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Apr 21st, 2:00 PM

## Paper Session I-A - Space Strategy and the New World Order

Lt Col Michael A. Hamel

Lt Col Michael L. Wolfert

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# Space Strategy and the New World Order

by Lt Cols Michael A. Hamel and Michael L. Wolfert

Military applications of space were conceived well before the first orbiting satellites. For over a decade after World War II, the U. S. military studied possible uses of space and developed technologies essential for spaceflight. However, it took the shock of Sputnik in October 1957 for America to begin its military space program in earnest. Since that time, national imperatives and technology advances have driven our military space program, including surveillance and assessment of the Soviet military threat, and collection of data to monitor treaties. As advances were made in space technologies, applications, such as communications and meteorology, proved to be of significant value to military operations. Leaders within the defense community have long recognized our growing dependence on space. Today, we depend on space for indications and warning of hostile acts, command and control of nuclear and conventional forces, environmental information for planning air, land and sea campaigns and operations, and precise targeting and navigation data.

While the Department of Defense space program has evolved to meet military needs, it is now confronted with profound questions regarding its future direction. The dissolution of the Soviet Union and our experience in the war with Iraq create both challenges and insights for the future Defense space program. We no longer have the luxury of facing a clear competitor against which we can design and field space capabilities. We must explicitly tie our space force structure to our national security objectives and strategy. We must consider how space relates to all elements of our national power and how it can enhance our interests and security in an unpredictable world. At the same time, OPERATIONS DESERT SHIELD and DESERT STORM demonstrated the criticality of space in modern, high technology warfare. Space enabled warning of and defense against SCUD attacks; permitted the soldier in the field to navigate the featureless desert; helped coalition leaders assess enemy actions, discern their capabilities, and devise and execute a decisive campaign. Space communications enabled these capabilities. The events of the past year bring home two major points: first, we must evolve our defense posture to deal with the new world order -- one unconstrained by bipolar competition which defined and bounded political and military relations since the late 1940s; and second, space plays an increasingly critical role in military operations. Just as World War I gave the first glimmers of how airpower could be used in military operations, DESERT STORM only previewed the significant role that space will play in future military operations.

## Why a Space Strategy?

Strategy in its simple form is a design by which to achieve defined ends with available means. In this complex world, America must devise a strategy which will leverage our technological advantages and permit us to exert our political, economic, diplomatic and military power. Our fundamental national security objectives remain relatively stable even as we face a dramatically changed world after the demise of the Soviet Union. We still seek national survival, a healthy growing economy, and political cooperation and stability throughout the world. However, possible threats to those objectives have changed and, in fact, are largely unpredictable and unforeseeable. During the Cold War, the United States and the Soviet Union were able to mediate the actions of their counterpart. The superpowers communicated to their adversary their displeasure with certain definite signals, drew lines which bounded their national interests and objectives, and clearly defined the consequences if these bounds were crossed. This clear, unequivocal communication limited military confrontations between the two superpowers. In the new world order, the conforming force which each superpower held over their allies and friends which restricted the use of military force has been removed. National aspirations, fanned by ancient animosities based on nationalism, racism, and religious hatred, are now unleashed. A top-to-bottom reassessment of our national military strategy and defense postures is underway. Within the Department of Defense, differences abound regarding the roles and needed force structure of land, sea, air and space forces. While our future defense objectives, threats, and force structure are being debated, the resources which will be available to meet those ends will decline. Defense reductions of 25% are already planned and only the naive can believe that further reductions are not forthcoming.

This situation is not an unprecedented state of affairs. After every major war we have adjusted to the new environment and new realities. Our new National Military Strategy reflects the new world order. The foundations of the strategy are strategic deterrence, forward presence, crisis response, and force reconstitution; it focuses on regional threats to America's global interests. In the absence of a global competitor or predictable threats, crises may demand the United States, in conjunction with its allies and friends, to act quickly and decisively in regions far from our borders, areas where we have little forward presence or operating infrastructure. While the threat of global nuclear war has declined, we must protect ourselves and our friends from accidental or limited missile attacks.

A primary challenge must be to revise our military force structure -- both its composition and size -- to contend with these evolving threats. Our goal must be to best meet the new objectives and constraints imposed by our domestic economic problems and international politics. A space strategy is critical to examine the roles, contributions, and characteristics of the space component of our military forces. In the past, the role of space in our defense posture has evolved based on technology advances and incremental experience in operational applications. Today, technology has sufficiently matured that we are capable of fielding virtually any militarily significant space capability we choose to develop. Likewise, we have accumulated enough experience in military space applications to understand its contributions and potentialities. The changing security environment and substantial decline in defense budgets will force dramatic changes in force structure. Therefore, the time is right for thoughtfully reconsidering what the role and future force structure of military space should be.

Some might argue that we already have a space strategy. For years we have done long-range space planning to drive our investments in communications, warning, and other space missions. Others might argue that a strategy for space is unwarranted, or that space is simply a support function. These positions have merit, but ignore several central points.

First, space has significant military value. Because space will increasingly influence our ability to achieve our terrestrial military objectives, we must coherently articulate its role to support all elements of strategy. Second, having an investment plan is not substitute for a strategy. As Figure 1 shows, investment should reflect a strategy-to-task paradigm. From our national goals and objectives we devise a military strategy; that strategy must drive an aerospace strategy which reflects how to employ space and airpower; our space strategy should define concepts of operations which leverage our technical advantages and unique force structure; these concepts will in turn define military tasks; tasks will then permit us to explore which investments, systems and technologies can best fulfill these requirements. By exploring how technology can solve our military tasks and employing aggressive prototyping practices, future military systems will more completely meet the needs of our warfighters and should permit American forces to use their scarce research and development dollars to modernize our forces. Finally, our space strategy must provide an organizational vision and purpose. It must define a unifying direction and approach to handle an uncertain military threat in this post-Cold War period. A space strategy will serve to define a force structure and employment framework to pursue a coordinated and coherent defense space program.

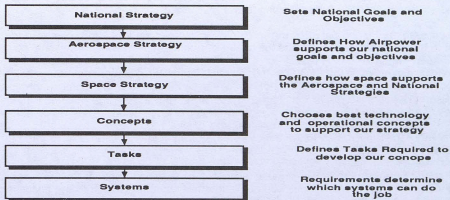


Figure 1: Strategy-to-Task Methodology

## The Role of Space in the New World Order

Space forces are integral elements of our national capabilities and influence both peacetime and military missions. They are employed to support service, joint or combined operations across the full spectrum of conflict from peacetime to post-war administration of a defeated foe. These space forces must continue to support all levels of strategy noted in Figure 2 and to provide our national leaders with flexible deterrent options -- both military and non-lethal -- which can be used globally to support our national goals and objectives. To summarize our ideas, let's review each of the four segments of the conflict spectrum.

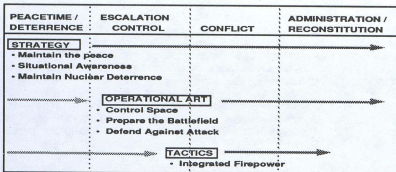


Figure 2: Role of Space Support across the Strategy Spectrum

Peacetime deterrence has been the key element of our defense strategy. The use of space systems to provide indications and warning of potential threats, arms control verification data, and early warning of impending nuclear attacks on the United States is well understood. Space has also been a significant part of our ability to characterize threats, and identify strengths, weaknesses and vulnerabilities which could be exploited by our national leaders as they exercised our diplomatic, political, and economic efforts to maintain a peaceful world.

In the post-Cold War era, space systems will permit the United States to be a good neighbor -- some would say an "honest broker." America does not want to be the world's policeman, but rather to be a respected international leader who seeks to create a stable, peaceful world. Space systems provide means by which we monitor potential instability, react to impending political crises, and provide irrefutable evidence of possible military aggression. In those instances, space data and information will be critical elements of how America will engage in potential crises. There will be instances where America will not send forces to respond to regional problems, but will provide information and other support to our friends and allies as they stand up to aggression and deny a rogue nation its ability to coerce or attack its neighbors. Space systems in peace will remain a "Constant Sentinel" which permits us to observe, orient, decide and react to political, diplomatic and economic crises without resorting to war.

As crises escalate, space provides the means by which our leaders can pressure renegade nations and persuade them to remain peaceful. The full use of our non-lethal elements of national power will permit us to "draw lines in the sand" which reflect our national desires, objectives, and interests. Actions, such as our use of AWACS diplomacy in the drug war and the Gulf Tanker War, demonstrate our resolve to terminate the crisis short of war. Although AWACS is not a space system, it reflects our commitment to use our C3I, weather, and surveillance systems to maintain a stable world and assure the peace. If these efforts fail, space systems can transition to provide direct support for combat operations. They would gather data about the terrain, enemy military forces, their capabilities, and possible strategies which could be used to tailor appropriate military forces packages to the threat and to quickly respond with decisive force to win the war with a minimum of casualties.

In the conflict phase, space will provide a myriad of support functions to the forces in the war. Communications, navigation, surveillance, weather, and other support are vital to the success of any campaign. The level of support provided to our forces in DESERT STORM will become a benchmark by which future force enhancement support is measured. As our forces become more familiar with space applications, they will define new and better ways, to employ space to solve their tactical problems. We must integrate space with our forces as they prepare for war and exercise their tactics and doctrines at RED FLAG or the National Military Training Center at Fort Irvin, California.

The final phase reflects the post war period. During the war, critical civil functions may well be destroyed. Communications systems, navigation aids, and other critical civilian systems will need to be rebuilt. They are crucial to occupying military and civil authorities as they work to restore normal functioning of a modern society. To assure that the defeated nation will not decay further into anarchy, a central government function, controlled by the legitimate ante bellum government or its successor must be established. Space support will be vital to support these civil affairs activities.

Figure 3 pictorially reflects the nature of space force support to our national leadership. In peacetime, space makes significant contributions to all four elements of our national power: political, diplomatic, economic and military. Reliable, secure communications from space permit diplomats and the NCA to express

our national interests and objectives to friends and adversaries. Space also permits us to gather data about the strengths, weaknesses and vulnerabilities in each instrument of national power which guides our national policies and strategies. Without question, space's peacetime role is crucial to our ability to exert leadership in the international arena. These contributions will become increasingly important as we reduce our forward presence and develop a collegial relationship with other nations towards maintaining the peace and assuring global stability in the coming decades.

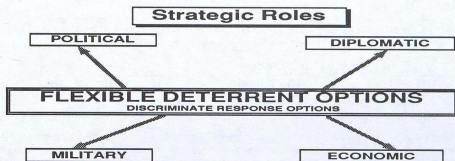


Figure 3: Space Support to Strategic Level

At the operational level, space provides the military commander with a wide range of data to reduce the "fog of war" which has always pervaded the battlefield and to remove many of the "frictions" which reduce the effectiveness of military planning and strategy. Figure 4 reflects many of the space support functions which are crucial to the modern commander. From this type of data, commanders today can make quicker decisions, based on more complete situational knowledge, and rapidly respond to transient tactical opportunities on the battlefield. Through better preparation of the battlefield and the warfighter, commanders can reduce their decision cycle while compounding the uncertainty for their adversary. As Colonel John Boyd noted, commanders must observe the battlefield, orient themselves to the situation, decide which action best meets their needs, and then act. Space today reduces the uncertainty, provides near-real time information and data, and permits commanders to quickly pass their concepts of operations and changes of plans to all field forces. This ability is a decisive advantage. DESERT STORM demonstrated that this capability not only can help save lives, but also can assure a victory if the information is applied properly with the right joint force. Today, space support is truly the ultimate force multiplier for air, land and naval forces.



Figure 4: Space Support to Operational Art

At the tactical level, company commanders want to know where they are, what they are expected to do and where the threats are. Space provides data can often spell the difference between being killed or defeating the adversary. Figure 5 demonstrates how space supports the tactical level of modern warfare. By insuring every soldier, sailor and airman understands the commander's intent, they can successfully implement plans, synchronize their efforts and assure enhanced effectiveness of forces in the field. Today, we are just beginning to understand how effective space can be at the tactical level. The 1990s should be the "Decade of Space Applications" as we develop the equipment, provide the training, and develop the doctrines to better employ space support to meet our tactical needs.



Figure 5: Space Support to Tactical Operations

In sum, space must support all levels of strategy and users across the full spectrum of conflict, often simultaneously. The imperative is to structure space forces with the capacity, flexibility and responsiveness to meet these competing needs. In the following section we'll review seven critical employment objectives identified in Figure 2. By discussing each objective in detail one can then begin to understand the full impact of space support to our military strategy and begin to perceive the role of space in the new world order.

### Space Force Employment Objectives and Concepts

Railroads, rifles and the telegraph shaped the timing and tempo of the Nineteenth Century battlefield; the internal combustion engine provided the means to produce aircraft, tanks and other mechanized equipment during the interwar years from 1920 to 1940. Space data shapes the modern battle arena by influencing the timing of war, permitting our forces to operate within the decision cycle of our adversary and stripping away the "fog and frictions of war" for our forces while multiplying them for our adversary. The information revolution caused by access to near-real time data, reliable navigation and timing data from Global Positioning System, and other space support made DESERT STORM our "first space war." The change in timing and tempo of battle is a key advantage created by space systems.

In the past, space planning has tended to focus on individual systems e.g. communications, navigation, and weather, and their role or contribution to particular military operations. While such an approach can provide logic and reason to planning it is difficult to do cross-system or functional tradeoffs or to prioritize efforts. Likewise, such an approach is often viewed as non-objective and self-serving in that individual systems are usually advocated by communities that have a stake in the outcome of the evaluation. In the past, the R&D focus of our military space efforts inhibited its integration with operational forces. Because of these technical and organizational impediments, the operations community was ignorant of the potential space support available to them. Accordingly, these support systems were not integrated into planning, training and exercises. DESERT STORM broke many of these barriers; we must work to remove the remaining obstacles to space integration and normalization. Yet it is not the individual components, but the entire spectrum of space support that is the essence of space's contribution to warfighting. Without the communication links, navigation and weather are of little use to the warfighter as he never receives his mission data in sufficient time to execute his commander's strategy. The end result is that space support today has changed the modern battlefield and our planning.

Before we commence our discussion of space strategy, a disclaimer is warranted. The space objectives and concepts of employment that will be discussed are an attempt to describe the comprehensive contributions of space to modern warfare. These examples are intended to illustrate, not to be an all inclusive view of space's ultimate contribution to deterrence or to warfighting. Only through imagination and creativity will we discover the ultimate bounds of space operations and strategy. Ours is only an attempt to codify that role today in light of our heritage and our war experience in DESERT STORM.

#### 1. EMPLOY SPACE CAPABILITIES TO MAINTAIN THE PEACE

Since the earliest days, a primary, perhaps paramount, role of space has been to support the maintenance of peace. Space provided unique capabilities to collect information on potential adversaries across the full spectrum of national power -- political, economic, diplomatic and military. By documenting strengths, weaknesses and vulnerabilities in each of these areas, space provided our national leaders with flexible deterrent options which helped maintain the peace during the Cold War. Most of the arms control agreements of the past three decades were enforced through the use of space systems which

monitored compliance. Space systems are an indispensable element of our "national technical means" for monitoring nuclear testing, and strategic arms treaties. Likewise, space provided global indications and warning (I&W) of dangerous situations and hostile actions.

The value of I&W is many fold. Strategic I&W reduced the potential for the "bolt out of the blue" attack on the North American continent and provided critical information which permitted our leaders to formulate responses to potential crises and threats to our global interests. No longer do we believe it is possible for an adversary, historically the former Soviet Union, but now perhaps its successor or a future global competitor, to launch a disarming attack against the United States without advanced warning. With I&W, actions can be taken to defuse or contain crisis situations and heighten the awareness and readiness of forces and decision makers.

In the face of the dramatic changes in the world situation, space must continue to support these same objectives, but must also consider broader aspects of maintaining the peace. Arms control will not be restricted to nuclear superpowers, but must address a host of potential weapons and countries. Although the thawing of superpower relations has opened new doors for treaty and inspection regimes, the lessons of the war with Iraq indicate the need for continued and probably wider ranging capabilities to assure compliance with multilateral arms control agreements.

Another aspect of space's future contribution to maintaining the peace is its role in underpinning alliances and coalitions. The United States is unquestionably the leading spacefaring nation in the world. We possess unchallenged abilities to observe militarily important events, warn of hostile actions and to significantly enhance political, economic, diplomatic or military action through the use of space. As our new National Military Strategy points out, we will engage in world affairs within alliances and coalitions. Space can become a powerful tool for the United States in forming, maintaining, and supporting those alliances. In some cases our interests may be achievable by providing space data and capabilities without a commitment of American forces. By increasing the use of space as an instrument of alliance building, we can spread American influence abroad. Much of the training, tactics and equipment of allied air forces have come from the United States, providing a foundation for potential allied cooperation at the institutional and unit level. Military space cooperation could become a similar instrument for building alliances.

## 2. STRATEGIC NUCLEAR DETERRENCE AND DEFENSE

Space systems have been integral elements of our strategic deterrent posture for several decades. They provide tactical warning of missile attacks, information on nuclear events for force execution, and survivable communications to permit decision making and command and control of our nuclear forces. Altogether, space systems have been the key to strategic deterrence by providing the information, decision making time, and assured means to direct our nuclear attack. Both we and the Soviets understood that these systems would do their job. This alone guaranteed our nuclear deterrent force would influence the opposite decision maker in Moscow or Washington.

As we look to the future, we must not only continue to preserve our strategic nuclear deterrent posture, but also adjust to the receding threat. As long as any nation can employ ballistic missiles against the United States, we must have the strategic warning systems which will assure detection of any attack, the ability to execute retaliatory strikes, and the reconstitution capabilities for our nuclear retaliatory forces and central government. Space warning and C3 systems will continue to fulfill these functions against current and evolving threats just as they have for the past forty years.

Defenses against ballistic missiles must become an integral part of our strategic and theater strategies. During the Cold War, strategic defense was oriented towards blunting a massive nuclear attack; in the future, the United States must be able to defend against limited and undeterrable attacks -- nuclear, chemical and biological -- on the American homeland, our forces deployed during regional conflicts and our allies around the globe. As was illustrated in the Persian Gulf War, the military and political implications of ballistic missiles in regional crises can be profound.

Space is a key enabling element for any form of missile defense. Because of the short flight times involved in missile attacks, the essence of effective defense is rapid detection, quick decisions and lethal action. Besides active defense, we want to destroy or disable any additional missiles which might have been withheld as a strategic reserve. Space provides the command, control, and communications infrastructure to manage the overall battle. Eventually space-based interceptors and interdiction weapons may provide a highly effective defense against missile attacks anywhere on the globe. The global coverage, flexibility, and responsiveness of space-based systems will be a key enabling element in this much needed defensive capability.

### 3. MAINTAIN GLOBAL SITUATION AWARENESS

The essence of preserving the peace is to be able to determine when and where situations and events around the globe could lead to hostilities. We must be able to see these evolving situations, understand their complexities, enunciate in clear terms our intentions and where possible, exert our influence to control, contain and isolate these threats. There are two reasons why deterrence worked during the Cold War period: both the United States and the Soviet Union clearly announced their interests and drew a line across which neither party dared cross. The consequences of global nuclear war or significant conventional conflict in Europe kept the peace. This same concept applies to American relationships with lesser powers during the post Cold War period. Yet, deterrence will only work when we have a global awareness of evolving political, economic, diplomatic and military events which could trigger a crisis or erupt into war. Space plays a critical role in this regard in that it provides a global information infrastructure to afford decision makers the time to formulate options and the capability to see, react and defuse these crises situations.

Space contributes to maintaining situational awareness in many different ways. Surveillance systems can detect unusual military activities or force movements which could be a precursor to hostilities. Space communication systems can rapidly relay individual intelligence indicators that once integrated and analyzed can highlight impending crises or hostile situations. One of the greatest contributions of space systems is their inherent flexibility, responsiveness, and global coverage. Literally within hours numerous space sensors and data capabilities can be focused in a non-provocative way on a crisis area to provide the best possible picture of an unfolding crisis. Once a clear understanding of an impending crisis is established, space systems can provide the means to exercise flexible deterrent options which exploit our political, diplomatic, economic and non-lethal military instruments to defuse or contain the potential crisis. The use of AWACS diplomacy, political demarches, establishment of ad hoc coalitions which confront the renegade nation are examples of how this space information could be exploited to avert crises. Such steps initiated early in a crisis and prior to initiation of fighting can mean the difference between war and peace.

The Gulf War points out the criticality of maintaining situational awareness. Reportedly, the United States had indications of unusual Iraqi military activities several weeks in advance of the invasion of Kuwait. Although such activities are not unambiguous evidence of intentions, they did provide advance indications of possible hostilities, and could have permitted rapid political response prior to the invasion. The prompt United States decision to act against Saddam Hussein and to clearly "demonstrate our resolve, no doubt deterred the Iraqis from further aggression. Likewise, the graphic evidence the United States provided showing the magnitude and extent of the Iraqi invasion clearly convinced the Saudis, the Gulf Cooperation Council, other Arab nations, and western allies that a definite threat was being posed to the world order and economic well being. Prompt decisions and allied participation were made possible by the situational awareness, much of which was provided by space systems.

In the future, global situational awareness will become even more critical. As we reduce forward deployed military presence we will have less terrestrial-based means to monitor possible trouble spots. In fact, reduced forward presence could invite crises and hostilities. We will also need more time to respond should American interests be threatened. Maintaining a robust space-based information capability will be an essential element of all American military strategies. Responding rapidly and appropriately to crises requires an accurate understanding of the nature and extent of the threat. Likewise, in those situations where United States' interest may not be sufficiently threatened to warrant our direct action or commitment of troops, information derived from our space systems could be invaluable in assisting our friends, allies, or international agencies in their efforts to resolve the crisis. It could be argued that maintaining global situational awareness is perhaps the most important space objective in the new world environment, where uncertainty and instability are the paramount threats.

### 4. FREEDOM OF ACTION THROUGH CONTROL OF SPACE

From the earliest days of military space, we have faced a dilemma. As a matter of policy, America has supported the concepts of free and peaceful use of space and conducted our military space program within that context. But as our military capabilities in space have increased, so too has our dependence on those capabilities. In fact, in many cases our primary means of performing critical missions, such as surveillance, warning, and communications, are via space-based systems. Other nations, notably the former Soviet Union, developed space capabilities which contributed significantly to their military power. In times of crisis or conflict, a clear advantage would accrue to the nation which can freely use its space capabilities while denying similar unimpeded use to its adversary. While we respect the right of free and open passage on the seas, we are also prepared to defend against hostilities and deny enemy use of the seas in times of war. Space control will be as critical as sea lane control in the future.



Control of space has traditionally been described in terms of protecting friendly space systems while denying the use of space by potential enemies. These objectives require a variety of capabilities: surveillance of space orders of battle and threats; satellite protective measures such as hardening and maneuver, mobile ground controls, and communication link protections; and anti-satellite weapons and targeting of enemy control links and ground facilities. The context within which we have framed space control has been dominated by the Cold War. The former Soviet Union was essentially the only space power that could threaten our space systems and which could employ space assets as integral elements of its military forces. Over the years, we have made substantial investments in protective measures for our space systems because of the threats posed by the former Soviet Union and our growing dependence on the data streams which emanate from our space assets. Such measures are viewed as essentially defensive in nature and therefore conform to public sentiments against the militarization of space. Throughout the same period, no substantial progress was made on deploying capabilities to deny enemy military space systems from performing their missions. Some argue we must not let space become the next venue for an arms race, while others have claimed that the contribution of space to potential adversaries is limited, and therefore not worth negating. The dissolution of the Soviet Union would, in the minds of some, make the space control issues moot, but the events of the past year create a new context for the issue.

In DESERT SHIELD/DESERT STORM, the United States and its allies enjoyed an unequalled advantage in space support capabilities. General Schwarzkopf and his commanders were able to communicate rapidly with their forces; they were confident that our forces could navigate across the featureless terrain of the desert and synchronize their actions according to our operational plans and concepts; they knew where the enemy was, his capabilities, weaknesses and vulnerabilities because of our ability to surveil the battlefield and pass this information in near-real time to our forces; and they were warned of potential missile threats from our space based sensors. These insights were unique coalition advantages. At the same time, our planners knew the Iraqi forces and leadership did not have the space-based capabilities to detect, react, or counter allied space systems, or ground forces as they were arrayed across the desert. The ultimate victory, with minimal casualties for the allied coalition, demonstrated the critical importance of space systems to modern warfare. The key lesson of the Gulf War was that the United States must be prepared for and be able to establish space superiority in any future conflict; certainly our allies and potential adversaries noted this lesson.

Within a decade as many as twenty nations are expected to have militarily useful space systems to include surveillance and communications. Likewise, the technologies for intercepting satellites, jamming communications links, and attacking ground systems are not so complex that we can expect unchallenged use of our space systems forever. In fact, circumstances and threats that were implausible during the Cold War could emerge. Desperate leaders could detonate nuclear devices in space in hopes of destroying our space capabilities or we could find space data being supplied, knowingly or unknowingly, to aggressors by neutral or even friendly sources. This volatile environment demands more global situational awareness and surveillance of technology efforts and developments.

These possibilities all mandate continued attention to the issue of space control. We now understand the value of uncontested supremacy in space during peace and war; we must insure we never relinquish that capability. Although we cannot define specific threats to that supremacy in the new world, we must protect against that eventuality, for the technologies and incentives to conduct space warfare will inevitably grow. In a strategic sense, we must view space control on a par with air and maritime control in any potential crisis situation or conflict.

## 5. PREPARE THE BATTLEFIELD AND THE WARFIGHTER

Throughout history, the fog and friction of warfare have played a major role in the outcome of conflicts. Misunderstood orders, battlefield surprises, attacks against the wrong targets, and timidity of subordinates have too often impeded the successful accomplishment of the commander's plan. Knowledge of the enemy, the environment, and the battlefield are essential elements of any plan. When afforded effective integration of space information and data, the modern commander now has the opportunity to dominate the battlefield and to orchestrate a successful operation. While operating within the decision cycle of his adversary, today's commander will be able to observe the battlefield, orient his actions quickly to a plan, react to the adversary's plans, and decide and implement operations which will seize transient tactical opportunities which will assure his victory.

Preparation of the battlefield requires the identification of enemy orders of battle, disposition of his forces, understanding the capabilities and weaknesses of the adversary's commanders and plans, and preparing the mission planning data, maps, and other accoutrements required to support the warfighter. Although information can be gathered and data bases built and assessed during peacetime, the majority of the data base will be updated during the warfighting. Space will play a major role in the creation and evolution of these threat data bases.

Most American military planning since the end of World War II has focused on central European conflicts and regions of the world where surrogate confrontations were the norm. An essential element of the overall containment strategy was sizeable forward United States presence to both demonstrate our resolve and our commitment to containment of communist expansionism. In the future, it will be difficult to predict where conflicts may arise; likewise, with diminished forward troop presence, we will have less advanced warning and less knowledge of the combat environment. This situation poses major challenges for theater commanders as they plan for potential conflicts. This dynamic environment demands that we have the capability to quickly see evolving crises, gather data to support planning and prepare the warfighter in a shortened period of time. Space systems will be the key ingredients to provide rapid, precise understanding of the evolving threats, environment, and opportunities offered in each potential theater of conflict.

DESERT SHIELD offered CENTCOM a five month period to build the threat data base, deploy communication systems, train coalition troops, develop operational concepts and campaign plans, and to practice those plans prior to the implementation of DESERT STORM. During this build up phase, space created theater maps which assured a common grid for all coalition forces and provided weather data which permitted us to flexibly use the optimum weapon at the correct time to assure the destruction of the target. We may not have this luxury in the future.

## 6. INTEGRATED APPLICATION OF FIREPOWER

Modern high technology warfare, conducted at fast paced tempos, is information intensive. No where is the military value of space systems better illustrated than in their contribution to modern combat. Today's military forces require detailed information on orders of battle, potential targets, weather and environmental information to select tactics and weapons, avenues for attacks, precise friendly and enemy positions, and assessment of battle damage for future attack planning. The term "hyperwar," coined during DESERT STORM to reflect the tempo and timing of operations by the coalition against the Iraqis, describes modern warfare where information can be passed in near-real time to combatants, where commanders can quickly identify and seize tactical opportunities, and where continuous pressure places enemy commanders under unrelenting attack by flexible, lethal combat forces.

Once again DESERT SHIELD/DESERT STORM provided evidence of how space systems could enable discriminate and decisive application of combat power. Information on potential targets and forces were gathered and delivered via space-based systems to theater and unit level users. Terrain data collected by space systems was used to develop guidance information for precision cruise missile targeting and then delivered by satellite halfway around the world to the Persian Gulf. Map and terrain information was used for mission planning systems at the unit level to plan and practice air missions against high-value, heavily defended targets. Ultra-precise space-based navigation enabled withering artillery attacks, lightning ground maneuver, and surgical bombing strikes. All operations were conducted at an unprecedented tempo; decision-action cycles were kept short because of an infrastructure that provided the right combat planning data and delivery information to the shooter.

The force multiplying effect of space systems will prove even more valuable in the future. With numerically smaller forces we must achieve the highest degree of precision, speed and lethality possible. Likewise, the performance of the allied forces in the Persian Gulf established new standards for discriminate firepower, friendly losses, speed and decisiveness. As we reduce forward deployed forces, space will increasingly provide the in-theater combat information infrastructure that will enable the swift, decisive application of firepower.

The global reach, speed and precision of terrestrial attacks from space platforms make such potential concepts appealing. In a world where dictatorial rulers and a handful of weapons of mass destruction can cause global instability, the ability to rapidly and surgically destroy threatening regimes and weapons, without putting friendly forces at risk would be invaluable. However, there are substantial questions of technological and operational feasibility. Many technical hurdles involving long duration, precisely guided hypersonic flight, cost-effective and responsive space launch and effective non-nuclear kill mechanisms would have to be resolved to enable space-based attack weapons. Operational and doctrinal issues involving targeting, command and control and organization would have to be resolved.

Today there is no compelling need for space-based, terrestrial attack weapons. At the same time, the policy and technical issues involved in developing and fielding such capabilities are substantial. However it is not inconceivable that future circumstances could change. In their early days, airplanes were considered a curiosity whose military value was limited to observation of the enemy and direction of artillery fires. It was not long before airplanes were found to be useful in attacking forces in the field, rear area support, industrial targets and population centers which supported those forces. Airplanes proved to be a successful defense

against these attacks as well. Space-based terrestrial attack weapons are not around the corner. However, it is prudent to pursue the concepts and long-range technologies for such weapons. Space-based weapons are not a panacea and will not replace conventional forces. Just as we used precision weapons against high value targets in DESERT STORM, space-based weapons may offer alternative methods to destroy critical targets. They might also provide a means to demonstrate resolve through limited attack options in remote areas to show an adversary we will fight. The United States is the preeminent aerospace power today and should insure it has the foundations to field such weapons should the need arise in the future.

## 7. ENABLE FLEXIBLE, ASSURED SPACE OPERATIONS

As with any modern, high-technology defense system, space requires a substantial supporting infrastructure to perform its mission. When addressing space support capabilities, we typically include space launch and ground-based command, control and processing elements necessary to operate the satellite vehicles. Placing a satellite in orbit remains a technically challenging task. Satellites and their launchers are expensive and there is little margin for error. Through the evolution of the space launch business, we have achieved very high success rates but have done so at considerable expense in terms of dollars, and limited responsiveness and flexibility. We likewise depend upon a global network of tracking stations to control satellites and to process and distribute information from our satellite systems. This network is essential for operating the satellite vehicles and their payloads which perform the on-orbit mission. Together, our launch and on-orbit control support infrastructure account for a substantial portion of the overall cost of space programs but at the same time significantly contribute to the overall effectiveness of the space mission.

Two other support bases are equally important, namely the technology and industrial bases. It is obvious satellites are highly technical products. The ever growing demands for increased data volumes and coverage puts a high premium on advanced technologies for satellite payloads, their internal subsystems, and user equipment. At the same time, state-of-the-art technologies are useless without the manufacturing, assembly, and test base needed to produce these items. The unique procedures and facilities required to produce highly-capable, reliable satellites demands substantial commitment of industrial resources. Furthermore, there must be continuous interaction between the builders and operators of satellites to resolve operational problems, correct design deficiencies, and insure the systems evolve to meet user needs. These factors point to the need for a seamless technology and industrial base to deliver and maintain first-rate systems and to keep them operating throughout their expected life.

To meet the objective of flexible, assured space operations in the future we must adjust our approaches to the new reality. As defense budgets decline, higher premiums will be placed on improving efficiency and cost effectiveness in all aspects of the support base. Increased use of commercial techniques and technologies will allow leveraging of larger commercial investments. Prudent investments in improving and modernizing facilities and equipment needed for launch and orbital support can reduce operating costs and improve responsiveness. Current practices and procedures used in developing, operating, and maintaining space systems must be examined to eliminate unnecessary effort and cost. More conscious balancing of costs, benefits, and risks are essential for a robust space support base. The clear goal must be to improve the "tooth-to-tail" ratio in the space program. The space support base must contribute directly to the overall effectiveness of the space program, for every dollar spent on support is one less dollar available for operational space capabilities.

## CONCLUSIONS

The Defense space program has undergone a profound evolution since its inception. What was once viewed as a technical curiosity is today accepted as an integral, essential element of our national defense posture. A broad spectrum of sophisticated space systems provides an array of information and services to a multitude of users all the way from the NCA to the soldier in the foxhole. To date, most of the planning and evolution of the space program has been driven by national imperatives and technological opportunities. The changing world situation demands that we reexamine our military strategy and the forces needed to implement that strategy. While much has been written regarding the roles and contributions of space, the experience from the war with Iraq can serve to validate and refine our operational concepts and planning. A space strategy is needed to provide an overall framework to link national security objectives to force structures, investments, and employment objectives. The perspectives offered can hopefully serve as a starting point for the dialogue that must occur if we are to reach a consensus. We will no longer have the luxury of permissive budgets and an easily identifiable enemy or threat. We simply must have a comprehensive and insightful strategy to guide our space planning and force employment.