AU/AF FELLOWS/NNN/2004-00

AIR FORCE FELLOWS (SDE)

AIR UNIVERSITY

MILITARY SPACE CONTROL:

AN INTUITIVE ANALYSIS

by

Adolfo J. Fernandez, Lt Col, USAF

A Research Report Submitted to Air Force Fellows, CADRE/AR

In Partial Fulfillment of the Graduation Requirements

Advisor: Lt Col Paula Flavell

ACSC, Space Specialized Studies

Maxwell Air Force Base, Alabama

April 2004

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE **APR 2004**	2. REPORT TYPE **N/A**	3. DATES COVERED **-**
4. TITLE AND SUBTITLE **Military Space Control: An Intuitive Analysis**		5a. CONTRACT NUMBER
		5b. GRANT NUMBER
		5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)		5d. PROJECT NUMBER
		5e. TASK NUMBER
		5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Air University Maxwell AFB, AL**		8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)		10. SPONSOR/MONITOR'S ACRONYM(S)
		11. SPONSOR/MONITOR'S REPORT NUMBER(S)
12. DISTRIBUTION/AVAILABILITY STATEMENT **Approved for public release, distribution unlimited**		
13. SUPPLEMENTARY NOTES		
14. ABSTRACT		
15. SUBJECT TERMS		

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**UU**	**57**	

Standard Form 298 (Rev. 8-98)
Prescribed by ANSI Std Z39-18

Disclaimer

Contents

Page

Illustrations

Preface

Many thanks to the Air Force Fellows staff and their outstanding support for helping to make my fellowship at the Congressional Research Service (CRS), Library of Congress, a terrific experience.

Abstract

Military space control describes the capability to secure a military asymmetric advantage in space. Space control protects space assets to guarantee access to space services, and at the same time, prevents an enemy from benefiting from resources in space. The tremendous growth in the integration of space system into today's warfighting machinery is driving a remarkable transition in the military space domain. The growing need for information dominance is the impetus for an increasing military dependence on space services. This reliance on space systems is compelling military decision-makers to make key strategic choices about the future of space control. The purpose of this paper is to analyze major aspects of military space control strategy and determine if U.S. initiatives are on track to meet the needs of the warfighter.

To analyze U.S. military space control strategy, this research effort takes an intuitive approach based on a methodology introduced by Newman, Logan, and Hegarty in their book, Strategy, A Multi-Level, Integrative Approach. The method analyzes a strategy by defining the competitive domain, evaluating advantages in resources and organizations, and identifying strategic investment priorities. Based on this approach, this report will address the following three questions:

1. What is the domain the U.S. seeks in the military space control environment?
2. What is the U.S. space control differential advantage?
3. What is the strategic thrust of space control initiatives?

This report will show that military space control strategy, like many other facets of space, is in a significant phase of transition. As the military need for information dominance grows, space will become an area the U.S. will have to defend. This transformation will require moving military operations into space, improving the mission survivability of space systems, and ensuring a continual awareness of activities in space.

Chapter 1

Introduction

The military space environment is in transition. Driving the transition, it is not so much the growth of systems in space, as it is the integration of space services into warfighting capabilities. The concept of "space control," the ability to secure the military asymmetric advantage in space, is also in transition. However, the notion of space control is not new. It has been part of U.S. space policy and strategy for over forty years, dating back to when President Eisenhower first set precedence during the U.S. "space race" with the Soviet Union.[1] The U.S. approaches to space were clear: Promote the peaceful use of space and prevent the proliferation of weapons in space. Today, the equation is much more complex. As the military becomes increasingly dependent on space for communications, positioning, navigation, and timing, space is becoming the "ultimate high ground." Military decision makers face having to make key strategic choices about the future of military space control to defend this high ground.

The purpose of this paper is to analyze major aspects of military space control strategy and determine if U.S. initiatives are on track to meet the needs of the warfighter. This research effort takes an intuitive approach based on a methodology introduced by Newman, Logan, and Hegarty in their book, Strategy, A Multi-Level, Integrative Approach.[2] The method analyzes a strategy by defining the competitive domain, evaluating advantages in resources and organizations, and identifying strategic investment priorities. Based on this approach, this report will address the following three questions regarding military space control:

1. What is the *domain* the U.S. seeks in the military space control environment? This is the first essential question in evaluating military space control strategy. Answering this question will help identify the U.S. military interest in space. By characterizing the competitive domain, it becomes possible to identify opportunities, challenges, and threats within the sphere of influence that that the U.S. seeks.
2. What is the U.S. space control *differential advantage*? This is the second fundamental question of the analysis. In order to gain an advantage over the competition, it is important to identify the areas of space control in which the U.S. seeks superiority. Understanding military strengths and weaknesses in the space domain will help identify the basis of any differential advantages that already exist, or any that are lacking, in current space control capabilities.
3. What is the *strategic thrust* of space control initiatives? If a gap exists between the present strategic position and the one sought, leaders inject strategic thrust to guide planning initiatives to achieve the competitive stance desired. This final question analyzes the strategic direction U.S. space leaders have given military space control. Strategic thrust steers the course between "too-much-too-soon" and "too-little-too-late." Asking this question will help identify policy direction, obstacles to progress, resource prioritization, and the timing of initiatives.

This report will show that military space control strategy, like many other facets of space, is in a significant phase of transition. As the military need for information dominance grows, space will become an area the U.S. will have to defend. This transformation will require moving military operations into space, improving the mission survivability of space systems, and ensuring a continual awareness of activities in space.

---

[1] Spires, David, N., Beyond Horizons, A Half Century of Air Force Space Leadership, Air Force Space Command in association with Air University Press, July 1998, p. 50-52.

[2] Newman, William H., Logan, James P., Hegarty, Harvey, W., Strategy, A Multi-Level, Integrative Approach, South-Western Publishing Co., Cincinnati, Ohio, 1989, p. 106-120.

Chapter 2

What Domain Does the U.S. Seek?

The first part of the analytical model used in this report asks to identify the environment in which the U.S. wishes to compete. To identify this domain, many questions come into play: Why must the U.S dominate the space control domain? Does the U.S rely on this sphere of influence? Are there vulnerabilities in the environment and, if so, what are the potential impacts? Who are the main players in this domain? However, most fundamental question is—what is space control?

U.S. space assets have become an integral part of today's warfare. They are now key enablers of precision wars. Space-based services allow the U.S. military to collect, transmit, and disseminate information to forces and decision makers all around the world. "Space Control" describes the means to ensure U.S. forces have unhampered access to space-based services and to deny an enemy the advantages of space capabilities.

Space control is one of four space mission areas. Defined in the 1996 National Space Policy these areas are: space control, space force enhancement, space support, and space force application.[1] Joint Publication 3-14 defines "space control" as the combat, combat support, and combat service support operations to ensure freedom of action in space for the United States and its allies and, when directed, deny an adversary freedom of action in space. Joint Publication 3-14 describes the other three mission areas as follows:

- Space Force Enhancement: These space operations enhance battlespace awareness and support the warfighter. This mission area includes five functions: Intelligence, Surveillance, and Reconnaissance (ISR); Integrated Tactical Warning and Attack Assessment (ITW/AA); environmental monitoring; communications; and position, velocity, time, and navigation.
- Space Support: These operations consist of launching, deploying, augmenting, maintaining, sustaining, replenishing, de-orbiting, and recovering space forces. Support operations also include satellite operations.
- Space Force Application: These space operations attack terrestrial-based targets by military weapons systems operating in or through space. DOD is clear to point out that the U.S. currently *does not* have this capability in space.[2]

Space Control Concepts

There are wide ranges of space control options. The concepts seem simple enough, but often space control conjures up a misperception of being the weaponization of space. Space control is a broad-based concept and *does not demand space* weapons to be successful. Many of the space control methods include passive defensive means or active capabilities that are temporary and reversible. Space control concepts include:

- **Hardening**. *Hardening* components on a satellite protects its receivers, amplifiers, and sensors from directed-energy weapons. Using filters and optical shutters prevents laser or microwave weapons from causing harm. Hardening a satellite makes it increasingly difficult to harm it from a distance.[3]

- **Shielding.** This technique keeps electromagnetic pulses (EMP) generated by nuclear detonations or weapons systems from penetrating satellite cavities and severely damaging a satellite. Metal shielding and resistant paint coats on the internal surfaces enhance survivability.[4]
- **Circuit Protection.** Another important protection strategy is the use of "circumvention circuits" in satellite design. During an EMP event, protective circuits switched off non-essential components to prevent possible damage by secondary nuclear or EMP attacks.[5]
- **Denial and Deception**. *Denial* prevents an adversary from gaining information about space systems by reducing the electro-optical and electro-magnetic signature of satellites. Using thermal blankets and energy absorbing materials on satellites makes optical and heat emissions harder to detect by enemy sensors or radars. *Deception* is another effective technique. This method misleads an adversary into believing false information about a space system. The use of decoy satellites is an example of how deception could force an enemy to waste resources on false targets or withhold fire for fear that it "shooting" at a decoy.[6]
- **Maneuvering**. Satellites can maneuver to evade enemy surveillance or targeting. However, most satellites do not carry fuel for this purpose. A satellite can no longer perform its mission once its limited supply of propellant is gone. Using maneuvers to avoid an incoming anti-satellite would significantly reduce the useful life of a satellite. Developing an on-orbit refueling capability in the future could present new

opportunities to consider satellite maneuvers as a cost-effective counterspace method.[7]

- **Redundancy and Reconstitution**. To increase survivability, most satellites have redundant subsystem packages to prevent single-point failures, and most system constellations have multiple satellites to provide system-level redundancy. A Launch-On-Demand (LOD) capability is another option that could quickly regenerate a constellation after an attack. One system under consideration is the Military Space Plane, which would launch with short notice and reconstitute small satellite constellations.[8]
- **Dispersion of Space Systems.** Because satellite orbits are very predictable, scattering them into various orbital altitudes and positions offers added protection. Dispersion also includes the building of networks of many smaller satellites, or micro-satellites. The "micro-sats" would operate collectively to perform the services of larger and more vulnerable satellites and result in a more survivable system.[9]
- **Ground Segment Security.** Ground control stations provide critical links used to operate space systems. Since terrestrial targets are much easier to destroy than targets in space, the ground control segment is probably the most vulnerable. Protecting the ground segment not only includes the hardening of facilities to survive kinetic weapons or EMP attack, but also physical, personnel, and information security measures. To protect against cyber intrusions or electronic attacks, firewalls and encryption techniques may be critical as well. In addition, mobile ground stations could be use to evade detection and attack, or assume control if a primary facility were destroyed.[10]

- **Satellite Bodyguards.** A large fleet of "satellite bodyguards" in orbit could protect vital U.S. space assets. Space-based bodyguards would function as a network of integrated micro-satellites designed to protect other satellites. These escorts would detect enemy presence and take actions to negate the threat. A bodyguard system would be costly and require key network components including sensor detection arrays, high-speed cross-linking communications, and a robust re-supplying launch capability. Some analysts suggest that the most cost-effective way of achieving this technology will require advances in miniaturization technology, such as microtechnology or nanotechnology.[11]
- **Stealth and Cloaking.** By minimizing energy reflection and maximizing the absorption of energy, *stealth* and *cloaking* technologies make satellites difficult to detect through use of radar, infrared, visual, or acoustic sensors. An option, in the future, may be to camouflage a space vehicle in an "adaptive skin" that changes molecular characteristics and deflects or absorb incoming energy.[12]
- **Direct Energy Weapons (DEW).** This weapon concept involves projecting intense energy to disable or destroy a satellite. DEWs would damage a satellite by using lasers, focused radio frequencies, or particle beams. The notion presents several engineering and technological challenges. One is trying to solve how to prevent the loss of energy as the beam travels through the atmosphere. Large quantities of corrosive fuel are required to produce a weapons-grade beam; consequently, such a weapon will have to be a ground or airborne platform. Another challenge is the need to develop a highly complex targeting solution to focus a beam on a target for sufficient time to cause damage.[13] The technology for space-based platforms is not

likely to mature for several decades;[14] however, current testing of Air Force Airborne Laser (ABL) indicates some progress.[15]

- **Kinetic Energy Weapons (KEW).** KEWs generate high-velocity projectiles to destroy a target. A kinetic energy anti-satellite (ASAT) weapon approaches a satellite and impacts, explodes, or propels shrapnel at the intended target to destroy or disable it. "Space mines" employ a variation of the KEW concept. Pre-positioned near their intended target well before hostilities break out, a space mines waits in reserve for a signal to detonate. A significant problem with KEWs is the resulting cloud of orbiting debris generated from the attack. This presents serious dangers to space assets orbiting through the field.[16]

Information Characterizes the Space Control Domain

Military space control seeks to conserve the asymmetric military advantage warfighters gain from space. Whether it is in the form of global communications, navigation signals, or missile warnings, at its bare essence, the most important commodity offered from space is information. On March 25, 2004, during his testimony to the Senate Subcommittee on Strategic Forces, Retired Vice Admiral Arthur K. Cebrowski, Director of Force Transformation, Office of the Secretary of Defense, stated, "Transformation across the force is happening much faster than we expected when we announced the journey just 28 months ago. Not just a concept and not just action in the future, transformation is happening today. It's happening due in large part to information and power derived from our vital space capabilities."[17]

John Logsdon, Space Policy Director at George Washington University, explains that information dominance is pillar of U.S. national security strategy and is a key to global power projection.[18] Space communication systems, ISR satellites, and space vehicles used for navigation, positioning, and timing are key to supporting the information dominance. Space control permits an unhampered use of these space systems to exploit an information centric environment, while at the same time denying this capability to an adversary. This is how the U.S. characterizes the space control domain. Space control aims to preserve the ability to capitalize on information from space, and ultimately, enhance warfighting effectiveness and the survivability of U.S. warfighters and platforms—space control saves lives and resources.

Military Reliance on Space Systems

Military reliance on information from space systems characterizes the space control domain. Since the Persian Gulf War in 1991, there has been a steady infusion of space capabilities into virtually all aspects of U.S. military operations—navigation, communications, meteorology, missile warning, and information management—the examples are many. The most prominent example includes the tremendous success of GPS-guided precision munitions. In 1999, GPS-aided weapons demonstrated all-weather precision strike capability in a very convincing manner during Operations Allied Force in Serbia and in Kosovo. During the Afghanistan War in 2001, precision munitions comprised two-thirds of all the bombs dropped during the first two months of the war. Of those precision munitions, 64% were GPS-guided Joint Direct Attack Munitions (JDAM).[19]

Military space has created a dramatic shift in the way military planners view the targeting of enemy forces. Once addressed in terms of *number of planes* needed to eliminate a target, today military planners address targeting in terms of *number of targets* a single plane can eliminate. Military space has also radically altered the efficiency of the "sensor-to-shooter" cycle, the timeline between target detect and its destruction. During the Gulf War, it took almost two days for U.S. military forces to detect a hostile target, like a Scud missile, and for air or ground forces to strike and destroy it. In 1999, during the War in Kosovo, the cycle was between one and two hours. In 2001 during the Afghanistan War, the cycle was 19 minutes, and most recently, in Operation Iraq Freedom, it was approximately 10 minutes. Some analysts predict that in the future, a sensor-to-shooter cycle as short as seven seconds will be sufficient to detect a target and redirect a missile already in flight to the new objective.[20]

Warfighters reliance on space also extends to resources and services outside of the military. Military use of commercial and civil space resources greatly complicates military "reliance equation." Today, military forces depend extensively on commercial and civil space resources. A good example is the dependence the military has on commercial space-based communications. According to Army General Joseph Cosumano, Commander of U.S. Army Space and Missile Defense Command and Army Space Command, during Operation Iraqi Freedom, over 70 percent of military communication where provided by commercial satellites.[21]

Based on a study from the National Defense Industrial Association (NDIA), student defense analysts at the Naval Postgraduate School estimate that U.S. military dependence on space systems will continue to outpace the DOD budget and it procurement capability.

The same study predictions, that by 2010, the military will acquire over 30% of space imagery from commercial sectors. The resulting demand will likely forced DOD to look to the commercial and civil sectors to satisfy a significant portion of its military requirements.[22] A strong military reliance on space assets, including civil and commercial resources, will characterize the space control domain for many years to come.

Vulnerability in the Space Control Domain

Since the collapse of the Soviet Union in the early 1990s, the U.S. has enjoyed a prolonged period of unchallenged military dominance in space. That era may end quickly, according to General Lance Lord, Commander U.S. Air Force Space Command. The General states: "Space is the center of gravity now. We must not let it become a vulnerability…our future adversaries understand that we have this advantage, and I think they are trying to develop capabilities right now to thwart that…we must protect this advantage."[23]

U.S. military reliance on space and its dependence on information from space systems have increased the likelihood that an adversary would target U.S. space resources. If an adversary employs space operations to deceive, disrupt, deny, degrade, or destroy U.S. space systems, they will reduce or altogether eliminate the military advantage gained from space.[24] In January 2001, The report of the *Commission to Assess United States National Security Space Management and Organization*, also know as the "Space Commission," made a strong statement about the susceptibility of U.S. space systems. The report states:

> "The relative dependence of the U.S. on space makes its space systems potentially attractive targets. Many foreign nations and non-state entities are pursuing space-related activities. Those hostile to the U.S. possess, or can acquire on the global market, the means to deny, disrupt, or destroy U.S. space systems…by attacking satellites in space, communications links to and from the ground, or ground stations that command the satellites and process their data. An attack on elements of U.S. space systems during a crisis or conflict should not be considered an improbable act. If the U.S. is to avoid a "Space Pearl Harbor" it needs to take seriously the possibility of an attack on U.S. space systems."[25]

Current DOD assessments also support this assertion. Based on two reports, "Interim Space Capstone Threat Capabilities Assessment," July 2003, and "Threats to US Space Systems and Operations over the Next Ten Years," February 2003, Air Force Space Command identifies three key judgments, which lend insight to the vulnerability of U.S. space assets:

1. The U.S. military depends on national and commercial space systems of both domestic and foreign (or international consortia) origin. Offensive operations to disrupt or deny access to these systems could seriously affect U.S. warfighting capabilities.
2. Space systems are potentially susceptible to offensive counterspace operations.
3. Potential adversaries could challenge U.S. access to space by taking advantage of a range of capabilities within their technological means to include denial and deception, ground station attack and sabotage, electronic attack, and direct attack on satellites.[26]

These reports indicate that military space assets are highly vulnerable. To minimize this vulnerability, an understanding of the impact of possible attacks on space resources is fundamental to solidifying an effective space control strategy.

Possible Impact of Enemy Attacks on Space Vulnerabilities

According to Tom Wilson, former Space Commission staff member, attacks on U.S. space assets—military, commercial, or civil—would reduce or eliminate the military effectiveness gained by terrestrial warfighters from space systems. He also adds, "As detrimental as the loss or degradation of commercial or civil assets would be, an attack on intelligence and military satellites would be even more serious for the nation in time of crisis or conflict."[27] In a threat assessment Wilson prepared for the Space Commission, he outlines several scenarios of how an attack on U.S. space assets would affect military forces. They include:

- Impairing or eliminating satellite communications systems would disrupt troop command and control at all force levels.
- Impairing or eliminating weather satellites and earth observation systems would make it more difficult to plan effective military operations.
- Impairing or eliminating navigation satellites would make troop movements more difficult, aircraft and ship piloting problematic, and could render many precision-guided weapon systems ineffective or useless.
- Impairing or eliminating satellites which detection missile launches would degrade U.S. ability to perform missile launch warning, missile defense, and could increase the psychological impact of an adversary's missile attacks.
- Impairing or eliminating reconnaissance satellites would reduce situational awareness and could lead to military surprise, underestimation of enemy strength

> and capabilities, less effective planning, and less accurate targeting and battle damage assessments.[28]

The impact from such scenarios would drive the price tag of victory in a war to very expensive costs, both in term of dollars and lives. The loss of military space capabilities could even lead to defeat.

Key Players in the Domain

Knowing who the main players are in the space control domain also helps characterize the competitive environment. Many countries have the capability to deploy sophisticated technologies that can impede our space systems and the ground facilities that command them. Because of trends in technology proliferation, globalization of space industries, and commercialization of space systems, the range of players becomes very broad. The following summaries provide an overview of the space capabilities of the countries most likely to offer the U.S. military competition in the space control arena.

Russia. Historically both a pioneer in space and our most serious competitor in the use of space for national security, Russia retains most of its Soviet-era industrial and technical space capabilities. The space industry represents a significant source of currency for Russia, particularly in launch vehicles and technology, so the threat of technology proliferation is a concern. Even as the rest of the Russian military endures cuts, the space (rocket) forces continue to have relatively high priority for modernization.[29] Russia maintains a co-orbital ASAT, although likely to be in a state of disrepair. The ASAT is, basically, a missile armed with a conventional explosive. After launching the missile into orbit, the ASAT closes in on its designated objective within one or two orbital revolutions, between about 90-200 minutes. Guided by onboard radar, the 1,400 kg interceptor would maneuver close to the satellite and detonate as it approached it. Initially tested between 1963 and 1972, ASAT evaluations consisted of approximately 20 launches, 7 interceptions, and 5 detonations. The Soviet Union declared the system operational after initial tests confirmed it would work in orbital altitudes of 230 to 1,000 kilometers.[30] In the 1980s, the then-Soviet Union also pursued the development of directed-energy weapons; however, neither the U.S.S.R. nor Russia has ever fielded an operational capability.[31]

China. The 2003 DOD *Annual Report to Congress on the Military Power of the People's Republic of China* states that China *publicly* opposes the militarization of space and seeks to prevent or slow the development of U.S. anti-satellite systems. However, the report also states that *privately*, China's leaders view ASAT systems and offensive counterspace systems as "inevitabilities." China may be developing passive measures designed to deny access to space systems or cause deception, such as GPS jammers. Moreover, the Chinese may have already acquired equipment and technical assistance to develop high-energy ground-based lasers to use as ASAT weapons. Although a specific Chinese programs for a *laser* ASAT system has not been identified, Chinese press articles indicate that the government has an interest in developing the capability.[32] The DOD report also suggests that China is intensifying key research to develop a *direct-ascent* ASAT system and could field a system in the next six years. Finally, U.S. military space analysts believe China has developed and tested a "parasitic micro-satellite," which attaches itself to high-value satellites and disable them upon command.[33]

Other Key Players. Europe is technically capable of constructing space control systems equivalent to anything that the United States can build, although maybe to a lesser degree of technical sophistication. Europe is generally a compatible partner for the U.S. on national security in space; however, European countries have not reached a consensus on a particular approach to space control. Likewise, Japan is also technically capable, but the Japanese constitution restricts its military to a very limited defensive charter.

Some defense analysts suggest that North Korea, Iran, Pakistan, and India are also key players in the space control arena. These countries may be key actors not for their space control capabilities, but more for their emerging missile technologies. Missiles armed with a nuclear warhead and detonated in space could indiscriminately harm or destroy low earth orbit satellites. In addition, the resultant radiation from the detonation would accumulate in the Van Allen belt and dramatically shortened the lifespan of unshielded satellites passing through the belt, to possibly weeks.[34]

Lastly, non-state actors are key players too. The ease of access to space technology and systems can make it simple for unconventional forces or terrorists to acquire space control capabilities, such as navigation or communications jammers. With operating budgets of a small business office, formidable space control methods may be available to these non-state groups.[35]

Analysis of Possible Threats in the Space Control Domain

In future conflicts, our opponents are likely to possess technologies that will challenge our space-based capabilities. These adversaries will probably attempt to jam satellite uplinks or downlinks, making commercial systems, wideband services, and small mobile users most vulnerable.[36] In the summer of 2003, a group of Iranians operating at a teleport in Cuba disrupted a satellite communications transponder carrying a broadcast to the Middle East.[37] This example and the attempted jamming of GPS by Iraqi forces during Operation Iraqi Freedom hint that future adversaries are willing and able to attack America's military and commercial space capabilities.[38] An opponent may choose to exploit electronic countermeasures to disrupt satellite navigation signals or may utilize laser-like means to "dazzle" imagery and sensing systems. More technically sophisticated opponents with moderately developed technology could develop direct ascent anti-satellite interceptors against low-altitude satellites or build ground-based high-energy lasers to use against low altitude satellites.[39]

Potential enemies will not need to possess a native space capability to be viable players in the space domain. Non-state actors may challenge the U.S by finding space commodities for military use from technically advanced countries that have the services, such as Russia or China. International businesses will also be a source of space capabilities. Opponents will likely gain access to secure command and control structures by using services or products adapted from business communications, such as using frequencies with smaller spot beams to make them increasingly difficult to intercept or jam. Even high-resolution commercial reconnaissance imagery to warn of U.S. military intentions will be available to an adversary at affordable prices.[40]

Although most defense analysts and strategists would agree that *vulnerability* characterizes the space control domain, some believe that vulnerabilities do not necessarily translate into military threats. Theresa Hitchens, Vice President of the Center for Defense Information, a non-partisan think-tank in Washington, D.C., asserts that for a threat to exist to U.S. space systems, a potential adversary must have both the technological capability (or access) and the intent to use them in a hostile way.

According to Hitchens, there is little hard evidence that any other country or non-state actors possess both.[41] It would be sensible for U.S. military planners to consider not only technical capability or access of a potential adversary, but also the propensity of an opponent to use such force.

---

[1] PDD-NSTC-8, "National Space Policy," September 19, 1996.

[2] Joint Publication 3-14, "Joint Doctrine for Space Operations," August 9, 2002, p. GL-6.

[3] Baines, Phillip J., "Prospects for Non-Offensive Defenses in Space," Center for Nonproliferation Studies Occasional Paper No. 12, p. 40-41.

[4] Ibid, p. 40-41.

[5] Ibid, p. 40-41.

[6] Ibid, p. 39-40.

[7] Ibid, p. 42-43.

[8] Krepon, Michael, and Clary, Christopher, "Space Assurance or Space Dominance? The Case Against Weaponizing Space," The Henry L. Stimson Center, Washington D.C., http://www.stimson.org/pubs.cfm, p. 72.

[9] Baines, p 43-44.

[10] Ibid, p 45.

[11] Zielinski, Robert H., Worley II, Robert M., Black, Douglas, S., Henderson, Scott A., Johnson, David C., "Star Tek-Exploiting the Final Frontier: Counterspace Operations in 2025," presented as part of *Air Force 2025*, a study to examine concepts, capabilities, and technologies, June 17, 1996, p. 22-23.

[12] Ibid, p. 28-29.

[13] Chun, Clayton K. S., "Striking Out to Space: Technical Challenges to the Deployment of ASAT Weapons," Center for Nonproliferation Studies Occasional Paper No. 12, p 28-29.

[14] Ibid.

[15] Bierstine, Leigh Anne, "Laser Aircraft Arrive for Test Work," Air Force Flight Center Public Affairs, http://www.af.mil/news/story.asp?storyID=122302409, December 23, 2002.

[16] Spacy, William, Assessing the Military Utility of Space-Based Weapons, Space Policy Institute, presented at the Space Policy Institute, Security Policy Studies Program, The George Washington University, Washington D.C., October 2003, p. 133.

[17] Statement of Arthur K. Cebrowski, Director of Force Transformation, Office of the Secretary of Defense, before the Subcommittee on Strategic Forces Armed Services Committee, United States Senate, March 25, 2004, p. 2.

[18] Logsdon, John M., "Just Say Wait to Space Power, Issues in Science and Technology, Spring 2001," http://www.nap.edu/issues/17.3/p_logsdon.htm, p. 2.

[19] Preston, Bob, and Baker, John, Editors Khalilizad, Zalmay and Shapiro, Jeremy, Strategic Appraisal, United States Air and Space Power in the 21st Century, RAND, Project Air Force, 2002, p. 154-155.

[20] Jing, Zhong, "Seeking a Better Approach to Space Security," The Nonproliferation Review, Monterey Institute of International Studies, Volume 10, Number 2, Summer 2003, p. 99.

[21] Roosevelt, Amy, "Space Control Vital for Future Operations, General Says," Defense Daily, November 3, 2003, p. 12.

[22] Douglas, Michael L., and Gray, Arlene J., "The Warfighters' Counterspace Threat Analysis (WCTA), A Framework for Evaluating Counterspace Threats," September 2000, Naval Postgraduate School, Monterey, California, p. 16-18.

[23] Dundney, Robert S., and Grier, Peter, "New Orbit for American Space Power," Air Force Magazine, February 2004, p. 40.

[24] Wilson, Tom, "Threats to United States Space Capabilities," prepared for the Commission to Assess United States national Security Space Management Organization, http://www.fas.org/spp/eprint/article05.html#r22, January 2001, p. 20.

[25] "Report of the Commission to Assess United States National Security, Space Management and Organization," January 11, 2001, p. viii-ix.

[26] Air Force Space Command, "Strategic Master Plan FY06 and Beyond," October 1, 2003, p. 5.

[27] Wilson, p. 40-41.

[28] Ibid, p. 39-41.

[29] Preston and Baker, p. 160.

[30] Grego, Laura, "A History of U.S. and Soviet ASAT Programs", Union of Concerned Scientist, http://www.ucsusa.org/global_security/space_weapons, April 9, 2003.

[31] Hyten, John E., "A Sea of Peace or a Theater of War: Dealing with the Inevitable Conflict in Space," University of Illinois at Urbana-Champaign, http://www.acdis.uiuc.edu/homepage_docs, April 2000.

[32] "Annual Report to Congress on the Military Power of the People's Republic of China," Department of Defense, July 28, 2003, p. 33.

[33] Ibid.

[34] Preston and Baker, p. 161.

[35] Krepon, p. 20.

[36] Preston and Baker, p. 167-170.

[37] Butler, Amy, "Heavy DOD Reliance on Commercial SATCOM Prompts Questions of Protection," Defense Daily, April 13, 2004.

[38] Air Force Space Command, "Strategic Master Plan FY06 and Beyond," October 1, 2003, p. 21.

[39] Preston and Baker, p. 167-170.

[40] Ibid.

[41] Hitchens, Theresa, "Weapons in Space: Silver Bullet or Russian Roulette? The Policy Implications of U.S. Pursuit of Space-Based Weapons," presented at the Space Policy Institute, Security Policy Studies Program, The George Washington University, Washington D.C., October 2003, p. 99-100

Chapter 3

What is the U.S. Space Control Differential Advantage?

Addressing the U.S. House of Representatives on February 5, 2002, Secretary of Defense Donald H. Rumsfeld stated, "Our goal is not to bring war into space, but rather to defend against those who would. Protecting U.S. military assets in space from attack by foreign aggressors must be a priority in the 21st Century."[1] Mastering the "ultimate high ground" will require DOD to gain a differential advantage in structures and resources to dominate a potential adversary in the space control arena. The second question of this analysis focuses on the key sources of superiority in the space control domain—does the U.S. have, or can it get, an advantage relative to an adversary seeking to dominate the space control domain? This analysis will ask this question of the three most logical areas to study—mission, organization, and resources. The chapter investigates each of these areas in a three-part analysis—space control mission, organizational differential advantage, and resource differential advantage.

Part I: Space Control Mission

A report from the Stockholm International Peace Research Institute (SIPRI) identified that at the end of 2001, the United States had nearly 110 operational military satellites. Russia had 40 and the rest of the world had about 20 satellites on orbit.

However, an inventory of operational military spacecraft is a poor indicator of a differential advantage in the space control domain. John Pike, a renowned space analyst, explains that the essence of military advantage in space does not reside in the number of spacecraft in orbit, but in the integration of space capabilities into the military operations of terrestrial military forces.[2]

The growth of U.S. military space vehicles since the Gulf War in 1991 is modest compared to the dramatic proliferation of diverse warfighting capabilities that have evolved in terrestrial user equipment sets. According to Pike, no other country can tie together terrestrial weapons platforms into integrated precision warfare systems the way the U.S. has by using military space systems.[3] The result is a "system of systems" that amalgamates information from communications, navigation, intelligence and a multitude of other military systems. The protection of military network centric systems and guaranteed access to them are at the heart of the space control mission.

Counterspace operations implement the space control mission. Air Force Doctrine Document 2-2, "Space Operations," states the purpose of counterspace operations is to "attain and maintain a desired degree of space superiority by allowing friendly forces to exploit space capabilities while negating an adversary's ability to do the same."[4] Counterspace operations consist of three sub-missions: Space Situation Awareness (SSA), Defensive Counterspace (DCS), and Offensive Counterspace (OCS). Space Situation Awareness operations provide a "big space picture" of what is going on in space. The SSA mission includes traditional space surveillance, reconnaissance of space assets, collecting and processing of space intelligence data, and the analysis of the space environment. Defensive Counterspace operations serve to *safeguard the ability* to exploit space by protecting space capabilities from enemy attack or interference. DCS operations are passive in nature. In contrast, Offensive Counterspace operations are active in nature and *preclude an adversary* from exploiting space to his advantage.[5]

SSA capability is a top DOD priority and seen as a crucial enabler for DCS and OCS operations. According to Major General Franklin J. Blaisdell, Director of Air Force Space Operations and Integration (AF/XOS), SSA tells decision makers what they need to know about "what's happening in our space environment. If something occurs, we need to know if it's (because) of natural causes or if somebody is trying to mess with our satellites."[6] The Space Surveillance Network (SSN), which is an aggregation of ground-based radars and optical sensors, is the mainstay of situation awareness operations. Network sensors find, fix, track, and provide data to DOD space control centers that characterize objects in space.[7] The military *Space Superiority Tier* depicted at Figure-1, described part of the military space power "construct" identified in the Air Force Space Command Strategic Master Plan. The diagram shows the relationship between counterspace operations and space superiority. According to DOD, without SSA, the pillars of OCS and DCS will sit on unsteady ground.[8]

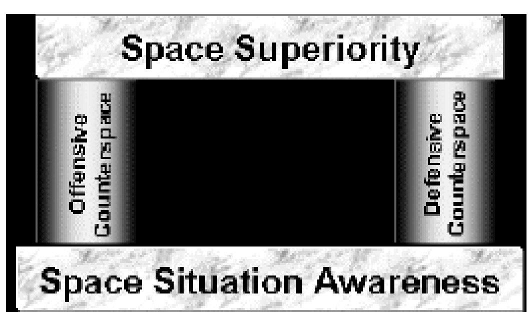

Figure 1 – Military Space Superiority Tier

Part II: Organizational Differential Advantage

The Space Commission identified an approach for a successful organizational and managerial structure to meet the future space needs of the military. One of those measures was to create an organization that "permits officials to be agile in addressing the opportunities, risks, and threats that inevitably will arise."[9] DOD has begun to pursue this objective by making key changes in the military space hierarchical structure. These organizational adjustments include designating the Air Force as the DOD *Executive Agent for Space*, enhancing the role of the *National Security Space Architect*, and aligning military space operations under U.S. Strategic Command (USSTRATCOM). An assessment of these structures provides insight to additional U.S. differential advantages in the space control domain.

DOD Executive Agent for Space

DOD Directive 5101.2, entitled "DOD Executive Agent for Space," regulates the management of space systems within the Department of Defense. It establishes policy for the planning, programming, and the acquisition of space systems. It also designates the Secretary of the Air Force as the Executive Agent for Space. The responsibilities of the Executive Agent include eliminating duplication of effort in the planning, programming, R&D, and acquisition of DOD space resources. The SECAF delegates the authority of Executive Agent of Space to the "double-duty" position of the Under Secretary of the Air Force/Director of the National Reconnaissance Office (USECAF/DNRO).[10]

The USECAF/DNRO serves as the Department of Defense executive agent for space and as the director of the National Reconnaissance Office. This position is the Air Force acquisition executive for space, has authority over all Defense Department and NRO space programs, and oversees and directs the National Security Space Architect.[11] The USECAF/DNRO reviews and assesses space programs in the Program Objective Memoranda (POM), a series of financial documents reflecting DOD program budgets over a six-year span. He reports his appraisal in the National Security Space Program Assessment (NSSPA), which evaluates the consistency of defense and intelligence space programs with policy, strategy, financial guidance, and space security architectural decisions.[12]

National Security Space Architect

The National Security Space Architect (NSSA) is an independent organization run by DOD and the Intelligence Community (IC), and chartered by an agreement between the Secretary of Defense and the Director of Central Intelligence. The NSSA is responsible for developing and integrating space system architectures for future space programs in DOD, IC, and civil agencies. The NSSA works collaboratively with representatives from military, intelligence, civil, and commercial sectors.

In January 2001, the Space Commission made several recommendations to expanding the roles and responsibilities of the NSSA. The organization has, since then, realigned to report to the USECAF/DNRO and expanded its functions to include:

- Conducting an annual assessment (NSSPA) of the consistency of defense and intelligence space programs with national security space policy, planning guidance, and architectural decisions

- Supporting the USECAF/DNRO to develop the National Security Space Plan (NSSP) based on the space plans and architectures of the DOD component services.
- Assisting the USECAF/DNRO with assessing trades-offs between space and non-space solutions to meet space user requirements.

No other organization in DOD, IC, or civil sector performs these functions. Accordingly, it is widely supported by various space planning and development organizations across the federal government and industry.[13]

U.S. Strategic Command (USSTRATCOM)

USSTRATCOM is responsible for military space control operations. It is one of nine U.S. Unified Commands under the Department of Defense. On October 1, 2002, USSTRATCOM merged two previous unified commands: U.S. Space Command, which oversaw DOD space and information operations, and the former USSTRATCOM, which was responsible for the command and control of U.S. strategic forces. USSTRATCOM operates military space forces through its service component commands—Army Space and Missile Defense Command (SMDC), Naval Network and Space Operations Command (NNSOC) and Space Air Forces (SPACEAF).

Assessment: Organizational Differential Advantages and Obstacles

Bob Preston and John Baker in their report "Space Challenges," which appears in the fourth of a series of RAND Strategic Appraisals, point out several organizational obstacles. These impediments may detract from the organizational differential advantages that the U.S. has in space control domain. The first obstacle centers on the culture and the people of the military space community. Air Force Space Command, formed in 1983, was created around a "nucleus of nuclear deterrence and warning." Preston and Baker suggest that the operational culture of the community is one of "caution and predictability" over "initiative and responsiveness."[14] As a result, they see this "Cold War" mentality as an obstacle to exploring and developing tactically useful space capabilities. Adding to this concern, Retired Admiral Cebrowski in his testimony to Senate Subcommittee on Strategic Forces stated:

> "The Cold War attributes of our existing space programs limit our ability to maintain space superiority required in today's rapidly changing strategic environment. Specifically, the mission criticality that grew out of the Cold War and the very high cost of our complex and highly capable space systems lead to a high consequence of failure. The required corresponding risk mitigation strategy incentivizes expensive, long lasting, heavy, multi-mission payloads."[15]

Reaffirming their hypothesis, Preston and Baker point to the merging of the space career field with the missile operations career field, and cite how, in this culture, missileers have risen to the top.[16]

The distancing of the newly operational military space community from its roots in the R&D and intelligence communities is a second obstacle that Preston and Baker point out. According to the RAND analysis, the military space community has isolated itself from the National Reconnaissance Organization (NRO) "cradle-to-grave" approach to space operations. The NRO method encompasses all elements contributing to the mission's accomplishment including technology, acquisitions, and operations. This separation is an obstacle to accessing the innovation and creative talents of the space R&D community and isolates the military space community from crucial sources of intelligence data from agencies. The integration of these intelligence sources into military operations could yield great dividends toward developing tactical military uses of space services.[17] The recent designation of the Executive Agent of Space as the oversight authority for both DOD and NRO programs should reduce this gap.

A third significant obstacle may stem from isolating space operations organizationally from air operations. The severing of communication between the two elements works counterproductively towards fully integrated space into the warfighter's tactical theater. Preston and Baker point out that the result is a competing advocacy of air and space platforms rather than determining: "What is the right mix of combined air and space capabilities for the mission tasks at hand?"[18]

This analysis of organizational advantages indicates a need to promote a military space culture of initiative and responsiveness that seeks to mold military space services into useful products for the tactical warfighter. Improving the military space community's relationships with external space agencies, especially the NRO, and the warfighter in the tactical theater will also help promote this aim.

Part III: Resource Differential Advantage

Conducting an inventory of space resources and their capabilities can provide meaningful indicators of differential advantage. The analysis helps identify strengths and weakness in military counterspace operations and their ability to meet space control strategic goals. DOD categorizes space control resources into four systems:

- **Space Surveillance Systems:** Detect, identify, assess, and track space objects and events. Space surveillance is a fundamental capability contributing to Space Situation Awareness operations.

- **Protection Systems:** Employ active and passive defensive measures including: ground facility protection, alternate control nodes, spare satellites, link encryption, increased signal strength, satellite radiation hardening, and space-debris protection measures. These systems may also provide notice of satellite attack or advisory of system malfunction caused by severe space weather, such as solar flare activity. Space protection systems support Defensive Counterspace Operations.
- **Prevention Systems:** Employ measures to prevent an adversary from using data or services from U.S. or friendly space systems. These systems support Defensive Counterspace Operations.
- **Negation Systems:** Measures designed to deceive, disrupt, deny, degrade, or destroy an adversary's space capabilities. Negation systems may act against ground, link, or space segments of an adversary's space system. These systems support both Defensive and Offensive Counterspace Operations.[19]

DOD Space Control Budget Analysis

A good snapshot of the state-of-health of space control resources may be gained from an analysis of "where and how much" money DOD is allocating to space control programs. Each military branch has "line items" identified as space control programs in their budgets. These budgets fund Operations & Maintenance (O&M) costs and Research, Development, Testing & Evaluation (RDT&E) efforts. The Air Force budget contains most of the DOD space control funds. This analysis will look at major spending identified in President's Budget (PB) requests for Fiscal Years '04, and '05. FY 03 figures are also included to depict any "deltas" in the out-year budget requests.

Space Control O&M Activities

Air Force Space Operations. This funding activity supports the DOD SPACETRACK program, which is a worldwide network of space surveillance sensors. The network's electro-optical and radar sensors provide data for the following functions: Space object identification and cataloging; satellite attack warning; space treaty monitoring; and scientific and technical intelligence gathering. Funding in this activity group includes support for Ground-Based Electro-Optical Deep Space Surveillance (GEODSS), HAYSTACK, Millstone, Moron Optical System, and the Maui Space Surveillance Site. The following figures identify the Air Force budget request in the FY 05 President's Budget:

FY 2003	FY 2004	FY 2005	
65,333	79,486	96,198[20]	(Dollars in Thousands)

Air Force Global C3I and Early Warning. Listed under "Combat Related Operations," the Air Force funds counterspace operations in a budget activity identified as the "space control." The program includes the acquisition of advanced counterspace systems used for counter-communications, counter-surveillance, counter-reconnaissance, and attack identification/detection. The Air Force plans to field three mobile counter-communication systems in FY 04. The financial summary for this program is as follows:

FY 2003	FY 2004	FY 2005 (Dollars in Thousands)
17,668	18,256	18,985[21]

Navy Combat Operations/Support. The majority of funding in the Navy O&M space budget supports the Navy Space Surveillance System (NSSS).[22] NSSS includes both the Navy Space Surveillance Fence and the Alternate Space Control Center

(ASCC). The radar system generates a radio frequency "fence" and can detect earth-orbiting objects passing through it out to 15,000 nautical miles. As part of the SPACETRACK network, NSSS provides data to support the cataloging of satellites and debris, track foreign launches, make orbit determinations, and provide collision avoidance warnings. A transfer of the NSSS from the Navy to the Air Force should occur in FY 04. The Air Force is deliberating whether to stop the program and instead pursue a space-based surveillance network.[23] The following fund lines identify this budget:

FY 2003	FY 2004	FY 2005	
292, 918	128,159	136,231[24]	(Dollars in Thousands)

Space Control RDT&E Budget Activity

Each military component pursues RDT&E activities in space control. The Army requests $3.04M in FY 2005 to explore miniaturization technology on integrated circuit boards capable of detecting satellite threats.[25] The Navy is pursuing space control initiatives in Space and Electronic Warfare (SEW) and requesting $25.9M in FY 05.[26] The Air Force budget funds the majority of space control RDT&E efforts and requests $252.7M in FY 05. Air Force space control initiatives are funded in three programs: SPACETRACK ($161.8M), Space Control Technology ($15.0M), and Counterspace Systems ($75.9M).[27]

SPACETRACK Program. This budget reflects a collection of linked developmental efforts aimed at accelerating the evolution of the Space Surveillance Network (SSN). One of the program's main efforts is to build an operational architecture capable of disseminating to warfighters a Space Common Operational Picture (Space COP). The Air Force FY 2004/2005 Biennial RDT&E Budget Estimates identifies the following initiatives:

- Acquiring the *Space Based Space Surveillance (SBSS)* system, which is a constellation of satellites designed to provide timely space situational awareness. The project follows the successful testing of optical sensors on the Mid-Course Space Experiment (MSX). MSX demonstrated the ability to track objects in space from a space-based platform. The Air Force estimates a budget of $78.9M in FY 04 and $109.5M in FY 05. The effort continues past FY 09 and has an approximate total cost of $801.6M up thru FY 09.
- Developing the *Orbital Deep Space Imager (ODSI).* The system will provide near-real time, high-resolution imagery of geosynchronous satellites. This capability will support battle space awareness and defensive counterspace operations. The Air Force projects a cost of $3.9M in FY 04 and $8.8M in FY 05. The development effort will continue past FY 09 and has an estimated total cost of $499.7 thru FY 09.
- Implementing *Service Life Extension Programs (SLEP).* The programs aims to extend the life of SPACETRACK radar systems by upgrading the hardware and software of equipment located at Eglin Air Force Base, the Navy Space Surveillance Fence, and at the HAYSTACK site at Westford, Massachusetts. The estimated budget is $19.8M in FY 04 and $31.7M in FY 05. The program will continue through FY 08 and has an estimated total cost of $116.8M.

- Completed upgrade projects for GEODSS. The upgrades included integrating the Modular Precision Angular Control Systems (MPACS) and installing new hardware and software for the sensor controller. Completed in FY 02, the upgrades had a total cost of $10.3M.
- Installing the HAVE STARE radar antenna. The 27-meter mechanical dish radar, sited at Vardo, Norway, provides high-resolution X-band tracking, and imaging to support space cataloging and payload assessment functions. Completed in FY 02, the project's total cost was $131.3M. [28]

Space Control Technology Program. This program supports a range of activities including planning, development, demonstrations, prototyping, modeling, simulations, exercises, and development of counterspace tactics. The Air Force FY 05 budget supports two Advanced Component Development and Prototype (ACD&P) projects that investigate space control technologies. They are *Space Range* and *Technology Insertion Planning and Analysis (TIPA)*.[29]

The FY 05 budget for Space Range Initiative is $6.4M. The program supports a "virtual" test range at Nellis Air Force Base in Nevada, which develops space tactics and conducts operational testing and training of new space systems.[30] ACD&P efforts include the development of a "Scintillation Phenomonology" Support Sensor (SPOSS), "Red" UHF testing system, an Adversary Network Emulator, and a mobile communications analysis and test system.[31]

TIPA initiatives, budgeted at $8.7M in FY 05, include efforts from all counterspace areas. Space Situational Awareness efforts focus on developing key enabling technologies—monitoring, detecting, identifying, tracking, assessing, verifying, categorizing, and characterizing objects/events in space. Defensive Counterspace (DCS) efforts aim to evaluate the vulnerability of U.S. satellites, space links, and ground control facilities, by studying protective measures against numerous threats including optical jammers, radiation effects, kinetic energy impacts, data fusion, and data mining. The investigation also examines techniques to deny an adversary the use of "blue systems," such as GPS. OCS efforts concentrate on the development of advanced techniques involving operations in counter-communications, counter-surveillance, and counter-reconnaissance. The current objective of OCS initiatives is to produce negation capabilities that have temporary, localized, and reversible effects.[32]

It is interesting to note that DOD has not requested funding for the Kinetic Energy Anti-Satellite (KEA) program for many years; however, continues to receive funding from Congress. Having appropriated funds to the KEA program in six of the past nine years, Congress added $4M to the Space Control Technology program in the Air Force budget in FY 04.[33]

Counterspace Systems Program. This program capitalizes on the technology and risk reduction efforts explored by the Space Control Technology program. The FY 05 budget is $75.9M and projects continued efforts past FY 09. The estimated total cost through FY 09 is $361.1M.[34] The Air Force FY 05 RDT&E budget identifies the following three major initiatives:

- *Counter-Satellite Communications System (CSCS)*: The program FY 05 budget is $6.24M. It explores the development of mobile and transportable systems with a capability to disrupt satellite communications signals. One system was delivered in FY 04 and two more are scheduled for delivery in early FY 05. Important acquisition milestones, System Requirements Review (SRR) and Critical Design Review (CDR), are set to start in late-FY 05 for a second-generation "Block 20" system.[35]

- *Counter-Surveillance Reconnaissance System (CSRS)*: This program supports concept exploration and follow-on system development of mobile and transportable systems to counter space-based surveillance and reconnaissance capabilities. The program budget in FY 05 is for $53.2M and continues past FY 09. The first system deliveries should begin in mid-FY 07.[36]
- *Rapid Identification Detection and Reporting System (RAIDRS)*: This system will detect the source of attacks on space assets and provide decision-makers with near real-time attack warning, threat identification, and threat characterization. Current efforts focus on developing target "geo-location" and laser detection capabilities. Initial system delivery should occur in late FY 06. The second spiral capability should begin in FY 08 and will focus on developing "data fusion" capabilities. The FY 05 budget is $16.4M and continues past FY 09.[37]

Assessment: Resource Differential Advantages and Obstacles

The U.S. enjoys a relatively threat-free military space control environment. Other than the occasional jammer aimed at confounding GPS-guided munitions or communications, military forces have complete access to space resources. Nonetheless, U.S. military space dominance exists largely because it has been uncontested, and not so much because of military counterspace endeavors. Historically, military space control efforts emphasize passive defense mechanisms such as shielding, EMP circumvention designs, and anti-jamming techniques, but the focus is shifting to Space Situation Awareness as a priority.[38]

The Space Surveillance Network (SSN) is the backbone of DOD space control resources. Unfortunately, most of the sensors in the networks are Cold War legacy systems that leave the U.S. woefully short on SSA capability. The Air Force Space Command (AFSPC) Strategic Master Plan writes, "Our SSA capabilities are less than adequate. The sensors cannot consistently find small debris and have limited capability to find, track, and characterize objects in high-altitude orbits…our current capabilities do not meet all our timeliness requirements and have resultant gaps in coverage." Additionally, the strategic plan identifies a deficiency in the ability to distinguish a hostile attack on a satellite from a glitch generated by natural environmental phenomena, such as a solar flare.[39] These SSA deficiencies point to a critical shortfall in differential advantage.

Although defensive and offensive counterspace efforts have a less urgent precedence than SSA, DOD places strong emphasis on defending the three segments of space systems: space, link, and ground. AFSPC assigns the defense of the ground segment to "force protection" in the Mission Support area. Consequently, physical protection of the ground segment is not part of the Space Control mission area. This is not a problem, so long as ground segment protection has the same priority in the Mission Support arena. With respect to the space and link segments, AFSPC identifies the following DCS and OCS shortfalls in differential advantage:

- Need for enhancing survivability using advance measures.
- Need to mitigate any mission impact resulting from an attack and determine how to restore military space services.

- Need to deny an adversary the use of U.S space capabilities.
- Need to develop reversible measures to *deceive, deny, or disrupt* adversary's space capabilities.
- Need to develop irreversible means to *degrade or destroy* an enemy's space capabilities.[40]

In addition to identifying gaps in differential advantage, this chapter showed the funding levels for current space control efforts. An important question may be—where will funding for growing space control initiatives come from in the future? According to the Space Commission, America's military space capabilities are "not funded at a level commensurate with their relative importance."[41] The DOD budget requests about $300 million per year to strengthen space control capabilities—approximately $1.5 billion over the next five years.[42]

This level of funding made sense in the past when there was little concern about threats to U.S. space assets. However, as this analysis has shown, the situation is quickly changing. Technologies for attacking near earth orbit resources are no longer science fiction, but now "lie well within the realm of validation and exploitation," according Benjamin Lambeth, author of Mastering the High Ground, Next Steps in the Military Uses of Space.[43] The problem is most evident in the space control budget. Even though space control is one of six of DOD transformation goals,[44] the space control RDT&E budget reflects less than 2% of the DOD $21.7B space budget in FY 05.[45]

This predicament is traceable to the fact that military space funding comes almost entirely out of the Air Force budget. Since the Air Force acquires most of the DOD space systems, the Army and the Navy fund little for R&D in space.[46] The Air Force is becoming increasingly "strapped" by having to fund both air and space mission priorities.

This may one reason why the other services are so readily backing-off from the Air Force's dominance of military space. It allows the other services to shunt virtually the entire military space-funding burden to the Air Force. In an era of tight budgets, the Air Force must constantly balance space priorities against equally vital nearer-term air operations. The Air Force simply cannot afford to abandon its core air missions to allocate more money for space. Seemingly, funding of space control initiatives will continue with very limited resources.

---

[1] Testimony of U.S. Secretary of Defense Donald H. Rumsfeld prepared for the House Armed Services Committee 2003 Defense Budget Request, http://www.house.gov/hasc/openingstatementsandpressreleases/107thcongress/02-02-05rumsfeld.html, February 6, 2002.

[2] Pike, John, SIPRI Yearbook 2002: Armaments, Disarmament and International Security, Oxford University Press, 2002, p. 613.

[3] Ibid.

[4] Air Force Doctrine Document 2-2, "Space Operations," November 27, 2001, p. 12.

[5] Joint Publication 3-14, "Joint Doctrine for Space Operations," August 9, 2002, p. GL-6.

[6] Blaisdell, Franklin J., DOD News Transcript: Air Force Briefing on "Space: The Warfighter's Perspective," http://www.defenselink.mil/news/Mar2003.html, March 12, 2003.

[7] Air Force Space Command, "Strategic Master Plan FY06 and Beyond," October 1, 2003, p. 6.

[8] Ibid, p. 21.

[9] "Report of the Commission to Assess United States National Security, Space Management and Organization," January 11, 2001, p. 80.

[10] Department of Defense Directive 5101.2, "DOD Executive Agent for Space," June 3, 2003, p. 1-3.

[11] Ibid.

[12] Ibid.

[13] Department of the Air Force, RDT&E Budget Item Justification Sheet (R-2 Exhibit), February 2003, for Budget Activity PE 0305917F, Operational System Development Space Architect, http://www.defenselink.mil/comptroller/defbudget/fy2005/index.html.

[14] Preston, Bob, and Baker, John, Editors Khalilzad, Zalmay and Shapiro, Jeremy, Strategic Appraisal, United States Air and Space Power in the 21st Century, RAND, Project Air Force, 2002, p. 175-177.

[15] Statement of Arthur K. Cebrowski, Director of Force Transformation, Office of the Secretary of Defense, Before the Subcommittee on Strategic Forces Armed Services Committee, United States Senate, March 25, 2004, p. 2.

[16] Preston and Baker, p. 175-177.

[17] Ibid.

[18] Ibid.

[19] Joint Publication 3-14, "Joint Doctrine for Space Operations," August 9, 2002, p. IV-5-8.

[20] Department of the Air Force, Fiscal Year (FY) 2005 Budget Estimates, Operation and Maintenance, Active Forces, Volume 1, February 2004, http://www.defenselink.mil/comptroller/defbudget/fy2005/index.html, p. 318-319.

[21] Ibid. (Note: This budget activity group includes other space programs that are not part of the Space Control mission area, so they have been excluded from the budget numbers represented. The Space Control Program within this budget activity makes up on a small fraction of this budget, which has a baseline of $9.7B in FY 2004 and a request of $1.15B in FY 2005.)

[22] Department of Defense, Operations Programs (O-1) Budget, Fiscal Year 2005, Office of the Under Secretary of Defense (Comptroller), February 2004, http://www.defenselink.mil/comptroller/defbudget/fy2005/index.html, pg 6.

[23] Department of the Air Force, Procurement Program, Fiscal Years 2004/2005, Budget Estimates, Other Procurement, Budget Item Justification (Exhibit P-40), OPAF/Electronics & Telecommunciation Equipment, Space Mods Space, February 2003, http://www.defenselink.mil/comptroller/defbudget/fy2005/index.html, p. 194

[24] Operations Programs (O-1), Department of Defense Budget, Fiscal Year 2005, February 2004, Office of the Under Secretary of Defense (Comptroller), http://www.defenselink.mil/comptroller/defbudget/fy2005/index.html, p. 6.

[25] Department of the Army, Supporting Data FY 2004/2005 President's Budget Submitted to OSD, Descriptive Summaries of the Research, Development, Test, and Evaluation, Army Appropriation, Budget Activities 1, 2, and 3, Office of the Secretary of the Army (Financial Management and Comptroller), February 2003, http://www.defenselink.mil/comptroller/defbudget/fy2005/index.html, p. 394-398.

[26] Department of the Navy, Supporting Exhibits (M-1, O-1, P-1, R-1 & C-1), FY 2005 Budget, Office of Budget, February 2004, http://www.defenselink.mil/comptroller/defbudget/fy2005/index.html, p. N-6.

[27] Department of Defense, Defense Budget Materials, FY 2005 Budget, RDT&E Budget (R-1), http://www.defenselink.mil/comptroller/defbudget/fy2005/fy2005_r1.pdf, p F-4–F-12.

[28] Department of the Air Force, Fiscal Year (FY) 2004/2005 Biennial Budget Estimates, Research, Development, Test and Evaluation (RDT&E), Descriptive Summaries, Volume III, Part II, Budget Activity 7, February 2003, http://www.saffm.hq.af.mil/FMB/pb/afpb.html, p. 1749-1764.

[29] Department of Defense, Defense Budget Materials, FY 2005 Budget, RDT&E Budget (R-1), http://www.defenselink.mil/comptroller/defbudget/fy2005/fy2005_r1.pdf, p F-4–F-12.

[30] Lewis, Jeffery and Cowan, Jessy, "Space Weapons Related Programs in the FY 2005 Budget Request," Center for Defense Information, http://www.cdi.org/news/space-security/SpaceWeaponsFY05.pdf, March 2004, p. 7.

[31] Department of the Air Force, Fiscal Year (FY) 2005 Budget Estimates, Research, Development, Test, and Evaluation (RDT&E), Descriptive Summaries, Volume II, Budget Activities 4-6, February 2004, http://www.defenselink.mil/comptroller/defbudget/fy2005/index.html, p. 524-527.

[32] Department of the Air Force, Fiscal Year (FY) 2005 Budget Estimates, Research, Development, Test, and Evaluation (RDT&E), Descriptive Summaries, Volume II, Budget Activities 4-6, February 2004, http://www.defenselink.mil/comptroller/defbudget/fy2005/index.html, p. 524-527.

[33] Lewis, Jeffery, "Liftoff for Space Weapons? Implications of the U.S. Department of Defense's 2004 Budget Request for Space Weaponization," July 21, 2003, p. 12.

[34] Department of the Air Force, Fiscal Year (FY) 2005 Budget Estimates, Research, Development, Test, and Evaluation (RDT&E), Descriptive Summaries, Volume II, Budget Activities 4-6, February 2004, http://www.defenselink.mil/comptroller/defbudget/fy2005/index.html, p. 869.

[35] Department of the Air Force, Fiscal Year (FY) 2005 Budget Estimates, Research, Development, Test, and Evaluation (RDT&E), Descriptive Summaries, Volume II, Budget Activities 4-6, February 2004, http://www.defenselink.mil/comptroller/defbudget/fy2005/index.html, p. 871.

[36] Ibid, p. 875-877.

[37] Ibid, p. 879-881.

[38] Air Force Space Command, "Strategic Master Plan FY06 and Beyond," October 1, 2003, p. 21.

[39] Ibid, p. 23.

[40] Ibid, p. 22-23.

[41] "Report of the Commission to Assess United States National Security, Space Management and Organization," January 11, 2001, p. 97.

[42] Testimony of U.S. Secretary of Defense Donald H. Rumsfeld prepared for the House Armed Services Committee 2003 Defense Budget Request, http://www.house.gov/hasc/openingstatementsandpressreleases/107thcongress/02-02-05rumsfeld.html, February 6, 2002.

[43] Lambeth, Benjamin, S., Mastering the Ultimate High Ground, Next Steps in the Military Uses of Space, RAND Project Air Force, 2003, p. 97-100.

[44] Department of Defense, Quadrennial Defense Review Report, September 30, 2001, p. 45.

[45] Smith, Marcia, "CRS Report: U.S. Space Programs: Civilian, Military, and Commercial," Congressional Research Service, November 19, 2003, p. 9.

[46] "Report of the Commission to Assess United States National Security, Space Management and Organization," January 11, 2001, p. 75.

Chapter 4

What Is the Strategic Thrust?

The previous chapter identified the U.S. differential advantage in the space control domain. This chapter analyzes how military leaders intend to close existing gaps between the present strategic position and the competitive stance required to meet military space control objectives. Political leaders use policy to guide the development of the military means to support national security objectives. Through the process, political leaders identify where they want to take the nation and spell out the goals necessary to move in that direction. From U.S. National Space Policy, military leaders identified the major space control objectives, their sequencing, and the appropriate timing to commence them. This final analysis focuses on the "strategic thrust" U.S. space leaders have given space control. Strategic thrust helps steer the course between "too-much-too-soon" and "too-little-too-late."

National Space Policy

President Clinton used *Presidential Decision Directive/National Science and Technology Council (PDD/NSTC)-8* to enact the current U.S. National Space Policy on September 19, 1996. The policy engenders a strong, stable, and balanced national space program that serves U.S. goals in national security, foreign policy, economic growth, environmental stewardship, and scientific and technical achievement. The policy identifies access and use of space as central to preserving peace and protecting U.S. national security, civil, and commercial interests in space.[1]

The PDD/NSTC-8 also identifies key space activities to be conduct in the interest of U.S national security. It designates the Secretary of Defense and the Director of Central Intelligence as the responsible agency for overseeing these actions. Directed military space activities include:

- Providing support for the United States' inherent right of self-defense and for the defense of allies and friends.
- Assuring mission capability and access to space.
- Deterring, warning, and, if necessary, defending against enemy attack.
- Ensuring that hostile forces cannot prevent the United States from using space.
- Ensuring that the United States has the ability to conduct military and intelligence activities in space.
- Enhancing the operational effectiveness of U.S. and allied forces.
- Countering, if necessary, space systems, and services used for hostile purposes.
- Satisfying military and intelligence requirements during peace, crisis, and all levels of conflict.
- Supporting the activities of national policy-makers, the Intelligence Community, the NCA, Military Services, and other Federal officials.[2]

Specifically addressing space control, PDD/NSTC-8 directs that "consistent with treaty obligations" the U.S. will develop, operate, and maintain space control capabilities to ensure freedom of action in space and, if directed, deny such freedom of action to adversaries. It is important to note that the directive also specifies that space control capabilities may be "enhanced by diplomatic, legal, or other military measures to preclude an adversary's hostile use of space systems and services."[3]

DOD Space Policy

Extrapolating directly from the 1996 National Space Policy, then-Secretary of Defense William Cohen issued Department of Defense Directive 3100.10, "Space Policy," on July 9, 1999. Before this directive, the last major revision of DOD space policy was in 1987, during the Cold War. A memo from then-Secretary Cohen, which accompanies the DOD directive, states:

> "Space is a medium like the land, sea, and air within which military activities shall be conducted to achieve U.S. national security objectives. The ability to access and utilize space is a vital national interest because many of the activities conducted in the medium are critical to U.S. national security and economic well-being."[4]

Specifically addressing space control and the defense of the U.S., then-Secretary Cohen states:

> "…The United States and its allies will be strengthened by ensuring that an adversary cannot obtain an asymmetric advantage by countering our space capabilities or using space systems or services for hostile purposes…the capability to control space, if directed, will contribute to achieving the full dimensional protections, battlespace dominance, and information superiority necessary for success in military operations."[5]

Reflecting the 1999 National Space Policy priorities, the directive establishes policy and assigns responsibility for space activities within DOD. The policy articulates the intended strategic thrust of military space control efforts as follows:

- The primary DOD goal for space and space-related activities is to provide operational space force capabilities to ensure that the U.S. has the "space power" to achieve its national security objectives.

- Ensuring the freedom of space and protecting U.S. national security interests in the medium are priorities for space and space-related activities. U.S. space systems are national property afforded the right of passage through space and the right to operation in space without interference.

- Purposeful interference with U.S. space systems will be viewed as an infringement on U.S. sovereign rights. The U.S. may take all appropriate self-

> defense measures, including, if directed by the National Command Authorities (NCA), the use of force, to respond to such an infringement on U.S. rights.[6]

Space Control Strategy

One of the documents used by the Air Force, as DOD Executive Agent for Space, to convey the strategy for space control is the *Air Force Transformation Flight Plan*. Key goals identified in the plan are to *protect* vital military space assets and *deny* an adversary the ability to access space capabilities. Critical to carrying out these goals, the plan recognizes the importance of a rapid launch capability to reconstitute or repair space resources when needed.[7]

To meet the first goal, "ensuring that an adversary cannot disrupt, deny, or destroy the military's ability to exploit space-based assets," the strategy focuses on developing the following advanced protection technologies:

- Space-based space surveillance systems that provide details of space objects that cannot be detected by ground-based systems;
- Developing a system capable of detecting and reporting hostile actions against U.S. military space systems;
- Active on-board capabilities to protect friendly space systems from man-made or environmental threats;
- Adequately protecting key ground systems and developing backup command and control capabilities.[8]

The second goal of denying an adversary access to space assets centers on the use of air, land, and space-based offensive counterspace operations. This objective focuses on preventing unauthorized use of friendly space services and negating an adversary's access to space capabilities in low earth and geo-synchronous orbits.[9]

Near-Term Strategic Thrust

On February 25, 2004, Undersecretary of the Air Force Peter B. Teets reiterated the DOD strategic thrust of space control in his testimony to the U.S. House of Representatives Subcommittee on Strategic Forces. Undersecretary Teets stated:

> "Americans have come to rely on the unhindered use of space and will demand no less in the future...while the United States supports the peaceful use of space by all, prudence demands that we must be able to ensure the United States, its allies, and coalition partners will be able to make use of space, while denying that use of space to adversaries. This includes robust capabilities for assured launch and space control."[10]

During his testimony, Secretary Teets pointed out that DOD predicts future adversaries will try to deny U.S. military forces the asymmetric advantage that space provides, and cited the use of GPS jammers by Iraq during Operation Iraqi Freedom as an example.[11]

The strategic thrust of near-term space control efforts explores a mix of key technological capabilities and emphasizes the protection of national security interests against known vulnerabilities and credible threats. To ensure freedom of action in space, DOD near-term initiatives investigate new space surveillance capabilities and ways to integrate them into space systems that enhance space situational awareness. DOD is investing moderately to improve the ability to detect, track, and characterize objects in space. By upgrading to new hardware on selected radar and optical sensors, DOD endeavors to modernize the Space Surveillance Network and establish it as the mainstay for space situation awareness. Ultimately, DOD seeks to integrate improved SSN sensor data with space intelligence and environment data to produce a common "space picture" for military decision-makers.[12]

Also expected in the near to mid-term, DOD plans to deploy two new space-based surveillance and characterization sensors: Space Based Space Surveillance (SBSS) and Orbital Deep Space Imager (ODSI). SBSS will be a constellation of optical sensing satellites in low-earth orbit designed to provide timely and accurate information on satellite locations. The first SBSS satellite will launch in FY 07. Once operational, the system will improve the U.S. ability to detect deep-space objects by 80% over the current system. The second new system, ODSI, will be a constellation of geo-synchronous orbit satellites that will provide a significant improvement in the ability to track and characterize objects out to 22,000 nautical miles from the Earth.[13]

Another defensive counterspace initiative still in development is the Rapid Attack Identification Detection and Reporting System (RAIDRS). RAIDRS will have the ability to detect radio frequency interference on communication satellites and the capacity to locate the attacking source on earth. The system will also detect laser-dazzling attacks attempting to disrupt missile-warning satellites, such as the Defense Satellite Program (DSP).[14]

In addition, offensive counterspace programs are developing and testing the first counter-communications systems. The first of these systems has been delivered to the 76th Space Control Squadron at Peterson AFB, Colorado. The delivery of two more of these first-generation units is expected in FY 05.[15] The next generation of OCS systems will be the multi-service (Army/Air Force) Counter Surveillance and Reconnaissance

Systems (CSRS). The system will be mobile and transportable and will use "reversible-effects." CSRS is expected to be operational by FY 09.[16]

Long-Term Strategic Thrust

In the long-term, past 2015, DOD envisions pursuing other counterspace programs and systems that will contribute to the operational goals of DOD transformation. Listed in the Air Force Transformation Flight Plan, they are:

- **Air Launch System**: This system will be a dedicated, all azimuth, weather avoiding, on-demand (within 48 hours) system, which is capable of launching a Space Maneuver Vehicle, Common Aero Vehicle, or a Conventional Payload Module.

- **Air-Launched Anti-Satellite Missile**: This program will develop small air-launched missile capable of intercepting satellites in low earth orbit.

- **Common Aero Vehicle**: The vehicle is an unpowered, maneuverable, hypersonic glide vehicle deployed from a possible range of delivery vehicles, such as a small expendable launch vehicle or a fully reusable Space Operations Vehicle. It will guide and dispense conventional weapons, sensors, or other payloads worldwide from and through space within one hour of tasking. It will be able to strike a spectrum of targets, including mobile targets, mobile time-sensitive targets, strategic relocatable targets, or fixed hard and deeply buried targets. The Common Aero Vehicle's speed and maneuverability will combine to make defenses against it extremely difficult.

- **Communication/Navigation Outage Forecasting System**: The system will combine data from ground-based and sea-based sensors to provide real-time predictions of disturbances in the ionosphere that will affect satellite communications and navigation systems. This will help space forces distinguish between an attack on space systems and natural phenomenon.

- **Compact Environmental Anomaly Sensor II**: This system is an on-board space environment sensor that will help rule out hostile attack as the cause of a satellite malfunction and provide warnings of dangerous space environment conditions.

- **Global Test and Launch Range**: The program will provide necessary Command and Control for the Space Maneuver Vehicle and the Space Operations Vehicle. The system will be a key enabler of responsive launch and operation of new space vehicles and refueling/repair of existing vehicles.

- **Ground-Based Laser**: The system will propagate laser beams through the atmosphere to Low-Earth Orbit satellites to provide robust defensive and offensive space control capability.

- **Orbital Transfer Vehicle**: This program will significantly increase the flexibility, warfighting utility, and protection of U.S. space assets while enabling on-orbit servicing of those assets.

- **Space-Based Radio Frequency Energy Weapon**: This system will be a constellation of satellites containing high-power radio-frequency transmitters that possess the capability to disrupt/destroy/disable a wide variety of electronics and national-level command and control systems. It will be a non-kinetic anti-satellite weapon.

- **Space Maneuver Vehicle**: This program will provide a rapidly reusable orbital vehicle deployed from the Space Operations Vehicle or Evolved Expendable Launch Vehicle. It will be capable of executing a wide range of Space Control missions.

- **Space Operations Vehicle**: This vehicle will enable on-demand spacelift capability with rapid turn-around, multiple standardized payloads, space vehicle maintenance, ISR, offensive and defensive counterspace, and space surveillance capabilities. The Space Operations Vehicle will also be one of the vehicles that will deploy the Common Aero Vehicle.[17]

Analysis of DOD Strategic Thrust

An analysis of the current strategic thrust of military space control reveals two potential issues. The first issue revolves around criticism that the current National Space Policy does not provide consistent guidance to the space security establishment. Steven Lambakis from the National Institute for Public Policy states:

> "Our Janus-headed space policy regime continues to baffle those in DOD who must carry-on with mission planning, generate requirements, undertake RDT&E activities, acquire weapon systems, develop doctrine, and a myriad other related activities in order to ensure freedom of space…the policies issued by Cohen in '99 and Clinton in '96 do not provide a definite guide for decision-makers."[18]

Critics of express that, on one hand, the current national space policy directs the military community to develop aggressive and offensive counterspace measures, but on the other hand, it spells out non-material methods as the priority. The present administration hints that a new National Space Policy may be required. On July 28, 2002, President G.W. Bush directed the National Security Council (NSC) to chair a review of national space policies to focus on possible “revision, consolidation, or elimination” of the existing national space policy.[19] To date, the NSC has not made any recommendations to revise the current policy. This leaves U.S. military space leaders with possible gaps in guidance while trying to define the strategic thrust of military space control.

The second issue revolves around growing public debate concerning the political consequences that the U.S. may face because of its aggressive stance to control space. Some analysts fear that the U.S. is provoking the beginning of an arms race by its desire to dominate space. Critics hypothesize that a single country dominating space would bring havoc to international cooperation and world political stability. These analysts think that the aggressive U.S. stance in space may sway once-allies to think twice about their place in the world order.[20] DOD efforts in SSA and DCS are not in debate. OCS initiatives, however, are the focus of much public deliberation. The means for achieving space security has evolved into a very contentious public issue, often resulting in very sharply divided views. The groups debating the issues tend to be from small security and policy “think-tanks.” Often the arguments suffer from definitional differences, lack of technical understanding, and strong emotions. One sees a wide range of positions. At opposite ends of the spectrum are “space sanctuary” advocates and at the other are those who support the “weaponization of space.” The arguments are prolific with a multitude of approaches sandwiched in between these two extremes.[21] This important issue has the potential to flare up into political debate in the near future. The Space Commission recommended that decision-makers should not ignore the sensitivity that surrounds the notion of weapons in space, as it would be a "disservice to the nation."[22]

The current national space policy allows for all aspects of space control that are “consistent with treaty obligations.” According to the Air Force Space Command “Strategic Master Plan FY 06 and Beyond,” there are presently no formal U.S. policies or treaties preventing the development or deployment of OCS capabilities.[23] The most relevant treaties are the 1967 Outer Space Treaty and the 1972 Anti-Ballistic Missile treaty. The 1967 Outer Space Treaty forbids the stationing of weapons of mass destruction in space, and the 1972 Anti-Ballistic Missile treaty prohibits the ballistic missile defense testing in space—neither treaty addresses the issue of OCS in space. To date, the countries most active in space have informally agreed not to deploy anti-satellite weapons and not to interfere with one another's reconnaissance satellites. However, there are no international restrictions to placing weapons in space or on conducting offensive counterspace operations, as long as they do not involve the use of nuclear weapons or other weapons of mass destruction.[24] Nonetheless, the public and political sensitivities surrounding offensive counterspace efforts may drastically shift the strategic thrust of military space control in the near future.

---

[1] PDD-NSTC-8, “National Space Policy,” September 19, 1996

[2] Ibid.

[3] Ibid.

[4] Memo from the William S. Cohen then-Secretary of Defense accompanying Department of Defense Directive 3100.10, “Space Policy,” July 9, 1999, p. 2.

[5] Ibid, p. 2-3.

[6] Defense Directive 3100.10, “Space Policy,” July 9, 1999, p. 6-7.

[7] "U.S. Air Force Transformation Flight Plan," November 2003, p. 62.
[8] Ibid.
[9] Ibid.
[10] Statement by the Under Secretary of the Air Force, The Honorable Peter B. Teets, before the Committee on Armed Services United States House of Representatives Subcommittee on Strategic Forces regarding the Fiscal Year 2005 National Defense Authorization Budget Request: Status of the Space Programs, http://www.armedservices.house.gov/openingstatementsandpressreleases/108thcongress/04-02-25teets.html, February 25, 2004.
[11] Ibid.
[12] "U.S. Air Force Transformation Flight Plan," November 2003, p. 62.
[13] Ibid.
[14] Statement by the Under Secretary of the Air Force, The Honorable Peter B. Teets, before the Committee on Armed Services United States House of Representatives Subcommittee on Strategic Forces regarding the Fiscal Year 2005 National Defense Authorization Budget Request: Status of the Space Programs, http://www.armedservices.house.gov/openingstatementsandpressreleases/108thcongress/04-02-25teets.html, February 25, 2004
[15] Ibid.
[16] "U.S. Air Force Transformation Flight Plan," November 2003, p. 62.
[17] Ibid, p. C-17-21.
[18] Lambakis, Steven, "Two Faces of U.S. Defense Space Policy," National Institute for Public Policy, http://www.nipp.org/publications/php, September 13, 1999, p. 1.
[19] NSPD-15, "National Space Policy Review," July 28, 2002.
[20] Jing, Zhong, "Seeking a Better Approach to Space Security," The Nonproliferation Review, Monterey Institute of International Studies, Volume 10, Number 2, Summer 2003, p. 99-101.
[21] Mueller, Karl P. "Totem and Taboo: Depolarizing the Space Weaponization Debate, paper presented at the Security Space Forum entitled Space Weapons: Are They Really Needed?" Space Policy Institute, Elliott School of International Affairs, George Washington University, May 8, 2002, p. 7-18.
[22] Logsdon, John M., "Just Say Wait to Space Power, Issues in Science and Technology," Spring 2001, http://www.nap.edu/issues/17.3/p_logsdon.htm, p. 4.
[23] Air Force Space Command, "Strategic Master Plan FY06 and Beyond," October 1, 2003, p. 35.
[24] Logsdon, p. 2.

Chapter 5

Conclusions

> "From the dawn of time, a key to victory on the battle field has been to control the high ground. Space is the ultimate high ground."
>
> – Secretary of Defense Donald H. Rumsfeld Testimony prepared for the House Armed Services Committee2003 Defense Budget Request, February 6, 2002.

This analysis has shown that space control strategy is very complex and consisting of many moving parts. Since Desert Storm, military space power has defined an irreversible trend in warfighter dependence on the "ultimate high ground." As military forces become increasingly dependent on space for communications, situational awareness, navigation, and timing, the U.S. will have to prepare to defend space. To date, the military has done a good job of defined the space control domain and the vulnerabilities of military space resources. However, the military struggles with obtaining a clear threat assessment, especially since U.S. dominance in space is relatively unchallenged. Military leaders also face issues dealing with their dependence on civil and commercial space resources—how will DOD plan for war when the space resources it depends on are not its own?

This report also analyzed the U.S. strategic advantages in the space control domain. The advantages are embryonic and mostly represent Cold War legacy resources used for space surveillance. The budget identifies the early stages of developing meaningful counterspace measures. Space control is one of the six DOD transformation goals;[1] however, the space control RDT&E budget, which is less than $400M, represents only a fraction of the $20.4B in the total DOD space budget.[2] Finally, this report also looked at the strategic thrust of military space control initiatives and found potential "time bombs" in the areas of National Space Policy and the weapons in space debate. Space control is not a new national security topic and has been around ever since the Soviet Union launched Sputnik. Surprisingly, little political debate concerning the implications of weapons in space has taken place since the end of the Cold War. The time may be quickly approaching for a broad-based public and political debate to begin.

Military space control strategy, like many other facets of space, is in a significant phase of transition. The ability of the U.S. to harness "space power" will be critical to victory on the battlefield, especially as information dominance becomes more pervasive in the ensuing evolution of network centric warfare. The U.S. must prepare to defend space—this transformation will require moving military operations into space, improving the mission survivability of space systems, and ensuring a high degree of situational awareness in space.

---

[1] Department of Defense, Quadrennial Defense Review Report, September 30, 2001, p. 45.

[2] Smith, Marcia, "CRS Report: U.S. Space Programs: Civilian, Military, and Commercial," Congressional Research Service, November 19, 2003, p. XXX.

Bibliography

Air Force Doctrine Document 2-2, "Space Operations," November 27, 2001.

Air Force Space Command, "Strategic Master Plan FY06 and Beyond," October 1, 2003.

Baines, Phillip J., "Prospects for Non-Offensive Defenses in Space," Center for Nonproliferation Studies, Occasional Paper No. 12.

Bierstine, Leigh Anne, "Laser Aircraft Arrive for Test Work," Air Force Flight Center Public Affairs, http://www.af.mil/news/story.asp?storyID=122302409, December 23, 2002.

Blaisdell, Franklin J., DOD News Transcript: Air Force Briefing on "Space: The Warfighter's Perspective," March 12, 2003, http://www.defenselink.mil/news/Mar2003.html.

Butler, Amy, "Heavy DOD Reliance on Commercial SATCOM Prompts Questions of Protection," Defense Daily, April 13, 2004.

Cebrowski, Arthur K., Statement from the Director of Force Transformation, Office of the Secretary of Defense, before the Subcommittee on Strategic Forces Armed Services Committee, United States Senate, March 25, 2004.

Chun, Clayton K. S., "Striking Out to Space: Technical Challenges to the Deployment of ASAT Weapons," Center for Nonproliferation Studies, Occasional Paper No. 12.

Cohen, William S., memo from then-Secretary of Defense accompanying Department of Defense Directive 3100.10, "Space Policy," July 9, 1999.

Defense Directive 3100.10, "Space Policy," July 9, 1999.

Department of Defense Directive 5101.2, "DOD Executive Agent for Space," June 3, 2003.

Department of Defense, "Annual Report to Congress on the Military Power of the People's Republic of China," July 28, 2003.

Department of Defense, Defense Budget Materials, FY 2005 Budget, RDT&E Budget (R-1), http://www.defenselink.mil/comptroller/defbudget/fy2005/index.html.

Department of Defense, "Quadrennial Defense Review Report," September 30, 2001.

Department of Defense, RDT&E Budget Item Justification Sheet (R-2 Exhibit), February 2003, for Budget Activity PE 0305917F, Operational System Development Space Architect, http://www.defenselink.mil/comptroller/defbudget/fy2005/index.html.

Department of the Army, Supporting Data FY 2004/2005 President's Budget Submitted to OSD. Descriptive Summaries of the Research, Development, Test, and Evaluation, Army Appropriation, Budget Activities 1, 2, and 3, Office of the Secretary of the Army (financial Management and Comptroller), http://www.defenselink.mil/comptroller/defbudget/fy2005/index.html, February 2003.

Department of Defense Budget, Operations Programs (O-1), Fiscal Year 2005, February 2004, Office of the Under Secretary of Defense (Comptroller), http://www.defenselink.mil/comptroller/defbudget/fy2005/index.html.

Department of the Air Force, "U.S. Air Force Transformation Flight Plan," November 2003.
Department of the Air Force, Fiscal Year (FY) 2004/2005 Biennial Budget Estimates, Research, Development, Test and Evaluation (RDT&E), Descriptive Summaries, Volume III, Part II, Budget Activity 7, February 2003, http://www.saffm.hq.af.mil/FMB/pb/afpb.html,
Department of the Air Force, Fiscal Year (FY) 2005 Budget Estimates, Operation and Maintenance, Active Forces, Volume 1, February 2004, http://www.defenselink.mil/comptroller/defbudget/fy2005/index.html.
Department of the Air Force, Fiscal Year (FY) 2005 Budget Estimates, Research, Development, Test, and Evaluation (RDT&E), Descriptive Summaries, Volume II, Budget Activities 4-6, February 2004, http://www.defenselink.mil/comptroller/defbudget/fy2005/index.html.
Department of the Air Force, Procurement Program, Fiscal Years 2004/2005, Budget Estimates, Other Procurement, Budget Item Justification (Exhibit P-40), OPAF/Electronics & Telecommunciation Equipment, Space Mods Space, February 2003, http://www.defenselink.mil/comptroller/defbudget/fy2005/index.html.
Department of the Navy, Supporting Exhibits (M-1, O-1, P-1, R-1 & C-1), FY 2005 Budget, Office of Budget, February 2004, http://www.defenselink.mil/comptroller/defbudget/fy2005/index.html.
Douglas, Michael L., and Gray, Arlene J., "The Warfighters' Counterspace Threat Analysis (WCTA), A Framework for Evaluating Counterspace Threats," September 2000, Naval Postgraduate School, Monterey, California.
Dundney, Robert S., and Grier, Peter, "New Orbit for American Space Power," Air Force Magazine, February 2004.
Grego, Laura, "A History of U.S. and Soviet ASAT Programs," Union of Concerned Scientist, April 9, 2003, http://www.ucsusa.org/global_security/space_weapons.
Hitchens, Theresa, "Weapons in Space: Silver Bullet or Russian Roulette? The Policy Implications of U.S. Pursuit of Space-Based Weapons," presented at the Space Policy Institute, Security Policy Studies Program, The George Washington University, Washington D.C., October 2003.
Hyten, John E., "A Sea of Peace or a Theater of War: Dealing with the Inevitable Conflict in Space," University of Illinois at Urbana-Champaign, http://www.acdis.uiuc.edu/homepage_docs, April 2000.
Jing, Zhong, "Seeking a Better Approach to Space Security," The Nonproliferation Review, Monterey Institute of International Studies, Volume 10, Number 2, Summer 2003.
Joint Publication 3-14, "Joint Doctrine for Space Operations," August 9, 2002.
Preston, Bob, and Baker, John, Editors Khalilizad, Zalmay and Shapiro, Jeremy, Strategic Appraisal, United States Air and Space Power in the 21st Century, RAND, Project Air Force, 2002.
Krepon, Michael and Clary, Christopher, "Space Assurance or Space Dominance? The Case Against Weaponizing Space," The Henry L. Stimson Center, Washington DC, http://www.stimson.org/pubs.cfm, April 2003.

Lambakis, Steven, "Two Faces of U.S. Defense Space Policy," National Institute for Public Policy, http://www.nipp.org/Adobe/The%20 Two%20Faces%20word.pdf, September 13, 1999.

Lambeth, Benjamin, S., Mastering the Ultimate High Ground, Next Steps in the Military Uses of Space, RAND Project Air Force, 2003.

Lewis, Jeffery and Cowan, Jessy, "Space Weapons Related Programs in the FY 2005 Budget Request," Center for Defense Information, March 2004, http://www.cdi.org/news/space-security/SpaceWeaponsFY05.pdf.

Lewis, Jeffery, "Liftoff for Space Weapons? Implications of the U.S. Department of Defense's 2004 Budget Request for Space Weaponization," July 21, 2003.

Logsdon, John M., "Just Say Wait to Space Power, Issues in Science and Technology," http://www.nap.edu/issues/17.3/p_logsdon.htm, Spring 2001.

Mueller, Karl P. "Totem and Taboo: Depolarizing the Space Weaponization Debate, paper presented at the Security Space Forum entitled Space Weapons: Are They Really Needed?", Space Policy Institute, Elliott School of International Affairs, George Washington University, May 8, 2002.

Newman, William H., Logan, James P., Hegarty, Harvey, W., Strategy, A Multi-Level, Integrative Approach, South-Western Publishing Co., Cincinnati, Ohio, 1989.

NSPD-15, "National Space Policy Review," July 28, 2002.

PDD-NSTC-8, "National Space Policy," September 19, 1996.

Pike, John, SIPRI Yearbook 2002: Armaments, Disarmament and International Security, Oxford University Press, 2002.

"Report of the Commission to Assess United States National Security, Space Management and Organization," January 11, 2001.

Roosevelt, Amy, "Space Control Vital For Future Operations, General Says," Defense Daily, November 3, 2003.

Rumsfeld, Donald H., Statement of testimony of the U.S. Secretary of Defense prepared for the House Armed Services Committee 2003 Defense Budget Request, http://www.house.gov/hasc/openingstatementsandpressreleases/107thcongress/02-02-05rumsfeld.html, February 6, 2002.

Smith, Marcia, "CRS Report: U.S. Space Programs: Civilian, Military, and Commercial," Congressional Research Service, November 19, 2003.

Spacy, William, Assessing the Military Utility of Space-Based Weapons, Space Policy Institute, presented at the Space Policy Institute, Security Policy Studies Program, The George Washington University, Washington D.C., October 2003.

Spires, David, N., Beyond Horizons, A Half Century of Air Force Space Leadership, Air Force Space Command in association with Air University Press, July 1998.

Teets, Peter B., statement by the Under Secretary of the Air Force submitted before the Committee on Armed Services United States House of Representatives Subcommittee on Strategic Forces regarding the Fiscal Year 2005 National Defense Authorization Budget Request: Status of the Space Programs, http://www.armedservices.house.gov/openingstatementsandpressreleases/108thcongress/04-02-25teets.html, February 25, 2004.

Wilson, Tom, "Threats to United States Space Capabilities," Prepared for the Commission to Assess United States national Security Space Management Organization, http://www.fas.org/spp/eprint/article05.html#r22, January 2001.

Zielinski, Robert H., Worley II, Robert M., Black, Douglas, S., Henderson, Scott A., Johnson, David C., "Star Tek-Exploiting the Final Frontier: Counterspace Operations in 2025," presented as part of Air Force 2025, a study to examine concepts, capabilities, and technologies. June 17, 1996.