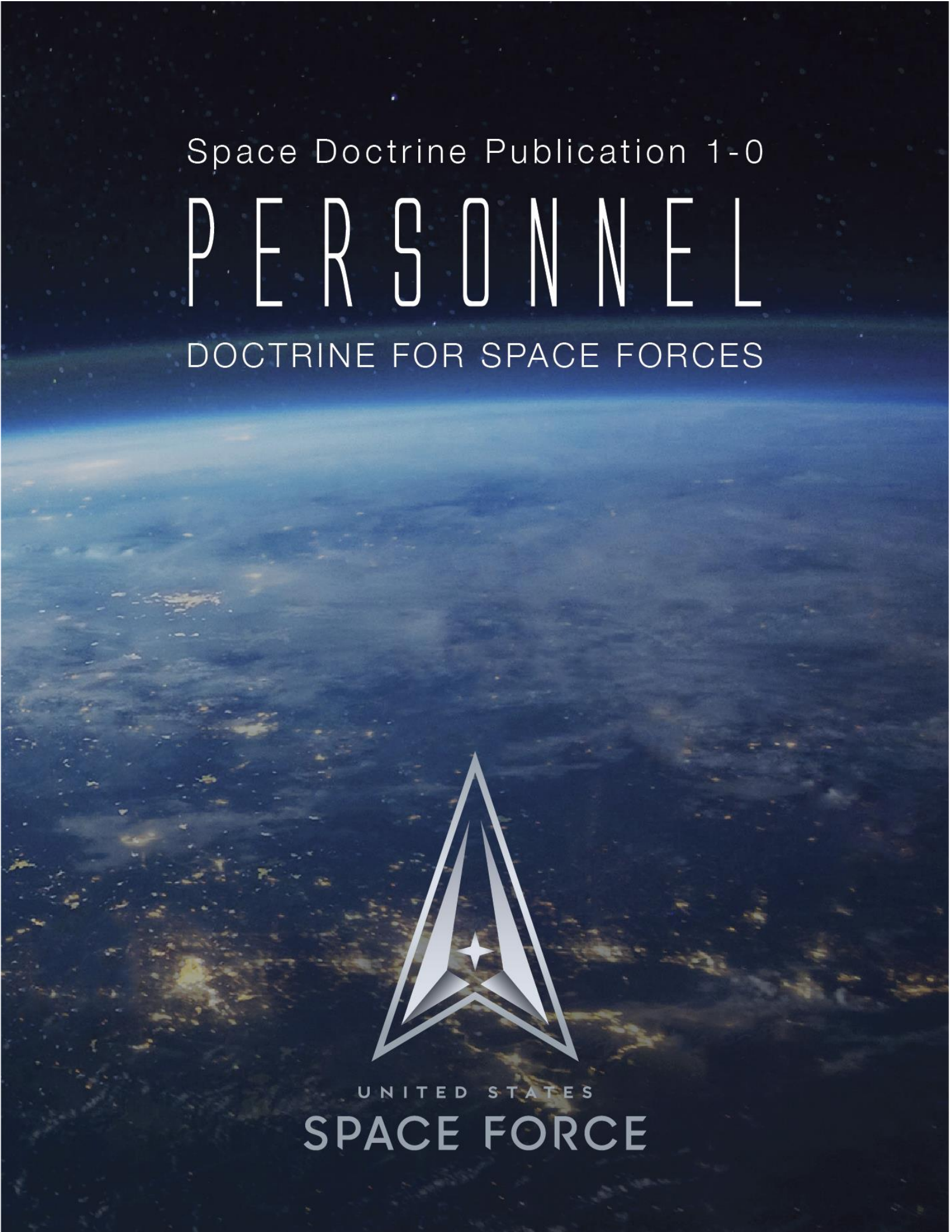
Space Doctrine Publication 1-0

PERSONNEL

DOCTRINE FOR SPACE FORCES



UNITED STATES
SPACE FORCE

Space Doctrine Publication (SDP) 1-0, *Personnel*
United States Space Force (USSF)
7 September 2022

Foreword

United States Space Force (USSF) doctrine guides the development and employment of Guardians in support of the Service's cornerstone responsibilities. A body of carefully developed and sanctioned ideas, doctrine establishes a common framework for understanding and applying USSF capabilities. This doctrine provides official advice and describes the best way to develop and sustain Guardians throughout their careers. By its nature, doctrine is not directive, and instead provides the USSF an informed starting point for decision-making and strategy development.

Space Doctrine Publication (SDP) 1-0, *Personnel*, aligns with current USSF doctrine and Chief of Space Operations' Planning Guidance. SDP 1-0 articulates the current USSF structure, the contributions of external agencies to the USSF, and best practices for force development and sustainment unique to the Guardian culture.

Personnel readiness and resilience enables the USSF to provide trained and ready forces, including Guardians, Active-duty Airmen, Department of the Air Force (DAF) civilians, Air Force Reservists, and Air National Guardsman. These forces contribute to prompt and sustained space operations that fulfill the cornerstone responsibilities of the USSF: preserve freedom of action, enable joint lethality and effectiveness, and provide independent options. SDP 1-0, while focused on Guardians, addresses the role of all these forces in enabling the USSF mission by ensuring a common presentation of forces to combatant commanders, and preservation of capability among forces performing space missions.

Many years of developing space personnel allows our doctrine to speak from a position of authority. I encourage you to study and learn from the time-tested knowledge compiled in this publication. Semper Supra!

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Chapter 1: Introduction

Our greatest assets are the individuals—Guardians—who develop, protect, sustain, employ, and advance spacepower for the nation. Sound doctrine and superior capabilities are of little use without personnel who have the expertise and empowerment required to implement them. The responsibility of the United States Space Force (USSF), like its sister services, is to organize, train, and equip forces to support the joint force commander conducting operations across the competition continuum (as defined in Joint Doctrine Note 1-19, *Competition Continuum*, 3 June 2019).

The USSF prioritizes the development and sustainment of Guardians, which include active-duty officers and enlisted personnel, and civilians, allowing the service to capitalize on the diversity of its personnel, along with their skills, talents, expertise, and perspective. Additionally, personnel transitioning from sister services bring with them rich experiences that are invaluable to shaping the culture, heritage, and expertise of the USSF and its ability to present capabilities and forces to the joint force.

While Guardians are the primary focus of this publication, the USSF recognizes that personnel from elsewhere in the Department of the Air Force (DAF) (active duty, reservists and civilians) and Air National Guard are essential to all areas of the USSF mission. They provide essential support to USSF Space Base Deltas and Space Force Bases. Chapter 6 addresses these essential service partners.

SDP 1-0, *Personnel*, addresses the USSF organizations that develop and support Guardians (including assigned civilians) throughout their careers (Chapter 2). The force development process addressed in Chapter 3, and programs supporting individual resilience addressed in Chapter 4, combine to ensure personnel are equipped with the leadership, weapons systems, skill sets, personal resilience, and foresight necessary to protect and defend interests of the United States (US) and its allies in any strategic or operational environment. Chapter 5 also addresses the need for every Guardian to develop and maintain a global perspective as part of their professional development.

This doctrine publication is official advice, and commanders should follow it except when, in their judgment, circumstances dictate otherwise. Doctrine reflects fundamental principles and best practices based on extant capabilities. It incorporates changes derived from lessons learned during operations, training, wargames, exercises, and, when appropriate, validated concepts.

The USSF is rapidly developing in every area and personnel practices are no exception. Where the USSF is developing new policies, processes, or structures, such as the *Guardian Ideal*, call-out boxes (light blue boxes with rounded corners) highlight those for the reader. As the USSF implements these changes, Space Training and Readiness Command (STARCOM) Delta 10 will update this publication.

Guardian Ideal

Published on 17 September 2021, the *Guardian Ideal* is the USSF's Human Capital Strategy, and explains how the USSF intends to attract and develop talent. The USSF will move to a regulated market approach to talent management that integrates and strengthens equity, development, and human dignity. It will empower individuals to pursue pathways that are informed by both their preferences and an understanding of Space Force requirements–unleashing the potential of *every* Guardian..

Chapter 2: USSF Organization

The USSF is responsible for organizing, training, and equipping its personnel, while ensuring they are ready and qualified to integrate with the joint force. In the USSF's first planning guidance publication, the Chief of Space Operations (CSO) directed the use of mission command and established his intent for the nation's newest military branch to operate as an empowered, lean, and agile service. This direction translates to a streamlined organizational structure supporting the employment of Guardians at locations around the globe.

USSF Structure

Three Field Commands (FIELDCOMs), Space Operations Command (SpOC), Space Systems Command (SSC) and STARCOM, support the Office of the Chief of Space Operations (OCSO). Forces assigned to OCSO, Space Base Deltas, FIELDCOMs, and their subordinate units (Deltas and Directorates) deliver space capabilities to the warfighter. The top three Guardians—the CSO, Vice Chief of Space Operations (VCSO) and Chief Master Sergeant of the Space Force (CMSSF)—lead the USSF.

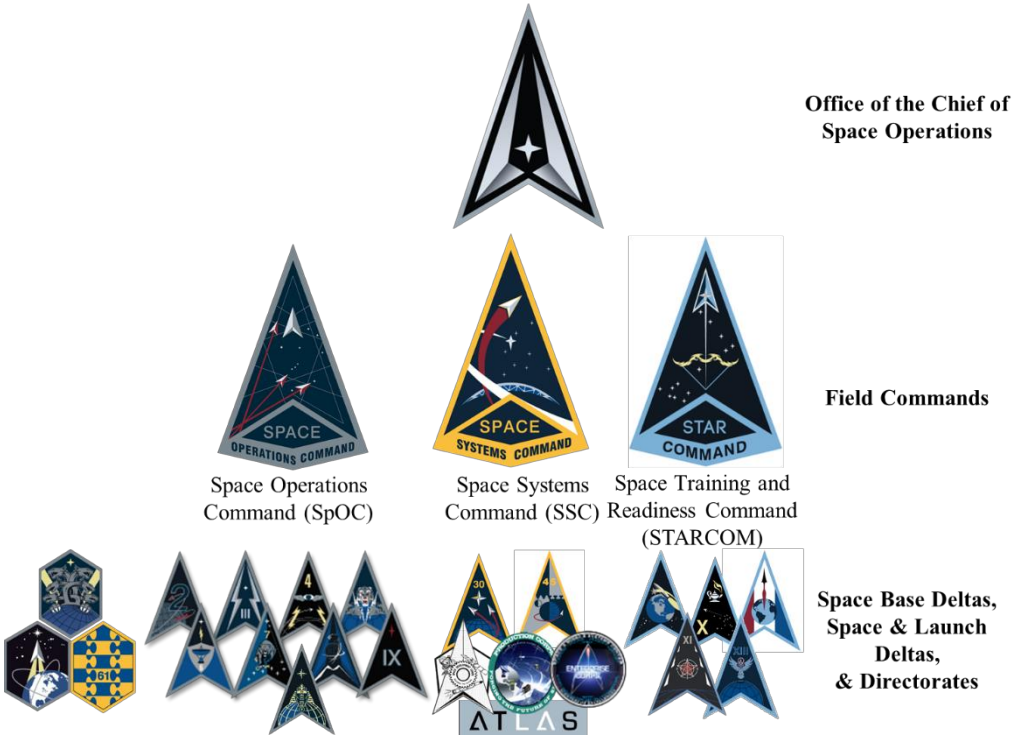


Figure 1. USSF structure

a. **SpOC.** SpOC generates, presents, and sustains combat-ready Guardians for space operations, intelligence, cyberspace, and combat support missions.

b. **STARCOM.** STARCOM is responsible for preparing every Guardian to prevail in competition and conflict by developing and conducting education, training, doctrine, wargaming, lessons learned, test, and evaluation.

c. **SSC.** SSC is responsible for delivering new space capabilities at operationally relevant speeds, to include developing, acquiring, equipping, fielding, and sustaining those capabilities. SSC builds, launches, and sustains space capabilities for military and civilian users worldwide.

USSF Personnel Organizations

a. **OCSO.** OCSO staff establishes policy, assigns responsibilities, and prescribes procedures for USSF personnel readiness. The VCSO implements plans, programs, and policies for managing the USSF and all Guardians. The CMSSF advises and assists the CSO and Secretary of the Air Force (SecAF) on matters concerning enlisted Guardians.

b. **Chief Human Capital Officer (CHCO).** The CHCO (SF/S1) assists the SecAF and the CSO by developing policies, programs, and processes for the recruitment, employment, organization, professional development, and retention of personnel to meet USSF manpower requirements. The USSF Talent Management Office (TMO) engages with Guardians to develop and effectively employ their talents from recruitment to retirement or separation. Offices under the CHCO develop USSF Total Force policy and guidance, and identify manpower and personnel requirements. They create and review personnel policies, guidance, programs, and legislative initiatives. Offices under the CHCO work with multiple Air Force offices and the Air Force Personnel Center (AFPC) to oversee manpower, policy, and management for Guardians. Specific Air Force offices include the Assistant Secretary of the Air Force Manpower & Reserve Affairs (SAF/MR), Air Force Manpower, Personnel and Services (AF/A1), and the Assistant Secretary of the Air Force for Acquisition, Technology, and Logistics (SAF/AQ) (for those in the Acquisition Demonstration program).

c. **FIELDCOM and Separate Units' Manpower and Personnel Offices.** The FIELDCOM and separate units' manpower and personnel offices execute military and civilian personnel management in support of those organizations' missions and priorities. These offices develop manpower inputs by providing operational assessments on required systems and capabilities that facilitate the planning cycle. The FIELDCOM and separate units' manpower and personnel offices are also engaged in force development for all Guardians. These offices are also responsible for readiness program management including Air Reserve Component (ARC) activations and mobilizations, continuity of operations plans, reporting instructions and accountability, deployment discrepancies, and force presentation management.

d. **Deltas and Space Base Deltas Personnel Support**. Guardians assigned to a Delta rely on their supporting FIELDCOM, Space Base Deltas, installation Force Support Squadron, and the USSF TMO for personnel and manpower transactions.

e. **Space Force Element (SFELM).** SFELMs consist of Guardians on duty with organizations outside the DAF (e.g., the National Reconnaissance Office, and combatant commands). Guardians assigned to an SFELM may rely on a FIELDCOM or the SF/S1 for manpower and personnel functions.

Component Field Command

Like any other military service, the Space Force will prepare to present forces to every combatant command. Service components are the primary building blocks of every joint force. In accordance with joint doctrine, Space Force components will be the organizational structures through which Guardians will integrate into the joint force. A component field command (C-FLDCOM) will integrate space operations at the component level, conducting military operations under the delegated authorities of a combatant commander. Space Force components will play an important role integrating space capabilities into joint operations in every domain and every area of responsibly.

Chapter 3: Force Development

Force development is the deliberate effort to establish an opportunity-rich environment for personnel to determine their career path. It helps build Guardians ready to execute the Service's cornerstone responsibilities in all domains and to outpace our adversaries. It depends on dynamic processes that integrate and synchronize senior leader perspectives and organizational needs to forecast qualitative and quantitative requirements for the service.

The desired outcome of force development is to increase readiness, and ensure Guardians are equipped and trained for their missions. Force development for all Guardians begins with recruiting followed by robust training, education, and experience to develop a skilled, resilient, and solution-oriented workforce.

For a Guardian there is no single pathway or definition of career success. Combining training, education, and experiential learning, the USSF works to produce the balance of expertise and competence needed to satisfy operational requirements and meet the CSO's priority to develop warfighters in world-class teams. The USSF invests in individuals and, as feasible, matches their interests, strengths, and potential with the Service's current and future needs.

Guardian Values

Essential to force development is instilling each Guardian with USSF values. *The Guardian Values Handbook* will formalize and support institutionalization of the USSF values. Guardian values will serve as the foundation of our culture and identity as Guardians.

Character… above all
Connection… toward unity
Commitment… to mastery
Courage… to be bold

Guardian Development

Talent management and employment of Guardians includes training, education, and experience-based development, enabling continuing professional development over the entirety of an individual's career. Building on the foundational knowledge provided through training and education, and solidified with practice and experience, every individual receives tailored developmental opportunities. This approach allows each Guardian flexibility in accessing available resources, maximizing their potential as they establish their career path. This process also allows the USSF to capitalize fully on a Guardian's knowledge and previous experience. The USSF TMO divisions each focus on an aspect of talent management and operations.

a. **Guardian Generation**. Guardian Generation focuses on recruiting talent, hiring, onboarding, inter-service transfers, and ensuring engagement with Guardians.

b. **Guardian Development**. Guardian Development manages the competency framework, oversees developmental programs such as mentoring and coaching, and manages the talent management related boards.

c. **Guardian Employment.** Guardian Employment, along with AFPC, orchestrates Guardian assignments and use of Department of Defense (DOD), DAF, and United States Air Force (USAF), programs.

d. **Studies and Analysis.** Studies and Analysis employs data and people-related science that helps to inform and improve all talent management decisions, processes, and programs.

Guardian Career Fields

Essential to the development of Guardians is career field assignment. The CHCO, under SecAF authority, uses the defined developmental categories and specialty codes within each category. The USSF assigns Guardians to one of the core specialties in figure 2 below. Guardian training focuses on developing skills and knowledge required to excel in their assigned specialty area.

Developmental Categories	Core Space Force Specialties
Operations	Astronaut (Officers) Space Operations Intelligence Cyberspace Operations
Force Modernization	Developmental Engineer Acquisition Management

Figure 2. USSF career field designations

Developmental Teams (DT)

DTs manage force development for all Guardians. DTs establish an understanding of both resources and requirements and ensure Guardians in every career field receive appropriate support for their professional development. The USSF uses a comprehensive and individualized approach to personnel development supported by centralized and concurrent boards for promotions, assignments, education, command selection, performance-based retention, development program matches, competency framework adjustments, diversity, and recruiting needs in accordance with all applicable laws and policies. Board members and hiring officials review competencies required to fill projected needs, and consider an individual's personal circumstances and capabilities, and any aspirations they wish to share with the board. While performance is necessary to identify qualified promotion candidates, it does not guarantee the preparedness of individuals to assume increased responsibilities.

Training

Training facilitates development of the necessary knowledge, skills, and abilities for Guardians to execute their role within the USSF, from initial entry to the Service, and throughout their career. Training moves Guardians from initial assessment through advanced skill development. Training also includes specialized skill development for a career field, qualification training for specific duties, tool or weapon system proficiency, or for deployment preparations. Training is not necessarily a sequential process, allowing individuals to request training exemption waivers that allow them to progress to more advanced training or to receive training in a new area. This is particularly true for Guardians transferring from another Service that bring with them extensive knowledge and experience. Guardians will require training throughout their career. Advancement through training courses is not dependent on rank, grade, or time in service.

Competencies and Development

An individual's competencies and experiences drive progress through the training process and achievement of higher tiers of expertise.

- Level 1 – Basic proficiency
- Level 2 – Intermediate proficiency
- Level 3 – Advanced proficiency
- Level 4 – Expert proficiency

Competencies are the knowledge, skills, abilities, and other characteristics necessary to complete tasks. The USSF identifies competencies in two broad categories: foundational and occupational. Foundational competencies or soft skills focus on the human aspects of an individual's strengths, including knowledge, skills, abilities, and other characteristics that transcend occupational knowledge and skills (e.g., character, emotional intelligence).

a. **Accession Training.** A new Guardian's first stop is accession training. Accession training establishes a foundational culture common to all Guardians. For enlisted Guardians this is basic military training. Officer accession training is via the individual's commissioning source (military academy, reserve officer training corps, or officer candidate school). Interservice transfers complete a Guardian orientation course.

b. **Individual Skills Training (IST).** Following accession training, Guardians proceed to IST. These specialty-awarding courses provide Guardians the basics of their assigned career fields.

c. **Spacepower Discipline Courses.** The 319th Combat Training Squadron (CTS), part of STARCOM/Delta 1, provides the spacepower discipline (SPD) courses for the USSF. SPD courses are open to all space forces. These courses teach the initial competencies and critical thinking skills for a specific spacepower discipline. There are currently four SPD 100-level courses, covering the disciplines of Orbital Warfare, Space Electronic Warfare, Space Battle Management, and Military Intelligence. The 319 CTS currently offers two SPD-300 courses, on Orbital Warfare and Overhead Persistent Infrared systems. The material in these courses deepens an individual's expertise in a discipline, and helps them understand the link between that discipline and the joint fight.

SPD Courses

The 319 CTS is maturing SPD training and adding new courses. Current SPD-100 level courses will migrate to on-line delivery to simplify participation. SPD-200 and SPD-300 courses will be more in-depth, building on the SPD-100 courses.

d. **Mission Qualification Training (MQT).** Following spacepower discipline training, Guardians complete MQT associated with a specific weapon system. MQT often contains a variety of hands-on instruction and simulator or weapon system evaluations that culminate in a certification to operate a weapon system.

e. **Career Specialty and Other Courses.** Guardians will require training beyond the SPD courses throughout their careers, whether to support their specific career field, to prepare for deployment, to maintain proficiency, or to support a new weapon system. The USSF, USAF, other services, and the joint community may provide these courses.

1) **Astronaut.** Guardians selected for the astronaut program complete required training through the National Aeronautics and Space Administration (NASA) or other agencies as directed.

2) **Operational TTPs.** The Ready Spacecrew Program focuses on enhancing knowledge and warfighting capability of space forces. Advanced training courses address operational TTPs that include cyberspace and intelligence to prepare space forces to integrate effects across multiple domains and achieve weapon system mastery. Examples of advanced training include, but are not limited to, exercises (e.g., Space Flag), and wargames (e.g., Schriever/STARCOM wargames).

3) **Intelligence.** Guardians assigned to the intelligence specialty may pursue training through intelligence community sources such as the Defense Intelligence Agency's Joint Military Intelligence Training Center, and the National Security Agency's National Cryptologic School.

4) **Cyberspace Operations.** Guardians assigned to the cyberspace operations specialty can leverage the DOD Cyber Exchange for a wide range of training courses.

5) **Deployment Preparation.** Guardians preparing for deployment receive preparation training, including tactics, techniques, and procedures (TTPs) and combatant commander support, from the 319 CTS. These preparatory courses include the Space Warfighter Preparation Course and Space Flag Preparatory Course. Space forces may also receive training at their deployed location.

6) **Acquisition Management.** Guardians assigned to the acquisition management or developmental engineering specialties can pursue training and certification within one or more of the six functional areas as established by the Under Secretary of Defense for Acquisition and Sustainment. The functional areas are Program Management, Contracting, Life Cycle Logistics, Engineering and Technical Management, Test and Evaluation, Business – Financial Management and Cost Estimating.

7) **Digital Fluency and Supra Coders Courses.** In the USSF's first planning guidance publication, the CSO established his intent to create a digital service to accelerate innovation. This vision applies to all USSF operations, acquisition, engineering, and business processes. The CSO calls on Guardians and other personnel assigned to the USSF, to acquire and use innovative digital skills in their assigned duties regardless of career specialty. Guardian Supra Coders, having completed an intensive software engineering curriculum, become members of agile software development product teams in the field so they can develop, deploy, and update software that works for its users at the speed of mission need. Digital Fluency courses are available through the Digital University (accessible via the Space Force Portal). Supra Coder courses are accessible at https://supracoders.us/.

8) **Other Courses.** Guardians may pursue a variety of other courses as their careers and assignments progress. Among these may be joint courses in planning and targeting.

Education

Building on the knowledge and skills developed through training, formal education hones knowledge, critical and strategic thinking skills, and leadership abilities. An individual attends professional military education (PME), professional continuing education (PCE), or pursues advanced degrees based on demonstrated ability, potential, and readiness to take the next step in leading inclusive, innovative, and agile teams.

a. **PME.** PME programs educate Guardians to leverage military power to achieve national security objectives. Courses such as Airman Leadership School, Noncommissioned

Officer Academy, Senior Noncommissioned Officer Academy, Squadron Officer School, Air Command, and Staff College – Schriever Space Scholars, School of Advanced Air and Space Studies, Air War College – West Space Seminar, and the Joint Professional Military Education courses support Guardians as they progress through the ranks.

b. **PCE.** PCE provides continued professional development for individuals in all specialty areas.

1) **Space PCE Courses.** National Security Space Institute (NSSI), part of STARCOM Delta 13, provides PCE for all DOD space professionals as well as allies and partners. The NSSI offers a wide range of courses through the College of Professional Development and the College of Space Warfare. Within the College of Professional Development, Space 100 (introduction to space capabilities and operations), Space 200 (space operations and the joint and space planning processes) and Space 300 (capability development, and space policy and strategy) serve to broaden an individual's overall understanding of space, and provide in-depth knowledge of specific topics to satisfy mission accomplishment, sustainment, or enhancement. Other NSSI courses within the College of Professional Development include the Space Executive Course and the Space Capstone Publication Course. Within the College of Space Warfare, existing and emerging courses include Introduction to Space, Space Familiarization Course, Space Intelligence Fundamentals Course, Joint Space Targeting Course, Fundamentals Application Space Targeting Course, Coalition Space Course, Joint Space Planners Course, Joint Integrated Space Team Course, Fundamentals of Orbital Operations Course, Concepts of Orbital Warfare Course, and Global Space Domain Awareness Course. The NSSI continues to develop new courses within both colleges as the need and interest arise.

2) **Weapons School.** Individuals assigned to space operations, cyberspace operations and intelligence can attend the United States Air Force Weapons School (USAFWS). USAFWS teaches graduate-level courses that provide advanced training in weapons and tactics employment. The 19th Weapons Squadron (WPS) (intelligence), 328 WPS (space), and 32 WPS (cyberspace) support USSF and USAF personnel. Additionally, enlisted space and intelligence personnel can attend the USAFWS Advanced Instructor Course.

3) **Intelligence.** Guardians assigned to the intelligence specialty may attend a wide variety of courses across the different intelligence disciplines. The 313th Training Squadron at Goodfellow Air Force Base offers the intelligence Basic Career Development Program, Intermediate Career Development Program, and Advanced Career Development Program courses. Additionally, enlisted intelligence personnel can apply to attend the National Intelligence University for Bachelor's or Master's degrees in a select field of study.

4) **Cyberspace Operations.** Guardians assigned to the cyberspace operations specialty may pursue PCE courses through the Air Force Institute of Technology (AFIT) School of Systems and Logistics or the School of Strategic Force Studies.

Intelligence and Cyberspace Education

STARCOM recognizes the need to extend intelligence and cyberspace advanced training to meet the growing requirements of the USSF. Future intelligence and cyberspace courses for Guardians may fall under the USAFWS to promote continued integration within the DAF.

5) **Acquisition Management and Developmental Engineering.** Guardians assigned to the acquisition management and developmental engineering specialties may pursue courses through Defense Acquisition University, the AFIT School of Systems and Logistics, or acquisition courses offered by other services or other government agencies.

6) **Acquisition Instructor Course (AQIC).** AQIC develops acquisition officers as expert instructors and integrators. Instruction focuses on instructorship, operational integration, and critical thinking

7) **USAF Test Pilot School Space Test Course.** The Space Test Course offers a rigorous education in test fundamentals, systems testing, and space sciences.

c. **Advanced Degrees.** Guardians can attend AFIT or the Naval Postgraduate School for space, cyberspace, engineering, and acquisition related degree programs. Individuals may also pursue other degree programs through traditional colleges and universities that support their professional and personal development goals. Guardians also have access to a variety of science, technology, engineering and math degree programs, and space research opportunities, through the USSF's University Partnership Program. While the nature of space operations means that science, technology, engineering and math degrees are most applicable to daily requirements, space forces are encouraged to pursue degrees in other fields of interest as well.

Experience

Experience contributes to an individual's development in ways that neither training nor education can. Diverse experiences enable Guardians to be more effective team members. This experience may come from operational experience on the job, experience developed while part of another Service, internships, education with industry (EWI), or other experience in the commercial sector. Guardians are encouraged to take advantage of the unique opportunities for development that come with assignments including those listed below:

- Joint assignments

- USAF assignments (such as at Air Force Research Laboratory (AFRL))
- Training assignments
- Recruiting assignments
- Deployments
- Participation in partnerships with our allies and international partners
- Engagements with allies and partners through wargames and exercises
- Liaison positions with other agencies
- EWI
- Engagements with academia (Seminars, Reserve Officers' Training Corps (ROTC) instructor, or instructor at the United States Air Force Academy)

Chapter 4: Guardian Resilience

The USSF's mission and commitment to serve our nation can be challenging and stressful to Guardians and their families. Developing individual resilience involves building skills to establish behaviors, and patterns of thought and action, which promote personal wellbeing and mental health. Resilience — an individual's capacity to recover from hardship or difficulties — is a critical element of readiness. People can develop the ability to withstand, adapt to, and recover from stress and adversity by using effective coping strategies. Thus, strengthening resilience has a direct impact on the lethality and effectiveness of a warfighting unit. Those who are physically, mentally, spiritually, emotionally, or financially overwhelmed may struggle to adapt and fail to perform successfully in dynamic and stressful environments. Safeguarding and strengthening resilience extends beyond the readiness imperative and constitutes a solemn commitment embraced by every leader.

The USSF is committed to providing this support to all Guardians and those forces attached or assigned to the USSF. A variety of programs including those detailed below, and equal opportunity, counseling, mental health support, and financial support, provide Guardians the means to develop resilience (physically, mentally, spiritually, or emotionally) or to deal with challenging situations.

Coaching and Mentoring

Coaching and mentoring programs, accessible through TMO, are central to continuous development and engagement. Mentorship programs match a Guardian to another more experienced Guardian who can share perspectives and insight. Coaching programs focus on helping Guardians improve in desired areas of their personal lives and professional performance. Mentorship and coaching programs supplement leadership efforts to address Guardian needs for individualized and small group support.

Diversity and Inclusion

A diverse, inclusive force is one strengthened by a myriad of unique perspectives and experiences. The Assistant Secretary of the Air Force for Diversity and Inclusion (SAF/DI) provides guidance, direction, and support to both USAF and USSF personnel. Diversity education and training is critical to the development of our Guardians at every stage of their careers to meet emerging operational challenges. Cultivating diversity acumen fosters an inclusive culture in which members of different groups bring diverse knowledge and perspectives to the organization. The SAF/DI office will assist STARCOM as needed with curriculum, content, and methodology for training Guardians. These efforts will set a strong foundation for Guardians to lead diverse teams in an increasingly competitive and dynamic global environment.

Sexual Assault and Harassment Prevention

"Each member of our team shares in the enduring responsibility to eliminate sexual assault and harassment from our ranks. I urge every Airman, Guardian, and Department civilian to treat each other with dignity and respect, hold others accountable to our high standards of conduct, and to take care of your teammates." SecAF Frank Kendall, 27 April 2022

Sexual harassment and assault undermine the cohesion, readiness, and morale of the force. Every Guardian has a role to play in fighting the crime of sexual assault. SecAF Frank Kendall signed a proclamation, on 27 April 2022, reaffirming DAF's commitment to preventing sexual assault and sexual harassment, and to supporting sexual assault survivors. Sexual Assault Prevention and Response (SAPR) supports Guardians in working to eliminate sexual assault in the Space Force. SAPR and Family Advocacy Programs support Guardians and other forces assigned to the USSF, and their families who are victims of sexual assault. SAPR provides support for adult sexual assault victims when the perpetrator is someone other than the victim's spouse or domestic partner. The Family Advocacy Program manages sexual assault allegations when the alleged offender is the partner in the context of a spousal relationship, domestic partnership, unmarried intimate partner relationship, or when the victim is a military dependent 17 years of age or younger.

Suicide and Violence Prevention

Losing a Guardian or family member to death by suicide or a violent event can have a significant impact on an organization's morale and readiness. The USSF's Prevention Team supports Guardians and other forces assigned to the USSF, and their families by creating a primary prevention program for interpersonal and self-directed violence, including domestic violence, child abuse, sexual assault, sexual harassment, and suicide.

Other Programs

a. **Family and Spouse Support Programs.** There are a variety of other programs including the Exceptional Family Member Program, Key Spouse Program, Spouse Education and Career Opportunities program, Priority Placement Program, Join-Spouse Program, Childcare Development Center, and Guardian Family Career Program, which support Guardians and their families.

b. **Morale, Welfare, and Recreation (MWR) Office.** MWR on Air Force and Space Force bases offers a variety of programs for Guardians and their families that support readiness and resilience. These include intramural sports, life skills programs, personal health and wellness programs, fitness programs, the hobby shop, religious services and programs, childcare, and other programs and events for children and teens.

c. **Air Force Services Center (AFSVC).** AFSVC offers a variety of programs at Air Force and Space Force bases intended to build a resilient force through creative customer-driven recreational programs for Guardians and their families both on and off the

installation. These programs include aero clubs, bowling, exercise facilities, combined clubs, golf courses, event tickets, and travel.

d. **ESport/Space Force Gaming.** Also managed by AFSVC, Air Force Gaming and Space Force Gaming are the official ESport gaming programs and competition hub for the USAF and USSF. ESport is a program designed to bolster resilience, forge camaraderie, and hone warrior-lethality in preparation for the future fight. Twice a year, Airmen and Guardians from around the world compete in the DAF Gaming League in order to find the best in the DAF.

Chapter 5: Global Perspective

Guardians must develop and maintain a global perspective in order to provide innovative solutions and spacepower effects for the US and our allies. Guardians must be sufficiently agile to leverage joint, interagency, allied, civil, and/or commercial resources. Our global persistence and enduring vigilance posture the joint force to assure allies, deter aggression, coerce competitors, and defeat adversaries. USSF training, education, and readiness inculcate Guardians with an understanding of joint planning, doctrine, and partnerships/engagements (multinational, interagency, academia, and industry) in order to advance national priorities as part of the joint force.

Engaging with the Joint Community

The USSF organizes, trains, and equips Guardians to provide capabilities to meet joint force requirements in support of the National Defense Strategy. Through their training, education, and experience, Guardians master concepts, doctrine, and practices as joint warfighters to maximize the power of integration with the Army, Navy, Air Force, Marine Corps, and Coast Guard. Guardians also focus on addressing threats and risks affecting our capabilities and forces, and institute mitigation steps in order to ensure our competitive advantage.

Guardians exercise close integration with their service and combatant command partners at all echelons of joint command. This includes participation in the planning, conduct, and assessment of operations to deliver space effects to all domains, to protect and defend space capabilities, and deny the advantage to the adversary. Joint integration is crucial to employing space expertise in the joint forces' synchronization, planning, and execution efforts. The USSF training and education includes the USSF planning process, as described in SDP 5-0, *Planning*, to prepare Guardians to engage with other services and the joint community.

Multinational Partnerships - Our Allies and Partners

Every day, Guardians take action and make decisions that can have international consequences. Expanding our cooperation with allies and partners to enhance prosperity and security is a priority for the USSF identified by the CSO. Deliberate engagements with our treaty allies and partners orient our responsibilities to enhance deterrence, protect mutual interests, assure access, and build capability and capacity for a common purpose. Guardians engage with our allies and partners to establish common norms of behavior, and to understand the unique backgrounds and the capabilities they bring to space in the combined fight. These partnerships may extend to foreign military, civil, and commercial entities as necessary to provide the USSF operational and strategic advantages in the space domain.

Guardians at every skill level and from every space discipline can have the opportunity to engage with allies and partners in several ways. Examples of such duties include:

a. **Mobile Training Teams.** These are short-term duties where Guardians engage foreign partners for a specific purpose, such as new equipment training, cultural alignment, or doctrinal exchange.

b. **Military Personnel Exchange Program.** These are positions, managed at the SecAF level, that directly exchange Guardians with a foreign command. Guardians fulfill their duties as a part of that organization. The foreign command reciprocates by assigning personnel to a position within a USSF organization. Both units benefit from the experience of being part of an international team.

c. **Liaison Officers (LNO).** The USSF selects Guardians to represent either the Service or a subordinate Field Command to an allied or partner organization. They are the "on the ground" resource for allies and partners to engage the USSF. LNOs reduce friction and synchronize action between their sending and receiving commands.

d. **Security Cooperation Officers.** Assigned as a staff member to a US Embassy Country Team, these Guardians coordinate and execute the Service's security cooperation programs directly with the government and militaries of allied and partner nations.

e. **Study Abroad.** These programs offer Guardians extended immersion in a foreign culture at an institution of higher learning. Study abroad programs allow participants to make personal connections with academic, civil, and commercial space experts outside of the United States. Guardians return to the USSF with increased knowledge and insights earned through the experience.

f. **Regional Space Advisor (RSA) Program.** The RSA Program identifies and prepares a select group of Guardians for direct interaction with allies and partners. RSAs form a cadre of Guardian leaders deliberately developed to enhance USSF capabilities by evolving and expanding partnerships to strengthen relationships, secure common interests, and promote shared values in space. As a career-broadening program, USSF expects RSAs to demonstrate proficiency in a core space discipline and receive additional training to increase their personal leadership competencies. With advanced knowledge of space policies and political-military affairs, regional and cultural expertise, and demonstrated language proficiency (as needed), the USSF assigns RSA to key strategic billets. In those roles, RSAs implement campaign support plans and inject, track, and assess the USSF's space domain interests within both regional theater security cooperation plans, and allied and partner nation activities.

Interagency, Industry, and Academic Engagements

USSF interagency, academic, and industry engagements are key components to strengthening our overall capabilities. Guardians with exposure to other government agencies as LNOs, in joint or interagency assignments, working in a DAF organization such as AFRL or at the LeMay Center, or through other engagements gain valuable experience while providing space expertise to these organizations. For example, today there are Guardians assigned to the National

Reconnaissance Office, National Geospatial-Intelligence Agency, National Air and Space Intelligence Center, the Department of Commerce, and NASA. Guardians can also participate in EWI to develop first-hand knowledge of industry capabilities and processes. The USSF has established developmental partnerships with a network of universities that can provide world-class space research and professional development opportunities. These outreach relationships enable the USSF to foster a diverse, highly technical, and specialized workforce. The aim is to collaborate, as permitted by law and policy, on the long and short-term science and technology (S&T) problem sets; and to promote partnerships with academic institutions, government labs, and private industry. This collaborative and inclusive approach allows the USSF to promote and strengthen strategic relationships to deliver new capabilities at operationally relevant speeds that enhance security and preserve prosperity of the space domain.

a. **University Partnership Program (UPP).** The UPP aims to establish strategic partnerships with some of the nation's top universities that possess high academic standards, nationally-ranked Science, Technology, Engineering, and Mathematics (STEM) degree programs, world-renowned space-related research, and established ROTC detachments. The UPP's objectives are to develop a highly competent and diverse workforce; advance strategic focus areas and pursue critical S&T topics that are significant to the USSF; and create workforce development and advanced academic degree opportunities for Guardians. In addition, the UPP provides scholarships, internships and mentorship programs for university students and ROTC cadets with the goal of recruiting and developing diverse Guardians with a particular focus on STEM and space disciplines.

b. **University Consortium (UC).** A vital component of the UPP, the UC represents an opportunity for universities to contribute to USSF's S&T priorities. The purpose of the UC is to connect universities to DOD space research and transition opportunities to USSF, communicate problem focus areas to space consortium members, and foster collaboration between universities, government, and industry. Additionally, the collaboration with government laboratories, including Air Force Research Laboratory, Naval Research Laboratory, Army Research Laboratory, Department of Energy, National Aeronautics and Space Administration, industry and international research institutions, aims to provide research and infrastructure to accelerate innovation and transition and foster space workforce development.

Chapter 6: USAF Support to the USSF

The USSF, as part of the DAF, employs Guardians, active-duty Airmen, DAF civilians, Air Force Reservists and Air National Guardsmen to execute the space mission. DAF Airmen and civilians also provide installation and facilities support for Garrisons and Space Force Bases.

Personnel Serving in USSF Organizations

a. **Active-duty Airmen.** Active-duty Airmen serve in all the space specialties. Active-duty Airmen also provide essential services at the Space Force Base and Garrison levels. AFPC and SAF/A1 handle personnel matters for Airmen assigned to the USSF or stationed on Space Force Bases.

b. **Civilians.** Civilian Guardians are members of the DAF. Civilians assigned to the USSF work at all levels of the service, including all space specialties. DAF civilians also provide essential services at the Space Force Base and Garrison levels. The USSF civilian personnel office (SF/S1C) is an extension of the DAF and is responsible for managing civilians assigned to the USSF in space specialty career fields. AFPC, AF/A1, and TMO handle personnel matters for all other DAF civilians supporting Garrisons or stationed on Space Force Bases. DAF civilian Career Field Teams manage civilian professional development through input from USSF career field leadership and talent managers. Civilian Guardians participate in DAF civilian development programs, development teams, and selection processes composed of boards and panels that include USSF senior leaders.

c. **Air Force Reserve (AFR).** The AFR is part of the reserve component of the USAF. Air Force Reservists, including Individual Mobilization Augmentees, enable surge capacity, conduct operations, and provide operational support for USSF missions. These forces remain in the Air Force and follow Air Force personnel processes and policies. The AFR provides follow-on forces to meet any joint force mission. The AFR allows the USSF to leverage industry experience as a force multiplier, enables a continuum of service, and provides expanded talent management options for the force.

d. **Air National Guard (ANG).** ANG is part of the reserve component of the USAF. Control of ANG units may alternate between their state governments and the federal government. The ANG is currently performing space missions in command and control, intelligence, space electromagnetic warfare, staff augmentation, and missile warning. The ANG builds partnerships at the international, federal, state, and local levels to contribute to the nation’s strength and readiness.

Development of Air Reserve Component Space Professionals

Today AFR and ANG space professionals remain part of the USAF. The USSF is developing processes and policies to ensure a common presentation of forces to combatant commanders, and preservation of capability among forces performing space missions. Coordination with the AFR and ANG to identify impacts to mission capability remains critical as the USSF grows.

USAF Organizations Supporting the USSF

USAF organizations provide many of the personnel functions for Guardians and USAF, AFR, and ANG personnel assigned to USSF units or Space Force Bases. In addition to the personnel support functions detailed below, USAF also provides legal, religious affairs, finance, contracting, meteorological, and mortuary affairs support to Guardians.

a. **Air Force Offices.** AF/A1, SAF/MR, and SAF/AQ in coordination with SF/S1, provide oversight for all DAF manpower, personnel, and service activities. These roles include policy development and oversight of DAF manpower (military and civilian personnel), reserve component affairs, the Acquisition Demonstration program, equal opportunity and diversity, medical readiness and health programs, family advocacy and readiness programs, sexual assault prevention and response, base services, exchanges, commissaries, and MWR programs.

b. **AFPC.** AFPC provides operational oversight, instructions, and guidance to USSF and its FIELDCOMs for Guardians and Airmen assigned to USSF units. AFPC in conjunction with offices under the SF/S1 manages assignments for Guardians assigned to the USSF.

c. **Air Force Materiel Command (AFMC).** AFMC is the servicing major command for installation and facilities operations on Space Force Bases. AFMC is responsible for ensuring Airmen assigned to USSF Garrisons receive the same force development opportunities, and functional and administrative support, as those at USAF installations.

d. **Air Force Reserve Command (AFRC).** AFRC provides operational oversight, instructions, and guidance to USSF and its FIELDCOMs including operating procedures to implement and maintain guidance. Air Reserve Personnel Center (ARPC) provides record keeping for Air Force Reserve (AFR) and Air National Guard personnel. AFR members assigned to USSF organizations formulate and implement policy, guidance, and resources pertaining to AFR forces, and advise USSF leadership on the operational employment of Reservists.

e. **National Guard Bureau (NGB)**. The NGB provides resources, policy oversight, and guidance to ensure Air National Guard personnel are ready, trained, and equipped for homeland and global operations. Guardsmen assigned to USSF organizations provide advice and assistance on NGB matters affecting the USSF. They synchronize NGB and USSF efforts, support unit readiness, and plan optimal integration into future missions.

Appendix A: Acronyms and Abbreviations

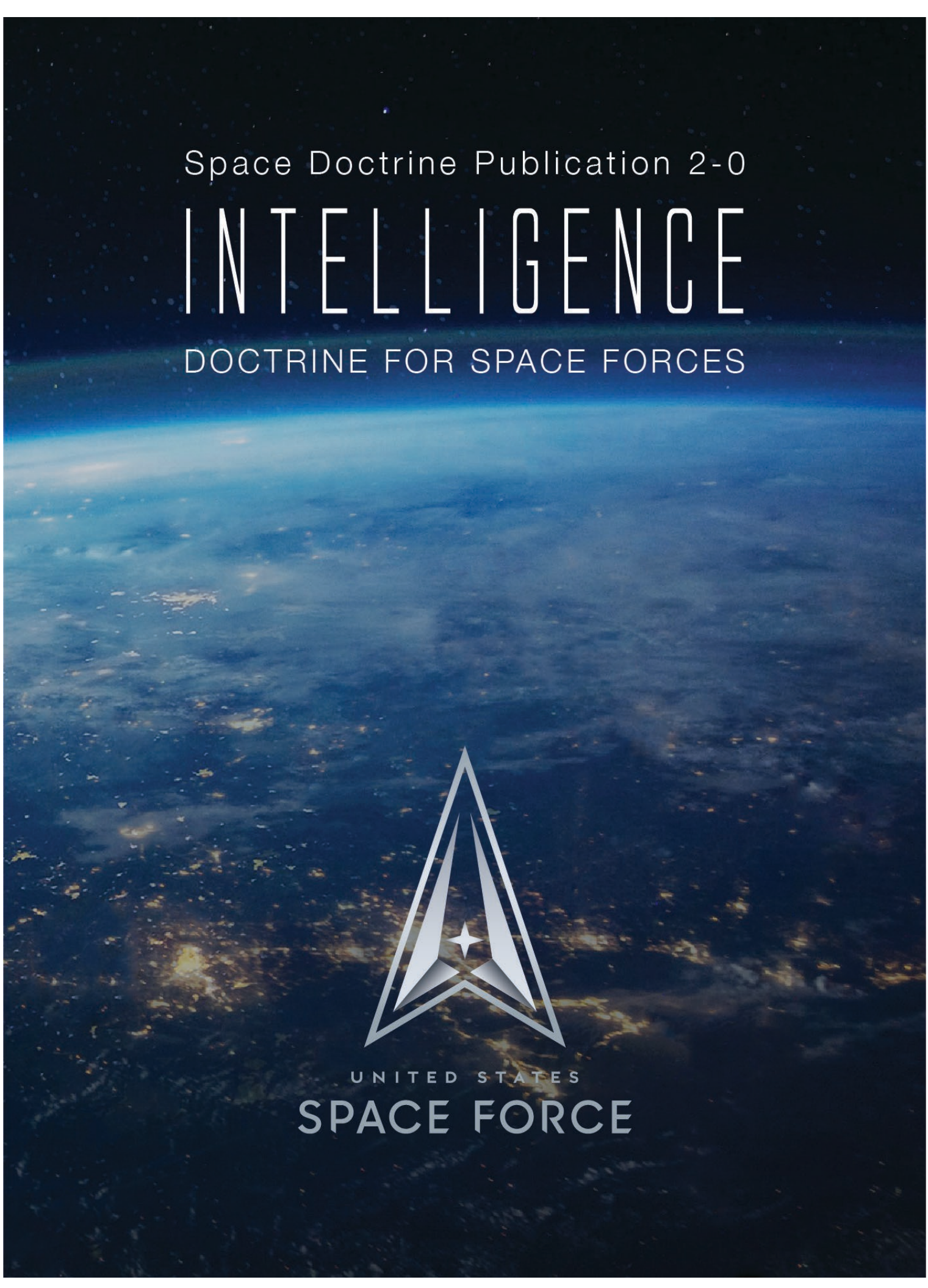
AFIT	Air Force Institute of Technology
AFPC	Air Force Personnel Center
AFMC	Air Force Materiel Command
AFR	Air Force Reserve
AFRC	Air Force Reserve Command
AFSVC	Air Force Services Center
ANG	Air National Guard
AFRL	Air Force Research Laboratory
AQIC	Acquisition Instructor Course
ARPC	Air Reserve Personnel Center
C-FLDCOM	component - field command
CHCO	Chief Human Capital Officer (SF/S1)
CMSSF	Chief Master Sergeant of the Space Force
CSO	Chief of Space Operations
CTS	Combat Training Squadron
DAF	Department of the Air Force
DOD	Department of Defense
EWI	Education with Industry
FIELDCOM	field command
IST	Individual Skills Training
LNO	Liaison Officers
MQT	Mission Qualification Training
NASA	National Aeronautics and Space Administration
NGB	National Guard Bureau
NSSI	National Security Space Institute
PCE	professional continuing education
PME	professional military education

MWR	Morale, Welfare, and Recreation
ROTC	Reserve Officers' Training Corps
RSA	Regional Space Advisor
S&T	science and technology
SAF	Secretary of the Air Force
SAF/AQ	Assistant Secretary of the Air Force for Acquisition, Technology, and Logistics
SAF/DI	Assistant Secretary of the Air Force for Diversity and Inclusion
SAF/MR	Assistant Secretary of the Air Force Manpower & Reserve
SAPR	Sexual Assault Prevention and Response
SDP	Space Doctrine Publication
SecAF	Secretary of the Air Force
SFELM	Space Force Element
SPD	spacepower discipline
SpOC	Space Operations Command
SSC	Space Systems Command
STARCOM	Space Training and Readiness Command
STEM	Science, Technology, Engineering and Mathematics
TMO	Talent Management Office
TTP	tactics, techniques and procedures
UC	University Consortium
UPP	University Partnership Program
USAF	United States Air Force
USAFWS	United States Air Force Weapons School
USSF	United States Space Force
VCSO	Vice Chief of Space Operations
WPS	Weapons Squadron

Space Doctrine Publication 2-0

INTELLIGENCE

DOCTRINE FOR SPACE FORCES



UNITED STATES

SPACE FORCE

Space Doctrine Publication (SDP) 2-0, *Intelligence*
Space Training and Readiness Command (STARCOM)
OPR: STARCOM Delta 10
19 July 2023

Foreword

Space Doctrine Publication (SDP) 2-0, *Intelligence* establishes doctrine for United States Space Force (USSF) intelligence operations to support the freedom to operate in, from, and to space. This doctrine publication is official advice and commanders should follow it except when, in their judgment, circumstances dictate otherwise. By its nature, doctrine is not directive, and instead provides the Space Force an informed starting point for decision-making and strategy development. Doctrine reflects fundamental principles and best practices based on extant capabilities. It incorporates changes derived from lessons learned during operations, training, wargames, exercises, and, when appropriate, validated concepts.

SDP 2-0, *Intelligence*, aligns with current Space Force doctrine and Chief of Space Operations' Planning Guidance. SDP 2-0 articulates the importance of intelligence in space operations, the contributions space makes to the body of intelligence data available to the joint warfighter, how the Space Force participates in the intelligence process to ensure that data is available, and the role of Guardians in the intelligence community.

Many years of developing space personnel allows our doctrine to speak from a position of authority. I encourage you to study and learn from the time-tested knowledge compiled in this publication. Semper Supra!

SHAWN N. BRATTON
Major General, USAF
Commander, Space Training and Readiness Command

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Space Force Doctrine

Space Force doctrine guides the proper use of military spacepower in support of the Service's cornerstone responsibilities. It establishes a common framework for employing Guardians as part of a broader joint force. Doctrine provides fundamental principles and authoritative guidance for the employment of military spacepower and an informed starting point for decision-making and strategy development. Since we cannot predict the timing, location, and conditions of the next fight, commanders should be flexible in the implementation of this guidance as circumstances or mission parameters dictate. Where the United States Space Force (USSF) is developing new policies, processes, or structures, call-out boxes (light blue boxes with rounded corners) highlight those for the reader. As the Space Force officially implements these changes, Space Training and Readiness Command (STARCOM) Delta 10 will update this publication.

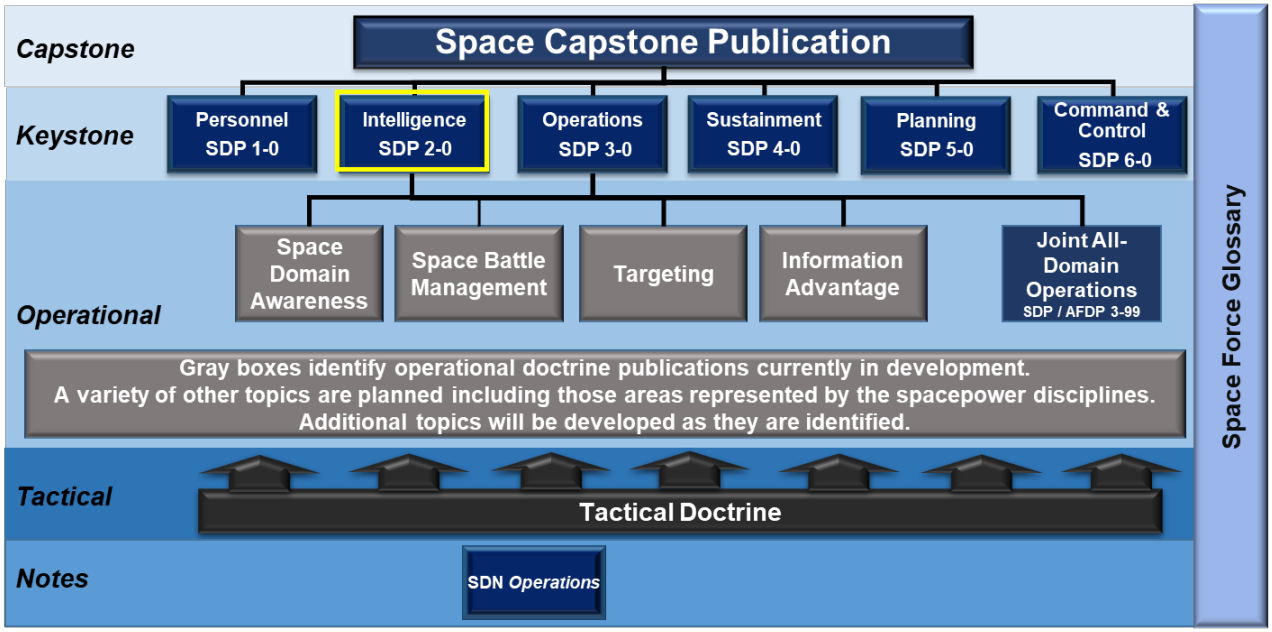

Figure 1. Space Force doctrine hierarchy

Space Doctrine Publication (SDP) 2-0

The Space Force doctrine hierarchy includes four levels of doctrine: capstone, keystone, operational, and tactical, and a glossary. Each level builds on the one above it, reflecting the role of Guardians in every specialty area. The Space Capstone Publication, *Spacepower*, is followed by a set of six keystone doctrine publications. As the capstone doctrine for the Space Force, the Space Capstone Publication, *Spacepower*, defines the necessity of spacepower for our Nation, how military spacepower is employed, who military space forces are, and what the military space forces value. Below the keystone level, the Space Force is developing multiple operational-level doctrine publications, each expanding on a specific area. Tactical doctrine will provide system and tactics, techniques, and procedure (TTP) for a specific area of space operations.

Space Doctrine Publication (SDP) 2-0, one of the six keystone doctrine publications, presents Space Force intelligence operations to support the freedom to operate in, from, and to space.

- Chapter 1 introduces intelligence as part of military spacepower and its contribution to operations across the competition continuum.
- Chapter 2 discusses the role of intelligence and intelligence integration with the other spacepower disciplines.
- Chapter 3 presents all the joint intelligence disciplines and their application to space intelligence.
- Chapter 4 describes the intelligence process, intelligence collection, and collection authorities.
- Chapter 5 presents Space Force organizations supporting intelligence, and how space is engaged across the Intelligence Community (IC), and with other organizations, agencies, allies, and partners to source intelligence data in support of joint and combined operations.

Chapter 1: Introduction

Timely and accurate intelligence is essential in achieving decision advantage for commanders at every echelon. Intelligence is one of the spacepower disciplines in which Guardians specialize, providing data and information essential to operations in the space domain, in areas of responsibility in every other domain, and in the information and electromagnetic spectrum environments. The Space Force organizes, trains, and equips Guardians to conduct operations, including intelligence, surveillance, and reconnaissance (ISR), as part of the joint force to meet national objectives (strategic and military) through the application of military spacepower.

Intelligence. Products resulting from the collection, processing, integration, evaluation, analysis, and interpretation of available information concerning foreign nations, hostile or potentially hostile forces or elements, or areas of actual or potential operations. (Joint Publication 2-0, *Intelligence)*

Intelligence, Surveillance, and Reconnaissance (ISR). An integrated operations and intelligence activity that synchronizes and integrates the planning and operations of sensors, assets, and processing, exploitation, and dissemination systems in direct support of current and future operations. (Joint Publication 2-0, *Intelligence)*

Reconnaissance. A mission undertaken to obtain information about the activities and resources of an enemy or adversary, or to secure data concerning the meteorological, hydrographic, geographic, or other characteristics of a particular area, by visual observation or other detection methods. (Joint Publication 2-0, *Intelligence)*

Surveillance. The systematic observation of aerospace, cyberspace, surface, or subsurface areas, places, persons, or things by visual, aural, electronic, photographic, or other means. (Joint Publication 3-0, *Joint Campaigns and Operations*)

Figure 2. Key definitions

The Space Capstone Publication*, Spacepower,* defines military spacepower as the ability to accomplish strategic and military objectives through the control and exploitation of the space domain. The Space Force frames its ability to deliver military spacepower in terms of its cornerstone responsibilities of preserve freedom of action, enable joint lethality and effectiveness, and provide independent options. Guardians trained and educated in the core competencies and the spacepower disciplines support operations for the joint force whether in competition or conflict. See appendix c for the full descriptions of the cornerstone responsibilities, core competencies, and the spacepower disciplines.

Intelligence and the Competition Continuum

Space operations and intelligence are fundamental to every major military campaign, operation, or activity. Joint Publication 3-0, *Joint Campaigns and Operations*, describes the competition

continuum (figure 3) as a world of enduring competition conducted through a mixture of cooperation, competition below armed conflict, and armed conflict or war.

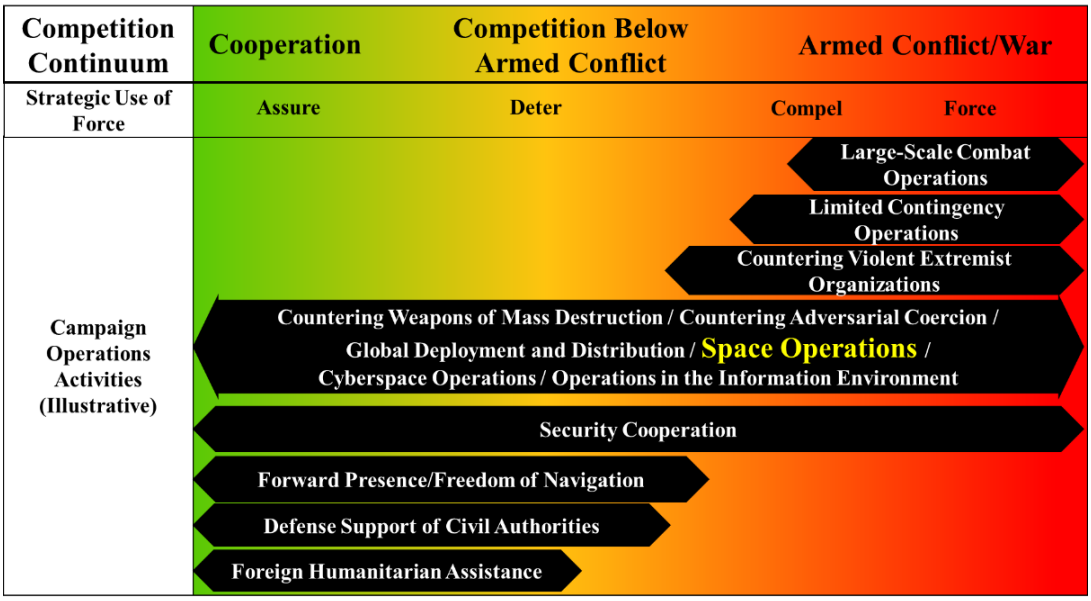

Figure 3. Competition continuum

Intelligence supporting space operations specifically seeks to define and identify all aspects of adversary capabilities, perceptions, intent, vulnerabilities, disposition, and readiness relative to the space domain, and other domains where actions may affect space operations. Guardians, presented to the joint force commander, integrate and fuse information received from multiple sources to provide decision advantage, resulting in the understanding of the operational environment in space, other physical domains, and the information and electromagnetic spectrum environments. Figure 4 includes examples of space intelligence operations across the continuum.

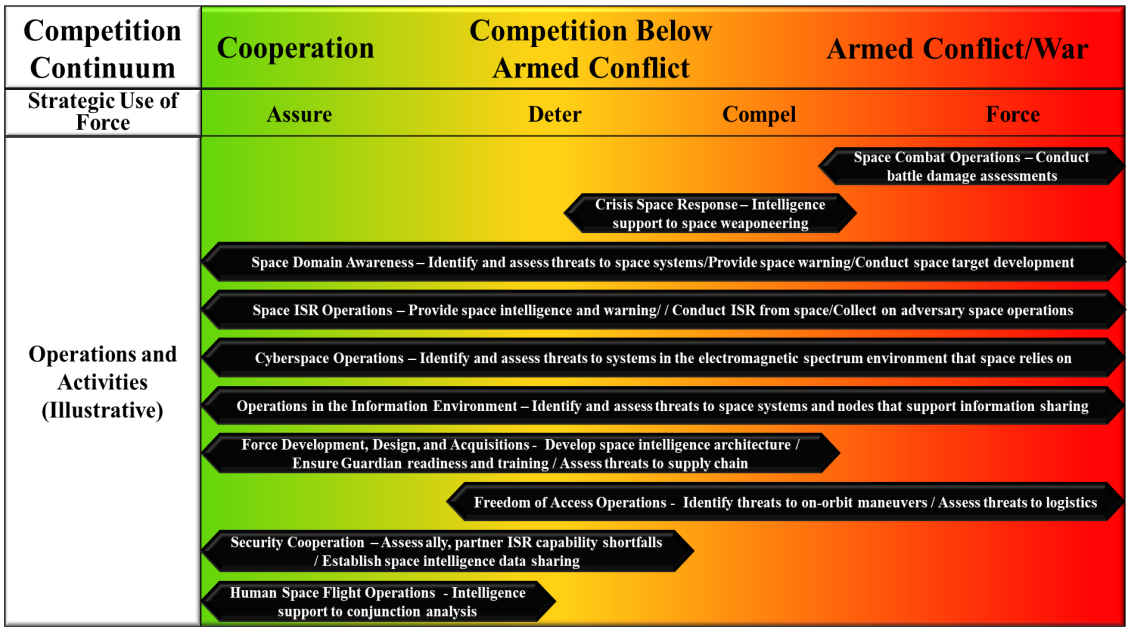

Figure 4. Space ISR operations across the competition continuum

Intelligence in the Space Operations Environment

The operational environment is a composite of conditions, circumstances, and influences that affect the employment of capabilities and bear on the decisions of commanders. These conditions, circumstances, and influences consist of natural and human-made factors. Intelligence helps the commander visualize the operational environment in time and place and understand the factors affecting it. With intelligence, commanders can prioritize activities, effectively allocate resources, assess, and to reduce uncertainty, take necessary risks, and ultimately make better decisions.

The space operational environment is inherently multi-domain, requiring operations in, to, and from the space, air, land, and maritime domains and the information and electromagnetic spectrum environments. See SDP 3-0, *Operations*, for a detailed discussion about the space operational environment.

The Challenge of Continuous Coverage

The integration of fused and processed intelligence from multiple disciplines, sensor types, and domains is vital to maintain a clear sense of the operational environment in the space domain.

Maintaining continuous situational awareness in the space domain is challenging. Tactical events occur in very narrow sectors of the space and terrestrial domains; thus, situational awareness can be short-lived. However, from the tactical to strategic level, long-term and persistent situational awareness of the space domain is critical. The nature of space operations is that the spatial relationships between assets (friendly and adversary) are continuously changing. This creates an operational environment that is extremely dynamic, where achieving and maintaining situational awareness is challenging.

Tracking an entity in space at periodic intervals to maintain situational awareness does not always provide insight into its capabilities, activities, or intent, resulting in a permissive and ambiguous environment in which a quick shift into a threat posture may occur with little warning.

Adversaries may use camouflage, concealment, and deception, creating satellites with secondary or tertiary military purposes concealed behind what may be or appear to be a legitimate civilian or commercial mission. This ambiguity combines with the vastness of space and the momentum of on-orbit platforms to create a situation in which it is impossible to identify and continuously observe all potential threats with the available sensors.

For the future of space intelligence, the Space Force will develop Guardians with knowledge and skills that span the entire spectrum of intelligence disciplines discussed in chapter 3. Exercises and wargames have clearly demonstrated the need for Guardians with expertise in real-time space domain awareness (SDA) and space intelligence to maintain persistent situational awareness. Those same exercises and wargames also highlighted difficulties in the ability to assign attribution, infiltrate threats, and understand motivation in the space environment. Addressing these challenges, and ensuring Guardian readiness to support the joint force, will require specialized training and education for Guardians in the military intelligence discipline.

Figure 5. Continuous coverage vignette

Chapter 2: The Role of Intelligence

Commanders drive intelligence and intelligence drives operations. Commanders shape the intelligence process by articulating clear objectives and mission specific priority intelligence requirements, across every spacepower competency and discipline, tied to commander decision points. Intelligence creates situational understanding supporting the commander's ability to make decisions including course of action selection, prioritization, and allocation of resources, and determining the acceptable levels of risk in all domains. Guardians assigned to the intelligence core specialty are responsible for executing the intelligence process to deliver decision advantage for space operations, and operations in other domains.

Levels of Intelligence

Joint Publication 2-0, *Joint Intelligence*, defines three levels of intelligence: strategic, operational, and tactical. These three levels of intelligence meet the needs of the commanders at each level by informing allocation decisions regarding resources required to collect, analyze, and disseminate intelligence.

a. **Strategic Intelligence.** Strategic intelligence shapes military strategy, policy, plans, and operations at the national and theater levels. Strategic intelligence is generally derived from foundational, broadly scoped, longer-term analysis and can include collaboration efforts with other members of the IC. Primary consumers include combatant commands, the IC, Department of the Air Force, other parts of the Department of Defense (DoD), and national level leadership.

b. **Operational Intelligence.** Operational intelligence informs the planning and conduct of campaigns and major operations to accomplish strategic objectives within the theater and areas of operations. This occurs at multiple echelons such as within a combatant or field command. Guardians ensure intelligence activities, such as analysis, collection, targeting, and integration align with the commander's priority intelligence requirements, decision points, and stated needs in support of mission objectives.

c. **Tactical intelligence.** Tactical intelligence drives the planning and execution of tactical operations. This type of intelligence activity occurs at the unit level and at organizations that maintain tactical control of forces. Guardians provide commanders the intelligence to identify, assess, and defeat threats, and protect assets in support of achieving mission objectives.

Intelligence Integration into the Spacepower Disciplines

The Space Capstone Publication, *Spacepower*, identifies military intelligence among seven disciplines that are necessary components of military spacepower. Intelligence-led, threat-informed operations are critical to the United States, its allies and partners, and their ability to defend the space domain and maintain a competitive advantage in all domains. Intelligence is unique among the spacepower disciplines because it plays a critical role in the successful

execution of the six other disciplines and is foundational in meeting service and national objectives.

a. **Orbital Warfare.** Orbital warfare uses orbital maneuver and offensive and defensive fires to preserve freedom of access to the domain and allows the United States and its allies and partners to deny the adversary the same advantage. Guardians must analyze foreign threat capabilities, vulnerabilities, adversary intent, and the adversary's respective levels of readiness to inform commander decisions on the employment of forces.

b. **Space Electromagnetic Warfare.** Guardians should understand the operations within and affected by the electromagnetic spectrum, including how to maneuver within the spectrum, and support targeting to conduct effective non-kinetic fires within the spectrum to deny access to communication pathways. Weaponized directed energy can damage a spacecraft or its payloads. Electromagnetic energy can disrupt or deny electromagnetic spectrum links, isolating a spacecraft from operators and users. These vulnerabilities present a tremendous risk to the viability of space operations. Therefore, Guardians should prepare to exploit and defend the electromagnetic spectrum operations environment through adversary analysis, targeting, aligned collections, and close integration with operational elements.

c. **Space Battle Management.** Space battle management includes knowledge of how to orient friendly capabilities and deny adversary access to the space domain, and skill in making decisions to preserve and ultimately ensure mission accomplishment. It also includes the ability to identify hostile actions and entities, conduct combat identification, target, and direct action in response to an evolving threat environment. Guardian-developed intelligence provides critical inputs to space battle management. Command and control, and proper orientation of space forces in relation to the enemy, requires timely detection of enemy activities and assessment of enemy capabilities and intent. Analysis and collections are pivotal to achieving mission objectives, aiding in the identification of hostile actions, providing combat identification, and informing the commander's battle plan.

d. **Space Access and Sustainment.** Space access and sustainment includes all the processes necessary to field, maintain, and prolong operations in the space domain. To avoid negative effects from enemy actions, space access, mobility, and logistics activities require timely and relevant intelligence. Threat-informed sustainment planning allows for proactive operations that mitigate the effects of enemy actions and maintain friendly force freedom of action. Guardians supporting space access, mobility, and logistics should remain aware of enemy actions that could exploit space logistics vulnerabilities and dependencies in the each of the domains or the information or electromagnetic operations environments. Of particular concern are enemy capabilities and actions that hold critical infrastructure, mobile space assets, reconstitution efforts, or telemetry, tracking, and commanding (TT&C) communications at risk.

e. **Engineering and Acquisition.** The engineering and acquisition discipline ensures the United States has the best capabilities in the world to defend the space domain. Guardians

depend on knowledge of adversary capabilities throughout the acquisition process and in the planning and execution of test and evaluation for new capabilities. Guardians continually assess the potential effectiveness of a program in a contested environment and against current and future adversary capabilities.

f. **Cyber Operations**. Guardians employ intelligence-driven cyber operations to defend the global networks that are critical to space operations. Guardians also maintain awareness of cyber threats and operations to derive intelligence relevant to military space operations in all domains and environments.

Chapter 3: Intelligence Disciplines for Space Operations

Intelligence disciplines are well-defined functions that involve specific approaches to collections and analysis with emphasis on technical or human resource capabilities. The Space Force leverages data from all available and appropriate intelligence disciplines over the course of any operation to:

a. Define the operational environment

b. Enhance space domain awareness (SDA), which is fundamental to the conduct of all space operations

c. Plan and execute TTP in support of the joint force

d. Support selecting and prioritizing targets to satisfy operational objectives through understanding adversary capabilities, disposition, personnel, units, facilities, systems, infrastructure, nodes, and links

e. Enable battle damage assessment, combat assessment, and restrike recommendations

f. Shape the space-based weapon systems and sensors of the future and TTP for employment

g. Support operations in all domains through ISR from space

Data from across the spectrum of intelligence disciplines and collections on a wide range of phenomena (observables), and modalities (behaviors) contribute to space missions and help define the operational environment for space operations.

Geospatial Intelligence

Geospatial intelligence (GEOINT) is the exploitation and analysis of imagery and geospatial information to describe, assess, and visually depict physical features and geographically referenced activities on or about the Earth. GEOINT consists of imagery, imagery intelligence (IMINT), and geospatial information (Joint Publication 2-0, *Joint Intelligence*).

a. **Imagery**. Imagery is a likeness or presentation of any natural or human-made feature, related object, or activity and the positional data acquired at the same time as the likeness or representation. This includes products produced by service and national intelligence reconnaissance spacecraft, and likenesses or presentations produced by commercial or civil systems. Assets operated by the Space Force and other members of the IC collect imagery on space-based and terrestrial objects. The Space Force leverages imagery data in assessing adversary space and terrestrial activities. These may indicate impending, unexpected, or threatening activity by an adversary such as maneuver of a space-based asset, a space launch, or other activity that could affect operations or assets. Space-based imagery is a significant contributor to intelligence development for terrestrial campaigns and operations planned by the joint and combined force.

b. **IMINT.** IMINT is the technical, geographic, and intelligence information derived

through the interpretation or analysis of imagery and other materials. IMINT includes exploitation of imagery data derived from electro-optical, radar, infrared, multi-spectral, and laser sensors. Analysts assess data from across the electromagnetic spectrum to provide information about impacts to United States (US), allied and partner space assets, and inform commanders about adversary space systems, capabilities, and actions.

c. **Geospatial Information.** Geospatial information identifies the geographic location and characteristics of natural or constructed features and boundaries on the Earth, including statistical data, and information derived from methods such as remote sensing, mapping, and surveying technologies, and mapping, charting, geodetic data, and related products. Positioning, navigation, and timing data, provided by the Space Force, is critical to geospatial analysis supporting military planning, training, rehearsal, modeling and simulation, and targeting. Without positioning, navigation, and timing support, geospatial information would not deliver the necessary intelligence value.

Signals Intelligence

Signals intelligence (SIGINT) includes all communications intelligence (COMINT), electronic intelligence (ELINT), and foreign-instrumentation signals intelligence (FISINT) (Joint Publication 2-0, *Joint Intelligence*). Guardians support the National Security Agency/Central Security Service (NSA/CSS) and deploy around the world providing actionable SIGINT in support of combatant command requirements. SIGINT data contributes to SDA and can cue collection from other space assets. SIGINT also contributes additional data regarding emerging adversary space capabilities, actions, and intent.

a. **COMINT**. COMINT is intelligence and technical information derived from collecting and processing intercepted foreign communications passed by radio, wire, or other electromagnetic means.

b. **ELINT**. ELINT is technical and geolocation intelligence derived from foreign non-communications electromagnetic radiation emanating from other than nuclear detonations or radioactive sources. ELINT includes operational electronic intelligence (OPELINT), and technical electronic intelligence (TECHELINT). OPELINT is concerned with operationally relevant information such as the location, movement, employment, tactics, and activity of foreign non-communications emitters and their associated weapon systems. TECHELINT is concerned with the technical aspects of foreign non-communications emitters such as signal characteristics, modes, functions, associations, capabilities, limitations, vulnerabilities, and technology levels.

c. **FISINT**. FISINT is technical information and intelligence derived from the intercept of foreign electromagnetic emissions associated with the testing and operational deployment of aerospace, surface, and subsurface systems.

Measurement and Signature Intelligence

Measurement and signature intelligence (MASINT) is information produced by quantitative and qualitative analysis of physical attributes about an object or event. Derived from specialized, technically derived measurements of physical phenomena, it helps characterize, locate, and

identify that object or event. MASINT exploits a variety of phenomena including electro-optical data, radar data, radio frequency data, geophysical data, materials data, and nuclear radiation data, to support signature development and analysis; perform technical analysis; and detect, characterize, locate, and identify targets and events (Joint Publication 2-0, *Joint Intelligence*).

a. **Electro-Optical Data**. Electro-optical data includes emitted or reflected energy across the visible or infrared portion of the electromagnetic spectrum. This includes ultraviolet, visible, near infrared, and infrared parts of the spectrum.

b. **Radar Data**. Radar data captures reflected radar energy (reradiated) from a target.

c. **Radio Frequency Data.** Radio frequency data includes electromagnetic pulse emissions associated with nuclear testing, or other high-energy events for the purpose of determining power levels, operating characteristics, and signatures of advanced technology weapons, power, and propulsion systems.

d. **Geophysical Data**. Geophysical data captures phenomena transmitted through the Earth (ground, water, and atmosphere) and human-made structures including emitted or reflected sounds, pressure waves, vibrations, and magnetic field or ionosphere disturbances. Subcategories include seismic intelligence, acoustic intelligence, and magnetic intelligence.

e. **Materials Data.** Materials data includes data from gas, liquid, or solid samples, collected by automatic equipment, such as air samplers, or directly by humans.

f. **Nuclear Radiation Data.** Data related to nuclear radiation and physical phenomena associated with nuclear weapons, processes, materials, devices, or facilities.

Many of the data types collected by Space Force assets fall under the MASINT discipline. This data also contributes to warning intelligence such as providing tactical warning and attack assessment information to operational command centers regarding nuclear detonations or missile launches. Space Force assets also collect space object identification data across the electromagnetic spectrum including electro-optical, radar and long wave infrared. This data provides critical information about the size (radar cross section), configuration, and health of adversary assets on orbit. This also supports battle damage assessment, allowing Guardians to assess the functionality of an asset following an event (e.g., spacecraft break up, anti-satellite test). Terrestrial space assets including the ground-based radars and telescopes operated by Guardians collect radar and electro-optical data to maintain the space catalog. MASINT data forms the foundation for maintaining SDA on orbit, enabling the analysis necessary to maintain space security including:

a. **Maneuver Detection.** Analysis of observation data indicates an object on orbit has changed planes, moved into a transfer orbit, or made some other expected or unexpected change to its behavior and location. This information is critical for maintaining custody of all assets and identifying changes in behavior patterns.

b. **Conjunction Assessment.** Analysis of observation data for asset behavior and orbit indicates the potential of collision or a close approach. This information is essential for protection of high-value assets and recognizing indications of an evolving threat.

c. **Uncorrelated Object Analysis**. When observation data indicates an object not previously correlated to known objects in the satellite catalog (a registry of all known or identified orbital space objects), the object is tagged as uncorrelated. This information may indicate a maneuver, break-up, debris-generating event, or separation. This information is critical for identifying a debris threat or the potential of a previously unknown adversary asset on orbit.

d. **Natural Hazards Identification.** Space debris, space weather, and naturally occurring objects and electromagnetic interference pose threats to United States and partner capabilities. Awareness of these threats allows for mitigation actions or informs assessments about the possible source of issues with an asset.

Open-Source Intelligence

Open-source intelligence (OSINT) derives from publicly available information that any member of the public can lawfully obtain by request, purchase, or observation. Examples of open sources include unofficial and draft documents, published and unpublished reference material, research, or cloud databases, and web-based networking platforms or repositories. OSINT complements the other intelligence disciplines and can fill gaps and provide accuracy and fidelity in classified information databases. However, OSINT is susceptible to manipulation and deception, and thus requires analysis and review during processing. The OSINT functional manager for the IC is the Director of the Central Intelligence Agency (CIA). The DoD lead for OSINT is the Director of the Defense Intelligence Agency (DIA) (Joint Publication 2-0, *Joint Intelligence*). Guardians leverage OSINT data regarding adversary actions that could affect space operations and in particular, data about space assets and impending launches.

Technical Intelligence

Technical intelligence (TECHINT) data originates from the exploitation of foreign materiel and scientific information. TECHINT begins with the acquisition of a foreign piece of equipment or foreign scientific/technological information. US weapons developers, countermeasure designers, tacticians, and operational forces use TECHINT products to prevent technological surprise, neutralize an adversary’s technological advantages, enhance force protection, and support the development and employment of effective countermeasures to newly identified adversary equipment. The Joint Captured Materiel Exploitation Center, managed by the DIA Joint Foreign Materiel Program Office, is the primary DoD contingency TECHINT organization (Joint Publication 2-0, *Joint Intelligence*). Space intelligence and acquisition organizations use TECHINT data regarding new space capabilities to develop intelligence regarding adversary equipment that could affect space operations.

Human Intelligence

Human intelligence (HUMINT) is a category of intelligence derived from information collected and provided by human sources. HUMINT includes intelligence interrogation, source operations, and debriefing (Joint Publication 2-0, *Joint Intelligence)*. When available, the Space Force can leverage HUMINT data regarding adversary actions that could threaten space capabilities or operations. These include impending launches, new space capabilities, and threats to terrestrial facilities, personnel, or cyberspace assets. The Space Force does not have any organic HUMINT capabilities and relies on collection from other military services and IC partners.

Counterintelligence

Counterintelligence includes information gathered and activities conducted to identify, deceive, exploit, disrupt, or protect against espionage, other intelligence activities, sabotage, or assassinations conducted for or on behalf of foreign powers, organizations or persons or their agents, or international terrorist organizations or activities. (Joint Publication 2-0, *Joint Intelligence*). Counterintelligence support to acquisition and engineering is critical to the protection of space systems and their components anywhere along the supply chain that could allow an adversary to exploit a device, or one of its components. Compromise of the supply chain can occur before or after the delivery of a product or service, or during software updates or hardware replacement. The Air Force Office of Special Investigation conducts counterintelligence for the Department of the Air Force, including the Space Force.

Chapter 4: Intelligence Process, Collections, and Authorities

The Chief of Space Operations (CSO) in the *Chief of Space Operations' Planning Guidance*, published in 2020, directed "…use of joint planning methodology throughout the Space Force. This ensures a common standard and prepares Space Force members for integration with joint forces." Based on that direction the Space Force employs the intelligence process as outlined in Joint Publication 2-0*, Joint Intelligence*.

The Intelligence Process

The intelligence process provides the basis for common intelligence terminology and procedures. It consists of six interrelated phases of intelligence operations: planning and direction; collection; processing and exploitation; analysis and production; dissemination and integration; and evaluation and feedback. The categories, while displayed as a cyclical function in figure 6, can interact with each other out of cycle. For example, analysis and production will affect planning and direction and define collection requirements for processing and exploitation even though analysis and production is the fourth step in the process. The intelligence process is continuous and iterative, tailorable, and scalable, shaping intelligence activities across all functions to support a commander's decision cycle.

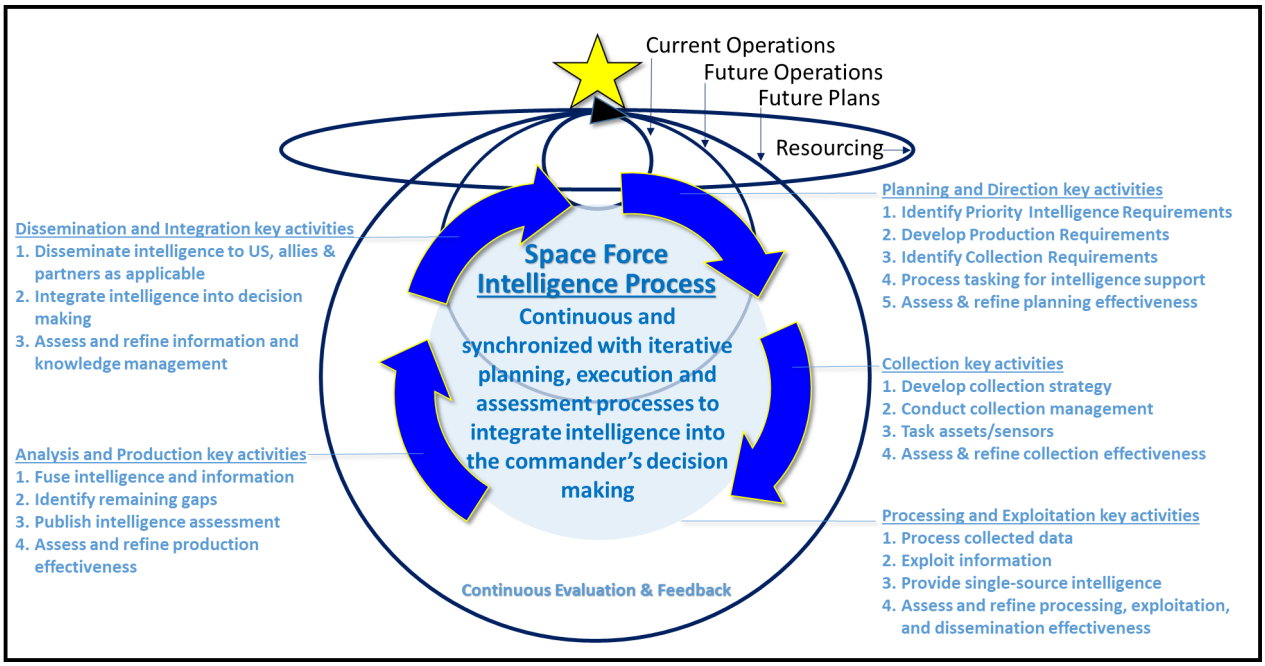

Figure 6. Intelligence process overlaid on decision cycles

a. **Planning and Direction.** Planning and directing of intelligence activities occurs continuously through the intelligence process, often in support of several simultaneous decision cycles. Synchronization and deconfliction across intelligence efforts is key for optimizing use of limited intelligence resources. Intelligence planning efforts begin with initial understanding of intelligence preparation of the operational environment (IPOE), friendly intelligence capabilities, commander's objectives, and associated intelligence

gaps and shortfalls. Priority intelligence requirements evolve with the planning and execution of operations and assessments. Guardians, as intelligence planners, identify analysis and collection requirements in accordance with the commander's needs and synchronize collection plans and production schedules to the needs of planning and operations. Commanders and intelligence leaders provide direction to synchronize intelligence efforts with other military functions and with applicable partners. Orders and other tasking programs of record are key for the orderly maintenance and distribution of intelligence requirements and directives.

b. **Collection.** Collection involves the acquisition of required information and provision of that information for processing. Collection managers task the most appropriate available asset, or combination of assets, to satisfy the information requirements. Successfully collecting timely, accurate, and actionable information against an adaptive threat is challenging. Use of multiple sensors and sensor types can increase the likelihood of achieving timely delivery of the information required.

c. **Processing and Exploitation.** Processing and exploitation sort, correlate, and transform raw data into forms suitable for exploitation by decision-makers and other consumers. This step in the process can include translations, decryption, and interpretation. It may be necessary to coordinate with other organizations to ensure data is in a state and form that end users can exploit and analyze.

d. **Analysis and Production.** Analysis and production involve the fusion of data and information from various, reliable sources for the purpose of correlating, linking, and assessing available intelligence with an emphasis on the overall intelligence requirement. Supported by the IPOE process (detailed below), the analysis and production phase provides end users with timely and actionable intelligence for intelligence and mission planning.

e. **Dissemination and Integration.** Processed intelligence needs to reach consumers in a timely manner. The needs of the user combined with the criticality and sensitivity of the intelligence determine the best means of dissemination. The Unified Data Library contributes to the timely dissemination of Space Force data, making intelligence data and products discoverable and accessible to users. Intelligence products integrated with other data or intelligence generated by other collectors prior to dissemination or at the receiving end can further develop understanding of the operational environment. The need to process, disseminate, and integrate intelligence into ever-reducing decision timelines requires Guardians to maintain running intelligence estimates, especially for priority problem sets and mission areas.

f. **Evaluation and Feedback.** Evaluation and feedback occur continuously throughout the intelligence process. A collaborative dialogue between intelligence planners, analysts, collection managers, collectors, and intelligence systems architects identify deficiencies and shares best practices throughout the intelligence process. Engagement with intelligence consumers is essential to assess how well products and dissemination methods meet the commander’s requirements. These inputs inform intelligence

prioritization and resourcing decisions, and Guardians integrate them back into planning for space intelligence operations.

Intelligence Preparation of the Operational Environment

The Intelligence Preparation of the Operational Environment, or IPOE, is a continuous analytic process that is integrated throughout the intelligence process. In accordance with tasked mission requirements and the federation of analysis and production, Guardians develop and maintain IPOE of the space domain to help commanders understand the complex operational environment, the relevant actors, factors, and courses of action to inform decision making. IPOE production is integrated with intelligence from other organizations to provide the joint force commander a holistic understanding of the operational environment (Joint Publication 2-0, *Intelligence,* and the Joint Guide for Joint Intelligence Preparation of the Operational Environment).

a. **Define the Operational Environment.** Accurately defining the operational environment is critical to scoping IPOE efforts and successfully informing mission planning. In this initial step, identify significant characteristics of the operational area relevant to the mission. Clearly defining the complexities of the operational environment becomes more important as operations expand across multiple domains, affect multiple factors, and generate near-to-long-term effects. Defining the operational environment is a significant challenge for space operations due to the complexity of the organizational relationships and large scale of responsibility, requiring an understanding of activities in all domains to preserve freedom of action within the space domain. All-source intelligence and collaboration is needed to frame, understand, and maintain the IPOE production for space.

b. **Describe Operational Environment Impact.** This step assesses the impact the operational environment may have on adversary, friendly, and neutral military capabilities. The operational environment benefits or hinders the United States, its allies, partners, and adversaries in a similar manner. Differences in military capabilities and the use of intelligence from multiple sources and disciplines can help the United States, its allies, and partners employ the operational environment to their advantage.

c. **Evaluate the Adversary and Other Relevant Actors.** Guardians comprehensively evaluate adversaries and relevant third parties by analyzing their capabilities, limitations, the current situation, centers of gravity, and their tactics, techniques, and procedures. Employing intelligence from multiple disciplines can increase the joint force's ability to understand opposing and neutral forces as part of the operational environment, and in turn, increase the likelihood of mission success.

d. **Assess Adversary and Actor Courses of Action**. Guardians estimate the adversary's most likely and most dangerous course of action and develop a detailed understanding of the adversary's and other relevant actors' probable intent and future strategy. In addition, the assessment informs commanders about the potential reaction of others (allies, partners, or other adversaries) to action on the part of the United States, the adversary, or other relevant actor under assessment.

Intelligence Collection

Collection is the acquisition of information and the provision of this information to processing elements. Collections enable the intelligence processes to generate intelligence products that support warfighter needs. Collections can also communicate changes in the operational environment and understanding of the adversary intent. Throughout planning, execution, and assessment, users should convert intelligence gaps, to include indicators, into collection requirements. Analysts and other users of intelligence products should evaluate and provide feedback on these products to help ensure collections are beneficial to the overall mission and are an appropriate allocation of resources.

According to planning directives and commander's guidance, Guardians conduct collection operations required to satisfy intelligence requirements. Understanding the collection authorities and processes is essential to ensure satisfaction of the commander's intent and objectives against approved priority intelligence requirements. It is also essential for effective allocation of limited assets or resources against the most critical requirements.

a. **Request for Information (RFI).** The identification of intelligence and information shortfalls triggers the RFI. The RFI articulates requirements that ensure intelligence needs are resolved. If existing intelligence products cannot satisfy a requirement, a production requirement leads to production of new products. If no existing production or data can fulfill the intelligence requirement, collection managers at every echelon develop collection requirements to task and drive collection operations to gather the data.

b. **Collection Management.** Collection management is the process of converting requests for information into collection requirements; establishing priorities; tasking or coordinating with appropriate collection sources or agencies; monitoring results; and retasking as required. Collection managers task the most appropriate available asset, or combination of assets, to satisfy the information requirements or request collection from resources not under their authority. The delegated collection management authority is responsible for assessing the best mix of sensors and sensor types to increase achieve timely delivery of the information required. DoD, joint, and service collection operations all fall under a delegated collection management authority. The collection process, aligned to the applicable collection management authority, is composed of two functions: collection requirements management and collection operations management. The collection management authority may delegate either or both responsibilities for execution to subordinate echelons. The Space Force's Senior Intelligence Officer exercises collection management authority in support of the service's overarching collection management plan for space missions. A combatant command's intelligence directorate exercises collection management authority in support of the overarching collection management plan for space missions for the joint force.

    1) **Collection Requirements Management.** Collection requirements management exists at each command level of every echelon in an organization. The collection requirements manager captures the needs of organizations and converts intelligence-related information requirements into collection requirements,

establishing priorities, tasking, or coordinating with appropriate collection sources or agencies, monitoring results, and retasking, as required. The collection requirements manager, acting on behalf of the collection management authority, prioritizes and registers collection requirements based on the commander's intent, objectives, approved priority intelligence requirements, and the current situation to ensure allocation of assets or resources against the most critical requirements.

2) **Collections Operations Management.** Collections operations management is the authoritative direction, scheduling, and control of specific collection operations and associated processing, exploitation, and reporting resources. Space Force assigned ISR organizations execute collections operations management for assets that they control, or resources delegated by the collection management authority. The collection operations manager schedules and controls collection operations, which includes the processing, exploitation, and dissemination of the collected data. The collection operations manager will select the assets best suited to collect the information needed to satisfy service-specific information requirements. This includes synchronizing the timing of collection with the operational scheme of maneuver and with other intelligence operations such as processing and exploitation, analysis and production, and dissemination. The combatant command's intelligence directorate guides collection operations management execution with a unified joint collection plan and approves assigned and attached component requirements.

Collection managers need to know the capabilities, limitations, survivability, and lead times of available collection systems, and the processing, exploitation, analysis, and production timelines to complete and disseminate a product. Collection managers are responsible for coordinating the employment of all available collection capabilities. This includes requesting external theater and national level resources to acquire needed information.

c. **Collection Plan.** The collection plan prioritizes and focuses collection efforts. Clearly articulated requirements help ensure the collection plan identifies and tasks the best resources for fulfilling the information requirement. Successfully collecting timely, relevant, and useful information against an adaptive target is challenging. Use of multiple sensors and sensor types can increase the likelihood of timely delivery of the required information. Guardians should be aware of any limitations that affect the collection plan when planning for space operations, responding to intelligence requirements, and working to correlate assets for collection operations. Some key areas for Guardians to consider in evaluating a collection plan include:

1) Revisit rates, dwell times, and sun angle over a potential target

2) Space and terrestrial weather

3) Terrain masking, concealment, and camouflage

4) Physical distance between on-orbit sensors and the limited number and location of downlink networks and antennas
5) All available sensor types and their ability to satisfy a priority intelligence requirement
6) High demand for space-based sensor data and limited sensor availability
7) Predictability of overflight impacting ability to collect desired data

d. **Intelligence Assets and Resources.** Collection of timely, accurate, and relevant intelligence is highly dependent the availability and capabilities of organic, attached, supporting or otherwise allocated collection assets. Use of service and national assets, as defined in US Code Title 10 (legal basis for the roles, missions, and organization of each of the services as well as the DoD) and Title 50 (authorities for IC operations in support of the National Defense Strategy), during collections is often essential to satisfy intelligence requirements. The Space Force can also leverage ally and partner space capabilities, in addition to sensors not traditionally employed for ISR or space missions, to satisfy the commander's collection plan.

Targeting

Targeting is the process of selecting and prioritizing entities or objects and matching the appropriate response to them, considering operational requirements and capabilities. Information and intelligence gathered during battlespace characterization and find, fix, track activities support deliberate (preplanned) and dynamic (target of opportunity) targeting. The targeting cycle spans the development of commander's objectives, guidance, and intent; target development, vetting, validation, nomination, and prioritization; commander decision and force assignment, planning and execution; and finally combat assessment. The Space Force conducts space-related targeting efforts through federated targeting support, target system analysis using all-source intelligence analysis, federated target system analysis production, and service organize, train, and equip actions to build and sustain a space targeting enterprise to support combatant commanders.

Intelligence Analysis

All Guardians regardless of specific intelligence discipline or mission area, are practitioners of analytic tradecraft. Intelligence Community Directive 203, *Analytical Standards*, defines analytical tradecraft. Intelligence Community Directive 203 identifies five overarching qualities and principles that guide Guardians conducting intelligence analysis and analytic production:

a. **Objective**. Analysts perform their functions with objectivity and with awareness of their own assumptions and reasoning. They employ reasoning techniques and practical mechanisms that reveal and mitigate bias. Guardians should be aware of influence by existing analytic positions or judgments and consider alternative perspectives and contrary information. Previous judgments should not constrain analysis when new developments indicate a modification is necessary.

b. **Independent of political consideration.** Advocacy of a particular audience, agenda, or force of preference for a particular policy viewpoint should not distort or shape a Guardian's analytic judgments.

c. **Timely.** Guardians should disseminate analysis in time for it to be actionable by customers. The Space Force's analytic elements are responsible for being continually aware of events of intelligence interest, of customer activities and schedules, and of intelligence requirements and priorities, to provide useful analysis at the right time.

d. **Based on all available sources of intelligence information.** Guardians should use all available relevant information to inform their analysis. The Space Force's analytic elements should identify and address critical information gaps and work with collection activities and data providers to develop access and collection strategies.

e. **Implements and exhibits analytic tradecraft standards.** Intelligence analysis should describe the quality and credibility of underlying sources, data, and methodologies upon which judgments are based. Using Intelligence Community Directive 203 defined terminology, Guardians also characterize any uncertainties associated with major analytic judgments and explain the basis for the uncertainties, the likelihood of occurrence of an event or development, and the analyst's confidence in the basis for this judgment.

Intelligence Mission Data Production

Intelligence mission data production is the ability to derive, produce, and rapidly update the intelligence used for programming Space Force mission systems in development, testing, operations, and sustainment. This includes but is not limited to the following functional areas: signatures, electronic warfare, order of battle, characteristics, and performance. The increasing capability of space systems, and platform and control systems that require intelligence information to operate as designed, has significantly increased the need for the production and rapid integration of intelligence mission data into space operations.

Intelligence Support to Acquisition

Intelligence support to acquisition and its associated analytical processes guide the acquisition community by informing space and ISR system design through technical characterization, analysis of future threat projections, and determination of the intelligence sensitivity of programs in development. Intelligence support also allows the Space Force to conduct threat-informed acquisition and testing activities. This includes production of detailed threat reports and digital threat models required to support the acquisition of systems from conception, through developmental and operational testing.

Intelligence sensitivity analysis performed for systems in development helps determine if they require intelligence mission data during development or in performing the system's intended mission. Additionally, an intelligence sensitivity analysis determines if a system will require direct support of intelligence personnel or will influence intelligence data at any point in the planning and direction; collection; processing and exploitation; analysis and production; and dissemination cycle. Subsequently, an intelligence supportability analysis will be developed for intelligence systems deemed sensitive.

Chapter 5: Intelligence Organizations, Roles, and Relationships

Space Force organizations at every level participate in the development of intelligence products for both internal use and dissemination to external users. Space Force intelligence organizations use foundational intelligence data from all disciplines to define the space domain operational environment, develop SDA, and provide the community warning about adversary assets and actions.

Figure 7 depicts the current structure of the Space Force. The Space Staff, three field commands (FLDCOMs) (Space Operations Command [SpOC], Space Systems Command [SSC], Space Training and Readiness Command [STARCOM)]), and two direct reporting units (Space Development Agency [SDA)] and Space Rapid Capabilities Office [SpRCO]) support the Office of the Chief of Space Operations (OCSO). The Space Warfighting Analysis Center (SWAC) is a primary subordinate unit to SpOC with direct liaison authority with the CSO and the Space Staff.

Figure 7. Space Force structure

Deputy Chief of Space Operations for Intelligence

The Deputy Chief of Space Operations for Intelligence (SF/S2) is the Space Force's Senior Intelligence Officer, Head of the Space Force Intelligence Community Element, and Defense Intelligence Component Head and, as such, is responsible to the Secretary of the Air Force and the CSO for delivering intelligence guidance, policies, and programming for the Space Force Intelligence Enterprise. These duties include serving as the focal point for foreign, adversary space, and counterspace capabilities analysis, assisting the FLDCOMs in providing operationally ready ISR forces in response to the needs of the combatant commanders and combat support agencies, and ensuring those forces can provide necessary intelligence support for space missions. SF/S2 serves as Chief, USSF Service Cryptologic Component and is the principal Space Force authority for all cryptologic matters. In this role, SF/S2 serves as the principal

advisor to the Director, National Security Agency/Chief, Central Security Service (DIRNSA/CHCSS) for matters related to Space Force cryptologic activities and retains management oversight of those activities. SF/S2 is subordinate to DIRNSA/CHCSS for matters related to Space Force cryptologic activities in accordance with DoD Directive (DoDD) 5100.20, *National Security Agency/Central Security Service (NSA/CSS)*, and US SIGINT directives. SF/S2 also oversees the intelligence activities of the National Space Intelligence Center.

Space Operations Command

SpOC generates, presents, and sustains combat ready Guardians for space operations, intelligence, cyberspace, and combat support missions.

a. **Deputy Commanding General for Operations (DCG-O)/S2**. DCG-O/S2 is responsible to Commander, Space Operations Command (SpOC/CC) and DCG-O to improve all ISR capabilities within the Deltas and at the Space Force component level. DCG-O/S2 is also responsible to SpOC/CC as Commander, Space Force Forces (COMSPACEFOR) for USSPACECOM for ISR employment considerations, planning factors, and integration with combatant commander ISR requirements. DCG-O/S2 ensures all SpOC intelligence reporting, analysis, and production complies with Director of National Intelligence (DNI) and agency-specific directives, policies, and guidance.

b. **Deltas.**

   1) **Delta 5.** Delta 5 is force presented to USSPACECOM and provides the majority of Combined Space Operations Center (CSpOC) manning. The CSpOC ISR Division provides timely, predictive, and actionable all source intelligence supporting all aspects of the space tasking cycle and target development in support of world-wide terrestrial operations. Delta 5 ISR Division personnel conduct 24/7 support to space operations through execution of real time electromagnetic interference (EMI) mitigation, indications and warnings for foreign space and missile launches, and collection operations management authority of tasked space sensors. Additionally, the Delta 5 ISR Division works closely with coalition partners to facilitate intelligence sharing and synchronization to achieve combined objectives.

   2) **Delta 7.** Delta 7 is the Space Force operational ISR element, employing a variety of fixed and mobile sensors across the globe to provide time sensitive, critical, and actionable intelligence for space domain operations. ISR squadrons under Delta 7 provide tailored intelligence products and mission planning support to other FLDCOMs, Deltas, combatant commanders, and IC partners. Delta 7 provides Guardians as liaisons to the National Reconnaissance Office (NRO), the National Security Agency/Central Security Service (NSA/CSS), and the National Geospatial Intelligence Agency (NGA). These Guardians execute service-retained operations in support of combatant commander requirements and weapons system acquisition and testing.

   3) **Delta 15.** Delta 15 provides the joint force commander, COMSPACEFOR, SpOC, and Delta 15 staff with IPOE, predictive battlespace awareness, target development,

tactical assessment, and ISR operations that help drive the space tasking cycle. Delta 15 monitors of the operational environment and maintains a common threat, targeting, and ISR picture supporting all-domain operations. Delta 15 Guardians conduct IPOE, integrated analysis and production, ISR planning, and targeting to shape decision-making and enable operations.

4) **Delta 18.** Delta 18, the National Space Intelligence Center (NSIC), provides foundational, scientific, and technical intelligence to inform senior policy makers, service and national acquisitions, and military operations. NSIC shares this responsibility with other service intelligence centers and DIA as federated in the Defense Intelligence Analytic Program.

c. **SWAC**. The SWAC intelligence advisor supports threat assessments contributing the force design work across the Centers of Excellence for Multi-Domain Awareness and Spectrum Warfare, and the Space Security and Defense Program (SSDP).

Space Systems Command

SSC is responsible for delivering new space capabilities at operationally relevant speeds, to include developing, acquiring, equipping, fielding, and sustaining those capabilities. The SSC Space Systems Integration Office provides intelligence support for all current and future programs, and for space launch operations through Space Launch Deltas 30 and 45.

The SSC Intelligence Directorate/S2 provides timely, relevant, and tailored acquisition intelligence and special security support to SSC and the entire Space Force acquisition enterprise (including SDA and SpRCO), in addition to other Space Force acquisition elements, industry and academic partners. SSC intelligence enables Space Force development, acquisition, equipping, fielding, and sustaining of lethal and resilient space capabilities for warfighters.

SSC's Intelligence Directorate partners with SSC program offices to ensure capability development is threat informed in accordance with regulatory prescription in the DoD acquisition system, and dynamically based on threat activity. This support leverages all forms of intelligence, from open source through exquisite intelligence, and when available counterintelligence. SSC program offices rely on regular access to current threat intelligence to develop and test space systems that are suitable for the operational environment, can mitigate risk, and exploit opportunities.

Space Training and Readiness Command

The mission of STARCOM is to increase Space Force readiness to prevail in competition and conflict through education, training, doctrine, and test. STARCOM intelligence personnel are embedded in the headquarters and across the five Deltas. Unit-level intelligence personnel reside in squadron intelligence flights or sections to provide support to all assigned missions. Intelligence management and oversight is through a Delta-level Senior Intelligence Officer who is responsible to plan, program, validate and manage all intelligence requirements for their organization and any subordinate or supported units.

a. **STARCOM Director of Intelligence Operations.** The STARCOM Director of Intelligence Operations is the FLDCOM Senior Intelligence Officer and is responsible for intelligence support to the STARCOM commander, sensitive compartmented information management, and plans and programs for intelligence across the FLDCOM. The STARCOM Director of Intelligence Operations is also responsible for managing intelligence resources and ensuring training and personnel are available to subordinate organizations for ISR operations.

b. **Deltas.**

1) **Delta 11.** Delta 11 delivers realistic, threat-informed test and training environments through the provision of live, virtual, and constructive range and combat replication capability to prepare Guardians, and designated joint and allied partners, to prevail in a contested, degraded, operationally limited, all-domain environment. Delta 11 intelligence personnel prepare Guardians and joint forces by developing, maintaining, and operating capabilities to replicate enemy threats to space-based and space-enabled systems. Delta 11 intelligence personnel also function as aggressors and support range operations including live, digital, and hardware in the loop-based threat elements capable of enterprise-level, system-of-systems test, and training. Finally, Delta 11 intelligence personnel partner with intelligence agencies and SpOC intelligence units to ensure current and near-term threats are replicated in live and virtual environments before threats reach full operational capability.

2) **Delta 12.** Delta 12 conducts independent test and evaluation of Space Force capabilities and delivery of timely, accurate, and expert information in support of weapon system acquisition, operational acceptance, and readiness decisions. Delta 12 intelligence personnel provide critical threat-based information to allow organizations to plan, execute, and report on prototyping, experimentation, and test and evaluation of space systems, from development through fielding and space system sustainment. Threat-based testing is critical to drive improvements in space program development, awareness of operational considerations, and informed acquisition and fielding decisions. Delta 12 intelligence personnel are an essential part of the acquisition and test communities.

Partnerships

Space security, as a core competency, establishes and promotes stable conditions for the safe and secure access to space activities for DoD, civil, commercial, IC, and multinational partners. Establishing partnerships with other members of the IC, joint partners, inter-agency organizations, allies, commercial partners, and academia is essential to developing and maintaining space security. Specific intelligence related partnerships within those communities focus on data sharing and collaboration on analytical processes and methods. In order to establish and maintain these partnerships with other members of the IC, Guardians assigned to these organizations help fulfill Space Force and IC missions.

a. **The Intelligence Community.** The IC (figure 8) is a coalition of 18 US government agencies and organizations, led by the Office of the Director of National Intelligence (ODNI). The IC agencies fall within the Executive Branch, and work both independently and collaboratively to gather and analyze the intelligence necessary to conduct foreign relations and national security activities. The IC's mission is to provide timely, insightful, objective, and relevant intelligence to inform decisions on national security issues and events. The DNI executes the IC's mission including development of IC capabilities, information sharing and safeguarding, and partnering with domestic and international partners.

Figure 8. The intelligence community

As a member of the IC, the Space Force interfaces with the other members to collect, analyze, and share data relevant to the space domain and operations in all domains. Highlighted below are examples of specific interactions between the Space Force and other members of the IC.

1) **Office of the Director of National Intelligence (ODNI).** The Space Force intelligence enterprise receives funding from the ODNI's National Intelligence Program. The SF/S2 represents the Space Force at the DNI-led Intelligence Community Executive Committee, and other forums; supports and is supported by (as appropriate) the IC space executive and ODNI; and communicates Space Force intelligence enterprise science and technology needs to the ODNI-led National Intelligence Science and Technology Committee.

2) **Defense Intelligence Agency (DIA).** DIA's Missile and Space Intelligence Center (MSIC) is the DoD center of excellence for analysis and assessment of foreign air and missile defense systems, ballistic missiles, anti-tank guided missiles, anti-satellite missile systems, and directed energy weapons. MSIC expertise supports Guardians with evolving foreign space threat information.

3) **National Security Agency/Central Security Service (NSA/CSS).** NSA/CSS provides peacetime, contingency, crisis, and combat SIGINT and cybersecurity support to the US military, which includes supporting space intelligence operations. Guardians engage with NSA/CSS across the agency and key offices that influence space intelligence operations as members of the CSS. Delta 7 units embedded with NSA offices support space ISR mission sets. Other Deltas are embedded with NSA on a mission dependent basis. Along with the other military services cryptological offices at the NSA, the Space Force's Cryptologic Office, is the Space Force's primary staff agent for overseeing cryptologic operations, programming, budgeting, training, personnel, policy, doctrine, and foreign relationships.

4) **National Geospatial-Intelligence Agency (NGA).** NGA is the IC and DoD functional manager for GEOINT. Guardians work with NGA to develop an understanding of GEOINT detectable signatures for targets affecting space operations around the world. Delta 7 liaisons to NGA support the overhead persistent infrared missile warning mission.

5) **National Reconnaissance Office (NRO).** The NRO designs, builds, launches, and operates national reconnaissance spacecraft. It integrates unique and innovative space-based reconnaissance technology and the engineering, development, acquisition, and operation of space reconnaissance systems and related ISR activities. As a consumer of orbital and terrestrial counterspace, and cyber threat intelligence, the NRO is responsible for the integration and coordination of its requirements across the services as well as IC partners to support both its acquisition and operations missions, and as needed to execute its protect and defend mission. Guardians provide support for the NRO's space ISR mission sets.

6) **Army Intelligence.** The Army's National Ground Intelligence Center (NGIC) is the DoD's primary producer of ground forces intelligence. NGIC produces scientific and technical intelligence and military capabilities analysis on foreign ground forces required by warfighting commanders and the force modernization and research and development communities. The Space Force leverages NGIC expertise on foreign satellite communications (SATCOM) jammers.

7) **Air Force Intelligence.** The Air Force National Air and Space Intelligence Center (NASIC), in collaboration with NSIC (Delta 18), discovers and characterizes air, space, missile, and cyber threats to enable full-spectrum, all-domain operations, drive weapon system acquisition, and inform national defense policy.

8) **Naval Intelligence**. The Office of Naval Intelligence is the US military maritime intelligence service. NSIC (Delta 18) collaborates with the Office of Naval Intelligence to develop strategic intelligence relevant to the space and maritime domains. Office of Naval Intelligence products inform Delta 7 Guardians of maritime intelligence in the fulfillment of their own mission areas.

9) **Marine Corps Intelligence**. The Marine Corps Intelligence division under the deputy commandant for information exercise supervision over the Marine Corps Intelligence Activity (MCIA). MCIA has service responsibility for GEOINT, SIGINT, HUMINT and counterintelligence, and ensures there is a single synchronized strategy for the Marine Corps ISR enterprise. Space Force intelligence contributes to MCIA products supporting terrestrial operations.

b. **Joint Community.** Guardians assigned to the joint staff and each of the combatant command, as part of the Component Field Command (when established), provide space intelligence expertise and support to the mission of those commanders and their organizations. At the joint level, Guardians in the Joint Staff and National Military Command Center provide expertise in the areas of targeting, global warning intelligence, and current intelligence. Guardians at the combatant command's joint intelligence operations center (JIOC) support joint forces with space expertise for targeting, warning, and current intelligence. Guardians assigned to the USSPACECOM JIOC contribute to Commander USSPACECOM's responsibilities for space operations including global sensor manager, global SATCOM operations manager, space operations joint force provider, joint space operations training, navigation warfare operations and joint resilient positioning, navigation, and timing. Guardians assigned to USSPACECOM may also be part of the Joint Integrated Space Teams. Guardians assigned to the National Space Defense Center (NSDC) work alongside NRO, other members of the IC, and commercial partners to execute the protect and defend mission, deterring aggression, defending capabilities, and defeating adversaries throughout the competition continuum to maintain space superiority in the USSPACECOM area of responsibility.

c. **Inter-Agency Organizations.** The Space Force partners with US government organizations and agencies in developing space capabilities. One of those organizations is the National Aeronautics and Space Administration (NASA). NASA is an independent agency responsible for the civil space program, aeronautics research, and space research. Both parties are at current capability limits for extending SDA beyond GEO and addressing the need for near-Earth object detection and tracking. While the Space Force and NASA domains, missions, and operational cadence remain distinct and different, the benefits of shared technologies and observational data are of increasing interest to both communities. The Space Force partners with the Department of Commerce through a new memorandum of agreement for tracking of space objects. The Space Force also partners with National Oceanic and Atmospheric Administration (NOAA) for terrestrial environmental monitoring.

d. **Allies and Foreign Partners.** Strengthening our alliances, military partnerships, and security cooperation makes deterrence more credible and effective. Through these actions, military space forces can reinforce the confidence our allies and partner nations place in their relationship with the United States. As the space domain becomes increasingly congested and contested, developing and maturing key partnerships among our allies and partners becomes a critical enabler of space security. The Space Force

continually reevaluates data sharing and collaboration agreements, including those for intelligence data, with its allies and partners.

e. **Commercial and Academic Partners**. The DoD and the IC are integrating data, analysis capabilities, and other services from commercial space entities and university programs. Remote sensing, surveillance and reconnaissance, geolocation, targeting, collection and analysis of radio frequency emissions, and electro-optical imagery from commercial space entities are enhancing DoD and space-based intelligence data.

Appendix A: Acronyms, Abbreviations, and Initialisms

ASAT	anti-satellite
C2	command and control
CHCSS	Chief, Central Security Service
CIA	Central Intelligence Agency
COMINT	communications intelligence
COMSPACEFOR	Commander, Space Force Forces
CSO	Chief of Space Operations
CSpOC	Combined Space Operations Center
CSS	Central Security Service
DCG-O	Deputy Commanding General for Operations
DIA	Defense Intelligence Agency
DIRNSA	Director, National Security Agency
DNI	Director of National Intelligence
DoD	Department of Defense
DoDD	Department of Defense Directive
ELINT	electronic intelligence
EMI	electromagnetic interference
EMP	electromagnetic pulse
FISINT	foreign-instrumentation signals intelligence
GEO	geosynchronous Earth orbit
GEOINT	geospatial intelligence
GPS	Global Positioning System
HEO	highly-elliptical orbit
HUMINT	human intelligence
IC	intelligence community
IMINT	imagery intelligence
IPOE	intelligence preparation of the operational environment
ISR	intelligence, surveillance, and reconnaissance
JIOC	joint intelligence operations center

KOT	key orbital trajectory
LEO	low Earth orbit
MASINT	measurement and signature intelligence
MCIA	Marine Corps Intelligence Activity
MEO	medium Earth orbit
MSIC	Missile and Space Intelligence Center
NASA	National Aeronautics and Space Administration
NASIC	National Air and Space Intelligence Center
NGA	National Geospatial-Intelligence Agency
NGIC	National Ground Intelligence Center
NOAA	National Oceanic and Atmospheric Administration
NRO	National Reconnaissance Office
NSA	National Security Agency
NSDC	National Space Defense Center
NSIC	National Space Intelligence Center
NUDET	nuclear detonation
OCSO	Office of the Chief of Space Operations
ODNI	Office of the Director of National Intelligence
OPELINT	operational electronic intelligence
OSINT	open-source intelligence
PNT	positioning, navigation, and timing
RFI	request for information
SATCOM	satellite communications
SDA	Space Development Agency
SDA	space domain awareness
SDP	Space Doctrine Publication
SIGINT	signals intelligence
SpOC	Space Operations Command
SpOC/CC	Commander, Space Operations Command
SpRCO	Space Rapid Capabilities Office
SSC	Space Systems Command
SSDP	Space Security and Defense Program
STARCOM	Space Training and Readiness Command

SWAC	Space Warfighting Analysis Center
TECHELINT	technical electronic intelligence
TECHINT	technical intelligence
TT&C	telemetry, tracking, and commanding
TTP	tactics, techniques, and procedures
U.S.	United States
US	United States
USAF	United States Air Force
USSF	United States Space Force
USSPACECOM	United States Space Command

Appendix B: Glossary

Collection. In intelligence usage, the acquisition of information and the provision of this information to processing elements. (Joint Publication 2-0)

Communications intelligence (COMINT). Technical information and intelligence derived from foreign communications by other than the intended recipients. (Joint Publication 2-0)

Decision advantage. The product of situational understanding, the ability to assure and exchange information, make, and communicate decisions by maintaining advantages in all domains. (Space Doctrine Publication 6-0)

Electromagnetic warfare. Military action involving the use of electromagnetic and directed energy to control the electromagnetic spectrum or to attack the enemy. (JP 3-85)

Electronic intelligence (ELINT). Technical and geolocation intelligence derived from foreign non-communications electromagnetic radiations emanating from other than nuclear detonations or radioactive sources. (Joint Publication 3-85)

Electromagnetic spectrum operations. Coordinated military actions to exploit, attack, protect, and manage the electromagnetic environment. (JP 3-85)

Foreign instrumentation signals intelligence (FISINT). A subcategory of signals intelligence consisting of technical information and intelligence derived from the intercept of foreign electromagnetic emissions associated with the testing and operational deployment of non-United States aerospace, surface, and subsurface systems. (Joint Publication 2-0)

Geospatial intelligence (GEOINT). The exploitation and analysis of imagery and geospatial information to describe, assess, and visually depict physical features and geographically referenced activities on the Earth. Geospatial intelligence consists of imagery, imagery intelligence (IMINT), and geospatial information. (Joint Publication 2-0)

Human intelligence (HUMINT). A category of intelligence derived from information collected and provided by human sources. (Joint Publication 2-0)

Imagery intelligence (IMINT). The technical, geographic, and intelligence information derived through the interpretation or analysis of imagery and collateral materials. (Joint Publication 2-0)

Information advantage. The superior position or condition derived from the ability to access, share, and collaborate securely via trusted information in order develop to more rapidly awareness and to execute decisions than an adversary while exploiting or denying an adversary's ability to do the same. (Space Doctrine Publication 6-0)

Information environment. The aggregate of individuals, organizations, and systems that collect, process, disseminate, or act on information. (Joint Publication 3-04)

Intelligence. 1. The product resulting from the collection, processing, integration, evaluation, analysis, and interpretation of available information concerning foreign nations, hostile or

potentially hostile forces or elements, or areas of actual or potential operations. 2. The activities that result in the product. 3. The organizations engaged in such activities. (Joint Publication 2-0)

Intelligence asset. Any resource utilized by an intelligence organization for an operational support role. (Joint Publication 2-0)

Intelligence community (IC). All departments or agencies of a government that are concerned with intelligence activity, in either an oversight, managerial, support, or participatory role. (Joint Publication 2-0)

Intelligence discipline. A well-defined area of intelligence planning, collection, processing, exploitation, analysis, and reporting using a specific category of technical or human resources. (Joint Publication 2-0)

Intelligence, surveillance, and reconnaissance (ISR). 1. An integrated operations and intelligence activity that synchronizes and integrates the planning and operation of sensors, assets, and processing, exploitation, and dissemination systems in direct support of current and future operations. 2. The organizations or assets conducting such activities. (Joint Publication 2-0)

Key orbital trajectory. Any orbit from which a spacecraft can support users, collect information, defend other assets, or engage the adversary. (Space Capstone Publication, *Spacepower*)

Measurement and signature intelligence (MASINT). Information produced by quantitative and qualitative analysis of physical attributes of targets and events to characterize, locate, and identify targets and events, and derived from specialized, technically derived measurements of physical phenomena intrinsic to an object or event. (Joint Publication 2-0)

Open-source intelligence (OSINT). Relevant information derived from the systematic collection, processing, and analysis of publicly available information in response to known or anticipated intelligence requirements. (Joint Publication 2-0)

Signals intelligence (SIGINT). 1. A category of intelligence comprising either individually or in combination all communications intelligence, electronic intelligence, and foreign instrumentation signals intelligence, however transmitted. 2. Intelligence derived from communications, electronic, and foreign instrumentation signals. (Joint Publication 2-0)

Appendix C: Cornerstone Responsibilities, Core Competencies and Spacepower Disciplines

Cornerstone responsibilities. Military space forces conduct prompt and sustained space operations, accomplishing three cornerstone responsibilities. Taken together, these cornerstone responsibilities define the vital contributions of military spacepower. (Space Capstone Publication*, Spacepower*)

Preserve freedom of action. Unfettered access to and freedom to operate in space is a vital national interest; it is the ability to accomplish all four components of national power – diplomatic, information, military, and economic – of a nation's implicit or explicit space strategy. Military space forces fundamentally exist to protect, defend, and preserve this freedom of action. (Space Capstone Publication*, Spacepower*)

Enable joint lethality and effectiveness. Space capabilities strengthen operations in the other domains of warfare and reinforce every joint function – the United States does not project or employ power without space. At the same time, military space forces must rely on military operations in the other domains to protect and defend space freedom of action. Military space forces operate as part of the joint force across the entire conflict continuum in support of the full range of military operations. (Space Capstone Publication*, Spacepower*)

Provide independent options. Providing the ability to achieve strategic effects independently is a central tenet of military spacepower. In this capacity, military spacepower is more than an adjunct to landpower, seapower, airpower, and cyberpower. Across the conflict continuum, military spacepower provides national leadership with independent military options that advance the nation's prosperity and security. Military space forces achieve national objectives by projecting power in, from, to space. (Space Capstone Publication*, Spacepower*)

Core competencies. The Space Force executes five core competencies. These core competencies represent the broad portfolio of capabilities military space forces need to provide successfully or efficiently to the Nation. (Space Capstone Publication*, Spacepower*)

Space security. Space security establishes and promotes stable conditions for the safe and secure access to space activities for civil, commercial, intelligence community, and multinational partners. (Space Capstone Publication*, Spacepower*)

Combat power projection. Combat power projection integrates defensive and offensive operations to maintain a desired level of freedom of action relative to an adversary. Combat power projection in concert with other competencies enhances freedom of action by deterring aggression or compelling an adversary to change behavior. (Space Capstone Publication*, Spacepower*

Space mobility and logistics. Space mobility and logistics enables movement and support of military equipment and personnel in the space domain, from the space domain back to Earth, and to the space domain. (Space Capstone Publication*, Spacepower*)

Information mobility. Information mobility provides timely, rapid, and reliable collection and transportation of data across the range of military operations in support of tactical, operational, and strategic decision making. (Space Capstone Publication, *Spacepower*)

Space domain awareness. The timely, relevant, and actionable understanding of the operational environment. (*U.S. Space Force Vision for Space Domain Awareness*)

Spacepower disciplines. The spacepower disciplines are necessary components of military spacepower theory. These disciplines are the skills the Space Force needs when developing its personnel to become the masters of space warfare. (Space Capstone Publication, *Spacepower*)

Orbital warfare. Knowledge of orbital maneuver as well as offensive and defensive fires to preserve freedom of access to the domain. Skill to ensure United States and coalition space forces can continue to provide capability to the joint force while denying that same advantage to the adversary. (Space Capstone Publication, *Spacepower*)

Space electromagnetic warfare. Knowledge of spectrum awareness, maneuver within the spectrum, and non-kinetic fires within the spectrum to deny adversary use of vital links. Skill to manipulate physical access to communication pathways and awareness of how those pathways contribute to adversary advantage. (Space Capstone Publication, *Spacepower*)

Space battle management. Knowledge of how to orient to the space domain and skill in making decisions to preserve mission, deny adversary access, and ultimately ensure mission accomplishment. Ability to identify hostile actions and entities, conduct combat identification, target, and direct action in response to an evolving threat environment. (Space Capstone Publication, *Spacepower*)

Space access and sustainment. Knowledge of processes, support, and logistics required to maintain and prolong operations in the space domain. Ability to resource, apply, and leverage spacepower in, from, and to space. (Space Capstone Publication, *Spacepower*)

Military intelligence. Knowledge to conduct intelligence-led, threat-focused operations based on the insights. Ability to leverage the broader intelligence community to ensure military spacepower has the ISR capabilities needed to defend the space domain. (Space Capstone Publication, *Spacepower*)

Engineering and acquisition. Knowledge that ensures military spacepower has the best capabilities in the world to defend the space domain. Ability to form science, technology, and acquisition partnerships with other national security space organizations, commercial entities, allies, and academia to ensure the warfighters are properly equipped. (Space Capstone Publication, *Spacepower*

Cyber operations. Knowledge to defend the global networks upon which military spacepower is vitally dependent. Ability to employ cyber security and cyber defense of critical space networks and systems. Skill to employ future offensive capabilities. (Space Capstone Publication, *Spacepower*)

Appendix D: References

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U.S. Space Force Vision for Space Domain Awareness, May 2023

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Bate, Roger B, Mueller, Donald D., White, Jerry E. (1971). Fundamentals of Astrodynamics, Dover Publications Incorporated

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Space Doctrine Publication 3-0

OPERATIONS

DOCTRINE FOR SPACE FORCES

UNITED STATES

SPACE FORCE

Space Doctrine Publication (SDP) 3-0, *Operations*
Space Training and Readiness Command (STARCOM)
OPR: STARCOM Delta 10
19 July 2023

Foreword

For decades, the United States executed space operations without concern for significant deliberate interference by potential adversaries. This freedom allowed the delivery of space capabilities essential to global operations of the United States Armed Forces with unmatched speed, agility, and lethality. However, peer and near-peer competitors understand the competitive advantage the United States derives from space capabilities and view shortfalls in the resilience of United States space capabilities as vulnerabilities. To exploit these perceived vulnerabilities, potential adversaries are developing capabilities to negate our space capabilities. Moreover, adversaries and competitors are now exploiting the space domain for their own purposes, which could grant their forces significant advantages in conflict with the United States.

Seizing space superiority at the time and place of our choosing can offer advantages to military forces. By concentrating forces to control lines of communication, United States space forces can achieve space superiority and enable joint lethality, without the fiscal and political costs stemming from pursuing space supremacy. In many ways, the modern use of various orbital regimes in the space domain provides similar advantages to military forces that control key terrain and positions. Space Doctrine Publication (SDP) 3-0, *Operations*, as keystone doctrine for the United States Space Force (USSF) describes official advice and best practices for supporting the joint force commander (JFC) in gaining and exploiting this position of advantage within the space domain.

Conducting space operations over many years gives our service experience and allows our doctrine to speak from a position of authority. I encourage you to study and learn from the collection of experiences compiled in this volume. Semper Supra!

SHAWN N. BRATTON
Major General, USAF
Commander, Space Training and Readiness Command

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Table of Figures

Space Force Doctrine

Space Force doctrine guides the proper use of spacepower and space forces in support of the service's cornerstone responsibilities. It establishes a common framework for employing Guardians as part of a broader joint force. Doctrine provides fundamental principles and authoritative guidance as an informed starting point for decision-making and strategy development. Since it is impossible to predict the timing, location, and conditions of the next fight, commanders should be flexible in the implementation of this guidance as circumstances or mission dictate.

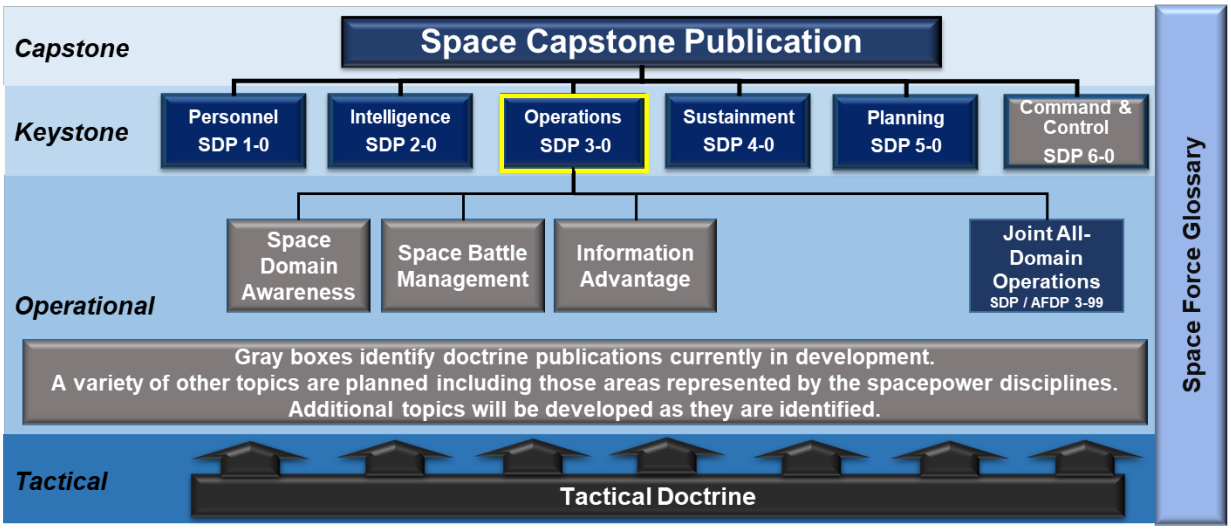


Figure 1. Space Force doctrine hierarchy

The Space Force doctrine hierarchy (figure 1) includes four levels of doctrine and a glossary. Each level builds on the one above it, reflecting the role of Guardians in every specialty area. A set of six keystone doctrine publications follows the Space Capstone Publication, *Spacepower*. Below the keystone level, Space Force is developing multiple operational level doctrine publications, each expanding on a specific area. Tactical doctrine provides details at the level of specific systems and tactics, techniques, and procedures. As the mission evolves the Space Force will add to the doctrine hierarchy.

Space Doctrine Publication (SDP) 3-0

Space Doctrine Publication (SDP) 3-0, *Operations*, one of the six planned keystone doctrine publications, presents Space Force delivery of spacepower as an independent option for national and joint leadership, and as a part of unified action under a joint force commander (JFC).

- Chapter 1 provides an overview of military space operations and the contribution of space to joint all-domain operations.
- Chapter 2 discusses the space operational environment, including the characteristics, threats, and challenges.
- Chapter 3 details the operational concept of spacepower and the role of Guardians in unified action across the competition continuum and the space operations that the Space Force organizes, trains, and equips Guardians to conduct.
- Chapter 4 discusses the structure of the Space Force and presentation of space forces as part of the joint force.

Chapter 1: Military Space Operations

Introduction - United States Military Space Operations

> An operation is a sequence of tactical actions with a common purpose or unifying theme, or a military action or the carrying out of a military mission.
>
> Joint Publication 3-0, *Joint Campaigns and Operations*

The United States military has studied, planned, and executed operations in the space domain since General Curtis LeMay declared spacecraft development an extension of strategic air power in 1946. In the 1950s, General Bernard Schriever spearheaded the development of strategic and theater ballistic missile programs; these programs laid the technological framework for the United States military spacecraft program. More than a decade after General LeMay's declaration, the United States placed its first spacecraft into orbit, Explorer I. By the 1960s, success of the CORONA spacecraft program led to the establishment of the National Reconnaissance Office and the expansion of space-based systems for intelligence, surveillance, and reconnaissance (ISR). On 1 September 1982, the United States Air Force (USAF) established Air Force Space Command as the home for space-related operational functions.

Prior to 1991, space-based systems functioned primarily as strategic assets and provided the National Command Authority and senior military leaders situational awareness of global events. The Gulf War ushered in the widespread use of space-based systems at the tactical and operational levels, transforming modern warfare.

As the joint force began integrating space capabilities into plans and operations, it did so from a place of sanctuary. Space capabilities became transparent and dependable. The United States military designed and sized its force structure in orbit and on Earth, assuming assured access to space.

Today, space capabilities are integral to the joint fight. Potential adversaries seek to replicate this success, developing new weapons and spacecraft with capabilities rivaling those of the United States. In response to these growing threats, the United States re-established United States Space Command as a combatant command on 29 August 2019.

Our allies, partners, commercial providers, civil agencies, and academia continue expanding the number and types of spacecraft on orbit. Today, more than 70 countries and intergovernmental organizations operate spacecraft, with the number of active spacecraft in orbit more than tripling over the last decade. Much of that growth came in the commercial sector, where active commercial spacecraft now substantially outnumber active government-owned spacecraft in orbit.

In December 2019, Congress established the Space Force as an armed service within the Department of the Air Force tasked with establishing and maintaining space superiority through the application of spacepower. The Space Force organizes, trains, and equips Guardians to provide freedom of operations in, from, and to the space domain; to provide independent military options for joint and national leadership; and to enable the lethality and effectiveness of the joint force to meet strategic and military national objectives.

Space Operations in the Joint Fight

Spacepower is the ability to accomplish strategic, operational, and tactical objectives through the control and exploitation of the space domain. The Space Force frames its ability to organize, train, and equip Guardians to deliver spacepower as part of unified action for the Nation in terms of its cornerstone responsibilities, core competencies, and the spacepower disciplines. Guardians seek solutions in the integration of people (including allies and partners), processes, and technologies to respond to the JFC's objectives, while adapting to overcome adversary capabilities and defeat the enemy. Guardians do not rely solely on technology to win the fight; they are thinking warriors able to adapt, adjust, and overcome. See appendix F for the full definitions of the cornerstone responsibilities, core competencies, and the spacepower disciplines.

Principles of Joint Operations and the Space Domain

The United States built the most effective expeditionary combat force on Earth in large part due to space's global reach. Joint Publication 3-0, *Joint Campaigns and Operations,* recognizes twelve principles of joint operations (defined below in italics in each paragraph) that reflect how Armed Forces of the United States use combat power across the competition continuum.

To provide effective space capabilities for the joint force, Guardians conduct a range of interconnected types of operations defined by core competencies and aligning to the principles of joint operations. The global, multi-domain, trans-regional reality of space operations means the Space Force contributes to each of these principles as part of daily operations or in support of a particular campaign or operation.

a. **Objective** *(The purpose of specifying the objective is to direct military action toward a clearly defined and achievable goal)***.**

   Clearly defined objectives provide focused, assessable means to conduct space operations. The persistent nature of space operations can challenge spatial-, event-, or time-based assessments without clearly articulated mission objectives. Employing a mission command approach to command and control (C2) requires specific objectives to satisfy the commander's end state. Those objectives provide subordinate organizations the ability to develop tasks and conduct crew force management to meet commander's

intent. For example, well-defined operational objectives clarify specific precision and signal strength requirements to enable optimization of a positioning, navigation, and timing (PNT) operation. Guardians at all echelons contribute innovative ways to adapt in a contested, degraded, and operationally limited environment to address JFC objectives.

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

Offensive operations leveraging space capabilities are critical to developing multi-domain and trans-regional solutions for the JFC. The ability to identify opportunities within any domain is vital. Seizing the initiative to place the adversary in a disadvantaged position requires Guardian support to plan and conduct operations with integrated space capabilities (including from allies and partners) creating effects across all domains.

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

Mass is the concentrated effect of combat power at the most advantageous time to provide decisive results in any domain. The massing or concentration of space forces and effects at the time and place of the JFC's choosing is critical to achieving space superiority. Joint operations require the combined effort of reversible and non-reversible effects with deliberate timing and tempo to concentrate effects to meet joint force objectives. All-domain fires may mitigate threats to space assets and threaten the adversary's ability to exploit the domain. For space operations, the principle of mass could apply to:

1) On-orbit force packaging
2) Re-allocation of sensors
3) Prioritization of antenna access for uplink and downlink
4) Enhanced Global Positioning System (GPS) support over a region of the world
5) Multiple space surveillance network sensors tracking a new foreign launch
6) Cyberspace tools watching and protecting segments of a defended network used for space operations
7) Multiple counter-communication systems blanketing a segment of the electromagnetic spectrum (EMS)

d. **Maneuver** *(The purpose of maneuver is to place an adversary or enemy in a position of disadvantage)***.**

The concept of advantage through maneuver for space operations can originate in any segment in response to operational capability gaps (e.g., surveillance coverage gaps), physical or EMS threats, or adversary actions with a focus of retaining an advantage or putting the adversary at a disadvantage. Maneuver in support of space operations can include maneuvering deployable ground assets and forces, reallocating space assets on-orbit, and maneuvering within the EMS by retasking or repointing terrestrial sensors or allocating uplink and downlink access to command spacecraft. For example, in January 2020, Iran launched theater ballistic missiles toward two air bases in Iraq housing United States personnel. Space-based overhead persistent infrared operations units pre-emptively maneuvered to create a sensor watch box and allocated crew personnel to ensure detection of the pending threat. The unit's ability to maneuver resources related to the Iranian threat put the regime at a disadvantage and mitigated its ability to induce surprise, enabling United States personnel in theater to take shelter.

e. **Economy of Force** *(The purpose of an economy of force is to expend minimum essential combat power [lethal and nonlethal] on secondary efforts to allocate the maximum possible combat power on primary efforts).*

Economy of force for space operations is imperative along the entire competition continuum. The cost to develop, launch, and operate a spacecraft, whether to field a new capability or to replenish an old or lost capability can be significant. Guardians keep these considerations in mind across the competition continuum to ensure economy of force. This has led to constellations that field only the minimum number of spacecraft to accomplish a mission. There is a natural tension between economy of force and resiliency, assuming greater redundancy and surplus capacity provides a more resilient capability. Given the high demand, low-density nature of space capabilities, deliberate mission planning, risk assessment, and prioritization are critical mechanisms to maximize operational effectiveness. This ensures allocation of the right capability to the right theater at the right time. Guardians should understand the domain's peculiarities, the global scope of the United States' responsibilities, and the limited access to space capabilities to give economy of force appropriate consideration in military operations. For example, in a situation where there are competing demands, Guardians may need to assess the cost of using a particular sensor (highest fidelity or lesser capability) to meet the JFC's needs, to avoid disruption of other high priority tasks or creation of a gap in coverage for other operations.

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

The global nature of space operations means Guardians are providing effects for multiple combatant commands. Coordinating and planning for simultaneous effects under one commander ensures consistent, timely, and concentrated effects for specific multiple operational objectives that can potentially be simultaneous and trans-regional. For Guardians this may mean that mission analysis will determine whether assigning forces globally through United States Space Command, to another combatant commander, or to the JFC, provides the best support.

g. **Security** *(The purpose of security is to prevent the enemy from acquiring an unexpected advantage).*

Security challenges Guardians to consider all potential vulnerabilities in the execution of space operations. Guardians consider vulnerabilities and mitigation actions across the operational environment (including all three segments – orbital, terrestrial and link) as a fundamental part of all mission planning and assessment. Mitigation of attacks across the space operational environment is fundamental to mission planning and operational effectiveness. For instance, Guardians maintain awareness of the access and cyberspace exploitation points of their mission system, physical threats to terrestrial facilities, the limits of spacecraft maneuverability, electromagnetic interference (EMI) effects, and processes that inhibit flexibility or expedited action. Guardians also need to understand how an adversary conducts C2 of their space systems, the authorities required to operate spacecraft or exploit EMS capabilities, and their communication requirements as avenues to disrupt the adversary's ability to operate in the space domain. The physical security of terrestrial components may require coordination with multiple combatant commanders. United States allies and partners are also critical to the security equation and maintaining freedom of action in space.

h. **Surprise** *(The purpose of surprise is to strike at a time or place where the enemy is unprepared).*

The nature of modern warfare means surprise could manifest itself in any domain and in any element of the competition continuum. Finding opportunities to exploit the adversary when they least expect it is foundational to winning an engagement. Guardians use their domain expertise to find opportunities to use surprise to put the adversary at a disadvantage. Guardians also leverage innovative means and resources to deny the adversary the element of surprise in space operations whether in the orbital, terrestrial or link segment. The active employment of intelligence and engagement with allies and partners is essential to creating surprise or denying it to the adversary.

i. **Simplicity** *(The purpose of simplicity is to increase the probability of success in execution by preparing clear, uncomplicated plans and concise orders).*

Space systems and operations are inherently complex; therefore, simplicity in planning for space support is essential. Simplicity does not equate to risk aversion; it reflects the importance of operating in the most efficient and effective manner, providing the JFC flexibility. The complexity of operating systems hundreds to thousands of kilometers away from a given location means that undue complexity risks proper execution of a planned mission. Additionally, simplicity enables optimal communication between agencies – typically geographically separated – to best execute the desired plan. Guardians may provide simultaneous support to multiple areas of responsibility (AORs), requiring coordination between units across the globe, where any communication or execution error could mean the failure of a mission or loss of life. Guardians support the JFC in developing executable plans to integrate space operations into joint all-domain operations and unified action to ensure the highest success probability. Exercises and wargames provide Guardians the opportunity to rehearse and visualize complex astrodynamics situations and force packaging opportunities, while contributing to streamlined planning and execution processes for space operations.

j. **Restraint** *(The purpose of restraint is to prevent the excessive use of force).*

Restraint in the orbital segment is essential as some actions can produce a long-term debris field jeopardizing or threatening the denial of an entire orbital plane. Orbital debris could last for tens or hundreds of years, which means understanding those effects before undertaking any action is critical. Chinese (2007) and Russian (2021) anti-satellite (ASAT) launches created debris clouds consisting of thousands of pieces of debris. These debris clouds may threaten lower low Earth orbit (LEO) altitudes for decades, creating a threat to international commercial, civil, and state-owned space systems. The Russian ASAT test necessitated an emergency response from the International Space Station crew as they encountered two passes in or near the debris cloud. As spacecraft, debris, and other objects make the domain more congested, these tests put more operational systems at risk. These tests appear to reflect little concern for spacecraft safety within specific orbital regimes. Guardians supporting the JFC consider debris generation, adversary perception of the movement of objects in space, the application of reversible and non-reversible fires and their impact to spacecraft and other operations, and the location of space systems (in any domain) as part of risk-based inputs to planning. Restraint is also part of reducing the risk of escalation.

k. **Perseverance** *(The purpose of perseverance is to ensure the commitment necessary to achieve strategic objectives).*

Space operations require a level of perseverance and resilience not always required in other domains. The deployment of space capabilities can take time to unfold. It could

take days, weeks, or even months for an asset to maneuver. For example, moving from one location on the geosynchronous belt to another (depending on drift rate) could take months. This maneuver may only be the initial step in a multi-step plan supporting a terrestrial engagement. Perseverance and the ability to adapt under changing circumstances is imperative to the long-term success of any space operation. Guardians require perseverance and flexibility to continuously assess the operational environment and to work through issues such as limited contact, cyberspace attacks, jamming, environmental impacts, or other types of degradation.

l. **Legitimacy** *(The purpose of legitimacy is to maintain legal and moral authority).* Legitimacy in space operations is vital from a national standpoint. Binding treaties, international and domestic law, national policy, and cooperation with allies and partners shape all United States space operations. The United States operates in a manner that establishes a behavioral example for allies, partners, and potential adversaries. Executing operations without considering allied and partner perspectives and constraints may undercut longer-term strategic or operational objectives. Space forces deliberately executing with restraint, objective, and unity of command provide a foundation to ensure legitimacy throughout an operation. Articulated risk, potential damage assessments, specific objectives, and allied and partner cooperation build trust and legitimacy.

Chapter 2: Operational Environment

The space operational environment is diverse and expansive. The unique characteristics of the space systems and the operational environment shape space contributions to joint operations across all elements of the competition continuum. Natural and human-made threats to space capabilities also have significant impacts on the space operational environment and the United States' ability to operate safely and freely in the domain.

Characterizing the Operational Environment

Guardians employ space systems to conduct activities and create effects in, from, and to the space domain. Space systems include components in three segments operating across all operational environments. The orbital segment includes space systems operating in the environment of the space domain. Terrestrial segment systems operate in the land, air, and maritime domains. Link segment components of space systems operate in the information operations environment (cyberspace is part of the information operations environment) and the electromagnetic operations environment. These characteristics of these segments and their operational environments play important roles in determining capabilities, limitations, and vulnerabilities for space operations.

a. **Space Environment.** While the United States has expressed the view that there is no legal or practical need to delimit or otherwise define a specific boundary between airspace and outer space, for the purpose of military operations, the Space Capstone Publication, Spacepower, defines the space domain as "the area above the altitude where atmospheric effects on airborne objects become negligible." The orbital segment includes spacecraft operating in planned orbits within an orbital regime, including United States military and Department of Defense (DoD) on-orbit assets, and those of allies, partners, commercial entities, civil organizations, academia, and adversaries.

    1) **Spacecraft.** Spacecraft can include both crewed and uncrewed systems in space. Typically, uncrewed spacecraft include a bus and one or more payloads. The bus hosts systems critical to the operation of the spacecraft, such as the electrical power system; propulsion system; attitude control system; thermal control system; telemetry, tracking, and command system; and the computer and software system. The payload, which determines the purpose of a spacecraft, may include equipment for functions such as communication, navigation, remote sensing, scientific research, intelligence, surveillance, reconnaissance, offensive or defensive functions, or a wide variety of other missions.

2) **Space Vehicles and Other Objects.** In addition to spacecraft, other human-made assets remain on-orbit either temporarily or permanently. These include boosters, other parts of the launch vehicles, and associated debris.

3) **Regimes.** An orbital regime is a region in space associated with a dominant gravitational system that can capture the orbit of other objects. Large celestial bodies generate gravitational fields within their sphere of influence, which also define the demarcation between orbital regimes. The Space Force currently defines three nested orbital regimes for space operations. Future military space operations may extend beyond these three regimes.

   i. **Geocentric Regime**. The geocentric regime is where Earth's gravity dominates, and objects follow orbital trajectories relative to the Earth. Current United States military space operations occur in a set of defined orbits within the geocentric regime. Guardians are preparing to move beyond the geocentric regime to provide space domain awareness (SDA) in all regimes as commercial and government entities reach new milestones and potential threats arise.

   ii. **Cislunar Regime**. The cislunar regime, characterized by the combined gravitational effects of the Earth and Moon, includes translunar space between these bodies, the Earth-Moon Lagrange points, and orbits around the moon (selenocentric). For more details see appendix c.

   iii. **Solar Regime.** The Sun's massive gravitational field defines the solar regime, where planets and other objects in the solar system orbit around the Sun. The solar regime also includes Lagrange points characterized by the combined gravitational effects of the Sun and the planets. Sun-Earth Lagrange Points 1 and 2 influence the region of space immediately beyond the cislunar regime.

4) **Orbits.** An orbit is a regular, repeating path that a spacecraft takes around another object. In the geocentric regime, Earth is the central gravitational body.

   i. **Geosynchronous Earth Orbit (GEO).** GEO spacecraft operate at approximately 35,000 kilometers, orbiting at the same rate the Earth rotates on its axis. Spacecraft in GEO appear to trace a figure-eight path over the ground. The more highly inclined (tilted off the equator) the orbit, the larger its ground trace. A geostationary orbit is a special type of GEO positioned directly over the equator at zero degrees inclination. To observers on the Earth a geostationary spacecraft appears at a fixed point in space. GEO is ideal for

worldwide communications, surveillance, reconnaissance, environmental monitoring, and missile warning.

ii. **Highly Elliptical Orbit (HEO).** A HEO takes the shape of a long ellipse. At their most distant points from Earth (apogee), spacecraft in HEO may be more than 40,000 kilometers away. On the other side of the elliptical orbit, the spacecraft's closest point of approach (perigee) may be only a few hundred kilometers above the Earth's surface. HEO provides very long dwell times over an area on the Earth when the spacecraft is near apogee. Spacecraft in HEO are normally highly inclined, so the long dwell times occur over high latitudes. Molniya, Three Apogee, and Tundra orbits are all types of HEO with varying orbital parameters. HEO is ideally suited for a variety of missions including communications, scientific research, surveillance, missile warning, and environmental monitoring missions.

iii. **Medium Earth Orbit (MEO).** MEO has no formally defined altitude but includes those orbits between LEO and GEO. MEO orbits are typically between 2,000 and 35,000 kilometers from Earth. A semi-synchronous orbit is a special type of MEO, repeating an identical ground trace after two revolutions, each taking just under 12 hours. MEO is home to PNT spacecraft such as the GPS.

iv. **Low Earth Orbit (LEO).** LEO is relatively close to the Earth (approximately 160 to 2,000 kilometers), so spacecraft can use less-powerful transmitters for communications and achieve higher-resolution imagery with similar-sized apertures as compared to objects in higher orbits. LEO spacecraft are only in view of a terrestrial user or station for a short period when overhead, requiring a large constellation of spacecraft spaced evenly around several orbital planes to maintain continuous coverage. LEO is ideal for ISR, environmental monitoring, and small communications spacecraft. Scientific instrument payloads and human spaceflight missions also frequently use these orbits.

5) **Lines of Communication.** Lines of communication are those physical and electromagnetic lines of communication in, from, and to space used for the movement of trade, materiel, supplies, personnel, spacecraft, information, and military effects. Access to lines of communication within the orbital segment enables the timely repositioning, on-orbit maintenance, and reconstitution of assets. In the orbital segment, lines of communication include but are not limited to launch trajectories, orbits, and communications links to and from terrestrial nodes (in the terrestrial segment) and between spacecraft in the orbital segment.

Intelligence plays a critical role in understanding and assessing lines of communication to drive mission planning for space operations. Understanding lines of communication in conjunction with key orbital trajectories is essential for Guardians planning, executing, and assessing space operations.

b. **Terrestrial Environments.** In the terrestrial environments (land, air, and maritime domains) space operations includes space systems used for C2, such as ground control stations, antennas, networks, end user devices, and the centers that conduct tasking, data collection, processing, exploitation, and data dissemination. Terrestrial space systems also include ground-based radars, electro-optical sensor sites, space launch facilities, and any other air, land, or maritime platforms or facilities that support space operations. Bases and facilities owned, operated, or maintained by another service, ally, or partner may host terrestrial portions of a space system and user equipment. For space operations in other domains, access to critical lines of communication enables timely repositioning, resupply, reinforcement of forces and assets to support space operations, sustainment, and continuity of operations to provide mission assurance for facilities, equipment, and personnel.

c. **Information Environment.** The information environment represents the aggregation of social, cultural, linguistic, psychological, technical, and physical factors related to information. With respect to space operations, there are factors that affect the impact of information on humans, and how humans and automated systems derive meaning from and act upon information. Guardians, and the systems they use, play a key role supporting national and joint force decision-making through the delivery of communications, PNT, and other types of data in cyberspace via the link segment. Gaining and maintaining advantage in the information environment, through intelligence-driven operations, provides options for the JFC to change or maintain perceptions, attitudes, and other elements that drive desired relevant actor behaviors that affect space operations.

d. **Electromagnetic Environment.** The electromagnetic environment is a composite of the actual and potential electromagnetic energy radiation, conditions, circumstances, and influences that affect the employment of capabilities and the decisions of the commander. It includes the existing background radiation (i.e., electromagnetic environment) as well as the friendly, neutral, adversary, and enemy electromagnetic systems able to radiate within the electromagnetic area of influence. This includes systems actively or passively capable of radiating or receiving electromagnetic signals that can potentially affect joint operations. Signals between spacecraft and terrestrial systems (to and from space), between terrestrial systems, and between spacecraft (in space), are all part of the link

segment and operations in the electromagnetic operations environment. The electromagnetic operations environment also includes the electromagnetic aspects of space weather, which can impact space operations in, from, and/or through the orbital segment. In the EMS, alternate communications paths, and tactics such as beam shaping and antenna nulling, provide control of those critical lines of communication. Identifying and securing friendly access to lines of communication, while taking measures to deny the same access to adversaries, is a key Guardian responsibility.

Threats to Space Operations

Space operations face natural environmental and human-made threats in every environment. Threats to United States space operations from adversary capabilities span the scale of reversible (non-destructive and temporary, system can return to normal operations) to non-reversible effects (permanent damage or destruction of sensors or other satellite components). The potential effects of these threats increase as space becomes more congested, contested, and operationally limited. The potential of threats to negatively impact space operations in the other domains and environments is also increasing.

a. **Natural Environmental Threats**. Space systems in every segment face a harsh natural environment, and unintentional and intentional threats. The effects to space operations range from minor nuisances to catastrophic loss of access to entire orbital planes or altitude blocks. Threats from the natural environment introduce the potential for damage or interference to sensitive spacecraft components and communications links (see appendix D for a more complete discussion). Terrestrial weather can affect space operations by attenuating signals in the EMS, degrading optical sensors, affecting communications with an on-orbit asset, or affecting the signal-to-noise ratio for end-user equipment in the link segment. The same severe weather can create physical risks for facilities, infrastructure, personnel, and equipment. Solar flares, magnetic storms, and atmospheric expansion can also distort or degrade communications signals.

    1) **Solar Flares and Radio Bursts.** Solar flares are large eruptions of electromagnetic radiation from the sun traveling at the speed of light, reaching the earth in about eight minutes. Impacts to military operations such as to some single-frequency GPS applications can occur even with smaller bursts. As the intensity of radio bursts increases, they impact more operations such as missile warning radars, and dual-frequency GPS applications. These larger bursts can mimic adversary actions such as jamming and can trigger false launch alerts on missile warning systems.

    2) **Galactic Cosmic Rays.** Galactic cosmic rays originate outside the solar system as the result of explosive events such as a supernova. The resulting energetic

particles constantly bombard spacecraft, degrading solar panels and circuitry, and gradually reducing spacecraft instrument performance.

3) **Geomagnetic Storms.** Fluctuations in the Earth's magnetic field, such as geomagnetic storms, can magnify atmospheric drag on spacecraft and can increase the radiation encountered by sensitive space systems and electronics.

4) **Atmospheric Heating.** Atmospheric expansion caused by heating can increase the population of corrosive oxygen molecules that can combine with some spacecraft surfaces and degrade critical components.

5) **Scintillation.** Periods of increased ionospheric turbulence, or scintillation, can significantly degrade GPS position accuracy, severely degrade satellite communications (SATCOM) signals, and decrease the accuracy of space object identification and tracking.

6) **Debris.** Micro-meteoroids and other naturally occurring particles can damage or destroy spacecraft, or spacecraft components.

b. **Human-Made Threats**. Space operations face intentional and unintentional human-made threats that can originate from multiple domains. The threats can disrupt or degrade space operations, or permanently disable or destroy space systems.

1) **Cyberspace Threats.** Malicious cyberspace maneuvers (or activities) can target any information system, network, infrastructure, or other computing devices. Cyberspace operations through the EMS can affect a spacecraft's functionality, or the functionality of multiple spacecraft simultaneously. Cyberspace attacks on spacecraft, to include malware installed in development or system software updates, can intercept, manipulate data, insert malicious commands, or cause anomalous behavior on the spacecraft. Cyberspace attacks, such as those examples in figure 2, can ultimately deny or degrade a spacecraft's capabilities, or prevent Guardians from communicating with the spacecraft to maintain health and status (to include providing system updates). Offensive cyberspace operations can disrupt or deny terrestrial computing functions used to support spacecraft, radar, optical sensor, and C2 operations. Cyberspace attacks on ground systems or terrestrial lines of communication can manipulate data, impede data flow, insert unintended commands, or cause anomalous behavior in systems which could prevent Guardians from being able to C2 spacecraft. Cyberspace attacks on terrestrial mission systems (such as radars, optical sensors, and space mission C2 systems) could make the data provided by the satellite or the ground-based space system (i.e., radars or optical sensors) unusable due to questionable integrity, or

impact the ability to collect, process, and disseminate mission data (data availability). Because space systems provide a significant amount of global bandwidth there is a symbiosis between operations in space and in cyberspace. Space and cyberspace planners and operators should consider the effects of an attack on both space and cyberspace operations. While cyberspace attacks require an elevated understanding of the targeted systems compared to other threats, they do not require significant resources to execute, which means contracted private groups or individuals can execute these types of threats. Accurate and timely attribution of cyberattacks can be difficult due to a variety of methods adversaries use to conceal their identity.

Cyberspace Threat Events

In October 2007 and July 2008, cyber actors attacked the Landsat-7, a remote sensing satellite operated by the U.S. Geological Survey, resulting in 12 or more minutes of interference on each occasion. The attackers did not achieve the ability to command the satellite.

United States - China Economic and Security Review Commission, 2015 Report to Congress

Twice in 2008, hackers exploited Terra, National Aeronautics and Space Administration's Earth observation satellite, and "achieved all steps required to command the satellite".

United States - China Economic and Security Review Commission, 2015 Report to Congress

In 2014, the National Oceanographic and Atmospheric Administration was forced to stop transmitting satellite images to the National Weather Service for two days in response to a cyber attack.

Office of the Inspector General, Cybersecurity Management and Oversight at the Jet Propulsion Laboratory

Figure 2. Cyberspace threat events

2) **Electromagnetic Interference (EMI)**. Intentional or unintentional EMI from a space or a terrestrial source can interfere with uplink, downlink, and crosslink communications, which are critical for controlling satellites, receiving data, and communications. As congestion in the orbital segment increases, so does the potential for intentional and unintentional EMI that interfere with or compromise signals.

3) **Electromagnetic Pulse (EMP)**. An EMP generated in space can induce damaging voltages and currents into unprotected electronic circuits and

components of affected spacecraft. A terrestrial EMP can induce damaging voltages and currents into unprotected electronic circuits and components of affected terrestrial nodes and their associated links. Air or ground bursts could render terrestrial space systems inoperable.

4) **Space Debris.** A variety of events, including rocket launch, spacecraft anomaly, ASAT testing, and spacecraft collision, can result in space debris. The increased congestion in space raises the possibility of collisions producing debris that can accumulate and further congest an orbital regime. Smaller pieces of space debris (below 10 centimeters) are harder to track, which increases the importance of SDA and collision avoidance to preserve space-enabled and space-based capabilities. Figure 3 below provides real-world debris event examples.

Orbital Debris Events

1983	The windscreen of the Challenger space shuttle was chipped by a 0.01-inch (0.33 millimeter) paint fleck that was traveling at 2.4 miles (4 kilometers) per second.
1991	Russian navigation satellite, Cosmos 1934, collided with debris from a defunct Russian satellite, Cosmos 926.
1996	Fragment from an exploded Ariane rocket launched in 1986 damaged a French spy micro-satellite, Cerise.
2005	Upper stage of a United States Thor rocket hit debris from a Chinese CZ-4 rocket.
2007	The Chinese used an ASAT weapon to destroy one of their weather satellites, Fengyun-1C. The event resulted in the largest creation of space debris in history, with more than 3,000 trackable pieces, and it is estimated of hundreds of thousands of debris particles.
2009	Obsolete Russian military satellite, Cosmos 2251, collided with a United States Iridium communications satellite, generating a debris cloud.
2021	The Russians used an ASAT weapon to destroy one of their satellites, Cosmos 1408. The event resulted in over 1,500 pieces of trackable debris.

Figure 3. Examples of orbital debris events

5) **Directed Energy.** Directed energy threats include laser, radiofrequency, and particle-beam weapons. Laser systems can temporarily disrupt or deny capabilities, or they can permanently degrade or destroy subsystems. Electromagnetic energy from terrestrial or on-orbit systems can target electronic components and uplink, downlink, and crosslink signals.

6) **Nuclear Detonation (NUDET)**. NUDETs can destroy assets in the immediate vicinity of the detonation and create charged particles that present a hazard to sensitive components on spacecraft well beyond the vicinity of the initial explosion. Because the effects of a NUDET expand rapidly, it is not necessary to target a specific asset. The radiation generated by the detonation could damage spacecraft components and shorten their effective operational lives. Just as it would affect assets on-orbit, a NUDET could damage or destroy space systems and user equipment. The same detonation could kill or severely injure Guardians and others operating those systems.

7) **Supply Chain.** The economic interdependence of international trade means nearly every industry is vulnerable to unintentional and intentional disruptions and threats to their supply chains. A delay in receiving critical components could affect the Space Force's ability to deploy new assets or maintain current capabilities. Due to the global nature of many technology components, there is a persistent threat of some form of pre-installed malware, stolen digital certificates, malicious code, or other intrusive devices that could damage or compromise components of a space system. There is also a persistent threat to engineering and production of vital components throughout the supply chain in the form of technical and industrial espionage, as well as counterfeit production of technological materials.

8) **Physical Attack.** Physical attack on terrestrial nodes or links can include any destructive or disruptive type of non-nuclear attack, cutting communications lines, damaging or destroying equipment or facilities, or attacking personnel. ASAT weapons are capable of destroying or degrading spacecraft and their components through kinetic impact or similar means. More advanced ASAT weapons could employ proximity operations such as using robotic arms to seize or damage target spacecraft. Spacecraft with standoff capabilities could damage or destroy spacecraft from a distance.

Challenges in the Space Operational Environment

While space offers some unique capabilities to military operations such as freedom of overflight and the ability to maintain nearly persistent observational or communications coverage over a given location, it is not without challenges. The physics of operating in, from, and to space alone make space a unique operating environment. The expanse that requires surveillance, increasing orbital congestion, and emerging threats introduce further challenges.

a. **Capability Sustainment.** Today, there are only a few cases where spacecraft return to Earth in an operational status. A role of space access, mobility, and logistics (SAML) is

to help extend mission life and operational effectiveness of current and future spacecraft. The amount of remaining onboard expendables, consumables (e.g., fuel), and spacecraft reliability are factors which limit mission duration and the spacecraft's functional life. Spacecraft sustainment through telemetry, tracking, and commanding to maintain health and status and provide system updates, helps preserve capability and extend a mission's life expectancy. Whether for initial deployment, station-keeping, reconstituting a constellation on-orbit, maintenance, operational degradation or loss, or end-of-life action, careful design ensures there is adequate fuel to sustain maneuvering a satellite into and within orbits (re-phasing). However, maneuvers in response to a threat can significantly diminish the operational life of a spacecraft. Other natural environmental and human-made threats can also degrade or destroy spacecraft, diminishing United States space capabilities. Where possible, the Space Force maximizes the operational value of every spacecraft through residual operations, such as using a spacecraft that can no longer conduct its primary mission to support other operations, experiments, testing, or training. See SPD 4-0, *Sustainment*, for additional details.

b. **Observational Limitations.** A key challenge for space operations is continuous surveillance of the expanse of space. Attaining and maintaining SDA requires a multi-domain approach, with terrestrial space systems, on-orbit systems, and systems in the link segment. Terrestrial and on-orbit space object surveillance and identification (SOSI) sensors have inherent limitations in their fields of view, fields of regard, and object discrimination capabilities. Terrestrial and space weather can further limit their capabilities. These sensors act as a space surveillance network and are adequate for keeping track of satellites and important objects in orbit (catalog maintenance), but they do not enable persistent awareness. Terrestrial and space-based ISR is crucial for monitoring prioritization and providing indications and warning of new or developing space activities by other nations.

c. **Anomaly Attribution.** Accurate, timely intelligence in every segment is vital for accurate attribution of disruption to a space capability. Reliable intelligence of adversary capabilities and purpose is essential for tracing the origin of an action. For instance, effects from natural EMI sources can resemble hostile behavior, and vice versa. Understanding the threat environment helps with characterization, identifying sources of anomalies, and attributing adversary operations. Observation constraints can further complicate anomaly attribution.

d. **Continuous Global Operations.** The continuous state of space operations at locations across the globe creates unique challenges for execution and management of operations. There is no start or stop of space operations, merely the transition of applied effects to the

area of interest, both terrestrial and on-orbit. The Space Force trains and equips Guardians to seek solutions in the integration of people, process, and technology, in order to adapt to meet the adversary and defeat the enemy. Therefore, Guardians continuously plan and dynamically conduct operations, assessing the options to meet the JFC's objective in concert with other prioritized user needs.

e. **Data Integration and Exploitation.** Data integration and exploitation is the ability to fuse, correlate and integrate multi-source data to support the JFC and other decision makers with earlier predictions at higher confidence. Historically, the biggest challenge with SDA and space situational awareness (SSA) has been developing the ability to fuse available data from all sources into decision-quality information to facilitate more responsive courses of action for space and non-space forces.

Chapter 3: Space Force Operational Concept

Spacepower is the Space Force contribution to unified action as part of the joint force across the competition continuum in all domains. Spacepower recognizes the nature of modern warfare in all-domain operations and the need to simultaneously conduct a fluid mix of operations. Strategic success requires an integrated approach with the efforts of other armed services, Federal agencies and organizations, allies, partners, and commercial providers to achieve unified action.

Unified Action

Joint Publication 3-0, *Joint Campaigns and Operations*, describes unified action as "the synchronization, coordination, and/or integration of the activities of governmental and nongovernmental entities with military operations to achieve unity of effort." The Space Force, as characterized by the Chief of Space Operations (CSO) in figure 4, supports unified action through space security, space support to operations, and space combat power to shape the operational environment, prevent conflict, and, if necessary, prevail in conflict. The Space Force provides trained and ready forces to support the JFC with continuous, simultaneous trans-regional capabilities, enabling all-domain military operations.

a. **Shape the Operational Environment.** Space operations include activities to promote security and stability, preserve freedom of action, and deter adversary activities to the contrary. These operations prove essential to achieving space superiority and satisfying the space cornerstone responsibilities. Guardians communicate with other DoD and Intelligence Community organizations, while building relationships with allies, partners, commercial entities, and academia. Along with data sharing and collaboration, where appropriate and authorized, these relationships help build support for operations in all domains, increase overall security in the space domain, promote appropriate behavior in space, and deter adversaries.

b. **Prevent Conflict.** Space operations to prevent conflict in, from, and to space include all activities to deter undesirable actions by an adversary. These activities include persistent intelligence driven space operations to provide national leadership with independent military options in response to indications and warnings of adversary actions in all domains. Space operations enhance safety and security of joint operations and deterrence in all domains. Additionally, Guardians maintain communications with DoD, the Intelligence Community, allies, partners, commercial entities, and academia, reducing the potential for misunderstandings and maintaining support for actions to deter adversaries. As part of the joint force, Guardians focus on actions to deter dangerous or unlawful adversary behavior in all domains through a range of reversible and non-reversible

effects. Across the competition continuum, credible spacepower underpins the Nation's ability to manage adversary perceptions, shape the operational environment, and deter aggression. These same actions seek to promote global stability and security in all domains.

c. **Prevail in Conflict.** Should deterrence fail, the Space Force is prepared to enable lethality and effectiveness of the JFC by delivering space combat power to ensure the United States prevails in conflict. Guardians as part of the joint force will take actions to deter undesirable adversary behavior and deny, disrupt, damage, or destroy adversary space capabilities in all domains. Planners may also consider deceptive operations with appropriate authorities. Guardians will support the JFC to secure a position of advantage through all domains during conflict and set advantageous conditions for the post-conflict environment. Guardians constantly prepare for offensive and defensive operations as a ready force to employ them at the direction of the JFC.

Space Contribution to Unified Action

Guardians, along with the rest of the services and joint force, are postured to deter and, if required, defeat these potential threats today. Maintaining this relative advantage, however, will require the Space Force to outpace the accelerating threat trajectory by relentlessly pursuing innovative and decisive operational capabilities. This includes fielding resilient and defendable architectures, preparing Guardians to outcompete and overcome these threats, and partner with joint, coalition, commercial, and interagency partners to maximize our combat capability. Our collective ability to deter a conflict from the beginning or extending into space relies on our cooperation with allies and partners to develop best practices and standards of behavior for responsible space operations and then to holding violators accountable to the international community.

Senate Armed Services Committee
Advance Policy Questions for Lieutenant General Bradley C. Saltzman, US Space Force Nominee for Appointment to be Chief of Space Operations of the Space Force, 31 August 2022

Figure 4. General Saltzman testimony

Joint All-Domain Operations

Joint all-domain operations, as presented in Space Doctrine Publication 3-99, *The Department of the Air Force Role in Joint All-Domain Operations,* are central to unified action. Today the effectiveness of operations in any domain depends on mutual support from operations in other domains. An integrated multi-domain plan, which employs capabilities and leverages effects from all domains, mitigates threats and maximizes operational effectiveness for the JFC. Negative effects from an action in space, such as fuel depletion or the generation of debris, may necessitate actions in other domains to mitigate risks to space operations. Similarly, the most effective operation to deny, disrupt, damage, or destroy an adversary's space capability, and

preserve freedom of action in space, may originate from a domain other than space. Examples of other domain support to space operations include:

a. An air assault to disable a jammer affecting SATCOM

b. A naval vessel launching a cruise missile strike to prevent an adversary from launching an on-orbit reconstitution capability

c. A ground force overrunning a terrestrial relay station

d. Action in the EMS to disrupt adversary spacecraft C2

e. A cyberspace effect that reroutes network traffic to avoid a cut cable

Similarly, space operations support operations in the terrestrial and link segments, such as using space-enabled EMS effects to prevent an adversary's use of PNT for its guided munitions, while simultaneously protecting unimpeded PNT use by friendly forces and preserving peaceful use of PNT outside the AOR.

Space Operations across the Competition Continuum

Actions across the competition continuum reflect fundamental aspects of joint operations (figure 5) and space operations as part of joint operations (figure 6). Joint Publication 3-0, *Joint Campaign, and Operations*, describes the competition continuum as a world of enduring competition conducted through a mixture of cooperation, competition below armed conflict, and armed conflict or war. The continuum is not a linear concept but a representation of actions that may move between strategic aims and operations simultaneously. The United States can simultaneously be in a different stage of competition in different domains with the same adversary.

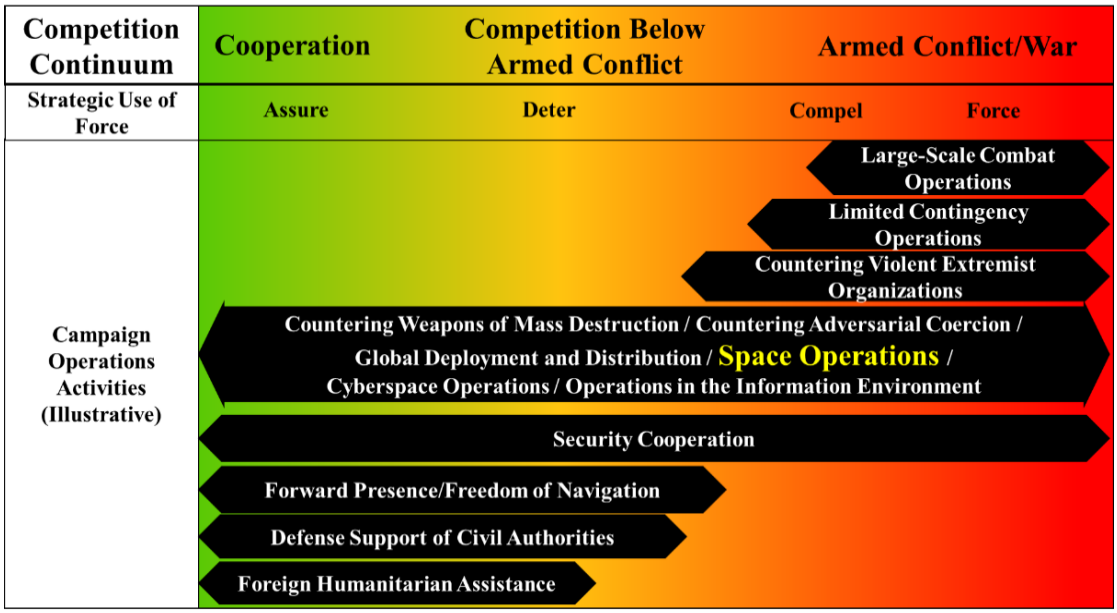


Figure 5. Competition continuum

Space operations occur throughout the competition continuum. The United States and its allies and partners are engaged in space operations that affect every type of campaign, operation, and activity characterized across the continuum, and in every domain.

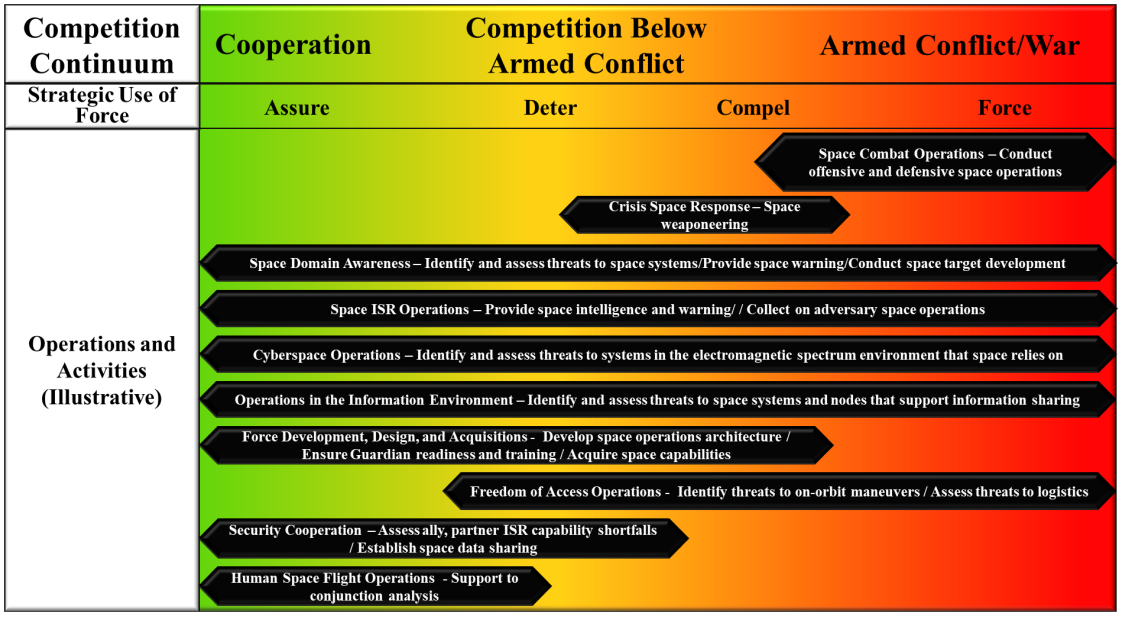


Figure 6. Space operations across the competition continuum

a. **Cooperation.** Actions in the cooperation element include all day-to-day space operations, in addition to space security cooperation, cyberspace protect and defend operations for space systems (in all segments), and support to human space flight operations. Cooperative space operations typically focus on assuring allies and partners and maturing partnerships. Examples include:

    1) Support for the International Space Station
    2) International data sharing agreements to promote safety of flight (such as the satellite catalog)
    3) Collaborating with allies, partners, industry, and academia to further space technology and logistics capabilities
    4) Space weather support to terrestrial operations including disaster recovery, and search and rescue
    5) Space-based data and imagery support to civil authorities
    6) PNT used worldwide in a wide range of national security, civil, and commercial applications
    7) Coalition participation in military space operations, wargames, and exercises
    8) Provide partner nations early missile warning data through the Shared Early Warning System

b. **Competition below the Level of Armed Conflict.** Operations in competition move from day-to-day operations to protecting United States interests and deterring potential adversaries. In the competition element, the Space Force continues to strengthen relationships with allies and partners consistent with national policy, while actively conducting SDA and intelligence operations to establish comprehensive understanding of adversaries' efforts to compete in the space domain. Space forces conduct operations to shape adversary perceptions and deter activities in a manner that best supports the JFC and national objectives. Actions in competition below the level of armed conflict element also include diplomatic responses to adversary action, such as the United States response

to Chinese and Russian ASAT tests (figure 7), each of which caused significant space debris affecting both military and civil space operations.

2007 Chinese ASAT

"The U.S. believes China's development and testing of such weapons is inconsistent with the spirit of cooperation that both countries aspire to in the civil space area," National Security Council spokesman Gordon Johndroe said yesterday. "We and other countries have expressed our concern regarding this action to the Chinese."

Washington Post, *China Criticized for Anti-Satellite Missile Test Destruction of an Aging Satellite Illustrates Vulnerability of U.S. Space Assets,* 19 January 2007 (https//www.space.commerce.gov/u-s-response-to-russian-anti-satellite-test/)

2021 Russian ASAT

Secretary of State Antony Blinken said, "The events of November 15, 2021, clearly demonstrate that Russia, despite its claims of opposing the weaponization of outer space, is willing to jeopardize the long-term sustainability of outer space and imperil the exploration and use of outer space by all nations through its reckless and irresponsible behavior."

U.S. Response to Russian Anti-Satellite Test, 15 November 2021, NOAA Office of Space Commerce (https://www.space.commerce.gov/u-s-response-to-russian-anti-satellite-test/)

Figure 7. United States responses to Chinese and Russian ASATs

c. **Armed Conflict/War.** Space operations in armed conflict include all the activities conducted in cooperation and competition as conditions permit. In addition, armed conflict includes reversible and non-reversible effects to protect and defend United States, allied and partner space capabilities (defensive space operations), and to deny adversaries freedom of action in, from, and through space (offensive space operations). In armed conflict/war the Space Force presents forces as part of a joint force conducting operations in all domains. Military spacepower can provide the JFC simultaneous and rapid attack on key nodes and forces, producing effects that can overwhelm the enemy's capacity to adapt or recover.

Assessing Risk

The Space Force uses the joint definition of risk, "the probability and consequences of an event causing harm to something valued." Guardians supporting unified actions continually assess adversary actions across the competition continuum and take further steps to evaluate and mitigate risks associated with space operations. Guardians continuously assess the probability and consequences of loss or damage to assets, or the loss or injury of personnel, in terms of risk to force, risk to mission, and risk of escalation. The JFC provides further direction when risk to mission outweighs risk to force or risk of escalation.

a. **Risk to Force.** Risk to force is a function of the probability and consequence of not maintaining the appropriate force generation balance ("breaking the force"). It reflects a force provider's ability to generate ready forces within capacities to meet current mission

requirements. In assessing risk to force, physical protection in basing and deployment decisions for personnel and equipment should be part of Guardian planning and assessment (see SDP 5-0, *Planning*, for additional details on the planning process). From a risk to asset perspective, Guardians should understand the operational environment including natural and human-made threats. For day-to-day operations, the potential effects of natural and unintentional human-made threats are persistent. These are just as damaging to assets, regardless of segment, as intentional acts by an adversary.

b. **Risk to Mission.** Chairman of the Joint Chiefs of Staff Manual 3105.01A, *Joint Risk Analysis Methodology*, defines risk to mission as "a function of the probability and consequence of failure to achieve mission objectives while protecting the force from unacceptable losses." Risk management requires commanders to recognize and balance these competing priorities. For instance, a threatened spacecraft may be able to evade an ASAT in the moment but performing defensive maneuvers may impair the spacecraft's capacity to carry out its mission. Guardians evaluate the likelihood and repercussions of each response, considering the commander's intent and acceptable level of risk in order to achieve military objectives with acceptable human, material, and financial costs.

c. **Risk of Escalation**. Due to the strategic nature of some space operations and their role in nuclear deterrence, interference with some space systems may pose unique escalation risks to the mission. For example, a nation could interpret an attack against an ISR, missile warning, or nuclear command, control, and communications spacecraft as a prelude to a terrestrial nuclear strike. Under certain conditions, even a seemingly innocuous move or change in the status of a spacecraft could unintentionally trigger response actions and escalate tensions. Guardians advise and assist the JFC in assessing the feasibility of plans in conjunction with operational concerns, including the potential for escalation as part of risk to mission.

Chapter 4: Space Force Operations

The Space Force is one of two military services under the Department of the Air Force, overseen by the Secretary of the Air Force and led by the CSO. The CSO is responsible for organizing, training, equipping, and presenting space forces to JFCs to conduct operations in support of the joint and multinational objectives. Guardians operating in geographically separated locations enable joint lethality for the JFC. Collectively, the Space Force, other United States Armed Services, and allies synchronize operations to achieve converged effects in support of named operations and contingencies throughout the competition continuum.

The Space Staff, three field commands (FLDCOMs) (Space Operations Command [SpOC], Space Systems Command [SSC], Space Training and Readiness Command [STARCOM]), and two direct reporting units (Space Development Agency [SDA] and Space Rapid Capabilities Office [SpRCO]) support the Office of the Chief of Space Operations (OCSO) (figure 8). Additionally, the Space Warfighting Analysis Center (SWAC) is a primary subordinate unit to SpOC with direct liaison authority with the CSO and OCSO. Refer to SDP 1-0, *Personnel*, for additional details about Space Force organizations and force development.

Figure 8. Space Force structure

Space Force Operations

The Space Force is a lean, agile, operations-focused military branch enabled by a set of critical capabilities provided by Space Force acquisition managers and developmental engineers (including sustainers). Units operating in geographic locations around the globe are at the heart of space operations. Guardians in those units include space operators, intelligence analysts, cyberspace operators, and engineers. Those Guardians are the forces presented to support the JFC. The Space Force leverages support from the USAF for personnel, facilities, infrastructure to support Guardians and space operations. SDP 1-0, *Personnel*, provides specific details on Space Force career specialties, force development, and USAF support to the Space Force.

Space operations help preserve freedom of action, enable joint lethality and effectiveness, and provide independent options in all domains for the United States and its allies. The complexities of the space operational environment and the required integration and coordination with elements of the joint force impact the degree to which space capabilities underpin the joint functions (C2, intelligence, fires, movement and maneuver, protection, sustainment, and information). A shared understanding of space operations and their relationships to the joint functions (described in appendix g) is essential to fostering and enhancing unified actions. Each of the operational areas below represents capabilities aligned to the joint functions (highlighted below) that the Space Force organizes, trains, equips, and provides Guardians to conduct as part of the joint force.

a. **Space Domain Awareness (SDA).** SDA is the timely, relevant, and actionable understanding of the operational environment that allows military forces to plan, integrate, execute, and assess space operations. SDA includes knowledge of potential adversary systems or activities, and insight into an adversary's intent or likely response to an event. SDA contributes to ensuring the security, safety, and economy of the United States, its allies, and partners. SDA leverages the unique subset of ISR, environmental monitoring, and data sharing arrangements that provide operators and decision makers with a timely depiction of all factors (including policy and strategy) and actors (friendly, adversary, and third party) affecting, or potentially affecting, space operations. Surveillance of spacecraft, debris, and natural objects using varied space and ground-based sensors generates SSA data, informing operations of military space forces executing all joint functions. Awareness data from the terrestrial and link segments, that identifies friendly, adversary, and third-party actions that could affect any aspect of space operations, contribute to the complete picture for SDA (figure 9).

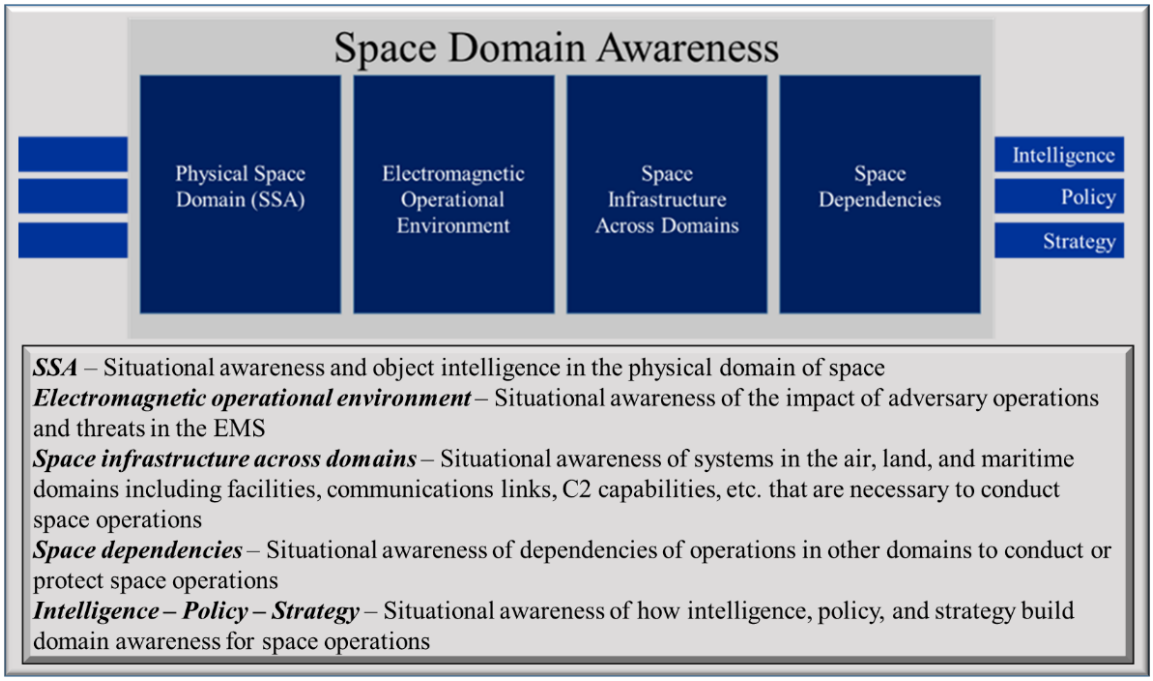


Figure 9. Space domain awareness

b. **Combat Power Projection.** The projection of combat power, as space combat power, includes offensive and defensive military force (***fires and protection***) in, from, or to the space domain (including navigation warfare). Offensive space operations attack the adversary in, from, or to space. These operations seek to impose cost on the adversary, compel a change in behavior, secure a position of advantage, or deny the adversary's military forces freedom of action. Defensive space operations seek to repel or defeat adversary attacks in, from, or to the space domain. These operations aim to maintain status quo, regain the initiative, deny the adversary a position of advantage, or protect freedom of action of friendly forces. The distinction between offensive and defensive operations is not always clear. All major combat operations include elements of offense and defense. For example, achieving operational-level defensive objectives may require limited offensive action at the tactical level to engage threats early in a conflict. Offensive operations in one domain may defend friendly military forces from attack in another domain. In planning, Guardians consider offensive and defensive ***fires*** in terms of which side is attempting to retain or exploit the initiative (offense) and which side is responding to the adversary's initiative (defense). All combat operations should include elements of offense and defense unified into coherent action to achieve desired effects.

c. **Positioning, Navigation, and Timing (PNT).** Space-based PNT is a global, multi-use service that is essential to executing the joint functions of ***C2, movement and maneuver,***

and fires in a military campaign, and crucial in its support to United States and allied diplomatic, informational, military, and economic objectives. PNT systems, in combination with user equipment, provide the joint force with precise four-dimensional positioning capability, navigation options, and a highly accurate time reference. Precision timing provides the joint force the capability to synchronize operations and enables communications capabilities such as frequency hopping and cryptologic synchronization, which improve communications security and effectiveness. Civil and commercial applications also widely use space-based PNT.

d. **Satellite Communications (SATCOM).** SATCOM includes the operation of spacecraft constellations that support beyond-line-of-sight communication links critical to establishing C2 and reach back for the worldwide-deployed joint force (***information***). Confidence in the availability of global SATCOM is critical to the posture of modern United States and allied forces.

e. **Intelligence, Surveillance, and Reconnaissance (ISR).** ISR is an integrated operations and intelligence activity that synchronizes and integrates the planning and operation of sensors and assets, and the processing, exploitation, and dissemination systems in direct support of current and future operations. Space-based ISR contributes data through multiple intelligence disciplines, providing ***intelligence and information*** about adversary military force capability, composition, disposition, and intent that is relevant to the planning, decision making, and operations in every domain.

f. **Environmental Monitoring.** Environmental monitoring includes sensing, characterizing, and exploiting the natural environment (***intelligence and information***). Terrestrial environmental monitoring provides information and support to joint forces throughout the world with meteorological and oceanographic information affecting all domains. Terrestrial environmental monitoring uses information from DoD and non-DoD spacecraft including National Oceanic and Atmospheric Administration spacecraft. Space environmental monitoring uses terrestrial and space-based sensors to detect natural environmental threats in space. Detection of space environmental events and impacts is critical to protecting spacecraft and operations for the United States and its allies.

g. **Missile Warning.** Missile warning includes terrestrial and space-based sensors providing time-critical event processing and releasing data for decision-maker notification throughout the world (***intelligence, information, and protection***). Strategic and theater systems provide joint forces the necessary means to detect, track, and mitigate missile threats throughout their AOR. Missile warning is essential in defending the United States, its allies, partners, and their forces throughout the world. The Integrated Tactical Warning and Attack Assessment network is a strategic missile warning system of

systems. It provides unambiguous, timely, accurate, and continuous missile warning and event characterization information to the United States leadership, combatant commanders, North American Aerospace Defense Command, and other users for assessment of attacks against North America and assets in space through all levels of conflict or national disaster.

h. **NUDET Detection.** Space-based NUDET detection systems provide a worldwide, highly survivable capability to detect, locate, and report nuclear detonations in the Earth's atmosphere, near space, or deep space in near-real time (***intelligence and information***). NUDET detection operations–informed by interagency partners including the Department of Energy and educational institutions–support national diplomatic, informational, military, and economic objectives.

i. **Electromagnetic Warfare**. Electromagnetic warfare are military actions involving the use of electromagnetic and directed energy to control the EMS or to attack the adversary (***fires and protection***). Electromagnetic warfare consists of three distinct divisions: electromagnetic attack, electromagnetic support, and electromagnetic protection (Joint Publication 3-85, *Joint Electromagnetic Spectrum Operations)*. The remoteness of spacecraft relative to their terrestrial control centers necessitates operations in the EMS. Space Force EMS operations can create space combat power (***fires***) while ensuring spectrum availability (***protection***) for critical spacecraft communications.

j. **Cyberspace Operations.** Due to the distributed nature of space operations, all space operations are simultaneously cyber operations and EMS operations. Space Force cyber operations project combat power through the cyberspace domain, creating offensive or defensive space operations effects (***fires and protection***). Cyberspace operations also include operational actions taken to secure, configure, operate, extend, maintain, and sustain space system's integrity, creating and preserving the confidentiality, availability, and integrity of the space system data.

k. **Spacecraft Operations.** Spacecraft operations include the ***C2***, health and safety monitoring, system updates (***sustainment***), and ***movement and maneuver*** of every spacecraft on-orbit. Due to the remote nature of spacecraft, operators simultaneously manage the systems in space, in cyberspace, and in the EMS. Guardians conducting spacecraft operations as part of the joint force, balance spacecraft safety and security (risk to force) with mission accomplishment (risk to mission). Current conditions in the space operational environment, including threats to operations, inform decisions regarding spacecraft operations. These include ***maneuvers*** and other actions to maintain health, safety, readiness, and the lifespan of the spacecraft (***sustainment***).

l. **Space Mobility and Logistics.** Space mobility and logistics, also referred to as SAML, supports joint space operations ***sustainment*** through spacelift, satellite operations, force reconstitution, maintenance of a force of space operations personnel, and support to human space flight. Access includes space launch services or capabilities, launch vehicle multi-mission manifesting, launch facilities, spaceport infrastructure, launch C2, and spacecraft processing facilities. The United States employs DoD, allied, partner, commercial, academic, and civil capabilities consistent with treaties, law, and policy, in support of space access. Mobility (***movement and maneuver***) includes post-launch transport of space vehicles between orbits, within orbits, and augmented maneuvering to enhance mission effectiveness or maneuvering related to reconstitution, operational degradation or loss, and end-of-life actions. In the future, logistics on-orbit may include spacecraft servicing, disposition, debris management capabilities, refueling, and in-space component installation.

m. **Command and Control (C2).** Joint Publication 3-0, *Joint Campaigns and Operations*, describes ***C2*** as "the exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission." The ***C2*** of space forces reflects the distinctive character of space operations and the unique attributes of the space domain's physical dimension. In order to meet the intent of mission command, the ***C2*** of military space forces must overcome the global and remote nature of space operations in a way that systematically provides tactical forces with the SDA (***intelligence***) required to recognize, coordinate, and exploit fleeting battlespace opportunities and prevent decision paralysis. To ensure an agile and lean force, C2 of space operations requires the proper authorities in place for operators to respond to adversary actions. Clearly defined rules of engagement, pre-determined plans, and pre-established priorities can mitigate systems degradation. It is essential that the Space Force philosophy of ***C2*** supports the way the JFC intends to fight. Mission command drives decentralization to ensure Guardians can respond to tempo, uncertainty, disorder, and fluidity as space operations move from cooperation to competition below armed conflict and ultimately to armed conflict/war. Individual initiative and responsibility are of paramount importance. However, due to the strategic nature and the potential implications of some space operations, mission command and ***C2*** of space operations may retain more senior leader oversight.

Presentation of Forces

The Space Force prepares and presents forces to every combatant commander. The Space Force component field command (C-FLDCOM) is the organizational structure through which Guardians integrate into the joint force and support combatant commanders. The C-FLDCOMs

are of the same echelon as the three FLDCOMs (SpOC, SSC, and STARCOM). While the FLDCOMs each conduct a unique subset of the Space Force mission, the C-FLDCOMs as units each have the same mission—to serve as the Space Force component command headquarters assigned to a combatant command, integrating space operations at the component level within the combatant command and conducting military operations under the authority of the combatant commander. The Space Force component commanders carry out C2 through designated operations centers to integrate space capabilities into joint all-domain operations.

The C-FLDCOMs exercise operational control, as delegated by the combatant commander, of assigned and attached Space Force forces. The C-FLDCOMs will, as directed, execute missions and assigned tasks, recommend effective employment, C2 assigned and attached forces, synchronize space effects with the other components of the combatant command, and coordinate with USSPACECOM components as required. Each C-FLDCOM commander (Commander of Space Force Forces, or COMSPACEFOR), under the authorities of the Secretary of the Air Force, exercises administrative control over assigned and attached Space Force forces, to include responsibility for administrative sourcing, oversight, development, and discipline of Space Force forces and members within the command.

Space Deltas provide crews who enable capability in missions including ISR, SDA, electromagnetic warfare, missile warning, SATCOM, PNT, NAVWAR, orbital warfare, cyberspace, and mission planning. They coordinate space requirements with other combatant commands through their C-FLDCOM and liaise with other agencies, allies, and partners.

The products and processes of the designated C2 operations centers allow each combatant commander and their C-FLDCOM the flexibility to adjust people, processes, and technology based on the assigned AOR and mission tasks. Four major organizational divisions supporting operations include:

a. **Strategy and Plans Division**. The strategy and plans division is responsible for crisis action planning, deliberate planning, orders management and tasking coordination.

b. **Combat Operations Division.** A combat operations division ensures combat relevant synchronization of forces to achieve desired effects. This includes:

    1) Real-time monitoring of the space domain (including status of space forces, threats to space operations, and changes to the space operating environment)

    2) Assessing the impact of changes in the space situation or space capabilities

    3) Developing credible courses of action for the re-planning and/or redirection of space force employment as appropriate, space control C2 fires coordination

4) Ensuring the execution of the current tasking for space forces is consistent with the commander's intent and national caveats

c. **ISR Division.** The ISR division provides the commander with timely, predictive, and actionable intelligence to support all aspects of the space tasking cycle.

d. **SATCOM Integrated Operations Division.** A SATCOM integrated operations division improves collective SATCOM efficiency, agility, resiliency, and situational awareness. This is necessary to "fight SATCOM" as an enterprise through benign and contested, degraded, and operationally limited environments.

Appendix A: Acronyms, Abbreviations, and Initialisms

AFDP	Air Force Doctrine Publication
AOR	area of responsibility
ASAT	anti-satellite
C2	command and control
C-FLDCOM	component field command
CSO	Chief of Space Operations
DoD	Department of Defense
DoDD	Department of Defense Directive
EMI	electromagnetic interference
EMP	electromagnetic pulse
EMS	electromagnetic spectrum
FLDCOM	field command
GEO	geosynchronous Earth orbit
GPS	Global Positioning System
HEO	highly elliptical orbit
ISR	intelligence, surveillance, and reconnaissance
JFC	joint force commander
LEO	low Earth orbit
MEO	medium Earth orbit
NUDET	nuclear detonation
OCSO	Office of the Chief of Space Operations
PNT	positioning, navigation, and timing

SAML	space access, mobility, and logistics
SATCOM	satellite communications
SSC	Space Systems Command
SDA	Space Development Agency
SDA	space domain awareness
SDP	Space Doctrine Publication
SpOC	Space Operations Command
SpRCO	Space Rapid Capabilities Office
SSA	space situational awareness
STARCOM	Space Training and Readiness Command
SWAC	Space Warfighting Analysis Center
U.S.	United States
USAF	United States Air Force
USSF	United States Space Force

Appendix B: Glossary

Adversary. A party acknowledged as potentially hostile to a friendly party and against which the use of force may be envisaged. (Joint Publication 3-0, *Joint Campaigns and Operations*)

Battle management. The management of activities within the operational environment based on the commands, direction, and guidance given by appropriate authority. (Joint Publication 3-01, *Countering Air and Missile Threats*)

Electromagnetic pulse. A strong burst of electromagnetic radiation caused by a nuclear explosion, energy weapon, or by natural phenomenon, that may couple with electrical or electronic systems to produce damaging current and voltage surges. (Joint Publication 3-85, *Joint Electromagnetic Spectrum Operations*)

Electromagnetic spectrum operations. Coordinated military actions to exploit, attack, protect, and manage the electromagnetic environment. (Joint Publication 3-85, *Joint Electromagnetic Spectrum Operations*)

Electromagnetic warfare. Military action involving the use of electromagnetic and directed energy to control the electromagnetic spectrum or to attack the enemy. (Joint Publication 3-85, *Joint Electromagnetic Spectrum Operations*)

Intelligence community. All departments or agencies of a government concerned with intelligence activity, in either an oversight, managerial, support, or participatory role. (Joint Publication 2-0, *Joint Intelligence*)

Joint functions. A grouping of capabilities and activities that enable joint force commanders to synchronize, integrate, and direct joint operations. (Joint Publication 3-0, *Joint Campaigns and Operations*)

Key orbital trajectory. Any orbit from which a spacecraft can support users, collect information, defend other assets, or engage the adversary. (Space Capstone Publication, *Spacepower*)

Link Segment. For this publication the link segment includes the information operations environment (which includes cyberspace) and the electromagnetic spectrum operations environment.

Mission command. The conduct of military operations through de-centralized execution based upon mission-type orders. (Joint Publication 3-31, *Joint Land Operations*)

Nonreversible effects. Include permanently damaging or destroying sensors or other satellite components, which causes the operators to lose data and time and face the burdens of

replacement or reliance on lesser assets. (Defense Intelligence Agency, 2022 *Challenges to Space Security*)

Orbital Segment. For this publication the orbital segment includes everything within the space domain.

Reversible effects. Nondestructive and temporary, and the system is able to resume normal operations after the incident. (Defense Intelligence Agency, 2022 *Challenges to Space Security*)

Space domain. The area above the altitude where atmospheric effects on airborne objects become negligible. (Space Capstone Publication*, Spacepower*)

Space domain awareness. The timely, relevant, and actionable understanding of the operational environment that allows military forces to plan, integrate, execute, and assess space operations. (*U.S. Space Force Vision for Space Domain Awareness*)

Space situational awareness. The requisite foundational, current, and predictive knowledge, and characterization of space objects within the space domain. (Joint Publication 3-14, *Space Operations*)

S**pace superiority.** A relative degree of control in space of one force over another that would permit the conduct of its operations without prohibitive interference from the adversary while simultaneously denying their opponent freedom of action in the domain at a given time. (Space Capstone Publication*, Spacepower*)

Terrestrial Segment. For this publication the terrestrial segment includes land, air, or maritime domains. Terrestrial systems are those systems operating in the land, air, or maritime domain.

Appendix C: Space Operations Outside the Geocentric Regime

Future space operations may expand beyond the geocentric regime into the cislunar regime. The cislunar regime consists of the combined Earth-Moon two-body gravitational system, with translunar space in-between, the Lagrange points and Halo orbits, and lunar orbits (selenocentric orbit). Descriptions below provide additional details about aspects of the cislunar regime.

Cislunar Space. Translunar space is the transitory operating area between and surrounding the Earth-Moon system, dominated by the two bodies' gravity fields. Circular orbits beyond 2 times GEO cannot be maintained due to the interplay of the Earth and the Moon's gravitational influence. This portion of cislunar space consists mostly of natural phenomena and systems transiting between the Earth, Moon, and their Lagrange points. In the frame of the lunar operations, space missions make trade-offs on expediency and efficiency that require maximization of payload mass, and simultaneously achieving reasonable transfer times.

Lagrange Points and Halo Orbits. Joseph Louis Lagrange (1736-1813) showed that a body of negligible mass could orbit along with a more massive body that is already in a near-circular orbit. With a minimum use of thrusters for station keeping, a spacecraft can orbit an unstable Lagrange point. Such an orbit is a halo orbit because it appears as an ellipse floating over the planet. Consider a system with the two massive bodies being the Moon-orbiting the Earth. The third body, such as a spacecraft, might occupy any of five Earth-Moon Lagrange points. Earth-Moon Lagrange points are locations for persistent presence within the Earth-Moon system. Earth-Moon Lagrange Point 1 is the natural gateway between both celestial bodies.

Moon. The Moon is Earth's only natural satellite, orbiting at an average distance of roughly 385,000 kilometers. It takes the Moon 27.3 days to orbit the Earth.

> **Lunar Orbit.** Lunar orbit (also known as a selenocentric orbit) is the orbit of an object around the Moon. As used in the space program, this refers not to the orbit of the Moon about the Earth, but to orbits by various crewed or uncrewed spacecraft around the Moon. Low lunar orbits are those orbits below 100 kilometers altitude. They have a period of about 2 hours. They are of particular interest in exploration of the Moon but suffer from gravitational perturbation effects that make most unstable and leave only a few orbital inclinations possible for indefinite frozen orbits, useful for long-term stays in orbit. Gravitational anomalies slightly distorting the orbits of some Apollo Lunar Orbiters led to the discovery of Frozen Orbits occurring at four orbital inclinations: 27°, 50°, 76°, and 86°, in which a spacecraft can stay in a low orbit indefinitely.

Appendix D: Natural Environmental Threats

A common misconception is that space exists as an empty vacuum. Such a depiction neglects the dynamic and hostile environment of space. For example, Earth's atmosphere extends well above the lower threshold for sustained orbital flight, expanding and contracting based on changes in solar activity. In this volume of space, atmospheric drag significantly affects orbital flight. A barrage of radiation and charged particles known as the solar wind bombard spacecraft operating beyond the protection of Earth's magnetosphere. Solar wind particles consist of energetic protons and electrons that are capable of severely damaging a spacecraft's physical and electrical components. While the solar wind pervades much of the domain, the Earth's magnetosphere traps and funnels them into the polar regions of the Earth. Some particles may become trapped in regions known as the Van Allen Radiation Belts. Spacecraft transitioning these regions encounter significant levels of charged particles and other high-energy radiation. Below are brief descriptions of the major spheres associated with the space environment.

Heliosphere. The Sun itself has a strong magnetic field that extends from below the solar surface all the way out to the farthest reaches of our solar system. The heliosphere is the region surrounding the Sun (to include the Earth) that includes the solar magnetic field and charged particles that comprise the solar wind. On an 11-year cycle, the Sun's magnetic field becomes active leading to semi-predictable periods of solar max and solar minimum. During solar maximum, large solar storms due to coronal mass ejections occur causing geomagnetic storms affecting the power grid, pushing spacecraft in LEO out of their orbits and disrupting communications. During solar minimum, higher solar wind velocities around strong magnetic fields lead to shock regions in the solar wind that can bring disruption to the Earth's magnetic field and inject damaging particles into operating environments for some spacecraft.

Thermosphere. The thermosphere is the portion of Earth's atmosphere between about 85 and 700 kilometers. While a considerably less dense portion of the atmosphere, the thermosphere still has components of oxygen and nitrogen that can rapidly change in density due to solar outbursts and fluctuations in the Earth's magnetic field (known as geomagnetic storms). When this happens, atmospheric drag on spacecraft increases considerably, with the greatest effects occurring between 150 and 300 kilometers. Additionally, atmospheric expansion can increase the population of corrosive atomic oxygen that can combine with some spacecraft surfaces and greatly degrade longevity of critical components.

Ionosphere. The ionosphere is a region of charged particles around the Earth that extends from approximately 50 to 1000 kilometers. Almost all beyond-line-of-sight communications pass through the ionosphere including SATCOM and refracted high-frequency

communications that enable over-the-horizon technologies. All electromagnetic signals passing through the ionosphere will experience some form of refraction. Significant disruptions to the ionosphere from solar radiation and changes to the Earth's geomagnetic field result in ionospheric turbulence (scintillation) that causes rapid changes in signal amplitudes and frequencies. Scintillation in the ionosphere can generate signal attenuation to the point that ultra-high frequency SATCOM signals experience too much degradation to be useful. As documented by the Space Weather Prediction Center at the National Oceanic and Atmospheric Administration, periods of increased scintillation can significantly degrade GPS position accuracy. GPS radio signals travel from the spacecraft to the receiver on the ground, passing through the Earth's ionosphere. The charged plasma of the ionosphere bends the path of the GPS radio signal like the way a lens bends the path of light. In the absence of space weather, GPS systems compensate for the average, or quiet ionosphere, using a model to calculate its effect on the accuracy of the positioning information. When a space weather event disturbs the atmosphere, the models are no longer accurate, and the receivers are unable to calculate an accurate position based on the spacecraft overhead.

Magnetosphere. The magnetic field surrounding the Earth creates a bubble around the Earth known as the magnetosphere. The Sun's magnetic field (in the form of the solar wind) compresses this bubble on the sunward side of the Earth to about 65,000 kilometers and extends out to several million kilometers in the magnetotail on the anti-sunward side. The magnetosphere typically shields the commonly used orbits from direct impacts from the solar wind. However, during periods of increased solar activity, the magnetosphere can compress further on the sunward side, exposing spacecraft in GEO to charged protons and electrons from the Sun. Additionally, strong coronal mass ejections can result in large-scale disruption to the magnetosphere known as geomagnetic storming. Strong storming causes damaging energetic particles to stream into polar regimes and increases the population of electrons at MEO and GEO orbits producing increased spacecraft internal charging which can damage onboard electronics.

Radiation Environment. While not a distinct sphere within the space operational environment, the radiation environment in all spheres poses a significant threat to spacecraft. Radiation can affect a variety of spacecraft components to include causing internal subsystem errors, decreasing solar array output, and degradation of component materials. Most solar radiation encountered by spacecraft occurs in the Van Allen Radiation Belts, which are belts of trapped particles that extend from approximately 1,000 to 60,000 kilometers above the Earth's surface. Over the South Atlantic, a portion of the inner belt (known as the South Atlantic Anomaly) can extend down to approximately 200 kilometers, which results in a rapid change in the radiation environment experienced by spacecraft moving through this region. The outer Van Allen Belt beginning at approximately 13,000 kilometers is primarily composed of trapped electrons, which are responsible for spacecraft internal charging.

Appendix E: Applicable Treaties, Laws, Agreements, and Policies

Guardians conduct all United States space activities in accordance with international and United States domestic law. The Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies (Outer Space Treaty) imposes restrictions on certain military operations in outer space. Additionally, the Outer Space Treaty provides for State responsibility for the activities of nongovernmental entities in outer space. In addition to the Outer Space Treaty, there are several additional treaties and United States domestic laws that address the conduct of military space operations.

The USAF supports the Space Force with the provision of legal support activities as appropriate. Many decisions and actions in the space domain can have serious legal implications. The staff judge advocate provides full spectrum legal support during the planning and execution of all space activities.

While international law is generally permissive with respect to State actions, United States laws, policies and regulations may be more restrictive and impose additional restraints or constraints on space operations. In addition to legal requirements, Guardians factor these policy and regulatory requirements into their activities.

Title 10, U.S. Code. Lays out the organization and general military powers of the Department of Defense, the military services, and the reserve components. It also contains laws specific to DoD personnel, training and education, service, supply, property, and acquisition. Among other things, Title 10 establishes the United States Space Force as an armed force within the Department of the Air Force and provides that the Space Force shall be organized, trained, and equipped to provide freedom of operation for the United States in, from, and to space; conduct space operations; and protect the interests of the United States in space. Additionally, it establishes the position and outlines the duties of the CSO and establishes the composition, functions, and general duties of the Office of the CSO. With respect to military operations, Title 10 provides for the establishment, administration, and support of Combatant Commands, the assignment of forces to Combatant Commands, and the powers and duties of Commanders of Combatant Commands.

Title 32, U.S. Code. Provides for the organization, personnel, training, service, supply, and procurement for the Army and Air National Guard, including Air National Guard units conducting space-related missions.

Title 50, U.S. Code. Provides discrete provisions of law related to war and national defense, including laws related to the National Security Council, foreign intelligence surveillance, insurrections, national emergencies, weapons of mass destruction, and the Intelligence

Community. Among other things, Title 50 lays out the responsibilities and authorities of the Director of National Intelligence and the responsibilities of Secretary of Defense pertaining to the National Intelligence Program. It also requires the Secretary of Defense to ensure that the elements of the Intelligence Community within the Department of Defense are responsive and timely with respect to satisfying the needs of operational military forces.

1945 Charter of the United Nations. Establishes the United Nations framework, requires states to refrain in their international relations from the threat or use of force against the territorial integrity or political independence of any state, and recognizes the inherent right of individual or collective self-defense in the event of an armed attack.

North Atlantic Treaty, 4 April 1949. Establishes the North Atlantic Treaty Organization and commits each member state to consider an armed attack against one or more member state, in Europe or North America, to be an armed attack against them all.

1963 Limited Test Ban Treaty. Prohibits nuclear weapons tests "or any other nuclear explosion" in the atmosphere, in outer space, and under water. While not banning tests underground, the Treaty does prohibit nuclear explosions in this environment if they cause "radioactive debris to be present outside the territorial limits of the State under whose jurisdiction or control" the explosions were conducted.

1967 Outer Space Treaty. Establishes the proposition that all space activities must be conducted in accordance with international law; recognizes that outer space, including celestial bodies, is free for exploration by all states and is not subject to national appropriation; recognizes that states retain jurisdiction and control over their space objects, and that the ownership of space objects is not affected by their presence in outer space or on celestial bodies; prohibits states from stationing weapons of mass destruction in outer space in any manner, including on celestial bodies and in earth orbit; prohibits states from establishing military bases, installations, and fortifications, or conducting military maneuvers on celestial bodies, but permits the use of military personnel, equipment, and facilities for scientific research or other peaceful purposes; requires states to conduct their space activities with due regard to the interests of other States and avoid harmful contamination of outer space and celestial bodies; requires states to avoid space activities that cause adverse changes in the earth environment from the introduction of extraterrestrial matter; and requires states to undertake consultations with other states if there is reason to believe their actions would cause harmful interference with another State's space activities.

1968 Rescue and Return Agreement. Provides that states shall take all possible steps to rescue and assist astronauts in distress in their territory, and that the states shall, upon request, provide assistance to launching states in recovering space objects that return to Earth and are discovered in territory under their jurisdiction.

1972 Liability Convention. Provides that a launching State is absolutely liable, regardless of fault, to pay compensation for certain damages caused by its space objects on the surface of the Earth or to aircraft in flight, and liable for certain damages to space objects or persons on board space objects due to its faults in space. The Convention also provides for procedures for the settlement of claims for damages.

1976 Registration Convention. Requires launching states to establish a registry of objects launched into outer space and to furnish to the Secretary General of the United Nations the appropriate designator of the space object, date and location of the launch, basic orbital parameters of the space object, and the general function of the space object.

1977 Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques. Prohibits states from engaging in military or any other hostile use of environmental modification techniques having widespread, long-lasting, or severe effects as the means of destruction, damage, or injury to other state parties. Such techniques refer to any technique for changing, through the deliberate manipulation of natural processes, the dynamics, composition, or structure of the earth, including its biota, lithosphere, hydrosphere, and atmosphere, or of outer space.

2011 New Strategic Arms Reduction Treaty. Bilateral arms control treaty between the United States and the Russian Federation that commits to limits on the parties' numbers of deployed strategic nuclear warheads, deployed delivery systems, and launchers, and provides inspection and verification mechanisms. The United States and Russian Federation agreed to extend the treaty through February 4, 2026.

2019 International Telecommunication Union Constitution. Forbids harmful interference while generally acknowledging military freedom of action.

2020 International Telecommunication Union Radio Regulations. Governs international allocation of EMS bands and GEO orbital slots.

Law of War (treaty and customary). The law of war is that part of international law that regulates the resort to armed force; the conduct of hostilities and the protection of war victims in both international and non-international armed conflict; belligerent occupation; and the relationships between belligerent, neutral, and non-belligerent States. Law of war comprises all applicable treaties and customary international law.

Executive Order 12333, United States Intelligence Activities, as amended 30 July 2008. Establishes the goals, directions, duties, and responsibilities with respect to United States intelligence efforts, including the responsibility and collection authority of the Intelligence Community Elements and the Secretary of Defense, and establishes procedures for the conduct of intelligence activities.

2001 Orbital Debris Mitigation Standard Practices and the November 2019 Update. Limits the generation of new, long-lived debris and mitigates existing debris by establishing United States government guidelines for controlling debris released during normal operations, minimizing debris generated by accidental explosions, selecting safe flight profile and operational configuration to minimize accidental collisions, and executing post-mission disposal of space structures.

2013 National Space Transportation Policy. Establishes policy to ensure the United States has access to diverse regions of space, from suborbital to Earth's orbit and deep space, in support of civil and national security missions.

Space Policy Directive-2, Streamlining Regulations on Commercial Use of Space, 24 May 2018. Presidential memorandum directing new policy regarding commercial space regulations, streamlining of launch and remote sensing regulations, consolidating the responsibilities for the Department of Commerce with respect to its regulation of commercial space activities, and directing reviews of radiofrequency and export control policy.

Space Policy Directive-3, National Space Traffic Management Policy, 19 June 2019. Establishes the policy and goal of shifting responsibility from DoD to Department of Commerce for providing publicly releasable SSA data.

Space Policy Directive-4, Establish the United States Space Force, 19 February 2019. Calls on the Secretary of Defense to submit a legislative proposal to create a sixth branch of the United States Armed Forces to organize, train and equip military space forces to ensure unfettered access to, and freedom to operate in space and to provide vital capabilities to joint and coalition forces in peacetime and across the spectrum of conflict.

2020 National Space Policy. Emphasizes the importance of assuring United States access to space, promoting a robust commercial space industry, returning Americans to the Moon, and preparing for Mars, leading exploration, and defending United States and allied interests in space.

2020 DoDD 2311.01, DoD Law of War Program. DoD program implemented to prevent law of war violations by military and civilian employees, which includes specialized training, legal advisors, guidance, reporting requirements and accountability actions. Requires DoD members to comply with the law of war during all armed conflicts, however characterized; in all other military operations, requires members of the DoD Components will continue to act consistent with the law of war's fundamental principles and rules, which include those in Common Article 3 of the 1949 Geneva Conventions and the principles of military necessity, humanity, distinction, proportionality, and honor; requires that the law of war obligations of the United are observed

and enforced by the DoD Components and contractors or subcontractors assigned to or accompanying United States Armed Forces; requires DoD Components to implement effective programs to prevent violations of the law of war; requires intended acquisition, procurement, or modification of weapons or weapon systems be reviewed for consistency with the law of war.

DoDD 3100.10, Space Policy (30 August 2022). Establishes policy and assigns responsibilities for DoD space-related activities in accordance with the National Space Policy, the United States Space Priorities Framework, the National Defense Strategy, the Defense Space Strategy, and United States law, including United States Code Titles 10, 50, and 51.

Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3121.01B, Standing Rules of Engagement, 2005. Provides implementation guidance on the application of force for mission accomplishment and the exercise of self-defense. Establishes fundamental policies and procedures governing the action to be taken by United States commanders during all military operations and contingencies and routine Military Department functions.

Joint Publication 2-01, Joint and National Intelligence Support to Military Operations, 5 July 2017. Explains the role of intelligence in military operations; describes joint and national intelligence organizations, responsibilities, and procedures; discusses intelligence operations, the intelligence process and intelligence support to joint operations planning.

Memorandum of Understanding between the National Aeronautics and Space Administration and the United States Space Force, 21 September 2020. Continues the longstanding partnership or mutually beneficial collaboration activities in furtherance of space exploration, scientific discovery, and security.

Defense Space Strategy, June 2020. Identifies how the DoD will advance spacepower to enable the Department to compete, deter, and win in a complex security environment characterized by great power competition.

United States Space Priorities Framework, December 2021. Outlines United States space policy priorities, including addressing growing military threats and supporting "a rules-based international order for space."

National Defense Strategy, March 2022. Sets out how the DoD will contribute to advancing and safeguarding vital United States national interests – protecting the American people, expanding America's prosperity, and realizing and defending our democratic values.

New United States Commitment on Destructive Direct-Ascent Anti-Satellite Missile Testing, 18 April 2022. United States commits not to conduct destructive, direct-ascent ASAT missile testing, and that the United States seeks to establish this as a new international norm for responsible behavior in space.

Appendix F: Cornerstone Responsibilities, Core Competencies and Spacepower Disciplines

Cornerstone responsibilities. Military space forces conduct prompt and sustained space operations, accomplishing three cornerstone responsibilities. Taken together, these cornerstone responsibilities define the vital contributions of military spacepower. (Space Capstone Publication*, Spacepower*)

Preserve freedom of action. Unfettered access to and freedom to operate in space is a vital national interest; it is the ability to accomplish all four components of national power – diplomatic, information, military, and economic – of a nation's implicit or explicit space strategy. Military space forces fundamentally exist to protect, defend, and preserve this freedom of action. (Space Capstone Publication*, Spacepower*)

Enable joint lethality and effectiveness. Space capabilities strengthen operations in the other domains of warfare and reinforce every joint function – the United States does not project or employ power without space. At the same time, military space forces must rely on military operations in the other domains to protect and defend space freedom of action. Military space forces operate as part of the closely integrated joint force across the entire conflict continuum in support of the full range of military operations. (Space Capstone Publication*, Spacepower*)

Provide independent options. Providing the ability to achieve strategic effects independently is a central tenet of military spacepower. In this capacity, military spacepower is more than an adjunct to landpower, seapower, airpower, and cyberpower. Across the conflict continuum, military spacepower provides national leadership with independent military options that advance the Nation's prosperity and security. Military space forces achieve national objectives by projecting power in, from, to space. (Space Capstone Publication*, Spacepower*)

Core competencies. The United States Space Force executes five core competencies. These core competencies represent the broad portfolio of capabilities military space forces need to provide successfully or efficiently to the Nation. (Space Capstone Publication*, Spacepower*)

Space security. Space security establishes and promotes stable conditions for the safe and secure access to space activities for civil, commercial, Intelligence Community, and multinational partners. (Space Capstone Publication*, Spacepower*)

Combat power projection. Combat power projection integrates defensive and offensive operations to maintain a desired level of freedom of action relative to an adversary. Combat Power Projection in concert with other competencies enhances freedom of action

by deterring aggression or compelling an adversary to change behavior. (Space Capstone Publication*, Spacepower)*

Space mobility and logistics. Space mobility and logistics enables movement and support of military equipment and personnel in the space domain, from the space domain back to Earth, and to the space domain. (Space Capstone Publication*, Spacepower*)

Information mobility. Information mobility provides timely, rapid, and reliable collection and transportation of data across the range of military operations in support of tactical, operational, and strategic decision making. (Space Capstone Publication*, Spacepower*)

Space domain awareness. The timely, relevant, and actionable understanding of the operational environment that allows military forces to plan, integrate, execute, and assess space operations. (*U.S. Space Force Vision for Space Domain Awareness*)

Spacepower disciplines. The seven spacepower disciplines are necessary components of military spacepower theory. These disciplines are the skills the United States Space Force needs when developing its personnel to become the masters of space warfare. (Space Capstone Publication*, Spacepower*)

Orbital warfare. Knowledge of orbital maneuver as well as offensive and defensive fires to preserve freedom of access to the domain. Skill to ensure United States and coalition space forces can continue to provide capability to the joint force while denying that same advantage to the adversary. (Space Capstone Publication*, Spacepower*)

Space electromagnetic warfare. Knowledge of spectrum awareness, maneuver within the spectrum, and non-kinetic fires within the spectrum to deny adversary use of vital links. Skill to manipulate physical access to communication pathways and awareness of how those pathways contribute to adversary advantage. (Space Capstone Publication*, Spacepower*)

Space battle management. Knowledge of how to orient to the space domain and skill in making decisions to preserve mission, deny adversary access, and ultimately ensure mission accomplishment. Ability to identify hostile actions and entities, conduct combat identification, target, and direct action in response to an evolving threat environment. (Space Capstone Publication*, Spacepower*)

Space access and sustainment. Knowledge of processes, support, and logistics required to maintain and prolong operations in the space domain. Ability to resource, apply, and leverage spacepower in, from, and to the space domain. (Space Capstone Publication*, Spacepower*)

Military intelligence. Knowledge to conduct intelligence-led, threat-focused operations based on the insights. Ability to leverage the broader Intelligence Community to ensure military spacepower has the ISR capabilities needed to defend the space domain. (Space Capstone Publication*, Spacepower*)

Engineering and acquisition. Knowledge that ensures military spacepower has the best capabilities in the world to defend the space domain. Ability to form science, technology, and acquisition partnerships with other national security space organizations, commercial entities, allies, and academia to ensure the warfighters are properly equipped. (Space Capstone Publication*, Spacepower)*

Cyber operations. Knowledge to defend the global networks upon which military spacepower is vitally dependent. Ability to employ cyber security and cyber defense of critical space networks and systems. Skill to employ future offensive capabilities. (Space Capstone Publication*, Spacepower*)

Appendix G: Joint Functions

Joint functions. There are seven joint functions common to joint operations: C2, information, intelligence, fires, movement and maneuver, protection, and sustainment. Commanders leverage the capabilities of multiple joint functions during operations. The joint functions apply to all joint operations across the competition continuum and enable both traditional warfare and irregular warfare, but to different degrees, conditions, and standards, while employing different tactics, techniques, and procedures. The integration of activities across joint functions to accomplish tasks and missions occurs at all levels of command. (Joint Publication 3-0, *Joint Campaigns and Operations*)

> **Command and Control.** The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. (Joint Publication 1, *Doctrine for the Armed Forces of the United States*)
>
> **Information.** The information function encompasses the management and application of information to support achievement of objectives; it is the deliberate integration with other joint functions to change or maintain perceptions, attitudes, and other elements that drive desired relevant actor behaviors; and to support human and automated decision making. (Joint Publication 3-0, *Joint Campaigns and Operations*)
>
> **Intelligence.** 1. The product resulting from the collection, processing, integration, evaluation, analysis, and interpretation of available information concerning foreign nations, hostile or potentially hostile forces or elements, or areas of actual or potential operations. 2. The activities that result in the product. 3. The organizations conducting such activities. (Joint Publication 2-0, *Joint Intelligence*)
>
> **Fires.** The use of weapon systems or other actions to create specific lethal or nonlethal effects on a target. (Joint Publication 3-09, *Joint Fire Support*)
>
> **Movement and maneuver.** Movement and maneuver encompass the disposition of joint forces to conduct operations by securing positional or informational advantages across the competition continuum and exploiting tactical success to achieve operational and strategic objectives. Movement is deploying forces or capabilities into an operational area and relocating them within an operational area without the expectation of contact with the enemy. Maneuver is the employment of forces for offensive and defensive purposes while in, or expecting, contact with the enemy. (Joint Publication 3-0, *Joint Campaigns and Operations*)

Protection. 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. See also mission-oriented protective posture. (Joint Publication 3-0, *Joint Campaigns and Operations*)

Sustainment. The provision of logistics and personnel services required to maintain and prolong operations until successful mission accomplishment. (Joint Publication 3-0, *Joint Campaigns and Operations*)

Appendix H: References

Space Capstone Publication*, Spacepower,* 10 August 2020

Space Doctrine Publication 1-0, *Personnel,* 7 September 2022

Space Doctrine Publication 4-0, *Sustainment*, 13 December 2022

Space Doctrine Publication 5-0, *Planning,* 20 December 2021

Space Doctrine Publication 3-99, *The Department of the Air Force Role in Joint All-Domain Operations,* 19 November 2021

U.S. Space Force Vision for Space Domain Awareness, May 2023

Joint Publication 2-0, *Joint Intelligence*, 26 May 2022

Joint Publication 3-0, *Joint Campaigns and Operations*, 18 June 2022

Joint Publication 3-01, *Countering Air and Missile Threats*, 4 May 2018

Joint Publication 3-09, *Joint Fire Support*, 10 April 2019

Joint Publication 3-14, *Space Operations*, Change 1, 26 October 2020

Joint Publication 3-31, *Joint Land Operations*, 16 November 2021

Joint Publication 3-85, *Joint Electromagnetic Spectrum Operations*, 22 May 2020

Chairman of the Joint Chiefs of Staff Manual 3105.01A, *Joint Risk Analysis Methodology*, 12 October 2021

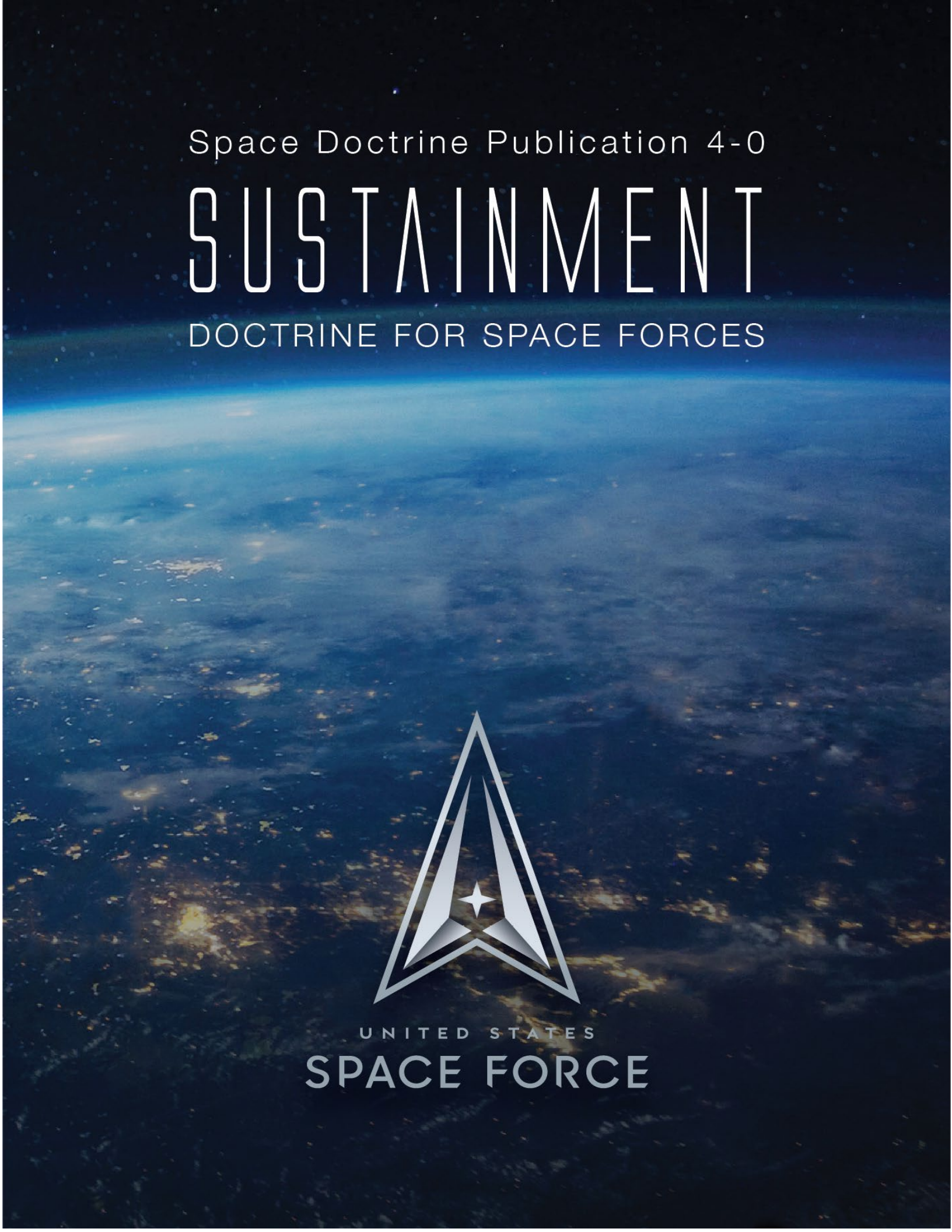
Defense Intelligence Agency, *2022 Challenges to Security in Space*

2022 Unified Command Plan, 25 April 2023

Space Doctrine Publication 4-0

SUSTAINMENT

DOCTRINE FOR SPACE FORCES



UNITED STATES
SPACE FORCE

Space Doctrine Publication (SDP) 4-0, *Sustainment*

Space Training and Readiness Command (STARCOM)

OPR: STARCOM Delta 10: Dec 2022

Foreword

United States Space Force (USSF) doctrine guides the proper use of military spacepower in support of the Service's cornerstone responsibilities. It establishes a common frame of reference on the best way to plan and employ Space Force forces as part of a broader joint force. This doctrine provides official advice and describes the parameters to execute and leverage spacepower utilizing its core competencies. It is not directive—rather, it provides Guardians an informed starting point for decision making and mission execution.

Space Doctrine Publication (SDP) 4-0, *Sustainment*, aligns with current Space Force doctrine and the Chief of Space Operations' Planning Guidance. It articulates extant best practices and lessons learned for sustainment of space forces.

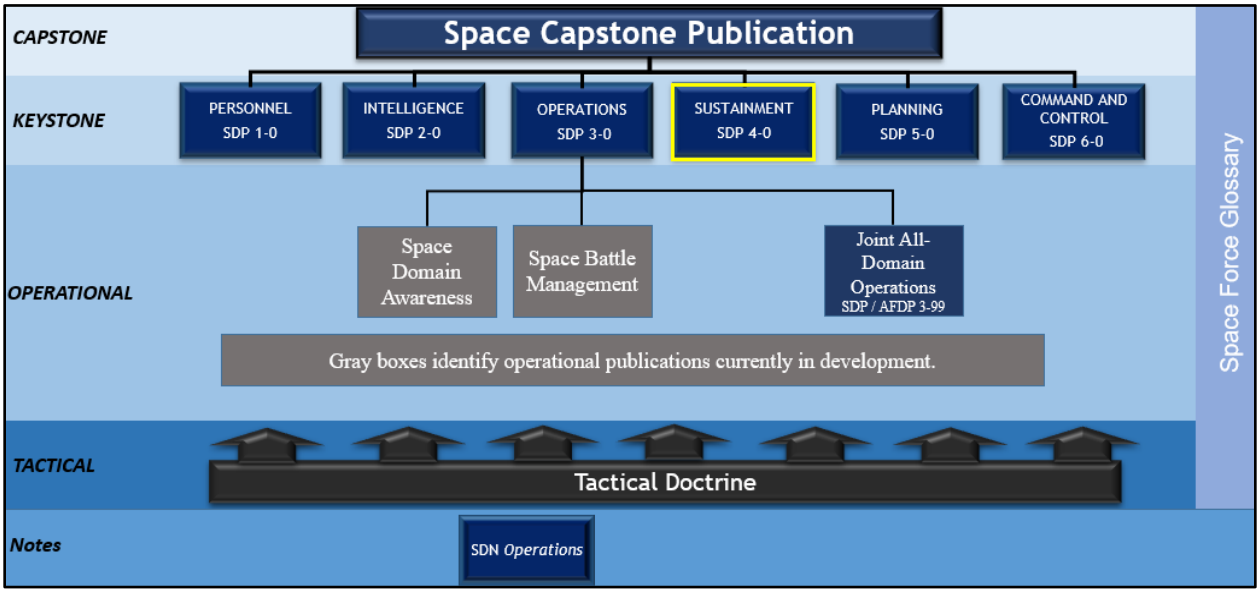
Strength and security in space provides national leaders with independent options and enables freedom of action in both space and other warfighting domains while contributing to international security and stability. Effective sustainment of weapon systems, critical infrastructure, logistics capabilities, and force protection measures is critical for enabling military space forces to conduct consistent and enduring space operations that fulfill the cornerstone responsibilities of the Space Force: preserve freedom of action, enable joint lethality and effectiveness, and provide independent options.

I encourage all Guardians to study and learn from the knowledge compiled in this publication. Semper Supra!

SHAWN N. BRATTON
Major General, USAF
Commander, Space Training and Readiness Command

Space Force Doctrine

Space Force doctrine guides the proper use of military spacepower in support of the Service's cornerstone responsibilities. It establishes a common framework for employing Guardians as part of a broader joint force. Doctrine provides fundamental principles and authoritative guidance for the employment of military spacepower and an informed starting point for decision-making and strategy development. Since we cannot predict the timing, location, and conditions of the next fight, commanders should be flexible in the implementation of this guidance as circumstances or mission dictate. Where the United States Space Force (USSF) is developing new policies, processes, or structures, call-out boxes (light blue boxes with rounded corners) highlight those for the reader. As the USSF officially implements these changes, Space Training and Readiness Command (STARCOM) Delta 10 will update this publication.



Space Force Doctrine Hierarchy

Space Doctrine Publication (SDP) 4-0

Space Doctrine Publication (SDP) 4-0, one of six planned keystone doctrine publications, presents Space Force sustainment activities to support the freedom to operate in, from, and to space.

- Chapter 1 introduces the operational environment and outlines the fundamentals of sustainment
- Chapter 2 discusses sustainment and the competition continuum
- Chapter 3 covers sustainment in relation to the three segments of space systems (on-orbit, terrestrial, and link) and identifies some challenges to the sustainment of space capabilities
- Chapter 4 presents roles, responsibilities, and relationships of organizations directly supporting the sustainment of space operations

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Chapter 1: Introduction

Purpose

Access to and the ability to operate freely in space are vital to national interests. This publication presents the United States Space Force's (USSF) current body of knowledge pertaining to the sustainment of space forces and capabilities. It provides the Guardian's perspective on the best way to approach sustainment of operations in the space domain throughout the competition continuum. It also identifies considerations for interaction with governmental and nongovernmental agencies, multinational forces, and other interorganizational partners.

Operational Environment

Space operations are unique and challenging because their operational environment (OE) spans multiple domains (e.g., air, maritime, land, and cyber). While the physical dimension of the space domain encompasses the orbital environment and the spacecraft operating within, the space system architecture—orbital segment, terrestrial segment, and link segment—traverses multiple domains and dimensions making defensive and offensive space operations inherently global and multi-domain. Thus, the operational environment for conducting space operations, and therefore sustaining space capabilities, is inherently global and multi-domain. The operational tempo for space systems differs from those for aircraft and missile systems. While major maintenance or maneuver activities may not be required regularly, there is a potential for major impact to operations in other domains when Guardians are required to take space-based or terrestrial-based space assets offline for maintenance activities. For example, warfighters rely on Global Positioning System (GPS), satellite communications, and space-based missile warning on a 24/7 basis; taking these systems offline for maintenance can disrupt or degrade operations and place warfighters at increased risk. Maintenance downtime on launch systems in the terrestrial domain can prevent responsive delivery of payloads to orbit. In addition, maintenance downtime on simulators, emulators, and other software development platforms can delay the delivery of critical software updates that provide new capabilities or are required for space systems to function properly.

a. **Orbital (Space) Segment.** The space environment contains numerous physical hazards and presents a dynamic and hostile OE. Every launch vehicle that travels from the terrestrial segment into the orbital segment remains an environmental consideration throughout the space access, maneuver, payload separation or deployment, and launch vehicle disposal phases of its mission. Currently, the limited ability to conduct physical maintenance (e.g., replace parts) of on-orbit spacecraft limits the options to respond to degradation or damage. On-orbit maintenance is generally limited to software updates or commands directing the satellite to use redundant systems already onboard. Space operators perform these types of maintenance remotely while the system is still operating. On-orbit refueling of spacecraft is also a limiting factor. As a result, most current space system lifespans are limited by the amount of onboard propellant they have when launched. Propellant is required for conducting station-keeping, orbit-raising, collision avoidance, end-of-life disposal, and many other types of on-orbit maneuvers.

b. Terrestrial Segment. The terrestrial segment consists of characteristics that offer substantial challenges to the sustainment of space capabilities that include, but are not limited to the following:

- Geographically dispersed systems. Maintenance and sustainment of terrestrial control stations, antennas (mobile and fixed), tracking stations, and other support equipment often requires on-site maintenance performed at geographically dispersed operating locations around the globe. This can create challenges in getting necessary personnel or parts on site. Operations, sustainment, and acquisitions professionals should consider ground, air, and sea ports of debarkation when assessing requirements and timelines to deliver the parts necessary to maintain operations. The Force Activity Designator, urgency of the item, and location of the site will aid in determining the mode of transportation. For example, the GPS control segment consists of a global network of ground facilities that track the GPS satellites, monitor their transmissions, perform analyses, and send commands and data to the constellation (figure 1). Space Force, via Space Operations Command (SpOC), provides and sustains operationally ready units and personnel in the terrestrial segment to deploy and employ space capabilities for the joint force commander (JFC).

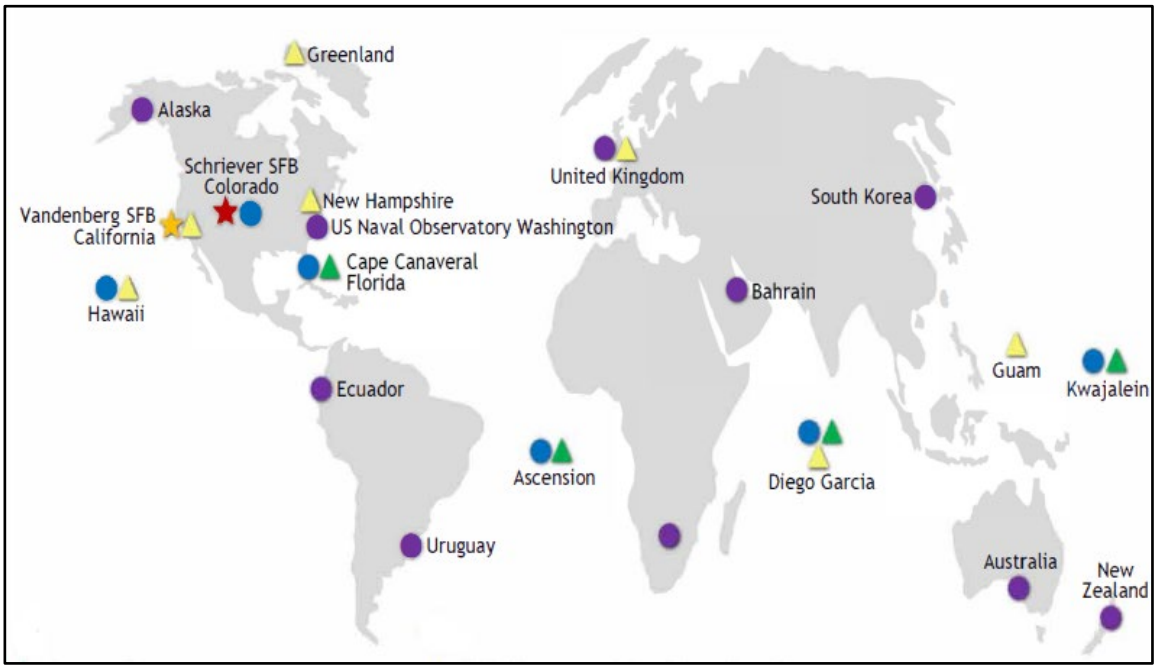


Figure 1. Global Positioning System Control Segment

- Obsolescence of systems. Terrestrial space systems often operate beyond their planned life expectancy. As a result, terrestrial space systems require significant support from Space Systems Command (SSC), the Missile Defense Agency, and other procurement authorities to provide engineering solutions and solve compatibility issues with well-defined sustainment requirement contracts.

- Harsh operating environments. Terrestrial space systems, dispersed around the globe, can be exposed to all types of weather. The environments they operate in drive constant infrastructure upkeep to keep the elements out and prevent corrosion.

The terrestrial segment includes extensive assets and infrastructure relating to sustainment of launch systems. This includes production and transport of vehicle systems, launch site infrastructure, provision of launch commodities and supplies (such as propellants), range infrastructure, and worldwide tracking sites.

c. Link Segment. Spacecraft on orbit require line-of-sight access to a ground station—or ability to crosslink to another spacecraft with access—in order to receive telemetry and tracking data from or send commands to the spacecraft. While some systems have dedicated ground systems for these activities, others are required to share limited resources (e.g., Satellite Control Network) to conduct telemetry, tracking, and commanding (TT&C). In general, link segments can be vulnerable to jamming or spoofing by adversaries, which could obstruct critical commanding or software updates. For launch vehicles, telemetry links are essential to tracking vehicle performance, and most modern launch vehicles depend on links from GPS satellites to ensure successful flight and accurate orbit insertion.

Fundamentals of Sustainment

Sustainment is the provision of logistics and personnel services to maintain operations until mission accomplishment and redeployment of the force. It is identified as one of seven joint functions—related capabilities and activities grouped together to help JFCs integrate, synchronize, and direct joint operations—and includes the provision of logistics, financial management, physical infrastructure, personnel services, and health service support necessary to maintain operations. Sustainment activities occur in a complex environment spanning the globe and multiple domains. Sustainment capabilities can come from a variety of military forces, other governmental organizations, nongovernmental organizations, or multinational forces. The essential challenge is to support increasing demand with constrained resources in a potentially contested environment. Understanding the global environment is essential to plan, execute, synchronize, assess, and coordinate sustainment operations.

Sustainment facilitates uninterrupted operations through means of adequate logistics support. Services accomplish this through supply systems, maintenance, and other services, which ensure continuing support through the lifecycle of the weapon system.

Acquirers should design sustainment into any system. Sustainment professionals cannot perform their duties properly, effectively, or efficiently if system sustainment is not part of system design. Sustainment professionals should consider all aspects (e.g., funding, other systems, personnel, processes) affecting a system's supportability posture to ensure the system performs its mission as intended and expected. System designs should consider eliminating unique hardware (where possible) and reducing logistics footprints to the greatest extent possible.

a. Principles of Sustainment. The nine principles of sustainment are essential to achieving the Space Force's cornerstone responsibilities of preserving freedom of action, enabling joint lethality and effectiveness, and providing independent options.

1) **Integration** is combining all of the sustainment elements within operations assuring unity of command and effort. It requires deliberate coordination and synchronization of sustainment with operations across all elements of the competition continuum. One of the primary functions of the sustainment staff is to ensure the integration of sustainment with operations to guarantee mission readiness.

2) **Anticipation** is the ability to foresee operational requirements and initiate necessary actions. Professional judgment resulting from experience, knowledge, education, intelligence, and intuition shapes anticipation. Commanders and staffs need to understand, visualize, and communicate future operations and identify appropriate or required support. They should then start the process of acquiring the resources and capabilities that best support the operation. Commanders integrate risk management into the operations process to identify threats, assess those threats, and anticipate the capabilities, processes, or controls, required to mitigate the risk of gaps in support.

3) **Responsiveness** is the ability to react to changing requirements and meet the needs to maintain support. It is providing the right support in the right place at the right time. It includes the ability to meet operational needs rapidly.

4) **Simplicity** relates to processes, procedures, and equipment to minimize the complexity of sustainment. Unnecessary complexity of processes and procedures leads to confusion. Clarity of tasks, standardized and interoperable procedures, and clearly defined command relationships contribute to simplicity.

5) **Economy** is providing sustainment resources in an efficient manner that enables the commander to employ all assets to the greatest effect possible and within acceptable levels of risk. Eliminating unnecessary redundancy of capabilities (i.e., duplication of efforts) and capitalizing on joint interdependencies, to include shared capabilities with allies and partners, further enhance the principle of economy. Disciplined sustainment assures greatest possible tactical endurance and constitutes an advantage to commanders.

6) **Survivability** consists of a quality or capability of military forces to avoid or withstand hostile actions or environmental conditions while retaining the ability to fulfill their primary mission. Hostile actions and environmental conditions can disrupt the flow of sustainment and significantly degrade forces' ability to conduct and sustain operations. In mitigating risks to sustainment, commanders are often forced to rely on the use of redundant sustainment capabilities and alternative support plans.

7) **Continuity** is the uninterrupted provision of sustainment across the competition continuum. Continuity assures confidence in sustainment allowing commanders freedom of action, operational reach, and endurance.

8) **Improvisation** is the ability to adapt sustainment operations to unexpected situations or circumstances affecting a mission. It includes creating, arranging, or fabricating resources to meet requirements. It may also involve changing or creating methods that adapt to a changing OE. Sustainment leaders should work closely with acquisition professionals and operational leaders to visualize complex operations and support contingency planning requirements development. These skills and contingency plans enable commanders to improvise operational and tactical actions when enemy actions or unexpected events disrupt sustainment operations.

9) **Interoperability** is the ability to act together coherently, effectively, and efficiently to achieve tactical, operational, and strategic objectives. It is in the best interests of the United States (US) that its Armed Forces be interoperable with our multinational partners. The Space Force advances interoperability by promoting materiel and operational standardization between allies and possible coalition partners.

b. Integrated Lifecycle Management. Integrated Lifecycle Management governs all aspects of infrastructure, resource management, and business systems necessary for the successful acquisition of systems, subsystems, end items, and services to satisfy validated warfighter or user requirements. The management of systems throughout their lifecycle involves a multi-functional collaborative effort among the requirements, acquisition and sustainment, test, information operations, and intelligence communities.

c. Maintenance. The Space Force employs a maintenance structure of depot- and organizational-level maintenance to repair and maintain assets. These levels separate maintenance functions and actions depending on level of repair complexity, level of certified personnel, and type of required equipment, tools, or facilities to accomplish the maintenance. Maintenance planning provides optimal availability of ready, reliable systems at best value.

1) **Depot-Level Maintenance.** The purpose of depot-level maintenance is to perform maintenance requiring major overhaul or a complete rebuilding of parts, assemblies, subassemblies, and end items. Depot maintenance includes the manufacture of parts, modifications, testing, and reclamation as required; provides a source of serviceable equipment; and supports organizational maintenance by providing technical assistance or performing maintenance tasks beyond their responsibility. Depot maintenance is the most complex and extensive level of maintenance work and is a significant tie between the nation's industrial base and military operations. Depot maintenance includes all aspects of software maintenance/sustainment, which are those activities after initial operating capability of fielding, necessary to:

   i. Correct defects and/or improve performance.

   ii. Upgrade or modify to adapt and/or perfect the fielded software baseline to a changing/changed environment. Maintenance/sustainment can include the modifications or upgrades necessary to ensure safety and relevance in operations and interoperability with other systems.

2) **Organizational-Level Maintenance.** The purpose of organizational-level maintenance is to return systems to operational use. Organizational maintenance encompasses on-line maintenance and repairs necessary for day-to-day operations, as well as the intermediate, offline repair of components and end items for weapon systems and supply chains. Organizational maintenance is less complex than depot-level maintenance and serves as the link between strategic capabilities and tactical requirements. Accomplishing organizational-level maintenance brings an inherent level of mission downtime risk; thus, commanders and sustainment professionals should plan, resource, and continuously assess organizational-level maintenance throughout capability life cycles.

d. Infrastructure. For fixed facilities, building infrastructure—to include heating, ventilation, and air conditioning systems; power supply; and water supply—is as vital to operations as the system itself. Facilities requirements for space systems should be identified as early as possible and consider compatibility, security, and capacity with existing infrastructure. As one of the integrated product support elements, the sustainment strategy should include a robust recurring maintenance program and reduce or eliminate unscheduled mission downtime. For Service-level resource planning and advocacy, the Space Force leverages the US Air Force and its organizations to ensure Space Force installations, geographically separated unit, site, and field command requirements are prioritized and executed transparently and methodically. Standardized processes allow Space Force and Air Force leaders to apply cross-functional collaborative resourcing for the maintenance, repair, and construction of real property facilities and infrastructure. However, final approval of all projects and designation of budgeting priorities resides with the Space Force. The proper planning, programing, budgeting, and execution of infrastructure projects ensures resiliency requirements are met, failing components are replaced in a timely manner, and obsolete equipment (e.g., generators) is updated such that off-the-shelf replacement parts are readily available.

e. Host-Nation Support. Host-nation support (HNS) is a means to enable deployed forces to operate for extended periods away from national resources or sources of domestic support. While not uniquely a sustainment activity, it is a key enabler and provides effective support to military activities. Host-nation support achieves efficiencies and synergies through the best use of all of a host nation's (HN) available, pre-arranged resources. Host-nation agreements provide a viable means to adjust and tailor support requirements. Sources of HNS are organic military resources, supplies, and services from other government agencies or commercial entities that the HN contracts, coordinates, and controls. A significant element of the sustainment activity support comes from the HN or through direct commercial contracts. Both methods of support rely on the commercial market and, consequently, may not have the same levels of resilience as the force. Commercial organizations, structures, and resources obtained through HNS may be more susceptible to direct or indirect action by an adversary or internal unrest, therefore require more risk mitigation.

To develop a proper support strategy, it is important to know the makeup of the operations and maintenance (O&M) team (e.g., US, contractors, allies, partners). O&M contracts should consider the presence of allies and partners to ensure they receive the same level of training/orientation and support as US service members. Sustainment planners should review current international agreements and ensure allies are considered in O&M and sustainment decisions and processes to improve supportability of the system.

f. System Reliability, Availability, and Maintainability (RAM) Metrics. Maintaining high readiness levels is dependent on having a robust RAM program enabling the ability to identify system deficiencies and negative trends before they affect operational capability. RAM refers to three related characteristics of a system and its operational support: reliability, availability, and maintainability.

- **Reliability** is the probability of an item to perform a required function under stated conditions for a specified period under stated conditions. Reliability is a function of the environment and the stresses it places on a system. The conditions of use include, but are not limited to, the environment of operation, maintenance as specified, and operation within the design specifications. It is critical because it contributes to a system's warfighting effectiveness as well as its suitability in terms of logistics burden and the cost to fix failures. Reliability is also one of the most critical elements in determining the logistics infrastructure and footprint. Some parameters used to determine reliability include failure rate, mean time between failure, and mean time to failure.

- **Availability** is a measure of the degree to which an item is in an operable state and can be committed at the start of a mission. Sustainment professionals can measure availability by the number of minutes a system is operational in a 24-hour period, the number of days a system is operational in a year, or some other measurement and timeframe appropriate for the given system and the mission it supports. For example, sustainment professionals might calculate availability by subtracting all the days a system is in a "not available for operations" status (e.g., non-mission capable for maintenance or non-mission capable for supply) from 30 and dividing the difference by 30 to come up with an availability percentage. Operational availability and operational dependability are the primary metrics used to determine the health of a weapon system. Operational dependability refers to the probability a weapon system will remain operational throughout a mission if all scheduled maintenance actions are stopped.

- **Maintainability** is the ability of an item to be retained in, or restored to, a specified condition when personnel having specified skill levels, using prescribed procedures and resources, at each prescribed level of maintenance and repair, perform maintenance. Many different parameters, such as mean time to repair, maximum time to repair, and maintenance ratio, can determine maintainability. The primary objective of developing maintainability and reliability requirements

for a system is to reduce the time it takes a properly trained maintainer to detect and isolate failures and repair them.

RAM, as well as other characteristics such as survivability and interoperability, is generally difficult to retrofit. Thus, it is paramount to factor them into a system or architecture early in the design and development process when life cycle sustainment costs are locked in. There is value in influencing the design of Department of Defense (DOD) and allied international systems (if intended to connect to an operational US system), as well as emerging commercial standards, as early as possible in the development and acquisition cycles to optimize future system compatibility, interoperability, life cycle cost, and the complexities of sustainment.

Chapter 2: Sustainment and the Competition Continuum

Competition continuum (figure 2) describes a world of enduring competition conducted through a mixture of cooperation, competition below armed conflict, and armed conflict. The Space Force delivers capabilities for space operations throughout the continuum. Sustainment solutions, challenges, and priorities for those capabilities change in relation to the situation. For example, the ability to acquire new technology and posture space systems during cooperation provides elevated deterrence from attack across the continuum. A successful sustainment and maintenance plan for ground stations and on-orbit repairs during the armed conflict element mitigates risks and capability losses.

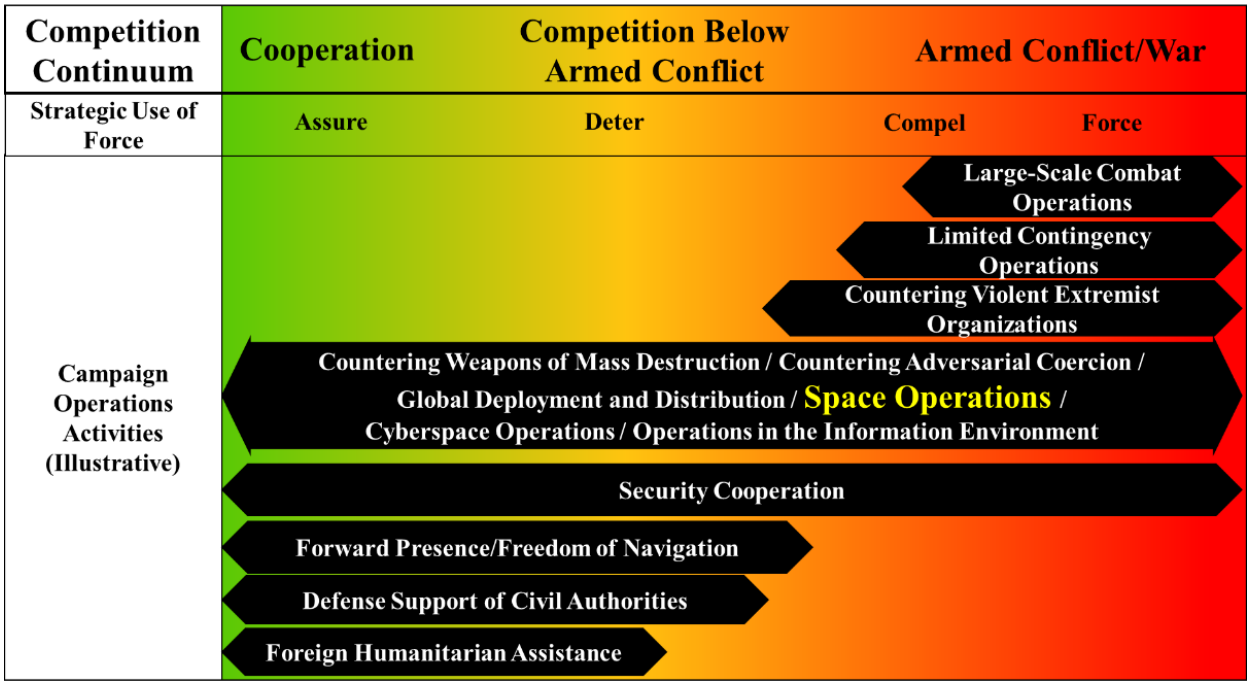


Figure 2. Competition Continuum

Cooperation and Adversarial Competition below Armed Conflict

In the continuum model above, sustainment operations to the left of armed conflict/war focus on building resources (human and materiel), projecting the force, protecting assets, and establishing sustainment processes and positions. During these elements, focus is on recruiting and training personnel to increase competency and ensure readiness of Guardians to conduct operations in support of armed conflict/war. Adversarial competition below armed conflict is also the time to stockpile materiel. One example might be the prepositioning of spare parts for remote space surveillance network sensors or satellite control network sites to prevent long outages caused by shipping delays or out-of-stock parts. Another example of this could be spare satellites on orbit to fill gaps in a constellation; however, rapidly evolving capabilities make it difficult and expensive to stock on-orbit spares for low-density constellations.

For the Space Force, operations include projecting power in, to, and from space, and around the globe through distribution of fixed and mobile terrestrial space assets. Distribution is a vital

logistical function that is much easier (and more successful) below the level of armed conflict/war. The Space Force should establish robust (redundant and resilient) sustainment capabilities at key locations through the cooperation and adversarial competition below conflict elements. Resource buildup often requires significant lead-time in order to secure funding, train personnel, and produce supplies. Sustainment and logistics personnel should consider a number of items during the cooperation element of the competition continuum:

a. Supply. Actions should be taken to order, receive, store, and issue all materiel needed for servicing and maintaining energy, power, resources, and capabilities, both in garrison and deployed, to supply the mission, forces, and infrastructure. Supply plans should analyze past demand and anticipate commercial/contingency services (i.e., power, water), and materiel parts failures to forecast services and materiel needed to support current operations and validate future requirements. The completed analysis should be included in applicable acquisitions—current and future—with relevant terrestrial requirements.

b. Maintenance. Routine maintenance and modification actions are required to prepare mission elements to conduct assigned missions. These can include, but are not limited to, corrosion control and replacement of consumable materiel and components. Commanders should be prepared to balance required operational availability (uptime) with scheduled and unscheduled maintenance requirements (downtime) to maximize system reliability, effectiveness, and longevity.

c. Critical Infrastructure. Commanders should maintain oversight of system status and understand the vital requirements of the mission systems to maximize coordination of scheduled utility downtime with system downtime. They should also acknowledge assessment results defining required redundancies, oversee maintenance and testing of redundancies, direct project planning and maintenance of hardening plans to achieve the required hardening and system readiness, and report infrastructure readiness of task critical assets. Space Force sustainment professionals should integrate combatant command critical infrastructure priorities in facilities sustainment, restoration, and modernization and military construction integrated priority lists to meet the most critical warfighting mission needs first.

d. Operational Contract Support. Operational units should create and maintain peacetime contracts with flexibility for non-steady state operations to ensure readiness to conduct operations across the competition continuum.

Sustainment Operations during Armed Conflict/War

Sustainment operations during armed conflict differ from operations that precede armed conflict. Adversaries will create contested environments to delay, disrupt, or destroy resupply chains to deny access to capabilities. Immediately before transition from adversarial competition below armed conflict to armed conflict/war is the ideal time to surge production of supplies. Funding is likely available during these times with a sense of urgency to provide the necessary supplies for mission accomplishment. To support operations, prepositioning critical spares at remote terrestrial operating locations is key to prevent extended outages waiting for replacement parts to arrive. This requires consideration of the availability of appropriate storage (e.g., capacity,

climate control) necessary to pre-position critical spare parts effectively. Once conflict begins, the sustainment operations should focus on replenishment and maximizing operational capability. Repositioning on-orbit satellites may be required to best support a specific geographic area or fill a gap in a constellation caused by an outage. Rushing a replacement part to a remote space surveillance network site may also be required to return it to an operational status. While supporting operations in armed conflict/war, deferring scheduled maintenance is an option; however, it may shorten the lifespan of equipment. Decisions on sustainment priority or conservation are key to successful sustainment of operational capabilities. Additionally, sustainment planners should consider potential increases to force protection of sustainment operations, as required. Sustainment and logistics personnel should consider a number of items while transitioning to, from, and during periods of armed conflict/war. They can coordinate to preplan and provide the following as services from the Base Operating Support-Integrator assigned in the region and via a base operations support agreement:

a. Positioning. Position mobile space assets in theater to support joint operations, as required, through (joint) reception, staging, onward movement, and integration of forces in the operational area. To successfully execute terrestrial expeditionary combat support, the following should be assessed:

- Seaport opening and handling of munitions
- Aerial port cargo handling, expeditionary airfield operations, and enroute support (strategic mobility)
- Rail assets, over-the-road trucking, container handling capability, and petroleum, oil, and lubricant (POL) storage/distribution
- Military heavy construction, specialized military construction, port operations support, engineering services, environmental units, and maintenance/munitions storage structures.
- Hospitalization, tactical and strategic evacuation, resupply of medical materials, HNS, and elements of force health protection
- Water production and distribution; electrical power; wastewater collection; heating, ventilation, and air conditioning; laundry; bath; food; shelter; mortuary; and decontamination services
- General support theater maintenance, intermediate maintenance (i.e., central intermediate repair facilities), and continental US depot capability
- Degradation of aerial ports of debarkation, seaports of debarkation, impact on HN, and contractor support bases
- Security Forces, force protection of assets, and storage of classified assets requiring 24/7 monitoring

b. Supply. The functional capabilities that contribute to the supply chain include management of supplies and equipment; inventory management; management of global supplier networks; and assessment of global (forward-deployed and pre-positioned)

requirements, resources, capabilities, and risks. Sustainment planners should forecast and plan for increased requirements at critical and/or geographically separated locations, as required by JFCs.

c. Maintenance. Maintenance professionals should synchronize service maintenance as much as possible to provide the most effective capabilities available to JFCs. Commanders may extend or temporarily waive scheduled maintenance requirements to maximize operational availability during surge operations. This could result in lengthy down time in order to return to full capacity following surge operations.

d. Critical Infrastructure. Sustainment professionals should minimize downtime of utilities they control by coordinating scheduled maintenance actions with operations. Sustainment professionals should identify, fund, and schedule facility upgrades to meet Space Force-defined resiliency, survivability, and endurability requirements. In addition, where the local community or HN provides utilities, sustainers should understand where this creates vulnerabilities and implement continuity of operations plans for critical capabilities. The dependency on HN utilities can have rippling effects and may impact ports, airfields, warehouses, depot resupply, maintenance facilities, medical facilities, beddown of forces capabilities, noncombatant evacuation operations facilities, POL storage & distribution, utility production capability, munitions storage, communication facilities, lines of communication, main supply routes, and basic expeditionary airfield resources assets and similar for future DOD and Space Force space logistics-related facilities.

e. Operational Contract Support. Implement flexible aspects of contracts to support operations during armed conflict/war, as required by combatant commanders. When writing or modifying statements of work for contracts, sustainment planners should ensure space systems operated and supported by contractors have specific requirements of the contractors (e.g., deploy to, live, and work at undisclosed locations) upon entering the armed conflict element of the competition continuum.

f. Reconstitution. Reconstitution is the restoration of functionality to an acceptable level for a particular mission, operation, or contingency after severe degradation. It includes both equipment and personnel. Reconstitution maintains control over resources and maximizes asset recovery. The objective is to replenish the force, primarily for future operations, but may also be necessary during armed conflict. One unique capability the Space Force should carefully plan for is conducting space access operations, in particular for reconstitution. The National Space Policy calls for “rapid launch options to reinforce or to reconstitute priority national security space capabilities in times of crisis and conflict.” Spacelift operations require planning and lead-up operations to build, integrate, and deliver a payload or payloads to orbit. Reconstitution of ground systems, whether damaged or degraded by natural causes (e.g., flood, hurricane, or lightning) or adversary attack, is critical to ensuring continuous space operations. SSC serves as the single point of entry for assured access to space for all DOD launch requirements and as the service provider for all critical space mission partners.

Chapter 3: Sustainment Capabilities

The Department of the Air Force (DAF) leads the acquisition of space capabilities for the DOD. In addition, the Space Force provides rapid capabilities in response to emerging threats by providing processes to expedite delivery and deployment of capabilities in response to combatant commander requirements. The Space Force also leverages commercial industry and international partnerships in its efforts to ensure robust acquisitions and logistics. In carrying out its responsibilities, the Space Force plans for and provides sustainment and replacement of terrestrial, on-orbit, and some portions of the link segment capabilities. The approach to sustain these systems is different for each of the segments.

Successful sustainment of space capabilities across the competition continuum requires the understanding that space is a warfighting domain. Space Force elements should understand that sustainment of capability—including positioning, execution, and reconstitution of terrestrial, link, and orbital segments of space systems—are ongoing processes happening simultaneously across all three segments. These processes should take into consideration the ability to continue sustaining those capabilities beyond the cooperation element and into the adversarial conflict below armed conflict and armed conflict/war elements of the continuum.

On-Orbit Sustainment

The orbital (space) segment comprises all spacecraft in orbit beyond Earth's atmosphere. The Space Force supports the joint force sustainment activities with unique on-orbit capabilities for supporting many of the core logistics functions. Management of constellation health and positioning of on-orbit assets is an ongoing process to respond to changes in the OE and requirements from the JFC. These processes require operators to communicate regularly with SSC acquirers and sustainers to ensure requirements synchronize with sustainment of current capabilities and delivery of future capabilities. Each orbital asset has a finite life span relative to onboard fuel, power, or other life-limited components. Sustainment of the orbital segment should include consideration for capability improvements and planning for end-of-life disposal. Today, capability improvements can only be implemented either through updates to on-board software or changes in tactics, techniques, and procedures relative to use of the asset. Both paths can be implemented independently, but usually occur together as a combined effort to maintain or improve capabilities.

Future On-Orbit Sustainment

Already demonstrated in the commercial sector, orbital sustainment will allow military space forces to replenish consumables and expendables on spacecraft when that option is more practical than recovery back to Earth or disposal/reconstitution. Orbital sustainment also enables spacecraft inspection, anomaly resolution, hardware maintenance, and technology upgrades. Orbital recovery allows for the recovery of personnel or military equipment from the space domain. This includes objects such as reusable spacecraft and launch systems.

a. **Space Access, Mobility, and Logistics (SAML).** SAML includes the movement, deployment, assembly as needed, and support of military equipment in, to, and from the space domain. The ability to control and exploit the space domain always begins with physical access to orbit. SAML starts with the ability to launch military equipment into the proper orbit in a safe, secure, and reliable manner. During conflict, space launch needs to be dynamic and responsive, providing the ability to augment or reconstitute capability gaps from multiple locations. In-space docking of multiple orbital assets is a pervasive and enabling operational capability providing physical connectivity that is a prerequisite to accomplishing many future mobility and logistics tasks. In addition, Space Force is the lead Service for ongoing studies and technology assessments to determine the viability of using rockets as a rapid, global cargo delivery platform to support military missions including rapid response, urgent resupply, and humanitarian aid delivery.

b. **Coordination.** Sustainment of certain on-orbit assets require extensive coordination both within the US Government and externally with the international community. An example of this is the maintenance of geosynchronous slots supporting Military Satellite Communications activities. Each slot used for communications should be deconflicted and prioritized to ensure each agency requiring bandwidth has access to the right locations in support of their unique missions. The registration and maintenance of locations and frequencies requires coordination with the International Telecommunications Union, which is responsible for assigning and de-conflicting these limited locations across the international community.

c. **Debris Mitigation**. Orbital sustainment activities also need to account for environmental sustainment. The exponential increase in the number of active and inactive objects in space demands that Guardians consider compliance with Orbital Debris Mitigation Standard Practices, conjunction de-confliction/maneuvers, and end-of-life disposal plans early and throughout the life of the system. The Space Force coordinates end-of-life planning to ensure it does not create additional debris or negatively impact the space environment.

d. **Positioning, Execution, and Reconstitution.** One consideration and challenge for the orbital segment is the concept of positioning, execution, and reconstitution. In space operations, the assets are on orbit regardless of where the joint force is operating on the competition continuum. In executing sustainment activities for the orbital segment, the main difference is in the focus. During cooperation, the focus is on efficiently managing constellations and assets to minimize fuel usage and maximize operational support to the other services. During armed conflict/war, sustainment of the orbital segment would focus on reconstitution type activities such as quickly returning degraded assets to operations or maneuvering assets, as necessary, to maximize capabilities. For example, the loss of a satellite in a constellation may require the repositioning of one or more remaining satellites in order to maximize coverage either globally or over a particular area of responsibility (AOR).

Reconstitution of on-orbit capabilities should also account for future concepts of on-orbit mobility, rapid access to space through launch of new assets on tactically defined timelines, and on-orbit logistics and maintenance. Planning for these capabilities should include the entire cycle from production of a new on-orbit asset, through processing, launch, refueling, maneuver, and maintenance of the capability.

On-Orbit Refueling

Commercial companies are exploring several concepts to conduct on-orbit fluid transfer between spacecraft to address maneuver without regret and mission extension (logistics) concepts. In addition to actual fluid transfer, other concepts for life extension exist to include "jet-pack" systems, which dock with and take over station-keeping functions for the client spacecraft. Commercial industry demonstrated this functional capability in 2020 by docking a servicing spacecraft with an Intelsat satellite and extended its operational lifespan by conducting station-keeping maneuvers for the satellite. Multiple commercial companies are also exploring entering the fluid transfer market, some with plans to field on-orbit capabilities in the next 5-10 years. These and similar capabilities present new opportunities for space sustainment operations and improve operations, training, and space access capabilities.

e. **Rendezvous, Proximity Operations, and Docking.** Rendezvous, proximity operations, and docking are prerequisite enabling capabilities for routinely accomplishing many future autonomous mobility and logistics tasks in space, including post-deployment orbit raising of spacecraft by orbital transfer vehicles. Rendezvous is a mission phase that begins when a visiting spacecraft locates and identifies a target spacecraft and maneuvers closer to the target vehicle. Proximity operations commence when a visiting vehicle enters the keep-out sphere established for the target vehicle. Proximity operations encompass multiple potential mission phases before and after contact with the target vehicle including fly-

In-Space Assembly and Modular Hardware Change-Out

Certain future orbital assets may be too large or complex to permit full deployment by a single launch. In-space assembly capabilities may enable modules deployed by multiple launches to connect through robotic or other autonomous/semi-autonomous techniques to achieve full deployment and operability. Likewise, hardware repair, hardware replacement, or technology upgrades through module change-out may become feasible and practical.

around and inspection, final approach, undocking, and departure. This also includes all maneuvers within the keep-out sphere associated with the target vehicle, to include docking with another vehicle.

Terrestrial Sustainment

The terrestrial segment encompasses all the equipment within the terrestrial domains required to operate or exploit a spacecraft. This includes control stations, antennas, tracking stations, radars, launch sites, launch platforms, user equipment, and facility critical infrastructure. The Space Force supports terrestrial capabilities, both fixed and mobile in all elements of the competition continuum. Mobile and fixed Space Force assets are postured to support space operations, as required by the JFC. Sustainment operations should include resupply of the following, at a minimum: food, fuel, critical infrastructure redundancy, primary and alternate sources of electricity, heating/cooling, water, sewer, and trash removal. Personnel need the support that provides the resources to operate the installations and medical support. Space Force planners should expect to coordinate with and receive sustainment support from service components assigned to, and directed by, the supported combatant command.

a. **Required Support.** The unique challenges and operational requirements to the Space Force necessitate that the Service employs a lifecycle management approach of sustainment concerning weapon system RAM. SSC plays a major role in weapon system sustainment by coordinating operational requirements, establishing sustainment contacts with the commercial vendor, and integrating the system-of-systems with the DOD and other agencies. The Air Force, Marine Corps, Army, Navy, and commercial partners support Space Force terrestrial assets in locations that span the globe. Examples include planning for the use, and support, of the assigned lead Service for the distribution of spare parts; the transportation of passengers and equipment for mobile capabilities; connectivity to communications networks; requesting operational contract support such as fuel delivery; and providing of food, water, and security to both fixed and forward deployed operating locations.

b. **Maintenance Priorities.** While the Space Force conducts most space operations from locations in the continental US, they support operations across the globe. Therefore, the Space Force should prioritize maintenance and sustainment of critical systems that support space capabilities based on the operations they are supporting. For example, heating, ventilation, and air conditioning systems that cool control system equipment are integral to keeping satellite control systems operational by preventing malfunction from overheating. These considerations go beyond basic installation management. Failure to prioritize activities appropriately to maintain or restore these functions could have significant operational impact on major combat operations.

   Similarly, commanders should give special attention to planning for maintenance (scheduled and unscheduled) and sustainment during periods of time when operational elements are supporting joint operations in high intensity conflict. While commanders may elect to delay scheduled periodic maintenance to ensure continuous support to operations, those delays can, and will, eventually result in reduced capability and risk of

major degradation from lack of maintenance. Both operational and sustainment elements should plan and coordinate for changes to maintenance priorities across the competition continuum to maximize operational effectiveness while minimizing negative long-term effects to the systems.

c. Personnel. The sustainment function of personnel services includes personnel management, readiness, and replenishment. Some elements of personnel management concerning recruitment, retention, and reconstitution of forces are unique to the Space Force. The small size of the Space Force brings unique challenges to how it can balance training, operations, and other institutional requirements. For space sustainment operations, the focus should be on maintaining technical proficiency in core disciplines without affecting the ability to conduct operations. This includes reconstitution and replenishment of personnel, which requires close coordination between organizations to ensure sustainment of personnel requirements through the recruiting and training pipelines, combined with efficient transition of Guardians from training into positions directly supporting operations, systems support functions, and operational systems development. This also includes the training of Airmen who are directly responsible for the protection and sustainment of critical Space Force facilities and infrastructure (e.g., radars, command and control nodes, critical communications, and link segments) around the globe.

d. Host-Nation Support. The terrestrial segment of space systems consists of fixed space surveillance network sites, fixed TT&C facilities (e.g., satellite control network sites), and mobile systems dispersed around the globe. As a result, many of these capabilities operate in foreign territories, resulting in sustainment challenges. HN agreements are a key component to ensure that HNS can effectively support operations. Some key considerations for sustainment professionals under these circumstances include site security and training for HN operators and maintainers (when required).

Link Sustainment

The link segment comprises the signals in the electromagnetic spectrum that connect the terrestrial segment and the orbital segment. Uplink signals transmit data from terrestrial assets to spacecraft. Downlink signals transmit data from a spacecraft to terrestrial assets (e.g., ground stations, ships, aircraft). Crosslink signals transmit data from one spacecraft to another. This link normally includes TT&C signals necessary for controlling the spacecraft and payload. In addition, the TT&C link is necessary to downlink important data regarding status of the spacecraft for sustainment requirements.

Preparation for, and execution of, sustainment activities for space systems need to be well thought out and preplanned to ensure disruptions are limited and risks to the spacecraft are mitigated. One threat to sustainment operations on orbit is the potential for adversaries to degrade or deny transmission and/or receipt of critical TT&C communications through either jamming or cyberspace activities. The link segment provides the means to connect space systems from different domains with each other (e.g., ground-to-ground, ground-to-space, and space-to-ground). The link segment accomplishes this via the electromagnetic spectrum or terrestrial links

to perform space operations as well as sustain terrestrial and on-orbit space capabilities. The link segment also provides the ability to operate various ground-based systems remotely; send commands to and receive telemetry and tracking data from on-orbit spacecraft; and command and control distributed forces within the space architecture.

The link segment is composed of a compilation of services provided by organic and non-organic (e.g., commercial) organizations. The link environment is contested and congested, complicated or disrupted by directed cyberspace attacks or signal interruptions resulting from natural, adversarial, or friendly electromagnetic interference. Sustainment of the link segment requires well-defined requirements implemented in service-level agreements combined with strong relationships and cooperation with allies and partners to maintain robust link architectures. Link segment sustainment plans should consider the link segment as operating in degraded environments and include recovery actions, considerations for alternate routing, and redundant systems. The plans should mitigate risks by incorporating primary, alternate, contingency, and emergency plans. The Space Force relies heavily on processes put in place by service providers and agreements to complete its mission objectives across the competition continuum.

Link Connectivity

Signal interference and congested frequencies are significant concerns resulting from the increasingly congested and contested space domain. Organizations such as the Space Development Agency are working to deliver low-latency, reliable connectivity for the warfighter through development of modernized waveforms and software defined solutions. Opening up secure lines of communication via new waveforms will allow warfighters to utilize uncompromised communications capabilities across the battlespace.

Successful sustainment of space capabilities across all three segments depends on the integration of sustainment processes with operations. From a sustainment perspective, the Space Force is responsible for those aspects of military operations required to deliver the required capabilities to the JFC. These include design and development; acquisition, storage, movement, distribution, maintenance, and disposition of materiel; acquisition or construction, maintenance, operation, and disposition of facilities; and acquisition or furnishing of services for space assets and personnel. Currently, the Air Force augments these activities with personnel and other support to include legal, religious affairs, finance, contracting, weather, and mortuary affairs. Other programs offered include equal opportunity and diversity, medical readiness and health programs, family advocacy and readiness programs, sexual assault prevention and response; base services, such as exchanges and commissaries; and morale, welfare, and recreation programs.

Challenges to Space Sustainment

The Space Force faces a number of challenges in the sustainment of terrestrial and on-orbit space systems. The ability of the acquisition and sustainment communities to address these sustainment challenges is crucial to mission success in providing enduring space capabilities to the joint force. Challenges specific to space operations include, but are certainly not limited to, high-demand, low-density (HDLD) nature of space capabilities, aging systems, and rapid fielding processes currently being implemented to modify existing capabilities or add new capabilities.

a. **High Demand, Low Density Capabilities.** The HDLD nature of space capabilities can make sustainment activities particularly challenging for systems throughout their lifecycles. The Space Force, when acquiring new systems, should focus on the supportability of the required space capability to emphasize sustainment during the system design and development. This should also be a key component during development of every mission's concept of operations to ensure the Space Force fields new systems with unique sustainment functions and features (e.g., refueling, docking, and upgrade interfaces and capabilities) in mind, and with the correct critical infrastructure configuration to support mission readiness. For legacy systems, sustainment activities are particularly challenging due to them operating well beyond their initial design life. Sustainment activities such as system upgrades, modifications, or normal maintenance activities require proper coordination between operators, users, and sustainment professionals to minimize operational impacts and ensure proper mission coverage during those events. Logistics planners should establish controls to maintain minimum stock level and contracts for fabrication of the items even when the items are no longer available. Future designs should consider flexible line replaceable units and easily upgraded software, where possible.

b. **Aging Space Systems.** The Space Force typically retains capabilities in the inventory well beyond their projected life expectancy; some operational systems are over 50 years old. The Space Force also repurposes a number of space assets to provide additional capabilities or meet new mission requirements in lieu of starting new acquisitions. Aging systems and support infrastructures being past their intended lifespan results in them experiencing obsolescence and diminishing manufacturer resources. It is also driving materiel shortages and cybersecurity issues while hindering the ability to keep up with new requirements. As these technologies continue to grow older, training and replenishing manpower becomes particularly difficult because the required expertise no longer matches available skills.

c. **Rapid Fielding Programs.** The Space Force often uses rapid fielding processes to upgrade or modify existing capabilities, which drives adjustment to the existing sustainment tail to match the new sustainment posture. Rapid fielding programs also enable the accelerated delivery of new capabilities needed to stay ahead of evolving threats. It is important for sustainment professionals to plan for sustainment obstacles and employ innovative approaches during acquisition to enable the system's sustainment capabilities to evolve after initial fielding to fulfill operational needs more effectively.

Examples include use of reliability growth strategies, implementation of resilient infrastructure coordinated with existing base support agencies, technology insertion, interim contractor support, and incremental or follow-on deliveries of sustainment items and documentation. A lifecycle sustainment plan should document how sustainment will be performed for rapid fielding programs. The plan should include funding the sustainment of these systems through the Future Years Defense Program.

d. Early Use prior to Operational Acceptance. Early use is another sustainment consideration a logistician should factor into their support strategy. A combatant commander can request the use of an asset before the formal operational acceptance process is complete. While the formalized operational acceptance process is necessary to round out the Research, Development, Test, and Evaluation and O&M processes of standing up new systems, enabling flexibility in the employment of capabilities is imperative to the real-time success of space systems.

As the servicing Major Command (MAJCOM) for the Space Force in the continental United States, Air Force Materiel Command (AFMC) provides security, civil engineering, base operations support, installation and mission support, and materiel services to the Space Force. Sustainment planners should coordinate with the servicing MAJCOM supporting Space Force systems to ensure consideration regarding appropriate infrastructure and proper security forces for the system.

Chapter 4: Roles, Responsibilities, and Relationships

During the analysis that led to the creation of the USSF, Congress identified over 60 offices responsible for elements of space policy, oversight, and guidance, with nearly 30 more who influence space architecture. We will work across the Department to unify and harmonize efforts.
Chief of Space Operations' Planning Guidance, 9 November 2020

The Space Force is a light, lean, and agile force focused on space operations. Its mission is to organize, train, and equip space forces in order to protect US and allied interests in space and provide space capabilities to the joint force. Space Force responsibilities include developing Guardians, acquiring military space systems, maturing military doctrine for space power, and organizing space forces to present to combatant commanders. Space sustainment should then focus on Space Force mission and readiness requirements while considering the interdependencies of internal and external support provided by the other services, commercial providers, and other DOD agencies. During its standup, the Space Force took a federated approach to differentiate sustainment roles and responsibilities between headquarters and field command levels. Headquarters will provide policy, guidance, oversight, enterprise planning, programming, and resourcing of organize, train, and equip functions. Field commands and component-field commands will develop, implement, field, and execute organize, train, and equip functions focused on readiness, training, and operations.

Office of the Chief of Space Operations

The Office of the Chief of Space Operations (OCSO) is comprised of four directorates: Human Capital, Operations, Strategic Requirements, and Technology and Innovation. The Mission Sustainment directorate (SF/S4O) reports directly to the Chief Operations Officer, as the service-level advisor for the sustainment of Space Force operations. The SF/S4O is responsible for standardization and normalization of space capability sustainment by developing and publishing sustainment policies and procedures that apply to all Space Force units; advocating for sustainment funding during budgeting decisions; working to improve space capability sustainment funding levels; and ensuring funding and planning of proper sustainment tails for new programs. The SF/S4O works closely with the Global Force Management and Readiness directorate (SF/S7O) to define and design sustainment metrics and readiness reporting; enhances collaboration between stakeholders; and develops infrastructure resilience requirements and security planning factors for future space capability.

a. **Space Systems Command.** SSC is one of the Space Force field commands responsible for developing, acquiring, equipping, fielding, and sustaining lethal and resilient space capabilities for warfighters. As part of fielding, SSC is responsible for developmental testing, launch operations, on-orbit checkout, sustainment, and maintenance of military

satellite constellations, their supporting ground stations, and other DOD space systems. This includes, but is not limited to the following sustainment activities:

- Develop and update life cycle sustainment plans
- Manage weapon system sustainment portfolios with Air Force Materiel Command
- Oversee the SAML portfolio of services and capabilities
- Ensure contracts include surge capabilities and adequate response times for increased flexibility
- Procure launch services and delivering on-orbit capabilities for warfighters, combatant commanders, intelligence, civil and commercial sectors, as well as responsibility for range sustainment programs supporting launch and test
- Manage acquisition lifecycle from research and development, to prototyping, to production line systems
- Ensure interoperability of space systems across mission portfolios and systems

b. Space Operations Command. SpOC is the Space Force field command charged with generating, presenting, and sustaining combat-effective warfighting capabilities to US Space Command. More specifically, pertaining to mission sustainment, SpOC is responsible for the following:

- Human capital issues to include organizational change requests; manpower recommendations; promotions; and Guardian/Airman development, evaluations, and recognition
- Maintenance and sustainment support, logistics, compliance, and resilience of fielded space mission systems and weapon systems
- The delivery, integration, and sustainment of capabilities generated and employed at the Space Delta and/or Space Force component levels
- Interlinking Space Deltas, Space Base Deltas, Mission-Area Teams, and Program Managers to optimize reliability, maintainability, and survivability of our fielded systems while improving and tracking the readiness posture of critical installation capabilities, which directly support our space missions
- Overseeing the delivery and sustainment of battle management command, control, and communications capability solutions at the Deltas and combatant commands
- Performing validation and verification analysis supporting operations acceptance decisions for new or modified space domain awareness sensor systems and space domain awareness command and control systems capabilities
- Managing and executing the Advanced Concepts and Missions Process to assess, sponsor, and transition new and innovative technologies/concepts through the process to programs of record and warfighter operations

- Development, assessment, and reporting of infrastructure resilience requirements, to include uninterruptable power supplies, for space task critical assets

c. **Space Training and Readiness Command (STARCOM).** STARCOM prepares combat-ready forces to fight and win in a contested, degraded, and operationally-limited environment through the deliberate development, education and training of space professionals; development of space warfighting doctrine, tactics, techniques, and procedures; and the test and evaluation of Space Force capabilities. More specifically, respective STARCOM Space Deltas perform the following missions:

- Develop Guardians through a career-long continuum of innovative basic military, initial skills, and advanced training courses as well as Space Force and joint exercises
- Deliver realistic, threat-informed test and training environments through the provision of live, virtual, and constructive range and combat replication capability
- Develop Space Force doctrine and tactics, conduct the Space Force Lessons Learned Program, and execute and support wargames
- Deliver institutional developmental education
- Develop Space Force officer accessions
- Execute advanced education programs in order to prepare Space Force forces and designated joint and allied partners
- Conduct independent test and evaluation of Space Force capabilities and delivery of timely, accurate, and expert information in support of space capability acquisition, operational acceptance, and readiness decisions

Other Department of Defense (DOD) Organizations

In addition to those within the Space Force, a number of other organizations fulfill roles that contribute to the sustainment of space capabilities.

a. **Air Force Materiel Command (AFMC).** In order to implement the vision of a light, lean, and agile force focused on space operations; reduce costs; and avoid duplication of effort, the Space Force obtains the majority of its enabling functions from the US Air Force. AFMC, as the designated servicing MAJCOM, is the primary source for infrastructure, logistics, base operating support, security, medical services, and a host of other common capabilities. This support relationship varies dependent upon whether the unit is located on a Space Force or Air Force installation. For Space Force units on Space Force installations, AFMC coordinates directly with OCSO and provides logistics support to the Space Base Delta or Space Launch Delta. For Space Force units on Air Force installations, the host wing supports those units through the base Mission Support Group.

b. **Air Force Research Laboratories (AFRL).** AFRL leads the discovery, development and integration of affordable warfighting technologies for DOD air, space, and cyberspace forces. In addition, AFRL coordinates and collaborates with academia and industry. AFRL enables the Space Force to leverage emerging and future technologies to

define current and future space sustainment efforts. Space Force performs these through existing relationships and forums with program offices and staff in SSC and SpOC.

Intelligence Community, Other US Government Agencies, Allies, and Commercial Partners

The 2018 National Military Strategy acknowledges the unique contributions of allies and partners, a strategic source of strength for the joint force. Building strong, agile, and resilient sustainment abilities requires better interoperability to enhance the combat lethality and survivability of our allied and partner space capabilities. Our allies and partners provide complementary capabilities and forces along with unique perspectives, regional relationships, and information that improve our understanding of the environment and expand our options. Allies and partners also provide access to critical regions, supporting a widespread basing and logistics system that underpins global reach. The Space Force should integrate and synchronize sustainment with operations at every level, to include those of our joint and multinational partners. Sustainment depends on joint and multinational strategic links for strategic airlift, sealift, intra-theater airlift, rail systems, ports of debarkation/embarkation (sea and air), and strategic and theater-level supply support. Sustainment also depends on host-nation partners to provide infrastructure and logistics support necessary to deliver both maneuver forces and follow-on sustainment to the right place, at the right time, and in an operable condition. Where appropriate, military space sustainment efforts should be coordinated with the Intelligence Community, civil, and commercial space programs. These can include the National Reconnaissance Office, National Aeronautics and Space Administration, and a host of commercial space systems developers. The Space Force benefits from government and commercial partnerships to enhance capabilities in space launch and space sustainment. The In-Space Servicing, Assembly, and Manufacturing (ISAM) National Strategy exemplifies the coordination of several US Government entities in developing current strategy relevant to space systems sustainment. This strategy outlines how the US will support and stimulate the US Government academic and commercial ISAM capability development. It provides strategic goals to advance ISAM capability development discussed in the US Space Priorities Framework.

Appendix A: Acronym Listing

AFMC	Air Force Materiel Command
AFRL	Air Force Research Lab
AOR	area of responsibility
DAF	Department of the Air Force
DOD	Department of Defense
GPS	Global Positioning System
HDLD	high demand, low density
HN	host nation
HNS	host-nation support
ISAM	in-space servicing assembly and manufacturing
JFC	joint force commander
MAJCOM	Major Command
MTA	middle tier of acquisition
O&M	Operations and Maintenance
OCSO	Office of the Chief of Space Operations
ODMSP	Orbital Debris Mitigation Standard Practices
OE	operational environment
POL	petroleum, oil, and lubricant
RAM	reliability, availability, and maintainability
RCO	Rapid Capabilities Office
SAML	space access, mobility, and logistics
SDP	Space Doctrine Publication
SF/S4O	Space Force Mission Sustainment Directorate
SF/S7O	Space Force Global Force Management and Readiness Directorate
SFB	Space Force Base
SWAC	Space Warfighting Analysis Center
SpOC	Space Operations Command

SSC	Space Systems Command
STARCOM	Space Training and Readiness Command
TT&C	telemetry, tracking, and commanding
US	United States
USSF	United States Space Force

Appendix B: Applicable Strategic and Planning Guidance, Policy, and Doctrine

1. **Interim National Security Strategic Guidance, March 2021** – Identifies National Security Priorities as an obligation to protecting the security of the American people, enduring interest in expanding economic prosperity and opportunity, and a commitment to realizing and defending the democratic values at the heart of the American way of life. Promotes doing this, in part, by reinvigorating and modernizing alliances and partnerships around the world.
2. **Fact Sheet: 2022 National Defense Strategy** – Consistent with the President's Interim National Security Strategic Guidance, the classified National Defense Strategy sets out how the DOD will contribute to advancing and safeguarding vital U.S. national interests – protecting the American people, expanding America's prosperity, and realizing and defending our democratic values.
3. **2018 National Military Strategy** – Provides the Joint Force a framework for protecting and advancing US national interests. Pursuant to statute, it reflects a comprehensive review conducted by the Chairman with the other members of the Joint Chiefs of Staff and the unified combatant commanders.
4. **Defense Space Strategy Summary, June 2020** – Identifies how DOD will advance spacepower to enable the DOD to compete, deter, and win in a complex security environment characterized by great power competition.
5. **National Space Strategy Fact Sheet, 2018** – The National Space Strategy prioritizes American interests, ensuring a strategy that will make America strong, competitive, and great. The strategy features four "essential pillars" that constitute a whole-of-government approach to United States leadership in space, in close partnership with the private sector and our allies.
6. **United States Space Priorities Framework, December 2021** – The Space Priorities Framework outlines the White House's space policy priorities, including addressing growing military threats and supporting "a rules-based international order for space." It guides the National Space Council's efforts to develop and implement national space policy and strategy.
7. **Space Capstone Publication, 10 August 2020** – The capstone doctrine for the United States Space Force and represents the Service's first articulation of an independent theory of spacepower. This publication answers why spacepower is vital for our Nation, how military spacepower is employed, who military space forces are, and what military space forces value.
8. **Chief of Space Operations' Planning Guidance, 2020** – Provides foundational direction for the Space Force to advance National and DOD strategic objectives. This authoritative Service-level planning guidance supersedes previous guidance and provides the context and outline for our new Service design.
9. **Joint Publication 3-14, Space Operations** – This publication provides fundamental principles and guidance to plan, execute, and assess joint space operations. 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 JFCs, and prescribes joint doctrine for operations and training.

10. **DOD Guide for Achieving Reliability, Availability, and Maintainability (August 3, 2005) –** This guide addresses RAM as essential elements of mission capability. It focuses on what can be done to achieve satisfactory levels of RAM and how to assess RAM.
11. **Orbital Debris Mitigation Standard Practices (November 2019 Update) –** The US Government Orbital Debris Mitigation Standard Practices (ODMSP) were established in 2001 to address the increase in orbital debris in the near-Earth space environment. The goal of the ODMSP was to limit the generation of new, long-lived debris by the control of debris released during normal operations, minimizing debris generated by accidental explosions, the selection of safe flight profile and operational configuration to minimize accidental collisions, and post-mission disposal of space structures. This 2019 update includes improvements to the original objectives as well as clarification and additional standard practices for certain classes of space operations.
12. **DODI 5000.80, Operation of the Middle Tier of Acquisition –** This issuance describes the responsibilities of principal acquisition officials and the purpose and key characteristics of the middle tier of acquisition (MTA) acquisition pathway. The MTA pathway is intended to fill a gap in the defense acquisition system for those capabilities that have a level of maturity to allow them to be rapidly prototyped within an acquisition program or fielded, within five years of MTA program start. The MTA pathway may be used to accelerate capability maturation before transitioning to another acquisition pathway or may be used to minimally develop a capability before rapidly fielding.
13. **DODI 5000.81, Urgent Capability Acquisition –** This supplement provides AF guidance for the acquisition of capabilities fulfilling Joint Urgent Operational Needs, Joint Emergent Operational Needs, and Urgent Operational Needs.
14. **DODD 5000.71, Rapid Fulfillment of Combatant Commander Urgent Operational Needs –** Establishes the Warfighter Senior Integration Group as a standing DOD-wide forum to: (1) Lead and facilitate agile and rapid responses to combatant commander urgent operational needs, and to recognize, respond to, and mitigate the risk of operational surprise associated with ongoing or anticipated near-term contingency operations. These urgent operational needs include joint urgent operational needs , and joint emergent operational needs identified by combatant command. (2) Facilitate the resolution of other urgent warfighter issues as identified by the Co-Chairs of the Warfighter Senior Integration Group.
15. **In-Space Servicing, Assembly, and Manufacturing National Strategy (April 2022) –** This document provides an interagency strategy to guide US Government direction for ISAM. The Office of Science and Technology Policy formed an interagency working group, in collaboration with the National Space Council, for which this is the product. This ISAM National Strategy directly supports the US Space Priorities Framework, with a focus on

scientific and technological innovation, economic growth, commercial development, the rule of law, open markets, freedom of navigation, and fair trade.

Appendix C: Glossary

Adversary — A party acknowledged as potentially hostile to a friendly party and against which the use of force may be envisaged. (JP 3-0)

Alliance — The relationship that results from a formal agreement between two or more nations for broad, long-term objectives that further the common interests of the members. (JP 3-0)

Area of Responsibility — The geographical area associated with a combatant command within which a geographic combatant commander has authority to plan and conduct operations. (JP 1)

Armed Conflict — Situations in which joint forces take actions against a strategic actor in pursuit of policy objectives in which law and policy permit the employment of military force in ways commonly employed in declared war or hostilities. (JDN 1-19)

Competition Below Armed Conflict — Situations in which joint forces take actions outside of armed conflict against a strategic actor in pursuit of policy objectives. These actions are typically nonviolent and conducted under greater legal or policy constraints than in armed conflict but can include violent action by the joint force or sponsorship of surrogates or proxies. (JDN 1-19)

Competition Continuum — A world of enduring competition conducted through a mixture of cooperation, competition below armed conflict, and armed conflict. (JDN 1-19)

Cooperation — Situations in which joint forces take actions with another strategic actor in pursuit of policy objectives. (JDN 1-19)

Debris — For space, refers to any spacecraft or artificial satellite (e.g., a rocket body) in orbit that no longer serves a useful purpose. (SCP)

Host Nation — A nation which receives forces and/or supplies from allied nations and/or North Atlantic Treaty Organization to be located on, to operate in, or to transit through its territory. (JP 3-57)

Joint — Connotes activities, operations, organizations, etc., in which elements of two or more Military Departments participate. (JP 1)

Link Segment — Comprises the signals in the electromagnetic spectrum that connect the terrestrial segment and the orbital segment. (SCP)

Logistics — Planning and executing the movement and support of forces. (JP 4-0)

Maintenance — 1. All action, including inspection, testing, servicing, classification as to serviceability, repair, rebuilding, and reclamation, taken to retain materiel in a serviceable condition or to restore it to serviceability. 2. All supply and repair action taken to keep a force in condition to carry out its mission. 3. The routine recurring work required to keep a facility in such condition that it may be continuously used at its original or designed capacity and efficiency for its intended purpose. (JP 4-0)

Multinational — Between two or more forces or agencies of two or more nations or coalition partners. (JP 5-0)

Operational Environment — A composite of the conditions, circumstances, and influences that affect the employment of capabilities and bear on the decisions of the commander. Also called **OE.** (JP 3-0)

Orbit — Any path through space an object follows based on the pull of gravity. While orbits are commonly depicted as circular or elliptical paths, orbits can be repeating or non-repeating. (SCP)

Orbital Segment — Consists of a spacecraft in orbit beyond Earth's atmosphere. Depending on the application, spacecraft can be remotely piloted, crewed, or autonomous. (SCP)

Partner Nation — 1. A nation that the United States works with in a specific situation or operation. (JP 1) 2. In security cooperation, a nation with which the DOD conducts security cooperation activities. (JP 3-20)

Reconstitution — Actions taken to rapidly restore functionality to an acceptable level for a particular mission, operation, or contingency after severe degradation. (JP 3-14)

Resources — The forces, materiel, and other assets or capabilities apportioned or allocated to the commander of a unified or specified command. (JP 1)

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. 3. The ability of a space asset to contribute to a mission from seabed to the space domain. (JP 3-14)

Spacecraft — An object which has been engineered to be controlled and deliberately employed in order to perform a useful purpose while traveling in, from, and to the space domain. (SCP)

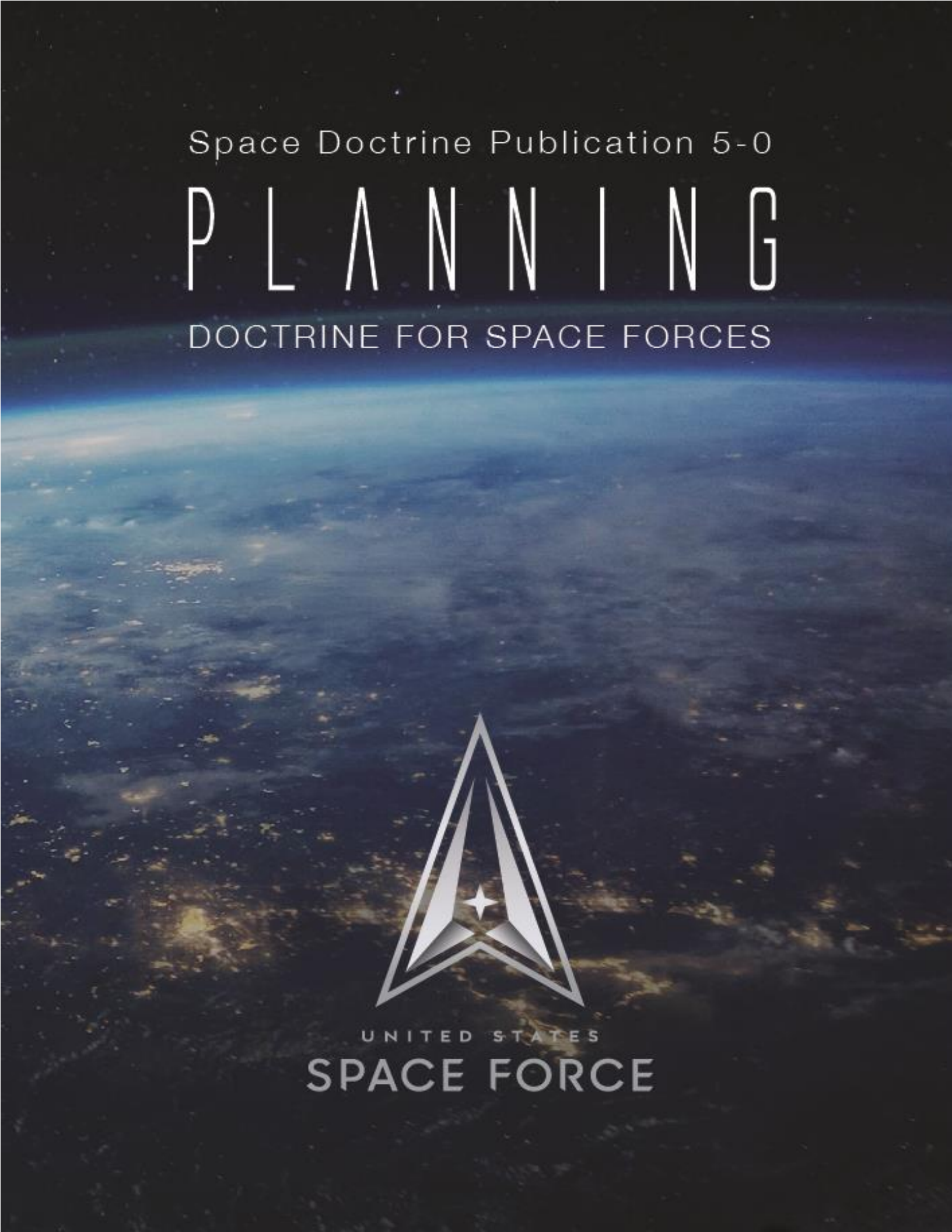
Sustainment — The provision of logistics and personnel services required to maintain and prolong operations until successful mission accomplishment. (JP 3-0)

Terrestrial Segment — Encompasses all the equipment within the terrestrial domains required to operate or exploit a spacecraft. This includes control stations, antennas, tracking stations, launch sites, launch platforms, and user equipment. (SCP)

Space Doctrine Publication 5-0

PLANNING

DOCTRINE FOR SPACE FORCES



UNITED STATES

SPACE FORCE

Space Doctrine Publication (SDP) 5-0, *Planning*

Space Training and Readiness Command (STARCOM)

OPR: STARCOM Delta 10

DEC 2021

Foreword

United States Space Force (USSF) doctrine guides the proper use of military spacepower in support of the Service's cornerstone responsibilities. It establishes a common frame of reference on the best way to plan and employ USSF forces as part of a broader Joint Force. This doctrine provides official advice, and describes how to execute and leverage spacepower utilizing its core competencies. It is not directive—rather, it provides Guardians an informed starting point for decision-making and strategy development.

Space Doctrine Publication (SDP) 5-0, *Planning*, aligns with current USSF doctrine and the Joint Planning Process (JPP) in accordance with the Chief of Space Operations' Planning Guidance. It articulates best practices and lessons learned for spacepower planning by today's Guardians while highlighting planning considerations unique to space operations. SDP 5-0 marks an initial step in transitioning service space doctrine from Air Force Doctrine Publication (AFDP) 3-14, *Counterspace Operations*, into USSF doctrine.

Strength and security in space enables freedom of action in other warfighting domains while contributing to international security and stability. Effective planning is critical for enabling military space forces to conduct prompt and sustained space operations that fulfill the cornerstone responsibilities of the USSF: preserve freedom of action, enable joint lethality and effectiveness, and provide independent options. USSF commanders and their staffs rely on objective-focused and integrated planning, combined with mission command to satisfy these responsibilities and strategic or higher headquarters guidance.

I encourage all Guardians to study and learn from the knowledge compiled in this publication. For the planners and would-be planners out there, we built this guidance for you, and it is you who will lead us as we plan and execute space operations. Semper Supra!

SHAWN N. BRATTON
Brigadier General, USAF
Commander, Space Training and
Readiness Command

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Chapter 1: Introduction

I am directing use of Joint planning methodology throughout the Space Force. In addition, we will template to Joint style, formats, and terminology unless explicitly required by DAF direction.
Chief of Space Operations' Planning Guidance, 9 November 2020

Purpose

This publication describes the Service's current body of knowledge for spacepower planning. By intention, it closely aligns with the JPP, but provides the Guardian's perspective on how to best organize and employ today's military space capabilities in support of joint force objectives. The approaches outlined within this publication are not static—lessons learned are at the heart of doctrine and, much like a plan, this body of knowledge is subject to continuous refinement, improvement, and expansion.

While commanders play the central role in military spacepower planning, they do not navigate the planning process alone. This document is a guide for Guardians when developing plans and providing resources in support of joint space operations. It provides considerations unique to spacepower planning. Commanders and their staffs who participate in spacepower planning at all levels should have an in-depth knowledge of the process described within this document and its complementary joint doctrine, Joint Publication (JP) 5-0, *Joint Planning*. The remainder of this document will refer to commanders and their staffs simply as "planners."

Planning

Planning involves understanding a situation, envisioning a desired future, and laying out effective ways of fulfilling future campaigns and operations. Military planning, by extension, is a comprehensive methodology that enables planners to make informed decisions, solve complex problems, and ultimately accomplish assigned missions. More specifically, it is a deliberate process of identifying military ways and means (with associated risk) the commander can utilize to implement strategic or higher headquarters guidance.

The planning process can either be highly structured and sequential, designed to achieve desired conditions or end states over extended timelines (campaign and contingency planning), or compressed and parallel, designed to meet objectives as dictated by shorter timelines (crisis planning). Regardless of time horizons, to enable success, the planning process allows for continuous learning and plan refinement.

Planning and the Levels of Warfare

The three levels of warfare—strategic, operational, and tactical—define and clarify the relationships among objectives, the operational approach, and tactical action. There are no

finite limits or boundaries between these levels; they help commanders visualize a logical arrangement and synchronization of operations, allocate resources, and assign tasks to the appropriate command. Given the inherent interrelationships among the levels of warfare, commanders cannot be concerned with only those tasks associated with their respective echelon but must understand how their actions impact lower command echelons and contribute to the military end states established by political leaders and higher command echelons.

Planners need to understand the strategic, operational, and tactical-level effects generated during the application of spacepower. An organization or individual at any level is capable of generating an effect at any level of warfare; this is particularly true for effects generated by military spacepower, compelling planners to consider the potential for higher-level impacts when planning for the employment of these capabilities.

Planning and the Competition Continuum

Competition is a fundamental aspect of international relations. As states and non-state actors seek to protect and advance their own interests, they continually compete for strategic advantage through the instruments of national power. In most cases, the risks and costs of war compel the parties to compete with one another below the level of armed conflict. The actors instead adopt a combination of activities to achieve their strategic objectives and attain a desirable (or acceptable) strategic outcome without resorting to armed conflict. Rather than a world either at peace or at war, the competition continuum describes a world of enduring strategic competition conducted through a mixture of cooperation, competition below the level of armed conflict, and armed conflict. The planning process adopted by Guardians differs minimally throughout the competition continuum and it is the process that provides the consistency upon which success is achieved, irrelevant of where a state operates on the continuum. The key factors affected by the competition continuum are the time and speed at which action is required—this ultimately drives the pace of the planning process.

The continuum describes the environment in which commanders apply military power in conjunction with other instruments of national power (diplomatic, informational, and economic) to achieve national security objectives. This continuum recognizes that cooperation, competition below armed conflict, and armed conflict can occur simultaneously. Because the joint force rarely conducts operations without coalition partners, cooperation with allies and partners is a feature of nearly every significant military action. With cooperation and competition below armed conflict occurring almost continuously, the presence or absence of armed conflict is normally the only variable element.

Cooperation is usually an enduring activity with no discrete start or endpoint; relationships with allies or partners are purposefully developed to endure for the foreseeable future. Planners should combine an understanding of the environment with a realistic appraisal of each potential partner's objectives and the nature of their relationship with the United States (US) to derive a range of feasible and productive military options leading to sustainable and acceptable outcomes.

Competition below armed conflict also tends to occur over extended periods. To successfully operate through competition below armed conflict, commanders should adopt a long-term approach, which is flexible enough to react to rapid changes in the strategic environment. It is important to establish conditions to enable the maximum range of options to accommodate and respond to changing situations.

Upon escalation into armed conflict, Guardians serve as the nation's space warfighters under CCMD authorities. At the same time, planners should keep in mind that success in armed conflict still requires the skillful application of both cooperation and competition below armed conflict, and maintain a long-term view toward the transition period following the end of the main period of armed conflict.

First Principles for Spacepower Planning

Spacepower planning requires special considerations throughout the process. At the macro-level, a series of first principles informs these special considerations—objective-focused planning, integrated planning, and mission command. These first principles serve as broad and enduring guidelines for spacepower planning.

a. **Objective-focused Planning.** Objective-focused planning orients planning efforts to contribute to achieving national and military objectives. Planners should evaluate strategic guidance—to include national priorities and objectives—and analyze the operational environment (OE) to identify spacepower capabilities and effects to support the joint force. In short, spacepower planning should focus on desired outcomes to support strategic-level objectives rather than the capabilities or tactics employed to realize those outcomes.

b. **Integrated Planning.** Integrated planning aims to synchronize resources and integrate timelines, decision points, and authorities across commands to enable the achievement of objectives. Integrated planning allows for broad information sharing, consideration of all relevant factors, and coordinated action toward a common purpose by ensuring the right personnel from the right organizations are part of the planning process as early as possible. The complexity of space operations, which may include global, joint, multi-national, interagency, civil, and commercial aspects, increases when planned and conducted in support of multiple commands simultaneously. As a result, integration is imperative to effective spacepower planning. Planners should recognize the potential conflict between space operations that support terrestrial operations and those intended to defend space forces, and ensure continuous delivery of space effects to the joint force.

c. **Mission Command.** Mission command is a command and control (C2) approach to empower subordinate decision-making and facilitate decentralized execution. This approach preserves decision space, which permits lower echelons of command flexibility to adapt to and address the rapidly changing operational environment while maintaining the operational or strategic commander's intent. Mission command recognizes the

potential for uncertainty during planning and execution and allows freedom of action for lower-echelon commanders to exploit opportunities and counter threats. Application of this concept calls for planners to avoid overly restrictive C2 constructs and focus on the purpose of operations rather than the details of how subordinate echelons will execute assigned tasks.

The clear and concise communication of commander's intent—a *personally developed* expression of the purpose of the operation, the desired end state, and risk tolerance—is critical to the effective use of mission command. Commanders should use mission-type orders, when possible, to disseminate information and provide left and right bounds for lower-level commanders and subordinates to execute operations. Implementation of mission command will vary based on given situations, missions, and operating environments.

Keys to Effective Spacepower Planning

a. **Understanding Operations in the Space Domain.** A solid understanding of operations in the space domain, to include terrestrial, link, and orbital segments, is foundational to spacepower planning. Planners analyze each segment to detect threats to operations and identify ways to achieve positions of advantage. The terrestrial segment encompasses all the equipment within the terrestrial domains required to operate or exploit a spacecraft. Planners should understand the capabilities and effects terrestrial systems are capable of producing and consider them in the planning effort. The link segment comprises the signals in the electromagnetic spectrum that connect the terrestrial segment and the orbital segment. This provides potential avenues of attack for offensive or defensive cyber operations and electromagnetic warfare activities such as jamming. Understanding how network data is used, the timeliness of the data, pathways for the data, and related network infrastructure are critical responsibilities for staffs planning space operations. For the orbital segment, this includes identifying positions particularly vulnerable to space-to-space or ground-to-space attack and areas with heightened environmental risk (e.g., known debris fields or highly irradiated orbits). The orbital segment consists of a spacecraft in orbit beyond Earth's atmosphere. Attributes of orbital flight also impose unique characteristics to consider for spacepower employment.

   Use of standardized visualization tools and templates ensures a shared baseline knowledge of the environment and systems among planners. This is critical for streamlining communication of complex space concepts and ultimately facilitating effective planning. Additionally, planners should understand the shelf life of space plans might be shorter than plans in other domains due to rapidly evolving threats, competitors, and capabilities.

b. **Understanding the Strategic Environment of the Space Domain.** A comprehensive understanding of the strategic and operational environments of the space domain is a

prerequisite to effective spacepower planning. Space domain awareness (SDA) encompasses the effective identification, characterization, and understanding of any factor associated with the space domain that could affect space operations and thereby impact the security, safety, economy, or environment of the nation. Effective presentation of SDA requires the fusion of terrestrial, link, and orbital information from multiple sources to support understanding, exploitation, and decision-making. Additionally, SDA is based on continuous intelligence preparation of the operational environment (IPOE). The IPOE process analyzes all relevant aspects of the operational environment, including the adversary and other actors. IPOE focuses on providing insight of adversary capabilities and intent that aids the commander in anticipating future conditions and planners in identifying an adversary's most likely and most dangerous courses of action (COA).

c. **Classification and Releasability.** Space operations involve many levels of classification (e.g., alternative or compensatory control measures [ACCM], special access programs/special technical operations [SAP/STO], caveats, foreign disclosure), which further complicate plan integration and coordination. Without compromising security, planners should seek to reduce classification levels to the maximum extent possible to enable the greatest participation and integration.

d. **Risk Assessment.** Risk assessment requires sound military judgment and combines the likelihood of an event occurring with the severity of its projected impact. Commanders should be extremely familiar with their superior commander's intent, which forms the basis for making risk calculations. Mission-type orders should convey superior commanders' risk guidance and decision-approval authorities. This empowers subordinate commanders to assess risks and make decisions within their scope of authority.

   Planners conduct initial risk assessment during the mission analysis step of the planning process and continue to update it throughout the remainder of the process. A sound understanding of vulnerabilities that have the potential to interfere with successful space operations is a critical component of accurately rating risk assessments. While planners can never fully eliminate risk, quality risk assessment allows commanders to recognize acceptable risks and identify opportunities to gain advantages through planning.

e. **Risk Management.** Uncertainty and risk are inherent in all operations. The high cost of developing and launching on-orbit space systems, combined with the strategic necessity of the US maintaining a positive reputation in space, drive the need for effective risk management. Risk aversion can hinder rapid and agile responses required for space operations and prevent lower-echelon commanders from seizing opportunities to gain an advantage. Implementation of mission command mitigates this concern by recognizing the potential for uncertainty during planning and execution, allowing freedom of action for lower-echelon commanders to exploit opportunities and counter threats.

Understanding rules of engagement surrounding adversary hostile actions and self-defense—and avoiding adversary or friendly redlines—can improve effectiveness in spacepower planning while mitigating risk to an acceptable level.

f. **Multi-domain Considerations.** Spacepower planners should be wary of only considering space-based solutions to problems. In many situations, the most efficient, effective, or appropriate actions or responses will rely on effects created in, from, or through other domains. For example, the most effective way to protect a space capability may be through fires executed by terrestrial forces or effects on the link segments of space systems. The targets of these effects are likely to exist in multiple operational areas, requiring coordination across commands. Planning teams should consist of personnel with knowledge of available capabilities and maintain relationships necessary to coordinate the desired effects.

Introduction to the Space Planning Process

The Space Planning Process (SPP) drives spacepower planning. A derivative of the JPP, the SPP supports strategic, operational, and tactical-level planning; ensuring spacepower plans link to objectives and integrate operations with the actions of the joint force. To facilitate interoperability and common understanding, SPP terminology, products, and concepts are consistent with joint doctrine and compatible with sister-Service doctrine. In order to fully apply the SPP, planners should have an in-depth knowledge of JP 5-0.

An iterative process supported by continuous assessment (figure 1), the SPP assists planners in analyzing the OE and distilling a multitude of data and planning information. This provides commanders with a coherent framework for developing relevant objectives, effects, and tasks

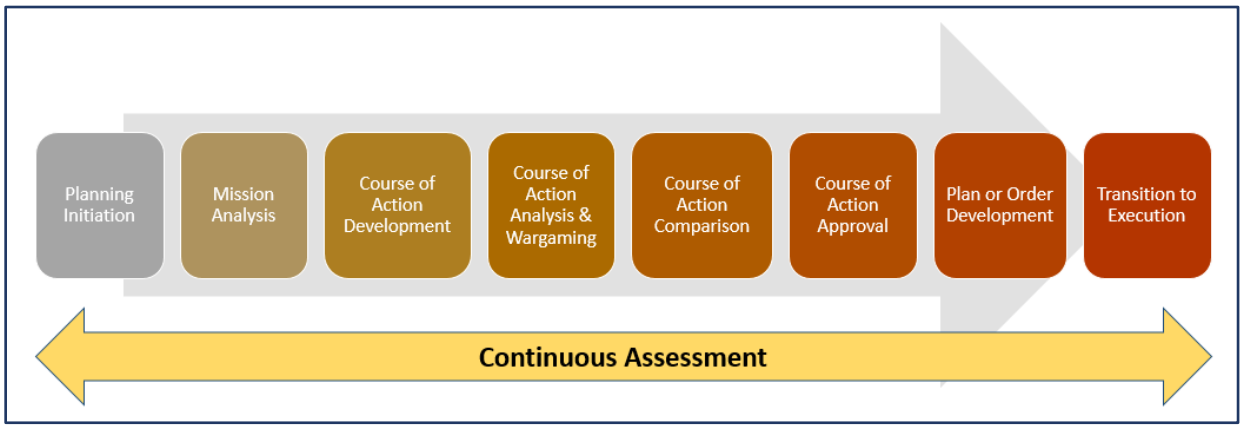

Figure 1. Space Planning Process

within acceptable levels of risk. This process adds clarity, sound judgment, logic, and professional expertise to identifying problems, developing solutions, and communicating direction.

The application of operational design and the employment of operational art provide context for decision making and the likely interaction of the aspects of a military problem. This ultimately enables planners to identify hazards, threats, consequences, opportunities, and risks for developing commander's intent, key tasks, and purpose statements.

Operational design is the analytical framework to conduct planning; it supports planners in organizing and understanding the OE as a complex interactive system. Operational design interweaves with the SPP to fill in gaps in guidance and information and provide a framework in which to plan. It enables planners to address the complexity of the OE; support mission analysis and COA development; and develop a concept of operations (CONOPS) with the highest likelihood of success. JP 5-0, *Joint Planning* identifies 13 elements of operational design that Guardians will employ to support spacepower planning.

Operational art, inherent in all aspects of operational design, is the cognitive approach used by planners—supported by their skill, knowledge, experience, creativity, and judgment—to develop strategies and operations for spacepower employment and organization. Operational art requires special consideration for the global nature and inherent strategic potential of space capabilities. Space operations can simultaneously affect tactical to strategic-level objectives in multiple areas of responsibility (AOR) and across other domains.

Joint Functions in the Space Planning Process

Joint functions are related capabilities and activities grouped together to help planners integrate, synchronize, and direct operations. In this context, a function is a group of tasks and systems (people, organization, information, and processes) united by a common purpose. Functions common to joint operations at all levels of warfare fall into seven basic groups: C2; intelligence; fires; movement and maneuver; protection; sustainment; and information. When properly integrated, spacepower enables and supports unified action through each of the seven joint functions.

Principles of Joint Operations in the Space Planning Process

Formed around the traditional principles of war, JP 3-0 describes the 12 principles of joint operations—objective, offensive, mass, maneuver, economy of force, unity of command, security, surprise, simplicity, restraint, perseverance, and legitimacy. These principles are time-tested general characteristics of successful operations and apply to the SPP. These principles serve as guides for the conduct of operations; provide planners a tool to analyze plans and operations; and ensure critical characteristics have been accounted for or that their absence is deliberate and not a matter of oversight. While not prescriptive nor equally applicable in all operations, the principles of joint operations represent characteristics that, when accounted for in plans and execution, positively affect the outcome of operations.

At a minimum, planners should leverage these principles as a basis for COA comparison as well as a tool for checking or evaluating plans before execution. Developing an understanding of and

the ability to apply these principles supports successful integration of spacepower into joint operations.

Chapter 2: Implementing the Space Planning Process

The SPP nests within the JPP and focuses on integration of space capabilities into operations to achieve overarching strategic and operational objectives. Further, it applies to both supported and supporting joint and combined forces' efforts to organize planning activities with common understanding of the mission and commander's intent. The SPP helps commanders understand and develop solutions to problems, anticipate events, adapt to changing circumstances, and prioritize efforts. Planners should reference JP 5-0, *Joint Planning,* for a general overview and additional background of JPP steps that correspond to SPP steps. This chapter concentrates on the specifics of spacepower planning.

The Space Planning Process

Depending on the scope of the framed problem, spacepower planning will likely encompass aspects of multiple spacepower mission areas and require knowledge of functional experts from across the staff. As such, the SPP employs one or more teams of functional experts (e.g., logistics, electronic warfare, orbital warfare, space battle management, intelligence, surveillance, and reconnaissance) and when required, external stakeholders (e.g., international partners, intelligence community [IC], adjacent commands). Spacepower planners should approach each step of the SPP in an integrated fashion to ensure all stakeholder interests are considered.

The SPP steps align with JPP steps with the addition of Step 8, Transition to Execution, and bring special considerations to the forefront of spacepower planning. The planning process should be responsive to guidance and feedback from commanders and informed by the OE, space domain awareness, observations, and assessments throughout the process.

Step One: Planning Initiation. Spacepower planning begins when an appropriate authority issues planning guidance upon recognizing the potential to employ military capability in support of the Joint Force Commander's objectives or in response to a potential or actual crisis. USSF component commanders can also initiate planning on their own authority when they identify a planning requirement not directed by higher authority. When planning space operations, staffs should refer to applicable policies, strategies, and existing campaign and contingency plans to guide spacepower planning (see Appendix B). Planners will utilize their understanding of the provided direction, the OE, and other relevant factors to develop the commander's initial guidance and identify applicable planning directives (figure 2). The commander's initial guidance may specify initial planning timelines, describe the OE, and outline initial coordination requirements. Contingency planning focuses on the anticipation of future events while campaign planning assesses the current state of the OE and identifies how the command can shape the OE to deter crisis and support strategic objectives.

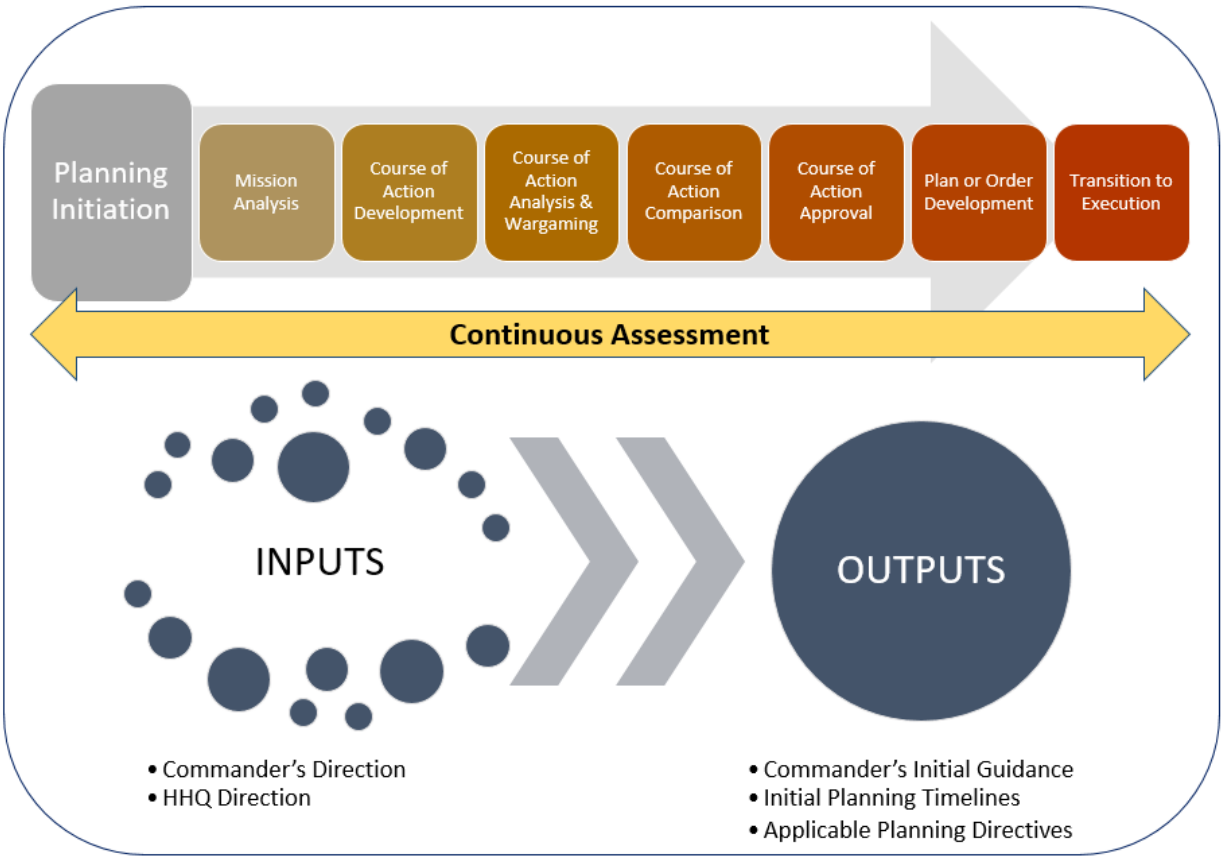

Figure 2. Planning initiation

Step Two: Mission Analysis. Mission analysis is used to study the assigned task and identify all other tasks to accomplish the mission. It focuses the commander and the staff on the problem at hand and lays a foundation for effective planning. Upon receipt of key outputs from Step One, planners use mission analysis to frame and study the problem; identify specified, implied, and essential tasks; and create the appropriate outputs as identified in figure 3. Planners provide the commander's intent, develop the commander's planning guidance, and develop a mission statement to facilitate subordinate and supporting commanders' initiation of their own estimates

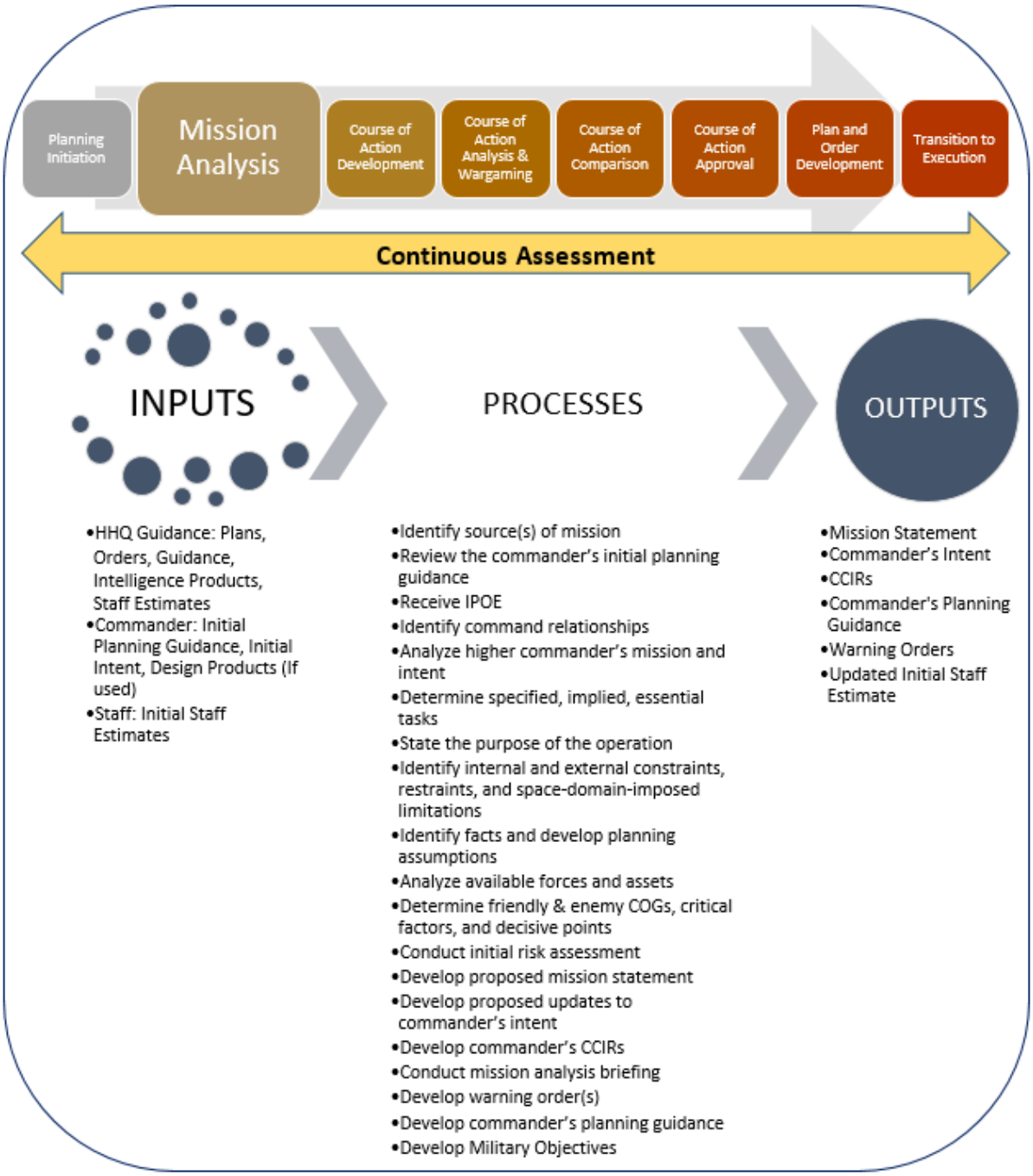

Figure 3. Mission analysis

and planning efforts. A warning order (WARNORD) initiates the development and evaluation of military COAs by a supported commander and requests that the supported commander submit a commander's estimate. Staffs also develop commander's critical information requirements (CCIR) and should account for operational limitations such as requirements or prohibitions imposed by higher authority (constraints and restraints) or other restrictions (e.g., diplomatic agreements, treaties, laws). A mission analysis brief should provide an updated understanding of the OE and the problem to solve.

a. Focus. Mission analysis focuses staff efforts on addressing specific topics related to the mission:

1) Define the purpose of space operations within the context of the mission statement
2) Identify required military spacepower core competencies
3) Align operational tasks with requisite spacepower disciplines
4) Identify CCIRs needed to accomplish the mission
5) Highlight potential limitations or gaps in capability
6) Produce an operational assessment strategy in coordination with mission partners
7) Identify friendly and neutral capability integration
8) Identify adversary threats to space capabilities

b. Initial Force Identification. Early in the mission planning process, planners should identify the necessary parties for both planning and execution activities. When characterizing the environment and identifying capabilities to support a mission, planners account for all stakeholder organizations, employing liaisons to augment planning functions. Planners should work to develop and maintain relationships with potential stakeholders across the space enterprise. Identifying and using liaisons early in the process allows staffs to plan and synchronize these capabilities with the desired scheme of maneuver.

c. Facts and Planning Assumptions. The planning team relies on known facts and assumptions throughout the planning process. Assumptions are required to address gaps in knowledge and are valid if they are logical, realistic, and essential for planning to continue. Planners should not assume away adversary capabilities or assume unrealistic friendly capabilities will be available. A planning team with diverse skillsets and knowledge of both friendly and adversary systems and capabilities, across classification levels, is key to providing the best possible COAs while minimizing the required assumptions.

d. Specified, Implied, and Essential Tasks. Planners use verbal or written tasks specified by higher echelon and commander's intent, desired effects, and concepts to derive specified, implied, and essential tasks. The commander and staff will typically review the planning directive's specified tasks and discuss implied tasks during planning initiation to resolve unclear or incorrectly assigned tasks with higher headquarters. If there are no issues, the commander and staff will confirm the tasks in mission analysis and then develop the initial mission statement. The mission statement describes the mission in terms of the elements of who, what, when, where, and why. The Military Spacepower Core Competencies create a framework to identify tasks within space operations and conduct spacepower planning, which likely involves planning across all five core competencies as seen in the anecdotal example in figure 4.

Planning Across Core Competencies (Example)

As an example, mission analysis of a mission objective or commander's intent stating, "preserve satellite communication (SATCOM) use over a specified geographic AOR" may result in the following specified and implied tasks for planners supporting that mission:

Space Security: Monitor and protect DoD, civil, commercial, IC, and multinational partner SATCOM assets over the specified AOR.

Combat Power Projection: Gain and maintain a desired level of freedom of action over the specified AOR. While defensive space operations may be used to maintain parity, consider offensive space operations if space superiority or supremacy are needed to achieve commander's intent.

Space Mobility and Logistics: Sustain all on-orbit SATCOM, combat power projection, and space domain awareness capabilities throughout the tasked period. Allow for commercial launch access throughout tasked period. Partner with Geographic CCMD to deliver in-theater capabilities.

Information Mobility: Provide long-haul and protected communications supporting the specified AOR.

Space Domain Awareness: Identify, characterize, and understand any factor, passive or active, that could affect SATCOM over the specified AOR. Maintain awareness of threats to on-orbit capabilities, to include space weather, space debris, and natural objects.

Figure 4. Planning across core competencies

e. Environment. Planners should consider the following challenges of the OE throughout the planning process:

1) Key Topology: Planners identify key topology in the physical domain, necessary to seize, exploit, and protect these physical regions. This methodology simplifies the

regions of concern, allowing creation of control measures such as area of operations. Key topology includes both lines of communications (LOC) for the movement and sustainment of space forces and the key orbital trajectories (KOT) upon which they rely. A LOC is any route that connects employed military forces with a base of operations and along which supplies and military forces move. Control of critical LOCs enables the timely repositioning, resupply, and reinforcement of military forces within the space domain. Planning teams may identify a KOT that must be secured and protected to maintain a critical LOC for a SATCOM asset, or a LOC required for sustaining or reconstituting a vulnerable spacecraft. LOCs supporting space operations may traverse multiple domains, to include the air, land, maritime, and cyberspace domains.

2) **Barriers to Access, Movement, and Recovery:** Orbital mechanics, atmospheric drag, solar radiation, space weather, availability of in-theater ground equipment, and access to logistics are examples of the shifting nature of the environment. Planners should also account for adversaries, which also influence the various domains and may have the ability to restrict access to, movement, or recovery of assets in orbit, on the ground, or in the electromagnetic spectrum (EMS). Each element of access, movement, and recovery is critical to continued success and progress of the larger strategy and execution of COAs. Due to this dynamic environment, a COA suitable today may not be feasible or logical in the future.

   The mechanics of orbital flight result in significant challenges for access to and movement within the space domain. For example, plane matching is a particularly challenging concept that requires either the ability to launch from the requisite latitude for the inclination to be achieved, or the expenditure of significant energy (fuel) to conduct inclination changes once on orbit. The time-distance problem is another challenging factor to consider in the planning process. Planners should understand considerations regarding changes in velocity (delta-V), differences in maneuvers based on the type of orbit (e.g., LEO, MEO, HEO), and energy considerations and their effects on the lifespan of a spacecraft.

3) **Hazards of Orbital Flight:** Planners should consider physical hazards to orbital flight, composed of spacecraft, satellites (e.g., orbital debris), and celestial bodies, prior to developing COAs. Identifying physical hazards that threaten friendly assets may levy significant operational limitations on planners. For example, the congested environment may preclude the use of certain capabilities, but also expose potential adversary vulnerabilities for exploitation.

4) **The Electromagnetic Spectrum:** The EMS is crucial to all space operations, incredibly complex in the operational environment, and utilized across the commercial enterprise and governmental organizations of each nation. With each nation potentially imposing different laws, rules, and authorities, it is imperative to

understand and operate effectively within this ecosystem. Additionally, planners should prepare for an adversary's attempts to deny friendly access to the EMS and develop primary, alternate, contingency, and emergency plans for all critical operations.

5) **Terrestrial Sites:** Space capabilities often rely on terrestrial equipment (terrestrial segment), which is not all based on US territory. Planners should recognize this limitation and plan for potential limited or loss of access to capabilities in these locations and identify suitable workarounds or solutions. In some cases, terrestrial access required for line-of-sight transmission may become limited due to adversary intervention, weather, maintenance, or other factors. Planners should account for these possibilities and take actions to maximize continuity of space capabilities. Conversely, planners should recognize that adversaries are subject to the same constraints and seek opportunities to create advantages as a result.

f. Commander's Planning Guidance. Commanders issue planning guidance to focus staff efforts based on analysis of the OE. This planning guidance provides a summary of the OE and the problem, along with a visualization of the operational approach, to the staff and to other partners. Refined or updated guidance should be provided as understanding of the OE, the problem, and visualization of the operational approach matures or, as required, to adapt to a changing OE or problem.

In addition to describing the strategic environment, describing the OE, defining the problem to be solved, and describing the operational approach, the commander's planning guidance should also include the commander's initial intent. The commander's initial intent describes the purpose of the operation, desired strategic objective, military end state, and operational risks associated with the operation. Commanders should consider mission command by providing intent that allows for decentralized execution. It should provide focus to the staff and enable subordinate and supporting commanders to take actions to achieve the military objectives or attain the end state without further orders, even when operations do not unfold or result as planned.

g. Staff Estimates. Staff estimates are initiated during mission analysis (problem framing) and evaluate how factors in a staff section's functional area support and impact the mission. During planning, staff estimates provide key facts and assumptions from the various staff sections; function and staff evaluations of various COAs; and the framework for sections and supporting annexes, appendixes, and tabs of the final order or plan.

h. CCIRs. CCIRs belong exclusively to the commander and serve to focus planning efforts and allocate resources. CCIRs consist of priority intelligence requirements (PIR) and friendly force information requirements (FFIR), all of which delineate elements of information the commander identifies as critical to timely decision making. PIRs focus on the adversary and the OE and drive the collection of information by all elements of a

command, requests for national-level intelligence support, and requirements for additional intelligence capabilities. FFIRs focus on information required to assess the status of the friendly force and supporting capabilities. Both commander-approved PIRs and FFIRs are automatically CCIRs.

It is important the space system segments (terrestrial, link, orbital), orbital regimes (geocentric, cislunar, solar), and three dimensions of the space domain (physical, network, cognitive) frame the CCIRs. A comprehensive understanding of these segments, regimes, and dimensions will provide commanders with a clearer view of the OE and support decision making later in the planning process. Commanders should continuously update CCIR lists throughout plan development, assessment, and execution based on the information required for decision making. CCIRs often relate to measures of effectiveness (MOE) and measures of performance (MOP). As part of continuous assessment, planners develop and refine MOEs and MOPs, which serve as indicators to measure progress towards an objective and ultimately, help commanders orient and execute their decision-making process. Planners should periodically reassess indicators throughout the process and validate or adjust them, as required.

i. **Employment Considerations.** Planners identify the capabilities needed to meet commander's intent and military end state in support of national objectives. While this can include 'alternative' capabilities not assigned, such as rapid prototypes, experimental systems, and re-purposed research and development systems, plans should only include capabilities available in the inventory during the development of the plan. If alternative capabilities are included, planners should initiate interaction with CCMDs early to increase likelihood of the system's approval for operational use. Planners consider the force sourcing process and level of readiness for these capabilities (to include training and CONOPS development) when creating the planning and execution timeline of these capabilities. Additionally, planners should coordinate with in-theater staffs early to deliver capabilities requiring terrestrial equipment in theater. During periods of direct conflict, or even in permissive environments, logistics may be limited based on location, so thoughtful and advanced planning is critical to the on-time delivery of a capability.

Step Three: Course of Action Development. A COA is a potential way (solution, method) developed to accomplish the assigned mission. It is an extension of strategy development using operational art and operational design. Staffs develop multiple COAs to provide commanders with options to attain the military end state. COA development considers all available capabilities necessary to arrive at the commander's desired end state. For each COA, visualize the employment of forces as a whole, taking into account constraints and restraints, the current or predicted OE, and the results of the mission analysis.

Planners should ensure all COAs meet the five validity criteria: suitable, feasible, acceptable, distinguishable, and complete. The COAs should include the adversary's most likely and most dangerous COAs. They should also address the requirements for supporting and supported forces from adjacent commands (e.g., other components, interagency, or multinational capabilities). This step in the SPP (figure 5) produces initial sketches and statements of proposed COAs, which describe how to accomplish the mission; what the objectives are; with which forces; and when, where, and why it will happen.

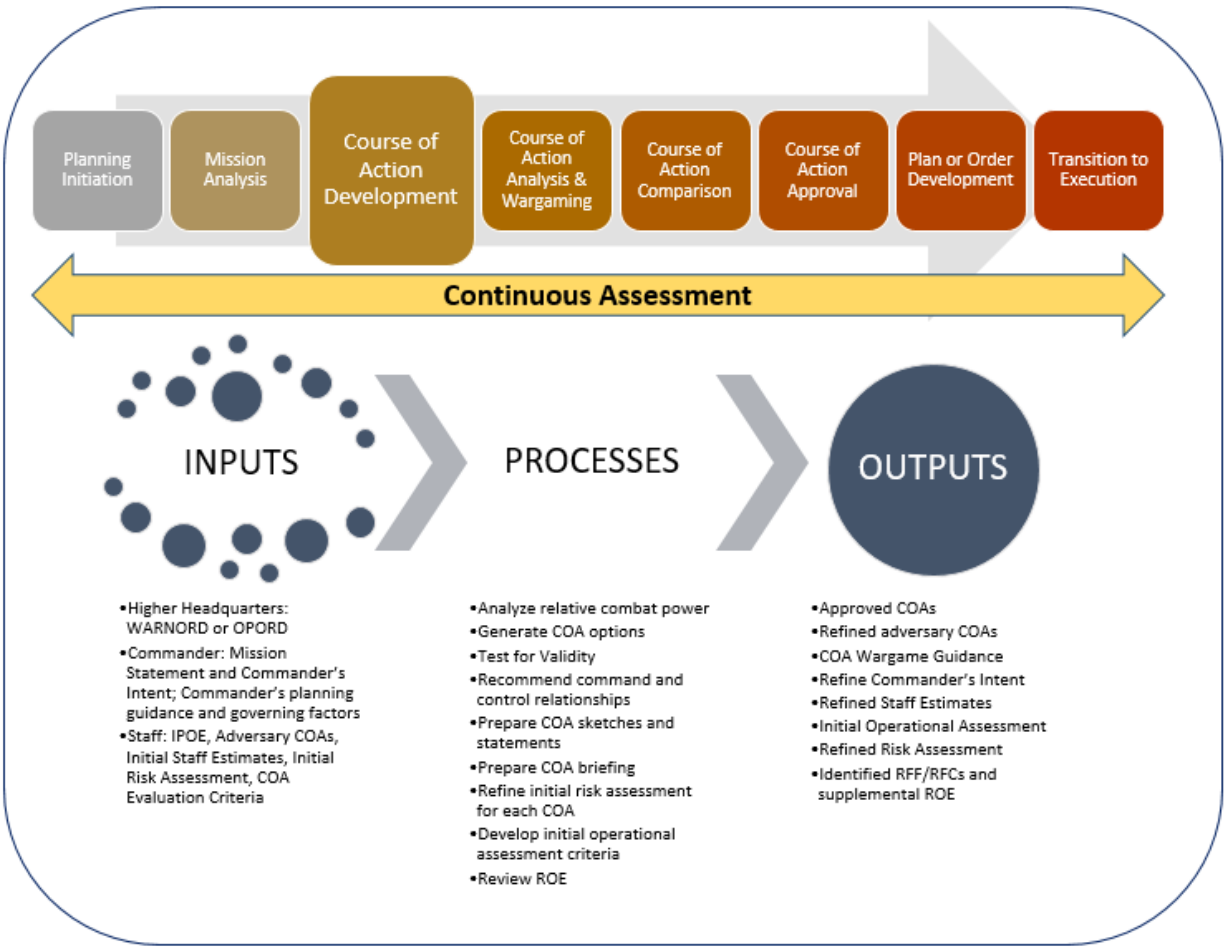

Figure 5. Course of action development

Planners should reference JP 5-0 for COA development techniques to consider when performing this step of the planning process. Some additional considerations for COA development during spacepower planning include:

a. **The Time-Distance Problem.** Creation of COAs that meet the five validity requirements requires an understanding of domain physics, to include the relationship between maneuver and mission duration. Generally, the amount of onboard propellant (fuel) is the primary factor that determines the usable lifespans of on-orbit assets. Maneuver in the orbital domain uses spacecraft propellant to achieve the energy state of the new desired orbit. In many cases, maneuvers accomplished over longer periods use less propellant, reducing the impact to the operational lifespan of the spacecraft. Conversely, a more rapid change to support operational needs may significantly increase the amount of propellant consumed, thus reducing the operational lifespan of the vehicle. For example, the most fuel-efficient way to transit a spacecraft from one operating location to another within the GEO belt is to conduct a relatively small maneuver and allow the spacecraft to drift to the new position (generally 2-5 degrees/day). At these rates, a significant location change may result in a spacecraft not providing service for days, weeks, or even months. In some cases, operational requirements may drive a commander to consider using more fuel to get to the new operating location sooner. Without sustainment activities (refueling), the amount of propellant used in one mission impacts the future mission capability of that system, a limitation to consider during COA development. Guardians consider this trade space to determine a COA's feasibility and acceptability relative to the mission's timing and tempo. Planners understand that a desired orbit may be infeasible for a spacecraft due to the difference in energy states, regardless of the timing component.

b. **Mission Impact.** Planners should always be cognizant of a COA's impact to the long-term mission and prioritize accordingly. For example, maneuvering a spacecraft may cause mission degradation or outage for a period. Planners should take measures to minimize negative effects resulting from the maneuver. Additionally, on-orbit assets generally support multiple AORs—during COA development, planners should consider and prioritize effects on all supported AORs. Similarly, some platforms support multiple missions or host multiple payloads, which require consideration and prioritization to determine the most acceptable impact to mission for each.

c. **Intended vs Unintended Effects.** Space operations are capable of creating effects that unintentionally exceed the planned levels of operation. As such, planners should consider intended and unintended consequences of each potential COA in development through a cognitive lens to understand the likely perception and reaction of friendly, neutral and adversary forces. A thorough understanding of the OE and an assessment of the intended and unintended effects is crucial in the analysis and comparison of COAs. For example, orbital engagement maneuvers conducted at the tactical level can have an

intended or unintended operational or strategic effect. Operational decisions of proximity or tactic selection may shape future norms of behavior or convey meaningful signals, whose interpretation by an adversary is difficult to predict.

d. Terrestrial Segment Access. Many space operations require access to or capabilities provided by terrestrial space assets situated in disparate locations across the globe. Logistics, geography, politics, weather, adversary input, etc. may hinder access to those capabilities. Spacepower planners should consider these potential barriers to delivering initial capability, shipping equipment, or moving replacement personnel. Adversary space systems are subject to the same access requirements, which planners may exploit to degrade, disrupt, or deny the adversary's access to space capabilities.

e. Control Measures and Visualizations. As part of COA development, planners establish a battlespace framework and control measures. Control measures increase operational effectiveness by promoting the safe, efficient, and flexible use of an operational domain or battlespace. Properly employed, a mix of procedural and positive control measures maximize operational effectiveness by deconflicting, integrating and coordinating operations without unduly restricting capabilities. Procedural control relies on a combination of common procedures and previously agreed-upon and disseminated orders while positive control enables precise decision-making, frequent updates, and quality control of maneuvers and tactics. For example, a SATCOM squadron may be authorized to conduct recurring station keeping maneuvers within a pre-designated operating window of the GEO belt (e.g., ½ degree) without higher-echelon approval (e.g., procedural control). Conversely, prior authorization from higher headquarters may be required for the same squadron prior to transiting that same spacecraft to another operating location in the GEO belt (e.g., positive control). Depicting control measures visually facilitates understanding and interpretability of different aspects of the plan. While not required for execution activities, staffs should create a synchronization matrix for wargaming purposes and aiding in development of the action, reaction, and counter-action process.

Step Four: Course of Action Analysis and Wargaming. COA analysis is the process of closely examining potential COAs to reveal details to enable planners to evaluate validity and identify advantages and disadvantages of each proposed COA. Planning teams develop COA evaluation criteria and use it to analyze each COA independently according to commander's guidance. COA analysis should not be cut short as it is a valuable use of time that ensures COAs are valid (figure 6).

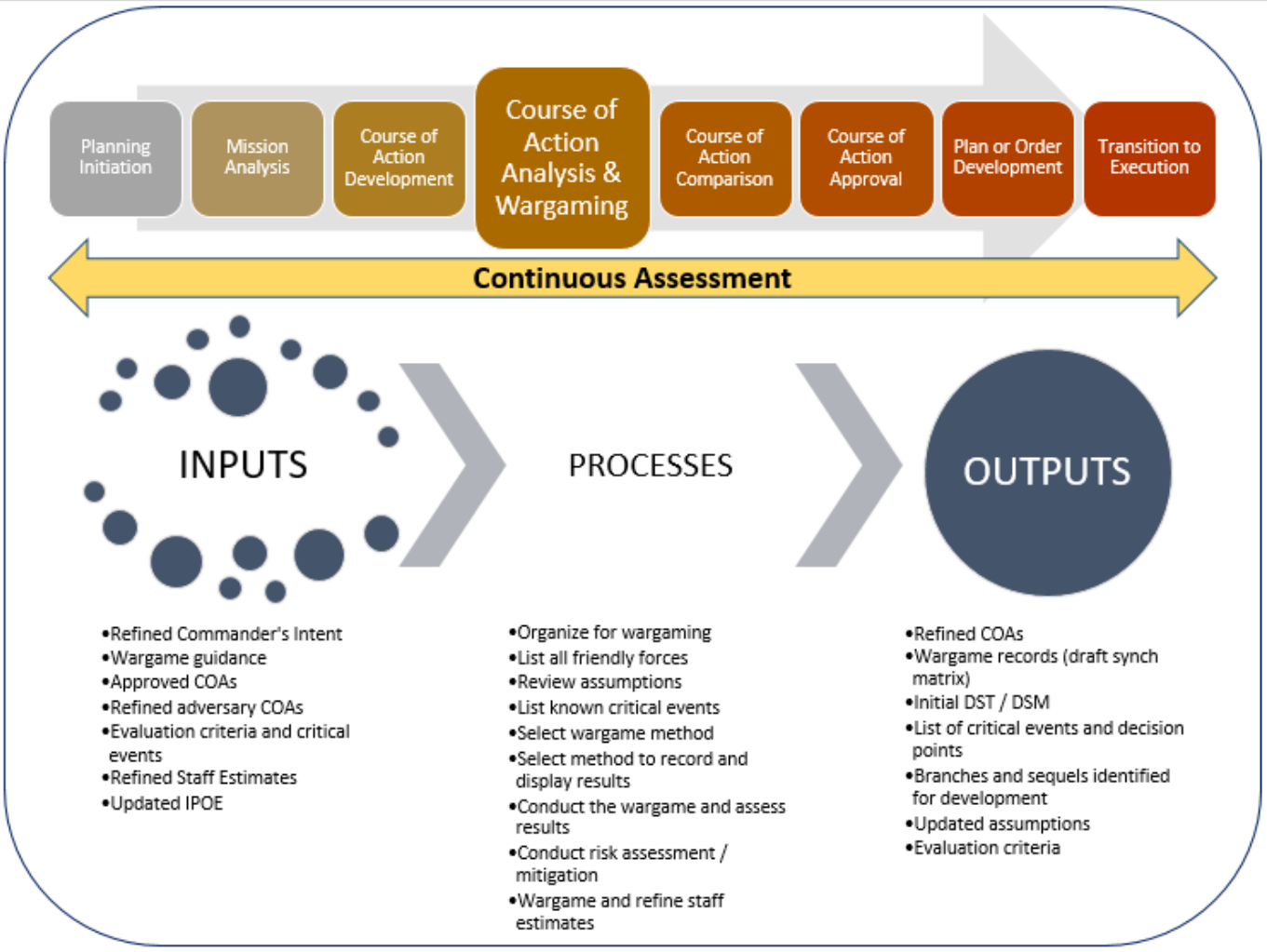

Figure 6. Course of action analysis and wargaming

Planners use wargames as a primary means for analyzing COAs. These wargames provide a benign environment where people make decisions and respond to the consequences of those decisions. Wargaming applies the friendly COAs against the adversary's most likely and most dangerous COAs, gaining valuable lessons learned for further COA analysis. Planners should wargame COAs independently to produce data for COA comparison afterward.

Depending on the complexity of the problem, wargaming for this step can vary across several activities including tabletop exercises or comprehensive modeling and simulation with dynamic

visualizations. Spacepower planners most commonly use tabletop exercises to wargame potential COAs unless model and simulation tools are readily available.

To portray the full range of realistic adversary space capabilities and options accurately, a red cell should role-play and model actions of adversaries and others during wargaming. The red team should include intelligence personnel and other subject matter experts with insight of adversary space capabilities and decision processes in order to integrate identification of weaknesses and vulnerabilities in COA analysis. Planners should continue to evaluate the feasibility of the COA throughout the wargame. A small white cell of arbitrators familiar with the plan should also be utilized to provide oversight to the wargame and conduct adjudication between the participants, as required. If resources permit, consider forming a separate "green cell" to role-play and model actions of others besides the adversary (e.g., neutral parties and red- or blue-aligned parties not participating in the wargame), composed of intelligence personnel and subject-matter experts with relevant insight on other potentially influential parties.

Spacepower planners can reference sample wargaming steps provided in JP 5-0. They should also be aware of the following potential limitations or pitfalls when wargaming COAs for space operations:

a. **Lack of precedents of adversary reactions and limited adversary space doctrine.** Historical examples of contested space operations are limited, thus creating a unique challenge for Guardians looking for best practices from past conflicts. In addition, access to published space doctrine among potential adversaries is limited. This challenge requires staffs to research given adversaries to understand cultural tendencies and geopolitical motivators in the context of space warfare at a deeper level when developing wargames. Staffs should make every effort to understand the cognitive dimension in the context of both competition and armed conflict in order to more accurately predict adversary reactions and provide a more realistic basis for wargame injects.

b. **Pre-conceived Outcomes.** Planners should guard against pre-conceived outcomes when wargaming proposed COAs. Pre-conceived ideas regarding specific COAs can cause an invalid or misinformed COA analysis (wargame) by failing to recognize a specific plan's strengths or weaknesses.

c. **Rapidly expanding nature of space technology and increase in space-faring nations**. The proliferation of space technology, its rapid advances, and rapidly expanding list of users and space-faring nations complicate the prediction of actions and reactions of neutral parties and potential adversaries. Wargame planners should pay particular attention to understanding the relevance and currency of adversary space capabilities and their use or dependence upon them.

d. **Failure to vet COAs fully**. Wargame administrators should fight the urge to escalate adversary response and end the wargame too quickly. When a wargame escalates too quickly, staffs may fail to thoroughly assess or fully vet quality COAs. Creating

additional iterations of the wargame can help overcome this potential weakness as new insights arise and COAs are measured through the full scope of the conflict. Similarly, wargame administrators should be cognizant of the tendency to initiate wargames too late into the timeline and miss opportunities to affect the battlespace early in a situation.

Step Five: Course of Action Comparison. COA comparison is both a subjective and objective process, whereby COAs are independently evaluated against a set of criteria established by the staff and commander (figure 7). The objective is to identify and recommend the COA that has the highest probability of successfully accomplishing the mission. COA comparison facilitates the commander's decision-making process by balancing the ends, ways, means, and risk of each COA. The key output from this step is identification of a preferred COA, as recommended by the staff, and development of a COA decision briefing that supports the overall COA recommendation to the commander.

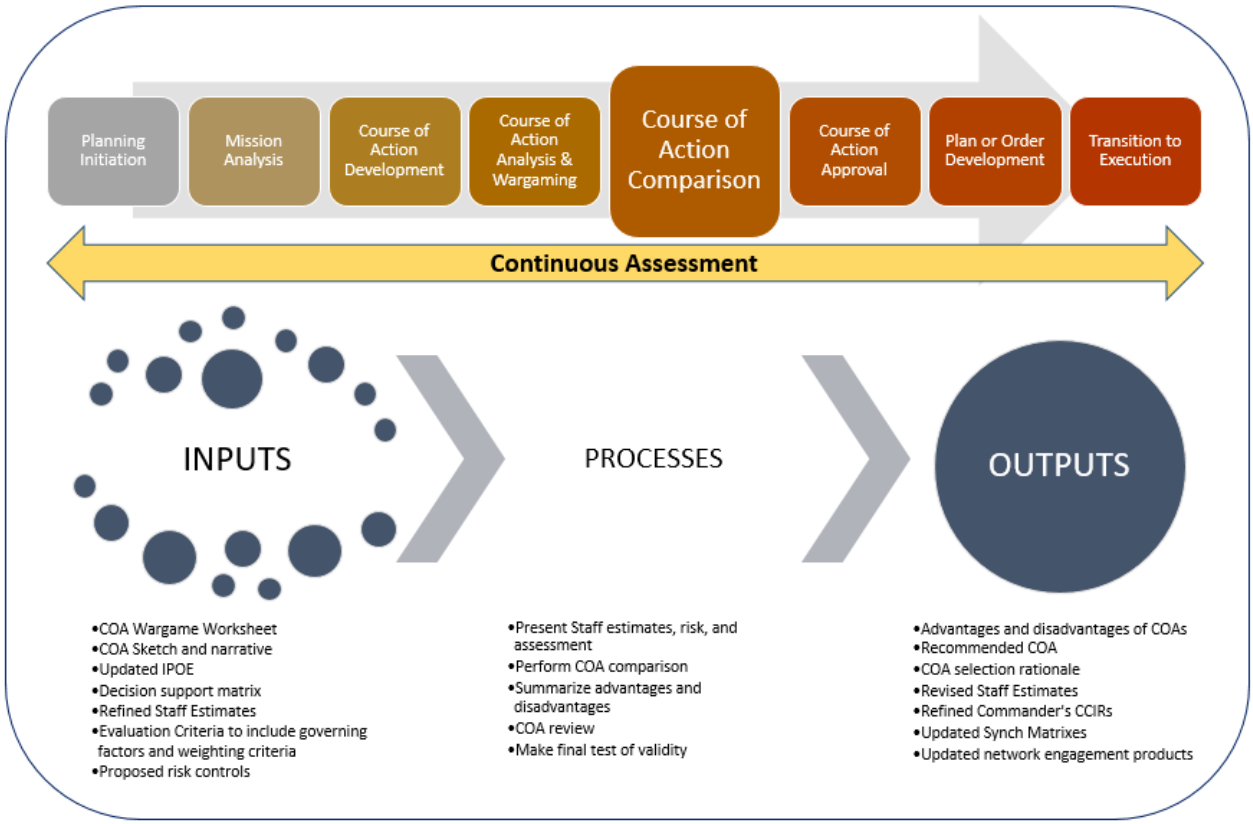

Figure 7. Course of action comparison

Staffs utilize the evaluation criteria and wargaming results from step 4 to compare and contrast the wargamed COAs, pinpoint the strengths and weaknesses of each, and identify a staff-recommended COA with the greatest likelihood of creating mission success. Staffs compare COAs against the identified evaluation criteria. Planning teams should not attempt to turn COA comparison into a mathematical process for determining the COA most likely to result in mission success. The focus should be informing commanders why one COA is preferred relevant to the

evaluation criteria and risk. This equips commanders and allows them to apply their judgment and make an informed decision.

Step Six: Course of Action Approval. In this step (figure 8), the staff briefs the commander on the COA comparison and the analysis and wargaming results, including a review of important supporting information. Staffs should follow the sample COA decision briefing guide provided in JP 5-0. The key output from this step is the commander's estimate, which is a concise statement describing the selected COA.

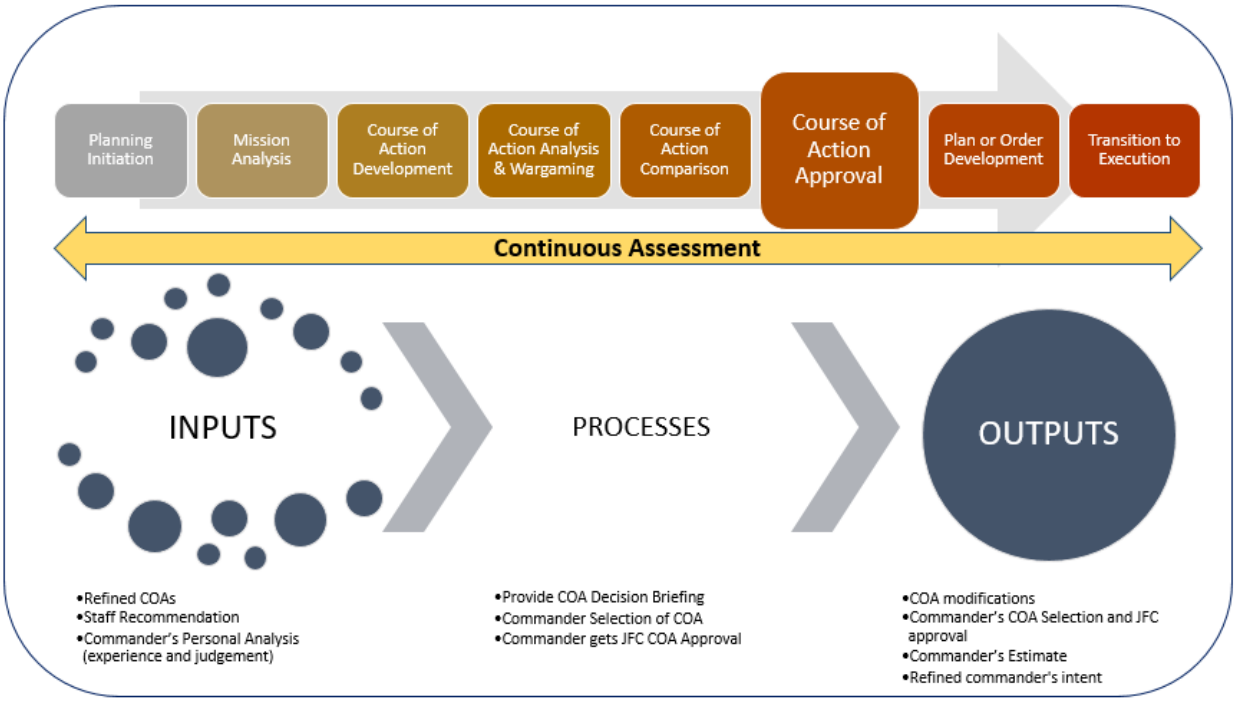

Figure 8. Course of action approval

Step Seven: Plan or Order Development. An order is any communication that directs actions and focuses subordinates' tasks and activities toward accomplishing the mission. Orders promulgate from all levels of command. The Plan or Order Development step (figure 9) translates the commander's chosen COA into an appropriate level plan or order (normally a support plan or space appendix to a contingency plan). USSF support plans are tied to CCMD or Joint Task Force (JTF) plans following the five-paragraph formats in CJCSM 3130.03A (e.g., operation plan [OPLAN], concept plan [CONPLAN], execute order [EXORD]). A plan is prepared in anticipation of operations and normally serves as the basis for an order. Joint planners normally produce OPLANs at the CCMD or joint task force level with subordinate Service or functional component commands producing supporting plans. The plan or order, once completed, becomes the primary means by which commanders express their decision, intent, and guidance. Planning teams should strive to implement mission command by creating mission-type orders, which provide left and right boundaries, while preserving decision space for subordinate commanders to execute.

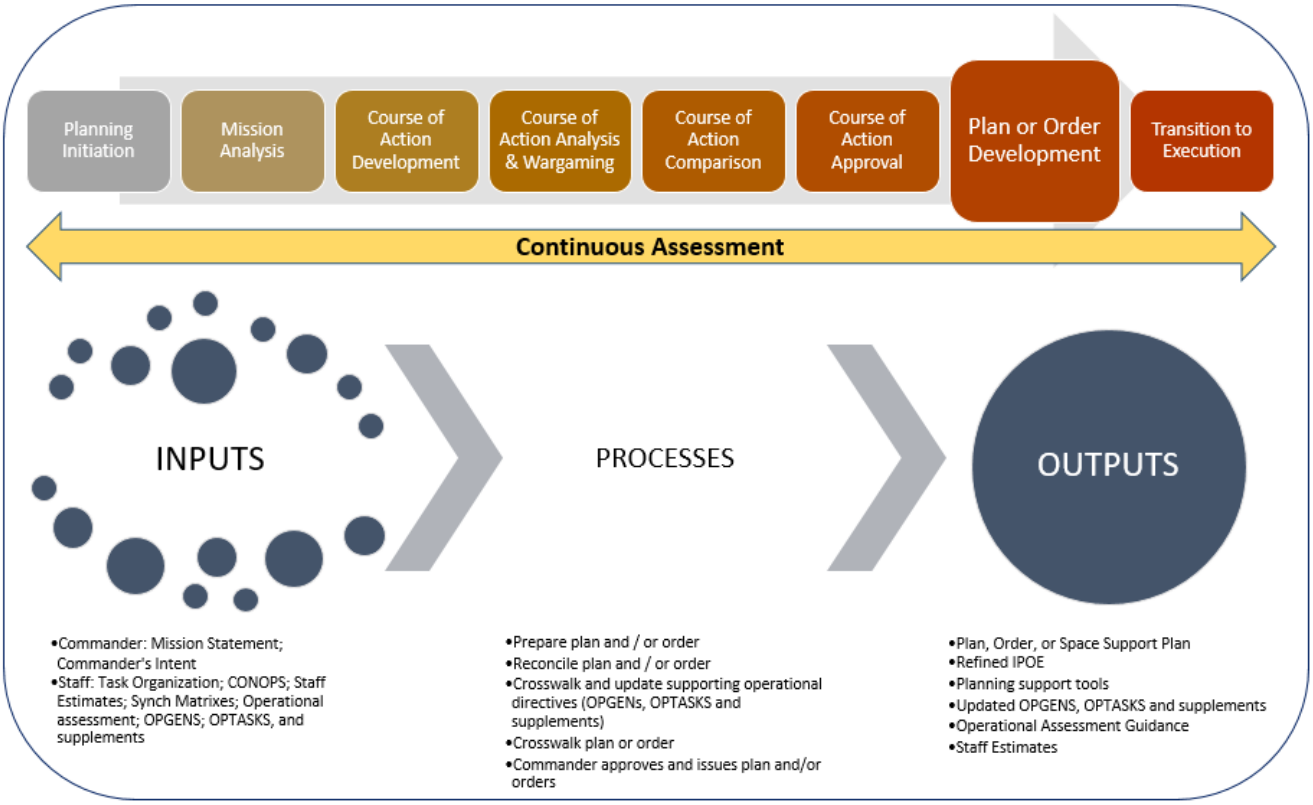

Figure 9. Plan or order development

Step Eight: Transition to Execution. The purpose of Transition to Execution (figure 10) is to ensure a successful shift from planning to execution. There are two types of transition: external and internal. External transition ensures units tasked with execution fully comprehend the order—especially the commander's intent, the CONOPS, and the leadership responsibilities of mission command. Internal transition ensures those charged with execution fully comprehend the order. Effective internal and external transitions promote unity of effort; generate tempo; facilitate the synchronization of plans between higher and subordinate commands; and aid in integrated planning by ensuring the synchronization of joint functions.

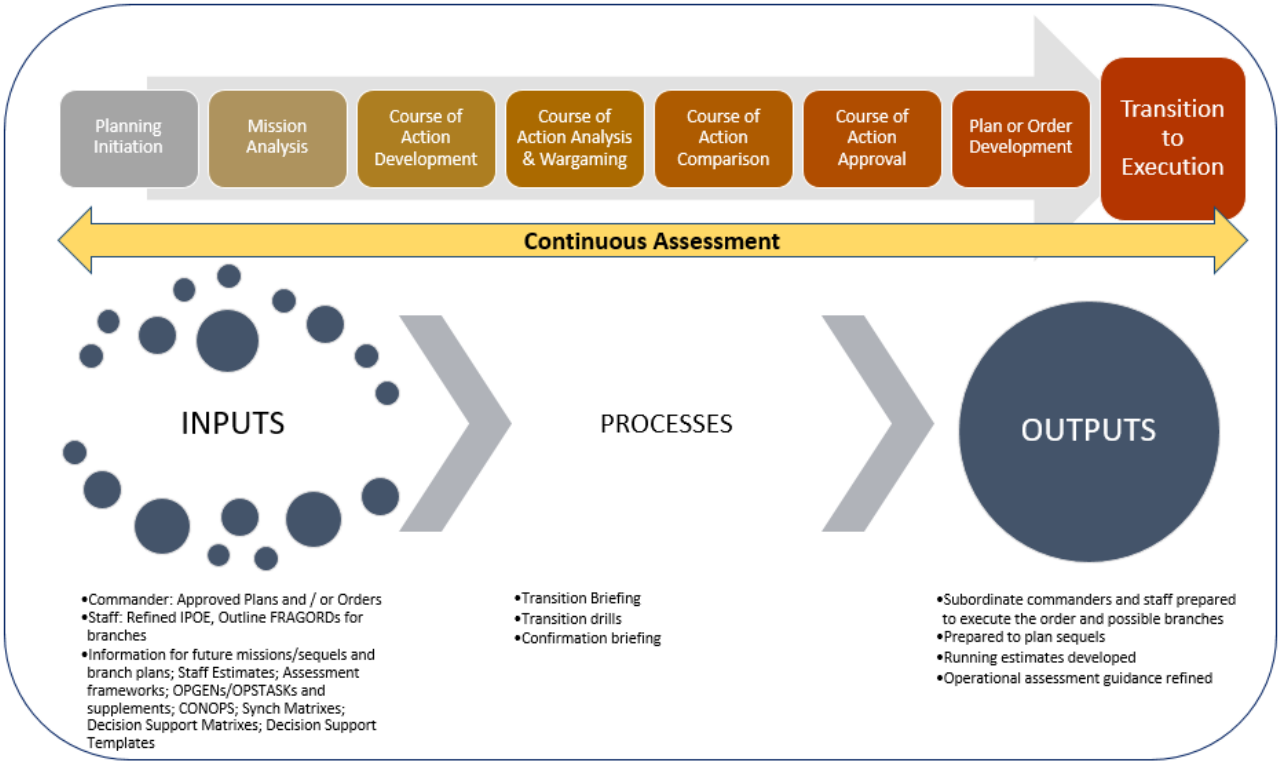

Figure 10. Transition to execution

While external transition typically occurs at all levels of command, a formal internal transition normally occurs on staffs with separate planning and execution teams. The transition process provides an opportunity to address necessary changes through coordinated plan adjustments before execution.

Transition Inputs. For transition to occur, an approved plan or order is required. The approved plan or order, along with additional staff products, forms the input for transition. These additional products may include refined intelligence and intelligence preparation of the OE (IPOE) products; planning and execution support tools; outlined fragmentary orders (FRAGORD) for branches; information on possible future missions (sequels); and staff estimates that transform into running estimates.

a. Transition Process. Regardless of the level of command, successful transition ensures those who execute the order understand the commander's intent, the CONOPS, and SPP planning aids. A commander may use transition briefs, daily intentions messages (DIM), or other forums to facilitate the transition.

Plan Proponent

A method that further supports internal transition is the designation of a staff member for each plan. The plan proponent performs a monitoring and directing function through each phase of the SPP. Staff members within SpOC lead the planning effort for USSF, and designate staff members to serve as the proponent for each plan or order. After plan or order development, the proponent takes the approved plan or order forward to the staff charged with execution. As a full participant in the development of the plan, the proponent can answer questions; explain and aid in the use of the planning and execution support tools; and assist the Office of the Chief of Space Operations (informally referred to as the Space Staff) and SpOC leadership in determining necessary adjustments to the plan or order.

1) Briefing. Transition may include a formal transition briefing to subordinate or adjacent commanders and to the staff supervising execution of the order. The transition briefing provides an overview of the mission, commander's intent, task organization, and adversary and friendly situation. This ensures the subordinates executing the order, and supporting components know and understand the commander's intent, risk tolerance, and their boundaries to conduct operations in support of the mission. While subordinate commanders' staffs conduct parallel planning in concert with HHQ, the transition process provides a natural point for all the staffs to review their responsibilities as output for the current planning horizon, as well as inputs for the next planning horizon.

2) Drills. Transition drills may include briefings, guided discussions, walkthroughs, or rehearsals used to facilitate understanding of the plan throughout all levels of the command. Drills are important techniques to maximize understanding of the plan or order by those who execute it and improve the ability of the commander and staff to supervise operations. Transition drills increase the situational awareness of subordinate planners and instill confidence and familiarity with the plan. Chart/map exercises and rehearsals of concepts are examples of transition drills.

3) Running Estimates. In transition, staff estimates convert to running estimates. While the content of a running estimate is similar to the staff estimate, the roles differ. The running estimate identifies current readiness of space forces and informs the commander's decision making by depicting key information from each functional

area as they influence current and future operations. Planners use their estimates to develop and refine MOEs and MOPs, which serve as indicators to measure the command's progress towards its objective.

Key Transition Points

1. Although a formal transition occurs on staffs with separate planning and execution teams, a similar process takes place at all levels of command. At higher echelons, the commander may designate a representative as a proponent who remains with the plan or order as it moves through the SPP and transitions to execution.

2. Transitions may require briefings, drills, exercises, or rehearsals. The level of understanding increases with time available to conduct the transition. As the completeness or complexity of the transition increases, additional preparation time and resources are required.

3. During transition, commanders at all levels, whether the SpOC Delta commander responsible for execution, or the USSPACECOM commander aggregating inputs from multiple components, continue to visualize, describe, direct, and assess. They continue to gather information to improve their situational understanding and revise the plan if necessary, coordinate with other units and partners, and supervise transition activities of subordinates to ensure assigned forces are ready to execute missions.

4. Commanders should describe any changes in their own visualization to their subordinates. Changes may result in updated planning guidance to the staff and modified orders or directives to subordinates. Status reports and rehearsals by subordinates help commanders assess the force's readiness. This force readiness assessment, coupled with an update on the OE (e.g., refined IPOE), may help commanders decide when to commence execution.

Figure 11. Key transition points

Chapter 3: Additional Planning Considerations

Command and Control

C2 planning fosters centralized command, distributed control, and decentralized execution through mission command by issuing mission-type orders, which provide operational forces left and right execution bounds. Space forces provide a diverse set of capabilities, which are constrained by the operating environment and provided by a variety of commercial, civil, IC, and military organizations with often diverging or unaligned interests. These competing interests can create barriers to access and warfighting integration that require critical consideration as they create C2 challenges to spacepower planning.

a. Force Presentation. Force presentation is the preferred organizational construct through which a service offers capabilities to combatant commanders. USSF planners should understand the reasoning behind the decision to provide forces to a CCMD and provide informed recommendations regarding C2 constructs. Factors may include (but are not limited to) effects being localized or global in nature, physical location, or speed of reallocation between theaters or regions. Ground-based space assets, whose effects can be theater focused, are likely to be assigned to the appropriate geographic combatant commander in support of theater requirements, while support to global space operations is likely to be conducted from USSPACECOM.

A service presents forces to the joint force with three elements: a commander of service forces, command and control mechanisms, and forces (personnel, equipment, units, or elements of units). If USSF members are assigned or attached to a joint force, a service component command is established. Operational control (OPCON) is normally delegated to the service component commander (e.g. Commander, Space Force Forces [COMSPACEFOR] for USSF forces). Although not required, the joint force commander (JFC) can designate functional component commanders (e.g. JFACC, JFSCC), if desired. If so, one of the service component commanders is dual-hatted as the functional commander.

COMSPACEFOR

At the time of this publication, USSPACECOM and SpOC staffs are working out specifics regarding JFSCC implementation. For almost all scenarios, the COMSPACEFOR for a given CCMD will be in the best position to fulfill the role of JFSCC if one is designated.

The USSF presents forces to CDRUSSPACECOM, and other combatant commanders as appropriate, to deliver combat and combat support capabilities necessary to enable prompt and sustained offensive and defensive space operations, and to provide space support to joint operations in all domains. USSF delivers the preponderance of its forces to USSPACECOM and provides forces to other CCMDs to integrate space capabilities into all CCMD planning and operations. USSF organizes,

trains, equips, and presents USSF service components to all CCMDs to support operational-level warfighting. USSF service components integrate at the component level and provide every combatant with a subordinate commander (who will serve as COMSPACEFOR to that CCMD), organic space planning and employment expertise, and C2 focused on the CCMD's operational warfighting priorities and requirements. The assigned service components organize assigned and/or attached forces under the space mission force (SMF) construct with the appropriate level of combat space unit (Delta, Squadron, etc.).

The majority of space capabilities and USSF forces are high demand, low-density assets that require thoughtful application. Existing C2 structures will inform COA development but may also drive staffs to recommend changes to the current structure. In cases where these structures do not currently exist, such as the standup of a new JTF, staffs should recommend one for each COA, keeping in mind the unique nature of space forces. Adequately balanced and clearly defined force presentation models are critical for planners to best integrate Service-retained and presented forces with the broader Joint Force.

b. Command Relationships. Command relationships (combatant command authority [COCOM], OPCON, tactical control [TACON], and support) define the authority a commander has over assigned or attached forces. The complexity of command relationships and the potential for shifting roles between commanders throughout the competition continuum complicates spacepower planning. Balancing the complexities of force presentation is essential for planners to design the necessary command relationships. Planners require clarity and definition of command relationship options specific to the plan they are developing or supporting. The nature of space as a contested, warfighting domain increases the likelihood of space forces executing several OPLANs simultaneously, each at different points in the competition continuum.

c. Prioritized Space Effects. In general, on-orbit space systems are inherently capable of providing persistent capabilities and simultaneous effects across multiple theaters and the competition continuum. Planners should consider providing services and effects from the space domain and contemplate the protection of these services and effects with offensive and defensive actions. Within any specific plan, staffs should consider the broader framework of the multiple OPLANs, CONPLANs, and other commitments supported by the limited inventory of space assets. CCMD campaign plan requirements place evolving and potentially conflicting demands on space assets. The same asset required for support to a tactical operation may also be providing capabilities to support ongoing strategic missions. Planners should appreciate this context and account for the potential conflict over limited resources when conducting spacepower planning.

Assessments

Assessments and lessons learned are key components to the SPP, from plan initiation through execution. Assessment, in this context, refers to the determination of progress toward accomplishing a task, creating a condition, or achieving an objective. Assessment is a continuous process that measures the overall effectiveness of employing capabilities during military operations. Assessment activities should begin with step one of the SPP, planning initiation. Integration with the planning process from the beginning ensures a plan is feasible and compatible with higher-level policy, guidance, and orders. Staffs should consider plans that lack assessment considerations and guidance as incomplete. Assessment planning should occur concurrently with the SPP steps and planners at every level should be engaged to ensure consideration of continuous assessment across the planning process. Planners continuously monitor the OE and progress of the planning and mission execution to identify necessary adjustments to the plan. This allows commanders to adjust to emerging situations and threats proactively. Assessments should measure progress and products should provide information that will help identify and implement necessary adjustments to current plans, procedures, resources, etc. Assessments are only valuable if they can feed future decisions and actions.

a. **Developing Assessment Plans.** Planners continually assess operations to determine if the generated effects are meeting operational objectives laid out in the plan by using MOP and MOE criteria. Effects through space are not easily visible and can be difficult to assess. Since these effects can be difficult to observe, it is imperative to build the right assessment tools and intelligence resources into assessment plans, ensuring there are appropriate assessment indicators for both MOPs and MOEs. Planners should synergize all aspects of assessments throughout the process, taking into consideration that each objective has different MOEs and MOPs that help commanders orient and execute their decision-making process. Planners should also tie their planning efforts to national and joint end states while leveraging outputs from operational and tactical assessments in order to revector planning, when necessary, to orient towards emerging objectives within a dynamic environment.

b. **Lessons Learned.** Once completed, assessments and observations from exercises or operational events translate into lessons learned, which feed back into future planning efforts. Once planning terminates, or when refined or adapted, staffs document their assessment approach and assessment results as part of their lessons learned. Documentation and communication are vital to successful lessons learned programs. Lessons learned should be stored in a central repository across all classification levels for planners to access when conducting spacepower planning.

Appendix A: Acronym Listing

ACCM	alternative compensatory control measures
AOR	area of responsibility
ASAT	anti-satellite
C2	command and control
CCIR	commander's critical information requirements
CCMD	combatant command
CFSCC	Combined Force Space Component Command
CJCS	Chairman, Joint Chiefs of Staff
COA	course of action
COCOM	combatant command authorities
CONOPS	concept of operations
CONPLAN	concept plan
CSO	Chief of Space Operations
DAF	Department of the Air Force
DIM	daily intentions message
EEFI	essential elements of friendly information
EXORD	execute order
FFIR	friendly force information requirement
FRAGORD	fragmentary order
IC	intelligence community
IPOE	intelligence preparation of the operational environment
JFC	joint force commander
JP	joint publication
JPP	joint planning process
JTF	joint task force
KOT	key orbital trajectory
LOC	line of communications
MOE	measure of effectiveness

MOP	measure of performance
NSDC	National Space Defense Center
OE	operational environment
OPCON	operational control
OPLAN	operation plan
PIR	priority intelligence requirement
SAP	special access program
SATCOM	satellite communications
SCP	Space Capstone Publication, *Spacepower*
SecDef	Secretary of Defense
SPP	space planning process
STO	special technical operations
TACON	tactical control
US	United States
USSF	United States Space Force
USSPACECOM	United States Space Command
WARNORD	Warning Order

Appendix B: Applicable Strategic and Planning Guidance, Policy, and Doctrine

1. **Interim National Security Strategic Guidance, March 2021** – Identifies National Security Priorities as an obligation to protecting the security of the American people, enduring interest in expanding economic prosperity and opportunity, and a commitment to realizing and defending the democratic values at the heart of the American way of life. Promotes doing this, in part, by reinvigorating and modernizing alliances and partnerships around the world.
2. **2018 National Defense Strategy of the United States of America** – Provides a clear road map for the Department of Defense to meet the challenges posed by a re-emergence of long-term strategic competition with China and Russia. The National Defense Strategy acknowledges an increasingly complex global security environment, characterized by overt challenges to the free and open international order.
3. **2018 National Military Strategy** – Provides the Joint Force a framework for protecting and advancing U.S. national interests. Pursuant to statute, it reflects a comprehensive review conducted by the Chairman with the other members of the Joint Chiefs of Staff and the unified combatant commanders.
4. **Defense Space Strategy Summary, June 2020** – Identifies how DoD will advance spacepower to enable the Department to compete, deter, and win in a complex security environment characterized by great power competition.
5. **National Space Strategy Fact Sheet, 2018** – The National Space Strategy is a classified document that prioritizes American interests, ensuring a strategy that will make America strong, competitive, and great. The strategy features four "essential pillars" that constitute a whole-of-government approach to United States leadership in space, in close partnership with the private sector and our allies.
6. **National Space Policy of the United States of America, 9 December 2020** – Sets out the nation's commitment to leading in the responsible and constructive use of space, promoting a robust commercial space industry, returning Americans to the Moon and preparing for Mars, leading in exploration, and defending United States and allied interests in space.
7. **Space Capstone Publication, 10 August 2020** – The capstone doctrine for the United States Space Force and represents the Service's first articulation of an independent theory of spacepower. This publication answers why spacepower is vital for our Nation, how military spacepower is employed, who military space forces are, and what military space forces value.
8. **US Code 9081, The United States Space Force** – Establishes a United States Space Force as an armed force in the within the Department of the Air Force. The United States Space Force is the sixth military Service within DOD responsible to organize, train, and equip forces to provide freedom of operation for the US in, from, and to space; and provide prompt and sustained space operations.

9. **Chief of Space Operations' Planning Guidance, 2020** – Provides foundational direction for the USSF to advance National and Department of Defense (DOD) strategic objectives. This authoritative Service-level planning guidance supersedes previous guidance and provides the context and outline for our new Service design.
10. **Department of Defense Electromagnetic Spectrum Superiority Strategy, October 2020** – Addresses how DoD will: develop superior EMS capabilities; evolve to an agile, fully integrated EMS infrastructure; pursue total force EMS readiness; secure enduring partnerships for EMS advantage; and establish effective EMS governance to support strategic and operational objectives. Investment in these areas will speed decision-quality information to the warfighter, establish effective electromagnetic battle management, enable EMS sharing with commercial partners, advance EMS warfighting capabilities, and ensure our forces maintain EMS superiority.
11. **United States Space Force Campaign Support Plan: Expanding, Strengthening, and Leveraging Global Partnerships** – Seeks to implement Chief of Space Operations' Planning Guidance to "Expand Cooperation to Enhance Prosperity and Security" in the space domain. It describes how the USSF will support Geographic Combatant Commands by organizing, training, equipping, and presenting a ready Space Force with an eye towards collaborative partnerships that yield decisive operational capabilities.
12. **Joint Publication 3-14, Space Operations –** This publication provides fundamental principles and guidance to plan, execute, and assess joint space operations. 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 JFCs, and prescribes joint doctrine for operations and training.

Appendix C: Glossary

Adversary — A party acknowledged as potentially hostile to a friendly party and against which the use of force may be envisaged. (JP 3-0)

Alliance — The relationship that results from a formal agreement between two or more nations for broad, long-term objectives that further the common interests of the members. (JP 3-0)

Area of Operations — An operational area defined by a commander for land and maritime forces that should be large enough to accomplish their missions and protect their forces. Also called **AO.** (JP 3-0)

Area of Responsibility — The geographical area associated with a combatant command within which a geographic combatant commander has authority to plan and conduct operations. (JP 1)

Armed Conflict — Situations in which joint forces take actions against a strategic actor in pursuit of policy objectives in which law and policy permit the employment of military force in ways commonly employed in declared war or hostilities. (JDN 1-19)

Assumption — A specific supposition of the operational environment that is assumed to be true, in the absence of positive proof, essential for the continuation of planning. (JP 5-0)

Campaign — A series of related operations aimed at achieving strategic and operational objectives within a given time and space. (JP 5-0)

Campaign Plan — A joint operation plan for a series of related major operations aimed at achieving strategic or operational objectives within a given time and space. (JP 5-0)

Celestial Bodies — Large natural objects that constitute a significant source of gravity. (SCP)

Cislunar Regime — the combined Earth-Moon two body gravitational system. The cislunar regime is nested within the **solar regime**. (SCP)

Cognitive Dimension — For the space domain, encompasses the perceptions and mental processes of those who transmit, receive, synthesize, analyze, report, decide, and act on information coming from and to the space domain. (SCP)

Combat Power Projection — Integrates defensive and offensive operations to maintain a desired level of freedom of action relative to an adversary. Combat Power Projection in concert with other competencies enhances freedom of action by deterring aggression or compelling an adversary to change behavior. (SCP)

Command and Control — The exercise of authority and direction by a properly designated commander over assigned and attached forces in the accomplishment of the mission. (JP 1)

Command Relationships — The interrelated responsibilities between commanders, as well as the operational authority exercised by commanders in the chain of command; defined further as combatant command (command authority), operational control, tactical control, or support. (JP 1)

Commander's Critical Information Requirement — An information requirement identified by the commander as being critical to facilitating timely decision making. (JP 3-0)

Commander's Estimate — The commander's initial assessment in which options are provided in a concise statement that defines who, what, when, where, why, and how the course of action will be implemented. (JP 5-0)

Commander's Intent — A clear and concise expression of the purpose of the operation and the desired military end state that supports mission command, provides focus to the staff, and helps subordinate and supporting commanders act to achieve the commander's desired results without further orders, even when the operation does not unfold as planned. (JP 3-0)

Competition Below Armed Conflict — Situations in which joint forces take actions outside of armed conflict against a strategic actor in pursuit of policy objectives. These actions are typically nonviolent and conducted under greater legal or policy constraints than in armed conflict but can include violent action by the joint force or sponsorship of surrogates or proxies. (JDN 1-19)

Competition Continuum — A world of enduring competition conducted through a mixture of cooperation, competition below armed conflict, and armed conflict. (JDN 1-19)

Concept of Operations — A verbal or graphic statement that clearly and concisely expresses what the commander intends to accomplish and how it will be done using available resources. (JP 5-0)

Concept Plan — An operation plan in an abbreviated format that may require considerable expansion or alteration to convert it into a complete operation plan or operation order. (JP 5-0)

Constraint — In the context of planning, a requirement placed on the command by a higher command that dictates an action, thus restricting freedom of action. (JP 5-0)

Cooperation — Situations in which joint forces take actions with another strategic actor in pursuit of policy objectives. (JDN 1-19)

Course of Action — 1. Any sequence of activities that an individual or unit may follow. 2. A scheme developed to accomplish a mission. (JP 5-0)

Debris — For space, refers to any spacecraft or artificial satellite (e.g., a rocket body) in orbit that no longer serves a useful purpose. (SCP)

Effect — 1. The physical or behavioral state of a system that results from an action, a set of actions, or another effect. 2. The result, outcome, or consequence of an action. 3. A change to a condition, behavior, or degree of freedom. (JP 3-0)

Employment — The strategic, operational, or tactical use of forces. (JP 5-0)

Essential Elements of Information — The most critical information requirements regarding the adversary and the environment needed by the commander by a particular time to relate with other available information and intelligence in order to assist in reaching a logical decision**.** (JP 2-0)

Essential Task — A specified or implied task an organization must perform to accomplish the mission. (JP 5-0)

Execute Order — 1. An order issued by the Chairman of the Joint Chiefs of Staff, at the direction of the Secretary of Defense, to implement a decision by the President to initiate military operations. 2. An order to initiate military operations as directed. (JP 5-0)

Fragmentary Order — An abbreviated operation order issued as needed to change or modify an order or to execute a branch or sequel. (JP 5-0)

Implied Task — In the context of planning, a task derived during mission analysis that an organization must perform or prepare to perform to accomplish a specified task or the mission, but which is not stated in the higher headquarters order. (JP 5-0)

Instruments of National Power — All of the means available to the government in its pursuit of national objectives. They are expressed as diplomatic, economic, informational and military. (JP 1)

Intelligence Community — All departments or agencies of a government that are concerned with intelligence activity, either in an oversight, managerial, support, or participatory role. (JP 2-0)

Joint — Connotes activities, operations, organizations, etc., in which elements of two or more Military Departments participate. (JP 1)

Joint Planning Process — An orderly, analytical process that consists of a logical set of steps to analyze a mission, select the best course of action, and produce a campaign or joint operation plan or order. (JP 5-0)

Key Orbital Trajectory — Any orbit from which a spacecraft can support users, collect information, defend other assets, or engage the adversary. (SCP)

Line of Communications — A route, either land, water, and/or air, that connects an operating military force with a base of operations and along which supplies and military forces move. (JP 2-01.3)

Link Segment — Comprises the signals in the electromagnetic spectrum that connect the terrestrial segment and the orbital segment. (SCP)

Measure of Effectiveness — An indicator used to measure a current system state, with change indicated by comparing multiple observations over time. (JP 5-0)

Measure of Performance — An indicator used to measure a friendly action that is tied to measuring task accomplishment. (JP 5-0)

Military Spacepower — The ability to accomplish strategic and military objectives through the control and exploitation of the space domain. (SCP)

Mission Command — The conduct of military operations through decentralized execution based upon mission-type orders. (JP 3-31)

Mission Statement — A short sentence or paragraph that describes the organization's essential task(s), purpose, and action containing the elements of who, what, when, where, and why. (JP 5-0)

Mission-type Order — 1. An order issued to a lower unit that includes the accomplishment of the total mission assigned to the higher headquarters. 2. An order to a unit to perform a mission without specifying how it is to be accomplished. (JP 3-50)

Multinational — Between two or more forces or agencies of two or more nations or coalition partners. (JP 5-0)

Network Dimension — For space operations, allows users to command, control, and exploit space capabilities through a physical and logical architecture that collects, transmits, and processes data around the world and across the domain. (SCP)

Operation Order — A directive issued by a commander to subordinate commanders for the purpose of effecting the coordinated execution of an operation. (JP 5-0)

Operation Plan — A complete and detailed plan containing a full description of the concept of operations, all annexes applicable to the plan, and a time-phased force and deployment list. (JP 5-0)

Operational Art — The cognitive approach by commanders and staffs—supported by their skill, knowledge, experience, creativity, and judgment—to develop strategies, campaigns, and operations to organize and employ military forces by integrating ends, ways, and means. (JP 3-0)

Operational Design — The conception and construction of the framework that underpins planning. (JP 5-0)

Operational Environment — A composite of the conditions, circumstances, and influences that affect the employment of capabilities and bear on the decisions of the commander. Also called **OE.** (JP 3-0)

Operational Level of Warfare — The level of warfare at which campaigns and major operations are planned, conducted, and sustained to achieve strategic objectives within theaters or other operational areas. (JP 3-0)

Orbit — Any path through space an object follows based on the pull of gravity. While orbits are commonly depicted as circular or elliptical paths, orbits can be repeating or non-repeating. (SCP)

Orbital Regime — a region in space associated with a dominant gravitational system capable of capturing the orbit of other objects. (SCP)

Orbital Segment — Consists of a spacecraft in orbit beyond Earth's atmosphere. Depending on the application, spacecraft can be remotely piloted, crewed, or autonomous. (SCP)

Partner Nation — 1. A nation that the United States works with in a specific situation or operation. (JP 1) 2. In security cooperation, a nation with which the Department of Defense conducts security cooperation activities. (JP 3-20)

Physical Dimension — For the space domain, encompasses the orbital environment and the spacecraft operating within the domain. This dimension starts in the upper reaches of Earth's atmosphere, intersecting and extending beyond the physical location required for sustained orbital flight. (SCP)

Planning Order — A planning directive that provides essential planning guidance and directs the development, adaptation, or refinement of a plan/order. (JP 5-0)

Positive Control Measures — Control measures that rely on surveillance, accurate identification, and tracking of spacecraft, as well as continuous communication between a designated C2 element and all entities conducting operations.

Procedural Control Measures — Control measures that rely on previously determined combinations of common procedures and disseminated orders.

Rendezvous and Proximity Operations — A series of intentional maneuvers to bring space objects close together and maintaining a close separation between space objects for a specific purpose.

Resources — The forces, materiel, and other assets or capabilities apportioned or allocated to the commander of a unified or specified command. (JP 1)

Restraint — In the context of planning, a requirement placed on the command by a higher command that prohibits an action, thus restricting freedom of action. (JP 5-0)

Ridesharing — For space, the approach of sharing available launch vehicle performance and volume margins with two or more spacecraft that would otherwise go underutilized.

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. (JP 3-14)

Space Forces —The space and terrestrial systems, equipment, facilities, organizations, and personnel, or combination thereof, necessary to conduct space operations. (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. 3. The ability of a space asset to contribute to a mission from seabed to the space domain. (JP 3-14)

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. (JP 3-14)

Space Supremacy — Supremacy implies that one side could conduct operations with relative impunity whilst denying space domain freedom of action to an adversary.

Space Weather — The conditions and phenomena in space and specifically in the near-Earth environment that may affect space assets or space operations. (JP 3-59)

Spacecraft — An object which has been engineered to be controlled and deliberately employed in order to perform a useful purpose while traveling in, from, and to the space domain. (SCP)

Spacepower Employment — The action of applying the spacepower disciplines to a required area of operations, in order to achieve a level of space superiority.

Special Access Program — A sensitive acquisition, intelligence, or operations and support program, that imposes need-to-know and access controls beyond those normally provided for access to classified information. (JP 3-05)

Specified Task — In the context of planning, a task that is specifically assigned to an organization by its higher headquarters. (JP 5-0)

Staff Estimate — A continual evaluation of how factors in a staff section's functional area support and impact the planning and execution of the mission. (JP 5-0)

Strategic Guidance — The written products by which the President, Secretary of Defense, and Chairman of the Joint Chiefs of Staff provide strategic direction. (JP 5-0)

Strategic Level of Warfare — The level of warfare at which a nation, often as a member of a group of nations, determines national or multinational (alliance or coalition) strategic security

objectives and guidance, then develops and uses national resources to achieve those objectives. (JP 3-0)

Tactical Level of Warfare — The level of warfare at which battles and engagements are planned and executed to achieve military objectives assigned to tactical units or task forces. (JP 3-0)

Terrestrial Segment — Encompasses all the equipment within the terrestrial domains required to operate or exploit a spacecraft. This includes control stations, antennas, tracking stations, launch sites, launch platforms, and user equipment. (SCP)

Warning Order — 1. A preliminary notice of an order or action that is to follow. 2. A planning directive that initiates the development and evaluation of military courses of action by a commander. (JP 5-0)