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Space Technology: Force Multiplier or False Sense of Security

by

Jessie W. Canaday

Major, USAF

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

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07 FEB 1994

Signature: J. Canaday

Abstract of
Space Technology: Force Multiplier or False Sense of Security

The premise that space technology is a force multiplier is analyzed. Lessons learned from Desert Storm are discussed to show the advantages that space systems can bring to the battlefield and how unprepared the space community and our military forces were to execute a war using space technology. New space technology applications are described to show how space technology can enhance our military forces and the need for space control is discussed as more and more countries acquire space capabilities. Finally, by relying too much on technology and believing that technology will win all wars, we may garner a false sense of security. The paper concludes that space technology can be used as a force multiplier if we integrate space technology into all military operations and exercises, develop space doctrine to drive requirements for technology, educate our people on space systems, develop a coherent space control strategy, win the technology race and carefully assess our military requirements in the "new world order".

TABLE OF CONTENTS

SPACE TECHNOLOGY: FORCE MULTIPLIER OR FALSE SENSE OF SECURITY

CHAPTER I

INTRODUCTION

Imagine a battlefield commander who has total "situational awareness" and knows exactly where all of his/her troops are and exactly where the enemy troops are at all times, or a pilot who has the ability to receive real-time intelligence on his/her target in the cockpit en route to the target. Imagine further, a ship-based theater ballistic missile defense system which could be stationed off an enemy's coast within a matter of days or a soldier on the battlefield consulting a doctor thousands of miles away on medical procedures to save a wounded marine's life. Sound like an AT&T commercial? No, these are just a few examples of what space technology could bring to battlefield of the 21st century.

"*Future space weapons are inevitable. The ability to strike targets directly from space will revolutionize warfare.*"[1] While we are still a few years, if not decades, away from developing and deploying weapons from space, our reliance on space technology has rapidly grown over the last four decades. But, it was not until Desert Storm--what some call the "first space war"--that many people, including our potential future adversaries, took notice of space capabilities. Almost 90% of the intra-theater communications were carried by satellites, multispectral imagery was used to prepare current and precise maps of the area of operations and accurate weather predictions from satellites were used to plan and execute attack missions and determine wind direction in the case of a chemical weapon attack.[2] Additionally, timely intelligence data from satellites provided key targeting information, warning satellites alerted the theater commander of Iraqi SCUD attacks and navigational satellites provided precise positional data to ground troops and air crews.

Desert Storm clearly demonstrated the military advantages of exploiting space technology, but it also highlighted how unprepared our military services and the space community were to execute a war using space technology. In particular, space capabilities were not integrated into military operations and exercises, space doctrine had not been developed and most people were ignorant of space capabilities and their limitations. These shortcomings will become increasingly more important to overcome as creative new ways to exploit space technology are developed and employed.

Exploiting space technology as a force multiplier has generated a lot of interest in this day and age where military budgets are shrinking. "Information dominance" will be made possible using space systems and promising results from two new applications of existing technology, Talon Sword and Ship-based Theater Ballistic Missile Defense, will increase our military capability in the near future. Moreover, controlling the space environment will become a new dimension to theater campaign plans.

With all the success that space systems enjoyed in Desert Storm and the potential force enhancements that new applications of space technology promise to bring to the battlefield, we can not let ourselves be lured into a false sense of security. In the "new world order", our military focus has changed and peacekeeping and humanitarian assistance operations are more likely than global war. While space technology can provide force enhancement in most scenarios, it may provide little to counterinsurgency or hunger relief operations. Space technology can not replace sound diplomacy, strategy and policy. Additionally, proliferation and the commercialism of space are rapidly diminishing our lead in space. Unless we are willing to stay ahead in technology, an expensive undertaking, space technology may no longer be a force multiplier.

CHAPTER II

WHAT WE LEARNED FROM DESERT STORM

James W. Canan, Senior Editor of Air Force Magazine, stated: "*The Gulf War demonstrated once and for all that space systems are indispensable tools of modern combat. Satellites never planned a sortie, dropped a bomb, executed a flanking maneuver, or fired a shot, but they might as well have. Their contributions to all such endeavors were central to the success of U.S.-led coalition forces in outwitting and outgunning the enemy.*"[3] Although there are many examples to support this claim, I've selected two that perhaps illustrate the most significant contributions that space technology made to Desert Storm without violating security classifications.

The Navstar Global Positioning System (GPS), consisting of a constellation of twenty-one operational and three spare satellites in circular orbits, provides accurate three-dimensional positional data--latitude, longitude and altitude--to anyone who has a GPS receiver. Since this system has both military and commercial applications, it was developed with a special mechanism called selective availability (SA) for military uses only. When SA is turned on, only military receivers equipped with a SA decryption device receive accurate positional data, while other commercial users receive degraded positional data.

At the time of Desert Shield/Desert Storm, the constellation only consisted of sixteen satellites (the full constellation of 24 satellites was achieved in June 1993). This meant that three-dimensional data, critical for air operations, was only available to the war zone about sixteen hours a day. Nevertheless, GPS proved extremely valuable in the desert environment where featureless terrain and frequent sandstorms made finding your way very difficult. Colonel Kenneth Walsh, space chair at Air University, Maxwell AFB, Alabama explained: "*GPS became one of the hottest tickets in the theater. People not only were putting in emergency requisitions for GPS receivers, they were buying them over the counter through*

long-distance phone calls back to families and relatives in the States."[4] The number of GPS receivers in theater increased from a few hundred at the beginning of the allied buildup to several thousand by the end of the war.

The Defense Support Program (DSP) is the second example illustrating the significant contributions of space systems. DSP is an early warning system designed to detect the launch of nuclear intercontinental ballistic missiles (ICBMs) against North America. It turned out that under the right conditions, DSP could be used to detect Iraqi-launched SCUD missiles and provide tactical warning to United States Central Command (USCENTCOM). Lt. General Thomas S. Moorman Jr., who commanded Air Force Space Command (AFSPACECOM) during the war recalled, *"we never thought of DSP as a tactical system until Desert Storm"*.[5] The General continued in a related article, *"Being able to warn of impending SCUD attacks had phenomenal psychological and political importance, as well as military importance, not only to the United States but also to our allies and to civilians in Saudi Arabia and Israel. The warning systems served to contain the conflict, and they clearly enhanced our Patriot missile defense."*[6]

Both GPS and DSP are real success stories from Desert Storm, but further investigation reveals that both our military forces and the space community were unprepared to execute a war using space technology. In particular, only a limited number of military GPS receivers, equipped with SA decryption devices, were in theater during Desert Shield. To correct this deficiency, commercial GPS receivers (non-SA) were procured on short notice and sent to the field. This meant that the advantage of SA could not be used during Desert Storm and any enemy forces equipped with commercial GPS receivers, enjoyed the same level of GPS accuracy that our own forces did. In a sense, because we were unprepared to exploit the advantage that GPS would have given our own military forces, we inadvertently gave our enemy the same military advantage. Additionally in the case of DSP, although the warning satellites could detect SCUD launches, the communications network to get that information to

the theater commander was not established. Without real-time warning communications, the DSP system would have been of little use in Desert Storm. The fact that we able to take a strategic system from the "cold war" era and reconfigure it to support a tactical mission attest to the initiative and innovation of our people, but it also points out again how unprepared we were to execute a war using space technology and highlighted how our strategy and doctrine were lagging behind in the "new world order". For example, most planning was ad hoc, space annexes to theater operations plans (OPLAN) were not developed and space assets were never integrated into major exercises.

Desert Storm opened many eyes to the tremendous advantage space capabilities can provide to the battlefield, but as the two examples pointed out, we have not integrated space technology into routine military operations and training. General Charles A. Horner, currently USCINCSPACE, recalls a story when he was the air component commander for the Gulf War: "*I was already aware of the danger from [Iraqi] SCUDS before we went to the Gulf. But, it never occurred to me to use DSP to provide warning of SCUD attacks, because I was ignorant of space.*"[7] General Horner's story depicts the primary reason why space technology has not been integrated into our military operations and exercises--lack of knowledge of space systems.

Historically, space systems were developed for strategic (cold war era) and intelligence purposes and shrouded in secrecy. Consequently, few people had access to space systems/technology. Now that Desert Storm has demystified space somewhat, the push for all services is education. General Gordon R. Sullivan, U.S. Army Chief of Staff, declared: "*My intent is to bring senior-level focus to Army space activities...we expect the payoff from this approach to be high in terms of exploiting space assets for Army tactical requirements...*"[8] Additionally Dr. Gray, a noted military strategist, suggests the following in his vision for naval space strategy: "*Our goal is to achieve the same quality of integration of support from space systems that we have achieved for aircraft...To think space for all levels of war--strategic,*

operational and tactical--to the point where an absence of the space dimension would be literally unthinkable."[9] Education is the key to understanding how space technology can act as a force multiplier and how to integrate that technology into our military forces. We must also educate our people on the vulnerabilities and limitations of space systems as well. For instance, satellites are vulnerable to jamming, ground stations are vulnerable to air attack and sabotage and we can not launch satellites on demand. Theater commanders must understand these limitations if they are to use space systems in the next war.

Along with the need to integrate technology, Desert Storm also pointed out the need to develop space doctrine. According to Lt. Colonel Michael L. Wolfert, Chief Strategy, Policy and Doctrine at HQ AFSPACECOM, *"Space forces today are in their infancy. Although we have rudimentary concepts, space doctrine is only now evolving."*[10] The employment of space systems must shift from a strategic focus to supporting the theater commander. Space doctrine is essential for the theater CINC and his component commanders to orchestrate campaign plans integrating air, land, naval and space power in order to employ decisive combat power. Moreover, instead of developing doctrine to fit already existing space systems, we should develop doctrine first, then develop space systems to support doctrine.

In summary, Desert Storm was the first war in which space assets were put to the test. In most cases, they performed better than expected. However, Desert Storm also showed how unprepared we were to use space technology as a force multiplier. A July 1991 Interim Report to Congress on the Conduct of the Persian Gulf Conflict sums up the deficiencies: *"The use of space-based support by operational and tactical commanders needs to be improved, institutionalized into military doctrine and training, and routinely incorporated into operational plans."*[11]

CHAPTER III

SPACE TECHNOLOGY AS A FORCE MULTIPLIER

Ever since the Industrial Revolution, technology has played a major part in the conduct of warfare. From machine guns, to tanks, to aircraft, and now to spacecraft, new technology has served to enhance military operations. But more importantly, in today's military arena of shrinking budgets and force structure, technology provides the mechanism to maintain strength despite the draw down. Lt. General Donald M. Lionetti, Commanding General U.S. Army Space and Strategic Defense Command asserts, "*Our smaller Army must be technologically dominant from the land to space to decisively contribute to future victory. High-data-rate communications, distribution of information at the speed of light, accurate location information in featureless terrain, warning of missile attack, multispectral imagery and mapping capabilities, are a few of the space applications that will continue to revolutionize the battlefield.*"[12] Promising results from experiments using new space technology applications, gives us a sense that significant change in modern warfare is about to take place. Three examples illustrate the potential enhancements that space technology can bring to future battlefields:

"Information dominance" is the new buzz-word for the 90's--the ability to assimilate all-source intelligence and information on the battlefield, while denying the same ability to our enemy. Information dominance will give the commander "real-time situational awareness" and the ability to "operate within the enemy's intelligence cycle". It is through the development of new space systems that such a concept would be possible for the theater commander. Michael I. Yarymovych, vice president of the strategic defense center for Rockwell International, believes that "*nano-technology, which will facilitate advances in micro-miniaturization, and tactical battlefield space systems in development will allow future commanders to sit in a command post with a 24-hour-a-day moving picture of the area of operations and the area of*

interest."[13] The battle for information will dominate future conflicts as the proliferation of space technology increases, and more and more countries have the capability to receive real-time space-derived information. Overwhelming the theater commander with too much information is a real concern and one that not easily solved. Lt. General Albert J. Edmonds, JCS/J-6, has developed the roadmap to solve this problem called Command, Control, Communications, Computers and Intelligence (C4I) for the Warrior. This concept provides, "*a fused real time, true representation of the warrior's battlespace--an ability to order, respond and coordinate horizontally and vertically to the degree necessary to prosecute his or her mission in that battlespace*".[14] An exact portrayal of all enemy and friendly forces with an integrated picture of all operations in the theater will enhance current battlefield operations and planning and thus decrease the "fog of war".

Talon Sword is an experimental program which feeds global all-source satellite data into cockpits. The program has already demonstrated that imaging data from satellites can be transmitted to aircraft and then displayed on a screen inside the cockpit. General Horner, USCINCSPACE, explains: "*Say a Landsat takes an image of a certain GPS coordinate on land. There's no reason in the world why we couldn't develop processing equipment that searches through the Landsat signal and finds that image and feeds it to the cockpit's multifunction display.*"[15] Experts are predicting that this system will be fully operational in the near future, because all of the required equipment already exists. If the system works as designed, future aircrews will have "real-time situational awareness" en route to the target and within combat zones. This provides an obvious advantage to aircrews who deploy on short notice to unfamiliar places.

Ship-based Theater Ballistic Missile Defense (TBMD) provides a new dimension to the land-based TBMD system. It would "*employ existing Aegis ships with their SPY radars and vertical launch systems, together with modified standard missiles*".[16] A sea-based TBMD system could provide a quicker response time for a theater CINC faced with a tactical

ballistic missile threat. The threat which is real and growing--according to projections, as many as 40 countries will acquire or produce their own ballistic missiles by the end of the decade. During Desert Storm, SPY radars on board several Aegis ships were able to track Iraqi-launched SCUD missiles with the precision required to support missile intercepts. With a few modifications, the weapon systems will be able to engage tactical ballistic missiles in the near future. Moreover, the Navy's forward presence role can be combined with the role of ballistic missile protection to exploit its current unchallenged command of the sea and provide the only on-scene TBMD capability in some scenarios. Basing a TBMD system on a ship also provides the advantages of protection to Marine expeditionary forces or insertion of Army or Air Force units into a hostile theater of operations with a ballistic missile threat.[17]

In addition to the three examples of new technology applications, denying space technology to our enemy is also a force multiplier. Space control, analogous to sea control, will be an important consideration for future conflicts. Dr. William E. Howard III, Director advanced concepts and space for the Office of the Assistant Secretary of the Army, believes: "*Increasingly, space control will be a prerequisite for effective land, sea and air control.*"[18] Theater commanders will have to include in their campaign plans, a "means" to attack enemy space assets as well as provide protection for his/her own space lines of communications. A "means" might include jamming satellites, anti satellite (ASAT) weapons or destruction of ground control sites. Can you imagine how Desert Storm may have turned out if we had lost our access to intelligence, communication, warning, navigation or weather satellites?

Space control is a highly controversial subject and is still being debated. The cost for such systems are exorbitant and developing such systems could escalate the "arms race" in a time of decreasing defense dollars. Consequently, we have yet to develop a coherent military strategy for space control, let alone a "means" to project it. Currently, "*Congress has imposed a constraint on the development and deployment of U.S. ASAT weapons which directly inhibits building a capability for space control.*"[19]

Meanwhile, the Former Soviet Union (FSU), has the only operational anti-satellite (ASAT) weapon capable of destroying satellites in low earth orbit and probably the technology for a ground based laser system and satellite jamming equipment.[20] While the FSU may not be our future enemy, the possibility that such technology may be sold to or stolen by our future enemy gives us a reason for grave concern. To put this in perspective, lets examine a North Korean scenario.

While North Korea has yet to develop the capability to build and launch satellites, they are capable of indigenously producing short range ballistic missiles, possibly with greater accuracy than the Iraqi Scuds.[21] Of great concern, is the suspicion that North Korea has produced nuclear weapons which could be launched on their ballistic missiles against South Korea or Japan. Moreover, while the relationship between North Korea and the FSU has diminished in recent years, the possibility exists that North Korea possesses or will be sold in the time of war, some of the space control technology developed by the FSU. North Korea presents a greater military challenge than Iraq did because the "technology gap" is smaller and we have not developed a space control strategy to ensure our military advantage provided by space systems will not be denied in the time of war. If North Korea decides to invade South Korea, what do you think the U. S. response would be?

In summary, promising results from new space technology applications will enhance our military force structure, increase our situational awareness on the battlefield and act as a force multiplier. However, if we are to remain the "leading" military power, we must develop a strategy for space control and drive requirements for a "means" to execute space control missions. Even as early as 1959, the idea of space control was discussed by General Thomas D. White, Chief of Staff United States Air Force: "*I visualize the control of space as the late twentieth-century parallel to the age-old need to control the seas and the mid-twentieth-century requirement to control the air.*"[22]

CHAPTER IV

PITFALLS OF RELYING TOO MUCH ON TECHNOLOGY

Desert Storm proved that space technology enhanced our combat forces and gave us an advantage in military operations that Saddam Hussein only dreamed of. But, are we allowing a false sense of security to blanket our future decisions on military strategy and force structure? Are we succumbing to the illusion that since we have the technological advantage, we can win any war? Case in point, in Vietnam we believed that extensive bombing and highly sophisticated laser guided bombs would win the war.[23] In reality, high-tech weapons and strategic bombing had little effect on guerrilla warfare and the cost far outweighed any possible gains. Additionally, in the "new world order", the U.S. is more likely to become involved in regional disputes consisting of operations other than war where space technology may not be a force multiplier. For example, a Ship-based TBMD system may not provide any real advantage to a humanitarian or peacekeeping operation. Therefore, we must be wary of this new sense of security that space systems provide and take a balanced approach when considering the effects that technology has on future military operations and force structure reductions.

Technology has been described as "*the physical means to project power into a medium.*"[24] Throughout history, technological advancements improved efficiency and usually decreased the number of required personnel. Take for example the military applications of GPS: It can streamline flight navigation, thus reducing flight times and fuel consumption; It can improve coordinate bombing and ballistic weapon delivery, enhance site survey and field artillery placement; And it can increase the precision of mine emplacement and coastal survey. On the other hand, technology can also be a liability--unless advancement in technology is continuously developed and integrated, we risk loosing our technological advantage.

Currently the U.S. and the Former Soviet Union lead the world in space capability. However, proliferation of space technology and the commercialization of space are rapidly diminishing our lead in space. James Woolsey, Director of the Central Intelligence Agency, stated during his confirmation hearings: "*Over the next ten years, we're likely to see several Third World countries at least establish the infrastructure and develop the technical knowledge that's necessary to undertake ICBM and space launch vehicle development. A shortcut approach that's prohibited by the missile technology control regime and by the nonproliferation treaty would be for such Third World countries to buy ICBMs or major components covertly, either with suitable nuclear warheads or fissile materials.*"[25] As more and more countries acquire indigenous space technology systems, the ability of the U.S. to control proliferation dwindles. Furthermore, any space launch vehicle can easily be converted to a surface-to-surface missile with the addition of a guidance and control package. Consequently, with enough money, any nation or group, such as terrorists or drug lords, can now have access to space.

Our challenge in the future is to stay ahead in the technology race--one that has proved to be very expensive. For example, a single military GPS receiver costs around $2,500 (compared to a commercial GPS receiver that costs around $600) and MILSTAR (Military Strategic and Tactical Relay) satellite system, replacement for some older communications satellites and considered the cornerstone of the satellite communications network for the late 90's and beyond, is projected to costs up to $40 billion.[26] Part of the reason that new technology is so expensive, is the instability of governmental funding. A company may invest its entire future in a new program, only to have Congress cut the program from the declining defense budget. Consequently, if we want a company to develop a unique military satellite or piece of equipment, we're going to have to pay a high price to keep that company in business. Certainly, the current military acquisition process could be drastically improved to cut costs, but that's a whole story of its own. We cannot win the technology race unless we

are willing to pay the cost to maintain a robust space industrial base that will continue the advances in space technology.

One way to cut costs is to share space assets with commercial users. For example, routine unclassified administrative communications traffic could be routed over commercial satellite circuits. INTELSAT, a civilian consortium-owned satellite comm tions network, and other commercial satellites provided about 20% of the total communi ns for Desert Storm. Additionally, the GEOSAT Follow-On satellite is designed to provide real-time data to U.S. Navy ships and also non-real-time date to the U.S. scientific community.[27]

Using commercial satellites for military applications presents several probl ns for the theater commander: *"Protection against jamming, secure datalinks, flexibility to reallocate system assets and extend service to new regions of the globe in crisis situations, hardening of satellites and terminals, and lengthy, continuous satellite operation are just a few of the critical military features not included on commercial systems."*[28] To save money, we may be decreasing our force readiness posture as some commercially-provided satellite services may not be available in wartime. More importantly, commercial satellite owners may not want to support military users if in the time of war, like any military-related equipment, their satellites could be targeted by our enemy. For instance, airlines who participated in the Civil Reserve Air Fleet (CRAF) during Desert Storm found that is was not a profitable arrangement. In fact, *"Northwest [Airlines] has not recovered from their involvement in the war and they are taking a long, hard look at the real costs of participating...they are not signing up again, unless there are changes to the CRAF program."*[29]

In summary, the pitfalls of relying too much on technology, gives us a false sense of security that we can win every war. Like in Vietnam and operations other than war, high technology does not guarentee success. We can not substitute technology for good diplomacy and clearly defined objectives. We must assess our military requirements as our efforts are refocused towards theater operations in the "new world order". Additionally, if we are to use

space technology as a force multiplier, then we have to stay ahead in the technology race--an expensive race where our lead is rapidly diminishing because of the proliferation and commercialization of space. To save money, we are examining ways to utilize commercial space systems for military operations. While this may sound good as the DoD budget gets smaller, many commercial-provided services may not be available during wartime and commercial users may not want to invest in such an arrangement because of the substantial profit risk to them.

CHAPTER V

CONCLUSION

Desert Storm was the impetus for space systems to gain notoriety and become household words--GPS and DSP, along with other space systems, were real success stories and played a vital role in the war. However, Desert Storm also showed how unprepared our military forces and the space community were to exploit worldwide space systems in support of theater military operations. It is imperative that we fully integrate space technology into our military operations and exercises, develop space doctrine to support theater warfare and educate our people on what space systems can do for them. According to Brigadier General Vernon Conner, USA, Director of Plans at USSPACECOM, "*Space is the ultimate new high ground. And if soldiers are to prevail in future conflicts, it's the frontier they must learn to master.*"[30]

Promising results from experiments involving creative new way to use space systems as a force multiplier, lead us to believe that changes in the conduct of modern warfare are on the horizon. They also provide a way to maintain strength while the defense budget declines. Information dominance through C4I for the Warrior will provide the theater commander with an integrated picture of air, ground, sea and space operations. Talon Sword will provide real-time targeting intelligence to pilots. And Ship-based TBMD will provide a a new dimension to the land-based TBMD system and could potentially provide the only on-scene TBMD capability in some scenarios.

As proliferation and commercialization of space technology increases, more and more countries and groups will have access to space. Space will become the new medium in which to conduct warfare and space control will become an essential addition to the theater commander's campaign plan. We need to develop a coherent space control strategy and drive

requirements for a "means" to execute space control missions if we are to remain a formidable military power.

However, we must use some common sense in our approach to using space technology as a force multiplier. As in one of the lessons learned from the Vietnam war--state-of-the-art technology does not solve all problems and does not win all wars. Thus we can not expect space systems to enhance operations in all circumstances, especially in operations other than war. We have to weigh the cost of space technology against the potential application--in other words we have to carefully access our military requirements in the "new world order". Additionally, to use space technology as a force multiplier, we have to win the technology race. We have to be willing to pay the price to keep a viable space industry base alive and we have to develop space doctrine that will drive the technology train.

Guilio Douhet said, "*Victory smiles upon those who anticipate the changes in the character of war, not upon those who wait to adapt themselves after changes occur.*" **31** Space technology has come of age. No longer can a theater commander dismiss the advantages space systems bring to the battlefield because of lack of knowledge. Both the military services and the space community need to be ready to fight the next war using space technology.

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