LESSON 7
SPACE OPERATIONS

"The security and economic well-being of the United States and its allies and friends depends on the nation's ability to operate successfully in space. To be able to contribute to peace and stability in a distinctly different but still dangerous and complex global environment, the U.S needs to remain at the forefront in space, technologically and operationally, as we have in the air, on land and at sea. Specifically, the U.S. must have the capability to use space as an integral part of its ability to manage crises, deter conflicts, and if deterrence fails, to prevail in conflict."

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

Introduction

The use of space and the advantages that it gives the warfighter have changed significantly since the first satellite was put into orbit. The promulgation of advanced communications, global positioning needs, and commercial imagery has led to rapid advances in space technology. Additionally, space dependent systems in the commercial sector such as satellite TV, satellite radio, satellite tracking, and global positioning have become integral parts of the day-to-day lives of much of the civilized world. Space enters homes, businesses, schools, hospitals, and government offices through its applications for the environment, transportation, health, telecommunications, education, commerce, agriculture, and energy. Much like highways and airways, services supplied from space are already an important part of the U.S. and global infrastructure.

From a National Security Space perspective, space capabilities help national leaders to implement foreign policy and, if required, use military power in ways never dreamed of previously. Space capabilities have become a significant force multiplier when integrated into military operations. Commanders can use space systems to achieve access in support of operations worldwide, as space systems are already deployed and are not constrained by international boundaries or overflight restrictions. These space systems provide unique capabilities and act as a global force multiplier and are critical to winning the conflicts of today and tomorrow.

In the coming period, the U.S. will conduct operations to, from, in and through space in support of national interest both on the earth and in space. As such, the U.S. must have assured access to space, have the ability to protect its assets on orbit, and, if required, deny the enemy's use of the same. The operational planner must understand how space assets can be capitalized upon in support of the greater mission, must understand planning and operational considerations for the employment of space assets, and must understand the threats to those systems. Furthermore, the planner must understand what can be done to limit an adversary's use of space and how to protect our own use of space.

Student Requirements by Educational Objective

Requirement 1

Objective 1. Describe the characteristics of space as they apply to the joint planner. [JPME Areas 1(a), 2(a)]

Objective 2. Identify the operational considerations for space as they apply to the joint planner. [JPME Areas 2(a)(c), 3(a), 3(c)]

Read:

- Joint Pub 3-14, *Joint Doctrine for Space Operations*, 9 Aug 2002, pp. I-2 to I-4 (3 pages)
- "The Marine Corps and Space," Major Franz J. Gayl, *Marine Corps Gazette*, Jan 2002, pp. 34-36 (3 pages)[1]

View:

- Lecture presented by Major Steve Redifer, USMC, Joint Space Plans Officer, Plans, Policies, and Operations Department, Headquarters, U.S. Marine Corps (29 minutes)

The use of space capabilities has proven to be a significant force multiplier when integrated into joint operations. To ensure effective integration, commanders at all levels must have a clear understanding of how space forces and space capabilities can potentially contribute to operations and how such military space capabilities and operations should be integrated with other military operations to achieve national objectives.

U.S. space systems provide unique capabilities and offer global force enhancements that are critical to winning the conflicts of today and tomorrow. To leverage this capability, commanders and planners must understand the application of space power, plan for access to space-based support, and make recommendations (based on operational maneuver) to deny or limit an enemy's use of his space systems.

Characteristics of Space

The space environment is a challenging place to operate, presenting numerous hurdles to the development and employment of space systems. However, these challenges are mitigated by the significant advantages provided by working in space. Space is not confined by geographic boundaries on a map sheet. Internationally accepted conventions do not extend a country's sovereignty into space, so nations enjoy unimpeded satellite overflight of other nations through

[1] Reprinted courtesy of the *Marine Corps Gazette*. Copyright retained by the *Marine Corps Gazette*.

space. This allows space systems access to restricted areas that offers obvious advantages for intelligence, surveillance, and reconnaissance (ISR), communications, and global positioning.

Given these advantages, it is important to remember that space can be a challenging and harsh environment in which to operate. The satellites are obviously controlled from earth, which can make troubleshooting and repair very challenging. Furthermore, satellites are subject to space weather, which can include solar flares, cloud cover, high-energy particles, and other anomalies that may prevent the satellite from executing its mission properly. If a window of opportunity is missed, a user must wait for the next overflight of the satellite or for another satellite in the constellation to make an overflight into the area of interest. Planners must consider satellite design capability, weather, cloud cover, and time of day when requesting space support to ensure getting the right platform for the right job.

Considerations for Planners

The space environment forces the planner to take into consideration many unique characteristics that are different from what is typical for land, air, and sea missions. It is, however, an integral part of the battlespace that bears careful consideration. Furthermore, the vehicles that operate in space have unique qualities that give them great advantages over terrestrial systems, but they come with their own unique set of challenges.

Space borne systems occupy the ultimate “high ground” and as such, operate in an environment unconstrained by terrain, overflight restrictions, or geographical boundaries. They have global access and can theoretically overfly any part of the earth’s surface. Furthermore, they remain in their orbits continuously with no need for logistical support and are ready to perform their duties at any time. Additionally, most satellites remain on station for an extended period of time, generally in terms of years.

Conversely, satellites are governed by the laws of physics and orbital mechanics. A satellite in a low earth orbit (LEO) can overfly any spot on the earth’s surface in a 24-hour period. However, the ability to overfly these spots is based on the orbital parameters of the satellite. These orbital parameters can be changed but only through the expenditure of on-board fuel (propellant). Since on-orbit re-supply is not practical for satellites, once their fuel is expended, further course corrections are not possible. Additionally, while an LEO satellite can access any spot on the globe, it is traveling at very high speed (on the order of 7 km/sec); hence, they are usually overhead for a limited period of time, on the order of minutes. Once the overflight has occurred, the theater commander must wait for the next orbit of the same satellite or for a different satellite with the same capabilities to pass overhead.

This ability to predict when overhead coverage will be available is a benefit of the consistency and persistence of in orbit assets. The constellations of satellites currently on orbit have very predictable orbits and allow space operations officers to readily predict when coverage is available. Unfortunately, the adversary is also aware of these times and schedules and may choose to time his actions accordingly to either hide his activity or deceive U.S. forces about his true intentions.

Space systems, as is true for any such system, are vulnerable to attack. Ground-to-satellite links are susceptible to jamming and intercept and can be exploited by hostile forces. Fixed command

and control nodes, to include ground stations as well theater injection points, are vulnerable to attack by hostile forces or terrorists. Furthermore, launch facilities are vulnerable to attack, and must be protected to ensure access to space. Knowledge of the general vulnerabilities of space systems as well as the enemy's negation and exploitation capabilities will aid the planner in employing and protecting our space-based assets.

One of the key considerations for planners to weigh when planning for and requesting support from space-based assets is the limited number of resources available. First, satellites are very expensive systems that require long lead times prior to launch. This cost and lead-time limits the quantity of satellites available for use. Furthermore, many of these systems are national systems, supporting the National Security Council, Department of Defense (DOD), and the intelligence community as well as the country as whole. Competition for bandwidth, priorities for tasking, and access to desired locations may impact the availability of space support. Requirements often exceed the capability of systems, so planners must weigh their needs to determine what other assets could provide the same function or if the data could be gleaned from archived records.

Planners may be further constrained by the ability of particular systems to access areas of interest. Once in their pre-determined orbits, satellites can only be moved by an expenditure of on-board propellant. Obviously storing such propellants requires space and weight, both key considerations when one considers that it costs approximately $10,000 to $12,000 (CY 2003) per pound to put a satellite into low earth orbit. The primary purpose of these on-board propellants is to perform stationkeeping, correcting the satellite's orbit due to physical perturbations. Because of this fact, each "burn" to change a satellite's orbit reduces the life of the satellite; as such, any alteration of an orbit to gain additional coverage must be carefully weighed.

Requirement 2

<u>Objective 3</u>. Describe the four space mission areas. [JPME Areas 1(a), 2(a)]

<u>Objective 4</u>. Compare and contrast how opportunities and vulnerabilities are created by increased reliance on information technology (space control mission area). [JPME Area 2(a), 5(d)]

Read:

- Joint Pub 3-14, *Joint Doctrine for Space Operations*, 9 Aug 2002, pp. IV-5 to IV-10 (5 pages)

Space Mission Areas

Joint doctrine recognizes four space mission areas. These are space control, space force enhancement, space support, and space force application.

Space Control

Space control operations provide freedom of action in space for friendly forces while, when directed, denying it to an adversary. Space control includes protection of U.S. and U.S.-allied space systems and negation of adversary space systems. Space control operations include surveillance of space, protection, prevention, and negation functions. These missions may involve activities conducted by land, sea, air, space and special operations forces. These forces would be brought to bear against space systems or facilities identified through the targeting process. They include offensive and defensive operations by friendly forces to gain and maintain space superiority and situational awareness of events that impact space operations. Space control operations will provide freedom of action in space for friendly forces and, when directed, deny the same freedom to the adversary.

Space Force Enhancement
Force enhancement operations multiply joint force effectiveness by enhancing battlespace awareness and providing the warfighter with required support. There are five force enhancement functions, as follow:

- ISR.
- Integrated Tactical Warning and Attack Assessment.
- Environmental monitoring.
- Communications.
- Position, velocity, time, and navigation.

These functions provide significant advantage by reducing confusion inherent in combat situations (the "fog of war"). They also improve the lethality of air, land, sea, space, and special operations forces. Force enhancement functions are often provided by agencies such as the National Reconnaissance Office (NRO), National Security Agency (NSA), National Imagery and Mapping Agency (NIMA), National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, commercial organizations, and consortiums.

Space Support
Space support operations consist of operations that launch, deploy, augment, maintain, sustain, replenish, de-orbit, and recover space forces, including the command and control network configuration for space operations. There are three broad space support functions, as follow:

- Space lift.
- Satellite operations.
- Reconstitution of space forces.

Space Force Application
This area would consist of attacks against terrestrial-based targets carried out by military weapons operating in or through space. Such weapons could include fire support from space-based assets (i.e., space-based "artillery"), ballistic missile defense, and force projection (i.e., space transport) through space. Currently there are no force application assets operating in space, although many such ideas may be considered in the near future.

Requirement 3

<u>Objective 5</u>. Apply the principles of war in space operations. [JPME Area 2(a), 3(b)]

Read:

- Joint Pub 3-14, *Joint Doctrine for Space Operations*, 9 Aug 2002, pp. IV-2 to IV-5 (4 pages)

Space and the Principles of War

The principles of war are applicable to the employment and use of space and space assets and provide an effective means for the joint planner to consider requesting and employing space assets. These space assets provide unique capabilities that enable the joint force commander and enable the application of the principles of war.

Objective

Space assets, as with any type of combat power, are best employed when they contribute directly to achieving the commander's objective. In order to ensure that this occurs, it is important that joint planners understand the capabilities and limitations of space-based assets and develop a plan for the employment of these assets.

Furthermore, joint planners must ensure they coordinate with space support teams and space subject matter experts when developing these plans. The members of the space support team must have a clear understanding of the joint force commander's plan, intent and objectives in order to best recommend space support. The space support team must be in concert with all aspects of the plan and should be a part of the decisionmaking process.

Offensive

With U.S. space assets available on orbit, the commander can seize and maintain the initiative while simultaneously assuring himself of in-place communications, precision navigation (to include weapons guidance), and ISR.

Mass

It is critical for commanders to integrate and synchronize supporting space forces so that the concentration of combat power at the proper time and place can be most effective. For example, having the capability for precision navigation and timing enables the application of overwhelming force at key points of attack. Such a capability enhances guided weapon accuracy, reduces the risk of fratricide, and aids in the synchronization of combined arms forces.

Economy of Force

Space systems and space-based ISR assets can support attainment of dominant battlespace awareness to a commander. This reduces uncertainty and permits a reduction in the number and type of forces needed for secondary efforts. Commanders can use the information garnered by space-based systems to determine the enemy's weaknesses, his plans, and to discover whether certain movements are feints or the main effort.

Space assets are in and of themselves critical assets that are limited in their ability to provide support to all users across a theater. Care must be used in ensuring that these assets and their corresponding information are allocated and tasked in support of the commander's overall objective. Space systems are also limited in their ability to move or change their orbit in support of a commander, and such decisions must be weighed carefully, taking national interests into consideration. As discussed previously, each movement of a satellite in its orbit results in a corresponding use of limited on-board fuel.

Maneuver
Satellite systems enhance maneuver by increasing the situational awareness of units and commanders on the battlefield. Precise navigation through the use of the global positioning system (GPS) allows for close coordination of maneuvering units and supporting fires as well as enables the use of blue force tracking to mitigate the risk of fratricide.

Unity of Command
Commander, U.S. Strategic Command (USSTRATCOM) is ultimately responsible for the conduct of U.S. military space operations. When space forces are transferred to geographic combatant commanders, care must be given to ensure that space forces are commanded through a single chain of command.

Supported JFCs may designate a single authority to coordinate joint theater space operations and integrate space capabilities. This authority is responsible for prioritizing all the space requirements for the area of responsibility to ensure supporting command and supporting agencies have clear guidance on the supported combatant commander’s intent.

Supporting space commanders must have a detailed understanding of the supported commander’s ability to use information and data derived from space capabilities. Additionally, the supporting commander should provide the type and number of systems employed, system capabilities, and operational status.

The joint force should integrate space capabilities into its planning and operations and should consider the impact if the support is unavailable. To minimize confusion and the misapplication of assets, requests within a theater for space forces should be prioritized and processed, applying a theater-wide perspective and assessing how they satisfy the objectives.

Security
The unique advantages of global coverage, wide fields of view, and the capability to revisit targets make observation of the Earth from space a powerful tool. Space forces can have access to any point on Earth, and proper management of satellite orbits and constellations offers overflight flexibility. This flexibility enhances the supported commander’s ability to observe the area of interest and increase battlespace awareness, reducing the commander’s uncertainty.

Surprise
Space operations contribute to the element of surprise by providing timely intelligence, enhanced information sharing, and precision targeting, allowing the joint force to achieve success that is well out of proportion to the expended effort.

Simplicity
Although space operations are innately complex, effort should be made to clearly detail each part of the plan as well as respective roles and missions. A common error that can lead to difficulties in space planning is the failure to establish a common vocabulary and failure to use doctrinal terms in the planning process.

Requirement 4

Objective 6. Discuss the role of space systems in intelligence, surveillance, and reconnaissance (ISR). [JPME Areas 2(a), 3(a)(c), 4(d), 5(a)]

Objective 7. Explain the role of space systems in communications. [JPME Areas 2(a), 3(a)(c), 5(a)]

Objective 8. Describe the role of space systems in position location, velocity, time, and navigation. [JPME Areas 2(a), 3(a)(c), 5(a)]

Read:

- Joint Pub 3-14, *Joint Doctrine for Space Operations*, 9 Aug 2002, Appendices A, D, and E (15 pages)

Space Systems' Role in Intelligence, Surveillance, and Reconnaissance
Space-based ISR is part of the space force enhancement mission area and as such increases the effectiveness of the joint force by increasing situational awareness and providing the warfighter with necessary support in the accomplishment of his mission. Space-based ISR systems provide updated information regarding terrain and adversary force dispositions, supporting the full range of military intelligence activities. Types of data and information that can be collected from space include signals intelligence, communications intelligence, imagery intelligence, electronic intelligence, and measurement and signals intelligence (MASINT).

In general, ISR is the collection of data and information on an object or in an area of interest on a continuing, event-driven, or scheduled basis, regardless of who or what system is doing the collecting. Each ISR platform has unique advantages and disadvantages, and consideration must be given to selecting the best tool for the intended use when developing surveillance and reconnaissance plans.

Space-based ISR platforms offer a variety of advantages to the user; however, each has its own unique limitations. Primarily, space systems have worldwide access to areas of interest and are not subject to borders or overflight restrictions. Furthermore, these systems may offer continuous or near-continuous coverage based on the number of systems in orbit and their orbital characteristics. Conversely, adverse weather, cloud cover, and the fact that they are in predictable, well-known orbits can limit the effectiveness of these systems.

Space Systems' Role in Communications
Satellite communications (SATCOM) provide an essential element of national and DOD communications worldwide and have continued to increase in importance on the modern battlefield. Space systems allow the user beyond-line-of-sight communications that support the warfighter in locations across the globe, regardless of whether these environments have an existing communications infrastructure. These systems allow for information transfer from the highest levels of government into theater for all matters.

Communication satellites provide near-global coverage (including the poles) as well as near-real-time transmissions. Furthermore, these systems are flexible as well as secure, as they are vulnerable to physical attack by only the most sophisticated adversaries. Additionally, the signals may be encrypted to add further security for the user. SATCOM systems also are flexible in that they can support a wide variety of global transmissions needs to include data, voice, and video links.

Communication satellites, like any other platform, have their limitations as well. The satellites themselves are limited by antenna size, weight, and in the amount of power they have available for transmissions. Furthermore, they are susceptible to jamming and weather, as are most communications platforms. Lastly, satellites, once in orbit, may not be able to adjust to communication technology advances; when a satellite is launched, its bandwidth, frequencies, and orbit are generally fixed. As a result, as technology changes, the space-based platform will be fixed until the next satellites are launched.

Space Systems' Role in Position, Navigation, Velocity, and Timing
Perhaps the most well-known and commonly used space-based system is the GPS. Space-based position, velocity, time, and navigation systems, in combination with user terminals, support strategic, operational, and tactical missions by providing highly accurate, three-dimensional position capability, velocity determination, and time reference.

GPS satellites broadcast navigation information on a continuous basis, which is used by the warfighter for position reporting, situational awareness, precision weapons delivery, as well as a multitude of other functions. GPS provides continuous global service that is readily accessible to all users, both civil and military.

Requirement 5

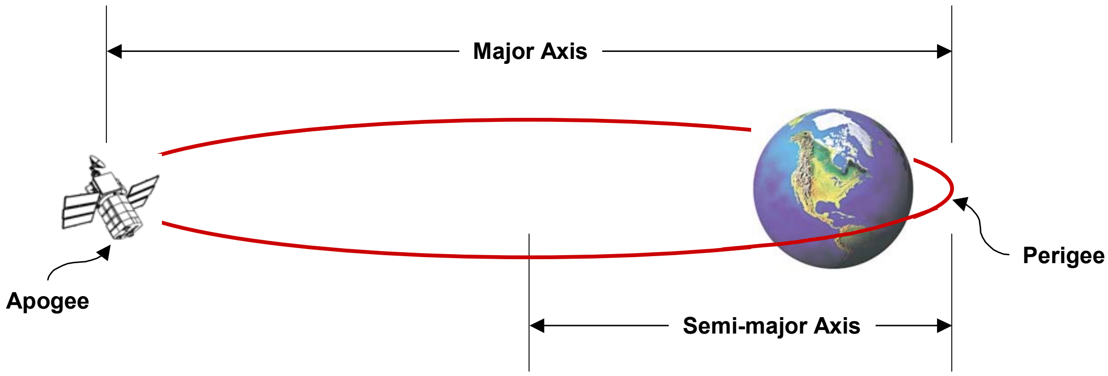
Objective 9. Relate orbital characteristics with how they impact the capabilities and limitations of space systems. [JPME Area 1(a), 2(a), 5(a)(d)]

Read:

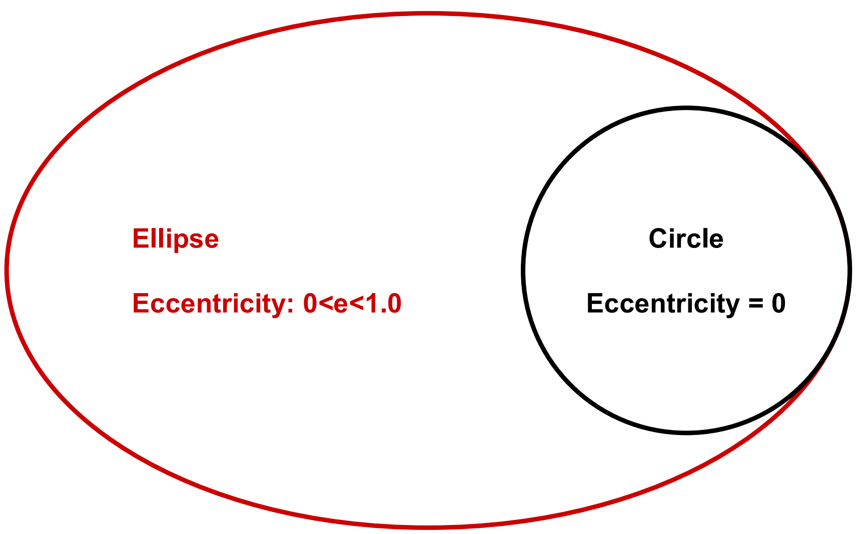
- Joint Pub 3-14, *Joint Doctrine for Space Operations*, 9 Aug 2002, Appendix F (7 pages)

It can be somewhat challenging to describe a satellite's orbit or its exact location in space; however, such a description is critical to understanding the capabilities of a particular space platform. Orbital elements are the quantities that describe an orbit and a spacecraft's place in it. These elements are called the classical orbital elements and can inform the user of the orbit's size, shape, orientation, and the spacecraft's location.

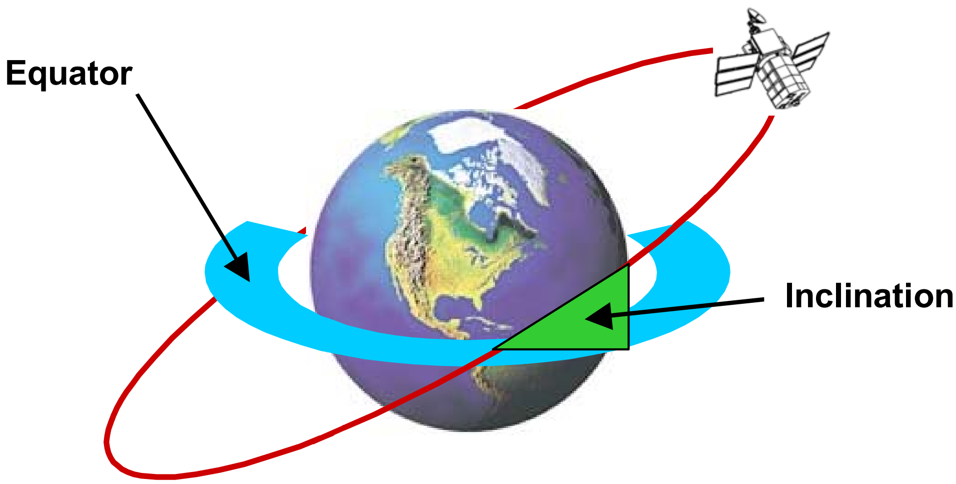
Size
The size of an orbit is dictated by its semi-major axis, which is half the distance of the long axis of the ellipse. In a circular orbit, this would merely be the radius of the circle.

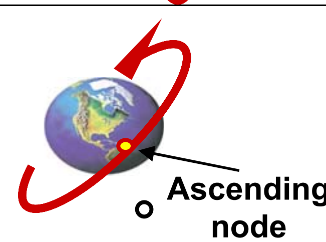
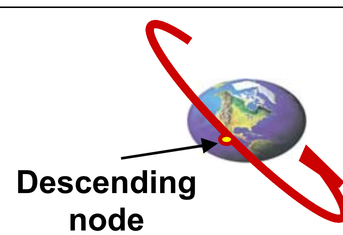


Eccentricity
Many orbits are elliptical in shape, but the question, “How elliptical?” arises. Eccentricity reveals how elliptical or “out of round” is an orbit. Eccentricity is a number between 0 and 1, with 0 being a circle and higher numbers describing an orbit that is elliptical—the higher the number, the more elliptical or oval shaped the orbit.



Inclination
Inclination is the angle of a satellite’s orbit relative to the Earth’s equator. Satellites are place into varying orbit inclinations based on their mission. For example, if a satellite were to provide images of the poles, it would be launched into an inclination that would enable it to overfly the poles (approximately 90°). A higher inclination generally means that more of the Earth's surface is covered. A polar orbit crosses all latitudes, while lesser or greater inclinations only provide coverage for increasingly higher latitudes, particularly for satellites in low Earth orbits. Inclination is determined at launch and can only be changed through maneuvering the satellite in orbit. Physics will not allow a launch site to launch directly into orbital inclinations greater than the launch site’s latitude—if such an orbital inclination is desired, then the satellite must be moved into that inclination once it is in space. This positioning requires that additional energy be applied to the satellite; additional energy means additional weight and, hence, additional cost.



Inclination	Orbital Type	Diagram
0° or 180°	Equatorial	
90°	Polar	
$0^\circ \le i \le 90^\circ$	Direct or prograde (Moves in the same direction as the earth rotates)	
$90^\circ < i \le 180^\circ$	Indirect or retrograde (Moves opposite the earth's rotation)	

Right Ascension of the Ascending Node
The orbital element that describes how the orbit is “swiveled” relative to the Earth is called the right ascension of the ascending node. During each orbit, the satellite will cross the equator 2 times, one time descending (north to south) and one time ascending (south to north). If a pre-determined direction is taken, in this case defined as the vernal equinox direction, and it is measured eastward to the ascending node, the angle that is measured called is the right ascension of the ascending node.

Argument of Perigee
Argument of perigee is another angle that describes the spacecraft’s orbit, once again with respect to the equator. This angle is measured in the direction of spacecraft motion and is the angle from the ascending node to the perigee. (Perigee is the point where the spacecraft is closest to the Earth; apogee is the farthest point of the orbit from the Earth.)

Types of Orbits
The size of a satellite’s orbit determines its period, or the time it takes to complete one revolution. The lower the orbital altitude, the shorter the period. Common orbits have periods ranging from about 90 minutes (low orbits just above the atmosphere) to 24 hours (“geosynchronous” orbits 35,780km or 22,300 statute miles above the Earth’s surface).

Low Earth Orbit (LEO). LEO is the easiest type of orbit to reach, and the object’s proximity to the surface provides the best potential for high-resolution imagery. However, while gaining greater resolution, objects in these orbits have relatively smaller fields of view than those at higher altitudes, and atmospheric drag can shorten mission duration. LEO applications include manned flight, reconnaissance, and communications missions.

Polar Orbits. Strictly speaking, polar orbits (typically a type of LEO) have an inclination of 90 degrees and fly over the poles, thus providing coverage of the entire Earth. A type of orbit that is approximately polar and frequently used synonymously (but incorrectly) with “polar” is a “sun-synchronous” orbit. A sun-synchronous orbit maintains a constant orientation towards the sun during the year. To do so, the inclination must be greater than 90 degrees (typically 90-120, depending on altitude and shape of orbit). This type of orbit is useful for various reasons — for example maintaining a constant viewing condition when observing the Earth (e.g., shadows, etc.). Applications include weather, Earth resources, and reconnaissance in the visible-light portion of the spectrum. Sun-synchronous orbits are applied to achieve global coverage from low altitude in minimal time, offering repetitive viewing of the same geographic locations at the same sun angle. For example, detection of troop movements can be accomplished through image and shadow changes.

Medium Earth Orbit (MEO). MEO provides a larger field of view and a longer dwell time than LEO. While atmospheric drag is negligible, much more energy is required to place a satellite in these orbits. Present applications include navigation systems (e.g., GPS). Another note about MEO is that the Earth’s Van Allen radiation belts also reside here. Charged particles are trapped in these belts, and can harm spacecraft by causing charging, damaging a satellite’s surface, and causing single-event phenomena, such as bit flips (i.e., exchanging a “1” for a “0” or vice-versa in a data stream).

Highly Elliptical Orbit (HEO). HEO also provides large fields of view. For example, HEO can furnish long dwell times over the Northern Hemisphere when in a highly inclined orbit with apogee (the point farthest from the Earth's surface) being over the Northern Hemisphere, including the polar regions (areas not adequately viewed by geosynchronous Earth orbit satellites that are stationed over the equator). Another term used for HEOs is "molniya" (the Russian word for 'lightning' and a constellation of Russian communication satellites in HEO). True molniya orbits are inclined at approximately 63.4 degrees, with perigee (the point in the orbit closest to the Earth) at the southernmost point of the orbit, and have a period of approximately 12 hours. They have long dwell times over the Northern Hemisphere, while traveling quickly past the Southern Hemisphere. Applications include communications, scientific missions, and ISR.

Geosynchronous Earth Orbit (GEO). GEO satellites have periods exactly equal to the Earth's rotation (24 hours). Orbits of any inclination can be geosynchronous. Geostationary satellites remain over one spot on the Earth at all times. To do so, they must not only be geosynchronous, but also equatorial (zero inclination) and circular (zero eccentricity). This particular type of orbit is known as Geo-synchronous Equatorial Orbit. Thus, all geostationary satellites are geosynchronous, but not all geosynchronous satellites are geostationary. The ground trace of GEO satellites in circular orbits with non-zero inclination describe a figure "8," spending equal time over the northern and southern hemispheres. Geosynchronous orbits have an altitude of approximately 23,000 statute miles, are difficult to reach, and require launch vehicles with significant energy to reach these orbits. Geosynchronous satellites provide wide fields of view with continuous coverage of the portions of the Earth they orbit. Therefore, they are very useful for communications, weather, and ISR.

Orbital Type	Example Mission	Altitude	Period
Geostationary	Nuclear Detonation Detection Communication ISR	~35,780 km	24 hours
Medium Earth Orbit	GPS	~17,700 km	12 hours
Low Earth Orbit	Space Shuttle Imagery Space Station	~300 km	~ 90 minutes
Sun-synchronous (98°)	Imagery	~450 km (perigee)	~90 minutes
Highly Elliptical	Communications ISR	~7,971 km (perigee) ~26,571 km (apogee)	12 hours

Requirement 6

Objective 10. Identify space support teams and their roles and functions. [JPME Areas 1(a)(e), 2(a)]

Read:

- Joint Pub 3-14, *Joint Doctrine for Space Operations*, 9 Aug 2002, pp. II-4 to II-7 (4 pages)

Services assign space operators to unified and subunified commands, theater component staffs, major commands, USAF numbered air forces and wings, Army corps, and Navy carrier battle group staffs. USSTRATCOM and Service component space support teams task-organize at the unified, subunified, joint task force (JTF), and component command levels to support operations at the operational and tactical levels.

Joint Space Support Teams

Upon request from a combatant commander, subordinate JFC, or USSTRATCOM theater space liaison officer (LNO), USSTRATCOM will deploy joint space support teams (JSSTs) to the theater to augment the supported commander's staff to assist in integrating space into the joint campaign plan. In addition, Commander, USSTRATCOM may direct space component commanders (i.e., Army Space Command [ARSPACE] or Naval Network and Space Operations Command [NNSOC]) to provide tailored space support through space support teams (SSTs) to train and assist Service forces in theater.

When requested by a combatant commander or JFC and followed by a SECDEF order, USSTRATCOM will transfer task-organized JSSTs to the OPCON of the supported combatant commander to facilitate tasking and use of joint space forces and ensure that space support is provided to the supported combatant commander. The USSTRATCOM Operations Center can be contacted telephonically and through the Global Command and Control System (GCCS) on a 24-hour basis with requests for JSST support. Response time will vary, depending on the situation and extent of support requested.

Space Support Teams

Commander, USSTRATCOM, may also direct space component commanders to provide tailored space support through SSTs. Both ARSPACE and NNSOC have SSTs that are task-organized and equipped to meet the needs of the supported commander. (The USAF does not maintain SSTs but has integrated space support personnel into all Air Force component staffs.) Once forces are transferred to the theater, all space support teams and personnel will provide support in accordance with theater space support plans.

Generally, the Marine Corps relies heavily on the experience of its intelligence and communications personnel to provide expertise on space systems. Additionally, the Marine Corps has assigned space systems operators to both USSTRATCOM and NNSOC to provide space support as well as to represent USMC interests to the supported commander. Comprised of active duty personnel and reservists, these personnel typically have the 9933 skill designator MOS (Space Operations Staff Officer) or the 9666 secondary MOS (Space Systems Operations Officer) and bring space support as well as operational experience to the supported command.

National Intelligence Support Team

The JSST and Service space component command's SSTs and deployed space support personnel coordinate support to a theater among themselves and other national agencies' theater support teams. Several DOD and national agencies deploy theater support teams whose capabilities and products can enhance or complement space force support. These teams include a national intelligence support team (NIST) from Defense Intelligence Agency (DIA), NSA, Central Intelligence Agency (CIA), NIMA, Central Measurement and Signature Intelligence Office

(Central MASINT Office), or other intelligence community agencies, as required. The NRO provides the combatant commands with an LNO and, if required, an Operational Support Office team as part of the NIST. The Marine Corps has liaisons or detachments with many of these organizations to include NSA, NIMA, and the NRO. In general, the liaisons can be reached via the staff intelligence officer and via the SIPRNET.

Marine Corps Tactical Exploitation of National Capabilities (TENCAP)
Additionally the Marine Corps sponsors a Tactical Exploitation of National Capabilities (TENCAP) program. The Marine Corps TENCAP program is a continuing effort that identifies, evaluates, and demonstrates the applicability of existing, new, and emerging space and national reconnaissance technologies to support MAGTFs.

The Marine Corps TENCAP program was initiated in 1977 to provide expertise to better exploit current overhead reconnaissance systems and influence the development of future systems to meet the information requirements of the tactical commander. To accomplish this objective, the Marine Corps TENCAP Office provides the vehicle for direct Marine Corps participation in decisions affecting new and advanced national intelligence systems capabilities.

The Marine Corps TENCAP approach explores and applies advanced concepts and technologies being developed by the National Intelligence Community to accomplish the following:

- To meet Marine Corps force (FMF) or joint requirements approved and established by the Marine Corps Combat Development Command (MCCDC).
- For inclusion into systems being developed and acquired by the Marine Corps Systems Command (MARCORSYSCOM) on behalf of Marine Corps forces.

Where possible, Marine Corps TENCAP places emphasis on its projects in an effort to integrate new technology, hardware, and software into existing systems or programmed upgrades to the MAGTF Command, Control, Communications, Computer, and Intelligence (C4I) Architecture. Marine Corps participation in TENCAP is executed by the Intelligence Plans & Policy/Tactical Exploitation of National Capabilities (TENCAP) Branch, Intelligence Department, Headquarters Marine Corps.

Lesson Summary

The ability to rapidly project U.S. military power across the globe is a basic requirement of the Armed Forces of the United States. Space and spaced-based systems play a key role in enhancing this ability by providing a variety of capabilities to include ISR, communications, global positioning, and space control. Commanders must address space force use during deliberate planning to effectively synchronize and integrate space forces within the theater, to counter an adversary's use of space, to maximize use of limited space assets, and consolidate theater operational requirements for support from space. Since they play such an integral role, planners at all levels need to understand the capabilities as well as the limitations of space systems in order to take advantage of their strengths while mitigating their weaknesses. As the United States' expeditionary force in readiness, it is imperative that Marine Corps officers consider possible applications of space and space systems and ensure that Marine Corps interests and needs are being addressed.

JPME Summary

AREA 1					AREA 2				AREA 3					AREA 4					AREA 5			
A	B	C	D	E	A	B	C	D	A	B	C	D	E	A	B	C	D	E	A	B	C	D
X				X	X		X		X	X	X						X		X			X