An Evolving Joint Space Campaign Concept and the Army's Role

A Monograph
by

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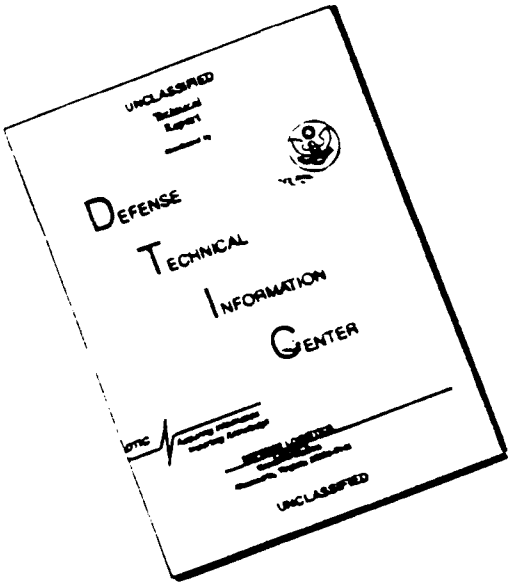

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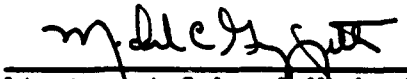

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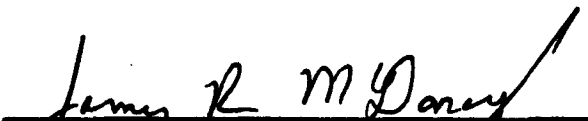

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ABSTRACT

AN EVOLVING JOINT SPACE CAMPAIGN CONCEPT AND THE ARMY'S ROLE by Major Henry G. Franke III, USA, 123 pages.

This monograph examines the question of an evolving joint space campaign concept and the Army's role in it over the next 20 years. Analysis progresses logically through a series of topics in order to arrive at a complete picture of this evolutionary space campaign concept, as well as the Army's place in it. Space plays an increasingly important role in US military operations, particularly when tied together with advances in information management. The synergistic impact due to the combination of these two areas suggests a revolution in the nature of modern warfare which saw its emergence during the 1991 Gulf War. With this theme in mind, I review the Army's roles, missions, and historical involvement in space, then present technological opportunities and a perspective on investment strategies for military space. A detailed discussion of a near-term military space theory and current space doctrines supports the need for an accepted military space theory as a foundation for joint and Service space doctrines, space campaign design and conduct, and space force generation. The basis for such a theory is established using Julian Corbett's maritime warfare theory as a point of departure, while recognizing that space as a unique military operating medium requires its own theory and a regime to govern the application of space forces. I then develop a time-phased planning scenario and apply elements of this military space theory to arrive at a joint space campaign concept that evolves over the next 20 years.

The fundamental object of a space campaign is space command, which consists of the separate objectives of securing space command and exercising space command. For the foreseeable future, space campaigns will be either strategic defense campaigns carried out in a space theater of war, or expeditionary theater supporting space campaigns conducted in a space theater of operations. The Army would have a major role in both types of campaigns, and its land forces would greatly benefit from the successful conduct of these campaigns. I propose a set of Army initiatives to improve the Army's ability to carry out these roles and to foster the US military's capacity to generate capable joint space forces.

The joint space campaign concept and recommended Army initiatives pass a first-order assessment using the qualitative criteria of acceptability, feasibility, and affordability. Key themes emerging from this monograph include the critical need for an articulated military space theory, capstone joint doctrine which encompasses the entire space regime (currently divided into the categories of space, strategic missile defense, and theater missile defense), an accelerated impetus to the development of capable US space forces, and the realization that the Army must become a more active member of the joint space community.

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I. INTRODUCTION

The 1991 Gulf War (Operation DESERT STORM, preceded by Operation DESERT SHIELD) has been hailed as the "first space war."[1] This characterization is not entirely accurate, since space support was not fully optimized, integrated, or coordinated to support terrestrial forces at the operational and tactical levels, nor did direct confrontations between military forces take place in space.[2] Nonetheless, this conflict represents the first major use of space as a warfighting medium, much as World War I served to introduce the atmosphere as a viable military operating environment.[3]

A significant transition in the nature of warfare itself has been signaled by the 1991 Gulf War. The leading nations of this planet are now entering the post-industrial phase of their economic development.[4] Due to the central part played by advances in information management technology, the collective social and economic regime now emerging is commonly referred to as the "Information Age." By its very nature, this regime is both global and immediate in its influence. Together with the global economy that it helps to foster, the Information Age promotes greater interdependence between nation-states in the evolving world community. Advances in information management have an attendant impact on the conduct of war, for they offer operational and tactical commanders new ways to dampen the "fog" and "friction" which continue to strongly influence the modern battlefield.[5]

Space systems and their associated technologies play a central role in this evolutionary change in warfare caused by significant improvements in information management. As a military medium, space offers the ability to gather battlefield data and to transmit information "over the horizon" in real-time or near real-time, spanning theater and global distances. As an "extra-global" force asset, even a single space-based system can have immediate, direct, and simultaneous impact at the strategic, operational, and tactical levels of war. Computer-aided decision support can process data, share and update databases, and maintain the location and status of forces at all echelons in real-time. Taken together, these two major facets of modern information management can vastly extend the reach of a single operational or tactical commander and radically shorten his decisionmaking cycle.[6]

In terms of Army doctrine, the proper leverage of space systems and integrated decision support tools can substantially enhance all four AirLand

Battle tenets (agility, initiative, depth, and synchronization) and extend the capability of the most essential element of combat power, leadership.[7]

These capabilities of military space forces and "automated troop control" systems had long been recognized by the only other major military space power, the now defunct USSR.[8] While the US focused its space efforts almost exclusively at the strategic level during the Cold War,[9] the Soviets early on pursued a doctrine in which space is simply another facet of one seamless battlefield environment at all levels of war.[10] The Soviets also saw the 1991 Gulf War as a clear indicator of the changing nature of war, marked by the growing preeminence of the "information battle" and the emergence of the electromagnetic spectrum as a critical warfighting medium. Winning this battle could be the necessary precursor for any successful follow-on operations. Presently, effective space operations and automated troop control depend almost completely on maintaining freedom of action within the electromagnetic spectrum. Both rely on electromagnetic links to tie critical battlefield nodes together in real-time. This supports the Soviet belief that the "information battle" will be based on effective radio-electronic combat operations for the foreseeable future.[11]

The 1991 Gulf War dramatically demonstrated to every Service the growing utility of space systems in support of its own operations. In particular, it provided further evidence that space systems are becoming critical facets of contingency operations, where rapid and decisive power projection is the foundation for military success.[12] Experience gained from the Gulf War has given impetus to joint and Service space-related programs and doctrinal initiatives.

Joint doctrine serves as the foundation for Service doctrine, and emerging joint doctrine has for the first time established a clear direction for military space operations which directly relates to the operational and tactical warfighting levels. This begins with Joint Publication (Joint Pub) 1, Joint Warfare of the US Armed Forces, which focuses on the operational level of war and the design of joint theater campaigns. First, Joint Pub 1 treats space as a distinct military operating medium and space forces as unique military forces. Second, it establishes that a common goal of joint campaigns should be to secure space control, along with air and maritime superiority. It implies that space control is one prerequisite or precondition necessary for the joint force commander's overall freedom of action,

and it presupposes that US military forces already maintain predominance in the realm of space power, as well as in sea and air power. Third, it recognizes in broad terms that military space operations include two general tasks: maintaining assured access to and freedom of action in space and providing the most effective space support possible to terrestrial forces.[13]

It is not a coincidence that this new operational and tactical focus for space forces is occurring now. During the Cold War, US space forces were national assets reserved almost exclusively for strategic purposes. Because nearly all US space systems evolved as strategic systems strictly optimized for specific strategic missions, they were not tailored to support general purpose military forces. The veil of secrecy surrounding them also ensured that they would not be available to these forces. Most significantly, the extremely high cost of these systems has meant that additional funding of space forces for operational and tactical support was prohibitive. With the end of the Cold War, however, strategic military, political, and security classification issues have shifted, freeing US space systems for new roles in operational and tactical support. In this regard, the Gulf War was a propitious event; following so closely after the end of the Cold War, it made the military utility of space systems a matter of widespread public and institutional knowledge just when they were available for new missions.

Despite these changes, the greatest restraint on the continued development of military space power remains the fiscal and technological investment necessary to field space forces and their infrastructure. For this reason, central management of US space forces continues, with a unified command (the US Space Command) responsible for administering military space assets.[14] The sheer cost of space operations demands that they be the most joint of operations, supporting Defense guidance which assigns space functions to each Service. Space assets are currently viewed as force multipliers for every Service's field forces at every level of war and across the operational continuum. Thus every Service has a vested interest in effective US space power and must contribute to the fielding of military space forces. Every Service is also responsible for fulfilling its own Service-unique space support requirements as part of this space force structure.

At the theater strategic and operational levels, the joint campaign remains the basis for application of military force in theaters of war and operations. Joint Pub 1 calls for the joint campaign to secure space control

as one requirement for effective projection of military power. Continued space control assures enhanced support to terrestrial forces throughout the theater of war campaign.[15] This suggests that parallels exist between an operational-level joint air campaign or maritime campaign and a "joint space campaign," each of which is a component of the overall theater of war campaign. Campaigns such as these which are based primarily in one medium (land, sea, air, or space) remain joint since they normally require forces from more than one Service, even though one Service may provide the preponderance of forces. They are supporting campaigns, rather than simply supporting major operations, because (1) they are executed in a geographically distinct theater of operations and (2) they include successive or simultaneous operations which are essentially independent of other theaters but which can be synchronized for the greatest effect in support of and by the overall theater of war campaign.[16]

However, any joint space campaign concept must address a number of unique issues, including the often simultaneous strategic. operational, tactical, and political impact of space operations; the unique design of both space theaters of war and operations, either of which may be global in extent; the evolution of combat operations in the space medium itself; and the role each Service, the US Space Command, and in-theater forces would play in a space campaign. Note that the space campaign concept could evolve drastically over the next two decades since developments in technology now provide unprecedented freedom in choosing among any number of force deployment options.

The objectives of any space campaign would be to maintain space control and to effectively support other theater campaigns and operations. The Army has recognized the importance of space to the AirLand campaign. The new AirLand Operations umbrella concept, embodied in Training and Doctrine Command Pamphlet (TRADOC Pam) 525-5, states that "the success of future joint and combined operations will depend on further development and integration of space operations with air, land, and sea operations" and that AirLand Operations will necessarily "rely on the uninterrupted use of space."[17] In fact, the Army has a long history of involvement in space and continues to conduct a major research and development (R&D) effort in space-related strategic and theater systems.[18]

All the evidence points to the growing importance of space operations to successful US warfighting and the need to employ limited space forces to the

greatest effect. To apply space power properly in a theater of war or operations, capable space forces and effective doctrine are vital. The joint space campaign is the key to the focused application of these elements. This paper will investigate the question of what the joint space campaign concept would be as it evolves over the next 20 years and what the Army's role should be. Twenty years is an appropriate timeframe because trends during this period are predictable and decisions made today will have a direct impact throughout. In addressing this issue, I will first note the Army's roles, missions, and activities in space and review technological opportunities and investment strategies for military space. Then I will develop the foundation for a military space theory, describe a plausible time-phased planning scenario for space forces based on potential threat capabilities in the future, and examine emerging joint and Army space doctrines.

Synthesizing the discussions on capabilities, threats, theory, and doctrine, I will describe an evolutionary concept for joint space campaigns and the role the Army should play. This joint space campaign concept and my recommendations for the Army's role to support such campaigns will be analyzed based on the qualitative criteria of applicability, feasibility, and affordability.

II. ARMY SPACE-RELATED ROLES, MISSIONS, AND ACTIVITIES

The current edition of JCS Pub 0-2, Unified Action Armed Forces (UNAAF), lists the functions for each Service.[10] The Army's space-related functions are wide-ranging, although in many cases they mirror in wording those of other Services. These functions are summarized below (Appendix 1 has a detailed listing of each Service's space-related tasks):

-- As a primary function, organize, train, equip, and provide forces for appropriate air and missile defense and space control operations, including the provision of forces as required for the strategic defense of the US.

-- As a primary function, organize, train, equip, and provide forces in coordination with the other Military Services for joint amphibious, airborne, and space operations.

-- Along with the other Services, the Army is assigned a number of specific responsibilities in support of space operations.

The Army, Navy, and Air Force had all been major players in early civil and military space efforts, and each fought vigorously to retain a role in space. Not surprisingly, the formal assignment of roles and missions to the Services has continued to give each one a significant part in military space (at least on paper), although the Air Force appears to have the greatest role. When the Chairman of the Joint Chiefs of Staff carried out the 1989 triannual review of Service roles and missions required by the Goldwater-Nichols DoD Reorganization Act, he considered shifting the responsibility for military space almost completely to the Air Force. Both the Army and Navy leadership were adamantly opposed to any dilution of their space-related tasks, and they successfully blocked this realignment of functions.[20]

This desire to remain a full partner in the military space community has its roots in the Army's significant historical involvement in space and strategic defense (Appendix 2 presents a detailed narrative on this subject). The Army has been actively involved in such areas as ballistic missile defense (BMD), anti-satellite (ASAT) weapons, satellite communications, and homeland defense for over 30 years. It fielded an operational ASAT system in the 1960s and the West's only operational BMD system in the early 1970s. Building on this foundation, the Army today is recognized as a major player in R&D in a number of strategic and theater space-related fields. It has the lead for several national BMD systems, theater and tactical missile defense programs, the national kinetic-energy ASAT system, and satellite communications ground terminal development.[21]

In the mid-1980s, the Army leadership realized that the Service lacked a cohesive strategy for its involvement in space and was not taking satisfactory advantage of space capabilities to support its field forces. Several initiatives resulted, including an Army Space Policy statement from the Secretary of the Army and the Chief of Staff of the Army to set an azimuth for Army space efforts in support of its strategic, operational, and tactical missions, as well as an Army Space Architecture to implement this policy (both are shown in Appendix 3).

Other positive steps were taken in organizations, personnel, and a documented strategy. The US Army Strategic Defense Command (USASDC) was realigned to execute the Army's portion of the Strategic Defense Initiative (SDI) Program. The US Army Space Command (USARSPACE) was activated as the Army component command to US Space Command (USSPACECOM).[22] To provide an

educational base and serve as a space programs integration office, TRADOC established the Army Space Institute (ASI).[25] The Army created a separate skill identifier for space operations to aid the development of a pool of space expertise. The Army also provides Space Shuttle astronauts to the National Aeronautics and Space Administration (NASA) and supports the Department of Defense (DoD) Military Man in Space (MMIS) program. To tie these efforts together, an Army Space Master Plan and Operational Concept for Space Operations were published and periodica'ly revised. Field Manual 100-18, a doctrinal publication on space operations, was initiated but remains in draft at this time.[24]

Today, Army space efforts are given new impetus by several events. (1) The new strategic environment prompted the revision of the National Security Strategy and National Military Strategy, which call for missile defenses for the US and deployed forces and for capable military space forces.[26] (2) Congress now supports the fielding of theater missile defenses and a Global Protection Against Limited Strikes (GPALS) system, with initial deployments in the mid-1990s. GPALS could evolve to an integrated architecture of theater, national, and global defense systems, but would begin with Anti-Ballistic Missile (ABM) Treaty-compliant ground-based defenses in the US.[26] (3) Lessons from the Gulf War underscored the utility of space and missile defense forces and the emerging threat to US contingency forces in a destabilized, multipolar world. (4) The Army's newly published AirLand Operations umbrella concept stresses the necessity for space control and space support. (5) Joint Pub 1 places space forces on an equal footing with the terrestrial forces and makes space operations a key component of theater campaigns. (6) The Chairman of the Joint Chiefs of Staff has called for improved integration of space by all Services in support of their operations.[27]

The publication of the AirLand Operations concept is a watershed in Army thinking about space support to its field forces; it has already prompted attempts at reorienting the Army's investment space strategy with AirLand Operations as a focus. But this approach is not comprehensive. It does not recognize the Army's role in strategic systems or the direct impact they will have on deployed Army forces. With the deployment of GPALS systems, the Army will again field strategic forces, placing it on more equal footing with the Air Force and Navy. Strategic defense and national ASAT systems can directly

provide for physical protection and operations security of forces deploying from the continental US (CONUS) and forces employed in-theater; the Army has a responsibility to ensure these systems retain this additional capability. Space systems also have a wide application across the operational continuum, with light and special operations forces major beneficiaries of such force multiplying assets.[28] However, such needs will be best met if the Army remains an active player at all levels in the joint space community, despite reductions in budgets and manpower.

Thus, it is appropriate that the Army's Deputy Chief of Staff for Operations and Plans has articulated one possible vision of the Army's future role in strategic defense and space, based on the three pillars of US homeland defense, assured space lines of communications, and space and missile defense support to forces on the battlefield. This vision is founded on the idea that ground-based space and missile defense systems, regardless of their strategic, operational, or tactical application, remain an Army responsibility. It also recognizes that the Army must be prepared to field and man strategic systems in the near future.[29]

Such a visionary outlook was required by the Army Space Policy, but the challenge is to implement it through an integrated, comprehensive strategy that is realistic in these times of dwindling resources.[30] Army space efforts should be directed to provide (1) effective strategic systems, (2) systems which best support AirLand Battle and AirLand Operations, and (3) forces necessary to fulfill its role in space campaigns.

III. TECHNOLOGICAL OPPORTUNITIES AND INVESTMENT STRATEGIES

To conduct successful space operations and campaigns, capable space forces must be fielded. However, there is a significant difference between current and potential warfighting capabilities of US military and civil space forces when measured against such standards as flexibility, responsiveness, robustness, survivability, availability, and ability to provide commanders at all levels with tailored products.

Accelerating advancements in technology now offer an unprecedented number of options for the future direction of US military space. Although technology now promises true freedom of action in choosing a path for space

force generation, decisions made today and current resource constraints will influence military space architectures and capabilities for the next two decades. Unfortunately, each Service views space in fundamentally different ways due to the bias of Service-unique requirements, roles, and missions. The increased impetus to space support generated by each Service's experiences in the Gulf War threatens to create divergent investment strategies and doctrinal development as each Service considers exercising these options, most often unilaterally, in the shortest possible time.

The joint community is currently working to develop a foundation for joint space doctrine, but it is doing so without fully exploring the need to ground this doctrine in a sound military space theory and without accounting for the radical impact that new technologies will have on evolving space forces.[21] Although for the most part the Services appear to be waiting on the publication of joint space doctrine before finalizing their own space doctrines, it is doubtful that these doctrines will truly mesh after this next iteration.

Under the leadership of USSPACECOM, the joint community also attempted to devise an azimuth and evolutionary architecture for US military space forces which would span the next 30 years and address the collective and individual needs of the Services and the warfighting CINCs. Published as the Assured Mission Support Space Architecture (AMSSA) in December 1990, this study was not resource-constrained and thus cannot serve as a true investment strategy.[22] The Services continue to develop their own investment schemes, and even some unified commands (notably, the US Special Operations Command) are looking at pursuing their own space-related efforts.

This lack of cohesion is unfortunate, because none of these embryonic strategies appear to properly consider several crucial issues: (1) Space will continue to be a costly endeavor for at least the remainder of the century, so that joint and interagency space operations will be the norm. To maintain an adequate space force structure, the Services must act as a joint team by sharing the burden and generating specific components of this structure. Although simplistic, a first-order division of labor would be ground-based systems to the Army, sea-based systems to the Navy, and air and space-based systems to the Air Force. This scheme is traditional and reflects the current approach to strategic defense and ASAT systems.[23] (2) Normally, each Service has unique requirements, most often with the user segment, which

it must resource and assume the program lead. However, overlapping or complementary needs and capabilities will exist, must be identified early, and must be worked on jointly. An example is joint Army and Marine Corps land warfare operations. (3) A top priority of every investment strategy must be to reduce the cost of all aspects of space operations. Until this is done, space forces will tend to retain their strategic focus and make-up, limiting the opportunity to field viable operational and tactical systems. (4) There are inherent weaknesses in current US space forces due to the strategic philosophy upon which they are based. Fundamental changes are necessary to make space forces responsive to theater, operational, and tactical commanders. These changes can be instituted only with early resolution of the desired mix of strategic and dedicated theater, operational, and tactical space systems. (5) Technology can now support both evolutionary and revolutionary changes to military space to field this force mix, with a variety of nontraditional systems available now or in the near future.

A comparison of the current space architecture with new system options highlights possible future changes to military space forces. Today's civil, military, and commercial space architectures depend on expensive, extended-lifetime, and strategically-oriented systems deployed in small numbers. Deployment of these systems depends on a costly launch infrastructure based on a limited number of fixed launch sites (which could be considered "space ports"). Launch systems lack redundancy, are slow to recover from catastrophic launch failures, and require long lead times for preparation.[34] Once launched, space systems usually need extensive start-up and check-out periods before they are deemed operational. Throughout their lives, satellites tend to require constant tracking and external control to keep them functioning properly. Satellite control is carried out from a few normally fixed tracking and control sites. In times of war, survivability of ground and space segments, particularly on the civil and commercial side, is of concern. While spares for several systems are maintained on orbit, the ability to replenish or surge additional assets with little notice is not possible.

There are solutions for each of these apparent shortcomings. New launch systems can be mobile and multi-based (ground, sea surface, submarine, and air-based). Use of very small satellites or systems which operate as suborbital packages require smaller boosters, which translates into less

expensive launches. Small inexpensive boosters, combined with multi-basing concepts, create the opportunity for theater launch systems, particularly important for suborbital systems which would directly support theater and operational commanders. In some cases, refurbished intercontinental and sea-launched ballistic missile boosters, recoverable booster stages, or fully recoverable single-stage-to-orbit systems could reduce launch costs.[35] Nontraditional launch concepts which avoid chemical-energy boosters also are possible. One promising approach is based on hypervelocity launchers such as electromagnetic and electrothermal guns which could place very small, hardened space systems into orbit or on suborbital trajectories.[36] Air-breathing boosters, such as the X-30 National Aerospace Plane (the NASP is both single-body-to-orbit and fully recoverable), would provide unique options for mission flexibility.[37] Finally, space systems could be staged in deep-space parking orbits for extended periods of time until redeployed on short-notice recall, thus avoiding the need to launch from earth at critical times.[38]

Any space system can be divided into three parts: the support segment (for launch and subsequent control of platform and payload), the space segment, and the user segment. As the primary component of the space segment, satellites are the most crucial nodes in any space architecture. While most current satellites are national systems with ancillary operational and tactical support capabilities, a new class of satellites has been proposed to directly support battlefield operations. These so-called "tactical satellites" (or TacSats) and the orbits they occupy would be designed specifically to best support these operations. The difficulty in talking about new classes of satellites such as TacSats is the current confusion in nomenclature. There is a tendency to use such terms as "TacSat," "LightSat," "MiniSat," "MicroSat," "NanoSat," "CheapSat," and "SpinSat" interchangeably, when they really mean different things.[39] In this paper, a TacSat fulfills theater, operational, and tactical battlefield support functions as opposed to strategic tasks, while LightSats, MiniSats, MicroSats, and NanoSats differentiate satellites by their mass and dimensions (arbitrarily, under 300 kilograms, under 100 kilograms, under 20 kilograms, and under two kilograms, respectively). The size and mass of a satellite determine the energy needed to launch it into orbit and thus the size of the booster, which relates directly to the cost of launch. The smaller and lighter the satellite, the smaller the booster or the greater the number of satellites which can be

carried by a single booster, even allowing at times for the launch of an entire constellation at once. Because TacSats are usually seen as special-purpose satellites, often with a single mission to perform, they are expected to be much smaller than their strategic, multi-purpose counterparts. This leads to the confusion between a TacSat, a functional description, and a LightSat, a mass-limited category. Naturally, small, lightweight TacSats could present the greatest benefit in many cases.

There are other characteristics which would improve the capability of a satellite or reduce its cost. Useful capabilities could include tailoring of satellite components (such as individual sensors) to meet battlefield needs just before launch, the use of standardized modular elements, massive onboard data processing to deliver final products to users while reducing information overload, multi-sensor payloads and replaceable programming packages, minimal check-out time after launch so that satellites are available for operations as soon as possible, and semi-autonomous satellites which rely less on (and place less burden on) ground control stations. Properly configured satellite constellations would allow for distributed and redundant functions, minimizing the effect of losing any one satellite and thus improving reliability of support.

Satellite costs could be reduced by relaxing space-certification requirements since TacSats normally would not require extended lifetimes and could be deployed in numbers great enough to absorb single-system losses. Other cost-cutting approaches include the use of common platforms and components and improvements in manufacturability, standardization, and producibility (that is, "assembly line" production). A revolutionary step would be the development of hardened NanoSats would could be launched by hypervelocity guns into orbit, eliminating the need for traditional chemical boosters.[40]

The control of a space system centers on ground control stations and tracking and relay sites, all of which tend to be fixed and, to ensure global coverage, may be stationed outside the continental US. The tracking and relay of information to and from satellites are moving away from ground-based sites to space-based systems, ensuring real-time worldwide coverage but creating potential vulnerabilities in the future.[41] Ground control stations can be downsized and made mobile, improving survivability and optimal siting. The satellite platform provides the necessary positioning and support functions for the one or more payloads carried onboard, while each payload carries out

specific operational missions for the user. Since the satellite platform and its payload can be controlled and tasked separately, the platform itself could remain under the command of consolidated control sites in CONUS while the payload is tasked directly by ground stations in-theater to maximize responsiveness.

The user segment consists of the various nodes which provide output directly to terrestrial forces, such as receivers and ground processors. Proper design of the satellite and application of miniaturization techniques allow for significant downsizing of receivers and processors, improving their mobility and availability to ground forces. Imbedded processors are now possible, as well. Advances in data processing and fusion can present tailored products in real-time or near real-time directly to users with a minimum of handling at intermediate levels, yet reducing the burden of information overload.

Limited manned space systems could be available for military uses in the next 20 years. Besides such temporary platforms as the Space Shuttle and the NASP, Space Station Freedom and eventually permanently manned stations on the Moon are scheduled for construction. Current space treaties limit some MMIS operations, particularly on extraterrestrial bodies, but the greatest limitation will be a lack of manned systems optimized for responsive military operations, available in sufficient numbers, and sustainable over long periods at reduced cost. Survivability would also remain a crucial issue.

Ultimately, these possible initiatives would have their greatest impact if integrated through a coordinated joint investment strategy with a clearly defined, evolutionary space architecture as the goal. Each Service would be apportioned segments of this architecture and resourced to field them, yet allowed the necessary freedom to pursue Service-unique elements. These could include not only user systems but space systems as well.

The extent of Service freedom of action would depend on the fundamental issue of whether the US military space architecture would retain an essentially single-tiered structure or would expand to a multi-tiered one. In this case, a multi-tiered structure suggests a functional, rather than a geographical, layering. An example of such an approach is the GPALS architecture, which includes theater, national, and global missile defense components. Expanding this approach to space systems in general, theater, operational, and Service component commanders could have their own dedicated space forces.[42]

IV. MILITARY SPACE THEORY AND DOCTRINE

Before the end of the Cold War, space doctrine and the employment of space forces were intimately tied to and overshadowed by the politics and strategies of general nuclear war. In the minds of many even today, "space war" remains synonymous with strategic missile defenses, still a politically charged issue. However, the Gulf War clearly demonstrated the operational and tactical utility of space support to terrestrial forces and the need to more fully integrate military space power with land, sea, and air power at the theater level and below. But there is still difficulty in overcoming the old mindset of strategically-focused space systems, stringent security classifications, and the fear of a possible space arms race, despite the disappearance of the Cold War's bipolar geostrategic environment.[43]

Fortunately, emerging joint doctrine recognizes the warfighting potential of space forces, particularly in support of contingency operations, and the growing capability of possible adversaries to conduct their own military space operations. Following the Gulf War, the Services have accelerated their efforts to develop space-related capabilities and their own space doctrines. The greatest concern is that if joint and Service space doctrines are not firmly rooted in an accepted military space theory, then Service biases will cause them to diverge from each other.

This section will explore possible foundations for a military space theory, develop a time-phased planning scenario for the employment of future space forces, and assess both emerging joint and Army space doctrines.

A. Foundations for a Military Space Theory

Based on technological, social, economic, and political changes through the centuries, the conduct of war has evolved and has expanded to encompass the media of land, sea, air, and space. Theories of warfare conducted in each of these media have emerged as well; while technological advances and social revolutions have chipped away at the more dated portions of these theories, the fundamental examination of war which they present appear to remain valid even today.

The most recognized theories on war begin with Sun Tzu's The Art of War (c. 500 B.C.), perhaps the most basic and most fundamental treatise on war, though grounded in the art of land warfare.[44] Carl von Clausewitz and

Anteine Henri Jomini were early nineteenth-century contemporaries who interpreted modern warfare between nation-states as it emerged in the Napoleonic era. Their theories continued to center on land warfare.[46] Theoretical treatments of mechanized maritime warfare appeared at the end of the nineteenth century and the beginning of this century with the writings of Alfred Thayer Mahan and Julian Corbett.[46] Both ignored the future impact of submarines and air power, providing a clear example of the sometimes sudden impact technology can have on modern warfare. Finally, Giulio Douhet's theory of air power appeared even as airplanes saw their first use on the battlefield.[47] Though it remains the preeminent work on air warfare, technology continues to affect its most basic premises, as well.

Unlike the emergence of an air warfare theory in the infancy of air power, no recognized military space theory exists today, even though military space systems have been employed for 30 years now. There are various reasons for this. The more significant ones include the early dominance of strategic nuclear war theory, the confusion between theory and doctrine, the lack of a catalyst such as the direct use of space systems in a conflict between space powers, and the drive to conceptually extend the air environment out to include space by assuming "aerospace" as an encompassing, seamless environment. Nonetheless, a military space theory is a necessary step for effective development of space doctrine and, specifically, the design and conduct of space campaigns.

I will develop the foundations of a military space theory based on four fundamental concepts. First, space is a distinct operating environment which imposes unique capabilities and limitations on military space operations. Second, a formal military regime or institution is required to generate and control space forces and to conduct both supporting and independent space operations. Third, military space will go through a staged process of maturation as warfighting shifts directly into the medium and space control becomes a common goal of the belligerents. Fourth, technology will have the primary impact on change, tempered by political, economic, and legal constraints. These constraints will lessen as technology advances and as a multipolar world replaces the more predictable bipolar arrangements now vanishing with the end of the Cold War and the dissolution of the Soviet Union. It must be stressed that any military space theory must be developed so that it can evolve rapidly along with these changes.

This section will consider a "near-term" military space theory which should be valid for at least the next 20 years. The distinguishing feature of this near-term theory is the continued focus on that region of space which is centered on the earth and which can directly impact terrestrial operations (more advanced theories must address warfare outside this region). The approach used in this paper to develop a military space theory is based on the concept that a distinct operating medium requires a unique military theory and an evolving military regime to conduct operations in it.[48] Once this concept is explored, I will use Corbett's theory of maritime warfare as a point of departure for the foundation of a military space theory. Consideration of other theoretical constructs will round out this discussion.

In the military sense, a medium is an environment which is exploited for warfighting, whether or not battle actually takes place in the medium itself. If the environmental characteristics of a military medium are sufficiently unique compared to other media, the objectives, ways, and means upon which military operations are based are also inherently different from those in other media. This requires a distinct military regime or institution to generate the forces and conduct operations in the medium; examples of such regimes are the US Army, Navy, and Air Force, which provide components to a unified command organized to apply coordinated military force in a theater.

As technology allows access to each succeeding medium, both the regime and operations in the medium mature in a predetermined way based on the nature of warfare. This maturation process follows an evolutionary cycle of "exploit-deny-protect." In the initial period, military forces simply exploit the medium to support other operations conducted outside the medium. As the adversary also gains the capability to exploit the medium, forces are generated to deny him the ability to do so. In turn, the enemy targets friendly forces in a reciprocal effort. Finally, friendly forces protect themselves against enemy action in order to retain freedom in the medium. Battle takes place in the medium or adjacent media to deny enemy access and exploitation or to protect friendly access and exploitation, including force projection. Maturity is reached at this stage, and tactical, operational, and strategic processes have significantly evolved.[49]

Battle is the catalyst which accelerates maturation, and normally one side will begin in a dominant position, forcing the other to attempt to respond in kind.[50] The development of the air regime so soon after the

introduction of the airplane was due entirely to the timing of World War I. The arrested development of the space regime is a result of political and legal constraints to conflict based in the medium.

Technology is blurring the boundaries between the military media, but distinct regimes remain necessary as the reach of military forces and the inherent characteristics of each medium imparts unique strategic and operational applications to these regimes. Thus theaters of operations and even theaters of war tend to center on a single medium, placing one regime in a predominant position in a campaign.[81]

The most telling obstruction to the development of a mature military space regime, space theory, and space doctrine is the ongoing debate over the question of space as a distinct medium. The US Air Force officially recognizes a single "aerospace" medium as "the total expanse beyond the earth's surface," with space a logical continuation beyond the atmosphere.[82] However, this is a contested issue even within the Air Force itself, at least at the academic level.[83]

It is true that space as an environment is not clearly delineated from the earth's atmosphere, nor is there a universally accepted legal boundary marking where near-earth space begins.[84] But this is a poor argument to decide that air and space are one. Other media also tend to encroach on each other, as manifested in amphibious, riverine, and air (both aircraft and missile) operations, without similar claims. The definitions of space forces and space operations suffer from such ambiguities, as well. In this paper, space operations are those conducted primarily in or from space, regardless of point of origin, to influence the situation in space or on the earth. Space forces include those assets, whether space, ground, sea, or air-based, whose primary mission is the conduct of space operations.[85]

The fact remains that space represents a unique environment which does draw various parallels with the land, sea, and air media.[86] Near-earth space most closely resembles the sea in many physical and legal aspects, but with some significant differences. Space is not homogeneous, but instead has its own topography, climate, and weather. Like the sea, space is a "supporting" medium in which vessels can retain their positions for extended periods of time; however, "position" in space lacks a stationary connotation, for objects are always in motion as they travel ballistic trajectories or orbital paths. The utility of the sea is defined in terms of lines of

communications and trade routes, and space is increasingly important for its military and commercial "space lanes" which ferry information around the globe. Just as viable sea lanes are determined by the most direct routes and chokepoints, space lines of communications are limited by the rigid physics of orbital mechanics and ballistics, as well as natural and man-made obstructions. The great energies necessary to gain access to space and to alter routes are dictated by physics and thus confine movement and maneuver. Physics and topography in space determine key and critical terrain.[87]

Space has a greater "dimensionality" than the other media, for it has substantial depth, and it borders on the entire earth's surface without being tied to it. The most significant difference between space and sea is the ability to gain an increasingly unobstructed view by climbing to greater altitudes. This is the most crucial military characteristic of space, since it supports long-range communications and surveillance. The ability to reach this "high ground" is best expressed in terms of land warfare. But as the sea borders the land at the shore, space encompasses the earth's surface (greatly expanding the number of possible ports), with the atmosphere and the earth's gravity well as its "coastline." All terrestrial forces become expeditionary forces from the vantage of space.[88]

There are a number of internationally accepted legal conventions concerning space which are founded on a handful of space-related treaties. These accords were most often the direct products of the Cold War environment; the disproportionate influence even today of a few US/USSR bilateral agreements reflects the earlier superpower status of these two nations. The most important legal convention is the recognition that no part of space, including extraterrestrial bodies, is under the sovereign domain of any nation. Space, then, is similar in nature to international waters or airspace, except that unhindered travel over the territory of any nation is recognized.[89] Certain prohibitions on military activities are enumerated, notably the explicit ban on testing or stationing weapons of mass destruction (considered to mean nuclear, chemical, and biological weapons) in outer space. Interestingly, there is no such restriction on suborbital nuclear ballistic weapons. These weapons are regulated only by arms control agreements. While military bases are prohibited on the moon and other celestial bodies, military personnel themselves are not, nor are on-orbit military space stations excluded.[90]

A fundamental tenet of international law is that if an act is not specifically prohibited, then that act is permitted. Thus a significant number of military uses of space is permissible, including the deployment of conventional, non-ABM weapons. A second tenet is that most treaties are crafted to regulate activities between signatories only during peacetime. Unless an international agreement clearly states or implies that its provisions apply in wartime, it must be assumed that armed conflict suspends or terminates their applicability. Finally, the customary interpretation of the right of nations to defend themselves in the event of armed attack includes the right to defend against impermissible coercion and to pursue "anticipatory" self-defense (the right to act in self-defense to remove a danger or threat of imminent armed attack, which, for example, is cited to support the development of ASAT weapons).[21] There is little precedent or explicit prohibition on such acts as preemptive strikes, blockading, commerce raiding, interdicting space lines of communications, or a clear understanding of the legal status in wartime of neutral nation assets, dual-use systems with both peacetime and wartime applications, and multinational civil and commercial systems.

To set the stage for the discussion of a near-term military space theory, the following conditions must be considered. For the next 20 years, military space operations will continue to be terrestrially oriented and conducted in near-earth space. In this paper, near-earth space is that region of space inside the orbit of the moon (sometimes referred to as cislunar space). Due to the global nature of space systems and their routes, military space operations will tend to have simultaneous strategic, operational, and tactical effects, often with political and economic implications. The physical processes which govern access to and travel in space set rigid limitations on freedom of movement and maneuver of space forces, requiring substantial expenditures in energy to alter physical routes. Thus, system mass will directly impact both cost and operational capability, and paths will normally be ballistic or orbital, so that no space system remains stationary.[22] Space provides the advantage of "high ground," allowing a direct view of terrestrial and space battlefields and supporting long-range communications. Space operations will rely on a chain of nodes linked by terrestrial and space lines of communications. Space lines of communications (or SpLOCs) will be either electromagnetic or physical. The major commercial

and military commodity transported along SpLOCs, however, will continue to be information. Finally, space will be largely unmanned at least in the near-term, leading to a unique moral climate for military operations.

Corbett's theory of naval warfare will serve both as a base and a point of departure in developing a foundation for a viable near-term military space theory. Corbett's theory, as embodied in his Some Principles of Maritime Strategy (1911) and "Green Pamphlet" (1906), is founded on the unique nature of the sea as a warfighting medium. With many strong parallels between the sea and space media, and recognizing Corbett's logical approach to his arguments, this theory is the best available for our needs.[63] Nonetheless, agreement will not always occur; space is a distinct medium, and technological capabilities are often quite different. It also significant that Corbett's theory was constructed when the naval regime was already mature, while the space regime is only now advancing beyond the immature state.

I will first present Corbett's concepts in maritime terms and then translate them directly into space terms. At times this translation will be implicitly assumed to reduce repetitiveness. It will be noted whenever parts of Corbett's theory cannot be readily adopted, and necessary adaptions or additions will be presented. I believe that more than enough of Corbett's framework will remain intact so that his theory retains its utility.[64]

War is conducted to achieve political objectives, and these objectives determine the nature of the war and the military strategy; war may be limited or unlimited in scope and object. Maritime theory and military space theory do not stand alone, but instead must fit together into a whole and agree with a more general theory of war.[65] Warfare in one medium must support warfare in the others to best attain the overall object. At least at the strategic level, warfare in each medium is interdependent on and interacts with warfare in the others.[66] However, unless a pure maritime or space campaign is waged, the land campaign or the threat of a land campaign ultimately decides the war's outcome.[67] While a maritime campaign may not directly affect a continental war fought by neighboring belligerents, space warfare will impact any terrestrial conflict, since the earth's surface is the "coastline" to near-earth space. On the other hand, naval warfare can physically deny sustenance and markets to a nation and its people.

The theory of maritime or space warfare and strategy is directly determined by the basic characteristics of its medium. Because land, sea, air, and

space are fundamentally different, warfare in these media is different, as well.[88] Military strategy decides the object, means, and ways by which warfare is conducted, and it too is fundamentally shaped by the medium. The sea (and space), unlike land, cannot be conquered and made the object of "political dominion or ownership."[89] Instead, the "problem of naval strategy can be reduced to terms of [maritime] passage and communications."[90] The nature of near-term military space strategy parallels this approach, but I will assign specific meanings to "passage" and "communications." Passage is the physical transit to, in, and from space, while communications is the flow of information.

A fundamental difference in the near-term between the sea and space is the use of their respective lines of communications. Sea lines of communications are used for physical transport, which in turn allows the physical concentration of fleets and combat power in order to attack enemy fleets, secure LOCs, and conduct blockades and commerce raiding to cut off sustenance to a nation and target the national will. On the other hand, space lines of communications primarily transport information, and "concentration" has a significantly different meaning. Although SpLOCs can be physical or electromagnetic, the gathering and transmission of information is a central feature of space warfare, even during direct engagements. This is because battles with space forces are not conducted in the classic sense of concentrated military forces, but instead are a coordinated set of physically separated engagements. However, information must be passed through a series of nodes, which tend to define and limit a line of communications and thus offer points of vulnerability. A major feature of SpLOCs is their extremely short transit times. Physically, access to low earth orbit from the earth's surface requires only minutes, as does return to the surface. A complete circuit of the lowest orbits takes less than 90 minutes. Electromagnetic transmissions travel at the speed of light (thus simultaneous two-way communications are possible here). Directed-energy weapons have great range in space, allowing for extended and instantaneous effects. Despite the apparent significance of line of sight in space, space itself represents a three-dimensional nonlinear battlefield. (The sea, despite air and subsurface forces, is still basically a two-dimensional battlefield and of more limited extent.) Near-earth space is shaped by the spherical earth, and nodes can transit any manner of orbits to place themselves on any flank in space or to arrive over a terrestrial

battlefield from any direction. Finally, with access to space possible from anywhere on the earth's surface, potential "space ports" exist everywhere on this "shore," limited only by the kind of access desired.

Based on the central issue of passage and communications, Corbett states that the fundamental tenet of naval strategy is embodied in the object of naval warfare, which "must be directly or indirectly to secure the command of the sea or to prevent the enemy from securing it."[71] The single most important concept forwarded by Corbett is that of "command of the sea," for it separates the two tasks of securing friendly access and freedom of action on the seas and of denying access and freedom of use by an enemy. Because of the nature of the sea, one condition is not automatically the result of the other. A fleet can have full use of maritime lines of communications without ever engaging the enemy fleet, as long as the enemy refrains from interfering. Command of the sea, then, could exist by default. Corbett takes this a step further with the idea of "common communications."[72] Unlike land LOCs which are necessarily physically separated on a battlefield, the sea LOCs of both belligerents can and usually are the same for a greater part of their extent, and may be shared by many neutrals. This applies even more so to SpLOCs, where the electromagnetic spectrum is shared by all, and where many satellites can occupy the same orbit as long as they are offset in time. Based on the concept of "command of the sea," I assert that the object of military space strategy is "space command," which can be defined as "directly or indirectly securing friendly access and freedom of action in space or denying the enemy access and freedom of action."

Expressing command of the sea another way, Corbett asserts that naval operations fit into two broad classes of object: (1) "to obtain or dispute command of the sea," and (2) "to exercise control of communications no matter the level of command secured."[73] The first requires that the enemy's means of interference or ability to use the sea is addressed, while the second refers to friendly use of maritime communications. In the simplest terms, then, one task is to "secure command," and the other is to "exercise command." Similarly, "space command" can also be defined in terms of these two tasks. Here Corbett recognizes three kinds of maritime LOCs: those to support the fleet, those to support an expeditionary force, and trade routes to support the nation (each translates directly to the space environment).

Command of the sea is a wartime phenomenon only, for it has no meaning in peacetime. There are various conditions of command, including general, local, temporary, and permanent. General command occurs when one side lacks the overall ability to seriously interfere with the other's communications or to defend its own. Local command means this state exists only in a theater of war or operations. Either condition may be temporary or relatively permanent in terms of the duration of the conflict. Under any of these conditions, command may be in one of three states: with the friendly side, with the enemy, or "in dispute." In fact, command in dispute at least to some degree is the normal state when a war begins and may remain so throughout a conflict unless one side can force a decision against the other's fleet.[74]

These conditions can all occur with space command for political, technological, or military reasons. "De facto" general command would exist if one side enters a conflict without the means to secure space control or even the ability to exercise the use of SpLOCs, while the other has these capabilities. Political constraints may limit command "locally" to certain enemy systems or orbits (for instance, interference with treaty verification systems may be taboo even in war). Even if both sides have the capability to exercise space communications but neither has the means to secure control, then a state of dispute prevails. If both sides have the ability to secure some command, the dispersed nature of space systems would make absolute command difficult. On the other hand, the general inability today of nations to surge and replace systems in a timely manner would offer the opportunity for one side to secure permanent command.

The means to secure and exercise command of the sea rests with the fleet. Corbett describes a functional division of labor with the "battlefleet" tasked to eliminate interference and secure command, and "cruisers and the flotilla" to exercise command and ply the sea routes.[75] While these categories are already outdated in describing modern navies, they do suggest that a space fleet would support similar functions. The space "battlefleet" would include space control systems such as ASAT weapons, missile defense interceptors, and other interdiction systems when directed against elements of the enemy's fleet still on the surface. The "cruisers and flotilla" would encompass intercontinental and theater ballistic missiles, various information gathering and communications satellites and their launch and control systems, and interdiction systems applied against

terrestrial forces. Again, this space fleet -- even the battlefleet -- does not physically concentrate to achieve decisive results.[76]

The methods or ways the fleet is applied to achieve the object of securing and exercising command of the sea are either offensive or defensive in character and are guided by the nature of the conflict itself, the positive or negative aim of each belligerent, and relative fleet capabilities. Corbett couches the traditional concepts of the *offense* and *defense* in terms of concentration and dispersion.[77] Essentially, a true battlefleet represents concentration of potentially decisive combat power and offensive capability. On the other hand, dispersion suggests a defensive posture pursued to protect a force (usually the weaker one), yet allowing it to concentrate enough power at the right time and place to deal offensive blows. Corbett embodies this use of dispersion in his "fleet in being," a force designed to conduct such active defensive operations in order to dispute command, retain at least a limited initiative through constant pressure on the enemy, and, perhaps eventually, favorably alter the balance of power between the opposing fleets through attrition.[78]

Corbett describes two general ways to secure command of the sea: through decisive battle or blockade.[79] "The true function of the battlefleet is to protect the cruisers and flotilla at their special work" of exercising command of the sea, and the best means of doing this is to destroy or neutralize the enemy's power of interference.[80] Thus it appears that the maxim of first seeking out and destroying the enemy's fleet should always apply. However, this presupposes overwhelming power, the concentration of the enemy's fleet, and the willingness of the enemy to place his fleet in a position to accept possible decisive defeat. Corbett believes that these conditions will rarely occur. In fact, he supports Clausewitz's belief that the defense is the stronger form of warfare. Thus the more practical approach is to position the battlefleet to threaten communications critical to the enemy's campaign, forcing him to come to you and do battle on your terms.[81]

Corbett reminds us, however, that decisive battle may not only be impractical, it may not even be the first object of the naval campaign in any case.[82] The overall object of the campaign may be gained if one is able to secure local command or even simply to exercise command of the sea to one's satisfaction. Instead, the condition of dispute over command may be allowed to continue. This may be so because the stronger force cannot set the condi-

tions for decisive battle, the stronger force is satisfied with measures such as blockading, or the weaker force is effectively employing defensive means. Measures to dispute command include the constant pressure from a fleet in being or from minor counterattacks, both of which can alter the balance of power through attrition and eventually allow for favorable decisive battle.

Blockading actually has two facets. It may be used to secure command of the sea or to exercise command, or to accomplish both during one operation. Closely related to these tasks are the broad categories of naval and commercial blockades. A naval blockade prevents an enemy's armed force from leaving port or brings it to action before it can carry out its mission. A commercial blockade stops the flow of the enemy's seaborne trade.[83]

Besides the obvious operational and tactical character of maritime operations, Corbett recognizes the inherently simultaneous strategic nature of the sea medium and naval strategy. This is clearly demonstrated in the three major areas of exercising command of the sea: defense against invasion; attack and defense of trade; and attack, defense, and support of military expeditions.[84] The sea may give the enemy ready access to one's homeland and allow invasion or counterstrikes by sea. Any maritime power must maintain a naval homeland defense force to protect against such a possibility. This is a key concept. While general permanent command would eliminate this danger, this condition is not always possible, as pursuit of this object may lead to an unlimited conflict.[85] A capable homeland defense, however, allows one to control the scope of a conflict and ensure that it remains limited.

The strategic command of trade, exercised through commerce war, blockades, and the right of private capture, attacks the enemy's economy and the sustenance and will of the population. Maritime operations protect expeditionary forces from interference and support combined operations. In addition, a maritime strategic reserve, normally stationed in the homeland, is available to reinforce one or more expeditionary forces. This discussion suggests that a maritime power must be prepared to conduct two simultaneous but linked campaigns in war. One is a strategic defense campaign to secure the homeland. The other is a theater campaign to isolate enemy nations, split coalitions, isolate the battlefield, and support operational and tactical joint and combined operations.

There are numerous parallels between Corbett's development of the ways to carry out maritime strategy and a logical approach to the ways a fully

mature military space regime would conduct space campaigns. Military space forces must be configured to support two possibly simultaneous but normally interrelated campaigns. First, a strategic defense campaign protects the homeland (perhaps extended to the homelands of allies) from invasion represented by space, air, and sea platforms delivering long-range weapons of mass destruction. This is a relatively independent campaign at the national strategic level, with the space regime commanded by a regional CINC responsible for a separate theater of war. This campaign ensures that any conflict remains limited in scope, commensurate with the defender's desires. Second, a space campaign is conducted in support of an expeditionary theater campaign. Here the space regime is responsible for gaining and exercising space command in the adjoining space theater of operations and for fully integrating its forces in combined and joint operations.

The global nature of both the strategic defense theater of war and the expeditionary space theater of operations will cause the overlap of both campaigns and the ready sharing of space forces. This will be most evident in the strategic reserve, which can be stationed throughout the homeland and the expeditionary theater(s) of war, allowing for maximum response and survivability. This great dispersion is possible because of the immediate access to space theaters from any number of space, ground, sea, and air sites. This immediate access also means that terrestrially-based space forces are ready components of the space fleet. In the near-term, in fact, the space fleet could actually be a "fleet in being." Thus the fleet in being would be both a large part of the operating fleet and the strategic reserve. This fleet would concentrate combat power in time and in effect, rather than physically in a small volume of space.[66]

This argues that the defense can become the stronger form of warfare in military space operations. However, at this time the offense retains the preeminent position.[67] Preemptive offensive strikes with weapons of mass destruction are extremely difficult to effectively defend against and require defenses with an order-of-magnitude increase in technological sophistication over offensive systems. Preemptive or first-strike offensive operations against space assets using ASAT weapons and interdiction of terrestrial nodes would be particularly decisive because today's asset inventories and replenishment capabilities are extremely limited. In both cases, offensive systems are not concentrated physically in the traditional sense of battle-

fleets, except when the points of origin are allowed to be collocated. Thus, "battles" are really distributed system-on-system engagements. Individual engagements can be destructive or nondestructive. With the future introduction of capable directed-energy weapons, active defense systems could protect selected space-based systems. Until then, protection must rely on such passive survivability measures as hardening, stealth technology, distributed functions, system proliferation and redundancy, terrestrial node mobility, and surge replenishment; protection will continue to be complicated by the difficulty in space system movement and maneuver. All this points out the incomplete maturation cycle of the space regime, still short of the "protect" stage.[88]

A significant deny and protect capability possible in the near-term is the deployment of space-based systems able to enforce true space blockades. These would necessarily be systems whose primary mission is global strategic defense, such as advanced elements envisioned as part of GPALS.[89]

This discussion highlights the evolutionary nature of space warfare even in the near-term and suggests that the military space regime could complete the full maturation cycle within the next 20 years. Based on a theoretical foundation incorporating this maturation cycle of "exploit-deny-protect," a vision of the space campaign begun here is available for further development.

Finally, it is recognized that other theoretical models besides Corbett's should be investigated (in fact, Corbett himself relies heavily on Clausewitz in developing his theory). The most obvious include concepts from Clausewitz (center of gravity, culminating point), Jomini (interior and exterior lines of operations, decisive point, pivot of maneuver), and US military principles of war. For example, in the near-term a culminating point will be reached through attrition of limited assets rather than by stretching already global SpLOCs. Currently, lines of operations originate only from a small number of fixed terrestrial launch sites or well-known orbiting constellations. Once multi-based launch sites are distributed in great numbers and satellites are proliferated, however, multiple exterior lines of operations can be applied against any theater. Properly interpreted, the principles of war would apply in varying degrees to an evolving military space strategy, as seen in earlier analyses of concepts related to objective, mass, offensive, unity of command, security, and surprise.[90]

B. The Threat and a Phased Planning Scenario

It was claimed earlier that the primary catalyst for the "exploit-deny-protect" maturation cycle is battle with a capable foe. At times when possible adversaries are not clearly identifiable, however, the catalyst must be a reasonable expectation of evolving capabilities available to any potential enemy state or coalition. Such a capability-based progression, rather than the former Cold War threat-based one, is necessary in today's more uncertain multipolar strategic environment.[81]

US national military strategy and expeditionary campaigning assume US preeminence in the areas of military space, sea, and air capability in order to quickly establish conditions for swift and decisive victory. It is already doubtful whether the US is truly dominant in military space in the context of operational and tactical support, particularly when space denial and protection systems are extremely limited.[82]

Other nations have long recognized the prestige, freedom of action, and commercial and military benefits which result from possessing their own space systems. The number of countries and international consortia owning satellites and space infrastructure is growing rapidly. The US National Security Strategy already acknowledges some ten significant spacefaring nations.[83] Even with the collapse of the USSR, the US competes with two major space powers, the European Space Agency and Japan. Several militant or isolated nations, such as China, Israel, India, and South Africa, pursue vigorous missile and space programs as a means to protect their sovereignty and bolster military capability.[84] In these troubled economic times, space systems and technology are increasingly marketed for hard currency. As technology transfer controls are lifted or subverted, dual-use technologies which support the development of both ballistic missiles and space launch vehicles are available to nations with questionable intentions. Space systems are often dual-use systems which can support both peacetime and wartime applications. Satellites with latent or active military utility are stationed on orbit long before the obvious start of any conflict.

Nations and coalitions of nations, eager to reduce their reliance on the US after the Cold War, are focusing more on acquiring their own military and arms control verification space systems. The Gulf War clearly demonstrated to many nations the critical utility of military space forces, particularly in support of expeditionary operations. France, already one of the leading

spacefaring nations, was especially impressed by these lessons from the Gulf War and has begun to accelerate its military space effort, even while other parts of its defense establishment are suffering cuts.[88]

France can serve as a benchmark in determining general timelines for potential threat capabilities used in a phased US military space planning scenario. Apart from its role in the European Space Agency and Western European Union, current French defense plans call for deployment of two optical-imaging reconnaissance satellites by 1995, an infrared-imaging satellite by 1998, and a radar-equipped surveillance satellite by 2001. The French are also testing communications intelligence packages and are fielding improved military communications payloads able to relay satellite imagery directly to ground forces.[89] Taken together with similar trends in other countries, this suggests that potential adversaries could have a militarily significant capability to support their forces and target US contingency forces in real-time in five to 10 years. Critical nodes, however, will remain small in number, and there are no apparent attempts to develop active space control assets at this time.

The proliferation of ballistic missile and cruise missile technology, along with the means to develop chemical, nuclear, and biological warheads, is well documented. The threat of tactical and theater missiles targeted against US expeditionary forces, theater support structure, and allied nations in theater was realized during the Gulf War and has prompted accelerated efforts to field improved active defenses in the next five years. Although their inventories are limited and often crude, several nations other than those of the former USSR already have or soon will have missiles with intermediate or intercontinental range, placing the US homeland at risk.

It is a US goal to remain a dominant power in military and commercial space endeavors. Based on this goal, the potential but growing threat to US forces, and burgeoning technological opportunities available to space forces, the following phased scenario describes one plausible way space forces will evolve to maturity over the next 20 years, assuming US space forces can maintain the lead in capabilities.

Initially, reliance on strategic systems for exploitation and limited passive defenses for denial and protection are the mainstay. Within five years, active systems are deployed for strategic and theater missile defense and possibly ASAT functions. Due to treaty requirements and funding con-

straints, these are primarily ground-based and fielded in limited numbers and with limited capabilities. Space doctrine now relies on a mix of offensive and defensive measures for securing space command, but US space forces will be limited to disputing space command, rather than fully securing and exercising it. It is easier to deny enemy access to and use of space by interdicting his SpLOCs and space-based nodes than it is to assure responsive friendly access to space, due to limited infrastructure, launchers, and systems.

A new phase opens with renegotiated provisions to the ABM Treaty, allowing for the deployment of space-based weapons for ballistic missile defenses. Global coverage and enhanced protection of allies are possible. This advanced BMD system has inherent ASAT and blockading capabilities, and it can protect friendly space assets by intercepting terrestially-based kinetic-energy ASAT weapons. This permits at least limited operational military-man-in-space activities to proceed with greater confidence. At the same time, exercise of space command is greatly improved through the development of (1) responsive, lower cost, launch-on-demand strategic and theater launch vehicles capable of operating from multiple bases, (2) lower cost, tailorable space systems optimized to support all military forces, and (3) mobile and survivable control nodes and ground processing stations. Proliferation of systems and dispersion of assets lead to the beginnings of a true "fleet in being." Space forces provide long-range fire support to terrestrial operations with conventional kinetic-energy weapons. Friendly space forces not only can blockade enemy space ports, but can now directly interdict them.

The next major phase is signaled by the introduction of large numbers of directed-energy weapons deployed in space and on the earth's surface.[97] While these weapons allow space systems to be largely self-protecting, they also greatly increase the risk to space-based systems. The tension between denial and protection reaches extremes as the mix of directed and kinetic-energy weapons permit the ready interdiction of all space-based and terrestrially-based assets and infrastructure, with space-based systems the most vulnerable. This forces greater reliance on a terrestrial fleet in being, augmented by a fleet in being dispersed in various parking orbits in deep space. This advanced fleet in being requires even greater dispersion, redundancy, proliferation, and surge replenishment capability to remain effective. Operational and even tactical terrestrial forces habitually employ space systems of all kinds; technology has finally blurred the boundaries of

the space regime at all levels of war. Dispersion of space assets has created the condition of a diffused space battlefield, as space warfare becomes routine. Strategic missile and air attack of the friendly homeland becomes extremely difficult. A major unknown is the extent of manned space operations in this much more lethal battlefield. Space warfare may retain its machine-based orientation throughout the maturation cycle.

Thus far, this scenario has retained the expected near-term focus on terrestrial affairs. However, as the human presence extends beyond the earth in significant numbers or major commercial operations penetrate to deep space and extraterrestrial bodies, military operations may focus entirely on purely space-based theaters. This will require a revolutionary adjustment in military space theory, space strategy, and space forces.[99]

Elements of this scenario can be synthesized to describe a three-phased evolutionary concept for US space campaigns over the next 20 years (these phases tend to follow the stages of the maturation cycle). These phases may or may not coincide for the strategic defense campaign and the expeditionary theater supporting campaign. In the first phase (from now to 1996), both US and adversary forces concentrate on maximizing the exploitation of the space medium in support of terrestrial operations.[99] Early on, however, space forces are limited in their ability to fully support theater, operational, or tactical forces. Neither side has an effective means of securing space command. Because both sides are able to exercise space command with little interference from the other, a condition of dispute characterizes this phase and leaves terrestrial operations on both sides vulnerable to space forces.

In the second phase (1997-2015), the US deploys strategic defense systems, ASAT weapons, and other means to secure space command; these constitute components of a battlefleet.[100] The US also expands its ability to exercise space command and exploit space capabilities. Taken together, the "fleet in being" becomes a reality. Adversaries, however, lag behind the US in fielding systems to secure space command, although they do improve their ability to exploit space. These forces remain noticeably vulnerable to interdiction. Thus the US can secure local or general space command, either temporary or permanent, at its leisure. The US has gained preeminence in military space.

In the third stage (2016 and beyond), potential adversaries acquire the means to secure space command for themselves and develop their own fleets in

being. The condition of dispute returns to space warfare, as space forces directly confront one another in extended campaigns. The normal objective of space campaigns is now temporary and local space control. Active defense and survivability measures become critical as space forces must invest greater resources in protection.

C. Joint Space Doctrine

Like any doctrine, military space doctrine should have its roots in a generally accepted military theory, a rigorous historical perspective, and the nation's philosophical approach to war. In fact, current and developing US military space doctrine is founded in none of these. US space doctrine is unique in that it has been dictated from "top down," due in large part to the immediate strategic application of space forces at the time of their introduction. Space forces did not go through the traditional tactical-level "teething period" which terrestrial forces experienced and which served as the base for creating their early doctrines.

Due to the rapid changes in capabilities and conditions offered by advances in technology, space doctrine itself must be designed to evolve incrementally, with revolutionary leaps anticipated. This section, however, will only provide a "snapshot" of current and emerging space doctrines. For better or worse, these will serve as the foundation for space campaigning and operations for the foreseeable future.

An articulated vision of the use of space by US military forces begins at the highest level with the current National Security Strategy and National Military Strategy. The former devotes sections on space-related security concerns, clearly recognizing the critical part space plays in the prestige, economic well-being, and technological leadership of the US. To secure US national interests in space, a viable military space capability, supported by passive and active space control measures, is necessary. In addition, a GPALS missile defense system is required to protect the US homeland and its deployed forces in theater.[102]

The National Military Strategy articulates the American "way of war" and a broad evolving strategy for the use of US military forces in today's emerging multipolar security environment. The American way of war is characterized by strategic conventional and nuclear deterrence, application of decisive power, quick resolution, power projection, initiative, mass and fire-

power, multiple fronts, asymmetric battles, joint operations, and minimal US casualties.[102] Space figures prominently in the military strategy, where it contributes to all four National Defense Foundations and seven Strategic Principles upon which the strategy is based. Space is a central component in (1) the Foundation of strategic deterrence and defense, to include the protection of the US homeland, forward deployed forces, and allies, and (2) the Principle of maritime and aerospace superiority, where "achieving and maintaining preeminence in the air, in space, and at sea is key to our continued success as a global leader."[103] US military forces are configured on a Base Force concept, which depends on the four supporting capabilities of transportation, space, reconstitution, and R&D.[104] Space forces must be prepared to accomplish four tasks: "space control (combat against enemy forces in space and their infrastructure); force application (combat against enemy land, sea, air, and missile forces); force enhancement (support for land, sea, and air forces); and space support (satellite control and launch capability)."[105] (Appendix 4 defines these functions in detail.)

This concept of four basic tasks for space forces is fundamental to the development of US space doctrine. Referred to as "tasks," "functions," or "mission areas" in various joint and Service publications, the delineation of these four functions now shapes military space operations, campaign plans, and force structure. The space force functions evolved through a series of National Space Policies and supporting Defense Space Policies beginning with the Carter Administration, and were further refined by USSPACECOM and its components.[106] With the current drive to develop viable, fully encompassing joint doctrine, these functions are being readily adopted in space-related joint publications. However, there is concern that these functions and their labels reflect their political, strategic, and force development origins and do not translate well into warfighting terms.

The impetus to develop better joint doctrine has served to recognize the legitimacy and importance of space forces and space operations in the US military hierarchy. Joint Pub 0-1 (Proposed Final Pub), Basic National Defense Doctrine, includes homeland defense forces and space forces among the major components of the US national military posture (it, too, notes the four space force functions). It also acknowledges that theater commanders exercise overlapping strategic and operational responsibilities. describes theaters as maritime or continental, and details the strategic and operational levels of

war. Finally, it adopts a set of principles of war applicable to all US armed forces.[107]

Joint Pub 1, Warfighting of the US Armed Forces, guides the joint action of the US Armed Forces and regards theater of war and subordinate theater of operations joint campaigns as the unifying focus for the conduct of warfare.[108] This publication elevates space forces to a level coequal to that of the terrestrial forces and requires that space operations be a fully integrated component of joint campaigns.[109] Joint campaigns rest upon key collective capabilities which serve as the foundation for joint operational art. This includes an objective of the joint campaign to secure air and maritime superiority and space control for effective projection of power and freedom of action.[110] Interestingly, JCS Pub 3-0 (Test Pub), Doctrine for Unified and Joint Operations, which focuses on theater strategic and operational actions across the operational continuum, does not mention space forces or operations. It does describe the role of the joint force commander and the supporting joint force air, land, maritime, and special operations component commanders.[111]

Joint doctrine for space-related operations is currently detailed in three publications: Joint Pub 3-14 (Final Draft), Joint Doctrine: Tactics, Techniques, and Procedures (TTP) for Space Operations; Joint Pub 3-16 (Initial Draft), Joint Doctrine for Integrated Strategic Defense, and Joint Pub 3-01.5 (Initial Draft), Doctrine for Joint Tactical Missile Defense (note that USCINCSPACE is the lead agent for the first two and the Army for the third). These publications have artificially divided up the space regime into two areas: relatively independent and nationally focused strategic defenses, and terrestrial battlefield supporting space operations. There is no true umbrella or keystone space doctrinal publication which acknowledges (1) that supporting space operations and strategic defenses are facets of a single space regime; (2) that the space regime will conduct simultaneous national, theater, operational, and tactical operations as part of interrelated strategic defense and theater supporting campaigns; and (3) that space theaters of war and operations, joint space campaigns, and space forces must be designed upon the basis of a unique military space theory. In addition, expeditionary missile defenses, at least at the theater level, logically fall under the space regime. The linkage between space and missile defense has been borne out by theory, history, organizational development, and trends in R&D. The

integration of national, theater, and even tactical missile defenses under GPALS and vested operationally in USSPACECOM is further evidence of this. Theoretically, strategic offensive missiles with conventional and mass destruction warheads could become part of the space regime, as well.

Joint Pub 3-14 (Initial Draft), Doctrine for Joint Space Operations, was the first attempt at joint space doctrine; however, it provided only a sketchy framework for such doctrine. This publication described the four traditional space force functions as broad objectives of space operations, then classified space control and force application as combat operations and force enhancement and space support as combat support operations. It did suggest that "space systems will mature, increasing the likelihood that space could become a theater of conflict where traditional 'principles' of war are constant."[112]

The Final Draft of Joint Pub 3-14 has taken a quantum leap beyond the earlier version in presenting a cohesive, detailed description of joint space doctrine, but still focuses only on space operations in direct support of the terrestrial battlefield. This publication presents the physical attributes of the space medium in terms of extent, vantage, gravity, composition, radiation, temperature, and propogation, then lists the operational considerations of the space medium for space forces under difficult access, placement, long-duration flight, maneuver, global coverage, decisive orbits, and weapons range.[113] Unfortunately, it also appears to limit space systems and space forces by and large to assets which operate in space for extended periods, as well as their supporting infrastructure.[114]

The most significant change in doctrine, however, is in the description of space activities in more standard warfighting terms. Although it acknowledges the utility of classification by space force functions, it presents four the "military space operations" of counterspace operations, space combat support, space fire support, and space operations mission support. These "are derived from military space functions and capabilities, and are specifically focused to encompass the terrestrial combatant commander[']s co-relationship to space;" that is, "they contain military space force capabilities which are used to support joint military commanders and their forces."[115] This terminology, while effective in describing supporting space operations, may be limited when applied to more independent space operations. They may also be somewhat redundant, for they tend to parallel the functions of space control, force enhancement, force application, and

space support, respectively (see Appendix 4 for a comparison of these terms). This paper will continue to use the standard space force functions, since they are more encompassing, currently more recognizable, and still the basis of operational plans now in effect. The great failure of the Final Draft of Joint Pub 3-14 is the lack of a more balanced approach to the space regime, so that it cannot properly fulfill the role of capstone doctrine.

A substantial doctrinal foundation is found in Joint Pub 3-16, which "establish[es] basic doctrinal guidance for the unified strategic defense of North America and strategic defense support to combatant commands," both theater commanders and allies.[116] Integrated strategic defense (ISD) is defined as "the combined, coordinated, and mutually supporting application of air defense, ballistic missile defense, and space defense forces to defeat single or multi-mission area attacks against the vital elements of national power."[117] Because ISD is made up of the functionally independent mission areas of air defense, BMD, and space defense, Joint Pub 3-16 provides overarching doctrine which "influences but does not supplant individual mission area doctrine."[118] Note that such joint doctrine for BMD or space defense does not yet exist.

USCINCSPACE is the JCS-designated Coordinating Authority for strategic defense. USCINCSPACE is also the combatant commander responsible for BMD and space defense, while the CINC, North American Aerospace Defense Command (CINCNORAD) is the commander responsible for air sovereignty and air defense and for integrated Tactical Warning and Attack Assessment.[119] Other warfighting CINCs provide support for ISD as necessary.[120] Strategic defense forces also provide direct support to theater commanders through global surveillance, warning, and forward engagement of hostile elements, with further support from a strategic reserve available to augment theater defense forces.[121]

A common framework of functions and tasks for each ISD mission area facilitates integration and is supported by overarching strategic intelligence warning. The common functions are surveillance (with the tasks of detect, track, and identify), command and control (assess, warn, and execute), and engagement (intercept, nullify, and report).[122] A set of ISD principles, derived from the fundamental principles of war, guides strategic defense application. These include centralized direction and decentralized execution, forward defense, and defense-in-depth.[123] While a joint strategic defense

operations plan provides the framework for all subordinate plans, Joint Pub 3-16 does not designate an overall combatant commander. Finally, Joint Pub 3-16 recognizes the synergy possible with simultaneous strategic offense and defense operations when coordination fosters mutual support and precludes mutual interference.[124]

Joint tactical missile defense (JTMD), as described in Joint Pub 3-05.1, seeks to counter the tactical missile threat, to include surface-to-surface missiles, air-to-surface missiles, and ground and sea-launched cruise missiles; of primary concern, however, are tactical ballistic missiles.[125] Despite the "tactical" label, JTMD actually encompasses both theater and tactical threats, and applies to the integration of each Service's and (at times) coalition tactical, theater, and national capabilities. The emphasis on the ballistic missile threat and the integration of theater and strategic systems (such as envisioned with GPALS) suggests that JTMD is in many ways a space-related endeavor.

JTMD operational elements include the four mutually supporting measures of passive defense, active defense, attack operations, and command, control, communications, and intelligence (C3I).[126] The responsibility for the integration of Service JTMD assets to carry out these measures rests with the joint force commander.[127]

The joint space doctrine just summarized will serve as the foundation for joint space campaigns at the national, theater, and operational levels. This doctrine has a number of potential strengths and apparent weaknesses. Without a true capstone space doctrine document but with the need to integrate broad mission areas both inside and outside the space regime, the current joint space doctrine tends to have discontinuities. The four basic space force functions do not necessarily translate directly into warfighting terms, while the new military space operations may be too limiting when describing independent space activities. Unity of command as a principle is stressed but not supported with clear guidance. The process of integration between national, theater, operational, and tactical systems lacks detail. Space is seen as a warfighting medium, but design of a space theater of war or operations is not addressed. Space forces are differentiated from other military forces, but a joint space component command organization to support a theater is lacking. Finally, two trends are worth noting. First, USSPACECOM, a combatant command, has the major influence on the development of joint

space doctrine. Second, the term "aerospace" is all but missing in emerging space doctrine.[120] (Space doctrines for Services other than the Army are summarized in Appendix 5.)

D. Army Space Doctrine

The Army's doctrinal perspective on space today resides almost entirely in TRADOC Pam 525-5, which presents the AirLand Operations umbrella concept and which focuses on the operational level of war (notably in contingency theaters). Before the publication of this concept, the Army produced a number of documents meant to devise a strategy to integrate space support with ground operations. Unfortunately, key doctrinal manuals, to include FM 100-5, Operations, ignored this aspect of warfighting.[120] Experience gained in Operations URGENT FURY and JUST CAUSE demonstrated the need for the Army to foster this integration, while the impetus behind SDI rekindled the Army's strategic role in space. The AirLand Battle-Future studies provided the first comprehensive approach to Army involvement in space at the national, theater, operational, and tactical levels.[120] However, the approved AirLand Operations concept has a narrower focus. It recognizes the critical part space plays in the success of AirLand Operations at the theater, operational, and even tactical levels, but does not describe the Army's role in space operations at these or the national levels.

There are ongoing efforts to correct this shortcoming with proposals to provide an updated Army space strategy and detailed doctrine. The Army Space Concept, the foundation for evolving Army space operations, is being realigned with the AirLand Operations concept. TRADOC is considering an Army Space Operations Enabling Concept aimed at supporting the AirLand Operations umbrella concept; it applies the Army's near-term, mid-term, and far-term phased strategy to develop Army space capabilities.[121] The draft FM 100-18, Space Operations, which provides a broader doctrinal base and includes the strategic level of war, continues along the doctrinal publication approval process. Finally, the Army leadership is currently reviewing the initial Army Long Range Plan for Space (ALRP-S), which details an integrated, long-term strategy to acquire necessary Army space capabilities.[122]

Perhaps the most useful innovation in space doctrine could be the application of the Army's description of military operations in terms of functional operating systems. Termed the "Blueprint of the Battlefield,"

this is a hierarchal framework of military functions at the strategic level (organized into two parts, national military strategic and theater strategic operating systems), operational level (operational operating systems), and tactical level (battlefield operating systems).[133] This structure of operating systems could be used to describe both the military space regime and the integrated support it provides terrestrial forces. (Appendix 6 details this functional blueprint.)

This discussion of joint and Army space doctrines highlights the great strides being made to develop space doctrine. It also points out several deficiencies, most of which occur because space doctrine is not properly anchored in a military space theory. A telling example is the fundamental concept of space command, which theory states is made up of the dual tasks of securing space command and exercising space command. Based on a political and strategic focus, however, space command is artificially separated into and managed as the standard space force functions of space control and force application, leading to poor unity of effort in attaining a critical object.

V. JOINT SPACE CAMPAIGNS

The building blocks necessary to describe an evolving joint space campaign concept have appeared during discussions of Service roles and missions, military space theory, a time-phased planning scenario, and military space doctrine. Military space operations will remain a joint endeavor for the foreseeable future, both because of the space-related functions mandated to each Service and the need to diffuse the cost and operation of space systems among the using Services. To further complicate unity of effort for military space operations, interagency coordination between the civil and military space sectors and cooperation with the private commercial space sector will remain the norm across the operational continuum.[134] Combined operations with allied or coalition military, civil, and commercial space organizations and multinational space corporations will often be necessary to fully augment US space forces.

The ultimate object of any space campaign is space command, either as an end to itself, such as in the case of homeland defense, or to support terrestrial operations. Space command includes the two distinct and separate

objects of securing space command and of exercising space command. In general terms, the space force functions of space control, defensive force application, and necessary space support are ways to secure space command. The functions of force enhancement, offensive force application, and appropriate space support are ways to exercise space command.

In the near-term (that is, the next 20 years), there will be two fundamental and distinct space campaigns, which may or may not be interdependent. The first is the strategic defense campaign, and the second is the expeditionary theater supporting campaign. The principles of theater design and campaign design used in terrestrial campaigns would apply to these, as well. (Appendix 7 summarizes the evolution of these campaigns over time.) In the far-term, wholly independent space campaigns divorced from today's terrestrial orientation may be necessary.

As long as strategic defense remains focused primarily on ballistic missile defense of the US homeland, the strategic defense campaign will be carried out in a space-oriented theater of war and will be the responsibility of USCINCSPACE, fulfilling the role of a true regional CINC (note that USCINCSPACE is currently assigned only functional, and not geographical, responsibilities for space).[136] Despite the greatly reduced possibility of massive nuclear strikes by any adversary, the political reality is that even a very limited attack against the US with weapons of mass destruction would be devastating. Characterized as the "30-Minute War," this confrontation would see multi-tiered national defense systems and eventually global defense systems will engage incoming ballistic missiles. Integration of operations with US theater and allied defenses will be necessary. As more capable defense systems are fielded, the ability to secure space command through strategic and theater blockading or neutralization of enemy space systems already on orbit will cause the strategic defense campaign to overlap any expeditionary theater support campaign. In any case, capable strategic defenses ensure that US military forces have the freedom of action to limit the scope of any strategic or regional conflict.

As capable integrated strategic defenses expand to include air defense and space defense, the strategic defense campaign will become more complex. The theater of war will expand, and the space theater may devolve into a subordinate theater of operations and the BMD-oriented campaign into a supporting campaign under integrated strategic defenses. Unity of command and

the position of theater of war CINC may be an issue. However, USCINCSPACE, already responsible for two of the three aspects of ISD and closely integrated with NORAD, could retain this position.[15e]

Even greater concerns over unity of command will arise when strategic offense and defense operations are truly synchronized. The result would be a strategic campaign (rather than a purely strategic defense campaign), which might consist of phased simultaneous and successive offensive and defensive operations. USCINCSPACE would be responsible for defensive operations and CINC, US Strategic Command for offensive operations, but overall command is an open issue for now.

The expeditionary theater supporting campaign would support the overall theater campaign and take place in a space theater of operations "adjacent" to the terrestrial theaters of operations, completing the makeup of the regional theater of war. This campaign would include independent, general support, and direct support space force operations.

Ultimately, supporting space forces would be deployed in several functional tiers. Each tier would consist of ground, sea, air, and space-based elements supporting the appropriate ground, space, and user segments. The first tier would include strategic systems and a limited number of theater systems normally maintained on orbit in peacetime, as well as the global space-based communications net used by the majority of space forces. The second tier would be made up of some strategic systems and most theater systems, launched starting at the beginning of the regional crisis. The third tier would be temporary assets launched when needed to satisfy specific theater, operational, and tactical requirements and would include both sub-orbital and near earth orbit,short-term orbiting theater, operational, and tactical offense and defense systems. The final tier would be the strategic reserve or homeland "fleet in being" maintained in the US, possibly with some elements "forward" in-theater. A limited but immediately responsive theater reserve or fleet in being maintained in CONUS or deployed in-theater might be a reasonable means to provide the quickest support.

The uniqueness of the space medium leads to unique issues in theater design and command and control. The global "paths" traveled by space systems expand the space theater of operations to fill USCINCSPACE's area of responsibility; Appendix 8 illustrates this phenomenon. Because of this global theater of operations, USCINCSPACE serves as a supporting CINC and

conducts the expeditionary theater supporting campaign. This campaign includes both independent and supporting space operations which ultimately support theater of war campaign objectives. An original approach to command and control would be USCINCSPACE designating a joint space component commander (JSCC) to support the regional CINC in-theater. USCINCSPACE would retain day-to-day control of independent operations and manage the appropriate space operating systems. The in-theater JSCC would be the regional CINC's direct interface with supporting space forces, as well a ready link between other theater of operations commanders and space forces. His tasks would include the coordination of supporting major operations and the integration of space assets in direct support of terrestrial operating systems. The role of the JSCC would be particularly important if significant space forces are deployed in-theater. Service space component commands could designate representatives to serve respective regional component commanders, as well. In any case, space staff cells should be assigned to theater, operational, and appropriate tactical headquarters lacking this organic capability.

Besides the global extent of the supporting space theater of operations, there are other reasons for USCINCSPACE to retain command in this theater: (1) USCINCSPACE would retain command of the strategic homeland reserve/fleet in being and the strategic systems in the first and second tiers; (2) he is in the best position to coordinate interagency, commercial, and coalition space support and fully integrate strategic systems into the theater structure; and (3) Service component space commands largely remain stationed in the US.

Another challenge to controlling and coordinating space operations in support of a theater is the significant overlap of space force operating systems and terrestrial operating systems. For example, each Service will deploy JTMD assets in a theater, but currently it is the responsibility of the JFC to integrate. Even though JTMD systems are treated as air defense or anti-air warfare systems, a major task of these forces is local suborbital space control through defensive and offensive force application. A major function of the JSCC should be coordinating and deconflicting friendly access to and use of the space medium, to include suborbital missile defense and deep fire systems. To accomplish this, the JSCC would maintain an electronic Space Tasking Order to foster "space management," analogous in many ways to the JFACC's Air Tasking Order. The JSCC's effectiveness rests in unity of com-

mand, the synchronized application of space power, and integration of space and terrestrial operating systems.

Space campaign plans are not a theoretical concept. USCINCSPACE OPLAN 3400-90, Space Campaign Plan (U), is currently in effect, with guidance now published for the development of the follow-on OPLAN 3500-95.[157] These plans, however, orient on strategic and theater space control, force application, force enhancement, and space support. They do not distinguish between strategic defense and theater space support campaigns, clearly address the tasks of securing and exercising space command, or organize space forces and missions around functional operating systems. (Note that the Joint Strategic Capabilities Plan now requires all regional CINC plans to include an Annex N, Space Operations.[158]) Appendices 9 and 10 provide additional considerations for space campaign design and development of space operating systems.

The evolving joint space campaign concept highlighted in this section passes a first-order test based on the qualitative criteria of acceptability, feasibility, and affordability. This concept is acceptable under the provisions of the military space theory developed in this paper. It is firmly based in joint doctrine for theater campaigning, and it implements the emerging vision of space forces in support of US military operations. It is technologically and organizationally feasible, based on military space organizations and personnel already available and managed through a unified space command. Despite reductions in military budgets and forces, this concept is affordable given appropriate DoD emphasis on resourcing and on support from all Services. The high cost of space forces, however, will pose the greatest challenge to effective space campaigning.

VI. RECOMMENDED ARMY INITIATIVES

The Army must orient its space strategy in part to foster the ability of US military forces to conduct viable space campaigns. This benefits the total force in homeland defense and in theater operations. In addition, this is necessary because (1) the Army is mandated a role in organizing, training, equipping, and providing forces as components of joint space forces; (2) the Army acknowledges its traditional mission of homeland defense; (3) Army field forces would greatly benefit from a capable US space regime; and (4) the Army

would have a major voice in the joint space community only if it participates and invests as a full partner.

The Army should focus both on fielding Service space forces capable of supporting joint space campaigns and operations and on fully integrating space capabilities with appropriate land power operating systems. Taken together with current Army efforts, the following initiatives would help reach these goals. They should be pursued as early as possible and as a total package.

(1) The Army should support a realistic but innovative joint space architecture and long-range investment strategy which have the flexibility to adjust to technological revolutions in the space regime and which can accomodate "plug-in" Service, interagency, and coalition space systems. Space forces would be generated based on functional operating systems and operational tiers.

(2) The Army should support a change in the UCP giving USCINCSPACE both geographic area and functional responsibilities in space.

(3) The Army should require that joint and Army doctrine include a capstone doctrinal approach to the space regime as a whole, built upon a sound military space theory. Implementing doctrine should incorporate the concepts of space campaigns, space theaters, space force operating systems and tiers, and the joint space force component commander.

(4) One articulated, cohesive, and long-range Army vision for space which is fully supported by the Army senior leadership is needed as an extension of the Army Space Policy (which itself might be updated and reissued). This vision should be widely disseminated throughout the Army and among its leadership.

(5) The Army should formally incorporate its part in strategic defense into its set of strategic roles. Despite the Army's long-term commitment to and experience in homeland defense, as well its stated desire to be a player in space and strategic defense over the years, this step has not been taken.[126] This must be corrected, since the Army will find itself manning, equipping, and fielding new strategic forces in less than five years. In addition, the Army must reinvigorate its commitment to developing a national KE ASAT system, the centerpiece of any near-term US capability for active space control.

(6) The Army must adopt a philosophy of integration, rather than of exploitation, of space with land warfare. This suggests two-way interaction

and support, and requires that the Army contribute a fair share back into the space regime, which will remain a totally joint force for the foreseeable future. The Army would supply forces operating at all levels of war; the suitable balance of Army space control, force application, force enhancement, and space support elements necessary to support space force and Army operating systems would be determined by Army roles and missions, demonstrated expertise, and land power requirements. Appropriate space doctrine should be fully incorporated and integrated into Army doctrinal publications.

(7) The Army should create a separate Space and Strategic Defense Mission Area and Program Element in order to resource and manage the effort to develop national, theater, and operational Army space forces. A Program Executive Officer for Space and Strategic Defense, supported by a robust acquisition command (founded on USASDC), would carry out necessary research, development, and acquisition for major Army programs, Army-led joint programs, and Army-supported joint programs. Tactical systems would remain under the purview of the appropriate schools, centers, and acquisition commands, with a space programs integration office tasked to mandate necessary integrating actions. The Army's acquisition philosophy must take a broader view of space; space should always be considered as a possible solution to any land warfare shortcoming, recognizing that the unique characteristics of space forces may offer the primary, an alternate, or perhaps the only answer to a deficiency.

(8) The Army must build a more effective space organizational framework. In the near-term, due to the limited resources available, this will require the consolidation of many current Army space organizations under a single Army space advocate, complemented by a counterpart on the Army Staff. This consolidated space organization should be designated an Army major command, and its commander invested with the authority and status to operate effectively in the joint space community.

(9) For now, the commander of this consolidated space organization should be dual-hatted as the commander, USARSPACE. This would improve the position of the Army's operational space component command to USSPACECOM in the joint space community. Army theater space and missile defense forces should be consolidated and reorganized as a separate theater element under a single commander responsible to commander, USARSPACE. USARSPACE should expand its Regional Space Support Centers to Theater Space Coordination Cells capable of augmenting theater Army component commands and providing a direct

interface with joint and Army space forces. In addition, space staff officers would be assigned as permanent members of all theater, operational, and necessary tactical headquarters.

(10) To support such requirements for Army space expertise, the Army must eventually establish a space operations personnel functional area to better manage its pool of space R&D and operations personnel, rather than relying only an a skill identifier.[140] These personnel would fill appropriate positions in all joint and Army space organizations.

(11) The Army must foster an effective technology base effort for space, with research on national, theater, and operational space systems consolidated under an Army Space Technology Center, part of the Army's space major command. The Army Space Exploitation Demonstration Program, developed to show field commanders at all levels the utility of joint and Army space forces, would focus on Advanced Technology Transition Demonstrations which would allow for the early fielding of approved systems. Army technology programs should center on areas of demonstrated Army expertise or Army-unique requirements, such as ground-based interceptors and launchers, hypervelocity gun launchers and projectiles, directed-energy weapons, information processing, communications, and survivability. Particular attention should be paid to reducing the cost of all space systems and components.

(12) Ultimately, the Army must be an active and fully contributing member of the joint space team. As potential partners in most land force operations, the Army should develop special relationships with the Marine Corps, including a strong one in the area of space.

This summary of Army roles and initiatives which could support joint space campaigning stands the qualitative tests of applicability, feasibility, and affordability. These roles are applicable because the Army is currently charged to develop appropriate space forces, has a longstanding commitment to strategic defense, and now recognizes that space support is critical to successful land operations. They are feasible on the basis of technological opportunity and the foundation of current Army space organizations and expertise now available to build upon. At a time when Defense and Army budgets and manpower are shrinking, the greatest concern is affordability. Nonetheless, Army space capabilities are now necessary components of land forces. Cost, benefit, and risk analyses will ultimately determine the appropriate balance in investment.

VII. CONCLUSIONS

This paper explored the issue of the joint space campaign and the Army's role in it as this concept evolves over the next 20 years. Discussion progressed logically through a series of topics which supported the development of such a campaign concept, as well as the Army's place in it. The growing capability and criticality of space support to US military forces, particularly in expeditionary operations, was highlighted. I reviewed Army roles, missions, and historical involvement in space and then presented technological opportunities and a perspective on investment strategies for military space. A detailed discussion of a near-term military space theory and current doctrine underscored the need for a generally accepted military space theory as the source for compatible joint and Service space doctrines. The foundation was laid for such a theory based on the unique aspects of the space medium and using Corbett's maritime warfare theory as a point of departure. Development of a military space theory should be of the highest priority within the space community.

The basis for joint space campaigns grew from the discussion of a military space theory and the development of a time-phased scenario for military space forces. The object of space campaigns would be space command, which consists of the normally concurrent tasks of securing and exercising space command. For the foreseeable future, US space campaigns would either be strategic defense or expeditionary theater supporting campaigns. Aspects of theater design, command and control, and campaign design based on the Army concept of echeloned operating systems were detailed. Future space campaign plans should be realigned to incorporate these fundamentals. The Army itself would have a major role in and directly benefit from the successful conduct of these campaigns. It must accelerate a broad investment strategy to organize, equip, man, and field necessary Army space forces which support appropriate operating systems at all levels of war. My recommended approach to an evolving joint space campaign concept and the Army's role in it passed a first-order analysis using the qualitative criteria of acceptability, feasibility, and affordability.

The Army's goal should be to serve as a full and active partner in the joint military space community. This requires commitment to a clearly articulated long-range vision endorsed by the Army's highest leadership.

Appendix 1: Space-Related Functions of the Armed Services

The functions of the Armed Services are established in Joint Chiefs of Staff Publication (JCS Pub) 0-2, Unified Action Armed Forces (UNAAF). Under the provisions of the Goldwater-Nichols DoD Reorganization Act of 1986, the Chairman of the Joint Chiefs of Staff must conduct a triennual review of Service missions and functions. During the review conducted in 1989, the most hotly contested area was space. The US Army and Navy fought to retain their full complement of space-related functions, and they were successful. These functions, extracted from the current JCS Pub 0-2, are listed by Service below.[141] Entries common to more than one Service are marked by an asterisk. (Note that another triennual review is scheduled for 1992.)

Functions of the Department of the Army

Composition and Broad Statement of Responsibility and Composition: No direct space-related entry.

Primary Functions of the Army:

* To organize, train, equip, and provide forces for appropriate air and missile defense and space control operations, including the provision of forces as required for the strategic defense of the United States, in accordance with joint doctrines.
[Comment: No such joint doctrines existed until recently.]

* To organize, equip, and provide Army forces, in coordination with other Military Services, for joint amphibious, airborne, and space operations and provide for the training of such forces, in accordance with joint doctrines.

Collateral Function of the Army: No direct space-related entry.

Army Responsibilities in Support of Space Operations: With respect to space operations, the Army has specific responsibility for the following:

* a. Organizing, training, equipping, and providing Army forces to support space operations.

* b. Developing in coordination with the other Military Services, tactics, techniques, and equipment employed by Army forces for use in space operations.

* c. Conducting individual and unit training of Army space operations forces.

* d. Participating with other Services in joint space operations, training, and exercises as mutually agreed to by the Services concerned or as directed by competent authority.

e. Providing forces of space support operations for the Department of Defense when directed.

Other Responsibilities of the Army: No direct space-related entry.

Appendix 1: Space-Related Functions of the Armed Services

Functions of the Department of the Navy

Composition and Broad Statement of Responsibility: No direct space-related entry.

Primary Functions of the Navy and/or Marine Corps:

To organize, train, equip, and provide Navy and Marine Corps forces [for ...], and to conduct such air, land, and space operations as may be essential to the prosecution of a naval campaign.

(*) To organize and equip, in coordination with the other Military Services, and to provide naval forces, including naval close air support and space forces, for the conduct of joint amphibious operations, and to be responsible for the amphibious training of all forces assigned to joint amphibious operations in accordance with joint doctrines.

To organize, train, equip, and provide forces for reconnaissance, antisubmarine warfare, protection of shipping, aerial refueling and minelaying, including the air and space aspects thereof, and controlled minefield operations.

* To organize, train, equip, and provide forces for appropriate air and missile defense and space control operations, including the provision of forces as required for the strategic defense of the United States, in accordance with joint doctrines.

To provide sea-based launch and space support for the Department of Defense when directed.

Collateral Functions of the Navy and Marine Corps: The Navy and Marine Corps to train forces for the following:

To be prepared to participate in the overall air and space effort, as directed.

Navy and Marine Corps Responsibilities in Support of Space Operations: With respect to space operations, the Navy and Marine Corps has specific responsibility for the following:

* a. Organizing, training, equipping, and providing Navy and Marine Corps forces to support space operations.

* b. Developing in coordination with the other Military Services, tactics, techniques, and equipment employed by Navy and Marine Corps forces for use in space operations.

* c. Conducting individual and unit training of Navy and Marine Corps space operations forces.

* d. Participating with other Services in joint space operations, training, and exercises as mutually agreed to by the Services concerned or as directed by competent authority.

Other Responsibilities of the Navy and Marine Corps: No direct space-related entry.

Functions of the Department of the Air Force

Composition and Broad Statement of Responsibility: No direct space-related entry.
[Comments: There are no entries which suggest that the Air Force is the preeminent Service in the space arena. Note that the term "aerospace" is not used in this publication.]

Primary Functions of the Air Force:

To organize, train, equip, and provide forces for the conduct of prompt and sustained combat operations in the air -- specifically, forces to defend the United States against air attack in accordance with doctrines established by the Joint Chiefs of Staff, gain and maintain general air superiority, defeat enemy air forces, conduct space operations, control vital air areas, and establish local air superiority except ad otherwise assigned herein.

* To organize, train, equip, and provide forces for appropriate air and missile defense and space control operations, including the provision of forces as required for the strategic defense of the United States, in accordance with joint doctrines.

To organize, train, equip, and provide forces for strategic air and missile warfare.

* To organize, equip, and provide forces for joint amphibious, space, and airborne operations, in coordination with the other Military Services, and to provide for their training in accordance with joint doctrines.

To develop, in coordination with the other Services, doctrines, procedures, and equipment for air defense from land areas, including the United States.

To provide launch and space support for the Department of Defense, except as otherwise assigned.

To develop, in coordination with the other Services, doctrines, procedures, and equipment employed by Air Force forces in the conduct of space operations.

Collateral Functions of the Air Force: No direct space-related entry.

Appendix 1: Space-Related Functions of the Armed Services

Air Force Responsibilities in Support of Space Operations: With respect to space operations, the Navy and Marine Corps has specific responsibility for the following:

* a. Organizing, training, equipping, and providing Air Force forces to support space operations.

* b. Developing in coordination with the other Military Services, tactics, techniques, and equipment employed by Air Force forces for use in space operations.

* c. Conducting individual and unit training of Air Force space operations forces.

* d. Participating with other Services in joint space operations, training, and exercises as mutually agreed to by the Services concerned or as directed by competent authority.

Other Responsibilities of the Air Force: No direct space-related entry.

Appendix 2: The Army's Historical Involvement in Space

The US Army played a leading role in this nation's entry into space and the early US militarization of space.[142] The Army's lead in the development of long-range ballistic missiles, space launch vehicles, and space exploration ended with the realignment of missions with the Air Force (limiting the range of Army ballistic missiles to tactical battlefield distances) and the transfer of space assets to the fledging National Aeronautics and Space Administration (NASA) by 1960.[143]

During the 1950s and early 1960s, US military forces had a primarily strategic focus based on nuclear weapons. At a time when Army land power -- even reshaped to embrace the nuclear battlefield -- took a back seat to Air Force and Navy strategic forces, the Army aggressively retained strategic missions oriented on its traditional function of homeland defense. As early as 1946, the Army established an Air Defense Command to perform continental US air defense, later deploying the first missile interceptors in 1954.[144]

As Soviet strategic offensive capabilities expanded, the Army sought to add to its tasks under homeland defense. In 1955, the Army initiated a study which included a look at anti-intercontinental ballistic missile requirements.[145] Since then, the Army gained and maintained preeminence among the Services in ballistic missile defense (BMD) research and development (R&D). Even with the Vietnam War, the Army developed and then fielded the SAFEGUARD anti-ballistic missile system (up to now the free world's only operational BMD system) in 1975. This system was inactivated soon after in 1976 due to its support costs and questions of its utility, already limited by the 1972 Anti-Ballistic Missile (ABM) Treaty, against a growing Soviet arsenal.[146]

To ensure positive space control through the use of an anti-satellite (ASAT) weapon, the Army proposed in 1957 that it develop such a weapon.[147] After successful demonstrations, the Army deployed the first operational US ASAT system in 1963 on Kwajalein Atoll under the aegis of Project 505/ MUDFLAP. The Air Force fielded its own system soon after, but both were eventually deactivated due to limited capability and political concerns.[148]

The Army also pioneered early communications and weather satellites in the late 1950s and early 1960s. The Army was ultimately given the lead in

fielding satellite communications ground terminals for the Ground Mobile Forces of all Services.[140]

As the Army's preoccupation with the Vietnam War grew in the 1960s demanded a greater share of its resources, the Service reduced its involvement in the military space arena. While maintaining its role in satellite communications ground terminals and in ballistic missile defenses, the Army's space structure quickly dwindled and fragmented. It would take many years for the Army to recover from this setback as it relied on the other Services to fulfill space-related battlefield requirements. However, US space systems remained strategic in nature, and most Army needs, even when articulated, were not met. Recognizing this, the Army undertook an effort in 1973 which eventually evolved into the Tactical Exploitation of National Capabilities Program (TENCAP); early on, attention was paid to the needs of contingency forces. The success of this program prompted Congress in 1977 to mandate similar programs by all the Services, and the Air Force and Navy began TENCAPs of their own.[190]

By the mid-1970s, Army BMD research began to search for non-nuclear solutions to anti-missile interceptions. Because technologies up to that time could not attain small enough miss distances to use interceptors with conventional warheads, strategic air defense, BMD, and ASAT missiles were all nuclear-tipped. Soon after President Reagan announced the Strategic Initiative (SDI) Program in March 1983, the Army garnered the first non-nuclear BMD intercept success.[191] Many of the Army's BMD R&D efforts were subsumed under this program while retaining Army management. When the Department of Defense (DoD) created the Strategic Defense Initiative Organization (SDIO) in 1985 to manage the SDI Program, the Army rechartered its BMD research organization as the US Army Strategic Defense Command (USASDC) and ensured that its commander held a grade equal to that of the SDIO Director and reported directly to the Chief of Staff of the Army. The Army was on its way, not altogether consciously, to revitalizing its role in space-related fields.

During this time, two parallel decisions made the Army the focus for battlefield missile defenses. The Department of Defense named the Army lead

Service in developing tactical missile defenses to protect deployed forces, while SDIO designated the US Strategic Defense Command the lead in managing SDI-funded theater missile defense research to develop means to protect deployed US forces and the homelands of Allies.[182] When Congress formally established the Theater Missile Defense Initiative in 1990 after Iraq's invasion of Kuwait, SDIO received the overall program lead, and the Army consolidated its theater and tactical missile defense efforts under USASDC. Early fielding of improved systems is a priority.[183]

Another outcome of the Cold War's end and the 1991 Gulf War was a presidential and congressional redirection of the SDI Program to develop an evolutionary BMD capability, dubbed Global Protection Against Limited Strikes (GPALS). As embodied in the Missile Defense Act of 1991, a limited ground-based continental defense system would be fielded first by Fiscal Year 1996.[184] This means that the Army must once again move from R&D to deployment of strategic forces. A fully capable GPALS architecture would weld together tactical, theater, national, and ultimately global defense systems, requiring extensive integration of all elements, including those deployed to any theater. This underlines the challenge to the Army of integrating battlefield defenses with an evolving strategic global system.

In late 1989, the Army committed itself to another strategic system when it successfully lobbied for the lead of a joint effort to develop a national kinetic-energy anti-satellite (KE ASAT) system. Despite its political baggage, an ASAT capability as the foundation for credible space control has been the goal of every Administration since President Carter's; it also received public support from several of the regional commanders-in-chief (CINCs) in its latest reincarnation. A ground-based weapons system concept was approved, with the Army expected to field the interceptor component. Since the end of the Cold War, the Army has vacillated in its support of the program, with funding dropping in each succeeding fiscal year budget.[185]

As the Army began to emerge once again as a player on the strategic space scene, the Vice Chief of Staff of the Army decided by 1985 that the Army must also aim to improve its use of space in support of its battlefield operations. He chartered the Army Space Initiatives Study, the first in a

series of efforts to set a new Army direction in space and to revitalize the Army's space organization.[186]

To establish direction, the Army published an Army Space Policy, developed an Army Space Master Plan which encompassed an Army Space Architecture and Strategy, produced an Operational Concept for Space Operations, and initiated a doctrinal publication on space operations, Field Manual 100-18 (still in draft). To improve the organizational base, a number of organizations were created or realigned. Two embryonic bodies formed in 1986 later evolved into the Army's operational space component command, the US Army Space Command (USARSPACE), under the US Space Command, and Training and Doctrine Command's space programs integration office, the Army Space Institute (ASI).[187]

To support the streamlined major systems development and acquisition process specified in the 1986 Goldwater-Nichols DoD Reorganization Act, the Army chartered a Program Executive Officer for Strategic Defense, which is currently invested in USASDC. To improve the management of non-strategic space technology base development, the Army Space Technology and Research Office (ASTRO) was created under the Army Materiel Command (AMC), while AMC's Communications-Electronics Command established a Center for Space Systems to better administer the development of satellite communications and related technologies. Other AMC commodity commands and laboratories and many Corps of Engineers elements are also actively involved in space-related R&D which touches on their particular functional areas. In addition, the Army Space Demonstration Program was formally initiated in 1987 to raise the awareness of field commanders to the benefits of space support to ground forces.[188]

In order to develop a foundation for Army space expertise, the Army has established a separate skill identifier for space operations, but attempts to expand this skill to a personnel functional area have failed so far. The Army has also provided Space Shuttle astronauts to NASA since the first selections were begun in 1977. The Army continues to be an active participant in the DoD Military Man in Space (MMIS) program to determine the utility of military astronauts to directly support battlefield operations.[189]

Appendix 3: Army Space Policy, Concept, and Architecture

(This document is not dated. The emphasis is mine.)

Army Space Policy[100]

Since the Sixties, space has become increasingly important to our national interests, joining the traditional land, sea, and air dimensions of National Defense. Space is host to advanced systems critical to this nation's security. Space systems already make essential contributions to AirLand combat operations and can play an even greater role in Army missions. Future Army operational doctrine must capitalize on emerging space capabilities.

Consistent with National and Department of Defense policies and in cooperation with other Services and agencies, the Department of the Army will exploit space activities that contribute to the successful execution of Army missions. The Army supports assured access to space and will use space capabilities to enhance the accomplishment of strategic, operational, and tactical missions.

Successful implementation of this policy will require development of a pool of Army space expertise and judicious planning, to include development of concepts, requirements and a long-term management strategy. Army plans and evolving space architecture must capitalize on national and joint programs, preserving options to support initiatives that fulfill Army requirements. Implementation of this policy demands a visionary outlook to exploit fully evolving space capabilities.

/signed/
JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

/signed/
John O. Marsh, Jr.
Secretary of the Army

Summary of the Army Space Concept[101]

The Army's Space Concept is to enhance the Army's ability to execute AirLand Battle, in joint and combined efforts, for all levels of war, across the full spectrum of conflict, by using space system capabilities:

-- leverage what is available now;

-- capitalize on developing programs;

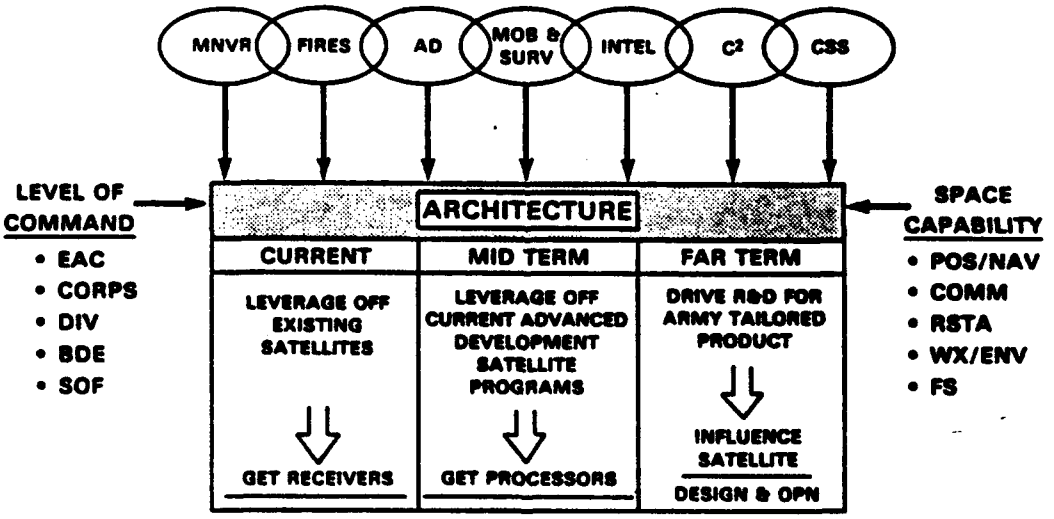
-- initiate Army-tailored capability.

Appendix 3: Army Space Policy, Concept, and Architecture

The Army Space Architecture currently provides the broad guidance for an Army investment strategy for space. It articulates a phased approach to improving space support to Army forces and classifies such support under the headings of five combat multiplying "space capabilities." These are position/navigation (POS/NAV); communications (COMM); reconnaissance, surveillance, and target acquisition (RSTA); weather and environmental monitoring (WX/ENV); and fire support (FS). Missile early warning is a subset of RSTA but is often treated as a separate area due to its unique aspects. Note that this strategy has a tactical and limited operational-level focus, as seen by the unit echelons and battlefield operating systems addressed. The source of the Architecture is the Army Space Concept, which may be revised to satisfy the needs of the AirLand Operations concept.

This broad-based approach is now being updated by means of an Army Space Architecture which recognizes that Army leverage of different space systems has progressed more rapidly for some systems than for others. This Architecture retains the earlier investment philosophy but applies it on a system-by-system basis. It will be made part of the Army Long Range Plan for Space.

Summary of the Army Space Architecture[102]



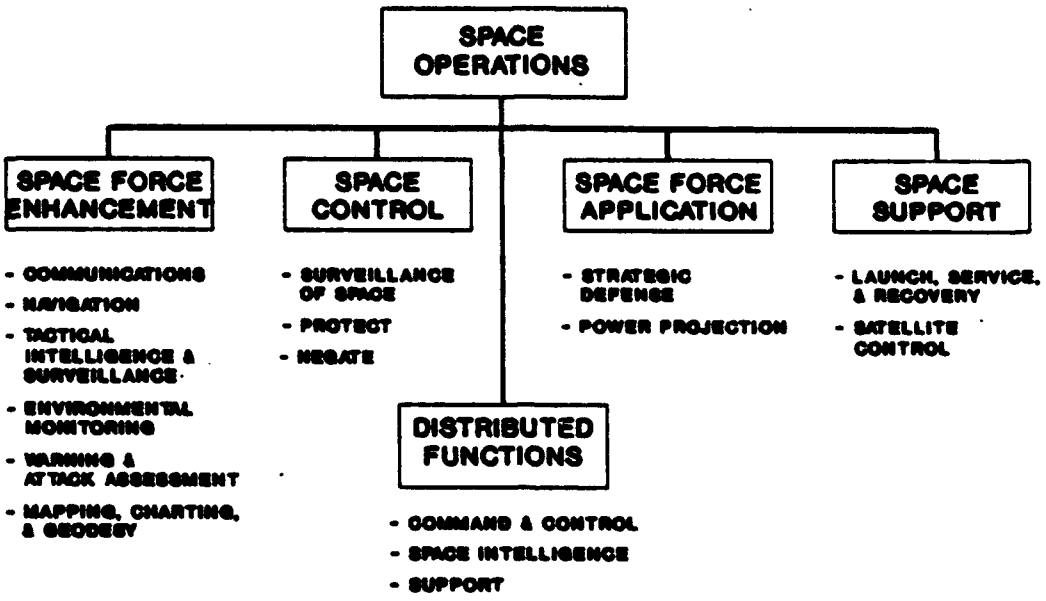
Appendix 4: Space Force Functions and Military Space Operations

The four standard space force functions of space control, force application, force enhancement, and space support are the foundation for current doctrine, USCINCSPACE campaign plans, and component command supporting plans. More specific capabilities are included under each function (see the figure on the next page). The very recent addition of the four military space operations (counterspace operations, space fire support, space combat support, and space operations mission support) is an attempt to describe the application of space force functions in support of terrestrial forces using more traditional war-fighting terms. However, this new terminology, introduced in the Final Draft of Joint Pub 3-14, has its drawbacks. Tied so closely to support of terrestrial forces, the meaning of these terms must be adjusted to fit independent space operations.

Almost none of the space doctrinal terms are found in the current JCS Pub 1-02, but will be included in future editions with definitions taken from joint space doctrinal publications as they are approved. Unfortunately, these publications are not consistent in their development of space doctrinal terms. For example, definitions introduced in the Initial Draft of Joint Pub 3-14 often differ greatly from those in the Final Draft. These definitions are reproduced below for easy comparison. The figures at the end of the appendix show the relationship of space force functions, space capabilities, and military space operations.

A comparison with the Army's standard "space capabilities" (depicted in the Army Space Architecture at Appendix 2) clearly shows the Army's emphasis on force enhancement at the tactical level and the lack of a cohesive architecture which addresses missions and operating systems at all levels of war.

Appendix 4: Space Force Functions and Military Space Operations



Joint Pub 3-14 (Initial Draft) Definitions:[165]

-- Space Force Functions.

Space control: Military mission that provides freedom of action in space for friendly forces while, when directed, denying it to an enemy. Includes the broad aspects of protection for US and allied space systems and negation of enemy space systems.

Space force application: Military mission conducted using space and space-related weapons with the objective of defending US and allied interests or projecting power into areas controlled or threatened by enemy forces.

Space force enhancement: Military support mission conducted with space and space-related systems to enhance the effectiveness of terrestrial and space-based forces. Operations are normally conducted in support of other forces to achieve mission objectives, to accomplish specialized tasks, and to provide direct operational support to terrestrial combat and space-based forces. Space force enhancement includes such capabilities as communications, navigation, environmental monitoring, and surveillance.

Space support: Military support mission to ensure that space control, space force application, and space force enhancement missions can be accomplished. Includes such activities as launching and deploying satellites, maintaining

and sustaining spacecraft while on orbit, recovering spacecraft if required, and exercising the command and control required to effectively employ space systems in support of terrestrial or space combat operations.

-- Other Related Definitions.

Space defense: All defensive measures designed to destroy attacking enemy vehicles (including missiles) while in space, or to nullify or reduce the effectiveness of such attack.
[Currently one of the few space-related definitions included in JCS Pub 1-02, and now somewhat out-of-date. Once Joint Pub 3-14 is approved, all other definitions in this appendix will be included in the next revision of JCS Pub 1-02.]

Space forces: Ground-based or space-based military systems and personnel used to defeat or control the actions of adversaries and to support terrestrial forces.

Space operations: Comprehensive term pertaining to the employment of space forces in accomplishing broad or specific objectives that support the military space missions of space control, space force application, space force enhancement, and space support.

Space system: A ground-based or space-based system designed to operate or support operations in the medium of space. Space systems include: launch, ground control, satellite, user processing and/or exploitation, and communications. The satellite segment comprises a constellation of satellites, each of which includes one or more mission payload(s). (This definition includes ground-based systems which support space operations, such as space surveillance systems designed to detect, track, and catalog objects in Earth orbit as well as ground-based directed energy or kinetic energy systems designed to negate satellites.)

Terrestrial forces: A collective term that encompasses land, naval, and air forces, exclusive of space-related forces and capabilities.

Joint Pub 3-14 (Final Draft):

-- "Terminology."[104]

Space system: A system designed for extended operation in the space environment. It includes on-orbit hardware (i.e., satellite, sensor, constellation, or vehicle); its means to communicate with a telemetry, tracking, and commanding (TT&C) network; the mission control segment; and its means to deliver/transmit its derived mission information or perform its assigned mission to supported forces. It also includes ground-based sensors which conduct missile warning/space surveillance (i.e., Ballistic Early Warning System [BMEWS], PAVE PAWS, etc.).

Appendix 4: Space Force Functions and Military Space Operations

[The first part of this definition closely matches Lupton's definition of a space system, but the second part does not. Note how narrow and somewhat arbitrary this definition is compared to the one from the Initial Draft.]

Space forces: Manned and unmanned space systems including the personnel and organizations dedicated to providing and maintaining military space capabilities. This includes those forces assigned to the Combatant Command (COCOM) of Commander in Chief United States Space Command (USCINCSPACE) by JCS in "Forces for Unified and Specified Commands."
[With the narrow definition of "space system," this definition is also narrowed in scope.]

Space force functions: Functional activities of military space forces that aid in the formulation of military space policies and space force roles and missions, and which drive the development of military space capabilities. USCINCSPACE tasks military space forces to develop and provide capabilities in four functional areas based on combatant commanders' requirements. The four functional areas are Force Enhancement, Force Application, Space Control, and Space Support.

Military space operations: The employment of space capabilities by land, sea, air, space, and special operations forces to gain and maintain a combat advantage throughout the operational continuum and across the three levels of war: strategic, operational, and tactical. Military space operations include space combat support; space fire support; counterspace operations; and space operations mission support.

-- Definitions.[166]

Counterspace operations: Offensive and defensive operations by friendly space and terrestrial forces directed against an enemy's space forces to gain and maintain a desired degree of space superiority.

Force application: Combat against enemy land, sea, air, and missile forces.

Force enhancement: The support for land, sea, and air forces.

Military space operations: Comprised of Space Combat Support, Space Fire Support, Counterspace Operations, and Space Operations Mission Support.

Space combat support: Comprised of the products and services available from space forces to support the combatant commander's employment of forces.

Space control: Combat against enemy forces in space and their infrastructure.

Space fire support: Space-to-space and space-to-ground fire in direct support of joint forces.

Space force functions: Comprised of Force Enhancement, Force Application, Space Control, and Space Support.

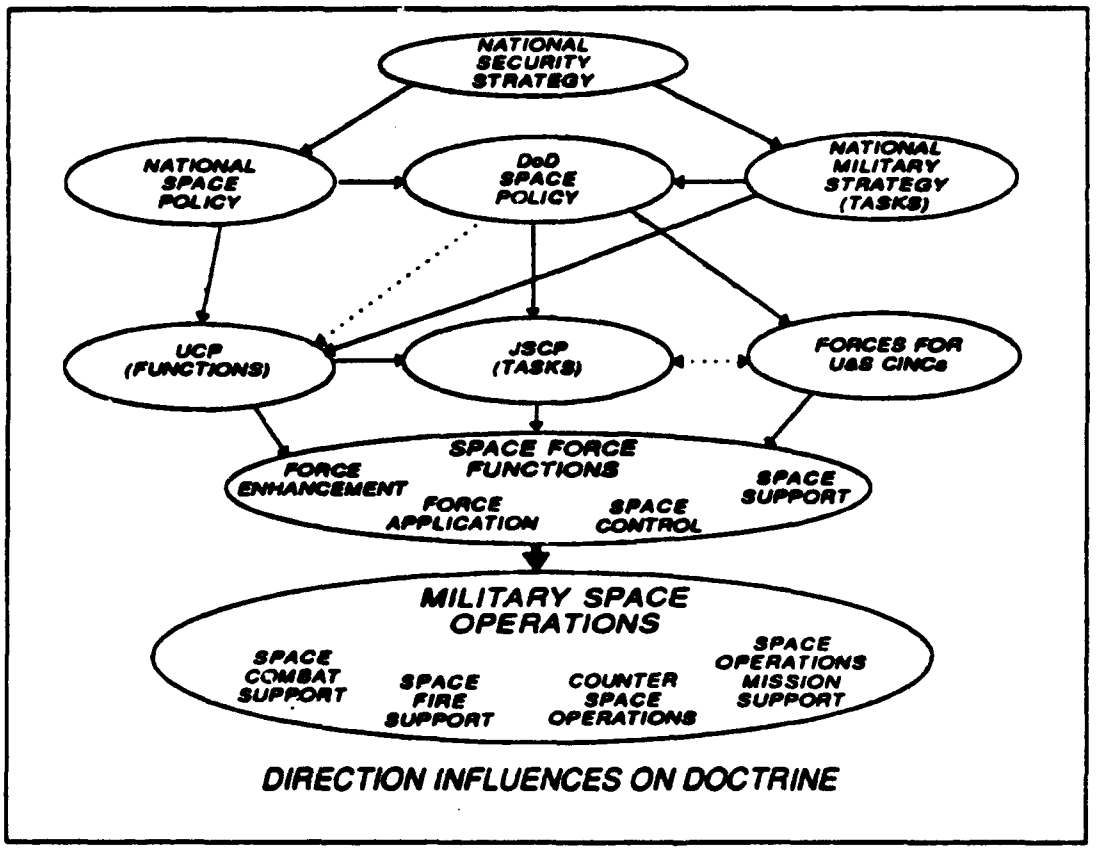
Appendix 4: Space Force Functions and Military Space Operations

Space operations mission support: The products and services of the space operations infrastructure.

Space support: Support for space forces including launch.

Relationship between Space Force Functions and Military Space Operations:

The figures below illustrate the relationship between space force functions, space capabilities, and military space operations.[166] Note the apparent redundancy of the space force functions and military space operations in the context of terrestrial support activities.



Appendix 4: Space Force Functions and Military Space Operations

Space Functions, Capabilities, and Operations		
SPACE FORCE FUNCTIONS OF:	PROVIDE SPACE FORCE CAPABILITIES* LIKE:	TO CONDUCT MILITARY SPACE OPERATIONS OF:
Force Enhancement	Communications; Navigation and Positioning; Intelligence and Surveillance; Environmental Monitoring; Mapping, Charting, and Geodesy; and Warning Processing and Dissemination	Space Combat Support
Force Application	Ballistic Missile Defense; Aerospace Defense; and Power Projection	Space Fire Support
Space Control	Protection; Negation; and Surveillance of Space	Counterspace Operations
Space Support	Launch; Satellite Control; and Logistics	Space Operations Mission Support
* These capabilities, derived from the space force functions, are mixed and matched to support military space operations.		

Appendix 5: Other Service Space Doctrines

Air Force Space Doctrine. Basic Air Force doctrine, recently updated in Air Force Manual (AFM) 1-1, remains wedded to the aerospace concept, which contends that "the aerospace environment can be most fully exploited when considered as an indivisible whole."[167] The newly published edition of AFM 1-1, Basic Aerospace Doctrine of the United States Air Force, includes several significant refinements over the 1984 edition. It replaces the earlier nine Air Force missions and seven specialized tasks with four basic aerospace force roles: aerospace control (control the combat environment), force application (apply combat power), force enhancement (multiply combat effectiveness), and force support (sustain forces), with "typical missions" identified under each.[168] Despite the apparent similarity with the standard space force functions described in joint doctrine, there are disconnects between the two sets. The manual also replaces previous Air Force principles of war with those adopted in joint doctrine, and it now includes a set of aerospace power tenets.

Air Force doctrine is built on a hierarchal framework made up of three levels: fundamental, environmental, and organizational doctrine.[169] Thus Air Force space doctrine, presently being updated as environmental doctrine in a new manual (AFM 2-25), must remain faithful to the fundamental aerospace doctrine described in AFM 1-1.[170] To ensure compatibility with joint space doctrine, AFM 2-25 is currently on hold, awaiting the refinement of Joint Pub 3-14.

Navy Space Doctrine. Navy doctrine is developed based on a hierarchal set of warfare mission areas (such as strike, anti-air, and anti-submarine warfare), warfare functions, and functional support systems, all integrated under a single combined warfare commander (CWC). Doctrinally, the Navy established Space and Electronic Warfare (SEW) as a warfare area in 1989. SEW is the "destruction or neutralization of enemy targets and the enhancement of friendly force battlement management through the integrated employment and exploitation of the electromagnetic spectrum and the medium of space."[171] With the SEW concept, the Navy has added three unique doctrinal outlooks involving space: (1) the Navy clearly recognizes the evolution of warfare based on information management wedded to the space medium; (2) naval warfare

has expanded to the five dimensions of sub-surface, surface, air, space, and spectra (like the Soviets, then, the Navy sees the electromagnetic spectrum as a warfighting medium); and (3) the tactical battle space for a naval formation now encompasses a much larger continuum in time and space.[172]

To properly conduct SEW, Navy doctrine is being developed which would place the Space and Electronic Warfare Commander (SEWC) directly under the CWC and coequal to the other mission area commanders. The SEWC's responsibilities would include force sensor, electronic combat, battle space, and information management. Thus, command and control as a warfare function would be a SEWC responsibility, with a fully integrated command, control, communications, computers, and intelligence system in support.[173]

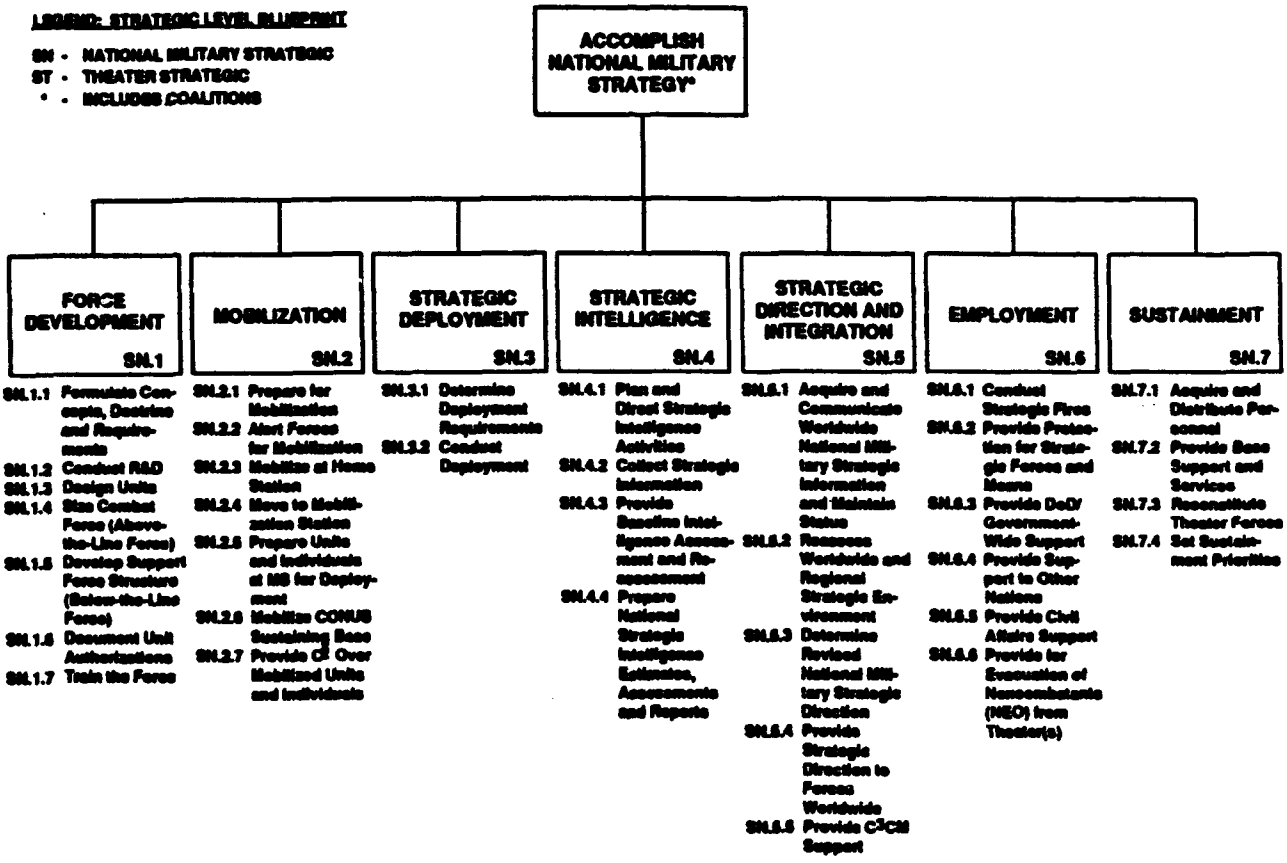
This force enhancement approach to space by the Navy is a result of requirements to support its missions of global forward deployment, presence, and power projection. The lack of a broader doctrinal perspective on space to include all four space operations functions is surprising, since the Navy pursued the KE ASAT program lead only two years ago and is continuing its efforts on the SKALAR launch vehicle.

Marine Corps Space Doctrine. The Marine Corps may have the most progressive approach to space doctrine among the Services and the joint community, although it remains focused on combat support to their expeditionary forces. Besides developing Fleet Marine Force Manual (FMFM) 3-7 as a guide to Marine Air-Ground Task Force (MAGTF) space operations, the Marine Corps is devising a long-term vision of space operations integrated into future MAGTF operations (specifically, over-the-horizon amphibious operations in the year 2010). The Marine Corps is particularly interested in long-range fire support from conventional space force application systems, reflecting the Corps' focus on power projection, self-contained expeditionary forces, and over-the-horizon capabilities.[174] The most significant contribution to joint space doctrine by the Marine Corps may be the adoption of their space warfighting terminology. The Marine Corps acknowledged the four traditional space force functions, but decided that warfighting commanders would mix and match capabilities under these functions in order to conduct "military space operations," which include counterspace operations, space-based fire support,

space-based combat support, and space operations mission support.[178] This attempt to couch space operations in the more easily understood terms of land force operations has now been accepted by the joint community. While this terminology has great utility when describing space operations in direct support of terrestrial forces, they may be less useful in classifying independent and strategic space operations.[179]

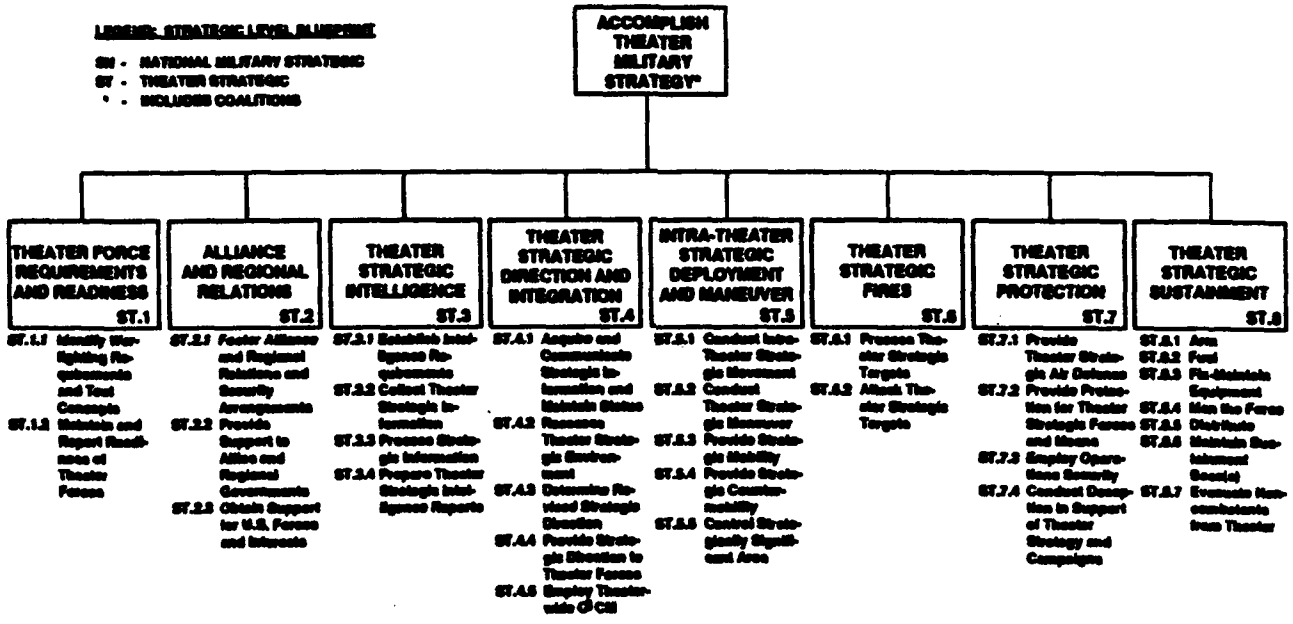
Appendix 6: "Blueprint of the Battlefield" Operating System[177]

BLUEPRINT FOR THE STRATEGIC LEVEL OF WAR
PART 1: NATIONAL MILITARY



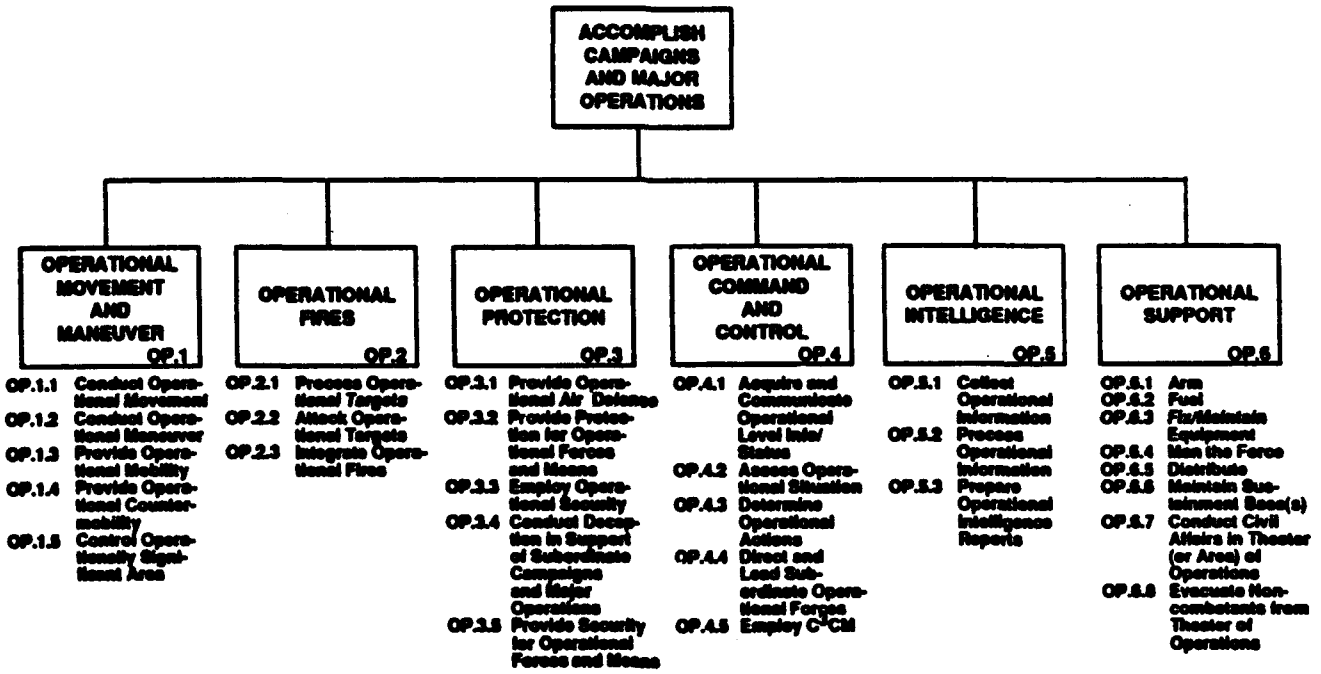
Appendix 6: "Blueprint of the Battlefield" Operating Systems

BLUEPRINT FOR THE STRATEGIC LEVEL OF WAR
PART 2: THEATER



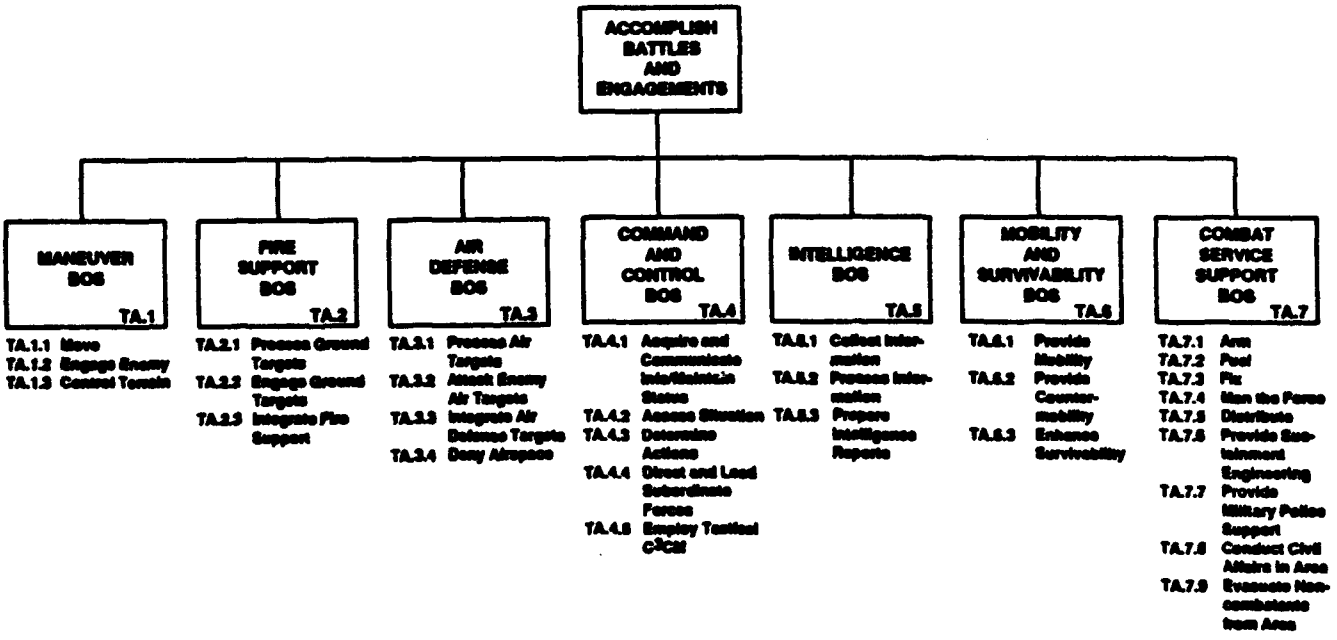
Appendix 6: "Blueprint of the Battlefield" Operating Systems

Blueprint for the Operational Level of War - Summary



Appendix 6: "Blueprint of the Battlefield" Operating Systems

Blueprint for the Tactical Level of War - Summary



Appendix 7: An Evolving Space Campaign Concept

Type Campaign	Strategic Defense[1]	Expeditionary Theater Supporting
Theater Design (Focus)	Theater of War (Weapons of Mass Destruction)	Theater of Operations (Conventional)
Theater C2/Commander	USCINCSPACE as a Regional CINC[2]	Terrestrial Regional CINC; USCINCSPACE a Supporting CINC May Have an In-Theater JSSC, Too
<u>Phase I</u>:		
Timeframe (For Planning, Now-1996)	Now until Initial GPALS Fielded	Now until US ASAT and TMD Fielded
Condition of Command	In Dispute	In Dispute
US Space Functions	SS/Strat Off FA	SS/SC/Theater Def FA/FE
Enemy Space Functions	SS/Strat Off FA	SS/FE
<u>Phase II</u>:		
Timeframe (For Planning, 1997-2015)	Until Enemy Fields Capable Strat Def	Until Enemy Fields ASAT and TMD
Condition of Command	US Secures Command	US Secures Command
US Space Functions	SS/SC/Strat Def FA/ Strat Off FA	SS/SC/Off FA/Def FA/FE
Enemy Space Functions	SS/Strat Off FA	SS/FE
<u>Phase III</u>:		
Timeframe (For Planning, 2016 +)	Until US Gains Greater Strat Capability	Until US Gains Greater Theater Capability
Condition of Command	In Dispute	In Dispute
US Space Functions	SS/SC/Strat Def FA/ Strat Off FA	SS/SC/Off FA/Def FA/FE
Enemy Space Functions	SS/SC/Strat Def FA/ Strat Off FA	SS/SC/Def FA/FE

Appendix 7: An Evolving Space Campaign Concept

Notes: (1) Later, the strategic defense campaign could be fully unified with strategic offensive operations, resulting in an integrated strategic campaign.

(2) With the development of an integrated strategic campaign, the theater of war CINC might be CINC, US Strategic Command, rather than USCINCSPACE.

Legend:
SS - space support
SC - space control
FA - force application
Strat Def FA - ballistic missile defenses (BMD)
Strat Off FA - intercontinental and sea-launched ballistic missiles (ICBM/SLBM)
Theater Def FA - theater missile defenses (TMD)
Theater Off FA - theater ballistic missiles (TBM) and kinetic-energy reentry penetrators
FE - force enhancement
GPALS - Global Protection Against Limited Strikes BMD system
ASAT - Anti-satellite weapon

Appendix 8: Space Theater Design

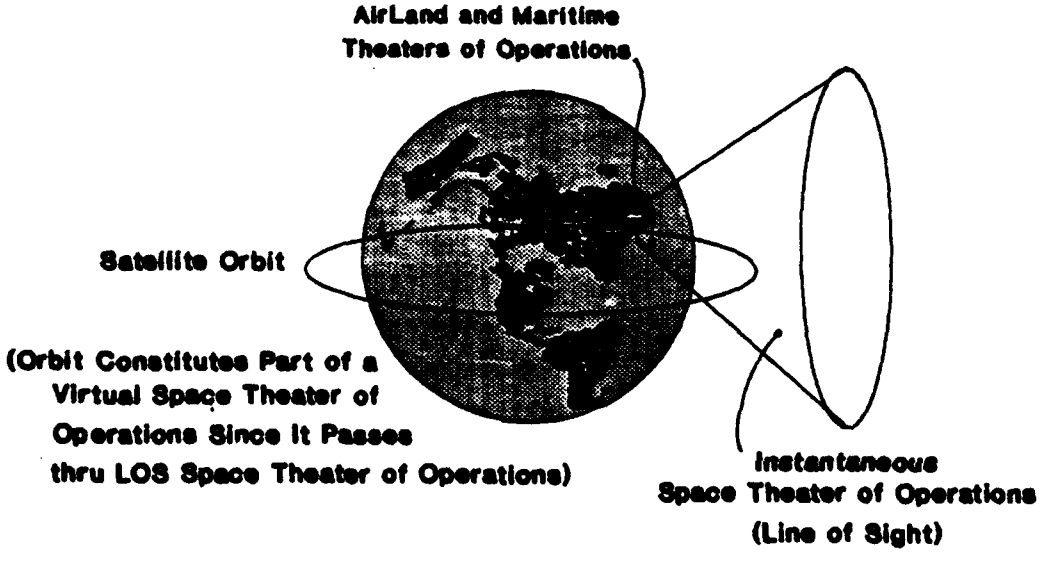
Both space theaters of war and theaters of operations tend to be global in extent and vast in depth; the difference between these two types of theaters is usually a matter of function and level of operations, rather than size. Thus, both tend to include most of what should be USCINCSPACE's area of responsibility.

Note that USCINCSPACE is <u>not</u> one of the five combatant commanders with geographical area responsibilities; instead, the Unified Command Plan (UCP) only assigns him worldwide functional responsibilities in space. With space as a distinct operating medium and USCINCSPACE assigned US space forces, the UCP should be revised to reflect USCINCSPACE as a combatant commander with a geographical area of responsibility.[176] He may be unique among CINCs in that he would balance both regional and functional responsibilities, with the mix determined by the type of campaign he conducts. (There are some parallels with CINC, US Special Operations Command, who is assigned functional responsibilities, but who also provides forces which may operate under a joint force special operations component commander (JFSOCC) or equivalent and which may occupy a separate joint special operations area in the theater of war.)

A space theater may be broken down into two parts (see the figure on the next page). The first is that section of space which is immediately in line of sight of terrestrial theaters or battlefields. The second is that part of space where spacecraft or suborbital systems will travel to reach this first part. These two divisions of the theater are less distinguishable over a period of time, since electromagnetic SpLOCs are traveled at the speed of light between nodes, while physical SpLOCs are routes traversed in minutes or hours. Thus, the second part of the space theater can often have a direct impact on any given engagement or battle in the theater of war.

Appendix 8: Space Theater Design

SPACE THEATER OF OPERATIONS



Appendix 9: Considerations for Designing Space Campaigns

The following considerations for designing strategic defense or expeditionary theater supporting space campaigns consolidate or augment the concepts developed in Sections IV and V.

(1) Strategic Aim. A campaign is designed to achieve one or more national or theater strategic aims. For the space campaign, the minimum and most fundamental strategic aim is space command, embodied in the dual tasks of securing space command and exercising space command.

(2) Operational Objectives. The strategic and theater environment plays a key role in determining the operational objectives established to achieve the strategic aim(s), as well as the constraints and limitations affecting the campaign's ends, ways, and means. Operational objectives decide the extent of the effort to secure space command (general or local, permanent or temporary) and to exercise space command. An adversary's space capabilities may be so meager that securing space command is a de facto condition or only requires a single major operation. In other cases, a condition of dispute may exist for some time. The theater strategy will decide if enemy assets are neutralized by early preemptive strikes or through escalatory or selective attrition. In nearly all cases, the campaign will actively seek to improve the ability to exercise space command, both for independent and supporting space operations. Thus, space campaigns will normally be phased and will continue until the conclusion of the conflict.

(3) Ways and Means. Direct attacks against the enemy's space fleet, including terrestrially-based assets, would secure space command early but may be politically or legally limited, especially when interdicted forces are stationed in the enemy's homeland; the limited or unlimited nature of the conflict itself would determine the acceptability of such ways. Blockading of enemy space ports and SpLOCs would serve as an appropriate measure to secure space command if direct attacks were limited. Another issue is determining the mix of offensive and defensive measures necessary to support the campaign.

The space "battlefleet," employed to secure space control in what are usually independent operations conducted by the space regime, would normally remain under the direct control of USCINCSPACE or in some cases (such as in JTMD) his representative JSCC. The "cruisers and flotilla" used to exercise

space control would operate under USCINCSPACE/JSCC for national and theater-level activities, but might respond directly to terrestrial commanders when supporting operational and tactical activities.

(4) Space Battlefield Framework. There are a number of ways to describe the organization of the space battlefield framework in order to support the planning and employment of space forces. In this paper, geographical or functional tiers were introduced in Section V. In the case of the strategic defense campaign, the most commonly used tiers for the employment of weapons, sensors, and C3I are the boost, post-boost, midcourse, and terminal tiers, which are determined by the flight path of a ballistic missile. In addition, this strategic framework includes security of the atmospheric flank and the establishment of a reserve. This framework can also apply to strategic offensive operations.

The multi-tiered battlefield framework for the expeditionary theater supporting campaign was presented on pages 40 to 41. Note that these tiers correspond roughly to national strategic, theater strategic, operational/tactical, and reserve functions. They tend to be determined by the immediacy of responsive support required and by geographic limitations of the battlefield (for example, suborbital tactical operations).

(5) Campaign Phases. A space campaign would consist of successive or overlapping major operations, or phases, each of which would support at least one operational objective. These phases would be synchronized internally to the space campaign, as well as externally with the overall theater of war campaign (in the case of the expeditionary theater supporting effort) and with terrestrial theater of operations campaigns. These operational objectives, and thus the phases which support them, are focused in "layers" across the spectrum of national strategic, theater strategic, operational, and tactical levels. Activities conducted at the upper end of this spectrum are independent operations carried out by the space regime, sometimes with support from outside regimes. On the lower end of the spectrum, activities are conducted in support of other regimes and their campaigns or major operations. (An illustrative analogy is the conduct of interdiction and close air support; the former is a relatively independent activity by air forces, while the latter

is carried out in direct support of ground forces.) Thus, in the context of the theater of war campaign, space operational objectives would run the gamut from independent to general support to direct support.

One model for this layering of campaign phases is the Operation DESERT STORM air campaign. The operational objectives of this campaign were to isolate and incapacitate the Hussein regime, destroy Iraq's weapons of mass destruction, gain and maintain air superiority, eliminate Iraqi offensive military capability, and render the Iraqi army in the Kuwaiti theater of operations ineffective.[179] To accomplish these objectives, air forces carried out four successive but overlapping campaign phases: strategic, air superiority, battlefield preparation, and close air support of the ground campaign.[180] These ranged from independent strategic operations through coordinated operational-level activities to supporting tactical operations.

Space campaigns would use the basic force generation stages which other campaigns follow. In the backward planning sequence, these stages are force sustainment, employment, deployment, mobilization, and training and readiness. A key part of this sequence would be a formal apparatus to activate civil and commercial space assets under military control to ensure early and responsive support, similar in ways to procedures now used to "federalize" civilian aircraft and shipping in times of national emergency.

(6) Space Force Operating Systems. Unique space force operating systems would support independent space regime operations, which tend to focus on securing space command. Space systems would be integrated with terrestrial operating systems when providing general or direct support to terrestrial activities; these normally would focus on exercising space command. (See Appendix 10 for examples of space force operating systems and the integration of space capabilities with Army operating systems, based on the Army's "Blueprint of the Battlefield" functional operating system hierarchy.)

This is not an exhaustive study of space campaign design. Such topics as theater design, theater organization and command and control, space operations principles, centers of gravity, lines of operations, culminating points, and branches and sequels must be left for further investigation.

Appendix 10: Space Force Operating Systems and Integrated Support

Army Functional Operating Systems	Applicable to Space Forces?	Direct Support to Army System?
National Military Operating Systems:		
Force Development	Y	--
Mobilization	Y	Y (ex: COMM)
Strategic Deployment	Y	Y (ex: COMM/Intel)
Strategic Intelligence	Y	Y (ex: Intel)
Strategic Direction and Integration	Y	Y (ex: COMM)
Employment	Y	Y (ex: FS)
Sustainment	Y	--
Theater Strategic Operating Systems:		
Theater Force Requirements and Readiness	Y	--
Alliance and Regional Relations	Y	--
Theater Strategic Intelligence	Y	Y (ex: RSTA)
Theater Strategic Direction and Integration	Y	Y (ex: COMM)
Intra-Theater Strategic Deployment and Maneuver	Deployment & Movement	--
Theater Strategic Fires	Y	Y (ex: FS/ASAT)
Theater Strategic Protection	Y	Y (ex: JTMD)
Theater Strategic Sustainment	Y	--
Operational Operating Systems:		
Operational Movement and Maneuver	Movement	--
Operational Fires	Y	Y (ex: FS)
Operational Protection	Y	Y (ex: JTMD)
Operational Command and Control	Y	Y (ex: COMM)
Operational Intelligence	Y	Y (ex: RSTA)
Operational Support	Y	--
Battlefield Operating Systems:		
Maneuver	Movement & Maneuver	Y (ex: POS/NAV)
Fire Support	Y	Y (ex: FS)
Air Defense	Protection	Y (ex: JTMD)
Command and Control	Y	Y (ex: COMM)
Intelligence	Y	Y (ex: RSTA)
Mobility and Survivability	Y	Y (ex: ENV)
Combat Service Support	Y	--

Note: Army functional operating systems used for purposes of illustration.

END NOTES

I. Introduction.

1. Labeling the 1991 Gulf War as the first space war has been common among many military leaders. See (a) the foreword to the Center for Army Lessons Learned Newsletter 91-3, "The Ultimate High Ground! - Space Support for the Army, Lessons Learned from Operation DESERT STORM" (Fort Leavenworth, KS: Center for Army Lessons Learned, October 1991); (b) interview with LtGen Thomas S. Moorman, Jr., Commander, US Air Force Space Command, in "The JDW Interview," Jane's Defence Weekly (9 February 1991), p 200; and (c) Air Force Issues Team, Headquarters, Department of the Air Force, Air Force Issues Book - 1991, (Washington, DC: US Government Printing Office, 1991). Some (former) Soviet analysts take the same view, with one pair calling the Gulf War "the first computer-space war;" quoted in Dr. Jacob W. Kipp, "The Gulf War, High Technology, and Troop Control: The Nexus between the Military-Political and Military-Technical Aspects of Future War" (draft) (to be published by the Foreign Military Studies Office, Fort Leavenworth, KS), p 30; manuscript provided by the author on 7 April 1992.

2. For example, see (a) Center for Army Lessons Learned Newsletter 91-3; (b) Memorandum from the Office of the Deputy Chief of Staff for Operations and Plans, Headquarters, Department of the Army, subject: "DESERT SHIELD/DESERT STORM After Action Report (AAR) (U)," dated June 1991 (SECRET), Section I: Narrative, p 10; (c) US Army Space Command, "Desert Storm/Desert Shield Lessons Learned: DS/DS Activities Reported in USARSPACE War Report (Colorado Springs, CO: Headquarters, US Army Space Command, not dated); (d) Briefing by CDR Dan McElroy (Joint Staff/J-3) to the Deputy Operations Deputies, subject: Brief on the Integration of Space Operations into Theater Campaigns," dated 25 February 1992 (in particular, pp 3-5).

3. Actually, the US and USSR began to militarize space in the 1950s, long before the 1991 Gulf War, but these efforts were political and strategic applications engendered by the Cold War. The Gulf War was the catalyst for significant and often well-publicized uses of space to directly support battlefield operations. For a more complete historical perspective on the Cold War militarization of space, see (a) Curtis Peebles, Battle for Space (New York: Beaufort Books, Inc., 1983); (b) Jack Manno, Arming the Heavens: The Hidden Military for Space, 1945-1995 (New York: Dodd, Mead & Company, Inc., 1984); and (c) Dr. Daniel S. Papp, "From Project THUMPER to SDI: The Role of Ballistic Missile Defense in US Security Policy" in Airpower Journal, Winter 1987-88 (Vol V, No 4), pp 34-51.

4. This "post-maturity" stage of a nation's economic development pattern is discussed in W.W. Rostow, The Stages of Economic Growth: A Non-Communist Manifesto, 3d ed (Cambridge: Cambridge University Press, 1990), pp 11, 73-74, 114. Rostow would not predict a definitive future scenario for this stage of economic and social development. The technological impact of the post-industrial era in altering warfare is noted in The Joint Chiefs of Staff, Joint Publication 1, Joint Warfare of the US Armed Forces (Washington, DC: US Government Printing Office, 11 November 1991), p 3.

5. The military theorist Carl von Clausewitz is best known today for his characterization of the nature of war with the terms "friction" and "fog." These fundamental phenomena experienced on the battlefield are the accumulation of difficulties and uncertainties "which make the apparently easy so difficult;" see Carl von Clausewitz, On War, ed. and trans. by Michael Howard and Peter Paret (Princeton, NJ: Princeton University Press, 1989), pp 119-21.

6. Even in this age of technology, the ability of a human being to gather and process information on the battlefield remains the single greatest limiting factor in shortening the decisionmaking process, particularly when that individual is an operational or tactical commander. Thus, the commander is augmented by a staff, communications systems, decision aids, and now the possibility of "virtual presence," where long-range televideo communications and computer-supported informational processors allow the commander to see and be seen anywhere on the battlefield in real-time. Computer-run information processing and decisionmaking, tailored by preset parameters decided on earlier by human beings, reduces the requirements for real-time man-in-the-loop, often a necessity when very little time is available for certain operations.

7. Headquarters, Department of the Army, Field Manual (FM) 100-5, Operations (Washington, DC: US Government Printing Office, 5 May 1986), pp 13-18.

8. For ease in discussion, "Soviet" represents nations of the former USSR, including the Commonwealth of Independent States. The central role of troop control and the growing need for automated troop control systems are discussed in Headquarters, Department of the Army, Field Manual 100-2-1 (Final Draft, Unedited), The Soviet Army: Operations and Tactics (Fort Leavenworth, KS: US Army Combined Arms Center, 18 June 1990), pp 5-1 to 5-156.

9. The Army was the first Service to actively pursue an ancillary tactical benefit for battlefield forces from strategic space systems when in 1973 it initiated what would become the Tactical Exploitation of National Capabilities Program (TENCAP). The success of this program prompted Congress in 1977 to mandate such programs by all the Services.

10. See (a) Ray Raehn, Cover Letter, and Dr. Michael I. Yarymovych, "Soviet Space Doctrine and Strategy" in Space Support of U.S. National Security Conference Report (conference sponsored by the US Global Strategy Council, the American Institute of Aeronautics and Astronautics, and the Institute for National Security Studies in Washington, DC on 24 November 1987), pp 17-19; (b) Department of Defense, The Soviet Space Challenge (Washington, DC: US Government Printing Office, November 1987), pp i, 1-17; and (c) Defense Intelligence Agency, Soviet Military Space Doctrine, DDB-1400-16-84 (Washington, DC: Defense Intelligence Agency, 1 August 1984), pp 6-25.

11. These concepts were proposed some time ago by various Soviet thinkers; see (a) Dr. Jacob W. Kipp, "The Problem of Space in Soviet Operational Art" (Fort Leavenworth, KS: Soviet Army Studies Office, US Army Combined Arms Center, 1988, not dated), pp 5-6, 11-12; (b) Gen John L. Piotrowski, "A Soviet Space Strategy" in Strategic Review, Fall 1987 (Vol XV, No 4); and (c) Uri Ra'anan, "The Soviet Approach to Space: Personalities and Military Doctrine" in International Security Dimensions of Space, ed. by Uri Ra'anan and Robert L. Pfaltzgraff, Jr. (Hammond, CT: The Shoe String Press, Inc.,

1984), pp 47-56. However, their full impact was realized by the Soviets with the Gulf War. Such views appear in a number of Soviet analyses of the Gulf War and in US assessments of Soviet observations of the war. See (a) Kipp, "The Gulf War, High Technology, and Troop Control: The Nexus between the Military-Political and Military-Technical Aspects of Future War" (draft), pp 4, 8, 16-17, 19-22, 30, 34; (b) LTC Lester W. Grau, " 'DESERT STORM' Ground Operations: A General Staff Assessment" (draft) (to be published by the Foreign Military Studies Office, Fort Leavenworth, KS), pp 9-10, 30-32, 36; manuscript provided by the author on 7 April 1992; and (c) CPT Gilberto Villahermosa, "DESERT STORM: The Soviet View" (Fort Leavenworth, KS: Foreign Military Studies Office, not dated), pp 1-2, 10-11.

12. The importance of space forces to US contingency operations was shown in practice long before the 1991 Gulf War. GEN (then LTG) Carl Stiner, while commander of XVIII Airborne Corps and immediately following his role as ground force commander during Operation JUST CAUSE in Panama, stressed the critical need of space support to contingency forces when he declared, "I can't go to war without space systems." GEN Stiner was quoted in "Air Force Tries for Close Space Support" in Military Space, 9 April 1990 (Vol 7, No 8), p 1. GEN Colin Powell, the Chairman of the Joint Chiefs of Staff, has stated that, "for communications and command and control, for intelligence and navigation, we need to be in space, and we need a variety of space systems" (14 December 1990; quoted in CALL Newsletter 91-3, Foreword). GEN Powell has since called for improvements in integration of space capabilities by all the Services (see Note 27).

13. Joint Publication 1, pp iii, 54. US military space forces were earlier recognized as "space forces" in Secretary of Defense, Annual Report to the President and the Congress (Washington, DC: US Government Printing Office, January 1990), pp 45-48, rather than merely as "military space programs" in the previous issue (Secretary of Defense, Annual Report to Congress - Fiscal Year 1990 [Washington, DC: US Government Printing Office, 17 January 1989], pp 211-14). "Nuclear forces and strategic defense" continue to be reported separately, however.

14. Centralized management by US Space Command continues to improve; military space launches were the province of the Air Force System Command's Space Division until those assets were turned over in 1991 to the Air Force Space Command, a component command of US Space Command.

15. Joint Publication 1, pp 54, 57-58, 61.

16. The Joint Chiefs of Staff, Joint Chiefs of Staff (JCS) Publication 3-0 (Test Pub), Doctrine for Unified and Joint Operations (Washington, DC: The Joint Staff, 10 January 1990) describes theater of war campaigns and plans on pp III-7 to 9; it then notes that when the regional CINC establishes theaters of operations within the theater of war, "the theater of operations commander develops a subordinate campaign plan or operation plan that supports the CINC campaign plan. . . . In additional to organizing subordinate theaters of operations, CINCs may assign strategic objectives and provide operational guidance to immediate subordinates. These component commands may, based on the importance of their assigned objectives, also develop subordinate campaign plans" (p III-9).

17. US Army Training and Doctrine Command and US Air Force Tactical Air Command, Training and Doctrine Command Pamphlet 525-5, AirLand Operations: A Concept for the Evolution of AirLand Battle for the Strategic Army of the 1990s and Beyond (Fort Monroe, VA: Headquarters, US Army Training and Doctrine Command, 1 August 1991), pp 21 and 3-4, respectively.

18. See (a) LTC Eddie Mitchell, "Apogee, Perigee, and Recovery: Chronology of Army Exploitation of Space," RAND Note No. N-3103-A (Santa Monica, CA: The RAND Corporation, 1991); (b) US Army Strategic Defense Command, U.S. Army: First in Space and Strategic Defense (corrected copy) (Huntsville, AL: Public Affairs Office, US Army Strategic Defense Command, July 1989); and (c) _____, The U.S. Army Strategic Defense Command: Its History and Role in the Strategic Defense Initiative, 3d ed (Huntsville, AL: Historical Office, US Army Strategic Defense Command, 1989).

II. Army Space-Related Roles, Missions, and Activities.

19. The Joint Chiefs of Staff, Joint Publication 0-2, Unified Action Armed Forces (UNAAF) (Washington, DC: The Joint Staff, 1 December 1986), with Change 1 (21 April 1989), pp 2-1 to 2-14. The UNAAF implements provisions of DoD Directive 5100.1, Functions of the Department of Defense and Its Major Components, 25 September 1987, which is based on Titles 10 and 14 of the United States Code.

20. (a) Army Joint Action Sheet, Office of the Deputy Chief of Staff for Operations and Plans (ATTN: DAMO-SWX), subject: "Subject of the Action, CJCS Report on Roles and Functions of the Armed Forces," dated 17 October 1989. (b) Memorandum for the Director, Joint Staff from the Army Operations Deputy, subject: "Space Warfare Functions," dated 20 October 1989. (c) Army Talking Paper, Joint Staff/J-5 (ATTN: Policy Division), subject: "Army Space Warfare Functions," dated 1 November 1989. (d) Memorandum for the Secretary of Defense from the Chairman of the Joint Chiefs of Staff, subject: "Report on Roles and Functions of the Armed Forces," not dated, with attachment (Report on Roles and Functions of the Armed Forces).

21. References listed in Note 18 were the source for most of this historical narrtive. More specific references for many of the activities described in this and subsequent paragraphs are noted in Appendix 2.

22. Information Paper, US Army Space Command (ATTN: MOSC-ZX), subject: "US Army Space Command (USARSPACE)," dated 30 August 1991, with Tabs A-R.

23. Briefing, "Army Space Institute/TPIO-Space" by the US Army Space Institute, dated April 1992. Note the designation of ASI as the TRADOC Program Integration Office for Space (TPIO-Space).

24. Headquarters, Department of the Army, Field Manual 100-18 (Final Draft), Space Operations (Fort Leavenworth, KS: US Army Combined Arms Center, August 1991). This manual has progressed through several draft editions since 1988, gaining substantial substance along the way.

25. (a) The White House, National Security Strategy of the United States (Washington, DC: US Government Printing Office, August 1991). (b) The Joint

Chiefs of Staff, National Military Strategy - 1992 (Washington, DC: US Government Printing Office, 29 January 1992).

26. (a) Missile Defense Act of 1991 (105 Stat. 1324, PL 102-190, Part C, 5 December 1991). (b) Briefing by Dr. Ed Gerry (Systems Architect, Strategic Defense Initiative Organization), "NMD and TMD Program Development Plan," cover slide dated 25 February 1992.

27. (a) Briefing by LCDR Bill Toti (Joint Staff/J-8) to the Deputy Operations Deputies, subject: "Normalization of Space," dated 19 November 1991. (b) Briefing by CDR Dan McElroy (Joint Staff/J-3) to the Deputy Operations Deputies, subject: Brief on the Integration of Space Operations into Theater Campaigns," dated 25 February 1992. These briefings describe facets of the Chairman's initiative. Specifically, they address the question, "How do we more effectively integrate the role of space in conventional theater operations?" identified in the Operations Deputies Memorandum to the Director, Joint Staff dated 19 June 1991. Note that the term "normalization" has been replaced by "integration." The first briefing points out the revitalization of interest in the field for space systems integration; that space is now considered the ultimate "high ground," which must be controlled and defended; that space offers the conventional theater commander ways to (1) reduce his uncertainty, (2) aid in command and control of forces, and (3) moderate the effects of friction; and that a joint military study group should be chartered to make recommendations on how to improve space integration.

The second briefing included results from a survey of the CINCs, the Services, and selected Agencies. It noted that, while space support during the Gulf War was not optimal, it showed that "nearly every aspect of military operations depended to some degree on support from space systems," and that "space system support had become widely recognized as a necessary element of joint operations." Awareness of the force multiplier effect of space systems was well understood, as was the need to better integrate space operations into theater campaign plans. This briefing also stressed the importance of educating leaders in the field, spreading "space experts" out more, developing space systems modules for simulations, and improving space systems play in exercises.

The bottom line is given in CDR McElroy's briefing (p 8): "The Chairman, JCS has said, 'I now refer to joint air, land, sea, and space warfighting doctrine'."

28. See, for example, US Army Space Institute, "Space Support in Low Intensity Conflict" (Fort Leavenworth, KS: US Army Space Institute, US Army Combined Arms Center, 6 November 1989). A current analysis of space support necessary under the AirLand Operations concept is provided by MAJ Henry G. Franke III, "Space, the Army, and AirLand Operations," accepted for publication in Military Review.

29. Memorandum from the Deputy Chief of Staff for Operations and Plans (ATTN: DAMO-SWX) , subject: "Army Strategic Defense Vision -- ACTION MEMORANDUM," dated 11 February 1992. Note that this statement has not been approved as policy above the level of the Deputy Chief of Staff for Operations and Plans.

30. The Army space effort may already be faltering because of the preoccupation with the challenges of shrinking budgets and manpower. For example, the

Army now plans to end the national KE ASAT program in Fiscal Year 1994 without flight testing a prototype, unless a program review in 1994 supports a major revision in the plan and boosters can be obtained from an outside program; see the briefing by the KE ASAT Joint Program Office to Commander-in-Chief, US Space Command, given in November 1991 and updated in February 1992. Another example is ASI, which is the Army's central combat development organization responsible for Army-wide integration of space programs. It continues to suffer severe cuts in manning and subsequent losses in capability and responsibility; see the briefing, "Army Space Institute/TPIO-Space."

III. Technological Opportunities and Investment Strategies

31. Nor are revolutionary technologies being looked at in a comprehensive way in terms of increased combat power or their impact on doctrine and force structure. Instead, space technology development receives focused attention only in the R&D community, with less attention paid to ways to insert technological breakthroughs into the acquisition stream. While space technology remains a high-priority area in the Army Technology Base Master Plan (and supported by a focused Army Space Technology Base Master Plan administered by the Army Space Technology Research Office), the Army lacks an umbrella space acquisition organization, a viable integrating combat developer, and a fully integrated investment strategy (the Army's broad investment strategy, embodied in the Army Space Architecture, remains oriented on tactical battlefield functions). If the Army is to support the fundamental principle of maintaining US preeminence in space, these shortcomings must be resolved.

32. US Space Command, Assured Mission Support Space Architecture (AMSSA) Study (U) (Peterson Air Force Base, CO: Headquarters, US Space Command, December 1990) (SECRET/NOFORN/WNINTEL), in seven volumes. The briefing by LCDR Bill Toti (Joint Staff/J-8) to the Deputy Operations Deputies, subject: "Normalization of Space," dated 19 November 1991, notes broad shortcomings in the AMSSA study.

33. Despite this general division of labor, the Army continues to have responsibilty for space-based experiments, components, and systems. For example, the Army was working the space-based mirrors which would support a ground-based free electron laser for BMD. The Army is currently leading the development of space-based BMD free electron laser, neutral particle beam, and sensor experiments for SDIO. The Service is also developing a satellite designed specifically to support tactical and operational ground forces.

34. The impact of the Challenger disaster, combined with failure of other launch systems during the same period, was disastrous to US military, civil, and commercial sectors, as well as a number of foreign concerns. DoD payloads where strictly tied to the Space Shuttle as a launch system, and the halt in US launches during the years of recovery still effects many systems today. See Dr. John M. Logsdon and Dr. Ray A. Williamson, "U.S. Access to Space" in Scientific American, March 1989 (Vol 260, No 3), pp 34-40.

35. (a) W. Paul Blase, "McDonnell Douglas to Construct First Reusable SSTO Spacecraft" in SEI Update - The High Frontier Newsletter, March-April 1992 (Vol XVIII, Issue 2), pp 1-3. (b) Col Gary Payton and Maj Jess M. Spoonable, "Single Stage to Orbit: Counting Down" and "Designing the SSTO Rocket"

in Aerospace America, April 1991 (Vol 29, No 4), pp 36-39 and 40-41, 43, 45, respectively. (c) Author unknown, "Single Stage to Orbit Gains New Momentum, Adherents" in Signal, June 1991 (Vol 45, No 10), pp 37-38.

36. For examples of hypervelocity gun technologies, see (a) LTC Anthony J. Sommer and Dr. Thaddeus Gora, "Futuristic Gun Slated for Yuma Test Firings" in Army RD&A Bulletin, March-April 1992, pp 41-42; (b) Breck W. Henderson, "Ram Accelerator Demonstrates Potential for Hypervelocity Research, Light Launch" in Aviation Week & Space Technology, 30 September 1991, pp 50-1; and (c) Briefing by Sandia National Laboratories, "ETO Briefing," 8 January 1990. For the current status of hardened, hypervelocity projectiles to be used in such guns, see (a) Paul Baker and Anthony V. Funari, "Army Lightweight Exo-Atmopsheric Projectile (LEAP)" and (b) Greg Bischer and Mark Castle, "D2 Hypervelocity Projectile," papers presented at the American Institute of Aeronautics and Astronautics 1992 Aerospace Design Conference, Irvine, CA, 3-6 February 1992.

37. Despite the uncertainty over the NASP budget year by year, the program continues along. "Space planes" are no longer the exclusive province of the US; the Europeans and Japanese also have ongoing programs, as did the Soviets. For descriptions of these efforts, see (a) Jim Banke, "NASP: America's Silver Streak" in Ad Astra, March 1992 (Vol 4, No 2), pp 17-19; (b) Douglas Isbell, "Proposal Would Defer NASP Construction" in Space News, 20-26 April 1992 (Vol 3, No 15), pp 1, 20; (c) Doug Fulmer, "Sanger" in Ad Astra, March 1992 (Vol 4, No 2), pp 14-16; (d) Neil W. Davis, "Japan Pins its Hopes on HOPE" in Aerospace America, August 1991 (Vol 29, No 8), pp 32-35; and (e) Stanley W. Kandebo, "Russians Want U.S. to Join Scramjet Tests" in Aviation Week and Space Technology, 30 March 1992 (Vol 136, No 13), pp 18-20.

38. A unique perspective on the use of space systems held in reserve in deep space can be found in a briefing by Earl W. Rubright (Space and Strategic Systems, Office of the Assistant Secretary of the Army for Research, Development, and Acquisition), "Space Systems: An Evolutionary Approach," not dated, presented to Headquarters, US Army Strategic Defense Command in 1990.

39. With the recent interest in lighter, specialized satellites, such terms are proliferating throughout the US and international military, civil, and commercial space communities.

40. While awaiting this revolutionary step in launch technology, an evolutionary development in chemical boosters is being pursued by DARPA in order to provide military space forces with smaller, less expensive, and more responsive launch systems. Two ongoing DARPA efforts are the Pegasus Air-Launched Vehcile and the Taurus ground-launched Standard Small Launch Vehicle, both part of DARPA's Advanced Space Technology Program; see the briefing by Col Ed Nicastri, "Progress To-Date: Vision for the Future," presented at the Air Force Space Systems Division Developmental Planning Industry Review, dated March 1992, pp 6-7.

41. The US has deployed a space-based Tracking and Data Relay Satellite System (TDRSS) to support Space Shuttle operations and a variety of satellite constellations. This system provides global, real-time support without the need for ground-based assets outside of the US. However, it is the only system of its kind at this time.

42. The challenge is the integration of a global network of systems which operate at such widely disparate echelons in order to maximize synergy. The high cost of individual systems and the proven utility of multi-tiered architectures (an "operations in depth" or "gauntlet" approach) make this a necessity.

IV. Military Space Theory and Doctrine.

43. This remains the central theme in most books on space power up to today; for example, see (a) Colin S. Gray, War, Peace, and Victory: Strategy and Statecraft for the Next Century (New York: Simon and Schuster, 1990); (b) Kenneth H. Luongo and W. Thomas Wander, eds., The Search for Security in Space (Ithaca, NY: Cornell University Press, 1989); and (c) Dr. Corbett L. Grabbe, Space Weapons and the Strategic Defense Initiative (Ames, IA: Iowa State University Press, 1991).

44. Sun Tzu, The Art of War, trans. by Samuel B. Griffith (London: Oxford University Press, 1971).

45. (a) Carl von Clausewitz, On War. (b) Antoine Henri Jomini, Summary of the Art of War (condensed), ed. by J.D. Hittle, in Roots of Strategy, Book 2 (Harrisburg, PA: Stackpole Books, 1987). There are claims that Clausewitz and Jomini fall short in explaining modern intra-state and revolutionary conflicts, but even Mao Tse-tung's writings acknowledge a foundation in Clausewitz.

46. (a) Alfred Thayer Mahan, The Influence of Sea Power upon History, 1660 - 1783 (Boston, 1890), and Naval Strategy: Compared and Contrasted with the Principles and Practice of Military Operations on Land (Boston, 1911). (b) Julian S. Corbett, Some Principles of Maritime Strategy (Annapolis, MD: Naval Institute Press, 1988).

47. Giulio Douhet, Command of the Air, trans. by Dino Ferrari (Salem, New Hampshire: Ayers Company, Publishers, 1972), reprinted by the Office of Air Force History (Washington, DC: US Government Printing Office, 1983).

48. This approach is more fully developed in my paper, "Perspectives on the Need for a Military Space Theory," submitted to the School of Advanced Military Studies, Fort Leavenworth, KS. It is a basic argument made by many who study military space doctrine; see references in Note 51. The concept of a distinct regime is often embodied in the assertion that a separate Service, a "US Space Force," will be required in the future.

49. There is a debate in the military space community over whether space is simply a "place" or a "mission." Many argue that the military should not "be in space for space's sake." However, the very fact that space is a militarily exploitable medium will make it the focus of military operations to control access to and freedom of action in the medium (see the Joint Staff/ J-8 briefing by LCDR Bill Toti, p 3: "Space has evolved from a 'place' to a distinct 'operating medium'."). Thus space is both a place and a mission (an argument which will be used later to support the contention that USCINCSPACE should be assigned both functional and geographic area responsibilities for space).

50. Again, it is US policy to retain dominance in the space medium (see the National Security Strategy). This demands that the US sustain the initiative in advancing capabilities for space operations. Current US military dominance in space is actually a relatively recent situation, made possible only by the dissolution of the USSR and the current economic woes of the former Soviet republics. Before this occurred, the USSR military space capability was equal to or exceeded that of the US, notably in the areas of responsive launch infrastructure, battlefield-oriented space systems, and deployed (if somewhat limited) BMD and ASAT systems. Before the decline of the USSR began, the entire Soviet space effort was consolidated under the Soviet military (specifically, the Strategic Rocket Forces and Air Defense Forces). For example, see Paul Stares, "U.S. and Soviet Military Space Programs: A Comparative Assessment" in Weapons in Space, ed. by Franklin A. Long, Donald Hafner, and Jeffrey Boutwell (New York: W.W. Norton & Company, Inc., 1986).

51. In some ways, this parallels the concept of "key forces" put forward by Col John Warden; see John A. Warden III, The Air Campaign: Planning for Combat (Washington, DC: National Defense University Press, 1988). Unlike Warden's idea of the key force coming predominantly from one Service, space forces will tend to be a more joint force due to the distribution of critical assets between the Services.

52. Headquarters, Department of the Air Force, Air Force Manual 1-1, Basic Aerospace Doctrine of the United States Air Force (Washington, DC: US Government Printing Office, March 1992), Vol I, p 5. Note that joint doctrine does not accept this concept as readily. CDR McElroy's briefing (see Note 27) states on p 8 that (1) "The Chairman, JCS has said, 'I now refer to joint air, land, sea, and space warfighting doctrine'," and (2) "top-level documents now include 'space' as a force to be integrated with 'air, land, and sea . . . forces'." Joint Publications 0-1, 1, and 3-0, for example, clearly differentiate between air and space forces and the air and space media.

53. For example, this debate has gone on for several years in the pages of Airpower Journal (earlier, the Air University Review). Notable articles include (a) Frank W. Jennings, "Doctrinal Conflict over the Word Aerospace" in Airpower Journal, Fall 1990 (Vol IV, No 3), pp 46-58; (b) Maj Grover E. Myers, "Aerospace Doctrine: We're Not There Yet" in Air University Review, November-December 1985 (Vol XXXVII, No 1), pp 91-93; (c) Col Kenneth A. Myers, "Real Tenets of Military Space Doctrine" in Airpower Journal, Winter 1988 (Vol II, No 4), pp 54-68; (d) Harry F. Noyes III, "Air and Space Forces: One Endures as the Other Emerges" in Airpower Journal, Spring 1990 (Vol IV, No 1), pp 62-71; (e) LtCol Alan J. Parrington, "US Space Doctrine: Time for a Change?" in Airpower Journal, Fall 1989 (Vol III, No 3), pp 47-62; (f) Gen Robert T. Herres, "The Future of Military Space Forces" in Air University Review, January-March 1987 (Vol XXXVIII, No 2), pp 40-47; (g) LtCol Charles D. Friedenstein, "The Uniqueness of Space Doctrine" in Air University Review, November-December 1985 (Vol XXXVII, No 1), pp 13-23. A significant work on the subject is LtCol David E. Lupton, On Space Warfare: A Space Power Doctrine (Maxwell Air Force Base, AL: Air University Press, June 1988).

54. Air Command and Staff College, AU-18, Space Handbook (Maxwell Air Force Base, AL: Air University Press, January 1985), pp 1-3 to 1-5. By convention, overflying space systems do not violate national sovereignty. There are

political and legal reasons to keep this demarcation between atmosphere and space hazy to allow for greater latitude in space activities.

55. Lupton offers a narrower definition centered on space-based systems (p 8: "space forces are those vehicles designed to operate in the environment for long periods of time"). Joint doctrine has become ambivalent over the issue of a broad or narrow definition of space forces, although it currently seems to include an interpretation which is broader than Lupton's (see Appendix 4). Using Lupton's argument would suggest that the air arms of the Navy and Marine Corps really are not naval systems because these aircraft do not operate in the water, despite their critical contribution to naval and amphibious operations. Note that Gen Herres, in his article "The Future of Military Space Forces," admits that even intercontinental ballistic missiles are space systems, although he argues that this fact is really not pertinent to the use of such systems.

56. A detailed description of the unique aspects of the space medium can be found in many articles; see (a) AU-18, pp 1-3 to 1-14; and (b) John M. Collins, Military Space Forces: The Next 50 Years (Washington, DC: Pergamon-Brassey's International Defense Publishers, Inc, 1989), pp 5-40.

57. For an excellent discussion on the concept of key terrain in space, see (a) Collins, pp 22-25; and (b) LtCol Alan J. Parrington, "Toward a Rational Space-Transportation Architecture" in Airpower Journal, Winter 1991 (Vol V, No 4), pp 47-62. Collins also applies other standard land warfare terrain considerations to space, such as avenues and obstacles, observation and concealment, and weapons and personnel performance (pp 25-40).

58. There are interesting parallels between space and the sea when using this shoreline or coastal analogy. Maritime operations include riverine (or brown-water) operations, operations within ready reach of a landmass (green-water operations), and independent operations on the open ocean (blue-water operations). Using this model, one could describe white-space (both offensive and defensive suborbital theater missile) operations, blue-space (both offensive and defensive suborbital strategic missile and cislunar space) operations, and black-space (translunar or deep space) operations. Each has unique military implications and requirements. The first two of these are the focus of the near-term military space theory.

59. Again, physics demands that satellites must travel in elliptical or circular orbits to stay aloft, taking them over extensive parts of the earth's surface. Debate over the issue of space sovereignty could halt even peaceful uses of space. As long-range ballistic missiles travel through space, they normally cross over international boundaries, yet this, too, has become accepted practice, despite the use of such systems to carry nuclear weapons.

60. International agreements which limit or affect military activities in space are summarized in AU-18, Space Handbook, pp 15-1 to 15-4. These include the United Nations Charter (1947), The Limited Test Ban Treaty (1963), the Outer Space Treaty (1967), the Anti-Ballistic Missile Treaty (1972) and its protocols, the Convention on Registration (1974), the Environmental Modification Convention (1980), as well as the Intermediate-Range Nuclear Forces Treaty (1987) and a number of strategic arms limitation agreements between the US and USSR.

61. AU-18, Space Handbook, pp 15-1, 15-4.

62. Although a geosynchronous system appears to maintain a fixed position over a particular point on the earth's equator, this is merely the result of matching the satellite's orbital period with the earth's rotational period. Both objects are simply moving in step.

63. Corbett is preferred over Mahan because Mahan's approach to maritime theory lacks the necessary detailed theoretical foundation. His central themes are the objects of destroying the enemy's battlefleet and keeping one's entire battlefleet concentrated. These objects are difficult to apply to space operations, and neither of them is fundamental to Corbett's theory.

64. Considering the immature state of the space regime, Corbett's theory could be the target, rather than just a point of departure. For now, though, many of the details of Corbett's theory are actually unnecessary until man's use of space has expanded considerably. The most obvious example of this is the concept of maritime commerce raiding and capture.

65. Corbett, pp xviii, 307.

66. Ibid, p 15-16.

67. Ibid, p 16.

68. Ibid, p 155-61.

69. Ibid, pp 93, 314.

70. Ibid, p xx, 316.

71. Ibid, p 91 (emphasis is mine).

72. Ibid, pp 100-1.

73. Ibid, p 161.

74. Ibid, pp 103-5, 318-20; also see p 91: ". . . [T]he most common situation in naval warfare is that neither side has the command [of the sea]; that the normal position is not a commanded sea, but an uncommanded sea. . . . It is this state of dispute with which naval strategy is most nearly concerned, for when the command of the sea is lost or won pure naval strategy comes to an end."

75. Ibid, p xxx, 112-14.

76. This phenomenon of dispersion is now reflected in the modern carrier battle group, which is deployed as a set of mutually supporting nodes, each of which has extensive reach and conducts engagements as part of a larger operation. Compared to potential space fleets, however, such a formation is more limited in range, and individual elements are limited in dispersion. A challenge is coordinating engagements between elements "beyond the horizon;" the Navy's solution is a separate warfare area (Space and Electronic Warfare)

which supports effective command and control through the proper use of communications, informational management systems, and the medium of space.

77. Corbett, pp 128-34, 151-52.

78. Ibid, pp 209-12.

79. Ibid, pp 163-65.

80. Ibid, p 115.

81. Ibid, pp xx, 310-11, 323-24.

82. Ibid, pp 319-20.

83. Ibid, pp 183-89.

84. Ibid, pp 233-39, 259-62, 280-86, 298.

85. If an enemy can attack one's homeland with impunity, the conflict has the potential to be unlimited in nature, at least for the defender. To eliminate any danger of this, the defender would use preemptive strikes to apply the maxim of seeking out and destroying the enemy's capability to invade. To secure such longlasting command, however, suggests a conflict approaching unlimited aims, with the survival of either nation possibly at stake. This is the foundation for today's offensively oriented strategic nuclear policy, which threatens an unlimited and mutually destructive war as the deterrent (i.e., too unlimited to satisfy rational strategic objectives). Capable missile defenses, paralleling maritime defenses espoused by Corbett, replace such a deterrent with another and potentially safer means to ensure that a missile-based conflict does not become unlimited.

86. A fleet in being takes on special significance for a space regime. The characteristics of the space environment make space-based systems increasingly vulnerable as more capable kinetic and directed-energy weapons are developed. Considered together with the inherently dispersed nature of space operations, this means that attrition will underlie future operations to secure space command. The fleet must be designed to quickly replace lost systems from the terrestrially-based reserve or fleet in being, and this reserve/fleet in being must be survivable and protected, primarily through protection and dispersion of assets, which again resembles a classic Corbett fleet in being. (This may be more a fleet in being and less a true reserve if replenishment of individual systems becomes its major task.) I have expanded Corbett's definition of a fleet in being to mean more than just a dispersed, defensively oriented battlefleet. While the central feature of dispersion remains a defensive measure, the space fleet in being includes assets necessary to do more than just attack the enemy's battlefleet.

87. Corbett supports the classic Clausewitzian position that the defense is the stronger form of war (Clausewitz, pp 357-59); however, each was dealing with conventional forces with limited range, firepower, and precision capabilities. Nuclear weapons mounted on long-range delivery platforms tend to invalidate the assumptions upon which Clausewitz made this claim. The technological and economic difficulty in defending against such offensive weapons,

particularly when they are deployed in a large preemptive strike over a very short period, suggests that the offense is the stronger form of nuclear warfare. On the other hand, it may never be politically expedient for the US to attack another nation with nuclear weapons, even in retaliation, especially if this nation has a limited arsenal, is a small landmass, or is surrounded by neutral neighbors. By necessity, a defensive posture may be the only acceptable strategy, particularly if it means limited destruction on either side. The global and often instantaneous character of SpLOCs also chips away at Clausewitz's assumptions.

88. A credible deterrent is an effective form of protection and is a fundamental principle of US security strategy. To be effective, however, one must have the perceived or demonstrated will and capacity to retaliate or strike preemptively, as well as the ability to absorb any damage from an exchange. This requires survivable forces capable of passive and active defense measures, which returns us to the other aspects of protection.

89. Space-based GPALS elements would be deployed in large constellations in near-earth orbit. Besides their primary mission of intercepting ballistic missiles early in flight, these systems could also serve as ASAT interceptors against satellites in low earth orbits. Because they could attack any launch vehicle during the boost phase when it is most vulnerable, these GPALS systems would be an excellent means to impose a space blockade; see Maj Tom Blow, "Defending against a Space Blockade," Center for Aerospace Doctrine, Research, and Education (CADRE) Paper (Maxwell Air Force Base, AL: Air University Press, 1989). These systems, however, would not be able to attack satellites in higher orbits. Unless upgraded in self-defense capabilities, they would eventually be vulnerable to terrestrially-based kinetic and directed-energy weapons.

90. The US principles of war are now a part of joint doctrine; see The Joint Chiefs of Staff, Joint Publication 0-1 (Proposed Final Pub), Basic National Defense Doctrine (Washington, DC: The Joint Staff, 7 May 1991), pp I-30 to I-32. For a detailed discussion of the applicability of the principles of war to space operations, refer to Maj James H. Mueller, "Developing a Foundation for Space Doctrine: Do All the Principles of War Apply to Military Space Operations?" Master of Military Art and Science thesis (Fort Leavenworth, KS: US Army Command and General Staff College, 2 June 1989).

91. This is not a new approach for US strategy. A ready example is the Washington Treaty of 1922, which sought to limit the naval capability of Great Britain and France, which were certainly unlikely foes after World War I, but which represented impediments to clear US dominance on the seas.

92. During the Gulf War, for example, the US had to rely on European and Japanese weather satellites because its own aging civil weather satellite fleet has dwindled without adequate replacements. Without the benefit of non-US and international consortia communications satellites, long-haul communications requirements would have been an overwhelming burden. US capability shortfalls even in space surveillance are noted in James W. Canan, "Our Blind Spots in Space" in Air Force Magazine, February 1988 (Vol 71, No 2). Recall the earlier discussion on Soviet military space capabilities (see Note 50).

93. National Security Strategy, p 23, states that there are now "ten significant spacefaring nations, with others on the way." Note that US security concerns for space are predominantly addressed in the Economic Agenda section of the Strategy; only missile defense is found under the Military Agenda. The link between US economic interests and space is first established in the broad and enduring interests and objectives of the US, which include a "healthy and growing U.S. economy . . . ." This requires the US, among other things, to seek to "ensure access to foreign markets, energy, mineral resources, the oceans and space" (p 3).

94. The general proliferation of space technology and capabilities is discussed by Dr. John M. Logsdon, "Emerging Space Nations" in Space - A New Era: Fifth National Space Symposium Proceedings Report (Colorado Springs, CO: United States Foundation, 1989), pp 57-63.

95. Peter de Selding, "France Weighs Radar-Equipped Satellite: Move Is Part of Stepped Up Military-Space Investment Plan" in Defense News, 4 November 1991 (Vol 6, No 44), pp 3, 29.

96. There are numerous references to these efforts in France and similar ideas in other nations: (a) Author unknown, "French Begin Military Radar Satellite" in Space News, 11-18 November 1991 (Vol 2, No 38), pp 1, 20; (b) Michael Mecham, "Gulf War Rekindles European Interest in Developing Military Satellites" in Aviation Week & Space Technology, 8 April 1991 (Vol 134, No 14), pp 54, 56; (c) Giovanni de Briganti, "France, U.K., Want Europe Satellite Network" in Defense News, 3 June 1991 (Vol 6, No 22), pp 1, 36; (d) Scotty Fisher, "Iraq Missile Attacks Spur Backing for Israeli Military Satellites" in Armed Forces Journal International, April 1991, p 29.

97. Directed-energy weapons would include high-energy lasers, neutral particle beam weapons, and high-powered microwave systems.

98. For example, significant adjustments include (1) the incorporation of enclave operations, (2) extended SpLOCs which either do not begin or do not terminate on earth, and (3) physical SpLOCs which may require days to transit.

99. The first stage ends for the strategic defense campaign in 1996 only if the US begins the planned deployment of an initial GPALS capability. It marks the end of the first stage for the expeditionary theater supporting campaign if an ASAT weapon is available and theater missile defenses are fielded.

100. The year 2015 is simply a projected date when at least a few nations may have the means to secure space command (ballistic missile defenses and/or ASAT systems). The continued proliferation of technologies for long-range missiles and weapons of mass destruction will force many nations to acquire both an increased strategic strike capability of their own (to exercise command) and the means to protect their homelands (to secure command). With the growing political and economic divergence of nations or blocs of nations and an increasing economic and military reliance on space, indigenous satellites will have been deployed in relatively large numbers (to exercise command), and ASAT weapons will also have spread (to secure command). This will signal well-developed, regionally-oriented/multipolar arms races in space, regardless of US unilateral actions, much as we now see regional competitions in acquiring weapons of mass destruction and long-range ballistic missiles.

101. National Security Strategy, pp 23, 27. The Strategy describes space lanes as "highways to discovery and commerce," but realizes that they can be used as "springboards for attack. . . . Assured access to space requires a healthy military space program." Military options must include "active defense systems, including an anti-satellite system, to stop an aggressor before he can use a space system to threaten objects or people in or from space." The Strategy suggests several economic and military parallels between the seas and space (p 23). The redirection of SDI to pursue GPALS is described on p 27; potential advantages of such a system are the protection of the US against limited or accidental launches of ballistic missiles, of forward deployed forces, and of allies, as well as incentives against further proliferation of ballistic missiles.

102. National Military Strategy, pp 5-10. Beginning with the broad and enduring US national security interests and objectives, the Military Strategy proceeds to describe the National Defense Foundations for the use of military forces and then presents the Strategic Principles necessary to build on these Foundations. I contend that a national military strategy's foundation is the national "way of war," based on the capabilities, history, and aggregate will of the nation, as well as the current strategic environment. In more general terms, the American way of war during this century has been characterized by relaince on technology, firepower, brute force and the direct approach, a responsive mobilization and industrial base, and fighting conflicts away from the US homeland.

103. National Military Strategy, p 6.

104. Ibid, pp 19, 24-25.

105. Ibid, p 24.

106. AU-18, Space Handbook, pp 15-4 to 15-12 summarize the evolution of national and DoD space policies from the Eisenhower to Reagan Administrations. The current policies are: (a) The White House, National Security Directive (NSD) 30, "National Space Policy," dated 2 November 1989; and (b) Secretary of Defense, "Department of Defense Space Policy (U)," dated 4 February 1987 (Classified), with an unclassified version of the policy released under a Memorandum for Correspondents, dated 10 March 1987. Both documents can be found in Air Command and Staff College, Space - The Fourth Military Arena (Maxwell Air Force Base, AL: Air Command and Staff College, April 1992), pp 164-77.

107. Joint Publication 0-1 details US military power and posture, to include homeland defense and space forces, on pp III-1 to III-20. It notes that theater commanders have overlapping strategic and operational responsibilities on p IV-4. The publication describes maritime and continental theaters as the two basic types of theaters of war on pp IV-4 to IV-12. It explains the strategic and operational levels of war from the perspective of the theater of war commander, as well as joint and combined warfare, on pp IV-3 to IV-20. Finally, it lists the principles of war on pp I-30 to I-32. Note that the principles of war are just one of the military fundamentals; the others are objectives, missions and tasks, freedom of action, offense and defense, deception, and human factors (pp I-27 to I-34).

108. Joint Publication 1, pp iii, 45.

109. Ibid, p 47.

110. Ibid, p 54.

111. The Joint Chiefs of Staff, Joint Publication 3-0 (Test Pub), Doctrine for Unified and Joint Operations (Washington, DC: The Joint Staff, 10 January 1990), pp xi-xii. One reason space forces are not addressed directly in this publication could be that it preceded the initiative to incorporate space forces in joint doctrine; note the date of publication.

112. _____, Joint Publication 3-14 (Initial Draft), Doctrine for Joint Space Operations (Washington, DC: The Joint Staff, 15 November 1990), p 2-1.

113. _____, Joint Publication 3-14 (Final Draft), Joint Doctrine: Tactics, Techniques, and Procedures (TTP) for Space Operations (Washington, DC: The Joint Staff, 15 April 1992), pp II-3 to II-12. This publication also divides space into three regions: near-earth, cislunar, and translunar space (pp II-1 to II-3). Near-earth space extends from the outer boundary of the atmosphere to the altitude of geosynchronous orbits. Cislunar space begins at geosynchronous altitude and continues to that of the moon's orbit. Translunar space extends from the moon's orbital altitude to the outer reaches of the solar system.

114. Ibid, pp vi-vii.

115. Ibid, pp III-4 to III-6.

116. The Joint Chiefs of Staff, Joint Publication 3-16 (Initial Draft), Joint Doctrine for Integrated Strategic Defense (Washington, DC: The Joint Staff, August 1991), pp i, iii.

117. Ibid, p x.

118. Ibid, p iv. This publication also notes the difficulty in using common space operations terms; the BMD mission area is a defensive aspect of force application, while the mission area of space defense is a defensive aspect of space control (p I-1).

119. Ibid, p. I-3. In this capacity, USCINCSPACE is designated the Director of the Joint Strategic Defense Planning Staff (JOSDEPS), which has responsibility for developing ISD plans and procedures. Currently, USCINCSPACE is dual-hatted as CINCNORAD, and many functions of the two commands are closely integrated. However, NORAD is a combined US/Canadian command. Should the US pursue unilateral operations, the Commander, US Element NORAD (CDRUSELMNORAD) would provide the necessary support for air sovereignty, air defense, and integrated Tactical Warning and Attack Assessment (p I-3).

120. Ibid, p I-3.

121. Ibid, p I-6; these are concepts suggested by an evolving GPALS architecture with integrated national and theater assets and, eventually, an

overarching global space-based defense system. Employment of a global defensive system could be complicated if other nations

122. Ibid, p II-1. However, an overall combatant commander is not named.

123. Ibid, p III-1.

124. Ibid, p V-4. The issue of offense-defense integration is addressed in CDR McElroy's briefing (see Note 18), which notes that "as the battle space becomes more densely populated with a variety of both offensive and defensive systems, such integration will become crucial" (p 12). No overall coordinator is suggested, however.

125. The Joint Chiefs of Staff, Joint Publication 3-05.1 (Initial Draft), Doctrine for Joint Tactical Missile Defense (Washington, DC: The Joint Staff, 10 June 1991), p I-3.

126. Ibid, p I-5.

127. Ibid, p II-13.

128. Revision of Joint Publication 1-02 lags behind new doctrine being developed; most space-related terms are still missing from this lexicon. Individual doctrinal publications are the only source for the definitions of these terms for now.

129. Besides the draft Field Manual 100-18, Space Operations, ASI has produced papers describing the integration of space support in low, mid, and high intensity combat operations; see "Space Support in Low Intensity Conflict," "Space Support in Mid-Intensity Conflict," and "Space Support in High Intensity Conflict" (Fort Leavenworth, KS: US Army Space Institute, US Army Combined Arms Center, all dated 6 November 1989). Note again that the current edition of Field Manual 100-5 does not mention space a single time.

130. US Army Combined Arms Center, "AirLand Battle Future Umbrella Concept" (draft) (Fort Leavenworth, KS: Concepts and Force Alternatives Directorate, US Army Combined Arms Center, 1 August 1989) (FOUO/NOCONTRACT), Appendix B (Space).

131. US Army Space Institute, "U.S. Army Space Operations Enabling Concept" (Fort Leavenworth, KS: US Army Space Institute, US Army Combined Arms Center, 10 January 1992).

132. _____, "The Army Long Range Plan for Space (ALRP-S)" (Fort Leavenworth, KS: US Army Space Institute, US Army Combined Arms Center, 13 April 1992).

133. US Army Training and Doctrine Command and US Air Force Tactical Air Command, Training and Doctrine Command Pamphlet 11-9, Blueprint of the Battlefield (Fort Monroe, VA: Headquarters, US Army Training and Doctrine Command, 10 May 1991).

V. Joint Space Campaigns.

134. Joint Publication 3-14 (Final Draft), p II-17 recognizes at least the possibility of US military reliance on non-military and/or non-US space systems.

135. At this time, the Unified Command Plan (UCP) does not give USCINCSPACE geographic area responsibilities for space; Armed Forces Staff College, Armed Forces Staff College Publication 1, The Joint Staff Officer's Guide - 1991 (Washington, DC: US Government Printing Office, 1991), p 2-23.

136. Again, unilateral US action would keep NORAD as an organization from participating; USCINCSPACE would rely on CDRUSELMNORAD for necessary support.

137. (a) US Space Command, USCINCSPACE OPLAN 3400-90, Space Campaign Plan (U) (Peterson Air Force Base, CO: Headquarters, US Space Command, 1 October 1989) (SECRET/NOFORN/WNINTEL/NOCONTRACT). (b) _____, USCINCSPACE Strategic Concept 3500-95 (Peterson Air Force Base, CO: Headquarters, US Space Command, 20 December 1991) (SECRET). Both documents couch their mission statements in terms of the four standard space force functions. According to CDR McElroy's briefing (see Note 18), USCINSPACE Campaign Plan 3500-95 will have a regional focus (p 9). LCDR Toti's briefing acknowledges the shortcomings of describing space operations using these standard functions: "OK for policy/acquisition, but doesn't directly translate to principles of war" (slide 3).

138. The standard format for an Operation Plan Annex N is shown in JCS Publication 5-02.2, dated 30 March 1990, and reproduced in Space - The Fourth Military Arena, pp 213-16. Detailed guidance is provided in US Space Command, "Annex N Tutorial (U)" (Peterson Air Force Base, CO: Headquarters, US Space Command, 15 January 1992) (SECRET/NOCONTRACT). US Space Command is sending teams to other CINC headquarters to support their development of the Space Operations Annex as part of their plans.

VI. Recommended Army Initiatives.

139. There are mixed signals as to the Army's recognition of strategic defense as a basic Army strategic role. For example, such a role is missing from the list given in Secretary of the Army and Chief of Staff of the Army, A Statement on the Posture of the United States Army - Fiscal Year 1993 (Washington, DC: US Government Printing Office, not dated), pp 24-25, although the same statement acknowledges Army roles in space (p 26) and ballistic missile defense (p 49). Yet the Army is doing more than simply participating in these security areas. It has the joint program lead for the national KE ASAT system, and the current recommendation for GPALS systems acquisition gives the Army the lead in developing Operational Requirements Documents for four of the six Major Defense Acquisition Program System (MDAPS) elements of the GPALS architecture. These MDAPS are: (1) National Missile Defense (Army lead), which includes ground-based interceptors and sensors and space-based sensors; (2) Global Missile Defense (Air Force lead), which includes space-based interceptors; (3) Upper Tier Theater Missile Defense (Army lead), which includes high-altitude ground, sea, air, and space-based elements; (4) PATRIOT (Army lead); (5) Corps Surface-to-Air Missile (Army lead); and (6) GPALS/Battle Management, Command, Control, and Communications (USSPACECOM lead). (See

Gerry, "NMD and TMD Program Deployment Plans.") Another concern is that the Army, like the other Services, relinquished some of its responsibility to equip forces when the Services agreed in a Memorandum of Understanding that the director of SDIO would serve as the SDI Acquisition Executive throughout the life cycle of SDI-supported systems.

140. The Army is the only Service which has not established a space-related personnel management functional area.

Appendix 1: Space-Related Functions of the Armed Services

141. JCS Publication 0-2, pp 2-1 to 2-14.

Appendix 2: The Army's Historical Involvement in Space

142. Mitchell, pp 10-30.

143. Ibid, pp 58-59.

144. Ibid, pp 137-38.

145. Ibid, p 138.

146. Ibid, p 143.

147. Ibid, p 140.

148. Ibid, pp 140-41, 143.

149. Ibid, pp 125-36.

150. Ibid, p 111.

151. Ibid, p 145. The Homing Overlay Experiment made this successful intercept on 10 June 1984.

152. Ibid, p 146.

153. US Army Strategic Defense Command, "Theater Missile Defense" (Huntsville, AL: Public Affairs Office, US Army Strategic Defense Command, not dated), pp 2, 5.

154. Missile Defense Act of 1991, Sec 233b.

155. Mitchell, p 113.

156. Ibid, p 112. The Army Space Initiatives Study was published on 13 December 1985.

157. Ibid, pp 112-13. The Army Space Institute was established on 2 June 1986. The Army Space Command, after evolving through several interim organizational structures, was activated on 7 April 1988.

158. US Army Space Institute, "The Army Long Range Plan for Space (ALRP-S)" (Draft) (Fort Leavenworth, KS: US Army Space Institute, US Army Combined Arms Center, 7 February 1992), p 3.

159. The Army's MMIS efforts include the Terra Geode and Terra Scout programs, which studied the utility of trained engineer and intelligence analysts, respectively, to make observations in space which would support battlefield commanders. See (a) CPT John Karpiscak, "Terra Geode: The Army in Space" in Engineer, July 1991 (Vol 21), pp 37-41; and (b) Heike Hasenauer, "Soldiers in Space" in Soldiers, April 1992 (Vol 47, No 4), pp 18-20.

Appendix 3: Army Space Policy, Concept, and Architecture.

160. The Army Space Policy was issued as a single-sheet poster.

161. The current Army Space Concept can be found in many sources, including the briefing by the US Army Space Institute, "Army Space Concept Brief," not dated.

162. US Army Combined Arms Center, US Army Space Architecture - 1990 (U), (Fort Leavenworth, KS: US Army Space Institute, US Army Combined Arms Center, October 1990) (SECRET), p 1-6 and Figure 2.

Appendix 4: Space Force Functions and Military Space Operations.

163. Joint Publication 3-14 (Initial Draft), pp GL-2 to GL-3.

164. Joint Publication 3-14 (Final Draft), pp vi-vii.

165. Ibid, pp GL-7 to GL-8.

166. Ibid, pp III-4 to III-5.

Appendix 5: Other Service Space Doctrines.

167. AFM 1-1, Vol I, p 5.

168. Ibid, p 7.

169. Friedenstein, "The Uniqueness of Space Doctrine," pp 13-14.

170. The development of AFM 2-25 is detailed in James R. Wolf, "Toward Operational-Level Doctrine for Space: A Progress Report" in Airpower Journal, Summer 1991 (Vol V, No 2), pp 28-40. Since the original Air Force doctrinal manual on space, AFM 1-6, has been rescinded, the Air Force finds itself currently without any approved space doctrine.

171. The Copernicus Architecture, pp I-1 to I-2.

172. Ibid, pp I-9 to I-11.

173. LCDR M.S. Loescher, "Space and Electronic Warfare: A Navy Policy Paper on a New Warfare Area" (Final Draft) (Washington, DC: Director, Space and Electronic Warfare, Office of the Chief of Naval Operations, April 1992), pp 22-24. Note that this policy is not yet approved by the Chief of Naval Operations.

174. Headquarters, US Marine Corps, "MAGTF Space Operations: 2010," draft annex to a Fleet Marine Force Reference Publication on amphibious warfare in 2010, not dated (provided by Headquarters, Marine Corps, ATTN: PL96), p 10. This document does a better job of integrating strategic, operational, and tactical space systems and operations into Marine Corps operations, from the MAGTF perspective, than any comparable Army doctrinal publication does for Army operations, from the contingency operations perspective.

175. Briefing, Headquarters, US Marine Corps, "MAGTF Space Operations," presented at the USMC Command and Staff College, 7 and 8 January 1992, slides 10-17. This briefing also underscores the Marine Corps' recognition that space provides a significant ability to reduce uncertainty.

176. Army space officials supported the adoption of the Marine Corps military space operations terminology; see William E. Howard III, "Basic Functions of the Military Space Sector: Time for a Change!" (Washington, DC: Office of the Assistant Secretary of the Army for Research, Development, and Acquisition (ATTN: SARD-TS), 7 February 1992).

Appendix G: "Blueprint of the Battlefield" Operating Systems

177. TRADOC Pam 11-9, pp B-2, B-32, C-2, D-2.

Appendix H: Space Theater Design

178. The Soviets have believed for some time that space should be considered as a separate military TVD (theater of operations); see Kipp, "The Problem of Space in Soviet Operational Art," p 8. Taken a step further, the concept of a space theater of war in support of a strategic defense campaign suggests that Joint Pub 0-1 should be revised to include three types of theaters of war: continental, maritime, and space.

Appendix I: Considerations for Designing Space Campaigns

179. Various versions of the air campaign's operational objectives generally fit the one listed here. See (a) Headquarters, Department of the Air Force, "Airpower: Desert Shield, Desert Storm" (Washington, DC: Air Force News Center, Air Force Internal Information Directorate, not dated), p 4; (b) James P. Coyne, "Plan of Attack" in Air Force Magazine, April 1992 (Vol 75, No 4), p 45; and (c) Headquarters, Department of the Air Force, "United States Air Force in Operation Desert Storm" (Washington, DC: Office of Public Affairs, Office of the Secretary of the Air Force, not dated), p 4.

180. The four phases of the air campaign are described in "United States Air Force in Operation Desert Storm," pp 4-5.

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Memorandum for Director, Joint Staff from the Army Operations Deputy, subject: "Space Warfare Functions," dated 20 October 1989.

Memorandum for MAJ Henry Franke from Mark M. Vaughn, MAJ, USA, Kinetic Energy Anti-Satellite (KE ASAT) Joint Program Office, US Army Strategic Defense Command, subject: "KE ASAT Program Description," dated 25 February 1992, with attachments:

1 and 2. Briefing by KE ASAT Joint Program Office to GEN Kutyna (USAF), Commander-in-Chief, US Space Command, in November 1991 (cover slide missing, briefing not dated).

3. Briefing by KE ASAT Joint Program Office to US Central Command on 28 January 1992, not dated (additional notes by MAJ Vaughn).

4. Extract of current KE ASAT system description.

5. KE ASAT Joint Program Office, "US Strategic Defense Command Anti-Satellite Joint Program Office Historical Feeder Report for FY 89," dated 1 February 1990; "US Strategic Defense Command Anti-Satellite Joint Program Office Historical Feeder Report for FY 89," dated 19 November 1990; "US Strategic Defense Command Anti-Satellite Joint Program Office Historical Feeder Report for FY 89," dated 2 December 1991.
6. Memorandum for Director of Defense Research and Engineering, from Mr. Stephen K. Conver, Army Acquisition Executive, subject: "Defense Modernization Strategy," dated 7 January 1992.

Memorandum for MAJ Franke from R.W. Etter, CAPT, USMC, Plans Division, Plans, Policies, and Operations Department, Headquarters, US Marine Corps (ATTN: PL96), subject: "Information on MAGTF Space Operations," dated 26 March 1992, with enclosures, including:
1. Talking paper differentiating military space operations and military space functions, author unknown, not dated.
2. "MAGTF Space Operations: 2010," paper written to be an annex to a Fleet Marine Force Reference Publication on amphibious warfare in 2010, not dated.
3. Briefing, "MAGTF Space Operations," presented at the USMC Command and General Staff College, 7 and 8 January 1992.

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