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COVER: Air Force Space Command-operated Defense Support Program (DSP) satellites are a key part of North America's early warning systems. DSP satellites use an infrared sensor to detect heat from missile and booster plumes against the earth's background.

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Introduction

Space Superiority

General Lance W. Lord
Commander, Air Force Space Command

History does not long entrust the care of freedom to the weak or the timid.

- President Dwight D. Eisenhower

We recently published the AFSPC priorities for 2005 and our #1 priority is "Ensuring Space Superiority and Providing Desired Combat Effects for Joint Warfighting." While Space Superiority and providing combat effects to Joint Warfighting may seem like two distinct goals, they are inextricably linked. Just as we would not go to war without establishing Air Superiority, we cannot go to war and win without establishing Space Superiority.

Gaining and maintaining Space Superiority by itself will not ensure we win a war, but it is critical to providing effects to/from/in/through space. Just as we gain and maintain Air Superiority to then use the effects from airpower to achieve operational and strategic goals, we must gain and maintain Space Superiority to ensure we can deliver space effects to the battlefield when and where they are needed.

"Space Superiority is the future of warfare. We cannot win a war without controlling the high ground, and the high ground is space."

Space Superiority is comprised of three critical elements. We must have complete Space Situation Awareness to fully understand what is happening in space, we must be able to defend our space assets against hostile attack and the environment, and when required, we must have the ability and resources to deny our adversaries the use of space.

The foundation of Space Superiority is Space Situation Awareness, which means having a complete understanding of what is happening in space. To that end, we must have continuous situation awareness of both environmental effects and the actions of all nations that operate in space. The means for gaining that complete awareness is our Space Surveillance Network.

The Space Surveillance Network is comprised of 30 different sensors spread around the world, providing us a comprehensive picture of what is happening in space. While our surveillance network provides the most accurate and complete Space Situation Awareness in the world, it only provides a very small piece of the information we need.

It is no longer sufficient to simply know where a satellite is in space. We must also know what the satellite is capable of doing, what it is being used for and what it may be used for in the future. Once we know this vital information concerning each satellite, we must fully integrate this information to understand how everything is working together and what the "trickle down" effect of our actions would be.

In addition to man-made objects in space, we must also understand what is happening in the space environment. We must be able to predict solar flares, electromagnetic storms and much more, and then use that information to protect our assets against the environment.

The information gained through Space Situation Awareness allows us to better plan our use and defense of space rather than simply reacting to events. If we find ourselves spending most of our time reacting to the actions of others, it probably means we are losing our advantage. It is imperative to remain ahead of the rest of the world in space, which means being proactive and forcing our potential adversaries into a reactive posture.

Space has improved and enhanced our military capabilities, but with that increased capability comes an increased reliance and vulnerability. Our reliance on space presents a potential target to our adversaries; consequently it is our fundamental duty to safeguard the advantages space provides to our warfighters and nation. The mantra within AFSPC is that Defensive Counterspace is not a program--it's a mindset!

Throughout our history, each time the United States has sought the higher ground, our adversaries developed capabilities aimed at denying us that advantage. Space is no different and we cannot continue to think of it as a benign sanctuary. This naturally hostile environment will be made ever more so if we allow our adversaries to eclipse our capabilities to defend our assets and interests in space.

The war in space began during Operation IRAQI FREEDOM when Saddam Hussein's military forces placed GPS jammers around Baghdad in an attempt to defeat the accuracy of our GPS aided munitions. While we were ultimately able to neutralize those jammers, it took time and required sending more Americans into harm's way. We must expect future adversaries to attack our space capabilities with sophisticated attacks, which will be increasingly difficult to counter.

In addition to attacking our use of space, potential adversaries have witnessed the military advantage we derive from space. They know space capabilities make us faster, more reactive, more precise and, in turn, more lethal. In future conflicts, we must expect our adversaries to seek those same benefits for their own operations and we must be prepared to conduct Offensive Counterspace operations to nullify their efforts.

We must move forward by vigorously pursuing temporary, non-destructive means to deny adversaries the use of space. As we develop these capabilities, we must remember that a capability is not just a single system that delivers an effect. A capability must include the intelligence and support infrastructure

that allows us to conduct every step of the Find, Fix, Track, Target, Engage and Assess cycle.

Through a combination of robust Space Situation Awareness, untiring Defensive Counterspace and selective Offensive Counterspace, we will establish Space Superiority to ensure our advantage from space and, when required, deny our enemy's use of space. Space Superiority is not a birthright, so we must work hard to make it our destiny.

Space power today is at a similar point as airpower was immediately following World War I. We have employed space in combat and there is no doubt as to its importance. Just as the fathers of airpower devoted great effort to developing doctrine and theory to take full advantage of the air medium, we must continue to develop doctrine for space power. We have learned many lessons from recent operations, but the work has just begun. We must develop the most effective means of providing command and control for our Space Control systems. The intelligence infrastructure to support the "how" and "why" pieces of Space Situation Awareness must be fully developed. We must continue to instill the Defensive Counterspace mindset in every operator as well as develop and refine tactics, techniques and procedures to more effectively employ our space capabilities.

Space Superiority is the future of warfare. We cannot win a war without controlling the high ground, and the high ground is space. In future wars, gaining and maintaining space superiority will be equally as important as air superiority, so we must begin work now to ensure we maintain the high ground. Our doctrine and strategy for achieving space superiority are critical to realizing the full benefit of our systems and technology.

This issue of "*High Frontier*" is dedicated to the many facets of space superiority with many outstanding articles which will educate our readers and provide a springboard for conversation and debate. Dr. Everett Carl Dolman highlights the importance of such critical thought and the requirement for critical thinking to develop a strategic way ahead for space superiority in his article, "Strategy Lost: Taking the Middle Road to Wherever." Dr. Rick Sturdevant gives us a look at one of the earliest perspectives on space superiority as he provides an introduction to General Bernard Schriever's 1957 keynote address. Lt Col Gray Rinehart and the Space Warfare Forum examine space superiority and provide thoughts on its future. An article from Maj Elizabeth Waldrop describes the United States' national policy on weaponizing space. Articles from Maj Richard Adams and Col Martin France, Maj Larry Adkins, Maj John Shaw, and Capt Michael Todd provide a thorough analysis of the various aspects of Defensive Counterspace and the importance of protecting America's access to space effects when and where we need them. General Robert "Doc" Foglesong, Commander of US Air Forces in Europe, provides us with a perspective on space from the flying side of the Air Force in "Space: A User's Perspective." Maj Tommy Roberts highlights the importance of Space Situation Awareness and its role in Space Superiority. Our doctrine, strategy and way ahead are critical to the growth of space superiority, but we also need the weapons systems to bring it to fruition, so Col James Haywood provides an elucidate point of view from the Systems Program Office in "Delivering Counterspace Capabilities to the High Frontier."

The students of the Air Corps Tactical School brought about enormous advances in airpower doctrine by publishing comprehensive papers based on extensive study and personal experience. Our mandate is to advance space power in the same manner. The articles in this edition of "*High Frontier*" are a beginning to that effort. Advances in space power will not come from our Colonels and Generals; they will come from our Majors, Captains and NCOs. I encourage you to use these articles as a basis for discussion and evaluation of current Space Superiority doctrine and employment. A critical assessment of our current practices and our proposed way ahead will bear the fruits of improved space employment and Space Superiority well into the 21st century.

General Lance W. Lord (BS, Otterbein College; MS, University of North Dakota) is the Commander of Air Force Space Command, Peterson Air Force Base, Colorado. General Lord is responsible for the development, acquisition and operation of Air Force space and missile systems. The general overseas a global network of satellite command and control, communications, missile warning and launch facilities, and ensures the combat readiness of America's intercontinental ballistic missile (ICBM) force. The general has commanded two ICBM wings and a space launch wing as well as served as the Commandant of Squadron Officer School and Commander of Air University. Prior to his current position, General Lord was the Assistant Vice Chief of Staff for Headquarters US Air Force. The general is also a graduate of Squadron Officer School, Air War College and a distinguished graduate from Air Command and Staff College.

Space: A User's Perspective

General Robert H. "Doc" Foglesong
Commander, US Air Forces in Europe;
Commander, Allied Air Component Command Ramstein;
and Air Component Commander, US European Command,
Ramstein Air Base, Germany

Many call Operation DESERT STORM the first space war, but Operation IRAQI FREEDOM (OIF) was the first time our asymmetrical advantage in space was challenged by an enemy. During the early days of OIF, the Iraqi military sought to defeat our advantage by using low-tech Global Positioning System jammers in an attempt to disrupt our precision guided munitions. This was the first Offensive Counterspace (OCS) "shot" taken by an adversary at our space superiority—it will not be the last. Many innovations designed to counter an enemy's asymmetric advantage started out as simple efforts, poorly coordinated with the user's overall battle plan. Long-range escort fighters, surface-to-air missiles and radar all began this way, and as the technologies improved, so did the operational art of their use. We do not want our troops unprepared after bullets start flying. Instead, to fight more sophisticated enemies on the space front, we must continue to advance space expertise in our Air Operations Centers (AOC). There are three areas to focus our advancement efforts. First, the command relationships between theater commanders and space units. Second, the training our space professionals receive in preparation for combat operations, and lastly, the integration of new technologies into operational planning and combat execution.

Command Relationships: The Foundation

Our adversaries will challenge our space superiority. Being proactive in planning and efficiently coordinating our command and control allows the United States to exploit the advantages our space systems give us as well as establishing space superiority against increasingly more sophisticated adversaries. To do this, we have to efficiently integrate our space capability in the joint area of operations and this requires clearly defined command relationships.

Recognizing that each situation dictates a unique arrangement means we have to be flexible whether supporting global or theater operations. Most space assets available to a Joint Force Commander are not under their operational control -- capabilities are provided via reachback to a space AOC.

In the end, the "space footprint" in the AOC is kept at a manageable level, allowing the staff of trained space professionals to effectively execute the Space Coordinating Authority's (SCA) responsibilities. AOC space personnel should work closely with other Services' space planners to establish directives that set the stage for success.

Personnel: Enabling the Command Relationships

The space professionals at the USAFE AOC bring a wealth of knowledge and expertise to the theater. Their backgrounds vary from space control, missile warning, satellite communications and space-based navigation. Additionally, USAFE employs five space experts trained at the Air Force Weapons School—this unique blend of expertise and experience is a great start to forming the space expertise needed to take the USAFE AOC to war.

Air Force Space Command's new program to develop space professionals is a perfect fit for our positions in the AOC. The program provides a baseline for training space personnel at various times during their careers while giving functional managers space-centric visibility on all space personnel. This visibility allows managers to determine how much time our space professionals have spent at any of the nine separate space specialties ranging from nuclear operations to space warfare command and control (C2). As this process develops, USAFE space leaders will capture lessons learned and provide needed feedback to AFSPC. Though not all members of the new "space professionals" will serve in a Falconer AOC position, the courses to train these space experts must include accurate and constantly-updated lessons on how the theaters are using space effects and capabilities in their AOCs. Additionally, our future theater space personnel will also benefit from the insight gained at these developmental courses.

OIF taught our military that we need to employ additional full-time space experts in the AOC. In the early days, Air Force Space Support Teams (AFSSTs) and Joint Space Support Teams (JSSTs) provided a Joint Force Air Component Commander (JFACC) or Joint Force Commander (JFC) space expertise. The deployed personnel used during this essential first step have now been replaced by in-house space experts. We need to go even further if we are to live up to our own billing as the clearing house for space support and space operations for the Joint Task Force (JTF).

The next step is nothing less than a full-court press for theater space operations. As new systems like the single integrated space picture (SISP) find their way into our AOC tool kit, we need to make sure we're getting what we need from the folks posting information onto the SISP. We must think beyond just the "blue" needs of the Air Force. During OIF, embedded space personnel handled requests for space support on a piecemeal basis. The next logical step is to request other services send space experts along with their liaison elements to the AOC. This means we should incentivize the Army, Navy and Marines to send trained representatives to the Battlefield Coordination Detachment (BCD), Naval and Amphibious Liaison Element (NALE) and Marine Liaison Officer (MARLO) respectively, to ensure the integration of space effects among the various component commanders. Additionally, trained intelligence specialists in the Joint Intelligence Center (JIC) need to be identified and

dedicated to providing timely space-related intelligence either via reachback from various stateside agencies or from organic theater intelligence platforms.

The Near Future

With command relationships analyzed and personnel properly trained and matrixed within the AOC, the last step is to stay current. Our AOC exercises must feature increasingly space-smart adversaries. The Cuban Foreign Ministry admits their government has been jamming US television and radio broadcasting into Cuba, citing their right to defend their radio-electronic space from subversive aggression. In 2003, a US satellite carrying TV broadcasts to Iran was mysteriously jammed by a signal purportedly originating in Cuba, proving a nation does not have to be capable of launching satellites or anti-satellite weapons (ASATs) to have an effect on our use of space. It also introduces a complex idea of a nation halfway around the world from a potential conflict interfering with our ability to wage war. These are the kinds of tough scenarios today's exercises need to involve—a combination of legal and foreign policy wrangling, possibly followed by military action if a country denies our access to space.

A new initiative is on the horizon that could change our idea of how space integrates into a conflict. The Joint Warfighting Space (JWS) initiative would make small, low-cost satellites available to a theater commander to augment the existing constellation of missile warning, communications, intelligence and navigation satellites. While not a replacement for the national-level assets, they could provide additional capabilities or restore space-based capabilities degraded by either natural phenomena or enemy action. A similar, related initiative is exploiting the "near-space" environment (altitudes from 65,000 to 325,000 feet) by launching lighter-than-air payloads at the discretion of a theater commander. Though the unmanned platforms in development would be highly capable, the science behind the concept is not difficult; similar craft are being used today in remote parts of Western Texas to relay communications from remote oil wells. Such low-cost solutions could provide enormous benefits to a joint task force continually asking for more of everything space traditionally provides: communications bandwidth, missile warning, navigation, and intelligence collection.

The time to start integrating these new technologies is now. As they develop, experienced space professionals with AOC experience must ensure new designs help theater commanders achieve their desired effects. It does not help to have someone come to you and say, "Here's a bullet, now go find the target." When these new technologies are several years from deployment, they need to be given a "shakedown flight" at experiments like the Joint Expeditionary Force Experiment to work out command and control issues among the services, letting the providers connect the effects smoothly to the intended users. Then, before they're fielded, we need to integrate these new capabilities into our recurring AOC and joint exercises to get commanders comfortable with using these new capabilities. From the technicians all the way to the combatant commander, everyone must be as comfortable with these new ideas as we are now with employing a two-ship counter-air mission, deploying a special operations team, or launching cruise missiles. We do not need a team with new technologies showing up two days before hostilities commence and telling the JFACC about this new capability they can bring to the fight.

General Robert H. "Doc" Foglesong is Commander, US Air Forces in Europe; Commander, Allied Air Component Command Ramstein; and Air Component Commander, US European Command, Ramstein Air Base, Germany.

General Foglesong earned his wings at Columbus Air Force Base, Mississippi. His aviation career includes more than 4,250 flying hours, primarily in fighter and training assignments in the F-16, F-15, A-10 and AT/T-38. He has been a commander six times. His staff tours include duty as Assistant to the Chairman of the Joint Chiefs of Staff in Washington, D.C.; Commander, 12th Air Force; Commander, US Southern Command Air Forces; Deputy Chief of Staff for Air and Space Operations and Vice Chief of Staff at Headquarters US Air Force.

The Way Ahead: Maintaining Our Space Superiority in the 21st Century

During combat, one of our objectives as an air component is to gain and maintain space superiority. When enemy satellite communications uplink stations and mobile communication vans are targeted and destroyed, our asymmetric advantage in space is virtually guaranteed for the remainder of the operation. However, Operation IRAQI FREEDOM was a wake-up call that continuous, unimpeded access was not guaranteed and that future conflicts may find America fighting for space superiority every day of the operation. At the theater level, we need to be ready for that kind of fight; we need to be efficiently and effectively organized, and we need to be expertly trained and well-equipped for space warfare. The space frontier is becoming more critical to every engagement and we need our space Airmen integrated and ready to help the USAF continue to be the most respected and feared air and space force on the face of the earth.

General Bernard Schriever on Space Superiority

Introduction by Dr. Rick W. Sturdevant
Deputy Command Historian,
HQ Air Force Space Command

Perhaps the earliest public pronouncement by an Air Force officer on the importance of controlling space came on 19 February 1957 from then Major General Bernard A. Schriever, commander of Western Development Division, which was responsible for the nation's ICBM and military satellite development programs. In his delivery of the keynote address to experts from industry, the military, academia, and research institutions at the First Annual Air Force Office of Scientific Research Astronautics Symposium in San Diego, California, the general characterized ICBM development as a fundamental step toward the conquest of outer space. He went on to suggest that the safety of the United States eventually might depend on space superiority. Because the Eisenhower Administration sought to emphasize peaceful uses of outer space and, therefore, avoid open discussion of military activities in that realm, General Schriever received a severe, high-level reprimand and strict instructions to never again speak in such terms. Here is an edited version of what General Schriever said seven and one-half months before the Soviet Union launched the world's first artificial satellite on 4 October 1957.

Retired General Bernard A. Schriever, 94, considered to be the father of the Air Force's ballistic missile program

ICBM—A Step Toward Space Conquest

"I presume that the reason I have been invited to address you here tonight is because, as Commander of the Western Development Division, I am deeply engrossed in man's first concerted attempt to penetrate outer space.

The compelling motive for the development of space technology is the requirement for national defense. For this reason, the Air Force Ballistic Missile Program was assigned highest national priority and is being pressed forward with utmost vigor.

Since 1954, the United States has come a long way in the development of Space Technology. The Western Development Division was given full authority and responsibility for all aspects of the Air Force's Ballistic Missile Program at that time. Since its inception, this Division has organized the strongest possible industrial team selecting in all cases the best qualified segments of science and industry available. The program has already progressed through several important stages so that at this time we can identify a number of significant accomplishments toward the conquest of space. These include: (1) the evolvement of a development philosophy appropriate to the urgency and complexity of the task, (2) the establishment of a development team on an industrial base capable not only of development but of immediate production follow-up, (3) the construction of facilities for research, fabrication and testing, (4) the design, fabrication, and successful test of hardware components, and, finally, (5) a beginning of the flight test phase, including a substantial number of successful test flights that have confirmed theoretical design information….

Space technology, probably for some decades, will not revolve primarily around apparatus for controlled movement of vehicles from one point to another in empty space. Perhaps not only initially but for all time, space technology will include as its most characteristic problem the need for going from the surface of one celestial body to another with successful passage through the atmosphere of each. The first big problems then are how to bring a substantial mass up to empty space with velocity sufficient to continue inter-body space travel, with adequate precision in the velocity vector control, and how to bring it back through an atmosphere without disintegration. In each of these respects, if one by-passes human cargo ambitions for the moment, the ICBM is attaining the necessary capability and, in preparation for eventual manned flight, the ICBM test flying in substantial numbers could provide experimental data of direct interest.

Granted then that the ICBM program is a major, pioneering, and foundation step for space technology, what appears to be a logical future program? It is very difficult to make a firm prognosis on military need during a 20-year period for something as new and revolutionary as ballistic missiles, earth satellites, and space vehicles. We are somewhat in the same position today as were military planners at the close of the First World War when they were trying to anticipate the use of aircraft in the Second World War. Consequently my prognosis will go from those

which are reasonably firm to those which might be considered visionary. Fortunately, there is a considerable overlap between the advances in the state-of-the-art which are required for firm and for visionary military needs….

A word is necessary on the relationship between military need and scientific feasibility in space technology. In the long haul our safety as a nation may depend upon our achieving '**space superiority**.' Several decades from now the important battles may not be sea battles or air battles, but space battles, and we should be spending a certain fraction of our national resources to insure that we do not lag in obtaining space supremacy. Besides the direct military importance of space, our prestige as world leaders might well dictate that we undertake lunar expeditions and even interplanetary flight when the appropriate technological advances have been made and the time is ripe. Thus it is indeed fortunate that the technological advances required in support of military objectives can, in large part, directly support these more speculative space ventures even though in addition, it will be necessary to extend the navigational program and the space medicine program characteristic of this type of sustained flight.

"In the long haul our safety as a nation may depend upon achieving space superiority."

- General Bernard A. Schriever

Now, where does all this lead? My thought is that the evolution of space vehicles will be a gradual step-by-step process, with the first step beyond ballistic missiles being unmanned, artificial earth satellites and then perhaps unmanned exploratory flights to the Moon or Mars. These first flights would no doubt be research vehicles to gather scientific data and to accumulate information on space environmental conditions for future design use. The information gathered from these flights will supplement the information gathered from ballistic missile test flights. Many of the things that we can learn from satellites will lead not only to a better understanding of conditions to be encountered in space, but will lead to a better understanding of our own planet. Weather reconnaissance can be accomplished in a more effective manner. This will lead to a better understanding of the movements of polar air masses and the course of jet streams and will permit improved long range weather forecasts and improved aircraft and missile operations. A better understanding of the earth's magnetic field will lead to better radio communications, more reliable navigation instruments, and perhaps new ideas for propulsive devices. Refined data on the earth's gravitational effects will lead to improved guidance. Much remains to be known about cosmic rays. Unmanned satellites will be the means for obtaining this information….

In conclusion, we see that the ICBM program, through the technology it is fostering, the facilities that have been established, the industrial teams being developed and the vehicles themselves, is providing the key to the further development of space flight. Many fascinating new horizons are sure to open within the next decade as a direct result."

Readers can find the complete text of General Schriever's speech in the AFSPC History Office's recently published work titled *Orbital Futures: Selected Documents in Air Force Space History*. Compiled and edited by Dr. David N. Spires, who wrote accompanying essays and commentaries to place the documents in historical context, this two-volume reference set is a significant contribution to the preservation of US military space history.

Dr. Rick W. Sturdevant (BA and MA, University of Northern Iowa; PhD, University of California, Santa Barbara) is the Deputy Command Historian, Headquarters Air Force Space Command, Peterson Air Force Base, Colorado. He became chief historian for Space Communications Division in 1985 and moved to his present position when the communications division inactivated in 1991. An active member of the American Institute of Aeronautics and Astronautics (AIAA), American Astronautical Society (AAS), British Interplanetary Society (BIS), and Society for the History of Technology (SHOT), Dr. Sturdevant has published extensively and lectures frequently on military space history topics to both lay and professional audiences.

Space Situation Awareness: How Much Should the US Share?

Maj Tommy A. Roberts
Space and Missile Force Programmer,
Directorate of Plans and Programs, HQ Air Force

The United States (US) is the preeminent Space Situation Awareness (SSA) leader in the world. While the concept of SSA is certainly not new, the increasing focus on Offensive and Defensive Counterspace (OCS/DCS) has brought an accompanying focus on SSA, since situational awareness is the foundation for any OCS or DCS operation. In simple terms, it is hard to target (OCS) or protect (DCS) assets that you cannot find so the US makes an effort to "find" as much as it can. For example, using the Department of Defense (DoD) Space Surveillance Network's (SSN) 30 worldwide sensors, the US receives more than 100,000 daily observations to maintain a database on the location of more than 8,500 Earth-orbiting space objects.[1] In addition to tracking items in orbit, the US provides conjunction assessment and collision avoidance capabilities for launch and on-orbit assets, assists in spacecraft anomaly resolution through space imaging and predicts weather conditions in the harsh environment of space, all in an effort to maintain its SSA dominance.

If the reader generally agrees with the above claim of preeminence, the question then becomes: how does the US maintain that dominant position? Some might argue that our comparatively huge Gross Domestic Product (GDP) and an accompanying willingness to spend a small fraction of that GDP on SSA will be more than enough to sustain our current advantage. That being said, is it enough just to enhance our own capabilities, or should we pursue a policy that also discourages the SSA growth of our adversaries?

This article proposes that the US must develop a policy that promotes the sharing of its SSA capabilities with foreign and commercial entities in order to maintain its dominant position. This does not mean full and complete disclosure of everything we possess to whomever requests it, but rather a well-designed approach that fully considers the National Security interests of the United States. Such a policy should have three primary objectives: 1) derive additional SSA for the US by maximizing the relationships developed through SSA cooperation, 2) increase Joint and Coalition interoperability for future conflicts, and 3) drive dependence on US SSA to delay the development of foreign and commercial SSA.

Some would suggest that we already have a culture that promotes sharing. In fact, there are a number of historic documents that would support such a claim. In 1958, when President Eisenhower established the National Aeronautics and Space Administration (NASA), the legislative language talked about "cooperation by the US with other nations and groups of nations."[2] More recently, one of the long-range planning objectives from the 1999 Department of Defense (DoD) Space Policy was to "provide appropriate national security space services and information to the intelligence, civil, commercial, scientific, and international communities."[3]

These policy statements indicate either an attempt to develop a cooperative culture within the space community, or simply suggest an attempt to "seem" cooperative. Either way, the reality is that the military space community has not fully embraced a culture of sharing. In fact, quite the opposite is true. The development of stovepiped systems and the cover of security classification labels have created an environment where internal DoD cooperation is hard enough, without mentioning the difficulty in sharing capabilities with foreign and commercial "competitors." In the end, that mindset must change if the US is to maintain its asymmetric advantage and benefit from the synergy created through cooperation.

There are a number of historical space examples that provide important lessons for the development of a sharing policy. The best case study may very well be the Global Positioning System (GPS). The current US policy of providing free GPS service has stimulated the growth of commercial applications and has been beneficial to the US as well as the global community.[4] Although GPS has moved well beyond its original military design, the US military still utilizes the system through precision guided munitions, navigation, et cetera. Whether discussing banking, commercial shipping, or putting bombs on target, it is hard to escape the influence of GPS in today's global community.

Despite the significant global influence of the GPS program, the GPS policy would not be considered a success if graded against the three objectives desired for an SSA policy of sharing. Specifically, the GPS program has not adequately delayed the development of foreign or commercial competition. In fact, the perception of a US monopoly has actually generated competition. What aspects of the GPS program drove competition, and what lessons can the SSA community take away for its own policy?

During the proliferation of GPS there have been a number of significant milestones where the US has enhanced foreign and commercial GPS capability. Perhaps the most controversial was the decision to turn off Selective Availability (SA), and allow non-US military users to have an enhanced level of accuracy. This decision by President Bill Clinton in May 2000 was a prime example of a substantial US space capability being shared outside of the DoD. In fact, the President himself noted that, "the decision to discontinue SA is the latest measure in an on-going effort to make GPS more responsive to civil and commercial users worldwide."[5] However, one aspect of the

Presidential decision may have caused a world reaction opposite of what the US expected. Specifically, the accompanying declaration that the US would selectively deny GPS signals on a regional basis whenever its National Security was threatened has fueled foreign efforts to develop a competitor to GPS. After all, how could anyone rely on GPS if they never know when the US might decide to deny them service? Additionally, why would anyone want to become totally dependent on a system over which they felt they had no control?

The bottom line is that despite US efforts to share, global actors still decided they must develop an alternative to GPS. A number of statements from the European Space Agency (ESA) shed light on why they chose this path. First, the Europeans promote their counterpart system, Galileo, as a "guaranteed global positioning service under civilian control."[6] Two parts of this statement stand out: guaranteed service and civilian control. These are words clearly picked to differentiate the Galileo system from GPS. The ESA is counting on a market that wants guaranteed service not tied to American military control. The Europeans further elaborate on guaranteed service by claiming to provide, "availability of the service under all but the most extreme circumstances."[7] Although the exact meaning of "extreme circumstances" is debatable, it seems to imply a higher threshold for service denial then the current US policy. If nothing else, it seems more likely for one country to make a decision to deny service than it is for a multinational organization that requires some sort of mutual agreement.

Despite US attempts to modernize GPS, the ESA still proclaims the need for Galileo. In their Galileo brochure, the ESA discounts GPS and says, "there is a total absence of service guarantee and accountability – as these are incompatible with the system's military objectives."[8] Once again, the Europeans have a clear problem with the military control of GPS and the perceived lack of service guarantee. In hindsight, perhaps the US could have included coalition partners in the daily operation of GPS in an attempt to address their concerns over military control. While such a decision may be too late for GPS, these are issues the SSA community must address if the policy of sharing is to meet its objectives.

The European Geostationary Navigation Overlay Service (EGNOS) is another deliberate attempt to counter the GPS monopoly. This system is comprised of three transponders on three separate geostationary satellites, along with 34 ground-based positioning stations and four control stations, and is scheduled to be operational in 2005.[9] EGNOS will transmit an integrity signal giving real-time information on the health of the GPS constellation, and correction data intended to improve the accuracy of the GPS service.[10] Essentially, the system is designed to test the signal of GPS so users know the accuracy and reliability of the service they are receiving.[11] It is all part of an ESA effort to discredit the credibility of GPS by questioning the trustworthiness of the signal. In fact, Laurent Gauthier, the EGNOS project manager states, "When you get a GPS navigation signal, how do you know you can trust it? EGNOS will tell you whether you can trust the signal."[12]

What then are the GPS lessons that can be used in development of an SSA policy? First, and most obvious, foreign and commercial entities will resist what they perceive to be a monopoly. In the case of GPS, it is clear the Europeans feel they must come up with their own navigation alternative. Second, perceptions of a monopoly are compounded when there is an accompanying perception of no control. The ESA repeatedly points out they do not like the US military control of GPS, nor do they like the fact the US can single-handedly deny service. In the end, US military control of GPS, as well as the perceived US monopoly on space navigation, have prevented the US from driving foreign and commercial dependence and have actually generated competition.

One final lesson from GPS is that it does not matter if the US thinks it is fully sharing its space systems and capabilities. It only matters what the rest of the world perceives. Limited resources are going to be an issue for any country, especially in the high-cost business of space. If the US can persuade others they will reliably and responsibly provide certain space services; like navigation and SSA, others will spend their limited space resources in areas more beneficial to the US (e.g. international space station support). While the opportunity to prevent competitors to GPS is probably gone, the US can still use these key lessons to improve their SSA policy.

According to Air Force doctrine, SSA includes "traditional space surveillance, detailed reconnaissance of specific space assets, collection and processing of space intelligence data, and analysis of the space environment."[13] While space surveillance accounted for the majority of US SSA in the past, the areas of reconnaissance, intelligence, and environmental analysis represent the significant growth areas of SSA for the future. It is important that any policy designed to share SSA not focus simply on surveillance, but also incorporate the other components. What then are some of the issues associated with sharing all components of SSA?

As SSA continues to gain momentum and importance, one of the most obvious issues is determining what to share. In answering this question, the approach needs to identify ways to share data rather than reasons not to share. The latter approach has been the norm, and has deeply entrenched the space community behind its security classification labels. Appropriate items to share would fall into a number of categories. One category would be space safety support. This should be the most obvious and least restrictive of all the categories. Based on US dependence on space and the sheer volume of US assets, the US stands to lose the most in the event of a space mishap (e.g., collision that causes a large debris field in the geostationary belt). Therefore, it is in the best interest of America to share data that makes space a safer environment for all nations and commercial enterprises. An obvious example of SSA data in this category would be SSN tracking data and accompanying support necessary to prevent mid-space collisions. An additional example would be conjunction assessment analysis for upcoming launches to prevent collisions while new payloads are being put into their final orbit. Another category would be anomaly resolution support. For example, if a foreign country experiences an anomaly on one of their spacecrafts, the US

could provide earth-based images of the injured spacecraft to assist in resolving the problem. Looking to the future, it is also conceivable that one day the US could provide "fly by" images using space assets to provide more detailed photos. Once again, this is a category where the US stands to gain greatly by supporting others. In addition to the goodwill from resolving the anomaly, involvement in the resolution process will provide additional SSA for the US by obtaining knowledge of the anomaly, providing potential insight into the steps taken to resolve the situation, and providing insight into the long term consequences of the anomaly. All of these data points improve the overall SSA of the US.

Although an SSA policy should liberally encourage the sharing of data, there are a number of SSA categories that should not be shared. One category in this area would be SSA that could reasonably aid in offensive space capabilities. This includes, space intelligence that highlights a system vulnerability, or data that might be used for offensive targeting purposes. The difficulty here is drawing the line on what constitutes a reasonable threat. One of the common arguments in the surveillance community is the US should not share its SSN tracking data because the data could be used to target on-orbit assets. One of the assumptions in such an argument is that the offending party designing the offensive space capability would rely on US data to fulfill a critical requirement in their system. The validity of this assumption is certainly debatable, but, in the past, that argument has provided a readily available excuse to resist sharing. The bottom line is a culture of paranoia that refuses to share anything only hurts the US in the long run. If an SSA policy of sharing is to be successful, efforts must be made to find ways to share data rather then excuses not to.

As one determines what to share, a parallel question is who gets it? Like any type of support, it seems logical there would be differing categories of customers who receive various levels of support. However, where does one draw the line? Certainly our Allies and Coalition partners are going to receive special attention; however, simply dividing customers into friends and foes is not the long-term solution. In today's interconnected global environment, it is naïve to believe that support provided to one country or corporation will not be proliferated elsewhere. It is also naïve to believe such proliferation can be controlled. Therefore, the US must take the approach that anything shared with one is going to be provided to many. The point here is that positive control needs to be placed on the data being released, not on the recipient of the data. If the US can have a high degree of confidence that the information they are providing poses no threat to US National Security, then there can be a less restrictive review on who is actually receiving the data.

Based on the objectives of the policy, the intent should be to provide support to as many entities as possible. While our closest Allies might receive classified support others will not, the day-to-day support should be available for all, and the US should be comfortable the data they provide does not constitute a threat to its National Security. The US may still take some steps to try and limit proliferation of the data to the most obvious adversaries (based on inputs from the State Department, Commerce Department, etc.); however, the realization needs to be any support denial may drive that entity to develop their own SSA capability. Also, any service denial is a missed opportunity to receive access to data that could strengthen the SSA of the US.

Assuming the who and what questions can be adequately answered, should the US seek reimbursement for the SSA it provides? The answer is yes. However, the requested reimbursement should not be monetary, but should focus on gaining SSA data in return for the SSA given. In other words, the US needs to build symbiotic relationships with its customers so both can benefit. For example, instead of financial reimbursement, perhaps a foreign or commercial user would be willing to provide more precise tracking data on their spacecraft in exchange for collision avoidance support. In other words, the US would help them avoid collisions with other space objects in exchange for continual data on the location of the commercial users assets. This tracking data would provide the US with the day-to-day situational awareness they need on those assets without having to task a US resource to track the object(s). Given the fact that the US space tracking capability is heavily tasked, such an arrangement would free valuable resources to track other objects. The gained situation awareness not only benefits the US, but also makes space a safer environment for everyone by improving the US tracking database. The bottom line is to not scare away any potential customers over the issue of reimbursement. It is better to foster a relationship with the hope of future reimbursement then push them away and cause them to go elsewhere.

Even greater than the previous issues, security represents the single largest hurdle that must be overcome for a sharing policy to be successful. It is particularly difficult, not only because of the bureaucratic processes in place which already make security a nightmare for most operations, but also because of cultural issues within the space community. This is a community that was born under a veil of secrecy, and is still generally closed to most. As a result, relatively few outsiders understand space and the unnecessary constraints caused by security classifications. Unfortunately, this problem is not isolated to SSA. The institutionalization of space superiority as a whole has been hindered by the restrictive nature of security classification.[14]

Is the seemingly excessive need for security classification within space a necessary evil, or is the culture simply embedded and difficult to change? Perhaps the space community has voluntarily hidden behind the curtain of security. After all, it is theoretically easier to defend yourself when nobody really understands what it is you do. This culture, and the processes in place to support it, must be broken down if space is ever to be fully exploited. Not only for the US, but the global community as a whole.

One large security issue for SSA is trying to break it from its natural linkages to OCS. In today's current construct, anything remotely related to OCS is going to be highly classified. If data *might* be used for targeting, no matter how unlikely that case might be, it is traditionally slapped with a high classification label. Since the declassification of OCS capabilities is unlikely,

an effort must be made to break some of the linkage to SSA.

In addition, a thorough security review of current systems and data to identify potential areas for declassification must be done if efforts to share SSA data are to be successful. Most importantly, this review should not be done solely by members of the space community. Without a genuine effort at declassification the US falls into the trap of providing limited SSA, and global customers will ultimately determine the unwillingness to share requires them to develop their own capability.

Recent operations in Iraq and Afghanistan, as well as the tragic terrorist attacks on 11 September 2001, confirm that many of the US military's Cold War paradigms are no longer valid. In fact, as pointed out in the Air Force's Transformation Flight Plan, the transition to a post-Cold War force is one of two on-going transformations within the US military.[15] In addition to the shift to a post-Cold War force, the US military is undergoing a transformation from an industrial age force to an information age force.[16] The long-term ability of the US military to properly adjust to these transformations will ultimately spell the difference between victory and defeat in future operations, and space will certainly play a vital role.

Despite some positive results, there are still a number of areas where the space community needs to further embrace transformation. Specifically, within the SSA context, the lingering Cold War-mindset of tightly controlling information must change. This mindset encouraged a space culture that relied heavily on classification as a method of restricting enemy access to US capabilities. Such a culture served the US well during the Cold War. That mindset must now change to get in line with today's global reality--the whole world is now dependent on space. If the US wants to retain its long-term leadership position in that global reality, it must find ways to embrace the global community and persuade others to rely on US space capabilities. One such way is through the sharing of American SSA with the world.

In the context of SSA, the US is at an important crossroads. As noted in a recent RAND study, "Nations are facing important choices in deciding whether to acquire independent aerospace capabilities, whether to depend on other nations for aerospace support, whether potential costs and vulnerabilities are incurred for those relationships, and whether they are willing politically to accept both the benefits and the risks of dependence."[17] The US also faces an important choice. Is it willing to share its SSA capabilities in order to drive foreign and commercial dependence, or will it continue to hide behind its Cold War-era security blanket and fail to adjust to the changing global environment? It is clear a policy of sharing is the answer…now the devil will be in the details.

Notes:

[1] "1st Space Control Squadron Fact Sheet," on-line, Internet, available from http://www.peterson.af.mil/21sw/library/fact_sheets

[2] *National Aeronautics and Space Act of 1958*, Public Law 85-568, 29 July 1958, Sec 102 (d).

[3] William Cohen, *DoD Directive 3100.10: Department of Defense Space Policy*, 9 July 1999, Sec 4.6.1.7.

[4] Scott Page et al., *The Global Positioning System: Assessing National Policies* (RAND, 1995), xv.

[5] White House, Office of the Press Secretary, *Statement by the President Regarding the United States' Decision to Stop Degrading Global Positioning Accuracy*, 1 May 2000.

[6] "What is Galileo?," on-line, Internet, 30 January 2005, available from http://www.esrin.esa.it/export/esaNA/GGGMX650NDC_index_0.html

[7] Ibid.

[8] "Galileo Brochure," on-line, Internet, 30 January 2005, available from http://esamultimedia.esa.int/docs/GalileoBrochure.pdf

[9] "ESA navigation projects now online," on-line, Internet, 30 January 2005, available from http://www.esa.int/esaNA/SEM7OZ0A90E_index_0.html

[10] Ibid.

[11] "What is EGNOS?," on-line, Internet, 30 January 2005, available from http://www.esrin.esa.it/export/esaNA/GGG63950NDC_index_0.html

[12] Ibid.

[13] Air Force Doctrine Document 2-2, *Space Operations*, 27 November 2001, 14.

[14] Robert M. Patenaude, *How to Institutionalize Space Superiority in the United States Air Force* (Maxwell AFB, Ala., 2001), 4.

[15] Air Force Transformation Flight Plan (HAF/XPXC, November 2003), i.

[16] Ibid., i.

[17] Dana Johnson and Ariel E. Levite, *Toward Fusion of Air and Space: Surveying Developments and Assessing Choices for Small and Middle Powers* (RAND, 2003), 1.

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Space Superiority: Does the US Really Have It?

Maj Larry Adkins
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At the end of the last decade, a group of retired generals and admirals stated, "we can think of few challenges likely to pose a greater danger to our future security posture than that of adversaries seeking to make hostile use of space or to deny us the ability to dominate that theater of operations."[1] This prophecy is quickly becoming reality as the distinction between military capabilities has quickly merged with commercial services and products. Blending these capabilities allows potential adversaries access to detailed, unclassified space-based services and products they can use to deny the US the ability to gain and maintain space superiority.

The inherent dual-use application (i.e., commercial satellites used for military purposes) of many current and future commercially available space assets is cause for concern to US and friendly military forces. Satellite imagery like SPOT, IKONOS, and EROS are closing in on militarily significant capabilities (i.e., resolutions approaching one meter or below) and near-real time access to their products. This will allow future adversaries the ability to incorporate high-resolution imagery into military strike planning.[2]

There are currently no real controls over the end-users of these products other than those imposed by the service or product providers. The increase in worldwide demand will ultimately result in an increase in the number of satellite systems on orbit, the number of product and service providers, and finally, the number of users. All of these have an immediate impact on the United States ability to gain and maintain space superiority by increasing the degree of difficulty in accurately identifying product service providers, their satellite systems, and their end-user consumers.[3]

The United States can no longer maintain space superiority in every facet of space. The ability of the US to gain and maintain space superiority is fading and in some areas it is fading fast (satellite communications (SATCOM), imagery greater than .5-meters, weather). In the areas of early warning, imagery less than .5 meters, and Global Positioning System Satellite (GPS), the US holds an unquestionable degree of dominance over its adversaries and is able to exploit these capabilities to effectively execute military missions. The ability to exploit space is quickly fading from the firm grasp of the United States.

Our ability to exploit space relies on having the right space capabilities at the right place at the right time. Our adversaries understand this and have the technological and economic ability to deny US access to space and space services. Therefore, the United States must set a policy of protecting its ability to exploit space and space services to ensure unimpeded freedom of action in space.

"Our ability to achieve military victory in the future rests on the continued capacity to gain and maintain space superiority at the tactical and operational level of war."

Technological Threats

Technologically, our adversaries have the capability to blind imagery satellites or jam satellite signals.[4] According to Leonard David's article in *Space.com*, laser technology is rapidly becoming available to blind imagery satellites.[5] Countries and individuals have also shown they are willing and able to deliberately disrupt communication satellites. In 1997, India jammed Tongasat because of a disagreement over possession of a geosynchronous orbit slot.[6] In 1998, MED-TV accused Turkey of jamming its Kurdish broadcast channel that is beamed to 70 countries.[7] In early 2003, the FBI charged six people for selling software and decryption devices that allowed consumers to "steal" satellite television signals (e.g., DirectTV) which they had not paid for.[8] As late as the summer of 2003, the Iranian Embassy in Cuba reportedly jammed Voice of America satellite broadcasts being sent to Iran.[9]

Economic Threats

Due to issues of space debris, the lack of reliable anti-satellite technology and negative world opinion, destruction of satellites will probably be used as a last resort during any foreseeable conflict. Therefore, an adversary may choose an economic Course of Action (COA) to lower the overall supply of available capability. For example, if competition from the fiber optic cable market forced SATCOM revenues to fall to a point where providers needed to increase cash flow, they may choose to sell "contracts" for the future use of today's limited bandwidth. If this contract came with a "first right of refusal" clause, the purchaser could deny potential customer the opportunity to use the selected bandwidth during the option period.[10] This option would allow an adversary to decrease the supply of available SATCOM capabilities on the open market during surge operations and potentially hold the US hostage by dictating the "terms of use" of the bandwidth.

These economic threats may be disguised as diplomatic efforts masquerading as attempts to prevent the weaponization of space. China, for instance, is steadfast in their opposition to weaponizing space, and has brought their case before the United Nations. The stance against weaponization of space may be a diversion to prevent the US and its Allies from seeing the real threat; an economic threat focused on purchasing commercial satellite capabilities to remove them from the overall supply of capabilities, or worse; a technological threat of procuring, testing and fielding Counterspace capabilities to deny access to elastic, or even worse, inelastic space capabilities.

Elastic and Inelastic Capabilities

Commercial space-based services available on the open market represent elastic space capabilities. Space-based commercial communications, imagery with greater than .5-meter resolution, and to some extent weather allow the US to expand into (i.e., buy/lease satellite services from a commercial provider) or pull out of these capabilities as the situation dictates.

Inelastic capabilities include those organic capabilities not available on the open market such as space-based early warning, imagery with less than .5-meter resolution and position, navigation and timing (i.e., GPS). These groups illustrate America's uncontested technological superiority in space and comprise its greatest vulnerability due to the lack of substitutes to replace on-orbit assets, lack of spare satellites on the ground and a lack of a rapid launch capability. The major consideration when deciding which capabilities are categorized as elastic and which are categorized as inelastic is the supply of the available capabilities.[11]

Reliance on Commercial Space

For better or worse, the era of commercial space dependency has arrived for today's warfighting capability.[12] The contemporary reality is the US military could not exploit space, even against a modestly competent foe, without the support of commercial space systems. During Operation IRAQI FREEDOM, commercial providers picked up most of the eightfold surge in SATCOM requirements.[13]

The United States ability to exploit space relies on a mix of commercial and "organic" military capabilities. Organic capabilities are those capabilities the military builds and uses on a day-to-day basis, which includes satellite communications, precision navigation and timing, early warning of ballistic missile launches, and space-based imagery to meet joint warfighting needs. The combination of commercial and organic space capabilities are the backbone to all of today's joint warfighting capability.

This article further defines the interaction of these capabilities with the threats presented above. It combines this interaction with the supply and demand of a capability and visualizes all of these factors in the Elasticity Model. The model is a visual tool used to illustrate the need for a "Protection First" policy enabled by a robust awareness of an adversary's use or planned use of space and space services.

Elasticity Model

For purposes of this article, we will use SATCOM capabilities to highlight how the model works. The two axis of the Elasticity Model are "Capabilities" (y-axis) and "Spectrum of Conflict" (x-axis). Capabilities can be measured in a number of different ways: the amount of bandwidth needed for a particular mission or operation, images/day, precision capability over a specific area, et cetera. Spectrum of conflict moves from peace to major combat operations to post-conflict operations.

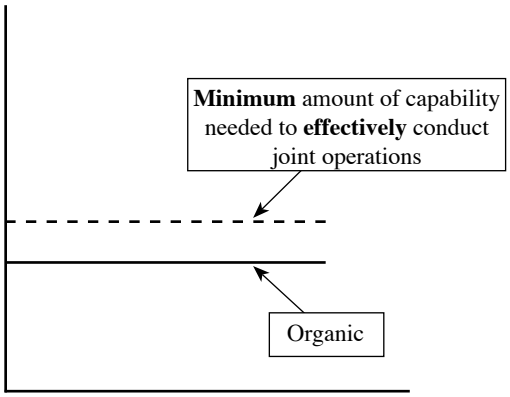

Figure 1 – Minimum Effective Capabilities

As mentioned earlier, the US military has a specific set of organic space capabilities it uses in any type of conflict. Although organic capabilities are substantial, commercial providers fill this gap between what the military brings to the fight and the minimum capabilities needed to effectively conduct Joint Operations (Figure 1).

Falling below the minimum capabilities line will affect a commander's ability to observe, orient, decide, and act, and may have grave consequences for US forces. This line identifies the point at which commanders will be forced to rely on alternative resources if an adversary prevents the US from having the available space capabilities needed to fight effectively.

For example, Predator UAV platforms use satellite links to provide near-real time information to command centers. If the Predator loses its satellite connection before arriving at its designated target, the mission may fail until the link is reestablished. In today's real-time environment, lack of Predator feeds will increase commander's decision cycles. Protecting our access to the supply of relevant space capabilities is essential to protecting lives on the battlefield.

Supply and Demand

Figure 2 adds Supply and Demand of capabilities to the Elasticity Model. In this instance, supply is defined as the amount of a capability provided across resources (e.g., all SATCOM (military and commercial) is grouped as one capability for the purpose of the model).

Demand for capabilities is determined by a number of variables (e.g., stage, intensity, and size of conflict). For example, in a low intensity conflict, demand for space capabilities may remain low, but if the size of the conflict is high, (i.e., number

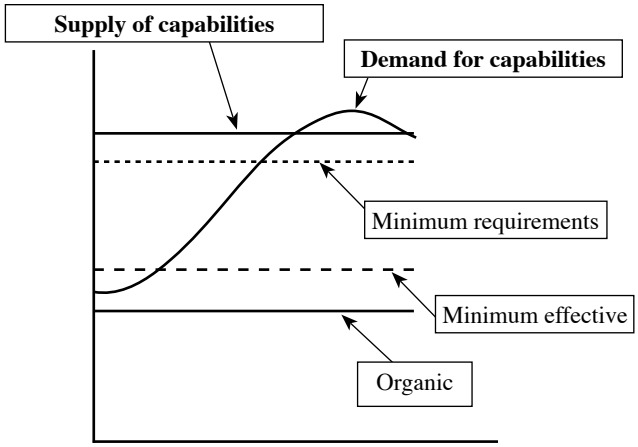

Figure 2 – Supply and Demand of Capabilities

of units or coalition partners participating in the conflict) demand may increase beyond the available supply of capabilities (as shown in Figure 2). In any of these instances, commercial capabilities will augment organic capabilities to help meet the increase in demand, but may not be able to meet all demand. If this happens, USSTRATCOM in conjunction with the Secretary of Defense and other agencies may need to prioritize space capabilities—a process that must be fully vetted in exercises before it is needed during major combat operations.

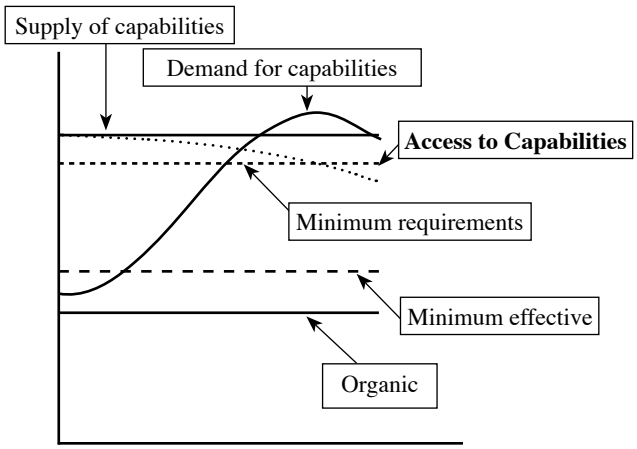

Figure 3 – Denial of Access

Denial of Access and Reduction of Supply

Figure 3 shows how access to capabilities, not the supply of capabilities, decreases when an adversary effectively jams or blinds satellites. In this instance, the supply of commercial capability remains constant, but access to the supply is degraded. If the enemy wanted to degrade the supply of satellites, they would have to deny access to the satellite by destroying them or employ previously mentioned economic measures (Figure 4).[14]

Putting It All Together

If the threats discussed above culminate at decisive points either geographically or temporally, an adversary can prevent the US from effectively exploiting space. Denial of service threats (i.e., jammers and laser blinders) coupled with reducing the supply of satellites (via economic measures) allows an adversary to force the total supply of space capability below the minimum effective line. These actions create a void between the demand for satellite capabilities and the supply of and access to those needed capabilities (Figure 5), and may prevent the US from gaining and maintaining space superiority.

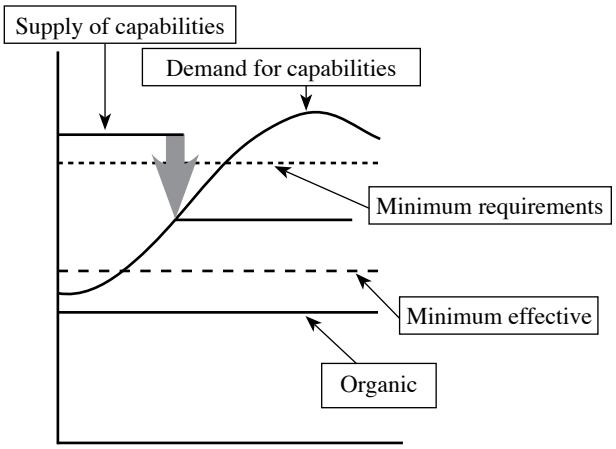

Figure 4 – Supply after Economic Threat

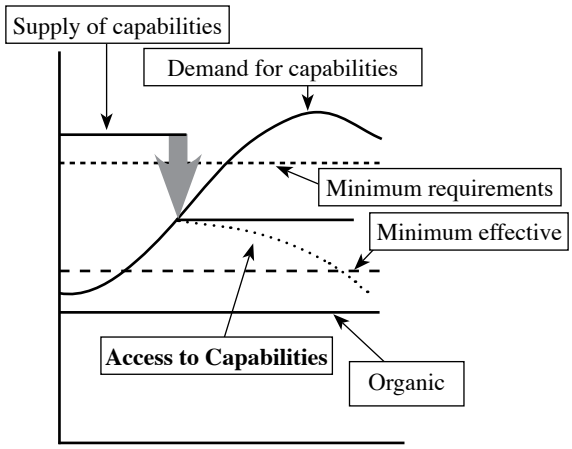

Figure 5 – Reduction of Supply/Denial of Access

Conclusion

Our ability to achieve military victory in the future rests on the continued capacity to gain and maintain space superiority at the tactical and operational level of war. To achieve this objective, the US must protect its ability to exploit space while at the same time characterize and adversary's ability to deny space superiority. In order to maintain its asymmetric advantage, the US must formulate and adhere to a "protection first" policy and test the ability to dynamically prioritize space capabilities during exercises. Establishing these new policies is a bold step in the right direction. Waiting to institute these recommendations, may prevent the US from gaining the "degree of dominance" needed to truly have space superiority.

The Eisenhower Administration set the precedent of "space for peaceful purposes," a precedent that has now made space a global commons for all to use. Conventional wisdom says it will stay that way for decades to come. Therefore, the ability to exploit space and to gain and maintain space superiority at the strategic level may be something the United States will find difficult to achieve in the future.

Notes:

[1] Lt Col David W. McFaddin, "Can the US Air Force Weaponize Space?" (Maxwell AFB, Ala.: Air War College, 1998), 30.

[2] Terrence Smith, "Challenges to Future US Space Control," *Army Space Journal* 1, no. 3 (Summer 2002): 34.

[3] Ibid.

[4] Leonard David, "Pentagon Report Calls for the United States Control of Space," *Space.com*, 8 Oct 2001, n.p., on-line, Internet, http://www.space.com/news/dod_space_011008.html.

[5] David.

[6] Lt Col Schaefer, *Sustained Space Superiority: A National Strategy for the United States* (Maxwell AFB, Ala.: Air University Press, 2002), 13.

[7] "Update on Satellite Jamming," *Med-TV: Stêrka Med*, Issue 3, January 1999, n.p., on-line, Internet, available from http://www.ib.be/med/med-tv/sterka/issue03/jamupdat.htm.

[8] Ashlee Vance, "Six Charged as Satellite TV Hackers," *PCWorld.com at Yahoo*, 13 February 2003, n.p., on-line, Internet, 28 February 2004, http://pcworld.shopping.yahoo.com/yahoo/article/0,aid,109353,00.asp.

[9] Stephen Johnson, "Cuban Jamming Demands a Firm Response," *The Heritage Foundation*, 22 July 2003, n.p., on-line, Internet, 20 January 2004, available from http://www.heritage.org/Research/LatinAmerica/wm319.cfm.

[10] In this instance, the right of refusal would allow the holder of the contract the right to deny the use of the bandwidth by another interested customer during the time the contract holder maintains the contract. For example, Entity A purchases a contract from Intelsat that allows it to use a certain amount of bandwidth anytime between today and 10 years from now. This does not mean that Entity A will use the bandwidth; it means they have the right to use it. This relationship between the user and the provider allows the latter to have an immediate stream of revenue to use to put back into the company. For the user it means having a capability at today's price (possibly lower than it will be in the future) that they may need as their objectives expand.

This may seem like a far-fetched idea, but the adversarial team used this concept during the Schriever II wargame at Schriever AFB, Colo. in early 2003. During the game, the adversary had purchased satellite bandwidth over a course of years with the notion it would not allow US access to the commercial satellites. This concept effectively denied the US the ability to purchase the SATCOM capability it needed to command and control forces during the conflict. NOTE: Game control eventually gave the US forces enough SATCOM to continue the game.

[11] Quoted in John A. Tirpak, "The Fight for Space," *Air Force Magazine* 83, no. 8 (August 2000): 65.

[12] Dr. Colin S. Gray and John B. Sheldon, "Space Power and the Revolution in Military Affairs," *Air and Space Power Journal*, n.p., on-line, Internet, available from http://www. airpower.au.af.mil/airchronicles /apj/apj99/fal99/gray.html.

[13] Michael Hardy, "Military Turning to Commercial Satellites," *Federal Computer Week.com*, 3 Jun 2003, n.p., on-line, Internet, 26 Nov 2003, available from http://www.fcw.com/fcw/articles/2003/0602/web-sat-06-03-03.asp.

[14] David. In his report, Leonard David states "future adversaries will also likely seek to deny the US forces unimpeded access to space" by using "ground-based lasers…and proximity micro satellites…" He continues, "During crisis or conflict, potential adversaries may target US, allied, and commercial space assets as an asymmetric means of countering or reducing US military operational effectiveness, intelligence capabilities, economic and societal stability, and national will."

"The Eisenhower Administration set the precedent of 'space for peaceful purposes,' a precedent that has now made space a global commons for all to use."

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The Chinese Threat to US Space Superiority

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Take unexpected routes to attack where the enemy is not prepared.

- Sun Tzu, *The Art of War*

Space is becoming as essential to the economic and military vitality of 21st century nations as the sea was for states in times past. Just as 18th century Great Britain drew a major portion of its influence from sea power, the United States relies tremendously on space power to secure its global position. America's leveraging of spaceborne assets creates both asymmetric advantages and vulnerabilities of strategic significance. The deep and pervasive embedding of satellite-enabled capabilities into modern systems makes functioning without them unimaginable throughout the developed world, especially in the United States. Recognizing the benefits conferred by space systems on the nations that rely on them most motivates potential adversaries to develop means to exploit their current fragility and susceptibility to attack (Fig. 1).

Fig. 1: Potential adversaries recognize the tremendous asymmetric advantage the US military derives from space-based communications, precision navigation and timing, weather, missile warning, and ISR.

The perceived emergence of threats to US space systems has led the Department of Defense to place a greater emphasis on space superiority and its components: space situation awareness; defensive counterspace; and offensive counterspace.[1] At the same time, discussion of increased US counterspace activity has drawn the ire of critics who contend such moves are unmerited and counterproductive. Space sanctuary and space arms control advocates discount the counterspace threat from potential rivals, arguing no nation possesses both the capability and intent to attack America's on-orbit assets. Numerous opponents of space superiority programs also claim US developments in this arena will only motivate potential adversaries to develop their own counterspace or anti-satellite (ASAT) systems.

In fact, military competitors already possess much more compelling motivations for deploying such capabilities. One would-be adversary, China, has both the intent and an expanding capability to exploit the vulnerability of US space systems in the event of a future conflict. China's counterspace ambitions are not a reaction to American space control activity, but instead are driven by more Earthly concerns of conventional and nuclear balance of power in Asia.

The Space Sanctuary Position

Space sanctuary and arms control proponents have downplayed US defense establishment concerns over a counterspace threat from emerging adversaries. They maintain that prospective foes lack either the intent or the capability necessary to pose a legitimate threat to American space assets. Space sanctuary advocates argue space-faring nations would have as much to lose as the US in a "space war," while more hostile, less developed nations and groups simply lack the technology necessary to mount an effective counterspace attack. Meanwhile, opponents of space weaponization have characterized space control advocates' goals as ill-considered and self-serving. As for China's role, they argue that Beijing seeks only peaceful cooperation in space and will only turn to space weapons if forced to respond to US counterspace initiatives.

Bruce M. DeBlois, Senior Adjunct Fellow at the Council on Foreign Relations, has been an outspoken proponent of the space sanctuary school of thought. In a 1998 Aerospace Power Journal article, he portrayed predictions of adversary space weapons as "paranoid justification for US space programs." He went on to discount any hostile Chinese intent, stating: "China is interested in space but has done nothing except persistently pursue collaboration with Europe and the United States."[2]

Theresa Hitchens, Vice President of the Center for Defense Information, has also been at the forefront of the debate over space weaponization. In a recent special issue of the *Disarmament Forum*, she suggests the current administration's view of the evolving threat to our space systems might be "overly pessimistic."[3] On the viability of a foreign threat she argues neither capability nor intent exist saying, "There is little evidence to date that any other country or hostile non-state actor possesses both the mature technology and the intention to seriously threaten American military or commercial operations in space ..."[4]

Contrary to the views of space sanctuary and space arms control advocates, fear of an emerging US capability to destroy Chinese satellites is not the primary catalyst behind Beijing's counterspace moves. Chinese interests in space weapons do not hinge on winning a potential US-Chinese ASAT battle or participating in a space arms race. Two other motivations play a much greater role in cultivating China's desire for counterspace weapons: to counter the space-enabled advantage of US conventional forces; and to guarantee the viability of Chinese nuclear forces in the face of emerging American missile defenses.

Chinese Intentions

The highest form of generalship is to balk the enemy's plans.

- Sun Tzu, *The Art of War*

In the event of a future Sino-American conflict, it is likely China intends to exploit the vulnerability of US space systems. Two key factors motivate Beijing to develop, deploy, and employ counterspace capabilities. The first is the need to neutralize the overwhelming conventional military advantage America currently derives from its space assets. In particular, China fears that American technical dominance encourages Taiwanese defiance and emboldens the US to intervene militarily in a future crisis. Second, the Chinese desire to bolster the viability of their nuclear deterrent by securing the means to threaten a space-reliant US anti-ballistic missile (ABM) network. Both objectives are driving China to evolve its military doctrine and expand its technical ability to function against a high-tech, information-hungry enemy.

"Without question, our most vital resource is people and that's why we are working hard to create a strong program that will professionally develop our next generation of Space Professionals."

- General Lance W. Lord

Beijing has closely followed the technology-driven revolution in US military affairs that, to a great extent, depends on spaceborne assets. The conventional military prowess demonstrated by the American military in recent operations seized the attention of Chinese strategists who view the space-networked nature of this new American way of war as a potential weakness. As a result, the People's Liberation Army (PLA) is developing new doctrine, based on surprise and information systems attack, to counter a threat it sees to its own strategic position.

The dramatic space- and information-fueled success of US military operations over the past 15 years profoundly impacted Chinese military thinking. The decisiveness with which the US dismantled the Iraqi army in the 1991 Gulf War shocked Beijing and highlighted the vulnerability of China's technologically inferior forces.[5] Operations DESERT STORM and ALLIED FORCE led the People's Republic of China (PRC) to develop a new *Three Attacks and Three Defenses* strategy emphasizing denial of enemy precision strike, electronic warfare, and reconnaissance capabilities—all dependent to some degree on space systems.[6] The introduction of Global Positioning System (GPS)-guided munitions in ALLIED FORCE heightened the PLA's consciousness of the critical role of space control in US warfighting.[7] China witnessed yet another quantum jump in American exploitation of space-based communications, navigation, and ISR (intelligence, surveillance, and reconnaissance) in Operations ENDURING FREEDOM and IRAQI FREEDOM.

The conduct of these operations increasingly leads Chinese strategists to focus on US Forces' dependence on space, as evidenced by several recent studies. A 1994 report by China's Academy of Military Science (AMS) emphasized the American military appetite for satellite services, noting 70 percent of all US military communications and 90 percent of all military intelligence flows through spaceborne systems.[8] A 1997 paper by China's Commission of Science, Technology, and Industry (COSTIND) characterized US military exploitation of space-based systems as a potential Achilles' Heel. In 2000, a report from Xinhua, a state news agency of the PRC, described US over reliance on technology and space as part of "The US Military's Soft Ribs and Strategic Weakness." The report went on to state, "For countries that can never win a war with the United States by using the method of tanks and planes, attacking the US space system may be an irresistible and most tempting choice. Part of the reason is that the Pentagon is greatly dependent on space for its military action."[9]

Open source Chinese publications reflect Beijing's increased interest in spaceborne targets. In a 1995 meeting, members of China's Central Military Commission (CMC) listed an adversary's "nervous system and brain" as essential objectives in modern warfare.[10] In a 1998 article, Captain Shen Zhongchang, Director of Research and Development at the Navy Research Institute in Beijing, described "mastery of outer space" as a precondition for victory in future battles.[11] In 1999, the Vice Minister of COSTIND stated, "Since GPS is playing an ever-increasing role in long-range precision attacks, precision bombing, accurate deployment of troops, requests for reinforcements and unified actions for command and control, anti-satellite systems centered on satellite navigation will be developed..."[12] It is apparent Chinese strategists have identified American space systems as a Center of Gravity and seek to degrade this asymmetric advantage through development of counterspace means.

Beijing's evolving military strategy could dramatically shape the conduct of a future Sino-American clash in Asia. In particular, PLA planning revolves principally around a potential conflict with the US over Taiwan. The island's political separation from the mainland is currently the most pressing challenge to Chinese sovereignty. Beijing, in fact, considers national unity a

fundamental requirement for China's survival as a nation.[13] The PRC has enumerated a number of triggers that would lead to a military response in the Taiwan Strait: a Taiwanese declaration of independence; internal instability in Taiwan; foreign intrusion into Taiwanese security affairs; and Taiwan's possession of a nuclear weapon.[14] China has also stated it may impose a forceful resolution to the Taiwan question if "progress" toward reunification stalls.[15]

The keys to any Chinese military action against Taiwan would first be deterrence of US intervention and then, if an attack is initiated, limiting America's capacity and will to respond. If China elects to use military measures to secure national unity, its primary goal will be to achieve a quick outcome through surprise, speed, and deception.[16] America's space-dependent information infrastructure presents an alluring target, making a non-lethal strike against US space assets a likely precursor or adjunct to an attack. A 1999 article in the PLA-affiliated *Kuang Chiao Ching* journal described electronic, information, and ASAT warfare as essential ingredients of a cross-strait conflict.[17] A recent RAND report argues that an information attack to degrade regional American military might would be a probable course of action for Beijing.[18] Attacking American space assets is a powerful, potentially deniable, and perhaps most importantly, non-lethal option that would dramatically hinder the ability of US forces to react rapidly or effectively.

"The keys to any Chinese military action against Taiwan would first be deterrence of US intervention and then, if an attack is initiated, limiting America's capacity and will to respond."

In the face of emerging American national and theater missile defense systems, Beijing also sees the threat of an ASAT attack as a means to maintain the deterrent power of its nuclear missile force. The PRC's ability to sustain a credible nuclear deterrent is a top national priority and an essential ingredient in its goal of preventing unwanted American intervention in the Taiwan Strait.[19] A missile defense umbrella would represent an unacceptable shift in the regional and global balance of power, emasculating China's nuclear deterrent, neutralizing conventional theater missiles and, in their eyes, emboldening a US military response to a Chinese move against Taiwan. China understands it cannot be a credible world power without the ability to hold America and its forces at risk within its own Asian sphere of influence.

As early as 1986, the Chinese government identified counterspace weapons as a means to nullify a US ABM system.[20] Concern over American missile defenses spurred implementation of a high-level project (known as the 863 Program) to develop technologies, including high-powered lasers, to negate US strategic systems. A recent article in the *Kuang Chiao Ching* journal, "Direction in the Development of China's Space Strategy," called for fielding ASAT weapons to destroy opponents' "space weapon information systems."[21] While evolving Chinese counterspace doctrine and rhetoric merit the attention of US space professionals, by themselves they do not constitute a threat. For a valid threat to exist, China must also possess the means to put US space assets in jeopardy.

Chinese Capabilities

A force which is inferior but prepared can often defeat a superior enemy by surprise attack.

- Mao Tse-tung, *On Protracted War*

Building on a solid base of design, manufacture, integration, test, launch, and TT&C capabilities, China is developing a range of technologies tailored for space control applications. Official sources (e.g., AMS, COSTIND, and the China Aerospace Corporation (CASC)) reflect both an increased interest in counterspace capabilities and the existence of actual ongoing programs.[22] Systems under study and/or development include space-based "killer" satellites, kinetic-kill vehicles, ground-based lasers, and electronic jammers. Numerous CASC articles describe detailed on-going research on terminal phase tracking and target discrimination using advanced methods such as ultra-wide-band radar, thermal imaging, and sensor fusion.[23] Two areas of particular relevance to China's future counterspace capability are directed energy weapons and agile microsats. These sophisticated approaches augment a growing list of ASAT options already available to China.

Technology accessible to China today enables attack by ground-segment interdiction, computer network disruption, communications jamming, laser blinding, direct ascent ASAT interceptors, space mines, debris rings, and high-altitude nuclear bursts.[24] Interdicting ground stations may be the easiest way to disable space systems. Due to their concentration within US and Allied borders, such attacks would likely be highly escalatory. Computer network attack, communication jamming, and laser blinding have the advantage of being bloodless and potentially deniable, but can be susceptible to countermeasures. Options such as ground-launched missiles, co-orbital mines, fragmentation rings, and high-altitude nuclear bursts (supercharging the Earth's Van Allen radiation belts) offer the advantage of a hard-kill, but are non-discriminatory. China's satellites, as well as those belonging to third parties, would likely be damaged or destroyed by residual debris and radiation. While the above-listed methods provide China a number of technologically-available near-term options, further advances may give them the additional benefits of increased range and precision.

It is highly likely China is developing ground-based directed energy weapons with the capability to temporarily disable, damage, or even destroy a satellite. With roughly 300 organizations, 3,000 engineers, and 10,000 total personnel participating in laser-related efforts, Beijing's aggressive pursuit of

advanced directed energy technology has given its program world-class status.[25] As early as 1994, the Chinese successfully tested a free electron laser with a 140 megawatt output. They have since pursued miniaturization of laser systems, perhaps to enable a mobile system.[26] According to other reports, China is seeking to build an ASAT system using a high-energy deuterium fluoride laser, mimicking the US Mid-Infrared Advanced Chemical Laser (MIRACL) design.[27] Based in Central China, and slated for additional upgrades, such a system would provide the ability to destroy, rather than simply blind, targeted vehicles. The PRC may have obtained technology from Russia to build a high-power, nuclear-driven laser. In 1999, a congressional commission concluded "it is possible that the PRC will be able to use nuclear reactors to pump lasers with energies high enough to destroy satellites" (Fig. 2).[28] The proximity

Fig. 2: The 1999 Report of the Select Committee on United States National Security and Military/Commercial Concerns with the People's Republic of China concluded Beijing could use nuclear reactors to power lasers with sufficient energy to destroy low-Earth satellites.

of low-Earth orbit systems makes them good targets for attack with this type of system. While Earth-oriented optical sensors on satellites in higher orbits may also be vulnerable, the distances involved and effects desired may make a space-based ASAT approach more attractive.

China's burgeoning microsatellite program enhances its ability to attack American spaceborne assets. Beijing could discretely launch such small, lightweight and difficult to detect satellites as secondary payloads on otherwise overt missions. When desired, the hitchhiker could then maneuver into position for attack. With the help of Surrey Satellite Technology Ltd, (the leading microsat development company in Europe, if not the world) China is making tremendous strides in microsat design, fabrication, and operations. In 1998, Great Britain and China formed the world's first joint venture company dedicated to microsat development – the Tsinghua-Surrey Small Satellite Company.[29] The first Chinese microsat, Tsinghua-1, was launched on a Russian booster in 2000 (Fig. 3). The 3-axis stabilized vehicle included a GPS receiver and multi-spectral camera.[30] The two companies are now collaborating on an enhanced agility microsat bus incorporating both a multi-spectral and high-resolution pan-chromatic imager (Fig. 4).[31] China plans on launching the vehicle in spring 2005 to support a global disaster monitoring mission.

In 2000, an oversight group gave Tsinghua University the go-ahead for a nano-class (1 to 10 kilograms) satellite program.[32] Officials at the 2000 Shanghai Science and Technology Forum described two other Chinese microsat projects.[33] The Harbin Institute of Technology (HIT) in the Heilongjiang Province is pursuing the first, Tansuo-1 (TS-1). HIT has been in-

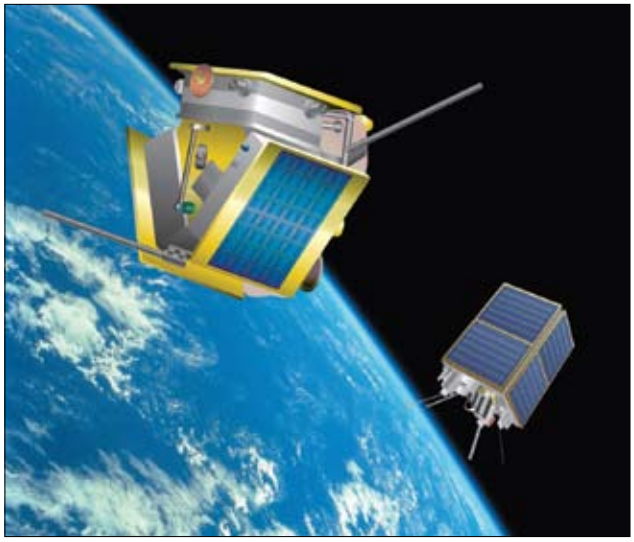

Fig. 3: Tsinghua-1, China's first microsatellite, observed by a Surrey Satellite Technology Ltd. (SSTL) microsat during proximity operations following a June 2000 launch. China has heavily leveraged its partnership with SSTL to advance its ability to field micro- and nano- class vehicles.

volved in microsat research since 1997. The second, Chuangxin-1 (CX-1), falls within the Microsatellite Project Department of the Chinese Academy of Sciences in Shanghai. Pre-flight observations of the unmanned Shenzhou 3 spacecraft, launched March 2002, led to speculation that the capsule carried a piggybacking CX-1 satellite.[34] The mission and launch status of TS-1 are unknown. In 2001, the director of the Chinese National Space Administration announced plans to develop a mobile, rapid response, solid-propellant booster system capable of launching a small satellite from "anywhere in the country."[35] Such a system dramatically enhances microsat military utility.

Other public reports continue to support a military mission for Chinese micro/nanosats. In early 2000, unnamed Chinese sources claimed the Small Satellite Research Institute of CASC built a "parasitic satellite" using nano-technology. These small vehicles, when deployed, would attach themselves to enemy communication, navigation, ABM, and/or ISR satellites. On command, they could disable or destroy the host satellite.[36] A similar account appeared in the Hong Kong press in 2001, describing a "piggyback satellite" weapon designed to jam or destroy an enemy target satellite.[37]

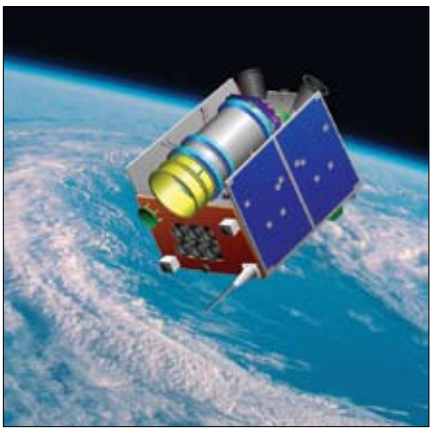

Fig. 4: China's latest microsat, another collaborative venture with SSTL, is scheduled for launch in spring 2005. Its highly agile bus houses both pan-chromatic and multi-spectral imagery payloads.

Conclusions

Military preparedness is the greatest task of the nation. A small mistake can make a huge difference.

- Zhuge Liang, *The Way of the General*

China possesses both the intent and a growing capability to threaten US space systems in the event of a future clash between the two countries. The PLA's development of ASAT weapons is primarily not a reaction to US space control initiatives. It is driven instead by very practical considerations of regional security and influence, and the desire to conduct asymmetric warfare against a superior foe if conflict arises. First, Beijing seeks to offset the dominance of US conventional forces by exploiting their dependence on spaceborne information assets. Second, China hopes to guarantee the viability of it's nuclear deterrent by holding the critical space-segment of American missile defense systems at risk. Both of these goals are deeply rooted in the issue of Taiwanese reunification and the potential for armed conflict over the status of the island. China's growing capability to attack American satellites could play an important role in a future military confrontation over Taiwan.

If the US wishes to enjoy the advantages of space-enabled communications, navigation, precision timing, weather, missile warning, and ISR in any potential conflict with China, the National Security Space community should aggressively pursue methods to defend its systems from attack. First and foremost, the Air Force – as Defense Department executive agent for space – must develop better Space Situation Awareness (SSA), both in breadth and depth. In breadth, the Air Force should build and maintain an improved catalog of objects from low-Earth to geosynchronous orbits. The catalog must not only be complete, capturing increasingly smaller objects; it needs also to be timely to ensure maneuvering vehicles are discovered in time to permit defensive action. In depth, America should develop the capacity to better characterize the nature and capabilities of known satellites. The US must improve its ability to identify the existence, origin, and nature of attacks on its space assets—differentiating these attacks from system or environmental anomalies. The need for depth and breadth in SSA extends to ground-based counterspace systems that might be employed against friendly forces. Passive and active defensive systems should follow and leverage SSA improvements to "close the loop" on American vulnerabilities. America stands a better chance of deterring aggression against its critical on-orbit assets if it possesses the capability to recognize emerging threats, capture timely indications and warnings, and respond (defensively or offensively) when attacked. To do otherwise presents an inviting vulnerability to an adversary seeking unconventional means to neutralize or defeat a stronger foe.

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On Cossacks, Subs, and SAMs: Defeating Challenges to US Space Superiority

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Space Warfare Center,
Schriever AFB, Colorado

** This essay is excerpted from a monograph-length work currently in progress. The effort originated as an Air Command & Staff College research project.*

In numerous military campaigns across history, those faced with overwhelming superiority within the mediums of land, sea, and air have devised *counterstrategies* designed to deny the ability of superior powers to exploit those mediums to military advantage. Such a situation is what the US will likely face in space in the near future, as no potential adversary seems likely to threaten the space capabilities the US currently wields, but neither is one likely to *concede* space superiority, and the terrestrial advantages it confers. If so, what would such a space denial counterstrategy look like? Do similar kinds of denial campaigns in military history have anything to offer on the subject? And, most importantly, what should be done to properly defeat such a counterstrategy of space denial?

These questions lead to the primary claim of this article: that *the near to mid-term response to US space superiority will be a counterstrategy that follows an asymmetric pattern of denial consistent with historical denial campaigns on land, at sea, and in the air; and the proper approach to defeating such a counterstrategy will follow principles derived from these same historical experiences*. Much has been written on campaigns of military denial usually focusing on the strengths and weaknesses of such pursuits within their respective mediums. What is missing is a more holistic review of such campaigns, one that extracts common "trans-medium" characteristics and principles that apply to the "newer" medium of space.

Is the prospect of a determined denial campaign against US space superiority both possible and imminent? The experiences of military history, combined with more recent developments regarding space, suggest it is. What once appeared to be a plausible stance for space sanctuary theory during the Cold War is swiftly evaporating in the 21st century world of space-enabled warfare. Whereas Cold War space systems such as missile warning satellites, reconnaissance platforms, and SATCOM emphasized the preservation of *stability* and *balance* between the superpowers at a *strategic* level, modern US use of space systems emphasizes *asymmetric advantage* at *all levels* of warfare, from the strategic to the tactical. There is no longer any pretension of balance whatsoever – the US now uses its space capabilities to achieve swift and decisive victory on the battlefield. This change in the exploitation of the medium of space is simply not compatible with space sanctuary theory – one can hardly expect a future adversary to simply ignore the tremendous military and economic advantages that space superiority provides the United States.[1]

Equally compelling is the long standing military concept of a denial counterstrategy to neutralize the advantages of a superior power. Denial campaigns have been waged on land, sea, and air throughout history and the US should expect such actions in space.

LAND, SEA, AND AIR DENIAL COUNTERSTRATEGY STUDIES

Russia's campaign of land denial against Napoleon in 1812, Germany's sea denial campaign during both World Wars, and North Vietnam's air denial campaign in Southeast Asia from 1962 to 1973 are effective examples of significant historical denial campaigns within three different mediums. In each of these campaigns, the weaker adversary attempted to *deny* the advantages of superiority to the superior power, and *did not pursue superiority* in that medium. The US may face this kind of counterstrategy in space in the near future.

Counterstrategy on Land: Russia, 1812

Napoleon intended to conduct and win the Russian campaign of 1812 with superior force of arms. Napoleon enjoyed a clear superiority during his conquest of Central Europe – leveraging people, resources, and, perhaps most importantly, political objectives, as evident in Napoleon's capture of Vienna in November of 1805.[2] Russian leadership, cognizant of the potential disasters awaiting their military should they meet Napoleon on his terms, devised a *counterstrategy* to deny Napoleon military superiority on land. First, contrary to the traditional norms of fighting wars at this time, the Russians refused to engage the *Grand Armee* in battle. The Russian Emperor Alexander declared to one of Napoleon's messengers, "I have space and time on my side…I shall not attack, but shall not lay down my arms so long

> *"I have space and time on my side… I shall not attack, but shall not lay down my arms so long as a single foreign soldier remains in Russia. If Napoleon goes to war and fortune smiles upon him, … he will have to sign the peace on the Bering Strait."*

as a single foreign soldier remains in Russia. If Napoleon goes to war and fortune smiles upon him, … he will have to sign the peace on the Bering Strait."[3] Second, the Russians engaged in a scorched earth policy, razing villages and burning fields as they retreated deeper into the Russian interior, depriving the *Grand Armee* of the resources it needed for self-sustainment.[4] Finally, the Russians sought to deprive Napoleon of earning political capital – ultimately abandoning and even destroying Moscow in the face of Napoleon's advance in order to erase its political value to him.

Thus, even after Napoleon "victoriously" entered Moscow, the Russian leadership was unconvinced of defeat. With the French Army withering away, Napoleon had no choice but return to the more hospitable regions of Central Europe. Unfortunately for Napoleon, what was left of his forces evaporated during the long return march to home in the midst of an early Russian winter[5] -- the French soldiers and their Allies were deprived of the means to sustain themselves and were sniped at by Cossacks at every turn.[6] The *Grand Armee*, which had attacked Russia with more than 600,000 strong, eventually stumbled back into Eastern Prussia with fewer than 60,000 soldiers.[7] In the end, the Russian land denial campaign defeated Napoleon by refusing to play him at his own game, instead seeking every means to "change the rules" and bide time until his strength evaporated. It stands today as a classic case of effective counterstrategy of denial, defeating a superior power by circumventing its "proven" strategy for victory.

Counterstrategy at Sea: The Atlantic, 1914-1945

Perhaps the most ambitious sea denial campaign in history actually spanned *both* World Wars, pitting Germany in a vigorous campaign to deny maritime superiority on the Atlantic to Great Britain and the United States. Germany determined from its failures to successfully wield surface power, during the Battle of Jutland, that winning outright superiority on the seas was out of the question.[8] As a continental power, Germany did not necessarily thrive on sea power, nor need it for survival, as did Britain. Germany therefore embarked upon a continuous strategy of *sea denial*, employing a relatively new technological marvel, the *Unterseeboot*, or U-boat – which extended sea power into a downward third dimension, and gave Germany an opportunity to counter British surface supremacy with an asymmetric means of its own.

Initially, in both wars, the U-boat campaign met with great success. The U-boat, for a time, was the most feared weapon of war, striking with complete surprise, and, in World War II, operating in groups at night in a practice known by the submariners as *Rudeltaktik*, or "pack tactics."[9] However, in both wars, the German sea denial campaign came close to starving Britain of basic resources but sputtered and fell short. In World War I, the failure owed much to Allied introduction of a basic convoy system, where merchant ships traveled in groups with armed escorts rather than sailing independently and aided by Allied innovations such as rudimentary sonar, depth charges, and "deep mine laying" in the English channel.[10] In World War II, Allies successes included the above tactics, plus advanced sonar, radar, effective use of both land and sea-based air power, and the cracking of German naval code via the capture of an Enigma cryptographic device.[11]

Counterstrategy in the Air: Southeast Asia, 1962-1973

During the Vietnam War, the North Vietnamese had a major goal: *deny* America air superiority over Vietnam, and, in so doing, extract material, and, more importantly, political costs (such as downed aircrew turned POWs). The centerpiece of North Vietnam's strategy was a new and ambitious air defense system centered on the Surface-to-Air Missile (SAM). It was a new kind of weapon, based on advanced rocketry and guidance technology, developed in the late 1950s, and used in anger for the first time to down US U2 aircraft over the Soviet Union and Cuba in the early 1960s. Despite these foreshadowings, the SAM threat was not properly anticipated or prepared for in Vietnam: "between 1955 and 1965, the Air Force made no concentrated effort to develop a SAM countermeasure."[12] Between January 1962 and January 1973, over 2300 US fixed wing aircraft fell victim to enemy anti-air efforts.[13]

The US soon began to find ways to counter the SAM threat at the tactical level. Anti-radiation missiles such as the Shrike and radar-jamming equipment like the ALQ-71 Electronic Countermeasures pod became available.[14] Ironically, though, it was not until the end of the air war that the US finally overcame the air denial efforts of the North Vietnamese and achieved unopposed air superiority. Just two days before Operation LINEBACKER II ended, the North Vietnamese air defenses shut down, as they had exhausted their national supply of SAMs. Thus, this achievement of air superiority was "won" by a long and costly battle of attrition, not by triumph of superior strategy.

CHARACTERISTICS OF DENIAL COUNTERSTRATEGIES

Stealth, Surprise, and Varying Tempo

One obvious but important observation about those powers that seek to *maintain* superiority over a medium is that their means to do so are *overt, obvious*, and *continuous*: Napoleon's armies, the Allies' WWII fleets and convoys, and the US air presence in Vietnam all fit this description. Accordingly, the means employed to *deny* superiority uniformly take on alternative characteristics: *stealth, surprise*, and *varying tempo* of operations. Russian armies proved ever elusive to Napoleon, evading battle, striking with Cossack raids on flanks and the rear, and doing so quickly. Even more decisively, German U-boats attacked targets without warning, and at high tempo, often escaping the scene of attack before their torpedoes even struck.[15] North Vietnamese SAM and anti-aircraft batteries relied often on ambush methods to achieve success, as a founder of the Naval Fighter Weapons School noted: "They had timed us so many times on our bombing runs that they knew how long we were going to be there, and when we were going out."[16] SAM sites, including radars and launchers, were highly mobile, and could relocate in under four hours.[17]

Accordingly, future denial strategies targeting US space superiority will likely evolve along these same lines: attacks that come out of nowhere, then ending quickly before the real

damage is even comprehended. Glimpses are already visible: developments in micro-satellite technology could produce orbital "parasites" capable of intercepting spacecraft without detection.[18] Well-placed directed energy weapons could blind sensors and then relocate or disappear before it is even understood by satellite operators that an attack has even taken place.[19] Unconventional forces could strike launch sites or ground stations and then melt away.

Asymmetric Technology

To suggest that an asymmetric strategy would employ asymmetric weapons seems tautological, but there is an important distinction between ways and means. The initial German efforts to employ surface raiders, such as the battleships Graf Spee, and Bismarck, ended in disaster for those warships. Likewise, North Vietnamese use of MiGs was never perceived as a serious threat to US aircraft in the skies over North Vietnam. Thus, a symmetric means to achieve asymmetric ways was not the primary vehicle to success.

"... the intent of the bombing of North Vietnam was not to achieve strategic objectives so much as to send 'signals' in a vain effort to convince Hanoi's leaders that continued fighting was futile."

- Benjamin Lambeth

In contrast, asymmetric means *did* achieve great success. When the Russian army avoided battle, and then resorted to pinprick raids by self-sufficient Cossacks living off their native land, that the greatest effects against Napoleon's army were achieved. Similarly, no naval weapon during the World Wars was more diametrically opposite to expensive surface warships than U-boats and mines. Both of which were at times deemed so "unfair" by powers with sea superiority that efforts were made to outlaw them. SAMs were also comparatively cheap, requiring neither the extensive pilot training nor the ponderous maintenance and logistics infrastructure that modern aircraft required.

How, then, might future space denial efforts conform to this characteristic of asymmetric and relatively cheap technologies? It seems they will *not* fit the current US space infrastructure mold: large, expensive spacecraft and launchers requiring long lead times from production to deployment. A 1998 study identified the most likely threats to be (1) direct ascent anti-satellite weapons (i.e. those launched from ground-mobile or even airborne platforms on small boosters), (2) low-power electromagnetic jammers or directed energy weapons enhanced by the proliferating technology of adaptive optics, and (3) information-based attacks, such as computer viruses constructed by "hackers" and inserted into vulnerable points in space command and control infrastructure.[20] All of these methods fit the mold of "cheap and asymmetric threats," and, more frighteningly, are at or near commercial of-the-shelf status – even a direct ascent capability tested ten years ago on the Russian MiG-31 Foxhound is capable of being exported.

Coordinated and Synchronized Operations

As these three case studies demonstrate, those seeking effective denial actually integrated tactics and technology into coordinated and synchronized operations in pursuit of the broader counterstrategy. Cossack attacks were haphazard and undirected. Combined with the deliberate scorched earth policy and the main Russian army's shadowing of the French, these actions coalesced into a coordinated and effective denial campaign.

Similarly, German U-boat attacks were at their most effective, and most frightening, when *Rudeltaktik* ("pack tactics") was employed. Further, the air denial campaign over North Vietnam saw the emergence of a modern Integrated Air Defense System (IADS) that integrated early-warning and height-finding radars with SAM batteries, and followed a Soviet practice of forcing US aircraft below 3000 feet to escape the SAM threat, where they were then engaged by complementary anti-aircraft fire.[21] These measures were simply yet another form of *Rudeltaktik*.

Accordingly, one may conceive of future space denial campaigns that feature synchronized activities, such as degradation of on-orbit sensors and platforms coupled with attacks on space launch sites, preventing any form of replenishment. The synergy of such denial operations may be – as were their land, sea, and air predecessors – difficult to overcome, and requiring a concerted response.

Political Objectives with Political Consequences

To the strategist familiar with Clausewitzian principles, no warfighting strategy exists outside the realm of politics. Alexander's counterstrategy objectives against Napoleon were "counter-political" as well as military in nature. He ultimately meant to deprive Napoleon of any political victory by denying him any potential political prize. Alexander was willing to keep moving, forcing his "Bering Strait" scenario, therefore, Napoleon failed to achieve any of his political objectives in the Russian campaign, and returned from his disastrous campaign mortally wounded.

Germany's goal in its World War I sea denial campaign was to compel a politically-motivated withdrawal and separate peace, believing Britain's economic ruin would force its government to halt further prosecution of the war. Yet, by pursuing unrestricted submarine warfare (which meant, counter to maritime law, firing upon ships without warning), Germany antagonized the United States and contributed greatly to America's entry into the war in support of the Allies.

Perhaps no modern conflict has been more political in nature than the Vietnam War. As Benjamin Lambeth observed, "the intent of the bombing of North Vietnam was not to achieve strategic objectives so much as to send 'signals' in a vain effort to convince Hanoi's leaders that continued fighting was futile."[22] Indeed, the primary bargaining objective sought by the US during the final Paris Peace Talks involved not political assurances in Indochina, but the return of American POWs, the majority of which were victims of North Vietnam's air denial campaign.

What are the political opportunities (or liabilities) of a space denial campaign? Space warfare that significantly impacts the interests of neutral parties would alienate the aggressor in world opinion, marginalizing their cause. The opposite is also possible, with the aggressor blaming hostilities in space on the US "space superpower" -- the "only legitimate" response to "superpower bullying."

Of further concern in the political realm is the potential for space denial actions executed by non-governmental organizations. Due to an orbital slot-leasing dispute, the Indonesian Pacifik Satellite Nusantara (PSN) Corporation jammed a communications satellite operated by Tonga's TongaSat Corporation in 1997.[23] During several days in June 2002, the Falun Gong religious cult cut into World Cup finals soccer coverage on China's SINOSAT and inserted its own broadcast.[24] These instances give initial glimpses into potential ways space denial activity may be carried out by non-state actors to effect political ends.

PRINCIPLES FOR DEFEATING COUNTERSTRATEGIES TO SPACE SUPERIORITY

Counter the Counterstrategy

To paraphrase Prussian Field Marshal Helmuth von Moltke, an *initial* strategy to exploit an existing superiority within a medium does not survive first contact with the enemy. This was the case in Napoleon's Russian campaign, and, in the early stages of the Battle of the Atlantic, when Britain found herself completely overwhelmed by the U-boat onslaught. In the initial stages of the air war over Vietnam, the US Air Force was completely unprepared to face the new SAM threat. Simply employing new and more "progressive" tactics and technology, *by themselves and without an accompanying integrating strategy*, may fall short. During the Battle of the Atlantic, Britain's use of sonar technology was handicapped by preconceptions and failures to integrate into a new strategy. Similarly, new tactics and technology employed by the United States in the skies over Vietnam may have slowed the momentum of the air defense efforts, but did not, by themselves, completely stymie the North Vietnamese air denial campaign. SAMs shot down fifteen B-52s during Operation LINEBACKER II, clear evidence that though the US may have had tactics, it had not solved the SAM problem.[25]

In contrast, it was only when the superior powers in each case *integrated the new tactics and technologies into a broader strategy framework* that the tide turned. The Allies in the Atlantic devised not only tactical means to counter German U-boats, but produced a coherent and all-encompassing *counterstrategy of their own – the convoy system*, with its full suite of integrated working parts: surface escorts, air cover, ship-based and aircraft-equipped radar, sonar, and the treasure trove of German encrypted communications via the Enigma device. Similarly, the US eventually overcame the threat of a modern IADS with a systematic approach of electromagnetic jamming, high-speed anti-radiation missile (HARM) targeting, decoys, and even deception operations. This operational approach was cemented with *new doctrine*; as clearly demonstrated in Operation DESERT STORM, now the first and overarching task for the air component of any joint campaign is to gain and maintain air superiority. Rather than being neutralized during the course of air operations as they emerge as threats (as they were in Vietnam), components of a modern IADS are now, in accordance with air operational strategy, destroyed early and totally. The same – a comprehensive strategy integrating the full spectrum of capabilities to defeat space denial efforts – will be required to maintain space superiority in the face of a determined denial threat. Simple tactics, by themselves, will not suffice.

"The Enemy Has a Vote"

As a nation with space superiority prepares to meet and defeat an emerging space denial counterstrategy, it is critical to recognize the full scope of disparities and asymmetries at work, and plan accordingly. As Azriel Lorber elucidates in *Misguided Weapons*, throughout history one of the most consistent and deadly mistakes made on the battlefield has been the tendency to project one's own practices, constraints, and value system on the adversary. This was Napoleon's fatal flaw in his Russian campaign – the assumption the Russian army would play by the battlefield rules of "war by annihilation."

The "projection" syndrome also plagued the air campaign in Vietnam. US national leadership "subconsciously assigned the enemy western values and translated a guerilla war into a conventional conflict they could better understand."[26]

Where might the dangers of self-projection manifest themselves in the space arena? The continued adherence by some to space sanctuary theory is a strategic-level example. Projecting one's own acquisition and fiscal restraints or levels of acceptable risk onto an adversary. A potential adversary may be less risk averse in the demonstration of a new technology than the US, or less deterred by world opinion, or less concerned with loss of life. Whatever the differences may be, *defeating a counterstrategy of space denial will require recognizing the dissimilarities in potential adversaries*.

Space Superiority is "Everybody's Business"

If one accepts the need for an all-encompassing counterstrategy to any adversary threatening to deny US space superiority, then it follows that the need to ensure US space superiority in the face of such a threat becomes a threat to *all* warfighter. Preserving space superiority in the future will require integrating all warfighting capabilities, from planning to execution, to ensure success.

Space superiority is typically viewed as a mission for the "space experts" only, not one integrated into the primary targeting, mission descriptions, and joint warfighting functions. This must change. Future wars will invariably require airstrikes on probable "space denial" platforms such as Electonic Warfare (EW) jammers and other directed energy weapons? Missions to destroy Iraqi GPS jammers in Operation IRAQI FREEDOM were the precursors to space denial missions of the future. Special operations missions will be conducted against possible mobile launchers seeking to launch space denial payloads – whether they be micro-satellites, or a potential low-earth orbit nuclear "spaceburst," or some other devices. In short, maintaining space superiority in the future will be "everybody's business" on the

joint or combined warfighting team.

RECOMMENDATIONS: SPACE, STRATEGY, AND JOINT DOCTRINE

The proper way to respond to an adversary's determined space denial counterstrategy is with a *space superiority counterstrategy* of one's own, *not constrained* by the "known rules," and involving the *full spectrum of warfighting capabilities*. It is not possible to precisely describe that strategy. Much will depend on the nature of the threat and the context of operational-level activities. But its characteristics should be familiar, sharing much in common with historical superiority counterstrategies.

Is the US properly postured today to develop and execute such a space superiority strategy in the face of a determined adversary? Space power analyst Stephen Lambakis argues that the "United States is secure in space *by default, not* because there is a deliberate policy framework and well-resourced, organized, and strategically guided military force to guard national space interests".[27] In a sense, the current US approach to space superiority resembles the strategic setting at the start of the air war in Southeast Asia. There is a basic understanding that controlling and exploiting the medium in question is important. An integrated approach to defeating space denial efforts on par with the convoy system does not exist. Neither is there a universally recognized doctrinal and practical mandate for preservation of space superiority in the face of a denial threat.

What needs to be done to put the US on the proper trajectory to anticipate and defeat future space denial counterstrategies? A reasonable starting point is to examine that body of thought that seeks to guide operational-level warfighting: Joint Doctrine. Unfortunately, it seems current US joint warfighting doctrine is *not* optimized to support the development and execution of an effective space superiority strategy. The central problem is that *current Joint Doctrine tends to focus on space and the advantages it yields as a logistical support concern to be managed, rather than a medium to be mastered*. To be fair, there is some attention in Joint Doctrine documents of the importance of gaining and maintaining space superiority, but these are clearly isolated and minority instances.[28] For example, in the only Joint Publication (JP) devoted to space, JP 3-14, the word "support" appears in the primary text over 200 times, while "superiority" appears only 6 times. Failing to place paramount importance on maintaining superiority within a medium in the face of a denial threat—as demonstrated in the historical campaigns discussed above--carries with it a price. To address this concern, Joint Doctrine must reflect the *paramount imperative to gain and maintain space superiority* in any Joint campaign, as necessary a condition to victory as gaining air or maritime superiority. In fact, in future conflicts it may very well not be possible to gain superiority within *other* mediums without first achieving it in *space*. Ensuring such superiority is the *sine qua non* for realizing the increasingly critical contributions space capabilities make in modern warfare.

Secondly, *Joint Doctrine provides neither the clear authority nor the mechanisms for the development and execution of a space superiority counterstrategy* to oppose a denial counterstrategy. Joint Doctrine seems to regard space superiority and space capabilities as responsibilities peripheral to combat operations, much as airlift and sealift are regarded as belonging primarily in the realm of USTRANSCOM and not in a geographic combatant command. This is not to suggest that inherently global space "forces"[29] should or even can be *completely* under the authority of a theater commander.[30] But clearly *someone* must develop a strategy of response to a space denial campaign, and its execution will certainly involve land, sea, and air forces performing counterspace missions under the command of a supported Joint Force Commander (this is especially true given that most of the "cheap" space denial means are generally ground-based jammers or launchers which will likely fall within the domain of a geographic combatant commander). Further, what is the staff mechanism by which such a strategy is developed and executed? Who "pulls the trigger"? For now, that individual should be the *JFACC* (Joint Forces Air and Space Component Commander), who, in the near term, is most likely to have the preponderance of theater space assets and the best means either to control them or to coordinate (with regard to inter-theater assets and effects) their operations. It is not inconceivable that a separate functional component for Space may be required (an expansion on the current DIRSPACEFOR's responsibilities), and/or that the executing functional commander may be working for a "global" Joint Force Commander rather than a geographic "theater" commander (such as the USSTRATCOM Joint Force Component Commander for Space/Global Strike construct). In either case, the identified individual must have both the authority to produce an effective strategy for space superiority to counter any adversary's space denial campaign.

CONCLUSION

Space is indeed a unique medium, but it does not necessarily follow that future military operations must also be unique. On the contrary, as demonstrated in the land, sea, and air counterstrategies in the preceding case studies, there is some transcendent commonality in elements of strategy and methods of warfighting across *all* mediums. Accordingly, the need to preserve superiority in a medium must be the first order of business if the full spectrum of advantages of that medium are to be fully realized. Only a thoughtfully-developed and well-executed space superiority counterstrategy can ensure this result.

During the Combined Bomber Offensive in World War II, the Allies struggled with rising bomber losses against German attackers. When General James Doolittle took command of 8th Air Force in late 1943, he noticed a sign hanging above the commander's door, reading: "The mission of the fighters is to protect the bombers." Doolittle ordered the sign changed to read, "The mission of the fighters is to destroy the Luftwaffe."[31] He refocused American daylight bombing by emphasizing air superiority. Doolittle believed achieving air superiority against the determined Luftwaffe would mean success in all follow-on military operations.

This is the remedy needed to develop a space superiority strategy for joint warfighting. In a sense, the current mission for space in Joint Doctrine is *"The primary space mission is to provide support to land, sea, and air operations."* While it is

true that it is essential for space capabilities to provide support for terrestrial operations, to focus solely on that result ignores the more immediate importance of gaining and maintaining control of the medium. What is needed is a Doolittle-like refocus: *"The primary space mission is to ensure space superiority,"* from which all the numerous advantages of space capabilities can flow for ultimate success on the terrestrial battlefield. The proposed recommendations: (1) gain and maintain space superiority to equal footing with superiority within the other mediums as the *sine qua non* for the advantages of space capabilities, and (2) establishment of a clear authority and process for the development and execution of a space superiority strategy, together comprise a positive start towards achieving this necessary refocus.

Notes:

[1] An important distinction made here – the space weaponization issue is most frequently looked at from the question "Should the US deploy weapons in space?" The underpinning belief in this analysis is that the US has no monopoly on that decision, and, indeed, adversaries have far more to gain by initiating attacks on space assets.

[2] Gunther E. Rothenberg, *The Art of Warfare in the Age of Napoleon* (Bloomington, Ind.: Indiana University Press, 1978), 46.

[3] Henri Troyat, *Alexander of Russia: Napoleon's Conqueror,* trans. Joan Pinkham (New York: Fromm International Publishing Corporation, 1986), 140.

[4] Carl von Clausewitz, *The Campaign of 1812 in Russia* (1843, Repub, USA: Da Capo Press, 1995), 179.

[5] Ibid., 163.

[6] Troyat, 162, 166.

[7] Rothenberg, 55.

[8] Andrew Williams, *The Battle of the Atlantic: Hitler's Gray Wolves of the Sea and the Allies' Desperate Struggle to Defeat Them* (New York: Basic Books, 2003), 144.

[9] Steven Trent Smith, *Wolfpack: The American Submarine Strategy That Helped Defeat Japan* (Hoboken, N.J.: John Wiley & Sons, Inc., 2003), 16.

[10] Ibid., 17.

[11] Williams, 127.

[12] Craig C. Hannah, *Striving for Air Superiority: The Tactical Air Command in Vietnam* (College Station, Tex.: Texas A&M University Press, 2002), 14.

[13] Ibid., 73.

[14] Ibid., 83.

[15] Williams, 91.

[16] Hannah, 54.

[17] Herman L. Gilster, *The Air War in Southeast Asia* (Maxwell AFB, Ala.: Air University Press, 1993), 91.

[18] David R. Tanks, "Future Challenges to US Space Systems." The Institute for Foreign Policy Analysis, Inc. (Washington, D.C., 1998), 7.

[19] John P. Geis, II, *Directed Energy Weapons on the Battlefield*, Center for Strategy and Technology Occasional Paper No. 32 (Maxwell AFB, Ala., 2003), 28.

[20] Tanks, 4-13

[21] Lambeth, 18.

[22] Ibid., 31.

[23] Tanks, 12.

[24] "Bejing Alleges Falun Gong Hijacked Chinese TV Sat During World Cup," *Space Daily*, 8 July 2002, on-line, Internet, available from http://www.spacedaily.com/cyberwar-02f.html

[25] Hannah, 86.

[26] Mark Clodfelter, "Of Demons, Storms, and Thunder: A Preliminary Look at Vietnam's Impact on the Persian Gulf Air Campaign," *Airpower Journal*, Winter 1991, 19.

[27] Steven Lambakis, *On the Edge of Earth: The Future of American Space Power* (Lexington, Ky.: University Press of Kentucky, 2001), 1.

[28] Joint Publication 3-0, *Doctrine for Joint Operations*, devotes a paragraph to the importance of achieving superiority in the space, electromagnetic, and information domains. Similarly, Joint Publication 3-14, *Joint Doctrine for Space Operations*, includes several references to the need for space superiority. But these appear more isolated instances rather than consistent themes, and no Joint Publication devotes significant attention to the development and execution of a strategy for maintaining space superiority.

[29] Michael V. Smith, *Ten Propositions Regarding Space Power* (Maxwell AFB, Ala.: Air University Press, 2002). Smith makes the case in his second proposition that space has inherently global properties.

[30] Command and control of space capabilities remains a central issue in joint warfighting today. This analysis acknowledges the ongoing efforts to define it, but notes a distinction between C2 of space forces during operations, and the planning of a strategy as part of an overall theater campaign. The latter, in the near-term, will need to be done chiefly in theater, with the JFACC as its champion.

[31] Stephen L. McFarland and Wesley Phillips Newton, "American Strategic Air Offensive," 183-252, *Case Studies in Strategic Bombardment*, ed., R. Cargill Hall (Washington, D.C.: US Government Printing Office, 1998), 211.

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Safeguarding Our "Space Approaches"

Capt Michael C. Todd
Space Warfare Center

On 5 November 2004, Navy Admiral Timothy J. Keating assumed command of US Northern Command from General Ralph E. "Ed" Eberhart. In doing so, the hefty responsibility of defending the United States from those that wish to harm this nation was transferred to Admiral Keating. In his acceptance speech, he stated, "Protecting the nation and its territories would require constant vigilance and more."[1] This statement may compel one to assume it only applies to safeguarding our air, land, and sea approaches, but in fact, it also emphasizes the importance of protecting our "space approaches."

When US Northern Command was established, a new Area of Operations (AOR) was created. This AOR includes the continental United States, Alaska, Canada, Mexico, and their surrounding waters out to approximately 500 nautical miles. It also includes the Gulf of Mexico, Puerto Rico, and the US Virgin Islands.[2] There was a day when this country did not have to worry about an adversary attacking our homeland. But the attacks of 11 September 2001 forever altered this perception. Similarly, serious challenges to US dominance in space technology development and application seem far-fetched today. But just as our terrestrial approaches were compromised by an innovative and bold new adversary, it is only a matter of time before our space approaches are challenged. The task of defending US space dominance is difficult, but extremely important given our dependence on space services to support our diplomatic, information, military, and economic instruments of power.

The Department of Defense is heavily dependent on space assets to conduct their operations. However, the national dependence on space extends beyond the Soldier, Airman, or Sailor on the front lines. Nearly all US government and civilian computer and communications networks utilize space systems to some degree. As a result, space technology has become the 'Achilles Heel' of this nation. According to US Strategic Command, the United States is the nation most heavily reliant on space technology for its economy, defense, and way of life. Some examples of our dependency on space capabilities include:

- Near real-time satellite imagery for weather and intelligence, combined with instant satellite communications and the accuracy and timing provided by Global Positioning System (GPS) satellites, gives US commanders unparalleled awareness of operations and enable commanders to achieve military objectives in a relatively short amount of time.
- Global communications are becoming a way of life for most Americans to include instant access to credit and cash worldwide, the use of satellite phones and pagers, and satellite-delivered radio and TV.
- Instant communication between diplomats stationed abroad and the US State Department keep administration officials informed and prepared for a rapid response.[3]

With a list of dependencies such as this, it is easy to see why an adversary would want to deny or disrupt our ability to use space. The effect felt by the warfighter is clear. Eliminating the GPS signal to a precision guided munition dropped over a target could create unnecessary collateral damage. If satellite communications were denied over forward lines, the US would face a significant problem trying to pass along coordinates for close air support, resupply, or medevac. Likewise, a downed aircrew member attempting to communicate his location and status will have a more difficult time without GPS or satellite communications. However, none of these military scenarios are likely to happen within the borders of the United States. What about the effects of denying or disrupting the space capabilities used by the everyday American right here at home?

Many Americans underestimate our reliance on space. Removing space capabilities can affect the conveniences Americans have become accustomed to having at their fingertips. Point-of-sale credit authorization such as gas stations, retail stores, and restaurants are linked to banking institutions over satellite networks. National and international television networks disseminate programming to local broadcast and cable television providers. Today, many Americans get their news and entertainment programming directly from satellites. Even as far back as August 1999, over 12 million homes received television programs directly from satellites.[4] Denying access to this technology removes a major entertainment medium but also eliminates a news source. For example, it removes America's ability to obtain weather reports of approaching severe weather. Imagine the impact of Florida not having weather imagery during hurricanes Charley, Frances, Georges, Ivan and Jeanne during 2004. Many more lives would have been lost as a result.

Denial of America's space capabilities impact how we operate on a daily basis. This nation has put many of its eggs in one basket by relying on space for everyday needs. Removing one or more of the technologies that Americans depend on will have serious consequences. What measures should we use to defend or limit the effectiveness of enemy attacks?

What measures should be in place to make sure America is able to use space capabilities at any time?

On 2 August 2004, the Air Force Chief of Staff, General John P. Jumper, issued Air Force Doctrine Document 2-2.1, *Counterspace Operations*. In this publication, General Jumper outlines the role of Air Force space in the conduct of counterspace operations. General Jumper states, "We must be prepared to deprive an adversary of the benefits of space capabilities when American interests and lives are at stake."[5] This involves America's use of space during combat operations, but it also includes everyday uses of space. Protecting those space capabilities is the hurdle that must be overcome to ensure uninterrupted use. There are DCS measures that can be taken to maximize usage of both military and commercial space systems.

For the most part, protecting our space systems does not require orbiting space sentinels or the pre-emptive destruction of enemy capabilities. The effectiveness of hostile attacks can be limited with passive techniques. Many of these techniques can be implemented long before the systems are launched into space. Designing satellite command and control and uplink/downlink facilities to be highly resistant to physical attack is one passive technique. This is an easy task when the ground station is on a military installation, but becomes difficult for commercial facilities, which often must be collocated with customers and employee populations. Protecting commercial sites will take more planning, manpower, and effort. However, the repercussions of an attack on commercial space systems are no less painful to the US than an attack on military space systems.

Another passive defense technique is the creation of a robust network employing tactics such as frequency hopping or spread spectrum signals comprised of multiple redundant systems with the ability to reroute information in the face of attack. Physical dispersion of redundant ground stations will prevent a single point of failure. Using mobile ground stations further complicates targeting by an adversary. Dispersal also applies to satellites in space. Deploying them in various orbital planes and altitudes may also be an option.

Passive techniques, however, are no longer applicable when effective attacks occur. It is important to detect and confirm an attack has taken place, and then characterize the nature and impact of the aggression. The location of the attacker is important for suppression or neutralization. Once detection and characterization occurs, it may be possible to employ an active technique, which may involve a change in the satellite's configuration or location.

Maneuvering a space system is an example of an active technique. This may allow the system to avoid electronic jamming, or kinetic or directed-energy attacks against the satellite. The downside of maneuvering is the use of a limited supply fuel and possible interruption of the satellite's mission during the maneuver. If these limitations eliminate the maneuver option, then changing the system configuration may be a course of action. If a satellite is designed with redundant or alternate systems not affected by the attacker, controllers may be able to switch to these systems and continue the mission.

Regardless of the type of DCS technique used, sustaining our ability to operate freely in space is paramount to effective operations on earth. This applies not only to combat forces on the front lines, but also to the civilian populace and commercial endeavors. There are many examples of America's critical dependence on space capabilities. An attack on our space systems affects our ability to project military power and impacts our diplomatic, information, and economic sources of influence. The United States cannot allow its space resources to go unprotected. US Northern Command was created to guarantee homeland security, a mission that must include a full spectrum defense. By advocating sound DCS techniques for the protection of critical homeland space infrastructure, US Northern Command can prepare the Nation to defend itself against attack from our "space approaches."

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Notes:

[1] "Remarks by Admiral Keating during the Change of Command," US Northern Command, on-line, Internet, available from http://www.northcom.mil/index.cfm?fuseaction=news.showstory&storyid=3CA87963-E5FD-8DE5-4299F61610AEF985.

[2] "Who We Are: Homefront," US Northern Command, on-line, Internet, available from http://www.northcom.mil/index.cfm?fuseaction=s.who_homefront.

[3] Military Space Forces Fact File, US Strategic Command, on-line, Internet, 31 January 2005, available from http://www.stratcom.mil/factsheetshtml/militaryspaceforces.htm.

[4] Net Monthly Satellite Subscriber Additions, Satbiznews, 1999, on-line, Internet, 31 January 2005, available from http://www.satbiznews.com/monthly.html.

[5] AFDD 2-2.1, Counterspace Operations (2 August 2004).

Strategy Lost: Taking the Middle Road to Wherever

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In 1982, Lieutenant Colonel Timothy Kline asked the simple question, 'where have all the Mitchells gone?'[1] The airpower leaders Kline observed about him were efficient, industrious, and quiet. Nowhere, he asserted, could be found the bombastic and irascible presence of an airpower zealot the rank of America's Billy Mitchell or Italy's Giulio Douhet. The modern Air Force eschews the maverick pilot who carves out a place in the popular imagination, separated from and above the control of proper chain of command. Successful leadership in the new Air Force tends to be managerial, Kline argued, much more in the mold of business-efficacy than reckless daring do. Careful husbanding of resources is valued over boldness, caution over ardent spirit, and the promise of planned evolutionary change over breakthrough innovation. Such entrepreneurial individualism as Mitchell displayed may even cut against the grain of a proud tradition of service and subordination to civilian authority.

Compounding matters for space is a complete absence of zealots like Mitchell over which to wax melancholic. Though more than forty years have passed since the first manned space flight sent Soviet cosmonaut Yuri Gagarin into orbit (all of the giants of military airpower strategy were evident in the first few decades of the Wright Brother's first manned flight at Kitty Hawk), no such obvious space strategist has emerged to capture the public imagination. Remarking on this obvious dearth, Colin Gray asked pointedly, "Where is the Mahan of the Final Frontier?"[2] How is it that this new ocean has failed to spawn a strategic theorist of the rank of America's Captain Alfred Thayer Mahan, or even Britain's Julian Corbett? Now this is an enticing question. Why is it that land, sea, air, and even rail power have incited titanic prophets of change, and yet outer space, the most imaginatively visionary arena of all, has not?[3] This is not to suggest that space has not had great leadership. It has. A succession of great Air Force generalship, starting with Bernard Schriever and Hoyt Vandenburg, and in my personal experience, Generals John Piotrowski and Robert Herres, has made its mark in the Air Force annals of space power. These men represent the very best of not just *space* leadership, but of post-World War II *Air Force* leadership. So where is the Mahan of space?

Brigadier General William "Billy" Mitchell

It is possible that a space Mahan or Mitchell simply cannot come to the fore. The conditions that created military visionaries in the early development of new technologies applied in the cauldron of war are generally absent in space. Rather than a race to acquire new destructive capabilities from emerging technology, from its very inception, humanity's entry into the cosmos was tied inextricably to the specter of total annihilation via atomic then nuclear power. Every operational space launch vehicle today began as, or was adapted from, a ballistic missile program with aspirations of invulnerable nuclear warhead delivery. These weapons of war, most beginning with Nazi Germany's vaunted V2, were from the start carriers of terror and broad destruction. Accordingly, the desire of most who worked on the various space programs of the United States (and especially its most visible manned space program) was that they would not usher in a new era of totally destructive war, but rather one of peace and cooperation. Quite obviously, there is little room for military power zealots to thrive in such an environment, yet obstacles mount higher.

Although states have lauded their space accomplishments and astronauts, seeing in them evidence of superior economic or ideological prowess, the type of national manifest destiny that spurred the passions of past military zealotry has generally not been associated with space exploration. For

the Mitchells and Mahans of history, the future belonged to the great nations, those ready and willing to seize the mantle of leadership and force—if necessary—states of lesser vision to bend to their will. To the contrary, humankind was expected to enter space peacefully, joined as one in a powerful show of borderless unity. Only the most intelligent and physically fit were chosen to enter space, as exemplary representatives not only of their countries and families, but of all of humanity. Political correctness and cultural relativism have been essential components of space—especially military space—policies from inception.

General "Billy" Mitchell

Likewise, in the post-war age of democratization that nurtured early space exploration, not lost on the rank and file of the Air Force, a notion that the best and brightest of even the lowest ranks could contribute and succeed under the right conditions further stunted the emergence of zealots. Mitchell, Douhet, Mahan, and their ilk were social elites, products of the upper classes and imbued with a surety of belief that they were born to greatness. The officer aristocracy, developing from cadre-sized elite interwar militaries that generated past visionaries, simply did not exist along side the advent of space power, suborned as it was to the need for the massive standing militaries of the Cold War era.

Perhaps in the end it was simply this noble vision, that humanity would send only its best into orbit, in the process shedding its atavistic impulses and rejecting space as a base for national power, that military visionaries have not stepped forward to declare a new manifest destiny for the state that seizes and controls space. To be sure, in this environment, strong advocates for the militarization of space were not likely to capture the popular imagination and achieve heroic status. Quite the opposite; such persons would be labeled immorally villainous.

And so we enter into a new century with a competent and dedicated core of space professionals, and with a decided lack of strategic vision—for few are ready to take on the mantle of zealot. In the most controversial ongoing debate, for example, the inevitable weaponization of space, the consensus approach is simply to wait and see what happens.[4] Michael Krepon is perhaps the most passionate advocate of the so-called *hedging strategy*, which he defines as a readiness to respond purposefully in the event of unwelcome or hostile activities in space by another nation.[5] Peter Hays concurs, and argues that it is essential to maintain a significant and ongoing research program, but that to deploy weapons in space unilaterally would be far too provocative.[6] Indeed, the "sensitivity that surrounds the notion of weapons in space for offensive or defensive purposes" is obvious, according to the drafters of the 2001 Space Commission Report, and overt weaponization of space would likely precipitate domestic and international opposition, reprisals, and direct competition in space.[7] Of course, should any other state, ally or adversary, place weapons in space, then the decision context for the US is plain: "The question would cease to be whether the United States should acquire these weapons and become how and what kind it should acquire."[8]

"Mitchell, Douhet, Mahan, and their ilk were social elites, products of the upper classes and imbued with a surety of belief that they were born to greatness."

The most palatable of the hedging strategy arguments is that the US should maintain itself at the forefront of space weapons technology, so that in the event of another state choosing to place weapons in space, the US could quickly match or exceed its capabilities. Ceding the initiative to an opponent is rarely considered a good strategy, however, and then only for states that are in an inferior strategic position. Moreover, such a strategy is fraught with dangers and pitfalls. It is difficult enough to gain sufficient funding for a weapons program that will likely see deployment, more so for one that it is expected will never be deployed and that cannot be developed or tested until after it is needed.

Common to all hedging strategy proponents is the fear that placing weapons in space will spur a new arms race. Unfortunately, such a strategy increases the likelihood of a space arms race if and when space weapons are ultimately deployed, as the only plausible response by the US would be to at least match the opposing capabilities. This dithering approach blatantly ignores the current real world situation. At present, the US has no peer competitors in space. For the US to refrain from weaponizing until another state proves the capacity to challenge it allows for potential enemies to catch up to American capabilities. At a minimum, there is no risk for potential peer competitors to try. On the other hand, should the US reject the hedging strategy and unilaterally deploy weapons in space, other states may rationally decide *not* to compete. The cost of entry will simply be too great; the probability of failure palpable. In other words, the fear of an arms race in space, the most powerful argument in favor of the hedging plan, is *most* likely if the US follows its counsel.

More damning is the implicit hedging stratagem that asserts maintaining research allows for the rapid adoption and incorporation of breakthrough technologies in space weaponry, if and when they occur. This, too, is poor strategic thinking.

The issue is clear. To what extent should technology dictate strategy? Clearly technology is determining in tactics, and *can* be for strategy, but *ought* it be so? Such wait and see anxiety allows for the possibility that should a dominant weapons technology become available, then the US will be *compelled* to pursue and deploy it. This would amount to the equivalent of deferring strategic consideration to tactical capacity: because we can, we will.

True strategic thinking is not so malleable as this. It is purpose driven; attentive to an ever-changing horizon of possibilities and focused on the means to maintain a favorable future. It establishes conditions and constraints to which all must adhere, and in so doing determines its own opportunities. To plan for a future one hopes will never come is a traditional function of military strategy. To put all one's hopes in a future that *could* come, by deferring initiative and subordinating decision-making to events and technologies outside the strategist's control is blatantly wasteful, and potentially disastrous.

Lacking a true strategy to guide and inform, we risk running before the wind as a ship without a rudder, captive to the siren calls of technology and succumbing to the forces of powerful and dynamic strategies aligned against us. As the most powerful state in the world, and the most benign that has ever held such influence, it is up to the US to create the structure within which it will operate efficiently and effectively, with a clear mandate for global leadership. Regardless of the form that vision takes, we should not fear the reactions of others if our motives are true and our aims are public. Perhaps it is past time for the Mitchells and Mahans of space to come forward and be recognized.

Notes:

[1] Lt Col Timothy E. Kline, "Where Have All the Mitchells Gone?," USAF *Air University Review* 33 (1982), 28-32; reprinted in *Aerospace Power Journal* 11 (1987), 69-76.

[2] Colin S. Gray, "The Influence of Space Power upon History," *Comparative Strategy* 15 (1996), 293-308.

[3] For a complete exposition of the various visionaries of geopolitical power, see Everett Dolman, *Astropolitik: Classical Geopolitics in the Space Age* (London: Frank Cass, 2002).

[4] Karl Mueller of RAND has pointed out, correctly, that nothing is truly inevitable. Anything can happen, it is true. But to fail to prepare for a strong likelihood simply because it is not assured is a strategically weak argument. See "Is the Weaponization of Space Inevitable?" (paper presented at the International Studies Association Annual Meeting, New Orleans, La., 27 March 2002).

[5] Michael Krepon and Christopher Clary, *Space Assurance or Space Dominance? The Case Against Weaponizing Space* (Washington, D.C.: Stimson Center, 2003), 59.

[6] Peter L. Hays, *United States Military Space: Into the Twenty-First Century*, INSS Occasional Paper 42 (Maxwell AFB, Ala.: Air University Press, 2002).

[7] *Report of the Commission to Assess United States National Security Space Management and Organization*, (Washington D.C.: Government Printing Office, 11 January 2001); See also Krepon and Clary, *Space Assurance or Space Dominance?,* 2-3. For an excellent rebuttal, see Steven Lambakis, "Space Weapons: Refuting the Critics," *Policy Review Online,* no. 105, February 2001, on-line, Internet, 1 February 2005, available from http://www.policyreview.org/feb01/lambakis.html.

[8] Bob Preston, Dana J. Johnson, Sean Edwards, Michael Miller, and Calvin Shipbaugh, *Space Weapons, Earth Wars* (Santa Monica, Calif.: RAND, 2002), 70-73.

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Weaponization of Outer Space: US National Policy

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The debate about whether space weapons should be prohibited has been extremely controversial. The 2002 withdrawal of the US from the 1972 Anti-Ballistic Missile (ABM) Treaty and recent US ballistic missile defense efforts have prompted many States and international non-governmental organizations to urge a ban on arms in outer space.[1] This issue has been on the agenda of the Conference on Disarmament since the mid-1980s without agreement, mainly because the Conference requires the consent of all participants to take action and the US opposes the effort. US opposition is based on its belief that the "...existing multilateral arms control regime adequately protects states' interests in outer space and does not require augmentation."[2] Since 1994 the UN General Assembly has passed a total of eleven resolutions calling on States to prevent an arms race in outer space (PAROS). Few States have ever voted against these resolutions, and very few nations (often only the United States and Israel) have abstained from voting.[3]

Efforts such as these illustrate that international debate about the militarization and weaponization of outer space has increased in recent years. However, many academic, legal, and political writers oversimplify the debate, inaccurately portraying the space weaponization issue as a battle between warlike space hawks at one end and peace-loving space doves at the other, where these extremes are the only viable positions on the issue.[4] In this debate, US space policy is frequently mischaracterized as being at the "warlike" extreme, pursuing an unrestrained policy with the goal of weaponizing space at any cost. In reality, there are a wide range of views on the subject of weaponizing space, and US policy is more constrained than is often portrayed in the debate.

This article will outline existing US space policy, briefly discuss issues raised by current proposals to restrict the weaponization of space, and suggest that the debate about space weaponization is incomplete without a thorough examination of *existing* behavioral constraints, both legal and practical, affecting use of space weapons that are frequently ignored in the often-oversimplified space weaponization debate. Such existing constraints on the use of space weapons include international law principles that govern resort to armed conflict (called *jus ad bellum*, essentially embodied in UN Charter provisions governing use of force),[5] principles that limit the conduct of States once they are in a state of armed conflict (called *jus in bello*, embodied generally in the Law of Armed Conflict), and principles of neutrality, as well as US domestic law, policy, and practical considerations.[6]

WEAPONIZATION AND MILITARIZATION OF OUTER SPACE

Current Issues and Proposals Regarding the Use of Space Weapons

There is a wide spectrum of views on the space weaponization issue ranging between two extremes.[7] At one end of the spectrum are those who believe that space is merely another theater of military operations, offering strategic advantages in which weapons should be deployed; at the opposite extreme are those who believe that only stabilizing military uses of space (such as monitoring compliance with arms control agreements and early warning) should be allowed.[8] However, the debate is far more complex than the two extremes, with many disarmament proposals falling in the so-called "middle ground."

In general, however, advocates of space weaponization believe that States will develop either defensive systems to defend their valuable space assets or offensive systems to deny an enemy's access to their valuable space assets. They further note that, once developed and deployed, space weapons could be used for either purpose, whether designed to be defensive or offensive. These experts cite the evolution of the use of space assets from indirect military support (such as reconnaissance) to direct support of ground-based weapons systems (such as GPS-aided munitions) as proof that the use of space assets as weapons platforms is the next natural step.[9]

In contrast, there are also those who argue that space powers should refrain from developing space weapons, since militarily those States have the most to lose by weapons in space.[10] A recent analysis stresses the growing importance of commercial space assets (both to national economies and to armed forces) as the strongest argument against weaponization of space, arguing that a stable, weapons-free space environment is in the best interests of those nations who heavily rely on commercial satellites.[11] The same source points out that private investors may hesitate to invest in space ventures given weapons-related risks on top of inherent technical hurdles. Surprisingly, the policy advocating the placing of weapons in outer space does not enjoy unanimous support among the US military. Some US active duty officers believe space should not be weaponized, both for practical and moral reasons.[12]

Many of the current proposals to restrict weapons in space are based on the idea that it is not easy to unring a bell, *i.e.*, it is easier to prevent weapons in space than to stop or control them once they are in space. Thus, *prevention* of the "weaponization" of space is a major theme of the Prevention of an Arms Race in Outer Space (PAROS) effort in the UN Conference on Disarmament, as reflected in the terms of the recurring General Assembly resolutions and associated papers submitted by the Chinese and Russian delegations.[13] Such space arms control

proposals are based on the idea that space is a new, as-yet-unspoiled frontier, a sanctuary for the "common interest" of all mankind that should be used for "peaceful purposes" and, accordingly, should be protected against "weaponization."[14] However, some space disarmament proposals go further and would also prohibit so-called "militarization" of space to the extent that military uses of space directly contribute to conventional warfighting. Under such a view, only limited military uses of space would be authorized, including the use of space for treaty verification and confidence-building measures.[15]

It is generally accepted that space is "militarized" – reliance on space systems by the militaries of space powers is well-documented.[16] Militarization includes the current use of space systems to directly support terrestrial combat operations and directly impact terrestrial targets.[17] However, it is also generally stated that space is not currently "weaponized," since there are no space-based weapons presently in orbit. Some authors have recently criticized this statement, instead arguing that space is already "weaponized," as well, based on three facts:[18]

> (1) space systems are already used in direct support of terrestrial combat and to directly impact terrestrial targets,
> (2) satellites are currently being targeted by ground-based weapons,[19] and
> (3) both the US and the former Soviet Union have already occasionally tested anti-satellite (ASAT) weapons and in the past have also developed and tested anti-ballistic missile (ABM) defenses.[20]

Thus, it can be argued that "maintaining" the "sanctuary" of space is an ideological myth contradicted by the practices of States. In addition, the lack of consensus regarding the very definitions of the terms "militarization" and "weaponization" contribute to the uncertainty in this debate. For simplicity, this article will generically refer to all proposals to restrict certain types and uses of space weapons as attempts to limit the "weaponization" of space.

Adding to the controversy inherent in the space weapons debate is the lack of a generally accepted definition of the term "space weapon."[21] The greatest point of contention appears to be whether ground-based weapons directed at targets in space are "space weapons" or whether "space weapons," almost by definition, are in orbit. Recent scholarship appears to be more willing to adopt an inclusive view that the term "space weapon" includes:

> (1) ground- and space-based weapons that can attack and/or negate on-orbit space systems, and
> (2) space-based weapons that can attack or negate targets on the surface of the Earth.[22]

However, it is not so clear that States accept this broad definition that ground-based weapons, even if directed at targets in space, are "space weapons."

In addition to the repeated PAROS calls for an international convention to ban "space weapons" outright.[23] There have also been more moderate "middle ground" proposals, such as those that would encourage unilateral restraint in developing or deploying all or certain types of space weapons, establish a space "Code of Conduct," or create "Rules for the Road" governing use of weapons in space.[24] Unfortunately, even these "middle ground" proposals tend to ignore existing, important restrictions on using space weapons, such as other international law principles governing the use of force in armed conflict. These existing restrictions will be discussed in more detail later in The Law of Armed Conflict section.

Another weakness is that many of these proposals (even the "middle ground" proposals) presume that additional prohibitions or restrictions on space weapons are desired *ends* unto themselves, rather than recognizing them as possible *means* to the desired end of global stability. As has been stated by the US Permanent Representative to the Conference on Disarmament, Ambassador Javits:

> [a]rms control and disarmament approaches are … only a means to an end, a tool that States can choose to employ - or not - in our mutual efforts to ensure international peace and security. And just as a screwdriver would be a poor choice for a carpenter who needs to hammer in a nail, it is clear that arms control and disarmament approaches may not always be suited to the circumstances at hand.[25]

Even when proponents do consider their disarmament proposals as means to an end, the "end" may be so narrowly defined as to presume the means (restrictions on weapons in space). For example, one recent study examined "space security" as the desired goal. Notably, the study focused on security in *space* as an end (rather than looking at the broader goal of *global* security), an approach which virtually preordains the results of the study, especially when the term "space security" is defined as "secure and sustainable access to and use of space; and *freedom from space-based threats*." [emphasis added][26] Using such a narrow definition, it is self-evident that limitations on deployment of weapons in space would further the stated goal. Any movement toward weaponization of space would almost by definition reduce this "space security," without considering the larger picture. In fact, restrictions on space weapons may not necessarily contribute to international stability. A very real argument can be made that proper employment of space weapons may actually contribute to global security. Again in the words of Ambassador Javits,

> Improving our ability to support military operations worldwide, monitor and respond to military threats, and monitor arms control and non-proliferation agreements are key priorities for our national security space activities -- and they help strengthen international stability and security.[27]

Protecting Space Assets: Potential Use of Force in Space

Once a State relies on space assets for its national security, it must ensure it has reliable access to those space systems and to space in general. States may accomplish this goal in a number of ways; one focus of so-called "space-faring" States is to maintain their own healthy domestic space industries, which may include efforts to deny access to space technologies to others through non-proliferation and export controls. At the same time, States have developed various means to protect their space assets. For example, satellites are hardened or shielded to protect them from naturally occurring radiation

and from hostile electromagnetic pulses. Satellites are often maneuverable, mainly for accurate positioning but potentially also to avoid collisions with space debris and other satellites, and to protect them in the future from space weapons. Satellites also have redundant components in case of failure. Further, signals sent to and from satellites may be encrypted to lessen the likelihood of spoofing,[28] interception, or jamming.[29] In addition, the ground segment, including launch platforms and communications links, is protected by physical barriers and armed forces.[30]

The US has defined "space control" as the ability to assure its access to space and, when directed, deny adversaries the use of space.[31] Notably, space control is a broad concept that does not necessarily require space weapons to be attained. In the past, anti-satellite (ASAT) weapons were seen as the key to denying adversaries the use of space, since the very purpose of an ASAT is to destroy or incapacitate other satellites in orbit. However, in 2001 the head of then-US Space Command expressed concern about using kinetic energy ASATs, since the debris left in orbit from the use of these weapons could damage friendly satellites, civilian and military, belonging to the US and its Allies.[32] This expressed concern is consistent with current US National and Department of Defense (DoD) space policy to minimize the creation of space debris.[33] Accordingly, instead of concentrating on ASAT technology as the centerpiece of its space control effort, recently the US has been funding alternative space control technologies to protect US space systems and to deny the use of space to adversaries through such means as jamming, spoofing, and disabling ground communications links, control centers, and launch pads.[34]

While both the US and the former Soviet Union have occasionally tested anti-satellite (ASAT) weapons and in the past have also developed and tested anti-ballistic missile (ABM) defenses, for forty-five years the major powers have, for the most part, refrained from deploying capabilities for armed conflict in space.[35] However, that may change in the not too distant future, as the US for one is actively pursuing a ballistic missile defense system capable of intercepting missiles of different ranges in all phases of flight. According to a White House press release of May 2003, systems planned for operational use in 2005 include ground- and sea-based missile interceptors using land-, sea-, and space-based early warning sensors and radars.[36] Potential future system upgrades include a planned airborne laser. Development of hit-to-kill (kinetic energy) interceptors based on the ground, sea, and air to destroy missiles in the boost and midcourse phases of flight continues. The US is also attempting to develop, as part of its missile defense program, space-based weapons capable of destroying missiles in the boost phase of flight.[37] One such project is a space-based laser (SBL), and another a kinetic energy weapon designed to physically hit a targeted ballistic missile in its boost phase and destroy it.[38]

However, all proposed "space weapons" being considered by the US do not require "shooting down" adversary satellites. Some new and planned space weapons systems are designed to be capable of incapacitating a satellite temporarily by degrading, denying, or disrupting its signal. In fact, US DoD Space Control Policy states that the *preferred* US approach to negating space systems or services hostile to US national security interests is such "tactical denial." Tactical denial means that the denial or negation of the hostile system will have localized, reversible, and temporary effects.[39] In September 2004, the Air Force declared operational a new system with such capabilities – the Counter Communication System (CCS), which is a "ground-based deployable system designed to deny a potential enemy the use of a satellite communications system employing temporary and reversible methods."[40] The CCS can be considered a "space weapon" under the broad definition described in this article, even though it is ground-based, since it is designed to negate (albeit temporarily) a satellite. That the CCS has not received extensive negative media coverage is likely due to the fact that it is ground-based, an Earth-to-space weapon, and therefore "less provocative" than a space-based system.[41]

Thus, despite the recent shift in focus from ASATs to alternative space control methods and ballistic missile defense, it is quite possible that the future will see States protecting their own space assets or attacking enemy assets from, in, or through space.

Summary of Legal Arguments Regarding Militarization and Weaponization of Space

"Peaceful Purposes"

Recent years have seen a continuous escalation of the uses of space for military purposes. Even as space powers reiterate their commitment to the use of space for "peaceful purposes," they now routinely and overtly use satellites and space systems in direct support of military operations, arguing that this direct support is "peaceful."[42] Such direct support includes the use of satellites for communications between forces engaged in armed combat; intelligence-gathering for selection of targets; precision-guidance systems to accurately steer weapons to their targets; and data-collection by remote sensing for battle damage assessment. These uses, coupled with a lack of formal protests regarding them, led one expert to conclude:

> Given the ambiguity of the term "peaceful" as used in the [Outer Space Treaty] OST, as well as the overt and covert practice of the two state actors in outer space, the conclusion is inescapable that all military uses of space other than those prohibited by treaty were – since the beginning of space exploration and still today – lawful as long as they do not violate any of the principles and rules of international law (*e.g.*, uses that represent the threat or employment of force).[43]

Article IV of the Outer Space Treaty provides two arms control provisions limiting military uses of space:

> (1) nuclear or other weapons of mass destruction will not be placed in orbit around the Earth, on the moon or any other celestial body, or in outer space, and
> (2) the moon and other celestial bodies will be used exclusively for peaceful purposes; establishing military bases, testing weapons of any kind, or conducting military maneuvers on the moon and other celestial bodies is forbidden.[44]

However, the term "peaceful" remains undefined in the context of international space law and has been the source of continuing

and frustrating debate. It has been argued that the plain meaning and

> "[t]he widely accepted interpretation given this key term of space law prior to and immediately after the advent of the space age, namely that 'peaceful' means 'non-military,' was soon contradicted by the practice of States, primarily the United States and the Soviet Union."[45]

Thus, the definition of "peaceful" seems to be expanding according to State practice. For example, for over forty years the US has defended the position that "peaceful" means "non-aggressive," so that any military use is lawful so long as it does not violate either Article 2(4) of the UN Charter, which prohibits "the threat or use of force," or Article IV of the Outer Space Treaty.[46] In 1991, while examining the legality of using Inmarsat communications satellites in support of armed conflict in the first Gulf War, The Judge Advocate General (TJAG) of the US Navy concluded that the use of Inmarsat to support the US-led coalition was legal since it was performed under the auspices of UN resolutions.[47] The US Department of State, in its support of the Navy opinion, stated:

> The Convention does not define "peaceful purposes," and its negotiating history does not suggest a specific meaning. Under such circumstances, the term ... should be given the meaning that it has been accorded under the law relating to space activities. Under such a reading, "peaceful purposes" does not exclude military activities so long as those activities are consistent with the United Nations Charter.[48]

One US official has expressed the view that "non-aggressive" is itself too restrictive a description, that "[t]here are times when 'aggression' is permissible (*e.g.*, for the common interest, peace-keeping or enforcement, or individual or collective self-defense").[49] He further argues that there is an important distinction between peaceful "purposes" and peaceful "uses." Thus, satellites may be "used" to support armed military operations, as long as the "purpose" of the use is to restore a "climate of peace."[50] Under this interpretation even weapons in space, as long as they are not weapons of mass destruction prohibited under Article IV, if used for "peaceful purposes" would not violate the Outer Space Treaty. Arguments could be made that Article IX of the Outer Space Treaty, which allows each State Party to request consultation if it believes the space activities of another State might cause harmful interference to the peaceful use of space, could be used to challenge and constrain a particular military activity.[51] However, various unopposed military uses of space may as a practical matter enlarge the unofficial definition of "peaceful purposes" to the point that specific arms control agreements may be the only effective limitation on development and deployment of various weapons in space. Nonetheless, it is also important to recognize that other bodies of international law govern States' resort to the use of force from, in and through space, and that the Law of Armed Conflict (LOAC), implemented on the domestic level in the US through Rules of Engagement (ROE), provides important limits on the actual *employment* of space weapons. These LOAC principles are often ignored in the general debate on space weaponization and will be discussed in The Law of Armed Conflict section.

"Our goal is not to bring war into space, but rather to defend against those who would."

- Donald H. Rumsfeld, US Secretary of Defense

Arms Control Limitations and Other Bilateral Agreements

Military uses of outer space may also be limited by specific disarmament and arms control agreements. In addition to the Outer Space Treaty, already discussed, the following merit mention:[52]

> (1) The 1963 Limited Test Ban Treaty prohibits "any nuclear weapon test explosion, or any other nuclear explosion" in the atmosphere, underwater, or in outer space.[53]
> (2) The Biological and Toxins Convention of 1972 and the Chemical Weapons Convention of 1992 prohibit development, production, stockpiling, and acquisition of biological agents, weapons containing toxins, and chemical weapons for hostile purposes.[54]
> (3) The 1980 Environmental Modification Convention prohibits all military or hostile environmental modification techniques that might cause long-lasting, severe or widespread environmental changes in Earth's atmosphere or outer space.[55]
> (4) A series of bilateral agreements between the US and the former Soviet Union (now binding on Russia) prohibit interference with early warning systems and technical means of verification (reconnaissance and communications satellites) to reduce the risk of nuclear war and monitor treaty compliance.[56]

It has been noted that the series of US/Russia bilateral agreements establish a limited regime that protects certain types of satellites. It has further been suggested that "[t]hese bilateral agreements may set precedents in codifying the norm of non-interference with Earth-orbiting objects," opening the possibility of widening the scope of satellite protection beyond the bilateral level.[57] Perhaps heeding this observation, a recent US Congressionally-mandated commission to assess space issues warned, "The US must be cautious of agreements intended for one purpose that, when added to a larger web of treaties or regulations, may have the unintended consequence of restricting future activities in space."[58] It is safe to conclude, therefore, that the US will at least in the foreseeable future preserve the *status quo* of relatively permissive space law (including resisting further multilateral arms control agreements) to keep its military options open.

On the other hand, the US is Party to numerous bilateral agreements that, although not traditional "arms control" agreements, may restrict space activities by limiting certain "space activities" from being performed in or from the territory of a State Party. For example, in the US pursuit of a ballistic missile defense system, it is entirely foreseeable that States

could impose additional restrictions on US space activities in exchange for the US right to base ground- or link- segments in that State. The existence of such agreements and potential limitations on space activities thereby imposed should not be ignored in a debate on the weaponization of space.

US POLICIES ON MILITARIZATION AND WEAPONIZATION OF OUTER SPACE

US Space Policy: Myth and Reality

There is no specific desire or goal to "weaponize space."[59]

-Peter B. Teets, Under Secretary of the US Air Force

Our goal is not to bring war into space, but rather to defend against those who would.[60]

- Donald H. Rumsfeld, US Secretary of Defense

Given the backdrop of relatively permissive international *space* law (often referred to as the *corpus juris spatialis*), it is necessary to look at other constraints on US use of space weapons imposed by other bodies of international law such as the Law of Armed Conflict, as well as domestic restrictions on the use of space weapons. In addition, given widespread mischaracterization of US space policy, it is important to understand what US space policy really says about weaponization.

For example, concepts such as "space superiority" and "space control" have been quoted out of context and cited as proof of an unrestrained US space policy, actively pursuing the goal of weaponizing space at any cost and denying other nations access to space under any circumstances. In fact, US space policy is far more restrained. Terms such as "space superiority" and "space control" have specific definitions and should be properly examined in the context of numerous lengthy policy and doctrine documents setting out a framework of: 1) deterrence, 2) warning, and then 3) if necessary, defending against or countering hostile attack.[61]

"Space superiority" is simply defined as the degree of dominance in space of one force over another that *permits the conduct of operations* by the former *without prohibitive interference* by the opposing force.[62] Space superiority is achieved through "space control" operations, which as pointed out previously do not necessarily include the use of weapons. Further, the phrase "space control" is defined as the ability to "ensure freedom of action in space for the United States and its Allies and, when directed, deny an adversary freedom of action in space." US policy documents repeatedly state that such direction and action to deny an adversary freedom of action in space must comply with international law.[63]

Although the US believes there is no legal prohibition on placing conventional weapons in orbit, the ultimate decision whether to develop and employ space weapons is left to the President, under the advisement of the Secretary of Defense, and with the approval and funding of the Congress. It would be more accurate to portray current US policy as keeping military options open while allowing the development of technology to drive evolution of law and policy.[64]

> It is incumbent on the [US] armed services to remain open to a wide range of possible capabilities and systems that will enable us to deny our adversaries the advantages gained from space that could be used in a manner hostile to the United States, our citizens, or our national interests. The force structure of the armed services is and will continue to be fully compliant with our international obligations, treaties, and our right to self-defense as spelled out in the UN Charter. If the research and development proves promising and an exhaustive analysis of alternatives concludes that the best/only way to ensure our national security is to base a defensive capability in space, then that option will be provided to the President and Congress for subsequent approval and funding.[65]

The focus of this article is on the two mission areas of space control ("develop, operate, and maintain capabilities to ensure freedom of action, and if directed, deny such freedom of action to adversaries"[66]) and force application (the concept of combat operations in, through, or from space -- including ballistic missile defense – again, consistent with Presidential policy and international law), since this article deals with the issue of space weaponization.[67] It is clear that development of weapons to meet these mission capabilities is authorized, and there is no policy limitation on where these weapons must be based, either on the ground or in space.[68]

Further, as mentioned previously, it is DoD policy that the preferred US approach to negating space systems or services hostile to US national security interests is "tactical denial," meaning that the negation will have localized, reversible, and temporary effects. However, the option for irreversible denial, including destruction, will be retained.[69]

US Rules of engagement (ROE) "provide guidance governing the use of force" by US Armed Forces. The ROE are evidence, therefore, of US interpretation and implementation of law and policy. Examination of the ROE, therefore, is instructive as they may contain additional restrictions on the use of space weapons.

Rules of Engagement: Implementation of Law and Policy

Rules of engagement (ROE) "provide guidance governing the use of force" by US Armed Forces.[70] Simply put, ROE are the rules under which the US military might fight. A pre-defined set of ROE, called the Standing ROE (SROE), applies to military attacks against the US and to all "military operations, contingencies, and terrorist attacks occurring outside the territorial jurisdiction of the US." Peacetime operations within the US are not governed by the SROE, but are covered by rules on the use of force.[71] The purposes of the SROE are threefold:

> (1) provide guidance for the use of force to accomplish a mission,
> (2) implement the inherent right of self-defense, and
> (3) provide rules to apply in peace, armed conflict, and transition periods between peace and conflict.

The SROE are issued by the Chairman of the Joint Chiefs of Staff (CJCS) and are approved by "the President and the Secretary of Defense or their duly deputized alternates or successors."[72]

Combatant commanders of specific theaters of operations may augment the SROE based on changing political and military policies, threats, and missions in their assigned areas.[73]

These theater-specific ROE must also be approved by the President and the Secretary of Defense through the CJCS. Commanders at every level of command establish ROE to accomplish their assigned missions. These supplemental ROE must comply with ROE of senior commanders. Importantly, these supplemental ROE may only issue guidance for using force for mission accomplishment – they may *never* limit a commander's right and obligation to use force in self-defense. Accordingly, supplemental ROE either authorize a certain action or place limits on the use of force. Notably, some types of actions and the use of certain weapons require combatant commander or even Presidential/Secretary of Defense authorization.[74]

The SROE, ROE, and the rules for the use of force are *not* law – they are military directives. However, the ROE are "the principal mechanism of ensuring that US military forces are at all times in full compliance with [US] obligations under domestic as well as international law."[75] Examination of the US SROE is instructive, since they are based on what one expert calls the "three pillars – national policy, operational requirements, and law."[76] The ROE are evidence, therefore, of US interpretation and implementation of law and policy. It is noteworthy that the office responsible for the ROE is the operations division (representing the warfighter), with the advice of the military lawyer.

In response to an increasing number of multinational coalitions and joint operations, the basic SROE are now unclassified to ease coordination with US Allies for the development of multinational ROE consistent with the SROE.[77] Attachments to the SROE (called "Enclosures") contain details about and guidance for using force in specific types of operations (including Space Operations and Information Operations), but will not be addressed in this article beyond a general, unclassified level. The discussion that follows will examine international law principles as applied to US and Allied forces through the SROE.

Self-defense

In addition to issuing guidance for using force to accomplish a mission, the SROE contain detailed provisions on self-defense. The basis for the self-defense guidelines in the SROE is the Charter of the United Nations and customary international law.[78] Article 51 of the UN Charter states in part: "nothing in the present Charter shall impair the inherent right of individual or collective self-defense *if an armed attack occurs* against a member of the United Nations [. . .]" [emphasis added]. Most States interpret this article to be much more limited in its coverage than the right granted States under customary international law – the right of preemptive self-defense. The US, however, has long maintained that so-called "anticipatory" self-defense is authorized under both customary international law and the UN Charter.[79] This view is controversial and not accepted by many UN Member States.[80]

This US position, which is embodied in the SROE, is based largely on a liberal reading of the famous dispute between the US and the United Kingdom in the *Caroline* case.[81] In this incident, probably the first recognition internationally of the concept of anticipatory self-defense, the parties agreed that such action, to be lawful, must not only rise from necessity, but it must also be proportional to anticipated harm.[82] Likewise, the SROE require necessity and proportionality for the application of force in self-defense.[83] According to the SROE, necessity "exists when a hostile act occurs *or when a force or terrorist(s) exhibits hostile intent*." [emphasis added] "Hostile intent" is further defined in the SROE as

> The *threat of imminent use of force against* the United States, US forces, and in certain circumstances, *US nationals, their property, US commercial assets*, and/or other designated non-US forces, foreign nationals and their property. *Also, the threat of force to preclude or impede the mission and/or duties of US forces*, including the recovery of US personnel or vital US property. [emphasis added][84]

While there is some historical and scholarly justification for anticipatory self-defense, the US position as reflected in the SROE is more expansive than the interpretation of that term given by many States.[85]

Under customary law, lawful anticipatory defense was limited by the requirement that the expected attack exhibit such a high degree of imminence that effective resort to non-violent response was precluded.[86] Many scholars argue that Article 51 of the UN Charter demands an even higher standard of necessity, since it recognizes the right to self-defense "if an armed attack" (as distinguished from an *expected* attack of any degree of imminence) occurs.[87] Other experts opine that anticipatory self-defense is not precluded by Article 51 of the UN Charter, arguing that: the drafting history of Article 51 does not indicate an intent to narrow the customary law definition; the language of Article 51 does not say "if *and only if* an armed attack occurs"[88] [emphasis added] and therefore does not narrow customary law's recognized inherent right to self-defense; also, newer weapons systems and contemporary nonmilitary coercion techniques must be considered in the definition of "armed attack."[89]

In any event, the broad view of anticipatory self-defense is clearly reflected in the now-unclassified SROE. On its face, the language of the SROE would appear to allow, at least in certain circumstances, anticipatory self-defense against threatened attacks on US telecommunications or remote sensing satellites. Accordingly, such defensive measures could be justified either as threats to US commercial assets or, in light of the military's reliance on such commercial systems, as threats that would impede the mission of US forces.

The requirement of proportionality in the application of self-defense has been defined as requiring the quantum of responding force to be "limited in intensity and magnitude to what is reasonably necessary promptly to secure the permissible purposes of self-defense."[90] Similarly, the SROE define proportionality as force "reasonable in intensity, duration, and magnitude to the perceived or demonstrated threat based on all facts known to the commander at the time."[91] Implementing these requirements, the SROE set out the following guidelines for self-defense:

(1) De-escalation: warning and giving the hostile force an opportunity to withdraw or cease, when time and circumstances permit;
(2) Using proportional force which may include nonlethal weapons; and
(3) Only attacking to "disable or destroy" when that is the "only prudent means" to terminate a hostile act or intent.[92]

These SROE restrictions may well limit US responses to attacks on US space systems, as they may require warning and/or the use of non-destructive force in certain circumstances.

The SROE also distinguish between national, collective, unit and individual self-defense. In defending oneself or one's unit (military force element), SROE requires that one be defending against an observed hostile act or demonstrated hostile intent. Notably, the SROE defines the role of the commander in exercising *unit* self-defense as a right *and an obligation*.[93] The invocation of *national* self-defense, which means defending US forces (and in some circumstances US nationals, property and commercial assets), will most often result from a designated authority declaring a foreign force or terrorist(s) hostile; hence, individual units need not observe a hostile act or hostile intent. *Collective* self-defense, which according to the SROE involves defending non-US forces and property, must be based on an observed hostile act or intent and can only be authorized by the President and the Secretary of Defense or their designated alternates.[94] These provisions also apply to space systems, and therefore may limit national self-defense to properly designated US space assets, and may limit collective self-defense to non-US systems only if designated by the President or Secretary of Defense *and* only to defend these non-US systems against actively or imminently hostile adversary systems.

It is generally accepted in the international community that the UN Charter provisions regarding the use of force in self-defense apply to the use of force in outer space.[95] This principle is also explicitly reflected in US space policy, which states that

> [p]urposeful interference with US space systems will be viewed as an infringement on our sovereign rights. The US may take all appropriate self-defense measures, including, if directed by the [President/Secretary of Defense], the use of force, to respond to such an infringement on US rights.[96]

The Use of Force for Mission Accomplishment

Although most of the unclassified portions of the SROE focus on self-defense, the SROE also provide guidance for the application of force to accomplish specific missions. Accordingly, the development of rules of engagement mandates consideration of political, military, and legal limitations that affect ROE such as: international law (including the UN Charter), US domestic law and policy, host nation law and bilateral agreements with the US, ROE of coalition forces, and UN Security Council resolutions.[97] This section will focus on those limitations imposed by the body of international law called the Law of Armed Conflict.

The Law of Armed Conflict

The law of armed conflict (LOAC, also called the "law of war") is the branch of international law regulating armed hostilities.[98] Under the SROE, "US forces will comply with the Law of War during military operations involving armed conflict, no matter how the conflict may be characterized under international law."[99] In other words, the US does not have to be in a declared war for LOAC principles to be binding on its military forces. Although a detailed discussion of LOAC is beyond the scope of this article, it is important to briefly outline its sources and general principles.

LOAC is derived from two main sources: customary international law and treaty law. The treaties regulating the use of force were concluded at conferences held at The Hague, Netherlands and Geneva, Switzerland and can be divided into two main areas: the "law of The Hague" and the "law of Geneva."[100] In general terms, The Hague treaties deal with the behavior of belligerents and the methods and means of war (for example, lawful and unlawful weapons and targets), while the Geneva agreements address the protection of personnel involved in conflicts (*e.g.*, Prisoners of War, civilians, the wounded). LOAC sets boundaries on the use of force during armed conflicts through application of several principles:

(1) **Necessity:** only that degree of force required to defeat the enemy is permitted. In addition, attacks must be limited to military objectives whose "nature, purpose, or use make an effective contribution to military action and whose total or partial destruction, capture, or neutralization at the time offers a definite military advantage";
(2) **Distinction or Discrimination:** requires distinguishing military objectives from protected civilian objects such as places of worship and schools, hospitals, and dwellings;
(3) **Proportionality:** requires that military action not cause collateral damage which is excessive in light of the expected military advantage;
(4) **Humanity:** prohibits the use of any kind or degree of force that causes unnecessary suffering; and
(5) **Chivalry:** requires war to be waged in accordance with widely accepted formalities, such as those defining lawful "ruses" (*e.g.*, camouflage and mock troop movements) and unlawful treachery (for example, misusing internationally accepted symbols in false surrenders).[101]

The combination of these LOAC principles, as implemented on the US domestic level by the SROE, imposes a legal and moral obligation to reduce non-combatant civilian casualties. In application, this can be difficult as military and civilian systems, particularly space systems, become more and more intertwined.[102] As one active duty military officer recently stated:

> Dispersing combatants and military objects into the civilian community is offensive to international law because it violates the principle that defenders have an obligation to separate military targets from civilians and their property [. . .] But as societies become technologically integrated and, more important, dependent upon technology, separating military and civilian facilities becomes immensely more complicated.[103]

Especially where civilian and military personnel and facilities are so intertwined, space systems currently provide an enhanced ability to meet these LOAC requirements (particularly necessity, distinction, and proportionality), since military use of space systems enables accurate targeting and a reduction in unnecessary civilian collateral damage. Accordingly, it may be argued that LOAC actually *requires* States engaged in armed

conflict to use available technologies, including space assets in direct support of the warfighter, to meet these LOAC requirements.[104] As a practical matter, public opinion worldwide expects the US military to successfully carry out near-surgical strikes with minimum civilian casualties, even when attacking legitimate military targets. Taking this argument one step further, future space *weapons* may similarly reduce civilian casualties in armed conflict. Therefore, States may well have a moral, if not legal, *obligation* under LOAC principles to use such future space weapons to reduce non-combatant civilian casualties. From this perspective, the idea that technological developments *should* be allowed to drive the evolution of law may well be correct,[105] even if unpopular when characterized as the danger of "creeping weaponization."[106] As one scholar has pointed out, the technological developments of the airplane and the tank eventually helped break the deadly stalemate of trench warfare with few attacks on the ethics of their use.[107] On the other hand, chemical and biological weapons were found to have unacceptable effects and have been outlawed in international conventions.[108] These are both examples of technology properly driving the evolution of law.

One US scholar has further proposed expanded application of these LOAC concepts and questioned whether the availability of such technology imposes a corresponding moral obligation on the US government to reduce the casualties of it's men and women in uniform once committed to armed conflict.[109] Again, even if not morally or legally required, public opinion certainly expects the government to minimize the loss of US military lives where possible.

ROE Relating to Outer Space

The SROE also contains rules that specifically apply to US military *space* operations (in an attachment to the SROE called an "Enclosure"). The unclassified description of this Space Enclosure states that it defines indicators of hostile acts and hostile intent directed against US space forces and space assets, as well as the circumstances and authority required for actions to protect both military and other designated space assets.[110]

Current SROE reflect great restraint in taking any action that could affect "military or civilian space systems such as communications satellites or commercial earth-imaging systems" even if they are used to support hostile action. This restraint recognizes that affecting "third party or civilian space assets can have significant political and economic repercussions." Accordingly, "commanders may not conduct operations against [foreign] space-based systems or ground and link segments of space systems" without specific authorization.[111] These significant restrictions on targeting adversary and third party military and civilian space systems clearly reflect the reality that the military and civilians rely on the same space systems for critical services and imbed the LOAC concerns of necessity, proportionality and discrimination in space-specific ROE.

Restrictions Based on Neutrality of Third Parties

Similarly, the restraints on impacting third party space systems respect the international law concept of neutrality. Under LOAC principles, legitimate military targets must be distinguished from protected civilian objects. Anticipated collateral damage must be weighed against expected military advantage, and excessive civilian damage avoided. However, force may lawfully be used against objects which an adversary is using for a military purpose, if negation of the object would offer a definite military advantage.[112] The analysis becomes more complex, however, when the object being used by the adversary belongs to a "neutral" third party.

Nonparticipants in a conflict may declare themselves to be neutral.[113] As long as the neutral State does not assist either belligerent party, it is immune from attack by the belligerents. However, if one of the belligerents uses the territory of a neutral nation in a manner that gives it a military advantage and the neutral nation is unable or unwilling to terminate this use, the disadvantaged belligerent has the right to attack its enemy in the neutral's territory.

Traditionally, the laws of neutrality did not require a neutral State to prevent its private entities from trading with belligerents.[114] However, increasing governmental control and involvement in trade led to the practical erosion of the distinction between private and governmental actors, and it is now commonly accepted that neutral States have an obligation to prevent acts of supply to belligerents by their private entities.[115] Since space law accords States responsibility over their private entities involved in space operations, an even stronger argument can be made to hold a neutral State responsible for the actions of its private entities.[116] In addition, when a State issues a license authorizing a private entity to provide certain services, there can be little argument that the State should be held responsible for subsequent conduct of the private entity. Accordingly, if a neutral State permits its space systems to be used by a belligerent military, the opposing belligerent would have the right to demand that the neutral State stop doing so. If the neutral State is unwilling or unable to prevent such use by one belligerent, it would seem reasonable to authorize the other belligerent to prevent the offending use. In the context of space systems used in time of conflict, before resorting to force a belligerent could (or should) demand a neutral nation not to provide satellite imagery, navigation services, or weather information to its adversary.[117]

However, belligerents may have no similar right to limited self-defense in neutral territory when the use of satellite *communications* systems is involved. Articles 8 and 9 of the Hague Convention V (which notably was concluded in 1907, decades before satellite communications systems were even envisioned) provide that a neutral State is not required to restrict a belligerent's use of "telegraph or telephone cables or of wireless telegraph apparatus belonging to it or to Companies or private individuals" as long as these facilities are provided impartially to both belligerents.[118] An argument can be made that these Articles would apply to modern day satellite communications, as well, but this remains an open question. In any event, scholars point out that the law of neutrality is heavily influenced by pragmatic factors such as power differentials between the parties to a conflict and nonparticipants; the intensity,

time duration, and geographical scope of a conflict; and other available coercion techniques, including economic pressure.[119] There is no reason to believe that the application of the law of neutrality to space uses will be any different.

Thus, the restraint reflected in the SROE regarding attacks against space systems clearly illustrates that US space policy is not unrestricted, contrary to the characterization it is often given in academic and disarmament policy rhetoric.

CONCLUSION

In summary, international debate about the militarization and weaponization of outer space has increased in recent years. However, the complexity of the debate has also expanded. Emerging proposals for restrictions on space weapons do not reflect the historical, extreme "all or nothing" approach. Instead, current proposals may recommend limits on certain types of weapons, based on such factors as:

> (1) severity of the effects of the weapons (temporary and reversible versus permanent destruction),
> (2) means by which the weapon achieves its effects (kinetic kill versus directed energy),
> (3) limitations based on whether the object was designed for offensive purposes,
> (4) location of the target (space or terrestrial), and
> (5) location of the space object/weapon itself (space or terrestrial)[120]

Some of these proposals, instead of limiting the types of weapons allowed (as outlined above), would limit *behavior* of States in space, imposing "codes of conduct" or "rules of the road."

However, even these "middle ground" proposals often *presuppose* that weapons restrictions are a desired end, rather than a means or a tool that States can choose to employ in the mutual effort to ensure global peace and security. This assumption, that some type of space arms control is a desired end in itself, results from the portrayal of space as a "sanctuary" that must be saved from virtually uncontrolled weaponization. This position appears to be an obvious attempt to take the perceived moral high ground, yet it does not acknowledge the strategic advantages a restriction on space weapons would give its most vocal supporters.[121] In addition, these proposals presume that "loopholes" in current international space law allowing weapons in space must be plugged so as to prevent an arms race in space, which is at best a theoretical premise that has simply not materialized, despite development of a US missile defense system and US withdrawal from the ABM Treaty.

Notably, while criticizing "loopholes" in international space law and arms control, proposals to restrict weapons in space all but ignore *existing* behavioral constraints, both legal and practical, affecting use of space weapons. Such constraints on the use of space weapons include international law principles that govern resort to armed conflict (called *jus ad bellum*, essentially embodied in UN Charter provisions governing use of force),[122] principles that limit the conduct of States once they are in armed conflict (called *jus in bello*, embodied generally in the Law of Armed Conflict),[123] and principles of neutrality. In addition, US space policy is also commonly mischaracterized as unrestrained and with the goal of weaponizing space at all costs. In fact, these international law restrictions, as implemented through US space policy and rules of engagement, constrain US policy on the use of space weapons far more than is commonly portrayed. Given these facts, even with the prospect of creating increased international goodwill by accepting new "middle ground" space arms control proposals, it is understandable why the US has repeatedly reiterated its position:

> maintaining international peace and security is an overarching purpose that guides activities on earth as well as in outer space, but in the final analysis preserving national security is likewise necessary and essential. For these reasons, the United States sees no need for new outer space arms control agreements and opposes negotiation of a treaty on outer space arms control.[124]

Notes:

[1] *Treaty Between the United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems*, 23 U.S.T. 3435 (entered into force 3 October 1972, but no longer in effect as of 13 June 2002 due to US withdrawal), Art. XII [ABM Treaty]; US White House, Press Release, "Statement by the Press Secretary: Announcement of Withdrawal from the ABM Treaty," 13 December 2001, online, Internet, 30 January 2005, available from http://www.whitehouse.gov/news/releases/2001/12/20011213-2.html.

[2] Eric M. Javits, "Statement to the Conference on Disarmament," US Mission Geneva, Permanent Representative to CD, 7 February 2002, online, Internet, 30 January 2005, available from http://www.usmission.ch/press2002/0207javits.htm.

[3] For a list of these resolutions and the votes, UN Vienna, Office for Outer Space Affairs, on-line, Internet, 30 January 2005, available from http://www.oosa.unvienna.org/SpaceLaw/gares/index_pf.html.

[4] Theresa Hitchens, "Mis-Framing the Debate," *Defense News,* 2 September 2004, 29.

[5] *Charter of the United Nations*, 26 June 1945, 59 Stat. 1031, 145 U.K.T.S. 805, 24 U.S.T. 2225, T.I.A.S. No. 7739 [*UN Charter*].

[6] For a good discussion of these principles and their applicability to outer space generally, see Robert A. Ramey, "Armed Conflict on the Final Frontier: The Law of War in Space" (2000), 48 A. F. L. Rev. 1, 77.

[7] Peter L. Hays, "Military Space Cooperation: Opportunities and Challenges" in James Clay Moltz, ed., *Future Security in Space: Commercial, Military, and Arms Control Trade-Offs* (Center for Nonproliferation Studies, Monterey, Calif., 2002), 32.

[8] George and Meredith Friedman, *The Future of War* (New York, St. Martin's Press: 1996), 333; US, Commission to Assess US National Security Space Management and Organization, *Report of the Commission to Assess US National Security Space Management and Organization, pursuant to P.L.* 106-65, 11 January 2001, on-line, Internet, available from http://www.space.gov/doc/fullreport.pdf, 64 [Space Commission].

[9] Friedman, Ibid., 331.

[10] Hays, *supra* note 7, 33.

[11] Charles V. Pena, "US Commercial Space Programs: Future Priorities and Implications for National Security" and Alain Dupas, "Commercial-Led Options" in James Clay Moltz, ed., *Future Security in Space: Commercial, Military, and Arms Control Trade-Offs* (Monterey, Calif.: Center for Nonproliferation Studies, 2002).

[12] Charles J. Dunlap, Jr., Brigadier General, US Air Force, *Technology: Recomplicating Moral Life for the Nation's Defenders* (Autumn 1999) Parameters 24; Bruce M. DeBlois, Lt Col, US Air Force, "Space Sanctuary: A Viable National Strategy," *Airpower Journal* 41, 12, no. 4 Winter 1998.

[13] UN General Assembly (UNGA), *Prevention of an Arms Race in Outer Space*, UN GAOR, 58th Sess., UN Doc. A/RES/58/36, 8 December 2003, [PAROS Resolution 2003]; *Existing International Legal Instruments and Prevention of the Weaponization of Outer Space* (a Non-paper by Chinese and Russian Delegations to the Conference on Disarmament), 26 August 2004, [Chinese and Russian CD Paper].

[14] PAROS Resolution 2003, Ibid., 13 (quoting the *Outer Space Treaty* for the phrases "common interest of all mankind" and "peaceful purposes"); see *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, T.I.A.S. 6347, 610 U.N.T.S. 205, Preamble and Articles I and IV [*Outer Space Treaty*].

[15] John Hyten and Robert Uy, "Moral and Ethical Decisions Regarding Space Warfare," *Air & Space Power Journal*, Summer 2004, citing Leonard David, "Space Weapons for Earth Wars," *Space.com*, 15 May 2002, (who is in turn quoting Bruce Gagnon, head of the Global Network against Weapons and Nuclear Power in Space).

[16] For examples of the considerable military reliance on space, see Space Commission, *supra* note 8; see also Elizabeth S. Waldrop, "Integration of Military and Civilian Space Assets: Legal and National Security Implications," (LL.M. Thesis, McGill University Institute, Montreal, July 2003) (publication pending, 2004, *Air Force Law Review*).

[17] Hyten and Uy, *supra* note 15. Direct support by space systems (loosely characterized as "weapons" due to this direct support) to warfighters includes the use of satellites for: communications between forces engaged in armed combat; intelligence-gathering for selection of targets; precision-guidance systems to accurately steer weapons to their targets; and data-collection by remote sensing for battle damage assessment. Notably, there have been no formal protests regarding such direct military uses.

[18] Ibid.

[19] Incidents in which satellites have been intentionally jammed have been well-documented in open sources. See e.g., J. Michael Waller, "Iran, Cuba Zap US Satellites: Official Likens Communications Jamming to 'Act of War,'" *News World Communications,* 7 August 2003 (the government of Cuba openly acknowledged jamming the US-operated Telestar-12 satellite, at the request of Iran (in protest of Voice of America broadcasts to Iran), from a jamming site near Havana which was reported to have been used since 1999 by the government of the Peoples' Republic of China); Christopher Bodeen, "Falun Gong Movement Angers Chinese Gov't By Jamming Satellite Signal," *Associated Press Report*, 9 July 2002 (the Chinese government openly alleged that the Falun Gong interrupted a broadcast on its Sinosat satellite and instead aired Falun Gong propaganda).

[20] The US has in the past few decades pursued limited ASAT capabilities, including a kinetic energy interceptor delivered into low earth orbit by an F-15 fighter aircraft and an Army kinetic energy ASAT. The Soviet Union tested a limited, space-based, co-orbital ASAT in 1967 that remained operational throughout the Cold War. Hyten and Uy, *supra* note 15; Bhupendra Jasani, ed., *Peaceful and Non-Peaceful Uses of Space: Problems of Definition for the Prevention of an Arms Race* (New York: Taylor & Francis, 1991), 2; John M. Logsdon, "What Path to Space Power," *Joint Forces Quarterly*, Winter 2003, GWU Space Policy Institute, on-line, Internet, available from http://www.gwu.edu; "Soviet Military Power, Prospects for Change, 1989," Ch. 4.

[21] Paul Meyer, *Space Security and the Prevention of an Arms Race in Outer Space*, Statement to the United Nations (UN) Conference on Disarmament (CD) by the Canadian Ambassador and Permanent Representative to the CD, 26 August 2004, on-line, Internet, 30 January 2005, available from http://www.reachingcriticalwill.org/political/cd/speeches04/26AugustCanada.pdf. This statement contains a discussion of the various options to consider in defining the term "space weapon":

> 1) *severity* of action or effects (temporary versus permanent, or destructive versus non-destructive effects),
> 2) *method* of action (kinetic or directed energy) used to obtain effect,
> 3) whether the object was *designed* for offensive purposes (or whether is an object *used* with intent to cause harmful effects),
> 4) location of the *target* (space or terrestrial)
> 5) location of the *space object/weapon* itself (space or terrestrial)

[22] Hyten and Uy, *supra* note 15.

[23] PAROS Resolution 2003, *supra* note 13; Chinese and Russian CD Paper, *supra* note 13.

[24] See e.g., United Nations (UN) Institute for Disarmament Research, *Safeguarding Space for All: Security and Peaceful Uses*, Conference Report, Geneva, 25-26 March 2004, [*Safeguarding Space*]; For an example of a proposed Code of Conduct, see *Model Code of Conduct for the Prevention of Incidents and Dangerous Military Practices in Outer Space*, The Henry L. Stimson Center, on-line, Internet, 30 January 2005, available from http://www.stimson.org/pub.cfm?id=106, which states:

> Key provisions of a Code of Conduct include avoiding collisions and dangerous maneuvers in space; creating special caution and safety areas around satellites; developing safer traffic management practices in space; prohibiting simulated attacks and anti-satellite tests in space; providing reassurance through information exchanges, transparency and notification measures; and adopting more stringent space debris mitigation measures.

[25] Eric M. Javits, "Statement to the Conference on Disarmament," US Mission Geneva, Permanent Representative to CD, Geneva, 7 February 2002, on-line, Internet, 30 January 2005, available from http://www.usmission.ch/press2002/0207javits.htm.

[26] *Safeguarding Space*, *supra* note 24, quoting Robert McDougall, Presentation to the Conference on an Independent Research Report Commissioned by the Department of Foreign Affairs and International Trade of Canada, 25-26 March 2004.

[27] Eric M. Javits, "Remarks to the Conference on Future Security in Space," US Mission Geneva, Permanent Representative to CD, England, 29 May 2002, on-line, Internet, 30 January 2005, available from http://www.us-mission.ch/press2002/0529javitssecurityinspace.html.

[28] Spoofing means transmitting false commands to a satellite. Paul B. Stares, "The Problem of Non-Dedicated Space Weapon Systems" in Bhupendra Jasani, ed., *supra* note 20.

[29] Jamming is the emission of noise-like signals to mask or prevent reception of signals. US General Accounting Office (GAO), Report to the Ranking Minority Member, Permanent Subcommittee on Investigations, Committee on Governmental Affairs, US Senate, "Critical Infrastructure Protection: Commercial Satellite Security Should Be More Fully Addressed," *Defense Daily*, August 2002, GAO-02-781, 29, on-line, Internet, November 2004, available from http://www.defensedaily.com/reports/101102fully.pdf.

[30] Robert McDougall and Phillip J. Baines, "Military Approaches to Space Vulnerabilities: Seven Questions" in Moltz, James Clay, ed., *Future Security in Space: Commercial, Military, and Arms Control Trade-Offs* (Center for Nonproliferation Studies, Monterey, Calif.: 2002).

[31] US DOD Directive (DODD) 3100.10, *Space Policy,* 9 July 1999, 6 (defining "space control" as "ensur[ing] freedom of action in space for the United States and its allies and, when directed, deny[ing] an adversary freedom of action in space); Marcia S. Smith, "US Space Programs: Civilian, Military, and Commercial," Issue Brief for Congress by the Congressional Research Service (CRS), 22 April 2003, doc. no. IB92011, 12 [Smith, *US Space Programs*].

[32] Smith, *US Space Programs,* Ibid. A kinetic energy ASAT would physically hit a target to destroy it.

[33] *Space Policy, supra* note 31; US White House National Science and Technology Council, National Space Policy, White House, 19 September 1996, on-line, Internet, 30 January 2005, http://www.ostp.gov/NSTC/html/pdd8.html.

[34] Smith, *US Space Programs, supra* note 31. The 2003 budget includes $13.8 million for these space control technologies and $40 million for "counterspace systems," a program which effectively moves some space control programs into the engineering and manufacturing development phase. DOD requested $14.7 million for space control and $82.6 million for counterspace systems in the 2004 budget.

[35] Jasani, *supra* note 20, 2; Logsdon, "What Path," *supra* note 20.

[36] US White House, Press Release, "National Policy on Ballistic Missile Defense Fact Sheet," White House, 20 May 2003, on-line, Internet, 30 January 2005, available from http://www.whitehouse.gov/news/releases/2003/05/20030520-15.html. The boost phase is the time from launch of a missile until burnout, which is still prior to the deployment of warheads or defensive countermeasures. Depending on the range of the missile, boost phase may stop in or continue out of the earth's atmosphere. The midcourse phase, during which the missile is no longer firing its propulsion system and is coasting toward its target, is the longest portion of a missile's flight. For an ICBM, this phase can last up to 30 minutes. For longer-range missiles this phase occurs outside the earth's atmosphere. For more details see the Raytheon website: on-line, Internet, 31 January 2005, available from http://raytheonmissiledefense.com/phases/#boost.

[37] Smith, *US Space Program*, *supra* note 31.

[38] Ibid.

[39] DoD Space Control Policy, DODI S-3100.15, January 2001. Notably, however, this Policy also explicitly requires that the option for irreversible denial, including destruction, be retained.

[40] Hyten and Uy, *supra* note 15; Edmond Lococo, "US Air Force Anti-

Satellite Weapone is Operational," Bloomberg.com, 30 September 2004.

[41] DeBlois, *supra* note 12.

[42] See e.g., the US White House National Science and Technology Council, National Space Policy, White House, 19 September 1996, on-line, Internet, 31 January 2005, available from http://www.ostp.gov/NSTC/html/pdd8.html (stating "The United States is committed to the exploration and use of outer space by all nations for peaceful purposes and for the benefit of all humanity. 'Peaceful purposes' allow defense and intelligence-related activities in pursuit of national security and other goals.").

[43] Ivan A. Vlasic, "The Legal Aspects of Peaceful and Non-Peaceful Uses of Outer Space," in B. Jasani, *supra* note 20, 45.

[44] *Outer Space Treaty, supra* note 14, Art. IV, which states:

> *States Parties to the Treaty undertake not to place in orbit around the Earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.*
>
> *The Moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military maneuvers on celestial bodies shall be forbidden.*

[45] Vlasic, *supra* note 43, 37.

[46] Ibid., 40.

[47] Richard A. Morgan, *Military Use of Commercial Communications Satellites: A New Look at the Outer Space Treaty and "Peaceful Purposes"* (September/October 1994) 60 J. Air L. & Com. 237, 294.

[48] Ibid., 295 (quoting the Memorandum for the Chief of Naval Operations by the Deputy Assistant Judge Advocate General (14 January 1991) and the Attachment to the Memorandum for the Chief of Naval Operations by the Deputy Assistant Judge Advocate General (14 January 1991).

[49] Ibid.

[50] Ibid.

[51] *Outer Space Treaty, supra* note 44, Article IX.

[52] M. Lucy Stoyak, *Excerpt from a Report Prepared for the Canadian Department of Foreign Affairs and International Trade Entitled 'The Non-Weaponization of Space'* (August 2001) (copy on file with the author).

[53] *The Treaty Banning Nuclear Weapon Tests in the Atmosphere, in Outer Space, and Under Water*, 480 U.N.T.S. 43 (entered into force 10 October 1963).

[54] *Convention on the Prohibition of the Development, Production, and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on their Destruction* (1976) no. 11 U.K.T.S., Cmd 6397 (entered into force 26 March 1975) [*Biological Weapons Convention*]; *Chemical Weapons Convention 1992*, 32 ILM 800 (entered into force 29 April 1997).

[55] *Convention on the Prohibition of Military or any other Hostile Use of Environmental Modification Techniques*, 31 U.S.T. 333 (entered into force 5 October 1978).

[56] *Agreement on Measures to Reduce the Risk of Outbreak of Nuclear War* (1972) 807 U.N.T.S. 57 (entered into force 30 September 1971); *Agreement on Measures to Improve the USA-USSR Direct Communications Link* (1972) 806 U.N.T.S. 402 (entered into force 30 September 1971); *Agreement Between the United States of America and the Union of Soviet Socialist Republics on the Prevention of Nuclear War* (1973), U.S.T. 1478 (entered into force 5 October 1978); *Agreement Between the United States of America and the Government of the Union of Soviet Socialist Republics on Notifications of Launches of Intercontinental Ballistic Missiles and Sub-Marine Launched Ballistic Missiles* (entered into force 31 May 1988); *Agreement Between the United States of America and the Government of the Union of Soviet Socialist Republics on the Prevention of Dangerous Activities* (entered into force 1 January 1990); *Memorandum of Agreement Between the Government of the United States and the Government of the Russian Federation on the Establishment of a Joint Center for the Exchange of Data from Early Warning Systems and Notifications from Missile Launches*. See Stoyak, *supra* note 52.

[57] Stoyak, Ibid.

[58] Space Commission, *supra* note 8.

[59] Peter B. Teets, Response to Congressional QFR from the Senate Armed Services Committee Hearing on Space Programs (25 March 2004).

[60] Donald H. Rumsfeld, Testimony before the House of Representatives (5 February 2002).

[61] *Space Policy*, *supra* note 31, para 4.3.1.

[62] US DOD, Joint Publication (JP) 3-14, *Joint Doctrine for Space Operations*, 9 August 2002 (defining "space superiority" as "The degree of dominance in space of one force over another that permits the conduct of operations by the former and its related land, sea, air, space, and special operations forces at a given time and place without prohibitive interference by the opposing force").

[63] *Space Policy*, *supra* note 31.

[64] Delbert R. Terrill, *The Air Force Role in Developing International Outer Space Law* (Montgomery, Ala.: Air University Press, 1999), Air University, on-line, Internet, 31 January 2005, available from http://www.au.af.mil/au/awc/awcgate/space/terrill.pdf.

[65] Rumsfeld, *supra* note 60.

[66] DoD *Space Policy*, *supra* note 31; US White House National Science and Technology Council, *National Space Policy*, White House, 19 September 1996, n.p., on-line, Internet, 3 November 2004, available from http://www.ostp.gov/NSTC/html/pdd8.html.

[67] DoD *Space Policy*, supra note 31. It is also US policy that the DoD maintain two additional mission areas of space support (deploying and sustaining space assets) and force enhancement (enhancing performance of air, sea, and land-based forces, as well as intelligence agencies and commercial users).

[68] Hyten and Uy, *supra* note, 15.

[69] DoDI S-3100.15, *DoD Space Control Policy*, January 2001.

[70] Chairman of the Joint Chiefs of Staff Instruction (CJCSI) 3121.01A, *Standing Rules of Engagement (SROE) for US Forces* (15 January 2000).

[71] Ibid, para. 3.a; DOD Directive 5210.56, *Use of Deadly Force and the Carrying of Firearms by DOD Personnel Engaged in Law Enforcement and Security Duties* (25 February 1992) [Rules for the Use of Force].

[72] Ibid.

[73] SROE, *supra* note 70, para 6.a. The term "CINC" (commander in chief) is used in the SROE to describe commanders of combatant commands, however more recent guidance (October 2002) restricts use of the term CINC to the President only. "Rumsfeld Declares 'CINC' is Sunk: Reminds Military only Bush is 'Commander in Chief'" *US Gov Info/Resources,* US Gov Info/Resources, 29 October 2002, on-line, Internet, 31 January 2005, available from http://usgovinfo.about.com/library/weekly/aacincsunk.htm.

[74] SROE, Ibid., para. 6.c.

[75] Richard J. Grunawalt, "The JCS Standing Rules of Engagement: A Judge Advocate's Primer" (1997) 42 A.F. L. Rev. 245, 246 [Grunawalt]. See also W. A. Stafford, "How to Keep Military Personnel from Going to Jail for Doing the Right Thing: Jurisdiction, ROE, and the Rules of Deadly Force" (November 2000) 2000 Army Law 1.

[76] Grunawalt, Ibid., 247.

[77] SROE, *supra* note 70, para 7.

[78] Grunawalt, *supra* note 75, 251; *UN Charter*, *supra* note 5.

[79] *National Security Strategy of the United States of America*, White House, September 2002, on-line, Internet, 31 January 2005, available from http://www.whitehouse.gov/nsc/nss.html, 15.

> *The United States has long maintained the option of preemptive actions to counter a sufficient threat to our national security. The greater the threat, the greater is the risk of inaction—and the more compelling the case for taking anticipatory action to defend ourselves, even if uncertainty remains as to the time and place of the enemy's attack. To forestall or prevent such hostile acts by our adversaries, the United States will, if necessary, act preemptively.*
>
> *The United States will not use force in all cases to preempt emerging threats, nor should nations use preemption as a pretext for aggression. Yet in an age where the enemies of civilization openly and actively seek the world's most destructive technologies, the United States cannot remain idle while dangers gather.*

[80] Stafford, *supra* note 75, 5.

[81] (1837) 2 Moore 409. In 1837 British subjects destroyed an American ship, the Caroline, in a US port, since the Caroline had been used for American raids into Canadian territory. The British justified the attack as self-defense. The dispute was resolved in favor of the Americans through the exchange of diplomatic notes. Daniel Webster, the US Secretary of State, proposed this definition of self-defense which the British accepted:

There must be a necessity of self-defense, instant, overwhelming, leaving no choice of means, and no moment for deliberation. [The force justified in the application of self-defense must consist of] nothing unreasonable or excessive; since the act, justified by the necessity of self-defense, must be limited by that necessity, and kept clearly within it.

See Myres S. McDougal and Florentino P. Feliciano, *Law and Minimum Public World Order: The Legal Regulation of International Coercion* (New Haven and London: Yale University Press, 1961), 217.

[82] McDougal and Feliciano, Ibid.

[83] SROE, *supra* note 70, Enclosure A at A-4.

[84] Ibid.

[85] McDougal and Feliciano, *supra* note 81, 210, 231-241 (noting, *e.g.*, that the preparatory record of the Charter indicates Article 51 was not drafted to intentionally narrow customary law requirements for self-defense by raising the required degree of necessity, but rather was drafted to accommodate regional security organizations within the Charter's scheme of collective security).

[86] Ibid., 231.

[87] Ibid., 233.

[88] Thus Judge Schwebel dissenting in *Military and Paramilitary Activities in and against Nicaragua* [1986] I.C.J. Rep. 14 (27 June), 259 [*Nicaragua v. US*]. In this case, the Court decided against the US claim that its use of force against Nicaragua was a lawful act of collective self-defense of El Salvador. The US had argued that Nicaraguan support (in the form of weapons and supplies) to rebels in El Salvador was an armed attack justifying self-defense. See also, Gregory M. Travalio, "Terrorism, International Law, and the Use of Military Force" (Winter 2000) 18 Wis. Int'l L. J. 145, 158.

[89] McDougal and Feliciano, *supra* note 81, 235, n. 261, and 238.

[90] Ibid., 242.

[91] SROE, supra note 70, Enclosure A at A-5.

[92] Ibid., A-6.

[93] Ibid., A-3.

[94] Ibid., A-4. The term NCA is defined in Joint Pub 3-0 page II-5; *Department of Defense Dictionary of Military and Associated Terms* (23 March 1994), 253.

[95] *Outer Space Treaty, supra* note 14, Article III.

[96] *Space Policy, supra* note 31.

[97] SROE, *supra* note 70, Enclosure L, L-2.

[98] James C. Duncan, *Employing Non-lethal Weapons* (1998) 45 Naval L. Rev. 1 at 43; JCS Pub 1-02. *Department of Defense Dictionary of Military and Associated Terms* (1994); see also McDougal and Feliciano, supra note 81, 521.

[99] SROE, *supra* note 70, Enclosure A, para. 1.g.

[100] Ingrid Detter, *The Law of War*, 2nd ed. (Cambridge: Cambridge University Press, 2000), 158. *E.g., Geneva Convention (I) for the Amelioration of the Condition of the Wounded and Sick in Armed Forces in the Field*, 12 August 1949, 75 U.N.T.S. 31, Article 13 [Geneva I]; *Convention (II) for the Amelioration of the Condition of the Wounded, Sick and Shipwrecked Members of Armed Forces at Sea*, 12 August 1949, 75 U.N.T.S. 85; *Convention (III) Relative to the Treatment of Prisoners of War*, 12 August 1949; 75 U.N.T.S. 135; *Convention (IV) Relative to the Protection of Civilian Persons in Time of War*, 12 August 1949, 75 U.N.T.S. 287; *Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I)*, 8 June 1977, 16 I.L.M. 1391; *Hague Convention (V) Respecting the Rights and Duties of Neutral Powers and Persons in Case of War on Land*, Oct. 18, 1907, 36 Stat. 2310, U.S.T. 540 [Hague V]. For a complete list, see Roberts, Adam & Guelff, Richard, eds., *Documents on the Laws of War*, 3rd ed. (New York: Oxford University Press, 2000).

[101] Roberts & Guelff, Ibid., 10 (noting that proportionality and discrimination are generally incorporated into the other principles); Duncan, *supra* note 96 at 50; see also McDougal and Feliciano, *supra* note 81, 521.

[102] In fact, US space policy for the military goes further than mere *recognition* of the interdependence of the commercial and the government space sectors *and openly encourages it*. In addition for mandating a "Preference for Commercial Acquisition," DoD policy encourages military-industrial partnerships, outsourcing and privatization of DoD space-related functions and tasks, and even extends a promise of "[s]table and predictable US private sector access" to DoD space-related hardware, facilities, and data.. The goal of the US government to promote commercial-governmental interdependence is furthered by requiring that government space systems be based on widely accepted commercial standards to ensure *future* interoperability of space services, as well. Space Policy, *supra* note 96.

[103] Dunlap, *supra* note 12.

[104] Hyten and Uy, *supra* note 15.

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Major Waldrop attended Duke University and received a Bachelor of Science degree in Electrical Engineering in 1989. After serving four years as a satellite operations officer performing on-orbit command and control of the Global Positioning System (GPS), the Air Force selected her to attend law school at the University of Texas. Since becoming a Judge Advocate General (JAG) in 1996, she has served in various legal positions in military criminal law (both prosecution and defense), administrative personnel actions, labor law, military operations law, international law, and space law. She received her LL.M in Air and Space Law from McGill University, Montreal, Canada in 2003.

[105] Delbert R. Terrill, *The Air Force Role in Developing International Outer Space Law* (Montgomery, Ala.: Air University Press, 1999), Air University, on-line, Internet, 31 January 2005, available from http://www.au.af.mil/au/awc/awcgate/space/terrill.pdf.

[106] *Safeguarding Space, supra* note 24.

[107] Ibid.

[108] *Biological Weapons Convention, Chemical Weapons Convention, supra* note 54.

[109] Hyten and Uy, *supra* note 15.

[110] SROE Information Paper (29 November 1999); SROE, supra note 70, Enclosure A, A-7.

[111] Ibid.

[112] Duncan, *supra* note 98, 50.

[113] *Hague V, supra* note 100.

[114] McDougal and Feliciano, *supra* note 81, 438, citing Hague V, *supra* note 100, Article 7.

[115] Ibid., 443.

[116] David L. Willson, "An Army View of Neutrality in Space: Legal Options for Space Negation" (2001) 50 A.F. L. Rev. 175 (referring to the *Outer Space Treaty* and the *Convention of International Liability for Damage Caused by Space Objects*, 29 March, 1972, 961 U.N.T.S. 187.

[117] DOD General Counsel, "An Assessment of International Legal Issues in Information Operations" (May 1999).

[118] Ibid.; Hague V, *supra* note 100.

[119] McDougal and Feliciano, *supra* note 81, 435.

[120] Meyer, *supra* note 21.

[121] China and Russia, for example, would enjoy a huge strategic advantage if weapons in space were prohibited as they propose, not the least of which would be the loss of the current asymmetric US advantage in space. Hyten and Uy, *supra* note 15.

[122] UN Charter, *supra* note 5.

[123] For a good discussion of these principles and these applicability to outer space generally, see Ramey, *supra* note 6, 77.

[124] Eric M. Javits, "Remarks to the Conference on Future Security in Space," *supra* note 27.

Toward Space War

Submitted by: Lt Col G.W. Rinehart
HAF/CX

Some may say that in recent years the topic of space warfare has received more attention than it deserves. One day it will get our attention the hard way.

SPACE WAR YESTERDAY

In the early 1990s, many people trumpeted the Gulf War as the "first space war."[1] Looking back with a critical eye, more recent writers challenged that assertion.[2] We must concede that the Coalition operations in the Second Gulf War—for example, the dependence on the Global Positioning System (GPS) that the Iraqis tried in vain to counteract—solidified (if that can be the right term) the importance of space to successful modern military operations.

We do not need to recount all that was written and said about the First Gulf War, for example, whether or not it represented a revolution in military affairs, how well the space systems worked or how they failed to live up to expectations, et cetera Nor do we have to anticipate all that will be written about the second. In the same way that we do not call the American Civil War the first air war, even though observation balloons were used, none of the contributions of space systems to the First Gulf War (or to later actions in Bosnia, Yugoslavia, or the Terror War) meet the common sense definition of a space war. Neither of the two Gulf Wars involved action against space units or space assets and therefore fall short of a "space war." Absent a contemporary space war, then, we are faced with two possibilities: either the first space war was already fought, or it has yet to be fought.

World War Two

Were Nazi Germany's V-2s the first salvoes in space warfare when they attacked England? Not really. Even though the rockets skirted the lower reaches of space, the V-2 was essentially a rocket-propelled artillery system—no more a space weapon than the "Paris Gun" of 1915 which had a 68-mile range and mid-flight trajectory in excess of 100,000 feet. "Rocket-propelled" does not a space weapon make. We do not call the Katyusha or Nebelwerfer multiple rocket launcher systems space weapons, nor for that matter the Me-163 Komet interceptor; all were based on cutting edge rocket technologies, but cannot be considered space weapons. Just because V-2s transited the edge of space we cannot claim that they demonstrated space weaponry, at least not the same way Italian aircraft demonstrated air weaponry in Libya in 1911.

The Cold War

It might be said that the first space war started with the Sputnik launch in 1957, and was a Cold War.[3] For instance, that launch may be thought of as the first engagement—the first shot in the first battle, so to speak—in a new theater of operations in the larger Cold War.

Sputnik was not a military "strike" *per se*, more of a shot across the National bow. It led to heavier investment in military rocket and satellite programs even when they were hidden in the plain sight of civilian programs (e.g., CORONA). The US, with the help of German scientists and captured V-2s, had worked hard on rocketry before Sputnik and planned a space launch for the International Geophysical Year, but being beaten to the punch by our prime adversary focused our attention and catalyzed US space development.[4]

After Sputnik, America pursued a fervent space race to build an arsenal of ballistic missiles, while gathering intelligence against its Communist adversaries. While part of our attention was on delivering weapons if the need arose, another was on making sure we knew whether our enemy was planning to do so. True space weapons came shortly thereafter, though their deployment was short-lived: a case may be made that the first space war was "fought" with nuclear test explosions in space between 1958-62, and then unfought when the US Air Force took the last nuclear-equipped Thor antisatellite (ASAT) systems off alert in 1969.[5]

Thinking of Sputnik as a first strike in a longer space war fits nicely with other wars. First, it correlates with the idea posited in *America's First Battles* that America performs poorly in, if not actually lose, the first battle of every war.[6] Second, wars often last a long time. Technological advances may be implemented during conflicts but do not themselves define new wars.

If Sputnik possibly began the first space war, the next obvious question would be whether that war ever ended; i.e., whether we are still "fighting" the war, or whether we may be in an "inter-war" period. The first statement seems more accurate; we are involved in a prolonged engagement in an ongoing or evolving conflict, not an inter-war period, since we currently use mission-essential space systems to support operations around the world.[7] From weather forecasts for aircraft sorties and troop movements, to Global Positioning System (GPS) navigational signals for Marine Recon platoons and Naval vessels, to ballistic missile warning for the National Command Authorities, to observing troop movements for theater commanders, space systems are indispensable to the US military. Indeed, space assets are important tools for all aspects of the DIME—diplomatic, information, military, economic—instruments of US national power.

Saying that space systems are indispensable does not mean we know everything about utilizing them effectively. The Space Commission report admitted as much; but while implementing their recommendations may improve the national-level organization, theater commanders will still wrangle with USSTRATCOM—and by extension AFSPC SPACEAF—for control of assets supporting their theater.[8] We have learned how well space assets contribute to terrestrial operations, but that experience only gets us started. If we are not yet ready—

organized, trained, equipped, and fielded—to fight a true space war, we must ask whether we should be and if so, when and how to get ready. Should we so prepare? The answer must be yes, unless we are willing to cede that highest ground to others. Those who claim that space can remain a sanctuary free of weapons would ignore history and human nature.

Human nature breeds conflict. Historically, whenever we traversed to a new medium (e.g., land to sea, land/sea to air, air to space) we brought conflict with us.[9] Unless the very nature of humanity changes, then it is logical to assume that we will take conflict into space. Accepting this precept, a "hot" war in space is inevitable. When we reach the bottom line of what that space war will entail, we see that Sputnik was not the first shot, nor was the first nuclear explosion in space. We have not yet made space a part of the battlesphere.

The first space war has yet to be fought.[10]

THE POTENTIAL FOR SPACE WAR TODAY

Despite the nascent International Space Station operation, with its rotating crew dependent for the time being on Russian launch vehicles, and the recent announcement of our intent to return a human presence to the Moon, space is not an environment where we go physically to conduct business. We project ourselves there vicariously—or perhaps virtually. Once there we do not conduct much space-oriented business; space is more a medium for enhancing our business on the ground. Using space in this way, whether for navigation or observation or communication, is akin to subscribing to cable in order to get CNN. Dead reckoning navigation is still possible, but GPS makes it unnecessary; forecasting the weather from terrestrial observations and rawinsonde balloons is still possible, but the National Polar-orbiting Operational Environmental Satellite System (NPOESS) makes it easier and more accurate; et cetera With few exceptions, space exploits, and especially military space exploits, are service providers. In that respect, in the short term our greatest risk is not armed conflict in space but interruption of those services.

With commercial multinational corporations encroaching on governmental use of space, the actual governmental presence in space will decline as more and more governments simply purchase services (including such specialized services as satellite imagery) from commercial suppliers.[11] In the same way that AT&T and Sprint vie for phone customers, commercial entities will engage in economic "battles" over space.

As military use of commercial space assets grows, use of this service becomes a legitimate target. If our enemy buys satellite imagery from a third country to support military action against us then everything from the satellite to the ground is a potential target. The case of imagery during the First Gulf War illustrates the risk of interruption: instead of jamming signals or destroying satellites or ground stations, the US bought all the available imagery and used political pressure to keep imagery out of Iraq's hands.[12] The same logic applies to the platform and the service provided: if the military uses commercial spacecraft for military purposes, they become legitimate targets for our enemies.

If the issue is the overall service provided and not the platform, why should we attack anything in space? Not to seize what we attack and benefit from it, as in land war or piracy, but to deny its service to someone else—but only if we cannot interrupt those services by other means. Therefore, the first reason to fight in (not through or from) space is to influence the local space environment—to stop those service providers. Beyond that, space warfare may be waged to influence earth (or, reaching farther in accordance with our lunar ambitions, some other body of interest). This debate raises more questions. For instance, who is the enemy and what threat does the enemy pose? Is the potential gain of fighting a space battle worth the expense? In other words, would the victory be worth the expense, or would losing be so catastrophic as to justify the cost of fighting? What battle in or from space would justify the investment required to fight it?

The Enemy

To paraphrase Clausewitz: We fight to achieve our national aims, be they political, ideological, or otherwise.[13] That fight can be economic, diplomatic, or military. Expanding the statement, we fight an enemy or enemies to achieve our national aims.

Who, then, is the enemy? A quick and easy answer is anyone who stands against us in the pursuit of our national aims. Given the national aim of security, our enemies are 1) international terrorists and the organizations/states that support them, 2) nations that have stated their intentions of harming us or our allies, and 3) nations with undeclared intentions but holding both animosity and substantial arsenals. Given the national aim of economic prosperity, our enemies are 1) nations that restrict international trade (although in some cases we are our own worst enemy in this area), 2) nations that (intentionally or not) inhibit development of indigenous industries, and 3) smugglers, pirates, and the like who interrupt trade. Given the national aim of spreading democratic principles of self-rule, our enemies are 1) totalitarian regimes, and 2) semi-democratic but repressive regimes. Putting all this together, we can list our enemies…but this may not be the place to do so. For the moment, most nations we might list do not possess large numbers of space assets.

Before we stop there, considering as our enemies only those who stand in the way of US achieving our national aims might be too simple. Taking a page from Mahan, the choke points we control, whether we need to control them for our "national aims" or not, are choke points that are not controlled by anyone else, friend or foe.[14] Specific orbital tracks, LaGrange (libration) points, resemble Mahan's coaling stations. On our way to a permanent lunar base, for instance, we might consider establishing and protecting permanent bases at the LaGrange points.[15] Our national aim might be well served by seizing "territory" or planting the flag before anyone else does to simply maintain our position relative to the balance of power. For a terrestrial example, Great Britain does not need the Falkland Islands anymore but they went to war to protect their national prestige.

Recalling our discussion of why we entered into a "space race" in the first place: it was not to put satellites into orbit for their own sake, or to boldly go where no man had gone before. Space was part of a larger Cold War, America faced a formidable enemy and found space a useful medium in that struggle. We raced into space in order to know what our enemy was doing, to

deliver strategic weapons quickly and accurately, and to maintain national prestige in the eyes of the world.[16]

As became painfully apparent in September 2001, America does not face a single monolithic enemy; but numerous adversaries—potential in intent as well as capability. Since we cannot prepare against every attack from every direction, America should not develop an opponent-specific space warfare infrastructure.[17] This Nations approach to space warfare must be general purpose, which is a much more difficult proposition.

Knowing our enemy, we turn to knowing ourselves.[18] Following Weigley, our space warfare architecture will be predicated on the threats we perceive, our available resources, and our National experience.[19]

The Threat

Each enemy (or potential enemy) may not threaten us in all ways. But the total threat is a combination of: 1) using space-transiting weapons; 2) using space-based force enhancement to support a terrestrial conflict; 3) denying America the benefits—economic as well as military—of its space-based assets; 4) denying America access to space; and 5) physically destroying America's space-based assets.

Recognizing the threats is essential, but only the first thing. Finding ways to neutralize the threats is the next measure of success.

Attack Through Space. The first threat we listed, an enemy using space-transiting weapons, is a reality we have lived with for nearly a half-century. Only recently have we taken concrete steps toward countering that threat. It has been two years since President Bush announced the US withdrawal from the 1972 Anti-Ballistic Missile Treaty.[20] The development and fielding of our missile defense systems continues. Improved defenses do not always deter aggression; we should maintain an adequate offensive capability as well.

Enemy Use of Space. Few nations are positioned to use space assets against us, at least for now. Most of the nations or supra-national groups that have fielded battle-support systems are either friendly toward us (e.g., NATO, with its Skynet communications system) or getting friendlier (e.g., Russia, with its GLONASS satellite navigation system). This should not blind us to the potential for space assets to be used by sub-national groups (e.g., Islamist terrorists using Thuraya satellite phones) or by space-capable nations against other nations (e.g., China collecting imagery of other nations in the region). The fact that not all nations pursuing space access are friendly to us or to their neighbors should keep us vigilant as we monitor their space systems development.

Denial of Service/Denial of Access/Destruction. Potential enemies are looking for ways to take away this advantage. Whether we field communication satellites, navigation satellites, or even laser weapon satellites, they represent only one thing to a determined adversary: target! An enemy wishing to level the playing field might pour resources into anti-satellites, directed energy weapons, et cetera—whatever will get their country to the "high ground."[21] A determined enemy need not seek actual space superiority; they could target US ground stations and other command and control elements with conventional weapons to achieve the same effect.

Beyond the Threats. How can fighting in or from space harm our enemy(ies)? Thwarting our enemy's intentions against us does not realize our military objective. It is not politically correct to admit it, but proactive (i.e., offensive) space systems may help us achieve our national goals just as surely as proactive action in Iraq helped achieve our national goals of security and promoting democracy. These are uncomfortable truths, however, and not ones that sit well in democratic societies. Perhaps it is best to leave that idea on the table for debate at a later time.

Our Available Resources

Most speculation on the topic of "space weapons" centers on particular technologies, but it may help to start at an even more basic level. If a "weapon" is defined as something that causes harm, then our current space systems cannot be considered weapons—a good thing for those who cling to the peaceful notion of space.[22]

Our space systems are deployed weapons only if "weapon" includes things that facilitate causing harm but are themselves harmless. This, however, is not unusual. We usually think in terms of "weapon systems," for example, bullet and gun together, bomb and airplane together, torpedo and submarine together, but often along with those examples we include enabling items such as communications, intelligence, or transport systems. The U-2 and C-17 are called weapon systems, for example.[23] What are the space equivalents? For analogs to guns and bombs, we have space-transiting missiles. For airplanes, ships, and tanks, we have manned and unmanned launch vehicles. If we include enabling functions, there are Defense Satellite Communications System (DSCS), and Defense Support Program (DSP) satellites.

Today's terrestrial weapon systems rely on space based assets for their functionality, accuracy, et cetera; for example, in the area of precision guided munitions every Service is trying to develop systems to improve their effectiveness in any future fight. Many such systems depend on space as an enabler; however, just as the sights on a rifle are not a weapon in and of themselves, the rifle is essentially useless without them, no one but a true believer would call a DSCS satellite a weapon. Our armed forces brethren who see weapons only as things that kill would probably agree, though technological advances may force us to broaden the definition. For example, computer network attack operations conducted via satellite or by fiber-optic medium may not kill but they can cause extreme damage on the tactical, operational, and even strategic scale.

In order for space operators to make the final leap into the area of having true "weapon systems," they must have actual weapons in space—be they kinetic kill weapons, lasers, or even the non-lethal variety. Those weapons must operate/maneuver in space. Recall our earlier historical discussion; current missile systems, descendents of the V-2, do not completely fit the bill for space weapons. But as we pursue true space weapon systems, which are only made possible by our technological prowess, it is vital to remember that "Man is the fundamental instrument of war. All else is means to ends."[24] The picture of a sword-and-

shield-bearing soldier must have the soldier in it.

Our National Experience

The Space Commission examined America's experience in space to date, and found its approach to space fragmented and in need of repair. Part of the fragmentation was deliberate; it stemmed from the need to hide some activities from prying eyes and the desire to separate peaceful space endeavors. Additionally, unintended fragmentation was caused by separate organizations battling over limited resources, an understandable if unfortunate fact of political life. While the Commission's recommendations are being implemented, only time and additional experience will tell whether the situation improves.

A single article does not permit a full examination of National experience as it relates to the issue of space warfare. Independence, isolationism, imperialism, and a dozen other factors could be considered, along with military experience both good and bad. We search for historical analogies to help us understand; thus the questions of whether we are in an interwar period or if a space Douhet or Mitchell or Mahan will emerge.[25] However, we may discover that space is too "different" for our past experience to be of much help in understanding it, or conquering it; this is discussed below.

Risks, Costs, And Benefits

No great venture is without risk; no risk worth taking is without reward. The United States runs a different risk in developing and fielding space weapons than in refusing to develop them, but both situations entail risk, costs, and benefits.

If space weapons are fielded, America runs the risk that other nations will perceive us as arrogant and possibly unite against us; along the way we incur significant cost, but we reap the benefit of improved security at least for a time. If we refuse to develop space weapons, we risk other nations developing them and wresting further control of the "high ground" from us; however, we avoid the cost outlay, and reap the benefit of improved international regard. Which course of action we advocate depends on whether we are pessimists or optimists about human nature, at least in the international environment.

Returning to Clausewitz, the space war must fit in with some objective state. Leaving aside the question of national goals met by war, efficiency and effectiveness seem to be what our population demands. Space-based weapons can meet those demands. The day may come when a laser in low earth orbit shoots down enemy aircraft that cross some "line in the sand" (read "air"), keeping that F-16 or M1A1 main battle tank out of harm's way. That operation is not a constant protection because low-orbiting spacecraft only re-visit targets, they do not provide persistent cover. Other platforms would have to share that mission—UAVs come to mind—but space weapons may reduce the number of US battle casualties in war.

This efficiency argument is interesting, but limiting. Effectiveness is another matter. Rather than looking at how many US lives space weapons might save, we should look at whether using space weapons will lead to victory. One measure of effectiveness might be how many enemy our space weapons will kill, but equating killing the enemy with "victory" does not necessarily follow. Vietnam, with a 19:1 kill ratio equaled "defeat" for the United States.[26] Victory is just as much convincing a potential enemy that the benefit of attack is not worth the cost (cf. Sun Tzu's ideal of defeating the enemy without fighting).[27] If use or even possession of space weapons could lead to this, they are worth the investment.[28]

SPACE WAR TOMORROW

The imminence of a "hot" war in space is directly proportional to the continued and growing human influence—if not actual presence—in space. Conflict will ensue as more players gain access to space and stress the environment. As Sun Tzu wrote, "When both sides can come and go, the terrain is said to be easily passable. When the terrain is easily passable, take up your position first, choosing the high and sunny side…for advantage in battle."[29] Notwithstanding that both sides may come and go in space with equal difficulty as opposed to equal ease, it's imperative the United States occupies the "high and sunny" positions with respect to space.

As of mid-2003, 37 different nations owned satellites.[30] So far, we have populated the orbits with satellites without coming into open conflict; the vastness of space has worked in favor of peaceful coexistence. That happy status quo cannot last forever.

Part of the difficulty of postulating realistic space-related scenarios is extrapolating our earth-bound conceptions and historical experiences to encompass the space environment. Through the years, naval experience and terminology have described space activities: witness a great deal of science fiction, notably the various *Star Trek* iterations and the works of Robert A. Heinlein. Indeed, using naval metaphors are most helpful. For instance, we can think of planetary orbit as analogous to "shore patrol," which leads to the proposal to form a Space Guard akin to the Coast Guard—a notion that makes sense considering the amount of commercial space activity in orbit to protect.[31] Furthermore, if the orbits around planets are similar to the shores around continents, then deep space must be analogous to the open ocean (if not the doldrums). This was the premise of a short article entitled "Space Is An Ocean," which noted that "an ocean is where navies go," another idea that makes sense.[32] The only military service with experience in building, outfitting, manning, and operating vessels for long voyages with little outside contact is the Navy—and the underwater Navy may be the best fit with space travel.

The way space vessels move might also benefit from seafaring analogies. For instance, orbits and optimal orbit transfers may be equivalent to "sea lanes." Orbital maneuvers may be thought of as analogous to tacking in the wind, in which the vessel steers in one direction for a period of time in order to produce a completely different cumulative motion. Finally, as noted above, theories of sea control are parallel to space control such as the "coaling station" used to re-supply ships on long voyages.[33] The LaGrange points in the Sun-Earth and Earth-Moon systems, being semi-stable, have been proposed for outposts; given the right kind of energy collection and storage mechanisms these could act as coaling stations. Since they are also potential "choke points" with tactical (if not strategic) value, we should not leave

them open to exploitation by others.

Before we venture too far out, however, we should address problems nearer to hand.

From Earth To Space

Access to space is the first problem to solve. Despite National Space Transportation Policy statements and slogans such as "Assured Access to Space," getting to and operating in space is still a difficult proposition. From a military utility standpoint, space systems must be on-station and working or they are useless; a satellite in a clean room is as useful as a B-2 in a hangar or a ship in dry dock. For the purpose of argument we assume the hardware and software are available and operating.

We might think of "physical" access to space assets as the ability to achieve orbit, or the ability to contact an orbiting platform (considering a stream of RF energy to be a quasi-physical touch). In many cases, that type of physical access would be reserved for owner/operators. Others might have "virtual" access, i.e., use of the orbiting platform without ownership or control as in the open use of GPS signals. Another way to think of accessing space assets is in terms of passive use (receiving a signal from a GPS satellite) and active use (downloading imagery or using communications). Active and passive use better describe how space assets are used in battlefield operations.

As more people come to accept what space assets can provide, access to those assets will be an important issue. The battlefield commander who wants to "control" space assets supporting his operations is another throwback to the ground commanders who controlled—without understanding what they were controlling—air assets in World War Two. To avoid repeating the mistake of deliberately limiting the role of a new space asset, the operational and doctrinal issues of space control and access need to be worked out.[34]

This question of access leads directly to the issues of denying access to unauthorized users, and protecting assets to keep them accessible. How do we protect our assets?

In order to avoid specifics of a "space order of battle," it may be enough for the purpose of this discussion to note that space assets will either be in low-earth orbit (LEO), medium-earth orbit (MEO), or high-earth/geosynchronous earth orbit (HEO/GEO). Examples of each orbit include, DMSP, GPS, and DSP. We already discussed the general threats we face in terms of space warfare, and the same threats may be applied to orbital assets. Discounting the natural threats of orbital matter, electromagnetic energy, and charged particles in the space environment, the first obvious threat (even if difficult to manifest) is physical destruction or disabling by kinetic or directed energy. The second threat is exploitation. Third, and easiest to accomplish, is denial through destroying or disabling ground stations, launch complexes, et cetera Thus we reach a paradox that the best protection for space assets is actually on the ground!

From Space To Earth

Given a scenario in which an adversary cannot be reached easily—either because they hold extensive amounts of denied territory or have many neutral or not-so-neutral neighbors—using space-based weapons provides a viable option. Space weapons could affect the enemy's systems and apply force without affecting neighboring countries or conducting conventional offensive action. Time does not permit this short article to include all the possible perturbations of attack scenarios and weapons (kinetic energy, directed energy, nuclear, etc.), but in all cases the more weapons at our disposal the better.

This proposition opens two near-term challenges. First, fielding a space weapon will be enormously difficult; second, the decision-making process to draw blood with it is not defined. In addition, we face again the challenge of defending those on-orbit assets. If used to execute a telling attack from, through, or in space, they will ripen from potential into full-blown targets. The difficulty of taking out an orbiting satellite probably means the risk of direct attack is low for now, but the more difficult problems of protecting satellites from attack need to be addressed in the near future.

Into The Space Lanes

While sea lanes are determined by currents and lines of commerce, orbital tracks are the current "space lanes." GEO slots are allocated by the International Telecommunications Union (ITU), based on the corresponding geographic position as well as the radio frequencies utilized. These slots are limited, and as more nations purchase geosynchronous satellites the chance of collision or RF interference increases. It is unlikely that nations would go to war over a particular ITU slot, but they could wage "denial of service" or "denial of access" attacks against satellites or slots (e.g., by jamming).[35] Furthermore, a serious space collision could cost owners and insurers millions of dollars in lost capital and revenues and, depending on what services are lost and the international climate at the time, could escalate into conventional conflict.

In contrast, MEO, LEO and other orbits are essentially "first-come, first-served." As discussed earlier in this paper, it's problematic to dislodge a satellite once it is on-station. It is unlikely, especially in the near term, that nations would go to war over a specific LEO track. The Outer Space Treaty is strong enough to handle disputes over these orbits is not yet tested.

Some problems of space warfare are not fundamentally different from conventional terrestrial warfare. For instance, electromagnetic "battle" over orbital slots may create confusion and annoyance but its collateral damage would be minute; in contrast, armed battle over an ITU slot would create a high risk of collateral damage in the form of debris that may damage or destroy any number of other spacecraft and make the slot—and others—unusable for a period of time. Given the inherent danger resulting from destroying an orbiting object, would we prefer to go for "soft" kills or removal?[36] Can we foresee the day when we issue letters of marque to civilian companies, creating "space privateers"? Certainly the nascent "satellite recovery" business—currently proposed as grappling an aging satellite with a new propulsion module in order to extend its on-orbit life, and eventually foreseen to include transferring propellant or making repairs—could be co-opted for other purposes.[37]

Controlling The Choke Points

As discussed in this paper, as America's space mission increases—through exploration, exploitation and commerce—we face the need to control the choke points of the solar system: the LaGrange points and other gravitational interstices. Interplanetary commerce, will flow through these points where gravitational attractions balance out (much the same way an old Apollo-era rocket stage was swept back into Earth orbit in 2002).[38] Is that development too far in the future for us to draw up tactics and plans today? It seems inevitable that maintaining space control will require us to hold and defend such points.

Space Tactics And Strategy

Clausewitz defined tactics as the conduct of battles or engagements, and strategy as the use of engagements in pursuit of the larger aims of war.[39] These classical, terrestrial concepts also apply to spatial conflicts. For example, "space-to-space" conflict fits the idea of "tactical" conflict. An orbital conflict (e.g., an anti-satellite attack) would be a tactical engagement, even though it may have strategic results.

Because almost all space assets can be considered strategic assets, space may be thought of as a national "center of gravity." But to call space—where the effects of gravity are felt much differently than on earth—a COG mixes metaphors in the extreme. This illustrates a further problem: most terrestrial language distorts the truth about operating in space. In the same way that maritime terminology developed into something different from the terminology of land, we eventually need a fundamental, descriptive grammar of space travel and space conflict.[40]

CONCLUSION: SPACE WAR FOREVER

All this discussion about space topics may seem premature, if not wasteful, but we look to the legacies of past theorists in thinking seriously about the implications of new technologies—including examples that pre-date our own service's Air Corps Tactical School. In the post-Civil War period up to the Spanish-American War and the Great War, there was a very real disconnect between command level Naval officers who held to the traditional age-of-sail paradigm and younger officers who advocated modern steam-powered, blue-water, show-the-flag Naval expansion. In the last quarter of the 19th Century, modern technological expansion of the Navy played to the educational strengths of those young Annapolis graduates.

To plan effectively for a future in space, America must contend with the same kind of institutional inertia without letting personal enthusiasms intruding on reality. If this country advocates exoatmospheric development, it must be based on its potential warfighting benefits, while keeping liabilities in full view, instead of viewing such development as an avenue to increased funding or organizational relevance.

How will we fight the space war? Russell F. Weigley asserts that, as a country and a people, America has a predisposition to make war in a certain way. Will there be a uniquely American approach to war in space? Given the prevalence of potential space-related threats, our national experience is driving us in the direction of cautious development. After the first blood—real or virtual—is spilled, we will rush into frantic response. That may not be the best way to use our available resources, but it does seem to be our way.

Notes:

[1] *Report of the Secretary of Defense to the President and the Congress,* United States Department of Defense (Washington, D.C.: GPO, February 1992), 85; and Sir Peter Anson and Dennis Cummings, "The First Space War: The Contribution of Satellites to the Gulf War," *The First Information War* (Fairfax, Virginia: AFCEA International Press, October 1992).

[2] Dwane A. Day, "The Air Force in Space: Past. Present," *Space Times*, March/April 1996, 18, which qualifies it as a "space applications war."

[3] Captain John Shaw, "The Influence of Space Power Upon History (1948-1998)," *Air Chronicles Contributor's Corner*, March 1999.

[4] James E. Oberg, *Space Power Theory* (Colorado Springs, Colo.: United States Space Command, March 1999), 48.

[5] Lieutenant Colonel Clayton K.S. Chun, *Shooting Down a "Star"—Program 437, the Nuclear ASAT System, and Present-Day Copycat Killers* (Montgomery, Ala.: Air University Press, College of Aerospace Doctrine, Research, and Education Paper no. 6, April 2000), 2-4, 30.

[6] Charles E. Heller and William A. Stofft, eds., *America's First Battles, 1776-1965* (Lawrence, Kans.: University Press of Kansas, 1986).

[7] Oberg, *Space Power Theory*, 121-2.

[8] They may have continued wrangling with USSPACECOM, except that USSTRATCOM absorbed USSPACECOM with the 1 October 2002 stand-up of USNORTHCOM.

[9] Robert L. O'Connell, *Of Arms and Men: A History of War, Weapons, and Aggression* (Oxford: Oxford University Press, 1989).

[10] Oberg, *Space Power Theory*, 123, 149, 165. "It is doubtful that history will remember either [the Gulf War or the Cold War] as space wars. This distinction likely awaits a clash between roughly equal competitors, one of whom suffers from a decided disadvantage in space support."

[11] Federal Aviation Administration, *Commercial Space Transportation: 2002*, Year In Review (Washington, D.C.: Associate Administrator for Commercial Space Transportation, January 2003), on-line, Internet, 23 April 2003, available from http://ast.faa.gov/rep_study/yir.htm.

Objective measures of commercial versus governmental presence are difficult to assess. One possible measure is the number of satellites designated as "commercial," except for the fact that many governments (including the US) purchase satellite services from commercial vendors. Another difficulty is separating military use from other governmental (i.e., civil) use. Still another is that some countries directly subsidize commercial space activities.

Even the number of commercial space launches cannot be used without some interpretation, since the number and cost of satellites launched is not constant. At any rate, commercial space launch activity has not yet outpaced governmental launches.

[12] John C. Baker, Kevin M. O'Connell, and Ray A. Williamson, "Satellite Imagery in the Post-Cold-War Era," on-line, Internet, 22 January 2004, available from http://www.fathom.com/feature/122209/.

"The United States and its Coalition allies benefited from Landsat and SPOT imagery data that were used to support various military missions and to provide a way of sharing imagery data among all partners. At the same time, steps were taken to deny Iraqi forces access to the same imagery sources during the Desert Shield and Desert Storm operations, as well as imagery from US and European weather satellites."

See also James Oberg, "Spying For Dummies: The National Security Implications of Commercial Space Imaging," *Spectrum*, November 1999, on-line, Internet, 22 January 2004, available from http://www.jamesoberg.com/articles/spy/.

[13] Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1976), 69. That is, war is an extension of politics.

John Keegan argued against it throughout *The History of War*, while Colin S. Gray upheld it in *Modern Strategy*. This dictum is still being debated. This paper accepts the proposition as an axiom.

[14] Alfred Thayer Mahan, *The Influence of Sea Power Upon History, 1660-1783* (Boston, Mass.: Little, Brown, and Company, 1903 reprint); or Philip A. Crowl, "Alfred Thayer Mahan: The Naval Historian," in Peter Paret, ed., *Makers of Modern Strategy: from Machiavelli to the Nuclear Age* (Princeton, N.J.: Princeton University Press, 1986).

See also Oberg, *Space Power Theory*, 6.

[15] Mahan, *The Influence of Sea Power Upon History*.

See also Arthur C. Clarke, *2010: odyssey two* (New York: Ballantine Books, 1982), 147. The Lagrange points L-1, L-2, etc., are points where a planet's gravity interacts with either the sun's or a moon's gravity to form semi-stable orbital points. Clarke referred to this type of intersection as a point on a "gravitational tightrope."

[16] One side benefit of through-space weapons delivery was that it did not risk aircrews; however, delivering the most powerful weapons in the world was the primary objective.

[17] Sun Tzu, *The Art of War*, trans. Samuel B. Griffith (London: Oxford University Press, 1963), 84.

[18] Ibid., chapter 6.

[19] Russell Weigley, *The American Way of War: A History of United States Military Strategy and Policy* (New York: Macmillan Publishing Company, Inc., 1973).

[20] "Remarks by the President on National Missile Defense," 13 December 2001, on-line, Internet, 19 January 2004, available from http://www.whitehouse.gov/news/releases/2001/12/20011213-4.html.

[21] Cheng Ho, "China Eyes Anti-Satellite System," *SpaceDaily*, 8 January 2000, on-line, Internet, 2 July 2003, available from http://www.spacedaily.com/news/china-01c.html. While the details of that proposed system seem fanciful given current technology, the Chinese successfully launched a 50-kg microsatellite in June 2000.

See also Frank Sietzen, Jr., "Microspace Technology Comes to China," *SPACE.com*, 19 October 2000, on-line, Internet, 2 June 2003, available from http://www.space.com/news/spaceagencies/microsat_china_001019.html.

[22] The number of potential sources are too numerous to count. Many related papers from Air War College, Air Command and Staff College, and the School of Advanced Air and Space Power Studies are available from https://research.au.af.mil. The Air Force 2025 study is available from http://www.au.af.mil/au/2025/. Other possibilities not referenced elsewhere in this article include:

Maj Howard D. Belote, USAF, "The Weaponization of Space: It Doesn't Happen in a Vacuum," *Aerospace Power Journal* XIV, no. 1, (Spring 2000): 46-52.

Robert L. Forward, "Surgical Strikes from Space Using Solar Sail Statites," *21st Century Space Propulsion Study Addendum*, Phillips Laboratory Propulsion Directorate Technical Report PL-TR-91-3022, June 1991.

Peter L. Hays, *United States Military Space: Into the Twenty-First Century* (USAF Academy, Colo.: USAF Institute for National Security Studies, 2002), INSS Occasional Paper 42, on-line, Internet, 19 May 2003, available from http://www.usafa.af.mil/inss/occasion.htm.

Col John E. Hyten, USAF, "A Sea of Peace or a Theater of War? Dealing with the Inevitable Conflict in Space," *Air and Space Power Journal* XVI, no. 3, (Fall 2002): 78-92.

Benjamin S. Lambeth, *Mastering the Ultimate High Ground: Next Steps in the Military Uses of Space* (Santa Monica, Calif.: RAND, 2003), RAND report number MR-1649-AF, on-line, Internet, 2 July 2003, available from http://www.rand.org/publications/MR/MR1649/.

Michael R. Mantz, *The New Sword: A Theory of Space Combat Power* (Maxwell AFB, Ala.: Air University Press, 1995).

Bob Preston, Dana J. Johnson, Sean Edwards, Michael Miller, and Calvin Shipbaugh, *Space Weapons, Earth Wars* (Santa Monica, Calif.: RAND, 2002), RAND Report MR-1209-AF, on-line, Internet, 27 March 2003, available from http://www.rand.org/publications/MR/MR1209/.

William L. Spacy II, *Does The United States Need Space-Based Weapons?* (Maxwell Air Force Base, Ala.: Air University College of Aerospace Doctrine, Research, and Education, September 1999), on-line, Internet, 24 April 2002), available from http://www.maxwell.af.mil/au/aul/aupress/CADRE_Papers/PDF_Bin/spacy.pdf.

[23] It may seem unusual that, for instance, C-17s are considered weapon systems, but not a lot of warfighting happens without units (or systems) that support but aren't lethal in themselves. Logisticians talk about the "tooth to tail" ratio, but that description is indistinct; it is more like teeth and jaw and brain and eyes and legs, etc., and determining where the "weapon" begins and ends is not always easy.

[24] Attributed to a member of the German General Staff; exact source unknown.

[25] Oberg, *Space Power Theory*, 120, and Maj Shawn P. Rife, USAF, "On Space-Power Separatism," *Airpower Journal* XIII, no. 1, (Spring 1999): 22.

[26] Using the figures of 1,100,000 North Vietnamese Army and Viet Cong killed in action, compared to the 58,202 US military killed in action (the latter figure includes non-combat deaths), the ratio is 18.8:1.

[27] Sun Tzu, *The Art of War*, 77.

[28] We might also consider whether space "spinoffs" improve the cost-benefit equation with respect to space weapons. Everyone is familiar with the types of technologies that filter down from space, e.g., computer chips, Pyrex, GPS navigation signals, etc. But while pursuing space dominance produces spinoffs, fighting for space dominance would not. Here again Clausewitz speaks plainly. We will only fight in/from space if it advances our national aims—spinoffs are nice, but not the main thing.

[29] Sun Tzu, *The Art of War*, trans. Thomas Cleary (Boston: Shambhala Publications, 1988), 143.

Note that this passage does not appear in the Griffith translation, perhaps because it "may possibly be ancient commentary which has worked its way into the text" (p. 130).

[30] "What's Up There," *Air Force Magazine* 86, no. 8 (August 2003): 24.

In contrast, "Satellite Situation Report," 1997, listed only 28 countries, on-line, Internet, 13 January, available from http://liftoff.msfc.nasa.gov/academy/rocket_sci/satellites/ssr.html.

Note that these figures do not take into account satellites owned by multinational consortia (e.g., ArabSat).

[31] Lt Col Cynthia A. S. McKinley, "The Guardians of Space: Organizing America's Space Assets for the Twenty-First Century," *Aerospace Power Journal* XIV, no. 1 (Spring 2000): 37-45. See also Oberg, *Space Power Theory*, 110.

[32] CDR Sam J. Tangredi, "Space Is An Ocean," *US Naval Institute Proceedings* 125, Issue 1 (January 1999): 52.

[33] Mahan emphasized the importance of maintaining control of such critical points in *The Influence of Sea Power Upon History*.

[34] In any discussion of access to on-orbit assets, we can expand our vision to include coalition space assets. Any coalition we form will be served mostly by US satellites but also by some Allied systems, e.g., NATO-Skynet.

[35] See Brig Gen Simon Peter Worden, USAF, "The Air Force and Future Space Directions: Are We Good Stewards?" *Aerospace Power Journal* XV, no. 1 (Spring 2001): 50-55.

[36] "Dealing with piracy" is identified as a space exploitation requirement in McKinley, "The Guardians of Space," 43.

[37] "Ariane 5 to Launch Space Tugs for Orbital Recovery Corp," *SpaceDaily*, 3 March 2003, on-line, Internet, 19 January 2004, available from http://www.spacedaily.com/news/salvage-03a.html; See also http://www.orbitalrecovery.com/.

One additional twist to the idea of satellite recovery is the possibility of on-orbit inspection. In this case, the "inspector" satellite matches orbits with its target and examines it—i.e., takes pictures of it—ostensibly for the purpose of determining the cause of malfunctions. The intelligence implications are enormous. See, e.g., Chun, *Shooting Down a "Star,"* 23-5, or Oberg, *Space Power Theory*, 73.

[38] "Mystery moon around Earth likely Apollo rocket," NASA/JPL News Release, 20 September 2002, on-line, Internet, 21 September 2002, available from http://spaceflightnow.com/news/n0209/21apollostage/

[39] Clausewitz, *On War*, 128.

[40] Colin S. Gray, *Modern Strategy* (Oxford: Oxford University Press, 1999), 60. Not to be confused with the Clausewitzian "grammar" of war.

The "Space Warfare Forum" convened in November 2001 as an informal, e-mail based discussion group among space and missile operators, acquisitions and engineering personnel, and civilian experts. It was an outgrowth of "Military Issues" roundtable discussions held at (then) Falcon AFB, Colorado; Offutt AFB, Nebraska; and Thule AB, Greenland.

This article was compiled from some of the early discussions, and is the combined work of the following members: Lt Col Graham W. "Gray" Rinehart (editor), Maj Erik "Eli" Eliasen, Maj Steve Julian, Maj Mike "Lips" Lutton, Maj Keith "Kiki" Phillips, Maj John Taylor, Capt Mark "Hammer" Van Voorhis, and Dr James H. Galt-Brown.

The Space Warfare Forum is now hosted as an interactive, on-line bulletin board, with 45 registered members as of December 2004. For information or to register as a member, e-mail the moderator@graymanwrites.com.

Making Vision a Reality: Delivering Counterspace Capabilities to the High Frontier

Col James E. Haywood
Materiel Wing Director,
Space Superiority, Space and Missile Systems Center
Los Angeles Air Force Base, California

The Space and Missile Systems Center Space Superiority Materiel Wing, home of the SMC/SY "Jedis", Los Angeles AFB, California, equip US forces with space surveillance and counterspace systems to gain and maintain space superiority. This article describes some of the SY efforts that contribute to the execution of the AFSPC Strategic Master Plan (SMP) and hence the realization of the AFSPC Vision to become a "full spectrum Space Combat Command."[1]

Through the annals of military history, the nation-state that demonstrated superiority in a particular art of warfare dominated the battlefield. Both Caesar with his Roman legions and Admiral Nelson with his superior seamanship and tactics dictated the outcome of encounters with their foes. So, too, has the United States Air Force demonstrated dominance through air superiority in every major engagement since World War II. Today's conflicts include another medium: space, and in order for the United States to maintain its military edge, it must demonstrate dominance through space superiority.

General Brian A. Arnold, the Space and Missile Systems Center (SMC) Commander, recently stated, "Just like we do in the air--the first thing we do before we try to send ground troops in or anything else is we gain and maintain air superiority, offensive and defensive counterair. The same thing in our philosophy, or our doctrine, applies to space--that we need to gain and maintain space superiority..." Like air superiority, space superiority can be viewed through its doctrinal components. Space situation awareness is the eyes and ears dedicated to providing timely and reliable information in support of space superiority. Counterspace, both defensive and offensive, allows friendly forces the freedom to utilize and exploit space capabilities while denying an adversary's ability to do the same. Finally, command and control (C2) and other enablers are those mission essential elements that fuse these components into a single space superiority architecture.

General Lord has declared space superiority as the command's number one priority and has dedicated more than several billion dollars over the next six years to fielding new capabilities. SMC's Space Superiority Materiel Wing, SMC/SY, is responsible for developing these new space superiority capabilities by acquiring and delivering new weapon systems to the warfighter. These systems will become part of the Combatant Commander's "toolbox" and form the foundation for protecting and ensuring our nation's space edge. The following are a brief summary of some of the weapon-system acquisitions executed by the Materiel Wing.

Futuristic illustrated model of a Space-Based Space Surveillance

Space Situation Awareness (SSA) is gained as the result of having sufficient knowledge about space related conditions, constraints, capabilities, and activities in, from, toward, or through space (AFDD 2-2.1). Today's SSA capability is provided by the Space Surveillance Network (SSN). The SSN is comprised of ground-based radars and optical sensors, and one space-based sensor. SMC/SY is developing two space-based systems that will close coverage gaps, improve the timeliness of observations, and supplement ground-based SSA capabilities. The Space-Based Space Surveillance (SBSS) and Orbital Deep Space Imager (ODSI) programs bring both near and far term SSA to bear for US forces.

In 2007, the SBSS Pathfinder satellite will launch to replace the Midcourse Space Experiment/Space Based Visible (MSX/SBV) sensor, a rapidly aging system. MSX/SBV started as an Advanced Concept Technology Demonstration (ACTD) and proved the military utility of space-based space surveillance. The single-ball SBSS Pathfinder will provide a sustained capability to find, fix, and track man-made space objects in both near-earth and deep-space orbits. In addition, it will reduce the development risk of the follow-on SBSS objective constellation by demonstrating key technologies and providing a platform for maturing operational tactics, techniques, and procedures. This more robust, multi-satellite SBSS program is scheduled for first launch around 2013.

The ODSI mission will perform reconnaissance on space objects of interest, providing US forces increased situation awareness as it relates to military operations. ODSI will provide the means to characterize adversary geostationary services and deny adversary clandestine space operations. The system will

leverage existing Air Force ground infrastructure and utilize a single operations center for C2 and data processing. With a constellation of approximately three satellites, slated for the first launch in FY11, ODSI will provide complete coverage against deep space assets and deliver data on space objects of interest in near real time.

In the far term, advanced concepts and capabilities for delivering more robust SSA, including inspector satellites, are being considered. The Materiel Wing is harnessing current technology investments to enable future SSA materiel solutions. However, achieving space superiority is contingent upon developing attendant capabilities in DCS and OCS.

Defensive counterspace (DCS) operations preserve US and Allied forces ability to exploit space to its advantage via active and passive actions to protect friendly space-related capabilities from enemy attack or interference (AFDD 2-2.1). As our asymmetric advantage in military utility of space continues to develop, we should expect an adversary's desire to thwart that advantage to consequently evolve. To provide an initial DCS capability, SMC/SY is developing the Rapid Attack, Identification, Detection, and Reporting System (RAIDRS).

RAIDRS is an evolutionary family of systems that support DCS by detecting, characterizing, locating, and reporting attacks against our military and commercial space assets. RAIDRS Spiral 1 (RS-1), the first increment of capability, provides detection and warning against satellite communications (SATCOM) electromagnetic interference (EMI) events. The information provided by RS-1 will permit warfighters to quickly identify and respond to attacks against selected space systems. Rapid response will improve the survival of the supported space systems and continuity of operations, enabling uninterrupted national security support. Users of SATCOM services will be able to quickly discern equipment malfunctions from intentional interference; allowing for satellite services to be re-routed, spacecraft to be put in safe mode, and the rapid prosecution of military action against hostile interferers, as required. At Initial Operational Capability (IOC) in FY07, RS-1 will deliver a limited capability for detection, characterization, geolocation, and reporting of EMI. At Full Operational Capability (FOC) in FY09, RS-1 will provide global EMI detection, characterization, geolocation, and reporting capabilities sufficient to support two regional conflicts simultaneously.

RAIDRS Spiral 2 (RS-2) will deliver more robust advanced warning capabilities for a broader set of US and commercial space systems. In addition to RAIDRS, the Materiel Wing also provides supporting technologies for the protection of space assets and develops potential technical solutions to address shortfalls in space systems protection.

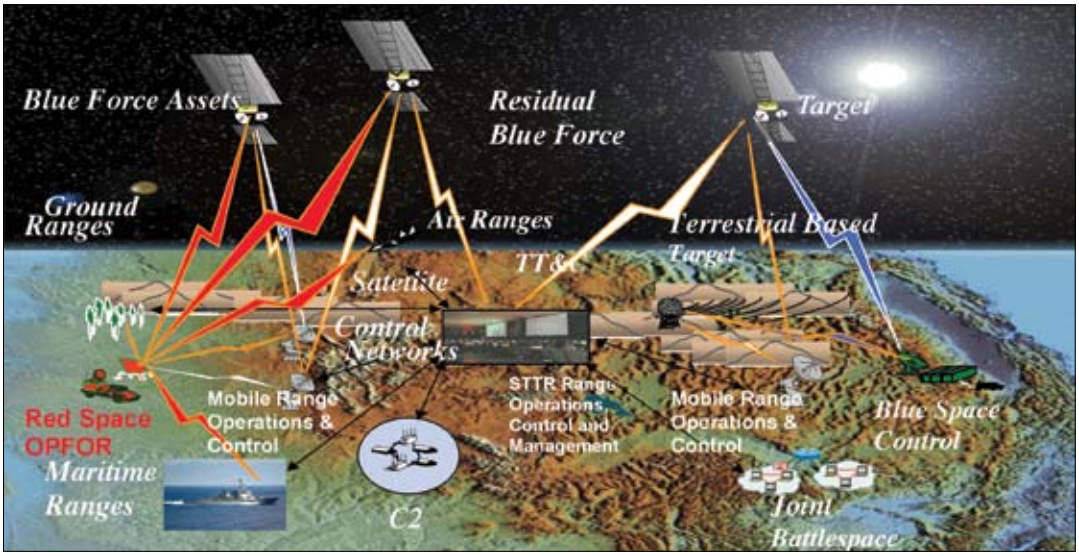
The mirror side of protecting our friendly space assets from potential adversaries is to deny those same adversaries, when called upon, the ability to exploit space contrary to our national threats. The domain of OCS capabilities is vast and includes the ability to generate both reversible and irreversible effects against adversary space systems.[2] To support this end, SMC/SY has delivered the Counter Communications System (CCS), a ground-based OCS capability designed to thwart adversary satellite communications.

Counter Communications System (CCS)

The CCS is a small, rapidly responsive, highly reconfigurable, transportable OCS platform that provides a reversible denial of satellite communications in multiple bands. The system can be configured to suit the needs of a given contingency and has a baseline design that is expandable to take on future requirements without presenting significant changes in operator interface or procedures. To date, three CCS units have been delivered to the 76th Space Control Squadron at Peterson AFB, Colorado, with IOC declared in September 2004. In addition, the Materiel Wing is also developing technologies to counter an adversary's potential space surveillance and reconnaissance capabilities.

An equally important operational component for achieving space superiority is integrated Command and Control (C2). Integrated C2 provides the "central nervous system" that ties together DCS and OCS capabilities with a constantly evolving SSA picture. In many real world scenarios, the coordination and deconfliction of multiple assets, in geographically separate locations and through disparate agencies, will demand the need for robust C2 and timely, actionable information. An example of the Air Force's ability to tie space control C2 capabilities together was demonstrated last year during JEFX04, when an Integrated Classified Combat Operations Process Initiative (ICCOPI) successfully fused Coal Warfighter, air, space, and IO processes and information into the Combined Air Operations Center. The demonstration highlighted not only the technical considerations necessary for future C2, but perhaps more importantly, the doctrinal implications of integrating SSA, DCS and OCS, and capabilities into theater combat plans and operations. Based upon the military value identified during JEFX04, ICCOPI received CSAF approval for transition and is slated to get additional play in JEFX06.

Much like the aircraft world, a "range" is needed to test, train, exercise, and demonstrate space superiority systems in a safe, secure, repeatable, and controlled environment. To fulfill this requirement, SMC/SY is teaming with the Space Warfare Center to equip the Space Test and Training Range (STTR) with



Space Test and Training Range (STTR)

the capabilities needed to test systems and train personnel in an operationally realistic environment. While the STTR initial focus is on counterspace systems and capabilities, the future space range will include an ability to exercise air, space, and information assets in an integrated environment.

The Materiel Wing is developing and delivering STTR capabilities through an incremental approach. Currently, the Interference Detection System (IDS), which provides satellite interference detection and characterization; the Terrestrial Based Transponder (TBT), which has the capability to emulate an RF transponder; and the Transmitter Locator System (TLS), which provides RF interference geolocation capability, are just a few examples of systems that will allow AFSPC operators a comprehensive capability to "train as we fight."

In summary, the SY "Jedis," along with our Command and community partners, are working hard to protect and grow our Nation's asymmetric advantage in space; we are making great strides. As a Command team, we are structuring the future of space superiority today, and leveraging our investment dollars in SSA, DCS, and OCS to the maximum extent possible. Our acquisition programs are solid—well supported, well defined, and well funded—and are on course to ensure we remain "guardians of the high frontier." Air Force Space Command Commander, General Lance W. Lord, recently stated: "We have a proud heritage with significant achievements in the development of innovative hardware and materiel solutions."[3] By all means necessary, SY will continue that tradition.

Notes:

[1] AFSPC Strategic Master Plan: FY06 And Beyond, 1 October 2003, 3.

[2] Ibid., 23.

[3] General Lance W. Lord, "Welcome to High Frontier," *High Frontier* 1, no. 1 (Summer 2004): 3.

Col James E. Haywood is the Materiel Wing Director, Space Superiority, Space and Missile Systems Center (SMC), Los Angeles Air Force Base, California. In this wing commander-equivalent position, he directs and equips US forces with offensive and defensive counterspace, space situation awareness and special access required systems to gain, maintain, and exploit space superiority. He manages a multi-billion-dollar budget and leads a 300-person system program office and 2500-person industry team at multiple locations throughout the country to support operational systems worldwide. He directs the planning, development, testing, deployment and sustainment of a complex and dynamic portfolio of space-superiority systems of the highest national priority.

Colonel Haywood was commissioned through the Carnegie-Mellon University's Air Force ROTC program in 1983. His career has included a wide variety of system acquisition and operational planning assignments involving space, missile, and aircraft systems. Prior to assuming his current position, he was the Deputy Director of the Navstar Global Positioning System Joint Program Office.

Book Review

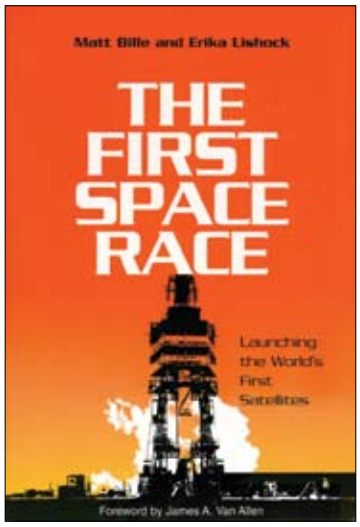
The First Space Race: Launching the World's First Satellites

The First Space Race: Launching the World's First Satellites. By Matt Bille and Erika Lishock. College Station: Texas A&M University Press, 2004. Illustrations. Photographs. Notes. Glossary. Bibliography. Index. Pp. xviii, 214. $19.95 Paperback ISBN: 1-58544-374-3

Nobody should assume the history of American and Soviet space programs during the 1950s has been chiseled in stone. Matt Bille and Erika Lishock make this perfectly clear in their new book titled *The First Space Race*. Through thoughtful analysis of events generally familiar to space historians and vigorous pursuit of details obscured by the passage of time, the authors supply new insights to one of the Cold War's most dramatic chapters. As the legendary James Van Allen admits in the foreword, this volume even provides still-living participants in that race with a "much improved context for their own fragmentary knowledge."

It took several centuries to lay the foundations for successful launch of the world's first artificial, earth-orbiting satellites in the late 1950s. During the 17th century, Johannes Kepler and Sir Isaac Newton formulated the necessary theories of motion. Edward Everett Hale and other science-fiction writers in the 19th century inspired serious spaceflight theoreticians like Konstantin Tsiolkovsky, Hermann Oberth, and Robert Goddard at the dawn of the 20th century. The pace of actual hardware development quickened at mid-century under the leadership of brilliant engineers like Wernher von Braun, Sergey Korolev, Theodore von Karman, and others. Long-range rockets built by the US and USSR could travel through outer space to deliver thermonuclear warheads halfway around the globe. Informed visionaries recognized the feasibility of using those same rockets to launch satellites that would enhance national security.

While long-range rocket and satellite development occurred within the military establishments of the US and USSR, plans for the International Geophysical Year (July 1957-December 1958) committed both countries to launching satellites for scientific research. The Soviet Academy of Sciences created a Commission for Interplanetary Communication, chaired by academician Leonid Sedov, to oversee its IGY satellite program. Meanwhile, a committee headed by the Jet Propulsion Laboratory's Homer Stewart selected the US launcher and satellite from among several proposals by the military services. On 4 October 1957, the USSR launched *Sputnik*, the world's first artificial satellite. After the US Navy's failure to launch a Vanguard satellite on 6 December, the Army put *Explorer 1*, America's first satellite, into orbit on 31 January 1958. Both nations commenced "storming the heavens" with civil and military satellites.

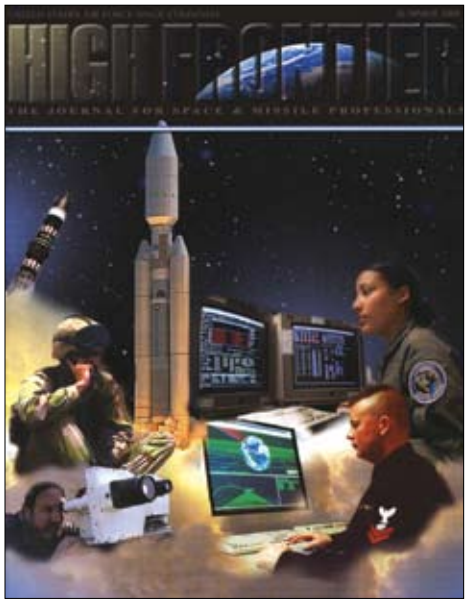


Bille and Lishock drew information from a variety of sources—written and oral, primary and secondary, older and recent—to tell this complex story in a relatively straight-forward, simple style. They discuss how erroneous "facts" have crept into the literature over time. For example, the color scheme on museum models of *Explorer 1* differs from the actual flight article. Furthermore, the Goldstone tracker could not have confirmed that Explorer 1 was in orbit, because Goldstone was set up months later to support the Pioneer lunar probes. The authors analyze in depth the Stewart Committee's choice of the Navy's proposal over the Army's, the relationship between early military and civil satellite programs, and the question of whether the US purposely refrained from being the first to launch a satellite. Finally, they surprise readers with a description of NOTSNIK, a "secret competitor" that aimed to place tiny satellites in orbit via a five-stage booster launched from a US Navy fighter aircraft.

When one considers that neither Bille nor Lishock is an academically trained historian, the rigor of their research methodology becomes all the more remarkable. Anyone wanting to know how these two associates with the global consulting firm Booz Allen Hamilton successfully managed this project should read their article titled "Chronicling Space: Adventures in Space History" in *Quest* 11:4 (2004), pp. 7-13. The authors explain its genesis and evolution from a manuscript titled "Little Star: The History and Promise of Small Satellites" toward the published work that is the subject of this review. Along the way, Bille and Lishock had the good fortune to interview such space luminaries from the 1950s as James Van Allen, Milton Rosen, Ernst Stuhlinger, Fred Durant, and William Pickering. They also learned that obstacles sometimes thwart research plans, that serendipity can play a delightfully rewarding role in the discovery of information, and that the practice of historical writing involves more than merely recording names and dates.

The First Space Race engages interested readers to the point where they will have difficulty putting it down before turning the last page. Bille and Lishock have achieved a wonderful balance between the American and Soviet sides of the story. Their new research and refreshing analyses correct inaccuracies that have crept into the literature over the decades and prompt space historians to question causal connections they once took for granted. Despite a few editorial errors, this volume offers space professionals a window on how past spaceflight successes might broaden our perspective on future possibilities.

Reviewed by Dr. Rick W. Sturdevant, Deputy Command Historian, HQ Air Force Space Command



Space Professional Development, High Frontier (Summer 2004)

I think publishing a new, space-centric periodical works contrary to efforts to further integrate air and space operations to provide needed capabilities to warfighters. We should save the tens of thousands of dollars spent to produce and distribute subject publication and focus efforts on getting our message out to all AF warriors.

Thanks to you folks and General Lord for soliciting feedback.

Col Douglas J. Wreath, USAFR
Deputy Chief, Strat Security Policy & Integration Division

Col David K. Cannon, Director of Public Affairs, AFSPC Reply:

Dear Colonel Wreath,

Thanks for your feedback to the High Frontier Journal. I'm glad you received the journal and read it.

We certainly appreciate your comments and hope the following answers your concern.

In the early days of air power, the pioneers continually suffered from lack of thoughtful reflection and doctrine. Even after the Air Corps Tactical School began to push the envelope of ideas, doctrine and integration lagged. Our Space doctrine, some could say, is in a similar state. High Frontier is an effort to get our ideas on the table and work toward the integration you refer to. It is hoped that High Frontier will eventually become just the type of publication you suggest.

Further, the development of Space Professionals is high on the list of many throughout the country. SECDEF, Congress, and our AF leadership are keenly interested in our Space Professional development plans. All have identified information sharing as key to our efforts. General Lord testified (22 July 04) before the House Armed Services Subcommittee on Strategic Forces concerning the development of our Space Professionals. A recent GAO report also identified "education and training" as an important factor in the entire Space Professional Development Focus.

Your thought that the Journal is of limited usefulness because it "...works contrary to efforts to further integrate air and space..." isn't entirely true. High Frontier, though designed and written for Space Professionals' is a forum for the entire defense establishment and is intended to assist in that very integration. This is part of our goal for the journal and feedback thus far is overwhelmingly positive. I ask that you bear with us as the journal evolves.

The AFSPC/CC was designated by the SECAF in July of 2003 as the focal point for managing career development. High Frontier is one of the methods General Lord selected to carry out his charge from SECAF.

The funds used for the Journal are from O&M funds (Title II), while weapon system and weapon system integration funds are from appropriated funds (Title III or IV depending on designation). Thus a simple transfer from the Journal to an undefined concept of integration is not possible.

Thank you for sharing the inaugural edition of your new journal, *High Frontier*. This publication presents a wonderful opportunity for all professionals to explore thought-provoking, contemporary space issues.

Incorporating input from the joint community into future editions of the Journal could enhance understanding of space capability needs in joint warfare. I am certain we can find eager contributors in the Joint Staff, USSTRATCOM and elsewhere.

I look forward to future editions of *High Frontier* and wish you continued success.

General Richard B. Myers
Chairman of the Joint Chiefs of Staff

General Lance W. Lord, Commander, AFSPC Reply:

Dear General Myers,

Thank you for taking time to provide valuable feedback on our inaugural edition of the High Frontier journal. Your suggestion to incorporate input from the joint community into future editions of the journal is already in the works. In fact, my staff is working closely with CENTCOM to include an article in our spring edition which is due out June 2005. We are also soliciting articles from the joint arena for our spring edition which will be dedicated to the Support to the Joint Warfighter theme.

Thank you again for taking time to offer such helpful feedback. We are eager to hear your thoughts regarding future issues of High Frontier.

Feedback

I was asked to review/read the new *High Frontier* Journal and provide my thoughts and feedback to you. Let me begin by providing my background in the USAF. I served with the Mighty Ninety from 1993-1997 as an ICBM Combat Crew Commander. I then did a career broadening tour as a PACAF Combat Search and Rescue Controller that was based in Hawaii from 1997-2000. This tour of duty took me around the world and enabled me to work with US Army, Navy, and Marines, as well as other nations military forces. It allowed me to see the importance of having a group of space professionals in the fight. After that tour, I came to the 45 SW as a Mission Flight Control Officer for the launches from 2000 to present. I also stood up the first Spacelift Weapons and Tactics Flight in AFSPC. I give you this background on myself, so you can better appreciate my comments.

I was very impressed with the content and quality of articles in the first edition. I was pleased to see AFSPC putting this very important and overdue effort to train our space members on the importance of what we do and why without us, we couldn't fight and win our nation's wars. I really enjoyed the Army Cadre article written by Lt General Larry J. Dodgen as it points out the significance of what we do. I would like to suggest for future publications, to add articles that show how space operations directly support the warfighter. Showing how what we do directly affects the guys on the ground and in the air, makes a very powerful impact on the non-deployed space operators. It also enables the Space Cadre to focus on how new procedures, tactics and even help develop new systems that can better support our warfighters around the world. Please keep up the good work on this publication.

Capt Ivan Wood
45 OSS/OSK

Colonel David K. Cannon, Director of Public Affairs, AFSPC
Reply:

Dear Captain Wood,

Thanks for the feedback -- we certainly appreciate you taking the time to let us know what you think. And I'm glad you enjoyed the first issue.

Your suggestion "to add articles that show how space operations directly support the warfighter" is a good one. You'll be glad to know that our Spring edition will focus on 'Space Support to the Warfighter' and will have articles from other Services as well as how space supports the current efforts in Iraq and Afghanistan.

Again, thanks for reading High Frontier and letting us know what you think.

Congratulations on your inaugural issue of *High Frontier*. We applaud your decision to launch the new journal because we believe dialogue plays a major part in force development. As we've discussed, we should do everything we can to encourage Airmen to discuss the latest air and space power concepts.

As you know, the Summer 2004 Air & Space Power Journal issue that focused on space power was a big success. Air War College, Air Command & Staff College, SAF/LL, and others have requested extra copies of that issue. Several articles from that space power issue, including your "Commanding the Future" article, are also being translated and published in other ASPJ language editions, giving them even wider circulation. We appreciate your continued support in supplying articles to ASPJ for publication.

ASPJ can continue to partner with you and your command. In addition, ASPJ will maintain its focus on a broad audience seeking professional dialog about the operational level of war from an air space perspective. *High Frontier* seems well positioned to emphasize topics of interest to all USAF space professionals and enthusiasts, and we think its excellent quality and content will harmonize well with ASPJ.

By tailoring content to their respective audiences, both journals can serve as valuable forums for professional dialogue. Whenever you wish to reach a broad Air Force and international audience, ASPJ will be ready to help. Please don't hesitate to call if we can be of further assistance.

Lieutenant General John F. Regni
Commander, Air University

General Lance W. Lord, Commander, AFSPC
Reply:

Dear General Regni

Thank you for your assistance and feedback on our initial issue of High Frontier journal. As publisher of Air & Space Power Journal, your endorsement certainly emboldens us to continue with this effort and challenges us to pursue the highest professional standards with each future edition. We're also very appreciative of Air University's eagerness to expand an already strong partnership between our two commands. I'm confident that together, we'll create a much-needed national forum for discussing the growing role of space in the joint operations arena.

Meanwhile, my staff is putting the finishing touches on the next issue of High Frontier. We're very excited to have Air University's help to improve our product and facilitate access to a broader audience. Thank you again for your support and please feel free to submit any additional suggestions regarding our new journal.

Feedback

Thank you for the opportunity to provide my thoughts in the inaugural edition of *High Frontier*. Joint integration is one of my highest priorities, and so I read with interest the contributions of all the Services to this journal for our space professionals.

Let me say first that *High Frontier* sets a high bar as a means of educating our space professional community. I found the articles to be engaging and well developed. As you've requested, I have a few suggestions that I believe would promote the continued success of this important journal:

- Encourage your readership to respond to articles, and print that feedback--good or bad.
- Devote a regular section of the journal to space technology and innovation, and solicit "state of the technology" articles from the civilian technology sector.
- Maintain the jointness of the first edition throughout the life of the journal--all warfighters have vested interests in space.

You're off to a great start with *High Frontier*. Our nation's space professionals and joint warfighters will be the better for it. Please let me know if I can be of further assistance to you in this worthwhile endeavor.

Admiral Vern Clark
Chief of Naval Operations

General Lance W. Lord,
Commander, AFSPC
Reply:

Dear Admiral Clark

Thank you for your valuable feedback on our initial edition of High Frontier journal. We share your commitment to maintain joint centric focus and provide a voice for warfighters everywhere. In that spirit, we will continue to solicit articles from all corners of the joint arena. Finally, our editorial committee is considering incorporating a section on "space technology and innovation." As word gets out and our reputation grows, we believe industry and commercial space experts will be eager to submit contributions to the journal as well.

While we're certainly proud of our inaugural effort, feedback like yours can only improve our publication with each edition. Thank you again for taking time to offer such helpful recommendations. We are eager to hear your thoughts regarding future issues of High Frontier.

I believe the first issue of *High Frontier* was right on target. The journal introduced the space cadre concept, and we learned what General Lord has planned for us. At this point I believe the journal needs to shift to a different format to help the entire space cadre maintain situational awareness of important information. It should have the following sections/departments:

1. Senior Leadership Section - contains senior leadership views for AFSPC and the space cadre, assessments on how well the cadre is developing, and other important messages to the cadre.
2. Features Section - Articles on what's new in the world of space & missile ops, including NASA and the civilian sector. Should also include perspectives of senior leadership outside AFSPC on how space can support their mission
3. Acquisition Section - contains information/articles (cost, timelines, etc.) on new systems and capabilities being acquired for space & missile operations and the supporting infrastructure
4. Operations Section - contains information/articles on new & future procedures, systems, capabilities, organization, etc., in space & missile operations. This is where the Space Warfare Center should provide articles regarding new concepts, TTPs, etc.
5. Support Section - contains information/articles on space supporting infrastructure (communications, security, logistics, etc.)
6. Personnel Section - contains information/articles on key leadership changes (commanders, AFSPC directors, etc.), personnel programs particular to the space cadre, education programs/courses, career information to include a timeline of upcoming AFSPC boards, etc.

Each section may not be applicable to every issue, but they address topics that I believe are important to the personnel in the cadre as well as the development of the cadre itself. The journal should also include articles written by the everyday operators, acquisition and support personnel, scientists, and engineers...where "the rubber meets the road." This helps broaden our perspective of space & missile operations as a whole. I would also recommend putting the magazine on the Space Professional Development website.

I hope this helps.

Maj Larry Wade Norman, Jr.
Assistant Deputy Director for
Operations, Operations Team 5,
National Military Command Center,
Joint Staff/ J-3

Col David K. Cannon,
Director of Public Affairs, AFSPC
Reply:

Dear Major Norman,

We're glad you liked the first issue of High Frontier and hope you'll continue to enjoy them.

Your suggestions are good. We have an editorial board process for the journal and we'll certainly discuss these ideas at the next meeting. As you might suspect, if we adopt the format you suggest, it will take awhile to get there. Please bear with us as our goal is to make the High Frontier meaningful and relevant to the professional Space and Missile community. Crucial to that is feedback like you gave us.

Feedback

As a space professional and supervisor of the Air and Space Power Journal, I want to let you know that I am very pleased with both the quality and content of your inaugural issue. *High Frontier* appears to be an excellent medium to get the word out on space issues. I am looking forward to upcoming issues.

I would be remise if I did not remind the staff of the excellent space issue we published this past summer with the ASPJ. It was very well received and is one of our most requested journals. As always, the ASPJ will remain a venue for both air and space articles and dialogue. It is good to see that their is room in this Air Force for a new publication and an established journal to exist and flourish simultaneously.

Col Dale L. Hayden, USAF
Director, Airpower Research Institute
College of Aerospace Doctrine, Research and Education (CADRE)

Col David K. Cannon,
Director of Public Affairs, AFSPC
Reply:

Dear Colonel Hayden,

Thanks for the great words concerning High Frontier. It's an honor to hear from the Director of Airpower Research Institute. We are true fans of ASPJ and are certainly aware of the special space issue you put out. General Lord still hands that out to visitors and carries it with him when he visits the Hill.

I know that we'll still submit articles for ASPJ and ask that if there are any articles that you see that won't be used in ASPJ but would fit our journal, please send them our way.

I enjoyed reading the journal, it was good to see the other services represented in the journal, it gives a bigger perspective of what we are trying to develope. What I would like to see is information on training and how to request training.

1Lt Reginald D. Best, USAF
Project Lead, Software Development & Integration Advanced EHF Satellite Communication Program

Col David K. Cannon,
Director of Public Affairs, AFSPC
Reply:

Dear Lt Best,

Thank you for the feedback on High Frontier. I'm glad you enjoy the journal.

You won't see articles in the journal on how to request training. The purpose of the journal is to keep the Space Professional community apprised of the latest within the community and to spark debate and discussion of matters that affect the community.

Your best bet reference training questions are to work with your supervisor and commander to identify the types of training you need that logically follows your Officer Professional Development. You will then request that training through your normal personnel channels or via your Officer Preference Worksheet.

Hope this helps. If not, please let the space pro folks know.

What an awesome idea. However, if I may offer up a more "appropriate" and cost savings idea...

Invest in a website that connects Space and Missile folks together (kind of like the Missile Mafia list that once existed) and provides a wonderful forum such as educational articles, MP3 downloads of latest issues, presentations made regarding the current and future activities of *High Frontier*. I believe this would be a much more powerful tool to tech-savvied members as well as the "next generation" --a more cost effective methodology.

Though a "digital migrant," I still enjoy hardcopies to read; however, going "on line" this would best serve the active duty, guard, reserve, other services, and also retirees; if you sent this out via web. Your reach could be far more extensive and the opportunities expansive in nature. Friends can send to friends to recommend getting a "subscription" and add to getting the word out.

Wish you all well!

Maj Marcia L. Weiss, USAF
Chief, Education Technology,
Headquarters Air University (AETC)

Col David K. Cannon,
Director of Public Affairs, AFSPC
Reply:

Dear Major Weiss,

Thanks for your feedback concerning AFSPCs journal, High Frontier.

You suggested establishing a website so all Space and Missile folks could get together.

We have one and it's:
https://halfway.peterson.af.mil/spacepro
or from a commercial address:
http://www.peterson.af.mil/spacepro

Check the site out and then let us know what you think. We, of course, will continue to update it to make it relevant.

Again, thanks for the feedback and please share the journal with others.

DEPARTMENT OF THE AIR FORCE

HEADQUARTERS AIR FORCE SPACE COMMAND

Dear Space Professional Colleague,

High Frontier, the Journal for Space and Missile Professionals, is designed with all of our space professionals in mind across the Department of Defense, the National Security Space community, our friends in Congress and partners in industry.

We are interested in what you think of *High Frontier* and request your feedback. We want to make this a useful product to each and every one of you as we move forward in the development of our space professionals and to stimulate intellectual thoughts.

Please send your comments, inquiries and article submissions to:

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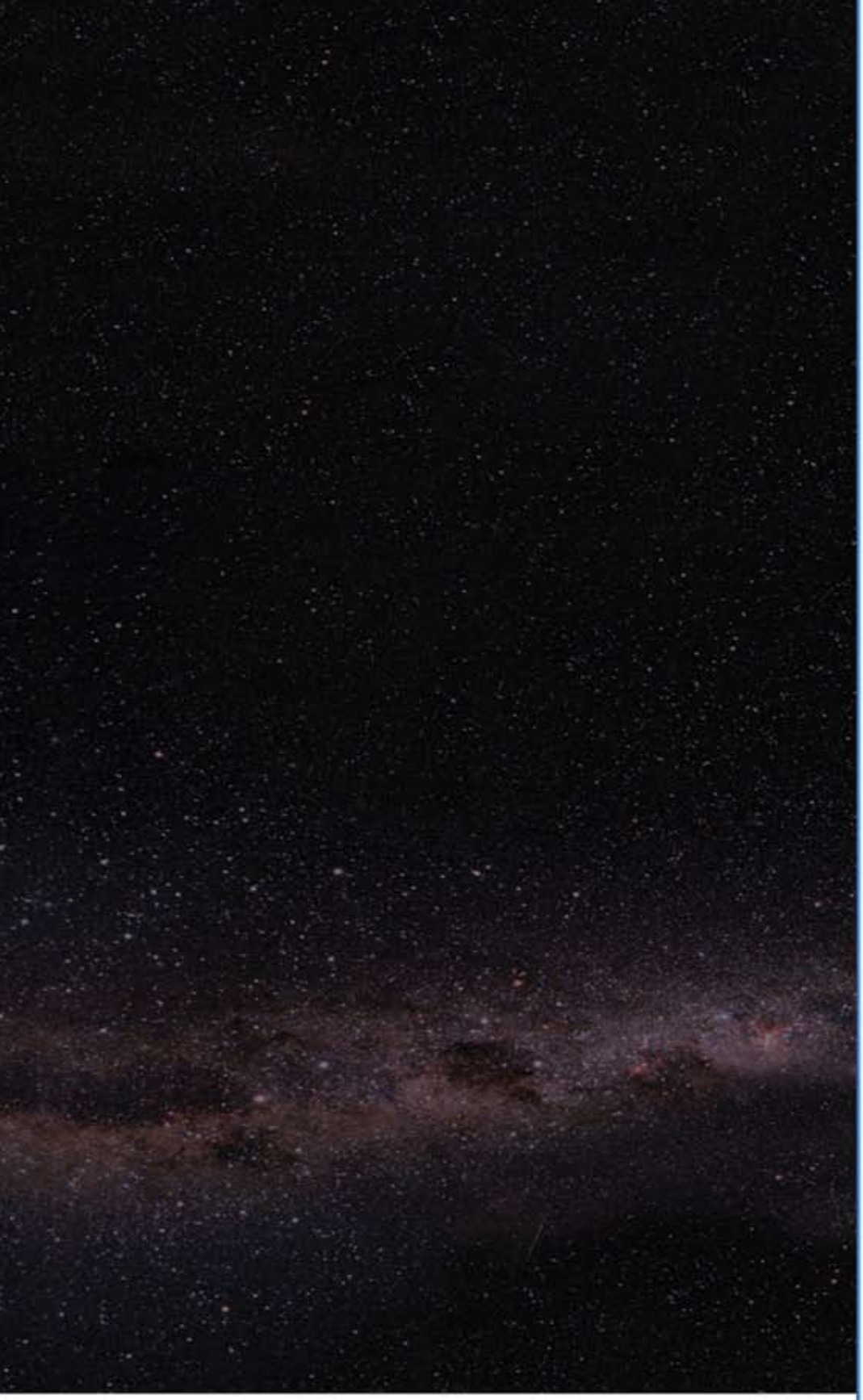
TELEPHONE: (719) 554-3523 FAX: (719) 554-6013
Email: afspc.pai@peterson.af.mil

Again, welcome to *High Frontier!* We hope you enjoy this edition and will make future editions part of your professional reading library.

LANCE W. LORD
General, USAF
Commander, Air Force Space Command

GUARDIANS OF THE HIGH FRONTIER



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For more information on space professional development visit: www.peterson.af.mil/spacepro

Air & Space Power Journal: www.airpower.maxwell.af.mil/airchronicles/apje.html