develops distribution protocols for the National System for Geospatial Intelligence (NSG) in accordance with the National Intelligence Priorities Framework.

(2) The NGA is also the functional manager for the NSG. NSG integrates technology, policies, and capabilities to conduct GEOINT in a multi-intelligence environment. The NGA provides GEOINT to support senior national decision makers and helps plan and prosecute military objectives. The NGA's strategy supports operational readiness through a set of geospatial foundation data. This 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.

(3) Per agreement between CDRUSSTRATCOM and Director, NGA, requests for OPIR utilize established NGA collection management processes. These requirements are managed, planned, and executed by the Joint OPIR Planning Center, a joint NGA and USSTRATCOM operations center.

For additional information on GEOINT, see JP 2-03, Geospatial Intelligence in Joint Operations. *For additional information on the NGA, see DODD 5105.60,* National Geospatial-Intelligence Agency (NGA).

d. **National Security Agency/Central Security Service (NSA/CSS).** The NSA/CSS leads the USG in cryptology that encompasses both SIGINT and cybersecurity activities and enables computer network operations to gain a decision advantage for the US and its allies under all circumstances. Central Security Service (CSS) conducts SIGINT collection, processing, analysis, production and dissemination, and other cryptologic operations. NSA/CSS provides SIGINT and cybersecurity guidance and assistance to DOD components, as well as national customers. The Director, NSA/Chief, CSS, serves as the principal SIGINT and cybersecurity advisor to SecDef, the Under Secretary of Defense for Intelligence, the DOD Chief Information Officer, the Chairman of the Joint Chiefs of Staff (CJCS), CCDRs, the Secretaries of the Military Departments, and the DNI, as well as other USG officials. NSA/CSS is designated a CSA of DOD and is also an element of the IC. NSA/CSS's SIGINT mission helps protect the nation by providing information in the form of SIGINT products and services that enable national-level leaders to make informed decisions and operate successfully. The joint force contacts the Integrated Radio Frequency Operations/Overhead Collection Management Center for support.

e. **Defense Intelligence Agency (DIA).** DIA, a DOD agency and element of the IC, provides intelligence support to all CCMDs for a variety of missions, including, but not limited to, all-source military analysis, measurement and signature intelligence (MASINT), human intelligence, counterintelligence, CO, IO, personnel recovery, peacekeeping and coalition support, warning, targeting, BDA, collection management, and intelligence support to operations planning.

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

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

(b) Facilitate and oversee the processing, exploitation, and dissemination of tailored and timely MASINT to help the joint force and national customers.

(c) Act as the senior defense-intelligence collection representatives and primary CCMD advocate for MASINT and technical collection capabilities.

(d) Characterize the OE, threats, and challenges and define technical and operational capabilities in support of DOD and IC planning.

(e) Conduct evaluations and assessments concerning space-based collection capabilities supporting the DOD Intelligence Information System.

(2) **Missile and Space Intelligence Center (MSIC).** MSIC is an element of DIA that produces finished, all-source scientific and technical intelligence in support of the CCMDs, Services, 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.

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

For additional information, see DODD 5105.21, Defense Intelligence Agency (DIA).

f. **Defense Threat Reduction Agency (DTRA).** DTRA is a CSA that enables DOD and the USG to prepare for and combat WMD and improvised threats and to ensure nuclear deterrence. DTRA programs include basic science research and development and operational support to US warfighters. This partnership is especially vital in developing and enhancing space capabilities for arms control and verification; chemical, biological, radiological, and nuclear (CBRN) defense and forensics; and CBRN response.

For additional information, see DODD 5105.62, Defense Threat Reduction Agency (DTRA).

g. **Defense Logistics Agency (DLA).** DLA functions as an integral element of the military logistics system, responsible for providing effective, efficient, and risk-mitigated worldwide logistics support to the DOD under conditions of peace and war, as well as to federal agencies, and when authorized by law or by agreement, state and local government organizations, foreign governments, and international organizations.

For additional information, see DODD 5105.22, Defense Logistics Agency (DLA).

3. Other Agencies and Organizations

a. The **NRO** is responsible for research and development; acquisition, launch, deployment, and operation of overhead systems; and related data processing facilities to collect intelligence and information to support national and departmental missions and other USG needs.

(1) The Director, National Reconnaissance Office, receives and implements SecDef and DNI guidance and direction by establishing strategic guidance policy and procedures for executing the NRO mission and accomplishing national security space responsibilities.

(2) The NRO designs, builds, and operates the nation's reconnaissance satellites, which are one of the primary collection sources for GEOINT data. The satellites also provide significant imagery to support DOD targeting and mapping requirements. Applications of this data include warning, monitoring of arms-control agreements, and the planning and execution of military operations. NRO field representatives are located within each of the CCMDs and serve as a direct link between the NRO and CCDRs and their staffs. NRO field representatives provide support covering pre-deployment training, education, weapon system integration, and dissemination of products and services.

For additional information, see JP 2-01, Joint and National Intelligence Support to Military Operations, *and DODD 5105.23,* National Reconnaissance Office (NRO).

b. **National Air and Space Intelligence Center (NASIC).** NASIC is a USAF organization that assesses foreign air and space threats. NASIC can provide deployed forces with unique aerospace intelligence capabilities for DOD operational commands, research and development centers, weapon acquisition agencies, and national planners and policymakers. In collaboration with other IC elements, NASIC's Counter Space Operations Cell provides foreign space threat intelligence supporting military operations and serves as the primary NASIC focal point for operational defensive counterspace support. As such, NASIC is an all-source intelligence integrator for intelligence relating to suspected purposeful interference and electronic attack directed against USG or allied space systems.

c. **National Ground Intelligence Center (NGIC).** The Director, NGIC, is responsible for intelligence concerning threat, ground-based, counterspace-related, and mobile EW systems; technical characteristics, performance, signatures, capabilities, limitations, and vulnerabilities of current and projected ground-based satellite jammers; and EW systems impacting space capabilities.

d. **NOAA.** A component of DOC, NOAA has many programs and products with military applications, including nearly all of its OE products.

(1) NOAA supports USG and civilian space weather customers through operations of the Space Weather Prediction Center (SWPC). In addition, SWPC partners with the 557th Weather Wing space weather production center to provide support to DOD. The two organizations work together to provide real-time monitoring and forecasting of solar and near-Earth space weather events that impact military operations. The 557th Weather Wing leverages SWPC's research and technique development capabilities to improve space weather support to military operations.

(2) NOAA's OE satellite system is composed of geostationary and polar orbiting satellites. Both kinds of satellites are necessary for providing a complete global weather monitoring system. The satellites also carry additional instruments that are used to support aviation safety and maritime/shipping safety, which can impact military operations.

(3) NOAA, in conjunction with the United States Coast Guard (USCG) and the USAF, operates SARSAT, a global search and rescue (SAR) system that detects and locates distress signals from emergency beacons carried by mariners, aviators, and land-based users. This information is relayed to SAR authorities around the world. SARSAT primarily supports civilian users. However, the system also supports military units, particularly in permissive OEs. Both the USAF and USCG rescue coordination centers receive SARSAT alerts for all US-coded beacons (globally) and all beacon alerts in the US SAR region. DOD use of the SARSAT system is discussed in DODI 3003.01, *DOD Support to Civil Search and Rescue (SAR).*

e. **557th Weather Wing.** The 557th Weather Wing delivers worldwide weather products to Air Force and Army warfighters, unified commands, national programs, and national-level authorities. The 2nd Weather Group delivers terrestrial, space, and climatological global environmental information to joint warfighters.

f. **USCG.** The USCG, through its USCG Navigation Center, monitors and reports on the differential GPS and nationwide automatic identification system signals, stations, and sites. The USCG, along with NOAA, NASA, and USAF, provides the governance, funding, management, and operation of the US SARSAT program.

For more information on USCG support to space operations, see 2017 Federal Radionavigation Plan *at https://www.navcen.uscg.gov/pdf/FederalRadioNavigationPlan 2017.pdf.*

g. **United States Naval Observatory (USNO).** USNO, a subordinate activity of the Naval Meteorology and Oceanography Command, provides precise time and astrometry information to DOD, USG departments and agencies, and the public. The USNO's mission focuses on four primary scientific disciplines tailored to support operations within DOD: precise time and time interval, astrometry, Earth orientation, and astronomical applications. Time signals produced and distributed by USNO are used to calibrate DOD systems, to include GPS satellites, secure Network Time Protocol servers, and other systems. USNO develops tools to integrate star catalogues into space surveillance planning and simulation applications. Finally, USNO leverages interagency and international partnerships to obtain astrometric and geodetic data needed to fill critical voids in the data used to support DOD.

4. Multinational Considerations

a. Multinational space operations provide the joint force opportunities to increase interoperability with and extend advantages to allies, to demonstrate responsible behavior in space and reassure allies of our commitments to mutual defense. Partnerships can enhance collective security capabilities and provide a deterrent effect against adversaries from attacking or interfering with friendly space capabilities. Space capabilities derived from a mix of DOD, commercial, and multinational platforms enhance the resilience of our overall national space enterprise and increase the ability of joint forces to operate effectively through a denied, degraded, or disrupted space OE. Allied and partner forces typically have the same vulnerabilities to space threats as the US, due to their equal reliance on space assets. It is important for joint planners to consider this when MNFs are involved in operations.

b. USSTRATCOM is participating in the multinational combined space operations effort to enhance cooperative space operations with allies and selected international partners. This effort focuses on building cooperation, collaboration, and integration of military space activities. Through the combined resources of interested countries, deterrence is strengthened, mission assurance is improved, and increased synchronization of existing capabilities is optimized. This effort extends to sharing information, data, and resources with militaries from partner nations.

c. The North Atlantic Treaty Organization (NATO) has integrated several space capabilities and established offices that coordinate specific programs. Supreme Headquarters Allied Powers Europe oversees most programs, such as coordinating with USSTRATCOM and US European Command for the SEW system. The NATO Consultation, Command and Control Board oversees the Consultation, Command and

Control Agency, which is responsible for NATO's commercial space imagery and SATCOM programs.

d. For most nations, the civilian and commercial sectors dominate space operations in the country. Therefore, civilian space agencies have often taken the leadership role for national space issues. The German Aerospace Center and the Indian Space Research Organization often issue national policies and strategies, which may not address military space operations. There are allied space operations centers, such as the European Union Satellite 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.

e. US forces rely extensively on foreign environmental satellite capabilities to augment military weather and oceanographic satellite data. Foreign geostationary environmental satellite data is essential for military operations in Europe and Asia and in the western-Pacific and Indian Oceans.

f. MNFs will have many of the same requirements as US forces for space operations and capabilities. 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 benefit multinational partners. Weather data is also readily available, as is GPS navigation support data. Of special importance is the provision for missile warning and defense against attack from ballistic missiles. USSTRATCOM is responsible, as part of an interagency process and in coordination with geographic CCMDs, for assisting in development of missile warning architectures and providing this information to MNFs under SEW.

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

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APPENDIX B
REFERENCES

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

1. Federal Law

a. Title 10, USC.

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

2. Strategy and Policy Documents

a. *National Security Strategy.*

b. *(U) 2018 National Defense Strategy.*

c. *(U) 2016 National Military Strategy.*

d. NSPD-27, *(U) US Commercial Remote Sensing Space Policy.*

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

f. Presidential Policy Directive-4, *(U) National Space Policy of the United States of America.*

g. *National Space Transportation Policy.*

h. *Unified Command Plan (2011).*

i. *National Security Space Strategy.*

j. *National Military Strategy for Space Operations.*

3. Department of Defense Publications

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

b. *DOD Global Positioning System Security Policy.*

c. DODD 3100.10, *Space Policy.*

d. DODD 3100.16, *DOD Management of Space Professional Development.*

e. DODD 4650.05, *Positioning, Navigation, and Timing (PNT).*

f. DODD 5100.01, *Functions of the Department of Defense and Its Major Components.*

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

h. DODD 5105.22, *Defense Logistics Agency (DLA).*

i DODD 5105.23, *National Reconnaissance Office (NRO).*

j. DODD 5105.60, *National Geospatial-Intelligence Agency (NGA).*

k. DODD 5105.62, *Defense Threat Reduction Agency (DTRA).*

l. DODI 3003.01, *DOD Support to Civil Search and Rescue (SAR).*

m. DODI 3100.12, *Space Support.*

n. DODI S-3100.13, *(U) Space Force Application.*

o. DODI S-3100.14, *(U) Space Force Enhancement.*

p. DODI S-3100.15, *(U) Space Control.*

q. DODI 4650.08, *Positioning, Navigation, and Timing (PNT) and Navigation Warfare (NAVWAR).*

r. DODI 8420.02, *(U) DOD Satellite Communications.*

4. Chairman of the Joint Chiefs of Staff Publications

a. CJCSI 3110.01J, *(U) 2015 Joint Strategic Capabilities Plan (JSCP).*

b. CJCSI 3910.01B, *Friendly Force Tracking Operations Guidance.*

c. CJCSI 6130.01F, *2016 Chairman of the Joint Chiefs of Staff Master Positioning, Navigation, and Timing Plan.*

d. CJCSI 6210.02C, *(U) Information and Operational Architecture of the Integrated Tactical Warning and Attack Assessment System.*

e. CJCSI 6250.01E, *Satellite Communications.*

f. CJCSM 3219.01D, *(U) Interruption of Remote Sensing Space System Data Collection and Distribution During Periods of National Security Crisis.*

g. CJCSM 3320.02D, *Joint Spectrum Interference Resolution (JSIR) Procedures.*

h. CJCS Guide 3130, *Adaptive Planning and Execution Overview and Policy Framework.*

i. *DOD Dictionary of Military and Associated Terms.*

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

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

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

m. JP 2-03, *Geospatial Intelligence in Joint Operations.*

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

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

p. JP 3-05, *Special Operations.*

q. JP 3-08, *Interorganizational Cooperation.*

r. JP 3-09, *Joint Fire Support.*

s. JP 3-12, *Cyberspace Operations.*

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

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

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

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

x. JP 3-30, *Command and Control of Joint Air Operations.*

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

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

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

bb. JP 5-0, *Joint Planning.*

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

5. International Law

a. *Charter of the United Nations, 1945.*

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

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

6. Service Publications

a. Air Force Doctrine Annex 3-14, *Space Operations.*

b. Army Regulation 115-11, *Geospatial Information and Services.*

c. Army Regulation 900-1, *Department of the Army Space Policy.*

d. Field Manual 3-14, *Army Space Operations.*

e. Chief of Naval Operations Instruction 5400.43, *Navy Space Policy Implementation.*

f. Commandant Instruction M16130.2F, *US Coast Guard Addendum to the National Search and Rescue Supplement (NSS) to the International Aeronautical and Maritime Search and Rescue Manual (IAMSAR).*

g. Marine Corps Order 5400.53, *Marine Corps Space Policy.*

7. Supporting Documents

a. *CDRUSSTRATCOM Concept Plan 8035 (Change 2).*

b. *CDRUSSTRATCOM Establishing Directive for Joint Force Space Component Commander.*

c. *Precision and Purpose—Airpower in the Libyan Civil War, Published by the RAND Corporation, Santa Monica, Calif. 2015, RAND Corporation.*

d. *Joint Functional Component Command Space Concept of Operations.*

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

f. United States Strategic Command Strategic Instruction (SI) 534-5, *Friendly Force Tracking Operations Guidance.*

g. SI 714-04, *Satellite Communications (SATCOM).*

h. SI 714-5, *Space System Electromagnetic Interference (EMI) Resolution Procedures.*

APPENDIX C
ADMINISTRATIVE INSTRUCTIONS

1. User Comments

Users in the field are highly encouraged to submit comments on this publication using the Joint Doctrine Feedback Form located at: https://jdeis.js.mil/jdeis/jel/jp_feedback_form.pdf and e-mail it to: js.pentagon.j7.mbx.jedd-support@mail.mil. These comments should address content (accuracy, usefulness, consistency, and organization), writing, and appearance

2. Authorship

a. The lead agent for this publication is the US Strategic Command. The Joint Staff doctrine sponsor for this publication is the Director for Operations (J-3).

b. The following staff, in conjunction with the joint doctrine development community, made a valuable contribution to the revision of this joint publication: lead agents, Lt Col Timothy Bos and Mr. Dan Peppers, US Strategic Command; Joint Staff doctrine sponsor, MAJ Steven Bell, Joint Staff J-3; Lt Col John Stratton, Joint Staff J-7, Joint Doctrine Analysis Division; and LCDR Brian Watt, Joint Staff J-7, Joint Doctrine Division.

3. Supersession

This publication supersedes JP 3-14, *Space Operations,* 29 May 2013.

4. Change Recommendations

a. To provide recommendations for urgent and/or routine changes to this publication, please complete the Joint Doctrine Feedback Form located at: https://jdeis.js.mil/jdeis/jel/jp_feedback_form.pdf and e-mail it to: js.pentagon.j7.mbx.jedd-support@mail.mil.

b. When a Joint Staff directorate submits a proposal to the CJCS that would change source document information reflected in this publication, that directorate will include a proposed change to this publication as an enclosure to its proposal. The Services and other organizations are requested to notify the Joint Staff J-7 when changes to source documents reflected in this publication are initiated.

5. Lessons Learned

The Joint Lessons Learned Program (JLLP) primary objective is to enhance joint force readiness and effectiveness by contributing to improvements in doctrine, organization, training, materiel, leadership and education, personnel, facilities, and policy. The Joint Lessons Learned Information System (JLLIS) is the DOD system of record for lessons learned and facilitates the collection, tracking, management, sharing, collaborative resolution, and dissemination of lessons learned to improve the development and readiness of the joint force. The JLLP integrates with joint doctrine through the joint doctrine

development process by providing lessons and lessons learned derived from operations, events, and exercises. As these inputs are incorporated into joint doctrine, they become institutionalized for future use, a major goal of the JLLP. Lessons and lessons learned are routinely sought and incorporated into draft JPs throughout formal staffing of the development process. The JLLIS Website can be found at https://www.jllis.mil (NIPRNET) or http://www.jllis.smil.mil (SIPRNET).

6. Distribution of Publications

Local reproduction is authorized, and access to unclassified publications is unrestricted. However, access to and reproduction authorization for classified JPs must be IAW DOD Manual 5200.01, Volume 1, *DOD Information Security Program: Overview, Classification, and Declassification,* and DOD Manual 5200.01, Volume 3, *DOD Information Security Program: Protection of Classified Information.*

7. Distribution of Electronic Publications

a. Joint Staff J-7 will not print copies of JPs for distribution. Electronic versions are available on JDEIS Joint Electronic Library Plus (JEL+) at https://jdeis.js.mil/jdeis/index.jsp (NIPRNET) and http://jdeis.js.smil.mil/jdeis/index.jsp (SIPRNET), and on the JEL at http://www.jcs.mil/Doctrine (NIPRNET).

b. Only approved JPs are releasable outside the combatant commands, Services, and Joint Staff. Defense attachés may request classified JPs by sending written requests to Defense Intelligence Agency (DIA)/IE-3, 200 MacDill Blvd., Joint Base Anacostia-Bolling, Washington, DC 20340-5100.

c. JEL CD-ROM. Upon request of a joint doctrine development community member, the Joint Staff J-7 will produce and deliver one CD-ROM with current JPs. This JEL CD-ROM will be updated not less than semi-annually and when received can be locally reproduced for use within the combatant commands, Services, and combat support agencies.

GLOSSARY

PART I—ABBREVIATIONS, ACRONYMS, AND INITIALISMS

AFSPC	Air Force Space Command
AOC	air operations center
AOI	area of interest
AOR	area of responsibility
ARSST	Army space support team
ASAT	antisatellite
BDA	battle damage assessment
C2	command and control
CBRN	chemical, biological, radiological, and nuclear
CCDR	combatant commander
CCMD	combatant command
CDRUSSTRATCOM	Commander, United States Strategic Command
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
CO	cyberspace operations
COA	course of action
COMAFFOR	commander, Air Force forces
COMFLTCYBERCOM	Commander, Fleet Cyber Command
CONOPS	concept of operations
COP	common operational picture
CSA	combat support agency
CSS	Central Security Service (NSA)
DIA	Defense Intelligence Agency
DIRSPACEFOR	director of space forces (USAF)
DISA	Defense Information Systems Agency
DLA	Defense Logistics Agency
DNI	Director of National Intelligence
DOC	Department of Commerce
DOD	Department of Defense
DODD	Department of Defense directive
DODI	Department of Defense instruction
DODIN	Department of Defense information network
DSC	defensive space control
DTRA	Defense Threat Reduction Agency
EMI	electromagnetic interference
EMS	electromagnetic spectrum
EW	electronic warfare

FFT	friendly force tracking
GCC	geographic combatant commander
GEO	geosynchronous Earth orbit
GEOINT	geospatial intelligence
GNSS	global navigation satellite system
GPS	Global Positioning System
HEO	highly elliptical orbit
HHQ	higher headquarters
IC	intelligence community
IO	information operations
ISR	intelligence, surveillance, and reconnaissance
JFACC	joint force air component commander
JFC	joint force commander
JFSCC	Joint Force Space Component Commander (USSTRATCOM)
JIPOE	joint intelligence preparation of the operational environment
JNWC	Joint Navigation Warfare Center
JP	joint publication
JSPOC	Joint Space Operations Center
JSTO	joint space tasking order
LEO	low Earth orbit
LOS	line of sight
LPD	low probability of detection
MAGTF	Marine air-ground task force
MASINT	measurement and signature intelligence
MEF	Marine expeditionary force
MEO	medium Earth orbit
METOC	meteorological and oceanographic
MNF	multinational force
MOC	maritime operations center
MOE	measure of effectiveness
MOP	measure of performance
MSIC	Missile and Space Intelligence Center
MWC	Missile Warning Center (NORAD)
NASA	National Aeronautics and Space Administration
NASIC	National Air and Space Intelligence Center
NATO	North Atlantic Treaty Organization
NAVWAR	navigation warfare

NGA	National Geospatial-Intelligence Agency
NGIC	National Ground Intelligence Center
NGO	nongovernmental organization
NOAA	National Oceanic and Atmospheric Administration (DOC)
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
NSS	national security strategy
OE	operational environment
OPCON	operational control
OPIR	overhead persistent infrared
OPLAN	operation plan
ORS	operationally responsive space
OSC	offensive space control
PNT	positioning, navigation, and timing
POC	point of contact
RFF	request for forces
RFI	request for information
RPO	rendezvous and proximity operations
SAR	search and rescue
SARSAT	search and rescue satellite-aided tracking
SATCOM	satellite communications
SCA	space coordinating authority
SecDef	Secretary of Defense
SEW	shared early warning
SI	United States Strategic Command strategic instruction
SIGINT	signals intelligence
SJOA	space joint operating area
SME	subject matter expert
SPINS	special instructions
SSA	space situational awareness
SSE	space support element
SSWG	space support working group
SWPC	Space Weather Prediction Center
TACON	tactical control
TPFDD	time-phased force and deployment data
TT&C	telemetry, tracking, and commanding
TTP	tactics, techniques, and procedures

USAF	United States Air Force
USC	United States Code
USCG	United States Coast Guard
USG	United States Government
USMC	United States Marine Corps
USN	United States Navy
USNO	United States Naval Observatory
USSTRATCOM	United States Strategic Command
WMD	weapons of mass destruction

PART II—TERMS AND DEFINITIONS

attack assessment. None. (Approved for removal from the DOD Dictionary.)

constellation. A system consisting of a number of like satellites acting in concert to perform a specific mission. (DOD Dictionary. Source: JP 3-14)

Defense Satellite Communications System. None. (Approved for removal from the DOD Dictionary.)

Defense Support Program. None. (Approved for removal from the DOD Dictionary.)

defensive space control. Active and passive measures taken to protect friendly space capabilities from attack, interference, or unintentional hazards. Also called **DSC.** (Approved for incorporation into the DOD Dictionary.)

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.** (DOD Dictionary. Source: JP 3-14)

multispectral imagery. None. (Approved for removal from the DOD Dictionary.)

navigation warfare. Deliberate defensive and offensive action to assure and prevent positioning, navigation, and timing information through coordinated employment of space, cyberspace, and electronic warfare operations. Also called **NAVWAR.** (DOD Dictionary. Source: JP 3-14)

negation. In space operations, measures to deceive, disrupt, degrade, deny, or destroy space systems. (Approved for incorporation into the DOD Dictionary.)

offensive space control. Offensive operations conducted for space negation. Also called **OSC.** (Approved for incorporation into the DOD Dictionary.)

overhead persistent infrared. 1. Those systems originally developed to detect and track foreign intercontinental ballistic missile systems. (JP 3-14) 2. Within geospatial intelligence, a capability that provides on-demand, persistent, global, and/or localized coverage of high- to low-intensity infrared events to detect energy radiation from various tactical to strategic objects. Also called **OPIR.** (DOD Dictionary. Source: JP 2-03)

period. None. (Approved for removal from the DOD Dictionary.)

polar orbit. A satellite orbit that passes over the North and South Poles on each orbit, has an angle of inclination relative to the equator of 90 degrees, and eventually passes over all points on the Earth. (Approved for incorporation into the DOD Dictionary.)

prevention. None. (Approved for removal from the DOD Dictionary.)

reconstitution. Actions taken to rapidly restore functionality to an acceptable level for a particular mission, operation, or contingency after severe degradation. (Approved for inclusion in the DOD Dictionary.)

regional satellite communications support center. None. (Approved for removal from the DOD Dictionary.)

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

space control. Operations to ensure freedom of action in space for the United States and its allies and deny an adversary freedom of action in space. (Approved for incorporation into the DOD Dictionary.)

space coordinating authority. The responsibility to plan, integrate, and coordinate space operations. Also called **SCA.** (Approved for incorporation into the DOD Dictionary.)

space domain. The area above the altitude where atmospheric effects on airborne objects become negligible. (Approved for inclusion in the DOD Dictionary.)

space force application. None. (Approved for removal from the DOD Dictionary.)

space force enhancement. None. (Approved for removal from the DOD Dictionary.)

space forces. The space and terrestrial systems, equipment, facilities, organizations, and personnel, or combination thereof, necessary to conduct space operations. (Approved for incorporation into the DOD Dictionary.)

space joint operating area. The operational area, bounded by the space domain, assigned to Commander, United States Strategic Command, in which space operations are conducted. Also called **SJOA.** (Approved for inclusion in the DOD Dictionary.)

space power. None. (Approved for removal from the DOD Dictionary.)

space situational awareness. The requisite foundational, current, and predictive knowledge and characterization of space objects and the operational environment upon which space operations depend. Also called **SSA.** (Approved for incorporation into the DOD Dictionary.)

space superiority. The degree of control in space of one force over any others that permits the conduct of its operations at a given time and place without prohibitive interference from terrestrial or space-based threats. (Approved for incorporation into the DOD Dictionary.)

space support. None. (Approved for removal from the DOD Dictionary.)

space surveillance. None. (Approved for removal from the DOD Dictionary.)

space systems. None. (Approved for removal from the DOD Dictionary.)

sun-synchronous orbit. None. (Approved for removal from the DOD Dictionary.)

theater event system. None. (Approved for removal from the DOD Dictionary.)

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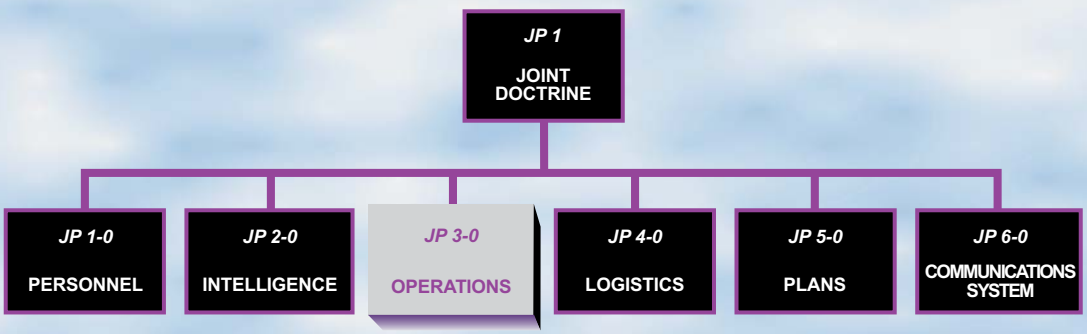
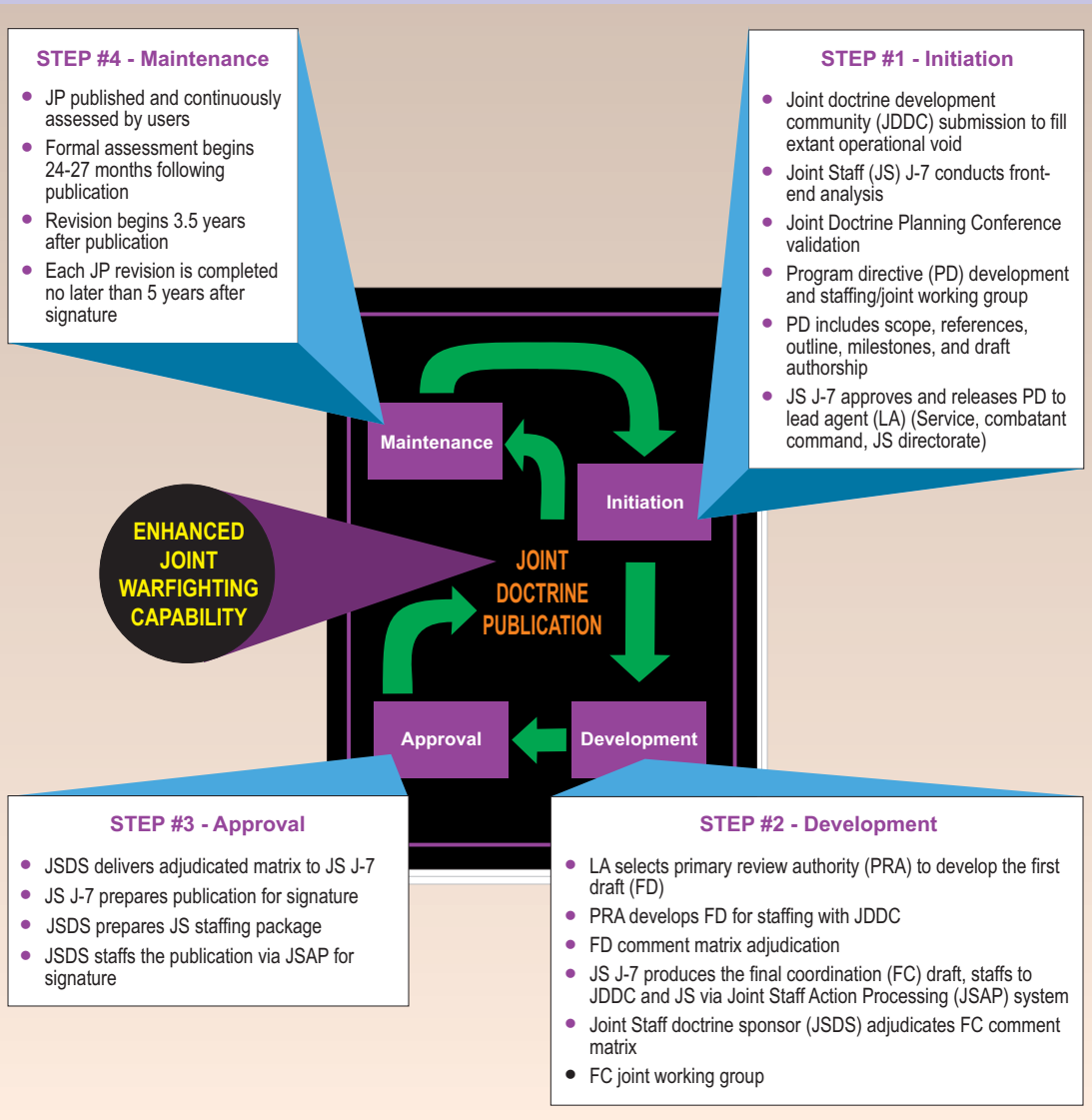
JOINT DOCTRINE PUBLICATIONS HIERARCHY



All joint publications are organized into a comprehensive hierarchy as shown in the chart above. **Joint Publication (JP) 3-14** is in the **Operations** series of joint doctrine publications. The diagram below illustrates an overview of the development process:




JOINT
CHIEFS OF STAFF