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):

Force Protection In An Era Of Commercially Available Satellite Imagery: Space Blockade As A Possible Solution (U)

9. Personal Authors:
Major Robert A. Fabian, USAF

10.Type of Report: FINAL

11. Date of Report: 4 February 2002

12.Page Count: 26

12A Paper Advisor (if any): Dr. E.A. McIntyre

13.Supplementary Notation: A paper submitted to the Faculty of the NWC in partial satisfaction of the requirements of the JMO Department. The contents of this paper reflect my own personal views and are not necessarily endorsed by the NWC or the Department of the Navy.

14. Ten key words that relate to your paper:
space control, space warfare, space combat, offensive counterspace, negation, prevention, force protection, countersurveillance, satellite imagery, remote sensing

15.Abstract:

The recent proliferation of high-resolution commercial imagery satellites holds a potential danger for the joint force commander. At relatively little cost, a potential adversary can gain detailed imagery of U.S. troop deployments and military operations. An adversary could use this data to accurately target U.S. deployments with stand-off weaponry such as short-range ballistic missiles. In addition, by monitoring troop movements via satellite, a future adversary can maintain situational awareness, making it much more difficult for a joint force commander to achieve operational surprise.

Individually, the traditional methods of denial -- diplomatic, economic, and military -- are insufficient to ensure protection from satellite imagery in this new, proliferated world. However, history provides a solution to this problem. The naval blockade was developed to deal with an adversary receiving commercial support through a neutral medium, in this case the oceans. The blockade model translates well to space, right down to the warning shot across the bow (reversible counterspace attacks).

By combining diplomatic, economic, and military efforts into an internationally understood model, the space blockade provides a joint force commander with a potentially effective means of denying adversary access to commercial satellite imagery. By allowing the joint force commander to operate and deploy securely, the space blockade may become a key element in campaign plans for the twenty-first century.

16.Distribution / Availability of Abstract:	Unclassified	Same As Rpt	DTIC Users
	X		

17.Abstract Security Classification: UNCLASSIFIED

18.Name of Responsible Individual: CHAIRMAN, JOINT MILITARY OPERATIONS DEPARTMENT

19.Telephone: 841-3556

20.Office Symbol: C

NAVAL WAR COLLEGE
Newport, R.I.

FORCE PROTECTION IN AN ERA OF COMMERCIALLY AVAILABLE SATELLITE IMAGERY: SPACE BLOCKADE AS A POSSIBLE SOLUTION

By

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

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

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4 February 2002

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The recent proliferation of high-resolution commercial imagery satellites holds a potential danger for the joint force commander. At relatively little cost, a potential adversary can gain detailed imagery of U.S. troop deployments and military operations. An adversary could use this data to accurately target U.S. deployments with stand-off weaponry such as short-range ballistic missiles. In addition, by monitoring troop movements via satellite, a future adversary can maintain situational awareness, making it much more difficult for a joint force commander to achieve operational surprise.

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My worry is that I may end up watching CNN as an entire Marine battalion landing team is wiped out on some foreign landing zone solely because I was unable to deny the enemy intelligence and imagery garnered from space-based assets.

General Charles A. Horner
USCINCSPACE, 1993

INTRODUCTION

Since the early 1990s, there has been an explosion in the commercial space sector. Rapid growth has made a wide array of services once reserved for world superpowers available to anyone with ready cash. Over the past several conflicts, from the Gulf War to the current action in Afghanistan, joint force commanders have learned how these commercial assets can augment U.S. space systems and provide meaningful support to their actions.

However, these systems are not just available to friendly forces. They are commercially available across the globe. In particular, satellite imagery has made incredible advances in recent years and is now able to provide even a minor opponent with first-class imagery.

This potential imagery "edge" creates a serious force protection issue for the joint force commander. Satellite imagery would allow an adversary to locate and classify high value targets behind friendly lines, as well as allowing him to strike U.S. forces with stand-off weapons such as ballistic missiles and cruise missiles. Commercial imagery could also allow the adversary to see friendly preparations for action and to plan a counter move before friendly forces can act. This loss of surprise would also increase friendly casualties.

Traditionally, efforts to counter space systems have been diplomatic, economic, or military. However, because commercial satellites are not part of the adversary's forces, but are outside of U.S. control, none of these is likely to be effective alone. Still, this is not a new problem. Historically, nations have used naval blockades to deny access to commercial

support through a neutral medium. Faced with a similar situation in space, there is no reason not to look back on military history and update the concept.

Like the naval blockade before it, the *space* blockade is the best way for a joint force commander to deny an adversary the benefits of commercial space services. By applying the well-accepted framework of the naval blockade to integrated diplomatic, economic, and military space denial efforts, a space blockade provides the joint force commander with effective force protection against satellite imagery.

COMMERCIAL SATELLITE IMAGERY THREAT

Along with mission accomplishment, the joint force commander's primary responsibility is the safety of his forces. Two major parts of this force protection are protecting friendly forces from attack, and preventing the adversary from gaining knowledge of friendly activities.[1] The advent of commercial satellite imagery has made both these tasks more difficult in recent years.

For decades, satellite imagery was the domain of the superpowers. During that period, the U.S. and the Soviet Union primarily used satellite imagery to conduct strategic surveillance on each other's nuclear arsenals.[2] It served as a means of maintaining the balance of power between them rather than as a tactical or operational tool.[3] Adversary access to satellite imagery was considered a national-strategic level issue and outside the purview of a theater commander.

This is no longer the case. Satellite imagery has become a useful tool in many non-military pursuits and, as a result, space access has grown. Many nations have or are developing their own satellite imagery capability. Japan, China, India, Israel, Brazil, Canada, Great Britain, and France have all joined the United States and Russia in the field of satellite imagery.[4]

Of even greater import to the theater commander, though, is the rise of non-governmental satellite imagery businesses. These companies include EarthWatch Inc. (USA),

Orbimage (USA), Space Imaging (USA), Terraserver.com (USA), SPOT Image Corporation (France),[5] ImageSat International (Israel),[6] and Sovinformsputnik (Russia).[7] They typically operate on a fee-for-service arrangement, selling images on request to any paying customer. Some will even sell ground control stations and the right to directly task their satellites.[8]

While U.S. satellite imaging companies grant the U.S. government the right to censor their images during times of war, no such standing agreements exist with foreign companies.[9] In addition, some legal experts believe that the U.S. rules may be unconstitutional and will certainly be subject to legal challenge if employed.[10] This makes satellite imagery available to even third-world nations, and dramatically increases the likelihood of a future adversary using imagery against the U.S.

Satellite imagery now has tactical and operational value in conventional conflicts.[11] While the details of NRO activities in the Gulf War remain classified, what is widely known is the role played by commercial imagery purchased from the French SPOT imagery satellite. American forces used these commercial images to draw up more accurate maps and for mission planning. [12]

Since that time, commercial imagery systems have only become more militarily effective. Advertised as "The New Way To Win!" in military conflicts,[13] the SPOT satellite used in the Gulf War had a resolution of 10 meters.[14] (Each individual pixel in the image was 10 meters across.) As of early 2002, the commercial standard was 1 meter, with some systems planned to achieve .5 meters in the near future.

At 10 m resolution, imagery can detect large features like roads, terrain, and buildings. At 1 m, imagery analysts can precisely identify troop movements, aircraft, C2 systems, and mine fields. At .5 m, one can precisely identify Surface-to-Air Missile sites and surface ships,

and can give a more general identification of different types of vehicles (tanks, armored personnel carriers, mobile artillery, etc.), supply dumps, and artillery emplacements.[15]

Now, instead of getting a simple overview of the terrain, an adversary can positively identify force bed downs and potential high value targets. This is a significant advance and should be of great concern to the joint force commander.

Adversary access to advanced commercial satellite imagery has two related effects on joint force commander's force protection concerns. First, it aids an adversary in targeting the commander's forces by detailing friendly force deployments. Second, availability of commercial imagery eliminates or greatly reduces our ability to achieve operational surprise; lack of surprise will likely increase friendly casualties.

Targeting

Available commercial imagery allows an adversary's planners to see concentrations of U.S. and allied forces and aids them in identifying weaknesses or choke points for strike. This allows the adversary commander to concentrate his efforts, directly or indirectly, on what he perceives to be the joint force's centers of gravity. Given the spread of ballistic and cruise missiles throughout the third-world, a space-savvy adversary would find these concentrations irresistible targets for his missile fleet. This in turn would force a greater dispersal of U.S. forces and hinder the ability to mass combat power. The more precise targeting available from space imagery would threaten even these dispersed bases, slowing movement and forcing U.S. forces to base further back from the fight, making the massing of effects more difficult.

Surprise

Historically, surprise has been a large factor in America's military victories and has served to reduce U.S. casualties. A recent National Defense University study looked at the 16 major conflicts the U.S. has been involved in during the 20th century. The study showed

that with surprise, the U.S. had an average casualty ratio of 1 U.S. soldier killed or wounded to 14.5 enemy soldiers. Without surprise, the average fell to 1 to 1.7.[16]

While these are chilling figures, a better picture of the impact of adversary access to commercial satellite imagery on force protection can be made by a concrete comparison. In the next pages we will examine the events of the Gulf War and compare them to a scenario of a similar conflict carried out with current space systems.

THE PERSIAN GULF – THEN AND NOW

OPERATION DESERT STORM – 1990

The Gulf War was, by all measures, a triumph of American military art. Facing a numerically superior force in entrenched positions, U.S forces relied on air power operating largely from bases outside of Iraq's vision to prepare the battlefield; they then used maneuver to create surprise, further shifting the odds in the U.S.'s favor.

American units were superior man for man, but their Iraqi opponents had built extensive defensive positions along the Kuwaiti border.[17] Classical military force ratios call for at least a 3 to 1 advantage when attacking prepared defenses.[18] The surprise generated by the allies' 'left hook' attack plan and the devastation wrought by the preliminary air campaign went a long way towards achieving that ratio.

The ground campaign's need for surprise meant the allies needed to control Iraq's perception of the battlefield.[19] This was accomplished by preventing Iraq's observations of ground force movements in the initial 'left hook' assault while allowing them to see the Marine feint of an amphibious landing in order to drive the Iraqis to mass their forces within Kuwait.

This operational surprise allowed U.S. forces to outflank nearly the entire Iraqi force in the theater of operations. It served as a force multiplier to shift the odds to favor the U.S. and coalition forces. Surprise also induced panic and a sense of shock in the Iraqi regular

forces, which, in turn, led to large-scale surrender and retreat. All of this resulted in vastly fewer allied casualties than had been predicted.[20] Had Saddam Hussein been able to observe the forces moving north, he might have shifted his forces, particularly his elite Republican Guard, to block the allied advance. This would have led back to the force-on-force situation that initially faced the allies and would have resulted in significantly more allied casualties.

Even apart from the issue of surprise, it was essential for operational protection to keep Iraq in the dark about the details of allied troop deployments during the build-up and initial air war. While Saddam's air force was largely unable to conduct offensive strikes at allied bases and logistics depots, that was not true of his missile fleet. SCUD short-range ballistic missiles were launched at targets in Saudi Arabia and Israel throughout the war.

General Schwarzkopf noted in his autobiography that, due to airfield congestion, a single Iraqi plane reaching the base could have "wreaked havoc," largely due to secondary explosions from aircraft and munitions stored too closely together. [21] A successful SCUD attack on those fields could have produced similar results.

Instead, Saddam's SCUDs were largely ineffective and unable to break coalition operational protection. This was more due to the SCUD's inaccuracy and Iraq's lack of firm targeting data than through any effort by the Patriot anti-aircraft batteries pressed into service as anti-missile systems. With no real idea where allied forces were concentrated, [22] Saddam had to content himself with political targets.[23]

Thus, allied information dominance served to enhance force protection. It allowed allied forces to operate unseen while simultaneously denying Iraq targets for their missiles. In doing so, it minimized allied casualties, both from Iraqi missile assaults and from an entrenched enemy on the ground. This dominance was primarily accomplished through air

supremacy. The allies established control over friendly airspace almost immediately and then seized control of Iraqi airspace.

What is less well known than allied air supremacy is that diplomatic efforts were used to secure *space* supremacy over Iraq as well. At the time, Iraq had access to two sources of satellite imagery: Russian military reconnaissance satellites and the French SPOT commercial imager.[24] The United States took swift action during the build-up of Desert Shield to cut Iraq off from both sources through diplomatic means, including a U.N.-mandated embargo on satellite imagery sales to Iraq.[25] As a result, America and her allies enjoyed a monopoly on satellite imagery. Saddam Hussein and his forces were largely blinded to the details of allied operations and positioning, leading, at least in part, to the one-sided victory of Desert Storm. It is logical to assume that the rest of the world watched…and learned.

OPERATION SON OF STORM – 2005

Today, editorial headlines speculate on the probability of another war against Iraq. This time, it is said, we will 'finish the job' and topple the Iraqi government and end its sponsorship of terrorist organizations.[26] With that in mind, it is reasonable to examine what Saddam might do in today's imagery-rich environment.

We know Saddam has retained at least a portion of his arsenal of ballistic missiles. Estimates range from 85 to 100 SCUDs left from the Gulf War. In addition, Iraq is currently working to develop a new, more modern, short-range ballistic missile called the Ababil 100.[27] It is safe to assume that Iraqi ballistic missiles will remain a threat in 2005.

For the purposes of this analysis, we will assume that the same factors that deterred Saddam from using weapons of mass destruction in the original Gulf War will continue to deter him. While this is admittedly an assumption open to challenge, the use of WMD

against U.S. and allied forces opens too many variables, which would make it impossible to assess the impact of satellite imagery.

What, then, would be a reasonable course of action for Iraq to take? Saddam could attempt to carry out one of four courses of action. First, he might attempt a diplomatic settlement without combat. If so, while force protection will remain an issue for the theater commander, satellite imagery would not likely be a threat. Second, Saddam could hunker down in a defensive posture and try to make the cost of toppling him too high. Third, he could actively strike U.S. and allied troop and equipment concentrations in an effort to deny us greater access to the region. Fourth, he could pursue both two and three, either in parallel or serial.

Unless a peaceful settlement could be reached, the joint force commander opposing Iraq would have to be concerned about Iraqi access to satellite imagery. The joint force commander would, like his predecessor in 1990/91, still need to maintain OPSEC for both security and surprise. Iraqi access to commercial imagery would greatly exacerbate the challenge for the joint force commander, no matter which option the Iraqis might choose.

Would Iraq be able to gain access to satellite imagery? Efforts to control commercial satellite imagery by buying exclusive rights to the images in the recent war in Afghanistan received a great deal of publicity within the space community. What did not receive notice was that the agreement with Ikonos, a U.S.-based imagery company, left many other providers untouched.[28]

It is equally important to note that even during the Gulf War, SPOT's deputy director-general was quoted as saying that his company would have broken the UN embargo, if another company had been willing to provide Iraq with imagery.[29] He would have sold Iraq militarily useful imagery rather than let a competitor get Iraq's business.

Although in the Gulf War another company did not offer Iraq imagery, eliminating the commercial issue for SPOT, in 2005 (or even 2002) there are many companies likely to provide such imagery to Iraq. In the Schriever 2001 space war game, a 'green cell' of actual representatives from the commercial space industry provided realistic commercial responses to war game actions. The cell was not given a script and was told to respond as they would in a real conflict. In the game, the cell refused to deny service to the adversary nation and cited their need to comply with existing contract commitments as their reason for doing so.[30]

These two items, combined with the profusion of imagery sources available, imply that Iraq would likely have access to one-meter resolution imagery. Instead of being able to maneuver unseen to achieve surprise, U.S. forces would face an adversary aware of their movements and ready for their assault. The rapid roll-up of Iraqi forces seen in the Gulf War would transform into a force-on-force slugging match. While the U.S. would still retain a significant edge in both equipment and training, it is obvious that the casualties would be higher.

Armed with an increased knowledge of U.S. force deployments, Iraqi missiles would likely target any heavy concentrations of U.S. forces with multiple salvos. This would greatly increase the likelihood of major damage.

New anti-missile systems are being developed and fielded. However, the ultimately dismal performance of the Patriot (in a role it was not designed for) and the inability of air forces to find and kill Iraq's mobile SCUDs in the Gulf War, imply that massed SCUD salvos on specific targets would likely get through and strike with some effect.[31]

Both of these results, the loss of surprise and the vulnerability to missile attack, would result in increased losses of both personnel and equipment. While there are potential solutions such as the dispersal of forces to avoid providing attractive missile targets, fielding

improved theater missile defenses, and offensive strategies that do not require surprise, none of these come without cost in time, troops, and treasure.

TRADITIONAL COUNTERSPACE SOLUTIONS

A better solution, perhaps, would be to address the source of the problem, access to satellite imagery. This could be done by a variety of methods. Access might be denied through diplomatic means, as was done in the Gulf War, through economic means, as was done with Ikonos in the recent operations in Afghanistan, or through military means.

Diplomatic

Diplomacy has worked in the past. The diplomatic efforts to deny Iraq access to SPOT and Russian imagery during the Gulf War serve as a case in point for this method. However, diplomacy can be slow and may not always be reliable. It depends on the neutral nation deciding that it is in its own best interests to stop providing imagery to the adversary. As imagery capability proliferates, more and more nations would have to come to the same conclusion. All it takes is one nation to disagree for imagery to get through.[32]

Even when common interests do exist, diplomacy can be a slow tool. For example, during OPERATION ALLIED FORCE in Kosovo, over three months of diplomatic maneuvers were necessary to convince Eutelsat, an international consortium made largely of our allies in the conflict, to cut off Serbian satellite television propaganda broadcasts.[33]

Economic

Economic measures have also met with limited success. These can be broken down into two types: regulatory and fiscal. Regulatory measures involve requiring a company to grant the U.S. the right to declare certain images off limits during times of emergency. These 'shutter control' clauses already exist for all U.S. satellite-imaging firms. However, they do nothing to deter a non-American company from providing data to an adversary. In essence,

this merely undercuts the commercial competitiveness of U.S. imagery firms and ensures any potential adversary will not 'buy American.'

The second type of measure, fiscal, was used by the United States during the recent Afghanistan conflict. Instead of trying to prevent a company from imaging the battlefield, the U.S. merely bought all rights to their images.[34] However, given the large number of commercial imagery sources, both corporate and national, this quickly becomes cost prohibitive. In addition, it is predicated on trust that the company will not simply sell additional copies to the adversary. As with diplomacy, the growing number of sources increases the likelihood of this happening.

Military

Military measures may be broken into two types; attacks on the ground infrastructure and attacks on the satellite. Only the first has ever been used in combat. However, when dealing with third-party providers like commercial satellite imaging firms, this may not be a viable option. The ground station may not be in the theater of operations. Instead, it is likely to be in a neutral third country. This effectively renders it immune to attack.

Even if the ground station is located within the theater, it may not be a politically viable target. As a commercial firm, it may be staffed entirely by civilians. During OPERATION ALLIED FORCE, the U.S. was accused of war crimes for the deaths of civilian employees during coalition attacks on a Serbian uplink station to Eutelsat.[35]

Attacks on satellites carry potential pitfalls. Much like ships in international waters, satellites are considered to be sovereign territory.[36] An attack on a neutral nation's satellites could be considered an act of war. Again, the large number of nations and firms that fly imagery satellites makes this a daunting task.

One commonly raised concern with attacking satellites, however, is not truly an issue for the joint force commander. While many people both in and out of the military believe

that attacks on satellites are forbidden by treaty, this is not the case. A more detailed review of current treaty limitations on a space blockade may be found in Appendix I.

In summary, diplomatic and economic means may be of limited value when multiple national and commercial organizations provide imagery. Military denial is also fraught with problems, particularly when an ostensibly neutral third party is providing the imagery. By themselves, none of these measures provide the joint force commander the assurance he needs for force protection.

SPACE BLOCKADE[37]

A better approach, combining all three methods, can be found by extending an analogy from naval warfare: the blockade. Historically, combatants used a blockade to prevent an adversary from gaining military advantage from neutral vessels.[38] In a more general sense, it is "the closure of an area, as a city or harbor, by hostile forces so as to prevent entrance and exist of traffic and communication."[39] This can include both military and commercial traffic.[40]

This is exactly the problem facing the joint commander with satellite imagery. He must prevent an adversary from getting support from third parties, military, civil, and commercial. This concept can be readily expanded to space as well. Historically, the definition and application of blockades has often been subject to evolution to fit changing times.[41] By extrapolation, a space blockade is a belligerent operation to prevent access to space services, neutral and enemy, within an area under enemy control.[42]

Unlike naval blockades, orbital mechanics make it nearly impossible to stop a satellite from over-flying a specific area without destroying it. While it is possible to turn an aircraft or ship around and force it to leave the blockaded area, little short of destruction can stop a satellite from continuing on its orbit. Extensive orbital maneuvers can delay over-

flight for a time, but at significant cost to the satellite's usable lifespan. However, unlike terrestrial blockades, denial of space services does not necessarily require preventing physical movement. An imagery satellite whose shutter remains closed (or is blinded) provides an adversary no more support than one that has been destroyed. The goal, then, of a space blockade, is not to bar physical passage, but to deny an adversary any information from the system.

How would a space blockade operate? Regardless of medium, blockades have several steps in common. A space blockade would run in five, sometimes overlapping, phases:

1. Blockade Declaration *(Tell 'em)*
2. Deployment of Forces *(Weigh Anchor)*
3. Voluntary Compliance *(Watch For Blockade Runners)*
4. Reversible Enforcement *(Board and Turn Back)*
5. Lethal Enforcement *(Sink 'em)*

Blockade Declaration

As in any blockade, before enforcement can begin, it must be announced. Historically, the announcement also contains the information necessary to remain clear of the blockade; start date, geographic area covered, and any exceptions or variations to a total blockade.[43] This allows third parties the opportunity to remove themselves from the blockaded area and remain neutral. In a space blockade, this announcement must include what sorts of systems are covered (a ban on high-resolution systems vs. a total imagery blockade), and what would be an acceptable means of showing inactivity (shutters closed, optics turned away from the Earth, no transmissions into the blockaded area, etc.).

Deploy Forces

Along with declaring the blockade, the United States would have to deploy forces to enforce it. Unenforceable, or 'paper' blockades have long been considered invalid.[44] It is not

sufficient for the U.S. to simply demand that neutral parties cease providing space services to an adversary simply because the U.S. wishes it so. The U.S. must field forces to enforce the blockade.

These forces need not be space-based themselves. In fact, a breadth of different systems for different situations would be preferable. These systems should range from reversible, non-damaging systems, such as jammers and dazzlers, to the capability to destroy both space and ground segments. The U.S. already has the capability to destroy ground sites within adversary territory through airpower. Air Force Space Command's (AFSPC) Strategic Master Plan, which outlines AFSPC's acquisition and modernization plans for the next 25 years, includes several systems which would be good candidates for the remaining capabilities needed to conduct a space blockade:

	ISR		COMM		NAV	
	REV	D	REV	D	REV	D
Mobile RF Jammer			X			
Laser Blinder	X					
Navigation Jammer					X	
Downlink Mission Data Jammer	X		X			
Counterspace Microsats	X	X	X	X		
Space-Based Laser		X		X		X

REV = Reversible

D = Destructive

Source: AFSPC Strategic Master Plan for FY02 and Beyond

Table 1

Voluntary Compliance

Like a naval blockade, the best outcome would be one of voluntary compliance, albeit compliance backed by a threat. Voluntary compliance could be pursued through diplomatic or economic (regulatory and fiscal) means depending on the ownership of the system in question.

The effectiveness of diplomatic and economic methods of denial would be greatly enhanced by the presence of fielded forces capable of conducting military operations to enforce the blockade. The presence of this 'stick' would strengthen the U.S.'s hand for negotiations and add a sense of urgency currently missing in such deliberations.

Reversible Enforcement

Lethal force is rarely the first option used when enforcing a naval blockade. In naval blockades, the first response is to attempt to turn back or capture the breaching party. While this is exceedingly difficult to do physically in space, the use of reversible counterspace means followed by a warning to the parties involved could be an acceptable substitute.

The key to this phase is proportionality. Lethal force is withheld when there are less harmful means of enforcement. Since a satellite cannot be stopped or captured easily, another means of non-lethal enforcement should be used where possible. Since this phase presupposes that efforts to obtain voluntary enforcement have failed, all that remains is military enforcement.

Once U.S. space surveillance or intelligence systems detected a breach of the blockade, reversible systems could be employed. Reversible counterspace weapons are those that do no lasting damage to the satellite. Once the service has been temporarily disabled, then the U.S. would issue a warning to the party committing the breach, emphasizing the U.S.'s resolution to enforce the blockade and warning of more lethal enforcement if they continue to try to breach the blockade. This reversible attack serves as a ‘shot across the bow’ to warn the satellite operator that the U.S. intends to enforce the blockade.

Reversible space control systems, like those listed in Table 1, would give the U.S. a means to enforce a space blockade through temporary denial. This capability to 'turn back' blockade violators without destroying or permanently damaging their extremely expensive space systems would allow the U.S. to show its intent to enforce its blockade without necessarily

creating a major international incident. However, if a party failed to heed the 'warning shot,' more destructive methods against the satellite or ground stations might be required.

Lethal Enforcement

This transition from declaration, to reversible enforcement, to lethal enforcement provides the joint force commander with a series of graduated options to deal with the force protection problems generated by adversary access to third-party satellite imagery. It also provides a commercial provider with an incentive to break existing contracts (the threat of permanent damage to his satellite) without requiring significant loss to prove it.

In a space blockade, lethal enforcement would likely involve the physical destruction of the satellite. Attacking the satellite instead of a ground site is more attractive to the theater commander for two reasons.

Proportionality: It is far preferable to strike an unmanned satellite in orbit than to risk killing civilians in a strike on ground facilities. At the end of OPERATION ALLIED FORCE, Human Rights Watch accused the U.S. and its allies of war crimes in the bombing of Serbian satellite television transmitters to stop propaganda broadcasts. They claim the deaths of the civilian personnel working there were not justified by the military utility of the target.[45] Attacks on satellites do not risk human lives, civilian or military.

Ground Site Location: For many third parties imagery systems, the ground site is located in allied or neutral territory. Physical destruction of such a site could be construed as an act of war against their host country. This would likely embroil the U.S. in additional conflicts or diplomatic emergencies that it neither needed nor wanted.

CONCLUSION

Satellite imagery has grown over the past few decades from a strategic tool of superpowers to a widespread commercial utility. This increase in both availability and capability means that even minor adversaries now have the capability to use militarily relevant satellite imagery against U.S. forces.

Adversary access to readily available satellite imagery poses a significant threat to the safety and security of the joint force. Access to imagery makes it feasible for an adversary to strike at U.S. troop deployments and equipment concentrations with readily available standoff weapons. At the same time it removes the element of surprise that has been a common force multiplier in American combat actions. Both effects serve to increase the vulnerability and casualty rate of U.S. forces. The joint force commander cannot allow this to happen.

Traditional methods of denying adversary access to satellite imagery are not sufficient when an adversary has multiple commercial sources from which to choose. Only a space blockade, encompassing elements all three methods (diplomatic, economic, and military) provides a high likelihood of success. In the interests of force protection, joint force commanders should consider the merits of a space blockade as part of operational plans.

By including the concept in deliberate plans well before any crisis, the myriad approvals and support arrangements needed to execute this concept could be obtained in advance. This would allow the joint force commander to conduct the blockade in a timely fashion and thereby protect his force from the effects of satellite imagery.

NOTES

[1] Joint Chiefs of Staff, Doctrine for Joint Operations, Joint Pub 3.0 (Washington, DC: 10 September 2001) pp. III-31-32
[2] Cynthia A. S. McKinley, "When The Enemy Has Our Eyes," in Beyond the Paths of Heaven: The Emergence of Space Power Thought, ed. Bruce M. DeBlois, (Maxwell AFB, AL: Air University Press, Sept 1999), pp. 307-315
[3] Ibid. pp. 309-315
[4] Ibid. pp. 327-328
[5] "Commercial Satellite Operators," Aviation Week and Space Technology, (17 Jan 2000), pp. 248-250
[6] "Press Releases," Lkd. ImageSat International web site. <http://imagesatintl.com> [25 January 2002]
[7] Ann M. Florini and Yahya Dehqazada, "Commercial Satellite Imagery Comes of Age," Issues in Science and Technology, Fall 1999, p. 45
[8] "Satellite Operating Partner (SOP)," Lkd. ImageSat International web site. <http://imagesatintl.com> [25 January 2002] In addition, the author has seen, but cannot document, Space Imaging's similar offer for a transportable ground station and processing facility.
[9] Vernon Loeb, "U.S. Is Relaxing Rules On Sales Of Satellite Photos," Washington Post, 16 December 2000, sec. 1, p. 3
[10] Florini, op. cit, p. 50
[11] Thomas S. Moorman, Jr., "Space: A New Strategic Frontier," Air Power Journal (Spring 1992), pp. 14-23
[12] McKinley, op. cit., pp. 317 - 318
[13] "SPOT a New Way to Win," advertisement, Defense Electronics (November 1988), p. 68.
[14] Ibid, p. 315
[15] James G. Lee, "Counterspace Operations for Information Dominance," in Beyond the Paths of Heaven: The Emergence of Space Power Thought, ed. Bruce M. DeBlois, (Maxwell AFB, AL: Air University Press, Sept 1999), p. 266
[16] Michael Sheehan, Sean Jersey, & Meridith Linn, Aggressor Space Applications Project: The Military Impact of Commercial Satellite Imagery Final Out-Brief (Kirtland AFB, NM: Air Force Research Laboratory/DEPI, 1999)
[17] Michael R.Gordon and Bernard E. Trainor, The Generals' War (New York: Little, Brown and Company, 1995), p. 163
[18] Naval War College, Commander's Estimate of the Situation Workbook, NWC 4111D (Newport, RI: 13 November 2001), p. B-3
[19] Joint Chiefs of Staff, Doctrine for Joint Operations, Joint Pub 3.0 (Washington, DC: 10 September 2001), p. III-36
[20] Donald J. Kutyna, "Spacecom: We Lead Today, But What About Tomorrow?," Defense 91 (July/August 1991), p. 27
[21] H. Norman Schwartzkopf, It Doesn't Take a Hero, (New York: Bantam Books, Oct 1992), pp. 350-351
[22] David Taylor, "Emerging Satellite Imaging Capabilities And Its Impact On U.S. Military Operations," (Unpublished Research Paper: U.S. Naval War College, Newport, RI: 1998) pp. 10-11
[23] The political, rather than military nature, of these strikes is borne out by the way in which they were launched. With a circular error probable (CEP) of 900 meters and a fairly small 250 kg warhead, individually launched SCUDs did major damage only by chance. As a terror weapons, that was all they needed to do. If Saddam had better targeting data available, multiple salvos could have been used to ensure that specific targets were struck. See William C. Story, Jr., "Third World Traps and Pitfalls: Ballistic Missiles, Cruise Missiles, and Land-Based Air Power," (Unpublished Research Paper: U.S. Air University. School of Advanced Airpower Studies, Maxwell AFB, AL: 1994) for more information on Iraqi SCUD capabilities.
[24] McKinley, op cit. p. 303
[25] Essays on Air and Space Power, Vol. II (Maxwell AFB, AL: Air University Press, 1997), p. 117
[26] Richard Perle, "The U.S. Must Strike At Saddam Hussein," New York Times, 28 December 2000, Late Edition - Final, sec. A, p. 19
[27] Center for Defense and International Security Studies, "National Briefings: Iraq," National Briefings, <http://www.cdiss.org/iraq_b.htm> [25 January 2002]

[28] Pamela Hess, "Defense Deal To Keep Satellite Images Secret", Washington Times, 14 October 2001, sec. A, p. 2
[29] McKinley, op. cit., p. 319
[30] Thomas E. Ricks, "Space Is Playing Field For Newest War Game," The Washington Post, 29 January 2001, sec. A, p. 1
[31] Story, op. cit., p. 72-73
[32] Joseph C. Anselmo, "Shutter Control: How Far Will Uncle Sam Go?," Aviation Week and Space Technology, (31 January 2000) pp. 55-56
[33] "Eutelsat Blocks Service To Yugoslavian Station", Space News, 7 Jun 1999, p.2
[34] Pamela Hess, "Defense Deal To Keep Satellite Images Secret", Washington Times, 14 October, 2001, sec. A, p. 2
[35] "NATO Rejects War Crime Allegations In Kosovo Campaign", CNN.com, 7 Jun 2000. <http://www.cnn.com/2000/WORLD/europe/06/07/nato.amnesty.02/> [29 January 2002]
[36] Peter T. Breier, "Legal Proscriptions Pertaining To The Use Of Force In Outer Space" (Unpublished Research Paper: SAIC, Washington, DC: January 2000), p. 57
[37] Much of the author's thoughts on the conduct of a space blockade were formed while serving as Chief of Space Control Strategy, Policy, and Doctrine for Air Force Space Command. See Robert A. Fabian and Tom Riebe, A Space Blockade: Flexible and Responsive Denial of Adversary Use of Space, Space 2000 Symposium Papers (Kansas City, MO: American Institute of Aeronautics and Astronautics, 2000) for an earlier version of the space blockade concept.
[38] Michael N. Schmitt, "Aerial Blockades in Historical, Legal, and Practical Perspective", USAFA Journal of Legal Studies, Vol. 2 (1991), p. 21
[39] "Blockade," Webster's II New Riverside University Dictionary, 1984 Ed.
[40] D.T. Jack, "Studies in Economic Warfare," in Modern Developments in International Law, 1940, p. 58
[41] Schmitt, op cit., p. 23
[42] See Peter Axup, "Space Control For The Theater Commander: Naval Blockade As A Precedent" (Unpublished Research Paper: U.S. Naval War College, Newport, RI: 17 May 1999) for another take on the space blockade analogy focused on reversible attacks and the legal precedents of blockades.
[43] Schmitt, op. cit., p. 41
[44] Jack, op. cit., pp. 58-59
[45] "NATO Rejects War Crime Allegations In Kosovo Campaign", CNN.com, 7 Jun 2000. <http://www.cnn.com/2000/WORLD/europe/06/07/nato.amnesty.02/> [29 January 2002]

BIBLIOGRAPHY

Anselmo, Joseph C. "Shutter Control: How Far Will Uncle Sam Go?" Aviation Week and Space Technology, 31 January 2000: 55-56.

Axup, Peter, "Space Control For The Theater Commander: Naval Blockade As A Precedent." Unpublished Research Paper, U.S. Naval War College, Newport, RI: 1999.

Banks, Brian, "Spy In The Sky." Canadian Business (10 January 2000): 31-33.

Breier, Peter T., "Legal Proscriptions Pertaining To The Use Of Force In Outer Space." Unpublished White Paper: SAIC, Washington, DC: January 2000.

Center for Defense and International Security Studies, "National Briefings: Iraq." National Briefings, <http://www.cdiss.org/iraq_b.htm> [25 January 2002]

"Commercial Satellite Operators." Aviation Week and Space Technology 17 (Jan 2000): 248-250.

Essays on Air and Space Power, Vol. II. Maxwell AFB, AL: Air University Press, 1997.

Fabian, Robert A. and Tom Riebe, A Space Blockade; Flexible and Responsive Denial of Adversary Use of Space. Space 2000 Symposium Papers, Kansas City, MO: American Institute of Aeronautics and Astronautics, 2000.

Florini, Ann M. and Yahya Dehqazada. "Commercial Satellite Imagery Comes of Age." Issues in Science and Technology, Fall 1999: 45-52.

Gordon, Michael R. and Bernard E. Trainor. The Generals' War. New York: Little, Brown and Company, 1995.

Grinter, Lawrence E. and Barry R. Schneider. "On Twenty-first Century Warfare." in Battlefield of the Future, 21st Century Warfare Issues, edited by Barry R. Schneider and Lawrence E. Grinter, 267-274. Maxwell AFB, AL: Air University Press, Sept 1998.

Horner, Charles A. "New-Era Warfare." in Battlefield of the Future, 21st Century Warfare Issues, edited by Barry R. Schneider and Lawrence E. Grinter, 47-63. Maxwell AFB, AL: Air University Press, Sept 1998.

Jack, D.T., "Studies in Economic Warfare," Modern Developments in International Law. 1940.

Kutyna, Donald J. "Spacecom: We Lead Today, but What About Tomorrow?" Defense 91 (July/August 1991).

Lee, James G. "Counterspace Operations for Information Dominance." in Beyond the Paths of Heaven; The Emergence of Space Power Thought, edited by Bruce M. DeBlois, 249-301. Maxwell AFB, AL: Air University Press, Sept 1999.

Lupton, David E., On Space Warfare: A Space Power Doctrine. Maxwell AFB, AL: Air University Press, 1988.

McKinley, Cynthia A. S. "When The Enemy Has Our Eyes." in Beyond the Paths of Heaven; The Emergence of Space Power Thought, edited by Bruce M. DeBlois, 303-362. Maxwell AFB, AL: Air University Press, Sept 1999.

Meyer, Donald A., "Space Countersurveillance: A Requisite For Theater Defense Planning." Unpublished Research Paper, U.S. Naval War College, Newport, RI: 1993.

Moorman, Thomas S. Jr. "Space: A New Strategic Frontier." Air Power Journal (Spring 1992): 14-23.

"NATO Rejects War Crime Allegations In Kosovo Campaign." CNN.com 7 Jun 2000 <http://www.cnn.com/2000/WORLD/europe/06/07/nato.amnesty.02/> [29 January 2002]

Naval War College. Commander's Estimate of the Situation Workbook. NWC 4111D Newport, RI: 13 November 2001.

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

Oberg, Jim, Space Power Theory. Colorado Springs, CO: U.S. Air Force Academy, 1999.

"Press Releases" Lkd. ImageSat International web site. <http://imagesatintl.com> [25 January 2002]

"Satellite Operating Partner (SOP)," Lkd. ImageSat International web site. <http://imagesatintl.com> [25 January 2002].

Schmitt, Michael N., "Aerial Blockades in Historical, Legal, and Practical Perspective." USAFA Journal of Legal Studies, Vol. 2, 1991.

Schwartzkopf, H. Norman. It Doesn't Take a Hero New York: Bantam Books, Oct 1992.

Scneider, Barry R. "Principles of War for the Battlefield of the Future." in Battlefield of the Future, 21st Century Warfare Issues, edited by Barry R. Schneider and Lawrence E. Grinter, 5-42. Maxwell AFB, AL: Air University Press, Sept 1998.

Sheehan, Michael, Sean Jersey, & Meridith Linn. Aggressor Space Applications Project: The Military Impact of Commercial Satellite Imagery Final Out-Brief. Kirtland AFB, NM: Air Force Research Laboratory/DEPI, 1999.

Spacy, William L., II, Does the United States Need Space-Based Weapons? Maxwell AFB, AL: Air University Press, 1999.

"Spot a New Way to Win" advertisement, Defense Electronics (November 1988): 68.

Story, William C. Jr., "Third World Traps and Pitfalls: Ballistic Missiles, Cruise Missiles, and Land-Based Air Power." Unpublished Research Paper: U.S. Air University. School of Advanced Airpower Studies, Maxwell AFB, AL: 1994.

Summers, Harry G., On Strategy II: A Critical Analysis of the Gulf War. New York: Dell Publishing, 1992.

Taylor, David. "Emerging Satellite Imaging Capabilities And Its Impact On U.S. Military Operations." Unpublished Research Paper, U.S. Naval War College, Newport, RI: 1998.

U.S. Joint Chiefs of Staff. Doctrine for Joint Operations, Joint Pub 3.0. Washington, DC: 10 September 2001.

APPENDIX I - POSSIBLE TREATY LIMITATIONS ON A SPACE BLOCKADE

Outer Space Treaty of 1967

Most commonly held to outlaw counterspace operations, the Outer Space Treaty is actually quite specific in its restrictions. It outlaws the placement of nuclear weapons and other weapons of mass destruction in space and the basing, testing, or deployment of weapons on the moon or other celestial bodies such as asteroids or other planets. By specifically limiting the ban to celestial bodies while banning nuclear weapons in general, it allows the use of non-nuclear weapons in orbit. However, it also serves to extend the United Nations charter, including Article 51 rights of self-defense, into space.[1]

Strategic Arms Reduction Treaties

All of these treaties prohibit the signatories from interfering with "National Technical Means of Verification." This was intended to ensure that each side could monitor treaty compliance.[2] This only applies when the satellite is being used to monitor treaty compliance.

ABM Treaty

The ABM treaty is the most restrictive of the existing treaties encompassing space weapons. It bans the space weapons that could be used as a part of a missile defense system. This means that any space blockade weapon cannot be capable of engaging ballistic missiles. While this seriously limits potential weapons, it is not a ban per se.[3] Since President Bush gave notice in late 2001 of American intent to withdraw from this treaty, it is unlikely to be a long-term issue.

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[1] Peter T. Breier, "Legal Proscriptions Pertaining To The Use Of Force In Outer Space" (Unpublished Research Paper: SAIC, Washington, DC: January 2000), pp. 54-70
[2] Ibid. pp. 83-84
[3] Ibid. pp. 87-89