NAVAL WAR COLLEGE
Newport, RI

SPACE CONTROL FOR THE THEATER COMMANDER:

NAVAL BLOCKADE AS A PRECEDENT

by
Peter Axup
Lieutenant Colonel, United States Air Force

A paper submitted to the Faculty of the Naval War College, in partial satisfaction of the requirements of the Joint Military Operations Department.

The contents of this paper reflect my views and are not necessarily endorsed by the Naval War College, the Department of the Navy, or the Department of the Air Force.

Signature: Peter Axup

17 May 1999

REPORT DOCUMENTATION PAGE

1. Report Security Classification: Unclassified	
2. Security Classification Authority:	
3. Declassification/Downgrading Schedule:	
4. Distribution/Availability of Report: Distribution Statement A: Approved For Public Release; Distribution Is Unlimited.	
5. Name of Performing Organization: Joint Military Operations Department	
6. Office Symbol: C	**7. Address:** Naval War College, 686 Cushing Road, Newport, RI 02841-1207
8. Title (Include Security Classification): Space Control for the Theater Commander: Naval Blockade as a Precedent (U)	
9. Personal Authors: Peter Axup, Lieutenant Colonel, United States Air Force	
10. Type of Report: Final	**11. Date of Report:** 17 May 1999
12. Page Count: [redacted] 26	

13. Supplementary Notation: A paper submitted to the Faculty of the Naval War College, in partial satisfaction of the requirements of the Joint Military Operations Department. The contents of this paper reflect my views and are not necessarily endorsed by the Naval War College, the Department of the Navy, or the Department of the Air Force.

14. Ten key words that relate to your paper: Naval Blockade, Operational Law, Space Control, Space Law, Space Warfare

15. Abstract: Theater commanders depend increasingly on space systems to conduct military operations. As the cost of space systems has dropped, the opportunities for an enemy to use space systems against the commander have increased significantly. The commander cannot afford to ignore such capabilities without sacrificing operational protection for friendly forces, sacrificing the principles of security and surprise in his operations, and leaving significant enemy capabilities outside his objectives. The thesis of this analysis is that naval blockade offers precedents that could be extended into space operations. Naval blockade provides precedent for both the concepts to employ in space warfare, and for the incremental approach to establish international law favorable to such operations. The analysis examines certain concepts relevant to military operations at sea, and offers an extension into space. The scope of this analysis is narrow. First, the analysis focusses on the commander's perspective, and assumes that the strategic issues have been resolved. This analysis does recognize the strategic ramifications of operational and tactical actions, and the proposed approach seeks to support, rather than undermine, the United States' strategic position. Second, the analysis looks at denial capabilities only because these are existing technologies that can readily be fielded for a commander's use within the Future Year Defense Program. The analysis does not look at destruction capabilities, because these capabilities can not be deployed soon. Denial capabilities represent a smaller step toward military space operations; therefore the international community is more likely to be accepted them. Third, the focus is limited to what the commander could use operationally under his command.

16. Distribution/ Availability of Abstract:	**Unclassified** X	**Same As Rpt**	**DTIC Users**
17. Abstract Security Classification: Unclassified			
18. Name of Responsible Individual: Chairman, Joint Military Operations Department			
19. Telephone: (401)841-6461		**20. Office Symbol:** C	

ABSTRACT

Theater commanders depend increasingly on space systems to conduct military operations. As the cost of space systems has dropped, the opportunities for an enemy to use space systems against the theater commander have increased significantly. The commander can no longer afford to ignore such capabilities without sacrificing operational protection for friendly forces, sacrificing the principles of security and surprise in his operations, and leaving significant enemy capabilities outside his objectives.

The thesis of this analysis is that naval blockade offers precedents that could be extended into space operations. Naval blockade provides precedent for both the concepts to employ in space warfare, and for the incremental approach to establish international law favorable to such operations. The analysis examines certain concepts relevant to military operations at sea, and offers an extension into space. The scope of this analysis is narrow. First, the analysis focusses on the theater commander's perspective, and assumes that the strategic issues have been resolved. This analysis does recognize the strategic ramifications of operational and tactical actions, and the proposed approach seeks to support, rather than undermine, the United States' strategic position. Second, the analysis looks at denial capabilities only because these are existing technologies that can readily be fielded for a theater commander's use within the Future Year Defense Program. The analysis does not look at destruction capabilities, because these capabilities can not be deployed for more than six years. Denial capabilities represent a smaller step toward military space operations; therefore the international community is more likely to be accepted them. Third, the focus is limited to what the theater commander could use operationally under his command.

TABLE OF CONTENTS

INTRODUCTION

Popular sentiment and congressional direction have made space control[1] off limits for all practical purposes. Congress made this especially clear when it cancelled all the antisatellite (ASAT) programs: the United States Air Force air-launched antisatellite weapon in 1988, the Navy sea-launched antisatellite system in 1989, and the Army ground-launched antisatellite program in 1993.[2] The sensitivity to the issue of military operations in space resulted in a congressional and international outcry about the use of the Army Mid-Infrared Advanced Chemical Laser (MIRACL) against the Air Force Miniature Sensor Technology Integration-3 (MSTI-3) satellite in 1997.[3] The executive branch also is reluctant to aggressively pursue space control. Although the National Space Policy gives the military the mission to control space,[4] budget actions call into question the commitment to the mission.[5]

The United States does not have an operational antisatellite capability. The technology for a kinetic kill weapon is available, though development and deployment would take upwards of ten years. The technology for a disrupting a satellite is available and operational today, although that technology is used for other purposes. The United States could easily redeploy this technology for use in combat by a theater commander within the period of the Future Year Defense Program. For all practical purposes, the United States is technologically ready to use antisatellite capabilities to disrupt the operations of enemy satellites.[6] The remaining obstacle is the unwritten national policy that effectively prohibits the use of antisatellite operations.

Maritime operations parallel space operations in some respects. The high seas are set aside, or intended for, the peaceful use of all nations; likewise space. The high seas are an

unstructured environment, compared with the highly structured environment of land, where all land belongs to some sovereign state. Only the seas close to land (within 12 miles for territorial waters, and 200 miles of exclusive economic zones) have a comparable structure, and even this is substantially less than that on land. Space is even more unstructured than the seas. The parallel between the high seas and space suggests that military operations in space could follow the precedents set by military operations at sea.

The thesis of this analysis is that naval blockade offers precedents that could be extended into space operations. The analysis examines certain concepts relevant to military operations at sea, and offers an extension into space. The scope of this analysis is narrow. First, the analysis focusses on the theater commander's perspective, and assumes that the strategic issues have been resolved. This analysis does recognize the strategic ramifications of operational and tactical actions, and the proposed approach seeks to support, rather than undermine, the United States' strategic position. Second, the analysis looks at denial capabilities only (e.g., jamming or blinding) because these are existing technologies that can readily be fielded for a theater commander's use within the Future Year Defense Program. The analysis does not look at destruction capabilities (e.g., intercepting and physically destroying a satellite), because these capabilities can not be deployed for more than six years. Also, denial capabilities represent a smaller incremental step toward military space operations, therefore the international community is more likely to be accepted them. Third, the focus is limited to what the theater commander could use operationally under his command.

THE THREAT

SPACE FARING NATIONS

The number of nations with space capability approaches two dozen. This capability ranges from the rudimentary (they own a communications satellite but contract with a foreign company to design, build, launch, and control the satellite), to the highly sophisticated. The nations with demonstrated launch capability are Russia, China, Japan, India, Israel, the European Space Agency,[7] and the United States.[8]

MILITARY USE OF SPACE ASSETS

The theater commander faces the prospect of the enemy possessing satellite imagery of the commander's entire theater assets, including bases, airfields, ports, roads, radar sites, communication sites, petroleum, oils, and lubricants facilities, munitions dumps, and ground force locations on the battlefield. Commercial satellites with 1-meter resolution are available today, with more on the way.[9] Such resolution is adequate to distinguish between different types of aircraft, or to count the number of vehicles dug-in along the front line.[10] The commander also faces the prospect of the enemy using mobile communications that use low Earth orbit commercial systems. Iridium is already available on the market today, and several other systems are in various stages of design, development, or deployment.

Although this paper does not address protecting friendly space assets, it is important to note enemy capability. Satellites in low Earth orbit (100-1,000 km)[11] are vulnerable today. Many countries are gaining experience with theater missiles such as the SCUD. This provides them with the technical know-how to build direct ascent weapons based on sounding rockets

(i.e., it does not go into orbit). A sounding rocket, with a warhead of 100 kilograms (60 pounds) of nails, could destroy a surveillance or communication satellite in low Earth orbit.[12] Today's theater commander uses low Earth orbit satellites for imagery intelligence and mobile communications. The Department of Defense supplements military satellite capabilities with commercial satellite capabilities.[13, 14] The Department of Defense is the largest single customer of French SPOT imagery, and the Department of Defense is buying substantial cellular telephone capacity on Motorola's new Iridium system.[15] Both of these systems operate satellites in low Earth orbits. Another example of enemy capability is the ability to jam Global Positioning System (GPS) signals. A United States flag carrier flying overseas experienced loss of its navigation system when the French conducted jamming exercises.[16] Those who claim that the United States should not weaponize space have missed the boat; other nations already have the capability. The United States would not be leading, but following others into space weapons. The nation that depends most on satellites is not leading the way into space warfare.

SPACE CONTROL

TREATIES

The most significant international legal document regarding this topic is the 1967 Outer Space Treaty. The treaty does not prohibit putting conventional weapons in space, although Article IV prohibits weapons of mass destruction in space, and prohibits the establishment of military bases on the Moon.[17] In addition, the Law of Armed Conflict may apply, encompassing concepts such as neutrality and belligerency.

POLICY

The National Space Policy states that the United States will develop the capability to control space.[18] The policy does not dictate that space control must be exerted by direct attacks against satellites. For example, we could deny the enemy's use of satellites by destroying the ground stations in enemy territory. We could defend our satellites by destroying the enemy's antisatellite weapon while it is on the launch pad in enemy territory. Nonetheless, the policy does not preclude the use of ground-based weapons against satellites, nor does it preclude the use of weapons in space.

DOCTRINE

Space is still an expensive place to operate. Consequently, the Department of Defense doctrine is not to develop and deploy space weapons. Instead, doctrine focusses on less costly alternatives. These alternatives include conventional attacks against vulnerable ground sites, including satellite control stations and launch facilities. The alternatives also include persuading third party suppliers of satellite services to discontinue service to the enemy. For companies based in the United States, the federal government is considering restrictions on high resolution (1 meter or less) imaging satellites, a practice referred to as "shutter control."[19] Under "shutter control," the federal government would have the authority to prohibit collection of images for specific areas. Some members of Congress want a standing requirement that the high-resolution satellites not image Israel.[20]

OPERATIONAL NECESSITY FOR CHANGE

The theater commander's dependence on satellites to conduct operations, the growing enemy capability to conduct operations against our satellites, and the increasing availability of satellite resources for even small enemy powers, all suggest that the theater commander cannot avoid conducting operations against satellites. No commander can afford to unilaterally give up the advantages of four of the principles of war: objective, offensive, surprise, and security; and not expect to suffer the consequences.[21] The principle of security applies in both war and military operations other than war.[22]

It is interesting to note that only recently did the Department of Defense stop releasing the orbital ephemera (data which allows determination of the position of a satellite at any time) of unclassified military satellites.[23] Although amateur astronomers track low Earth orbit satellites and publish the ephemera on the Internet, the new policy shows a realization within the Department of Defense that satellites are military assets that need to be protected.[24]

Although conducting operations against satellites is new, it is not without precedent. The history of naval blockade, and its less aggressive forms, provides not only precedent for operations in space, but it also reveals the way international law develops. An understanding of this development process indicates some profitable directions for military operations in space to pursue.

NAVAL BLOCKADE AS A PRECEDENT

Examination of naval blockade, and its less aggressive forms, is instructive for two reasons. First, concepts such as neutrality were developed over time. Through a process of

natural extension such concepts could be carried over into the arena of space. Second, the course of development of maritime law reveals the incremental way in which new law establishes itself. Both of these reasons will shed light on the issue of space control.

The Law of Armed Conflict divides states into two groups, belligerent and neutral, when applying the concepts related to naval blockade.

> ...[A] belligerent nation is defined as a nation engaged in an international armed conflict, whether or not a formal declaration of war has been issued. Conversely, a neutral nation is defined as a nation that has proclaimed its neutrality or has otherwise assumed neutral status with respect to an ongoing conflict.[25]

This is not a comprehensive summary of the Law of Peacetime Naval Operations and the Law of Armed Conflict; rather, this analysis addresses only those aspects that may have a bearing on space warfare.

MARE LIBERUM (FREE SEAS)

The high seas were not always considered free of sovereign control by states. It was not until 1700 that the concept of free seas, for the use of all, became a settled issue.[26] By contrast, Articles 1 and 2 of the Outer Space Treaty declare space free from claims of sovereignty and appropriation by states, and access to space is free and open to all states. The treaty has an additional restriction, that space is to be used for peaceful purposes.[27] The United States interprets "peaceful purposes" as "non-aggressive purposes," thus allowing use of space for military activity not constituting armed force against another state. Since the inherent right of self-defense applies generally throughout international law, it should also apply to space. The right of self-defense includes protecting against imminent attack.[28]

HISTORY OF NAVAL BLOCKADE

Siege warfare on land is the foundation stone for naval blockade. Dutch jurist Hugo Grotius justified the Dutch blockades of Spanish Flanders in 1584 and 1630 by appealing to the principle of siege warfare, and extending it to the maritime environment.[29] This is the first example of naval blockade in the modern legal context. The blockade of 1630 was further characterized by a published ordinance that stated that the ports were besieged and neutral vessels would be confiscated along with their cargoes, if the vessels intended to enter the ports.[30]

The next significant step in naval blockade occurred in 1695 when the English and Dutch declared a blockade against the entire French coast. The English and Dutch were incapable of enforcing the blockade. The Danish and the Swedes protested this act and established the precedent that a blockade had to be effective before it could be considered legal.[31]

The pacific blockade first appeared in 1827, when the British, French, and the Russians blockaded the Greek coast under the control of the Turks. The concept of pacific blockade is an example of an incremental change that did not gain international standing. The British, French, and the Russians were neutrals in the war between Greece and Turkey, and did not intended to go to war with the Turks. But they desired to force the Turks to accept the independence of the Greeks. Although the pacific blockade never gained standing in international law, several states used it during the 19th and early 20th centuries.[32]

The 1909 London Declaration codified the concept of naval blockade, and it was the last significant change to the law of blockade.[33] This declaration stated that for a blockade to be a legal act by a belligerent state, the belligerent had to meet four conditions: (a) declare the

area involved, and when the blockade would begin, (b) apply the blockade impartially to all vessels, including those of the blockading state, (c) not bar access to neutral ports, and (d) use sufficient forces to make the blockade effective.[34]

LAW OF NEUTRALITY

Related to the blockade is the concept under the Law of Neutrality is the belligerent right to visit and search. Visit and search is the means by which by which a belligerent warship establishes the neutral or enemy character of a merchant vessel. The neutral vessel must cooperate by allowing the belligerent to board the vessel, inspect the ship's papers, and inspect the cargo and crew. Neutral vessels engaged in non-commercial government service and neutral warships are not subject to visit and search.[35]

The Law of Neutrality does not prohibit commerce between belligerent and neutral states. A neutral state risks losing its neutral status, however, if it supplies war materiel to a belligerent.[36] Although contraband was formerly thought to consist of war materiel in a narrow sense (arms and munitions), the advent of total war (in the sense of the entire nation supporting the war effort) greatly broadened the class of contraband to include all materiel, even foodstuffs and medical supplies. As a result, nations now find it more convenient to list what is exempt from classification as contraband.[37]

To facilitate neutral commerce, and to reduce the adverse consequence of visit and search, belligerents can issue a certificate of non-contraband carriage (navicert) to a neutral merchant vessel. A belligerent consular official usually issues the certificate to the neutral vessel at its point of origin. The certificate does not change any of the rights or duties of any

of the belligerent or neutral parties, but it is simply a safer and more efficient means of verifying neutrality.[38]

QUARANTINE

During the Cuban missile crisis, the United States quarantined Cuba to stop the flow of nuclear missiles into Cuba, and to force the removal from Cuba of any nuclear missiles. Since a blockade would be the same as declaring war, the United States elected to use the technique of visit and search in combination with a limited blockade (termed "a quarantine"), avowing a limited purpose. The day after the United States declared the quarantine, the Organization of American States declared that a situation existed that endangered the peace of the Americas, and that the member states should take any and all measures they deemed necessary.[39] This Organization of American States declaration was the legal basis that the United States used after the fact to justify the quarantine. No country, including the United States, has used the quarantine since the Cuban missile crisis. The quarantine was the progenitor of the later maritime interception operation in two respects. First, the action was taken under the auspices of an international organization of states. Second, the action was declared to not be an act of war.

MARITIME INTERCEPTION OPERATIONS

Maritime interception operations are the confluence of several streams of events. The first, as recounted above, is the trend to move blockade out of the realm of belligerents and into the realm of neutral states. This is an attempt to increase the number of coercive tools, short of war, that are available to states to conduct international relations. The second trend is

the increase in the propensity of international and regional organizations to intervene significantly in the affairs of states. Third is the growing use of economic means (specifically, sanctions) by international and regional organizations to coerce states into complying with international will as expressed by these organizations.

Several episodes could be considered as the first maritime interception operation (two candidates are the 1962 Cuban quarantine and the Rhodesian trade sanctions in 1965). But the first clear maritime interception operation was in 1990, when the United Nations Security Council passes Resolution 661, imposing an economic and trade embargo against Iraq.[40]

PROPOSED SPACE CONTROL DOCTRINE

Capitalizing on the precedent of naval blockade, and its successors, several applications to space control become apparent. Additionally, noting the gradual development of maritime law from naval blockade to maritime interception operations gives an important indication as to the path that the development of space warfare should take.

STRATEGIC RESTRAINTS

Naval blockade and maritime interception operations are operational or tactical actions that have strategic ramifications. Although applied within a theater of operations, these operations could affect numerous third party nations, giving the space operations world-wide ramifications. Under international law, for the National Command Authority to authorize a maritime interception operation, an international or regional organization must take action to declare such operations in order. In a parallel fashion, the National Command Authority

retains the decision-making authority to use space control capabilities. Once the National Command Authority authorizes such operations, the theater commander will be able to take action.

The direct step to space warfare is too large at this time. Congressional and international sentiment stand strongly against space warfare, so that the United States will probably not initiate destruction of satellites unless in the midst of a large war which threatened vital interests.

The indirect step to space warfare has great possibilities. By focussing first on space control through non-destructive means, the United States will be able to achieve significant military gains at small political cost. Later, should the United States decide that destructive space control (space warfare) is in its national interest, the leap will be much smaller than otherwise.

NON-DESTRUCTIVE SPACE CONTROL

A high priority for the theater commander will be to establish operational protection in order to ensure the security of his forces. Imaging satellites will be a significant threat to maintaining security. Additionally, imaging satellites will place a significant limitation on the commander's ability to maintain the element of surprise in large-scale operations.

United States Space Command identifies and tracks all satellites, and routinely issues warnings to theater commanders when imaging satellites will be over the theater. Using the detailed ephemera provided by United States Space Command, the theater commander can use lasers (both infrared and visible) to blind or dazzle the satellite. If the laser power it too high, it will permanently damage the optics or the focal plane array. A low to medium power

laser will be able to temporarily blind the satellite. If the satellite is not looking at the theater, then it will be able to continue its mission unhindered.

Consistent with naval blockade and maritime interception operations procedures, the theater commander can issue a world-wide notice through the State Department, notifying all states of the geographic area within which the laser will be operating, and the time when the operations will begin. States that will want to avoid laser energy entering the satellite optics will be able to aim the satellite sensor away from the protected area. Although the enemy will also know about the laser denial operation and will be able to turn his satellite sensors away from the protected area, that will still accomplish the theater commander's intent. The objective is not physical destruction of the satellite, or even blinding the satellite, the objective is to deny the enemy the opportunity to image the protected area.[41]

Also falling within this category would be synthetic aperture radar (SAR) satellites. These satellites image the ground using radar signals. This active approach to imaging gives the added advantage of being able to image through clouds, while all visible and infrared satellites require clear weather. The synthetic aperture radar satellite will be jammed in the same fashion as any other radar. In both the imaging satellites and the synthetic aperture radar satellites, the theater commander will have to use his limited assets in the most efficient and effective fashion. One of the most significant trade-offs will be between wide area denial, which an enemy might be able to circumvent, and small area denial, which would have a greater likelihood of success.

If a neutral state did not want to take any risk with its satellite, it could arrange with the United States for a "spacecert," analogous to the navicert. If the neutral state agreed not to image the protected area, and if it agreed to random checks at its ground stations to confirm

compliance, then the United States can agree to not direct the denial laser at the satellite, avoiding any risk of damage to the satellite.

A second priority in space control, depending on the theater commander's operational scheme, might be to deny the enemy the use of satellite communication systems. Again, rather than attempt destruction of the satellites, the commander could seek to deny the enemy the use of the satellites by jamming the uplinks or downlinks. As with any other jamming operation, the theater commander will have limited assets available to achieve his objective, while at the same time not inadvertently jamming his own communication networks.

THIRD PARTY RAMIFICATIONS

One of the stronger objections to space control activities maintains that we cannot clearly distinguish between government and commercially owned satellites. International law does not resister satellites in the same fashion as ships or aircraft. States must notify the United Nations registry when they launch a satellite. Only states have the standing to file; individuals and businesses cannot—their state files on their behalf. Should a satellite (or other object related to that satellite, such as its booster) return to earth, the launching state is liable for any damage caused by the reentry.[42]

Nonetheless, maritime law provides precedent, in that merchant vessels are not exempt from blockades and maritime interception operations. In fact, merchant vessels are specifically the object of protection under international law in this area. The greater problem would be how to handle government satellites, since in a sense they would be classified as "warships," and hence immune from some aspects of blockade, such as visit and search.

A second objection might be that satellites are frequently jointly owned by several nations and that denial operations will not adequately differentiate between parties. Here again, the maritime precedent is useful. Many large ships, especially expensive super tankers, are built by one nation, owned by a multinational corporation in a second nation, registered in a third nation, and crewed by citizens of a fourth nation—yet the ship is still subject to blockade and maritime interception operations.

CONCLUSION

Theater commanders depend increasingly on space systems to conduct military operations. As the cost of space systems has dropped, the opportunities for an enemy to use space systems against the theater commander have increased significantly. The commander can no longer afford to ignore such capabilities without sacrificing operational protection for friendly forces, sacrificing the principles of security and surprise in his operations, and leaving significant enemy capabilities outside his objectives.

Naval blockade provides precedent for both the concepts to employ in space warfare, and for the incremental approach to establish international law favorable to such operations. By focussing on denial operations instead of destruction operations against space systems, the theater commander would achieve his operational objectives while not giving basis for strong international objection.

International law is reactive; it changes after states have altered their practices. A small step toward space warfare allows the United States to achieve its military objectives without sacrificing the legality of its operations in the eyes of the international community.

NOTES

[1] Actions taken to guarantee the free use of space, or to deny the enemy the free use of space.

[2] Michael R. Mantz, The New Sword: A Theory of Space Combat Power (Research Report No. AU-ARI-94-6. Maxwell Air Force Base, AL: Air University Press, May 1995), p. 11.

[3] The Army fired the ground-based laser at an operating satellite, "Laser of 30 Watts Blinded Satellite 300 Miles High," Defense Week, 8 December 1997. The author was on the team that built, launched, and operated the satellite, and was involved in the decision to conduct the test at the end of the satellite's useful life. The author neither confirms nor denies the Defense Week article.

[4] National Science and Technology Council, "National Space Policy," (Unclassified fact sheet summarizing the Presidential Decision Directive, the White House: Washington, D.C.: 19 September 1996), pp. 5-6. Paragraph (3) states: "National security space activities shall contribute to U.S. national security by: ...(d) countering, if necessary, space systems and services used for hostile purposes;...." Paragraph (6)(a) states: "DoD shall maintain the capability to execute the mission areas of space support, force enhancement, space control, and force application." Paragraph (6)(g) states: "Consistent with treaty obligations, the United States 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...."

[5] William B.Scott, "Clinton Team Defends Killing Milspace Programs," Aviation Week & Space Technology, 20 April 1998, p. 30.

[6] During Desert Storm, the Iraqi's had several Soviet made jammers that were capable of jamming 95% of the United States' military satellite communications capability. Cited in Tommy C. Brown, "Is the U.S. Prepared to Execute Operational Space Control?" (Unpublished monograph, U.S. Army Command and General Staff College, School of Advanced Military Studies, Fort Leavenworth, KS: 19 May 1995), p. 25.

[7] The European Space Agency is a consortium of 14 European countries with a launch facility in South America.

[8] Tamar A. Mehuron, "Space Almanac," AIR FORCE Magazine, August 1998, p. 39.

[9] Warren Ferster, "U.S. to Buy Private Imagery for Intelligence," Space News, 12 April 1999, p. 1.

[10] Ann M. Florini, cited by Jon F. Berg-Johnsen, "Space Control: The Operational Commander's Future Dilemma," (Unpublished paper, U.S. Naval War College, Joint Military Operations Department, Newport, RI: 12 November 1994), p. 9.

[11] Wiley J. Larson and James R. Wertz, ed., Space Technology Series: Space Mission Analysis and Design, 2nd ed. (Torrance, CA: Microcosm, Inc, 1992), p. 179.

[12] G. Harry Stine, cited by George and Meredith Friedman, The Future of War, (New York: Crown Publishers, Inc, 1996), pp. 363-373.

[13] Warren Ferster, "U.S. to Buy Private Imagery for Intelligence," Space News, 12 April 1999, p. 1.

[14] Bryan Bender, "DoD to Make Use of Commercial Satellite Images," Jane's Defence Weekly, 11 November 1998.

[15] "Commercial Satellite Operators Could See More DOD Action," Space Business News, 28 April 1999.

[16] Ed Hazelwood, "FAA Considering Backup For GPS," Aviation Week & Space Technology, 2 February 1998, p. 59.

[17] The United States of America is a signatory to the treaty. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 27 January 1967, in T.B. Millar and Robin Ward, ed., Current International Treaties (New York: New York University Press: 1984), p. 35.

[18] National Science and Technology Council, "National Space Policy," (Unclassified fact sheet summarizing the Presidential Decision Directive, the White House: Washington, D.C.: 19 September 1996), pp. 5-6. Paragraph (3) states: "National security space activities shall contribute to U.S. national security by: ...(d) countering, if necessary, space systems and services used for hostile purposes;...." Paragraph (6)(a) states: "DoD shall maintain the capability to execute the mission areas of space support, force enhancement, space control, and force application." Paragraph (6)(g) states: "Consistent with treaty obligations, the United States 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....7

[19] Warren Ferster, "U.S. Agencies Grapple with Regulatory Issues," Space News, 8 March 1999, p. 8.

[20] Ben Iannotta, "Setting the Rules for Remote Sensing," Aerospace America, April 1999, p. 34.

[21] Joint Chiefs of Staff, Doctrine for Joint Operations (Joint Publication 3.0), (Department of Defense, Washington D.C.: 1 February 1995). Appendix A.

[22] Ibid., p. V-2.

[23] "U.S. Ends Disclosure of Unclassified Satellites," Space News, 5 April 1999, p. 2.

[24] Allen Thomson, "Satellite Vulnerability: A Post-Cold War Issue?" Space Policy, February 1995, pp. 19-30.

[25] Naval War College, "Annotated Supplement to the Commander's Handbook on the Law of Naval Operations," (Unpublished paper, Center for Naval Warfare Studies, Oceans Law and Policy Department, Newport, RI: 15 November 1997), p. 7-2.

[26] Richard D. Zeigler, "*Ubi Sumus? Quo Vadimus?:* Charting the Course of Maritime Interception Operations," (Unpublished paper, U.S. Naval War College. Advanced Research Department, Newport, RI: 16 June 1995), pp. 18-19.

[27] The United States of America is a signatory to the treaty. Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, 27 January 1967, in T.B. Millar and Robin Ward, ed., Current International Treaties (New York: New York University Press: 1984), p. 35.

[28] Naval War College, "Annotated Supplement to the Commander's Handbook on the Law of Naval Operations," (Unpublished paper, Center for Naval Warfare Studies, Oceans Law and Policy Department, Newport, RI: 15 November 1997), pp. 2-38, 4-10, 4-13.

[29] Robert E. Morabito, "Maritime Interdiction: The Evolution of a Strategy," (Unpublished paper, U.S. Naval War College, Department of Operations, Newport, RI: 11 February 1991), p. 3.

[30] Jerrold Jay Negin, "The Case for Legitimate Interdiction of Commerce During Peacetime," (Unpublished paper, U.S. Naval War College, Department of Naval Operations, Newport, RI: 20 June 1986), p. 3.

[31] Robert E. Morabito, "Maritime Interdiction: The Evolution of a Strategy," (Unpublished paper, U.S. Naval War College, Department of Operations, Newport, RI: 11 February 1991), p. 4.

[32] Jonathan J. Olson, "Naval Interdiction Considerations in the Use of Limited Naval Force in Operations Short of War," (Unpublished paper, U.S. Naval War College, Department of Operations, Newport, RI: 19 June 1993), p. 5.

[33] Naval War College, "Annotated Supplement to the Commander's Handbook on the Law of Naval Operations," (Unpublished paper, Center for Naval Warfare Studies, Oceans Law and Policy Department, Newport, RI: 15 November 1997), pp. 7-26 – 7-30.

[34] Jonathan J. Olson, "Naval Interdiction Considerations in the Use of Limited Naval Force in Operations Short of War," (Unpublished paper, U.S. Naval War College, Department of Operations, Newport, RI: 19 June 1993), p. 6.

[35] Naval War College, "Annotated Supplement to the Commander's Handbook on the Law of Naval Operations," (Unpublished paper, Center for Naval Warfare Studies, Oceans Law and Policy Department, Newport, RI: 15 November 1997), pp. 7-23 – 7-24.

[36] Ibid., p. 7-17.

[37] Ibid., p p. 7-18 – 7-19.

[38] Ibid., p. 7-21.

[39] Richard D. Zeigler, "*Ubi Sumus? Quo Vadimus?:* Charting the Course of Maritime Interception Operations," (Unpublished paper, U.S. Naval War College, Advanced Research Department, Newport, RI: 16 June 1995), p. 8.

[40] Jonathan J. Olson, "Naval Interdiction Considerations in the Use of Limited Naval Force in Operations Short of War," (Unpublished paper, U.S. Naval War College, Department of Operations, Newport, RI: 19 June 1993), p. 9, 11.

[41] One could argue that an enemy satellite imaging an area is an aggressive act, but the argument has significant difficulties. First, peacetime imaging from space is a well-established peacetime activity; how could it also be considered an aggressive act? Second, ground-, sea-, and air-based parallels do not exist. When an enemy reconnaissance patrol enters friendly territory, it is not considered aggressive because they are observing, but because they violated territorial integrity—likewise for ships or aircraft. It is not uncommon for ships or aircraft to remain on the high seas or in international airspace and conduct surveillance and eavesdropping activities.

[42] Naval War College, "Annotated Supplement to the Commander's Handbook on the Law of Naval Operations," (Unpublished paper, Center for Naval Warfare Studies, Oceans Law and Policy Department, Newport, RI: 15 November 1997), p. 2-40.

BIBLIOGRAPHY

Air University. "2025 White Papers: Reach and Presence." Volume 2. Unpublished report, Air University Press, Maxwell Air Force Base, AL: October 1996.

_____. "2025 White Papers: Power and Influence." Volume 3, Book 1. Unpublished report, Air University Press, Maxwell Air Force Base, AL: November 1996.

Astley, John III and Michael N. Schmitt. "The Law of the Sea and of Naval Operations." Unpublished paper, Naval War College, Oceans Law and Policy Department, Newport, RI: April 1997.

Baucom, Donald R. Clausewitz on Space War: An Essay on the Strategic Aspects of Military Operations in Space. CADRE Paper Special Series: The Future of the Air Force. Report No. AU-ARI-CPSS-91-13. Maxwell Air Force Base, AL: Air University Press, Center for Aerospace Doctrine, Research, and Education, June 1992.

Bender, Bryan. "DoD to Make Use of Commercial Satellite Images." Jane's Defence Weekly, 11 November 1998.

Berg-Johnsen, Jon F. "Space Control: The Operational Commander's Future Dilemma." Unpublished paper, U.S. Naval War College, Joint Military Operations Department, Newport, RI: 12 November 1994.

Billman, Gregory. "The Inherent Limitations of Spacepower: Fact or Fiction?" Unpublished paper, Air University, School of Advance Aerospace Studies, Maxwell Air Force Base, AL: 1996.

Black, J. Todd. "Commercial Satellites: Future Threats or Allies?" Naval War College Review, Newport, RI: Winter 1999, p. 99-114.

Bolin, John W. "Maritime Zones: Instruments of Sea Control." Unpublished paper, U.S. Naval War College, Department of Operations, Newport, RI: 11 February 1991.

Brown, Tommy C. "Is the U.S. Prepared to Execute Operational Space Control?" Unpublished monograph, U.S. Army Command and General Staff College, School of Advanced Military Studies, Fort Leavenworth, KS: 19 May 1995.

_____. "Violating the Sanctuary—The Decision to Arm Space." Unpublished monograph, School of Advanced Military Studies, Fort Leavenworth, KS: 19 December 1994.

Butler, Rudolph E. III. "Integrating Adversary Space Capabilities into Exercises." Space Tactics Bulletin, Schriever Air Force Base, CO, Fall 1998, pp. 12-20.

Campen, Alan D. The First Information War: The Story of Communications, Computers, and Intelligence Systems in the Persian Gulf War. Fairfax, VA: AFCEA International Press, October 1992.

Carron, Brian E. "The Value of Space Control and How We Can Achieve It." Unpublished paper, Air University, Air War College, Maxwell Air Force Base, AL: April 1993.

Clark, Theresa R. "Rules of Engagement for Space Warfare 1990-2000." Unpublished paper, U.S. Naval War College, Newport, RI: 23 February 1990.

"Commercial Satellite Operators Could See More DOD Action." Space Business News, 28 April 1999.

Covault, Craig. "Military Space Dominates Air Strikes." Aviation Week & Space Technology, 29 March 1999, pp. 31-33.

David, Leonard. "New Imagers Might Reveal Corporate Secrets." Space News, 3 May 1999, p. 16.

Donatelli, Delia E. "Is the Weaponization of Space Inevitable?" Unpublished paper, 1997 Executive Research Fellow, National Defense University, Industrial College of the Armed Forces, Fort McNair, Washington, D.C.: April 1997.

Doughty, Robert A. and Harold E. Raugh, Jr. "Embargoes in Historical Perspective." Parameters, Spring 1991, pp. 21-30.

Ferster, Warren. "Newsmaker Forum: Keith Hall." Space News, 11 January 1999, p. 22.

_____. "Satellite Role Critical in Conflict: Commercial Spacecraft Pose Military Dilemma in War Game." Space News, 15 March 1999, pp. 3, 20.

_____. "U.S. Agencies Grapple with Regulatory Issues." Space News, 8 March 1999, p. 8.

_____. "U.S. to Buy Private Imagery for Intelligence." Space News, 12 April 1999, p. 1.

Friedman, George and Meredith. The Future of War. New York: Crown Publishers, Inc, 1996.

Fristachi, John C.P. "Analysis of Operational Factors Towards Achievement of Space Control: Transforming the Familiar." Unpublished paper, U.S. Naval War College, Newport, RI: 13 February 1998.

Green, James S. "A U.S. Plan for Space Control." Unpublished paper, U.S. Naval War College, Newport, RI: 3 March 1989.

Gruendl, Lois H. "The Impact of Offensive Economic Warfare on the Operational Commander." Unpublished paper, U.S. Naval War College, Department of Operations, Newport, RI: 16 June 1995.

Hazelwood, Ed. "FAA Considering Backup For GPS." Aviation Week & Space Technology, 2 February 1998, p. 59.

Howarth II, Thomas A. "The Impact of Space on Future Wars or, Will World War III be Waged in Space?" Unpublished paper, U.S. Naval War College, Newport, RI: 3 February 1989.

Hunter, Roger C. A United States Antisatellite Policy for a Multipolar World. Maxwell Air Force Base, AL: Air University Press, School of Advanced Airpower Studies, October 1995.

Iannotta, Ben. "Setting the Rules for Remote Sensing." Aerospace America, April 1999.

Joint Chiefs of Staff. Doctrine for Joint Operations (Joint Publication 3.0). Department of Defense, Washington D.C.: 1 February 1995.

Kagan, Frederick W. "Star Wars in Real Life: Political Limitations on Space Warfare." Parameters, Autumn 1998, pp. 112-120.

Kelly, Ricky B. "Centralized Control of Space: The Use of Space Forces by a Joint Force Commander." Unpublished paper, Air University, School of Advanced Airpower Studies, Maxwell Air Force Base, AL: 22 September 1994.

Larson, Wiley J. and James R. Wertz, ed. Space Technology Series: Space Mission Analysis and Design, 2nd ed. Torrance, CA: Microcosm, Inc, 1992.

"Laser of 30 Watts Blinded Satellite 300 Miles High." Defense Week, 8 December 1997.

Mantz, Michael R. The New Sword: A Theory of Space Combat Power. Research Report No. AU-ARI-94-6. Maxwell Air Force Base, AL: Air University Press, May 1995.

Mehuron, Tamar A. "Space Almanac." AIR FORCE Magazine, August 1998.

Millar, T.B. and Robin Ward, ed. Current International Treaties. New York: New York University Press: 1984.

Morabito, Robert E. "Maritime Interdiction: The Evolution of a Strategy." Unpublished paper, U.S. Naval War College, Department of Operations, Newport, RI: 11 February 1991.

Martorano, Matthew F. "Space Control Strategy for a Dynamic, Multipolar World." Unpublished paper, U.S. Army War College, Carlisle Barracks, PA: 1997.

National Science and Technology Council. "National Space Policy." Unclassified fact sheet summarizing the Presidential Decision Directive, the White House: Washington, D.C.: 19 September 1996.

Naval War College. "Annotated Supplement to the Commander's Handbook on the Law of Naval Operations." Unpublished paper, Center for Naval Warfare Studies, Oceans Law and Policy Department, Newport, RI: 15 November 1997.

Negin, Jerrold Jay. "The Case for Legitimate Interdiction of Commerce During Peacetime." Unpublished paper, U.S. Naval War College, Department of Naval Operations, Newport, RI: 20 June 1986.

Newberry, Robert D. Space Doctrine for the Twenty-first Century. Maxwell Air Force Base, AL: Air University Press, October 1998.

Nosenzo, Thomas E. "You Can't Spell Space Control 'ASAT' Any More." Unpublished paper, U.S. Naval War College, Newport, RI: 6 March 1996.

Olson, Jonathan J. "Naval Interdiction Considerations in the Use of Limited Naval Force in Operations Short of War." Unpublished paper, U.S. Naval War College, Department of Operations, Newport, RI: 19 June 1993.

Paccassi, Jerry G. "Space Control: A Military Necessity." Unpublished paper, U.S. Naval War College, Newport, RI: 20 June 1986.

Rohlman, William H. "A Political Strategy for Antisatellite Weaponry." Unpublished paper, Executive Research Project A106, Industrial College of the Armed Forces, Fort McNair, Washington, DC: 1993.

Scott, William B. "Clinton Team Defends Killing Milspace Programs." Aviation Week & Space Technology, 20 April 1998, p. 30.

_____. "Plan Confronts Space Control Issues." Aviation Week & Space Technology, 13 April 1998, p. 30.

_____. "Space Chief Warns of Threats to U.S. Commercial Satellites." Aviation Week & Space Technology, 12 April 1999, p. 51.

_____. "U.S. Adopts 'Tactical' Space Control Policy." Aviation Week & Space Technology, 29 March 1999, p. 35.

Schmitt, M. N., ed. International Law Studies: The Law of Military Operations. Newport, RI: Naval War College Press, 1998.

Thomson, Allen. "Satellite Vulnerability: A Post-Cold War Issue?" Space Policy, February 1995, pp. 19-30.

United Nations. Charter of the United Nations and Statute of the International Court of Justice. Department of Public Information, New York: n.d.

USAF Scientific Advisory Board. New World Vistas: Air and Space Power for the 21st Century. Space Applications Volume. N.p.: n.d.

"U.S. Ends Disclosure of Unclassified Satellites." Space News, 5 April 1999, p. 2.

United States Space Command. Long Range Plan. N.p.: March 1998.

Wald, Bruce. "Space Control Hot Buttons: Issues of Importance to Senior Decision Makers and Stakeholder Organizations." Unpublished annotated briefing, CAB 96-84, Center for Naval Analyses, Alexandria, VA: November 1996.

_____. "Space Control Issues: Plausible Threats and Assurance Strategies." Unpublished annotated briefing, CAB 96-92, Center for Naval Analyses, Alexandria, VA: January 1997.

Wald, Bruce, Gary A. Federici, and Linton Brooks. "Space Control Issues in the Post-Cold-War Era." Unpublished annotated briefing, CAB 96-83, Center for Naval Analyses, Alexandria, VA: November 1996.

_____. "Space Control Policy Issues." Unpublished annotated briefing, CAB 96-86, Center for Naval Analyses, Alexandria, VA: November 1996.

Washington, Tania M. "Denying Access to Commercial Communications Satellites." Unpublished paper, Naval War College, Department of Joint Military Operations, Newport, RI: 5 February 1999.

The White House. "President Clinton Issues New National Space Policy." Press release, Office of the Press Secretary: Washington, D.C.: 19 September 1996.

Work, Robert O. "Toward a National Space Warfighting Architecture: Forging a Framework for Debate About Space-Based Operational and Tactical Combat Support." Unpublished thesis, Naval Postgraduate School, Monterey, CA: September 1990.

Young, Timothy C. "Maritime Exclusion Zones: A Tool for the Operational Commander?" Unpublished paper, U.S. Naval War College, Department of Operations, Newport, RI: 18 May 1992.

Zeigler, Richard D. "Maritime Interdiction Mechanisms: Distinctions with Differences." Unpublished paper, U.S. Naval War College, Newport, RI: 7 May 1995.

_____. "*Ubi Sumus? Quo Vadimus?:* Charting the Course of Maritime Interception Operations." Unpublished paper, U.S. Naval War College, Advanced Research Department, Newport, RI: 16 June 1995.