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THEATER SPACE WARFARE:

REWRITING THE JOINT PLAYBOOK

by

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APPROVAL

The undersigned certify that this thesis meets masters-level standards of research, argumentation, and expression.

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Lieutenant Colonel Daniel D. Wright III entered the Air Force in 1990 upon graduation from the United States Air Force Academy. He has served in a variety of space operation, acquisition and staff assignments associated with weather, early warning and intelligence systems. Lieutenant Colonel Wright has a Bachelor of Science degree in Space Operations from the United States Air Force Academy, a Master of Arts degree in Organizational Management from The George Washington University, and a Master of Arts degree in Military Operational Art and Science from the United States Air Force Air Command and Staff College.

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Abstract

Theater space warfare is emerging from two streams of evolution in military space: the role of space in military operations and the role of the theater in space operations. Indispensable at the strategic level throughout the Cold War, space is now proving indispensable at the operational and tactical level. As the incorporation of space into warfare accelerates over the next decade, the concept of space-enabled warfare puts a premium on access to space and effective integration into joint operations. The role of the theater in space operations is also evolving, from passive consumer to that of an active consumer *and* producer of space effects. Microsatellites, near-space assets, and adversary satellite jammers all necessitate active theater participation in space operations. Unfortunately, today's joint doctrine has missed this on-going evolution, leaving the US military ill prepared to optimize space across joint operations.

The primary assertion in this study is that the US military needs to mature its command and control approach to space to best integrate the growing role of space in theater operations. The current command and control construct offered is weak: a unity of effort, but not command, through the Space Authority; decentralized control of transferred space assets via service components; and no identified control mechanisms. Simply put, the Space Authority provides a less then optimum integration of space into US joint warfighting.

A Joint Force Space Component Commander (JFSCC) offers a more mature approach to theater space command and control. Operationally, it enables the theater to command organic space systems, actively pursue space superiority, and integrate dynamic global space systems into joint operations. Doctrinally, the JFSCC provides unity of command, centralized control, and a set of viable control mechanisms. The JFSCC optimizes integration of both global *and* theater space operations into US joint warfighting.

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Introduction

> *The unresting progress of mankind causes continual change in the weapons; and with that must come a continual change in the manner of fighting.*
>
> Alfred Thayer Mahan

Space has supported US national security since its inception. Throughout the Cold War, space provided the technical backbone for nuclear warfare. As space capabilities matured, space evolved to provide a global infrastructure for conventional warfare as well. From Cold War nuclear deterrence through Operation IRAQI FREEDOM precision bombing, space has been an increasingly important piece of US military campaigns. As the pace of change accelerates, the growing interdependence of space with other aspects of the military campaign is moving the US from space-supported warfare to space-enabled warfare. Future space capabilities will continue the trend of increased integration of space into all levels of warfare.

As space evolves from a nice-to-have force multiplier to an integral part of the military campaign, the notion that space operations is not a core warfighting capability becomes a luxury the US can ill afford. Future opponents will see space as the source of America's asymmetrical advantage, and neutralizing space effects will become central to their planning. The US must lead turn a future "space Pearl Harbor," and its resulting ripple effect on all US military operations, by giving serious thought to how it will command and control the space piece of tomorrow's theater campaign.

The thesis of this paper is that the US military needs to mature its command and control approach for space to best integrate the growing role of space in theater operations—in particular, the approach to command and control of theater space operations. Indeed, the notion of *theater* space operations is a rather new one. The more traditional notion is of *global* space operations, with operators stationed in the United States controlling global, on-orbit satellites. Theater warfighters, as consumers of these global space effects, request support from the global provider. Theater command and

control of space, in the past, boiled down to a prioritized list of requirements for United States Strategic Command (USSTRATCOM) to fulfill. This approach, embodied as the Space Authority in joint doctrine, is inadequate to address the growing role of space in theater operations. A more mature command and control approach to theater space operations is required to integrate space into the operational and tactical levels of warfare.

Space command and control, theater or global, is a topic that few would find exciting. Doctrine for many is trivial matter, something best to be avoided. Yet doctrine codifies powerful ideas on the best way of doing business and, for US military operations, it provides the playbook for the entire joint team. Some may take this thesis for a separate space force or a give-space-to-the-Air-Force polemic, but it is neither. This thesis is about getting the space piece of the joint playbook right. Addressing theater space operations in joint doctrine is a small but necessary step. As Mahan commented over a hundred years ago, the continual change in weapons requires a continual change in the manner of fighting. The weapons are changing, so must the manner of fighting.

Chapter 1

The Problem and an Analytical Framework

Whereas those who have the capability to control the air, control the land and sea beneath it, so in the future it is likely that those who have the capability to control space will likewise control the earth's surface.

General Thomas D White
Chief of Staff
United States Air Force, 1957

There is a growing disconnect between the evolution of space, both in capability and usage, and the doctrine that guides the integration of space into joint operations. Space capabilities, their maturation coming in the bipolar logic of the Cold War, have always focused on the strategic level of war. Satellites provided intelligence for indications and warning, missile warning against nuclear attack, and secure communications for command and control of the nation's forces. In the 1980s and early 1990s, these strategic assets also supported the operational and tactical levels of war. Operation DESERT STORM demonstrated the success of leveraging global space in theater operations, Operation IRAQI FREEDOM cemented its place in future campaigns. Today, space is an integral part of joint operations: navigation and timing for precision weapons and troop movements; satellite communication for command and control, real-time intelligence and targeting; missile warning for theater missile defense; and infrastructure for blue force tracking. In other words, space touches every aspect of today's military by providing a global infrastructure for joint operations.

Some use the term space-enabled warfare to describe the growing integration of space with "air, land, and sea forces to produce effect."[1] Space-enabled warfare

[1] The Director of National Security Space Integration, Office of the Under Secretary of the United States Air Force, Major General Kehler, argued in 2003, "integration is the key" as "it's [sic] the combined effect that really enables modern warfare." Maj Gen Robert Kehler, "Space Enabled Warfare," *RUSI Journal*,

underpins the development of future networked military systems from the Air Force's Unmanned Aerial Vehicles (UAVs) to the Army's Future Combat Systems (FCS). Tomorrow's space capabilities will break the global space paradigm by focusing on theater space operations. The next-generation of space assets will put dedicated space capabilities into the hands of the joint warfighter, with tactical and operational microsatellites, theater-commanded near-space assets, and satellite systems designed for battlefield control expected over the next decade. Space capabilities and usage are evolving beyond the current command and control approach for theater space operations.

Three Observations

A review of space in past US military campaigns, current operations, and future planning, prompts three observations central to this paper: the focus of military space has evolved from the strategic level of war to the operational/tactical level, space is integral to future military forces, and space assets are an organic part of theater military operations. These observations provide the context for the analytical framework of this paper, underscoring the contention that space command and control is about space warfare.

The nature of space in warfare has changed over the last six decades, evolving from a theoretical idea into an integral element of warfare. Space, according to the Honorable Donald Rumsfeld, US Secretary of Defense, is now "fundamental to modern warfare."[2] Space warfare today must focus on assured access and effective integration, not on theoretical debates about weapons in space. Space warfare requires active participation and integration at all levels of war, from global US Strategic Command operations to theater operations. Global space operations, the dominant approach to space in the past, established command and control mechanisms that have served well—up to now. Theater space operations, designed primarily to request effects from global space, may not be prepared to command and control evolving space capabilities and

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August 2003, n.p., on-line, Internet, 4 May 2005, available from http://www.findarticles.com/p/articles/mi_qa3727/is_200308/ai_n9241425.

[2] Gerry J Gilmore, "Space, Missile Defense Essential to Defense, Rumsfeld Says," *American Forces Information Service*, 10 Dec 2003.

missions that put space assets into the hands of joint warfighter. Microsatellites and near-space vehicles, offensive and defensive counterspace operations, and global space systems designed for battlefield control require a higher level of theater participation in space operations. This participation goes beyond mere consumption of space effects from global providers. Theater warfighters, just as they operate tanks and airplanes to produce combat effects, will need to operate space systems to produce space effects. Theater warfighters, just as they fight to gain and maintain superiority on the land, sea, and in the air, will need to fight to gain and maintain space superiority. This evolving theater role does not eliminate the global providers, who remain vital, but does require the theaters to develop their own ability to plan, conduct, and assess space operations.

Theater space warfare, a result of evolving space capabilities, growing reliance on space, and changing role of the theater in space operations, serves as the conceptual basis for analysis with assumptions and limitations narrowing the scope to theater military space command and control. Effective command and control is vital to effective military operations. Theater space warfare, the result of the evolving nature of space in warfare, requires theater commanders to reassess how they fight the space piece of their military campaign.

The framework outlined below looks at joint doctrine to analyze the maturity of theater space operations, specifically in the area of command and control.

Space Warfare: A Pragmatic Approach

Space warfare is about more than weapons in space, yet most academic writing and public debate revolves around this topic. This principal focus on space weaponization tends to keep thinking at the theoretical level, and reinforces the traditional view of space as a strategic issue. While there is no doubt that weaponization of space deserves debate, the military must take a more pragmatic approach to space warfare. As Secretary Rumsfeld stated in 2003: "Over the past few years we have recognized that space and information are not only enablers, but (also) core war fighting competencies."[3] Space, as a warfighting competency, cannot remain in theoretical realm.

[3] Gerry J Gilmore, "Space, Missile Defense Essential to Defense, Rumsfeld Says," *American Forces Information Service*, 10 Dec 2003.

The US military needs to recognize space is long past infancy, operational in many areas, and maturing into an indispensable part of the battlespace.

The real strategic challenge of space warfare, at least in the near-term, is in maintaining an asymmetric advantage in space. Even if one does not fully accept the notion of a future net-centric military, the evidence of a growing dependence on space is difficult to refute. On this basis alone, the US military must take every opportunity to improve its space war-fighting competency. The issue of command and control of theater space is only one small piece of this competency, but deserves attention for three reasons. First, in the near future, theaters face new requirements to actively command and control a number of space assets. Second, command and control is key to optimization and integration of global space into the warfight. Third, there is an opportunity to further joint debate on the issue of space command and control with the on-going revision of Joint Publication 3-14, *Joint Doctrine for Space Operations*. Any improvement to space warfare, even on the margins, serves to meet the near-term challenge of maintaining the US's asymmetric advantage in space.

Theater space command and control is increasingly important, as the future portends the role of theater warfighters in space warfare evolving from passive consumers to active consumers *and* producers of space effects. First, many future global space assets, such as space radar, are designed for battlefield tasking and control. Battlefield tasking implies a need for real-time command and control processes that have not been required with past and current global space capabilities. Second, theater warfighters need to dynamically and swiftly detect, analyze, and neutralize an adversary's use of space or attempt to deny the US use of space. Space superiority implies a need for a comprehensive command and control process that allows the theater to plan, execute, and assess defensive and offensive counterspace operations. Finally, theater warfighters may receive operational control over space assets, ground and space-based, which will have to be commanded and controlled as any other asset provided to a joint task force commander. These organic assets should fit into the existing joint force command and control architecture to ensure effective integration across the joint force. The future of theater space command and control appears to be a significant departure from the past, with theaters not only concerned with the integration of global space but

responsible for the production and integration of theater space. In Chapter 3, today's theater command and control approach is applied tomorrow's space capabilities to determine how well current doctrine prepares the US military for future combat operations.

Space in Military Operations – Analysis Framework

The analysis in this paper seeks to inform one aspect of space warfare—the command and control of theater military space operations. An investigation compares the current theater command and control mechanism, the Space Authority, against a proposed Joint Force Space Component Commander. Three hypothetical examples assist in assessing the potential effectiveness of each construct: organic theater space forces, the space superiority mission, and battlefield control of global space assets.

Heuristic Thought Experiments

In this paper, effectiveness of the Space Authority and the proposed JFSCC construct are considered with regard to three hypothetical examples: theater organic space, space superiority, and battlefield control of global assets. In Chapter 3, the maturity of existing doctrine is assessed using the three hypotheticals. In Chapter 4, the potential of a functional component for space as an alternative command and control approach is considered. While analysis will address many doctrinal issues, the central concern is effective command and control that ensures US asymmetric advantage in space. The three cases are new aspects of space warfare that will directly affect theater operations over the next decade.

The first case concerns space-based assets transferred to theater with operational control, providing the theater with organic *on-orbit* space capabilities. For purposes of analysis, a joint force commander is given operational control of a constellation of microsatellites that provide imagery for the joint force.[4] In addition, the JFC receives operational control of several Air Force and Army near-space imagery and

[4] TacSat-1, a Department of Defense experimental microsatellite scheduled for launch in 2005, has both visible and infrared imaging payloads. See Maryann Lawlor, "Satellite Modularity Soars to New Height," *SIGNAL Magazine*, February 2005, n.p., on-line, Internet, 4 May 2005, available from http://www.afcea.org/signal/articles/anmviewer.asp?a=628&print=yes.

communication systems.[5] As described in the Air Force's Joint Warfighter Space (JWS) concept, space-based assets such as micro-satellites and near-space vehicles provide "dedicated, responsive space capabilities and effects to the Joint Force Commander in support of warfighting objectives."[6] According to General Lord, Commander of Air Force Space Command: "We want Joint Warfighting Space to be employed like any other theater asset."[7] To date, only a handful of ground-based space assets transfer to theater, such as the Joint Tactical Ground Station (JTAGS).[8] JWS introduces a new aspect to space operations, space-based assets that transfer to theater "to be employed like any other theater asset."

The second situation for consideration is one in which defensive and offensive counterspace operations are required to ensure space superiority. Defensively, the need for a joint force to protect access to space effects, such as GPS, is an obvious lesson learned from OIF. Future challenges could be more extensive with the DoD reporting: "China's current level of interest in laser technology suggests that it is reasonable to assume Beijing eventually could develop a weapon to destroy satellites."[9] Offensively, joint forces have a new offensive capability with the CounterComm system that can disrupt adversary access to communication satellites. For purposes of analysis, a JFC will face a GPS jamming threat and has operational control of a CounterComm system.

The third example looks at global space systems designed for battlefield control. New space capabilities, such as space radar, focus on generating effects to meet real-time operational and tactical requirements across the battlespace. The next generation of existing capabilities, such as space based missile warning, is also changing to meet the

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[5] Army developing a near-space asset for imagery (see US Army, *High Altitude Airship Fact Sheet*, n.p., on-line, Internet, 4 May 2005, available from http://www.smdc.army.mil/FactSheets/HAA.pdf) and Air Force working on a near space asset for communications (see Lt Col Richard Lane, "Near-space Demo Aims to Prove Boost in Combat Communications Ability," *Air Force Space Command News*, 8 March 2005, n.p., on-line, Internet, 4 May 2004, available from http://www.peterson.af.mil/hqafspc/News/News_Asp/nws_tmp.asp?storyid=05-070.)

[6] Senate, *Statement of General Lance W. Lord, Commander, Air Force Space Command, Hearings before the Senate Armed Services Committee, Strategic Forces Subcommittee*, 16 March 2005, 17.

[7] General Lance W. Lord, "Responsive Capabilities for Joint Warfighting Space," address to the Air Force Association's Air Warfare Symposium, Orlando FL, 17 Feb 2005.

[8] JTAGS is a mobile ground node that processes data from the space-based Defense Support Program satellite to provide in-theater missile warning. See Army Field Manual 40-1, *Joint Tactical Ground Station Operations*, 9 September 1999.

[9] Department of Defense, *FY04 Report to Congress on PRC Military Power* (Washington D.C., Office of the Secretary of Defense, 28 May 2004), 42.

needs of theater operations.[10] These future systems give the theater an unprecedented level of access to global space assets but require the theaters to take a more active role in command and control of global space assets. For purposes of analysis, a JFC has access to the space radar system and needs to provide battlefield control to ensure a robust integration of the system into theater operations.

Assumptions and Limitations

Assumptions and limitations focus this study on command and control of military space operations in future theater operations. While only one piece of the command and control issue (non-military space also plays a major role in theater operations), it provides a manageable and meaningful vehicle to gain insights on the maturity of space doctrine. Like eating an elephant, space warfare must be tackled one small piece at a time.

Assumptions

Three assumptions for this study address space integration, space acquisition, and joint doctrine. The first assumption is that the US continues to evolve towards space-enabled warfare, making space superiority a prime concern for effective theater operations. This assumption seems reasonable based on future military concepts and public statements from the Defense Department. The role of space in concepts such as network-centric operations and the Army's Future Combat Systems points to an increasing integration of space into all aspects of military operations. Public statements from the Department of Defense indicate a growing reliance on space. The 2005 US National Defense Strategy states: "As the nation's reliance on space-based systems continues to grow, we will guard against new vulnerabilities. Key goals, therefore, are to ensure our access to and use of space, and to deny hostile exploitation of space to adversaries."[11] The Army's perspective also stresses space: "The Army will increasingly rely on space-based capabilities that must be responsive, timely, and assured to joint

[10] SBIRS, with a new staring mode, can focus on small areas of interest vice scanning the entire earth. This provides improved performance to theater missile warning. See Air Force Space and Missile Center, *SBIRS Fact Sheet*, January 2005, n.p., on-line, Internet, 4 May 2005, available from http://www.losangeles.af.mil/SMC/is/pgs/downloads.html.

[11] Department of Defense, *The National Defense Strategy of the United States of America* (Washington D.C., Office of the Secretary of Defense, March 2005), 13.

warfighters."[12] As a final point, Air Force Secretary Roche stated in 2004: "We look at space support like oxygen. If you have it, you take it for granted. If you don't have it, it's the only thing you want."[13] Simply put, space superiority must be a theater priority in face of a growing joint force reliance on space.

It is further assumed that space radar, microsatellites, and near space assets will be acquired over the next decade. All three are in early stages of acquisition involving concept development and research and development activities.[14] It is difficult to speculate on their eventual disposition, given the vagaries of technical development and future budgets, but nothing appears to preclude development at this time. Even if these particular systems are not built exactly as planned, they represent a new approach to space that stresses integration at the operational and tactical levels of war. It is the role of the theater in command and control of this new generation of space capability, not the assets themselves, that most concerns the author.

The third assumption is that theater space operations exist independently of global space operations. The nature of space effects and current notions of command and control drive this perception. Space systems generate effects through the interaction of nodes connected by a link. There are two types of nodes, one ground-based and one space-based. A GPS satellite in orbit is a space node and a hand-held GPS receiver is a ground-based node. A link interconnects both nodes, usually based on radio frequencies that transmit information or data between the space and ground nodes. It takes a space and ground node, connected by a link, to generate a space effect. Often the space and ground nodes follow different C2 structures. The first example concerns the transfer of a ground node, JTAGS, to a theater to provide missile warning. The theater will have command and control of the JTAGS ground node, but not the on-orbit DSP satellites. The JTAGS, while dependent on the satellite data, is independent of global space

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[12] House, *Statement by Lieutenant General Larry J. Dodgen, USA, Commanding General, U.S. Army Space and Missile Defense Command and U.S. Army Forces Strategic Command, Hearings before the Committee on Armed Services, Strategic Forces Subcommittee*, 9 March 2005, 2.

[13] Peter Grier, "Space – The Next 50 Years," *Air Force Magazine* 88, no. 2 (February 2005): 70, n.p., on-line, Internet, 4 May 2005, available from http://www.afa.org/magazine/Feb2005/0205space.html.

[14] The Honorable Peter B. Teets discussed status of these capabilities in congressional testimony. See House, *Statement by The Honorable Peter B. Teets, Under Secretary of the Air Force, Director of the National Reconnaissance Office, Department of Defense Executive Agent for Space, Hearings before the Committee on Armed Services, Strategic Forces Subcommittee*, 9 March 2005, 7-14.

operations in that USSTRATCOM has nothing to do with integration of JTAGS into theater operations. Clearly, there is interdependence between the theater and USSTRATCOM that implicitly demonstrates the independence of theater space operations. A second example concerns the transfer of a space node, a microsatellite imaging satellite, for dedicated theater use. In this situation, a theater space operation of a global asset is independent of USSTRATCOM. A final example concerns GPS jammers and theater space superiority. The GPS jammers in Operation IRAQI FREEDOM focused on jamming the ground nodes of the GPS system, the terrestrial GPS receivers. The jammers did not affect the space node, the on-orbit GPS satellites. Given the jammers only affected theater operations, it seems logical that the theater would have the responsibility to deal with the jammers. Until a method to command and control *effects* is devised, US forces will continue to command and control *assets*. As long as space assets, ground nodes or space nodes, transfer to theater to produce space effects, then one must accept the notion of independent theater space operations.

The assumption of independent theater space operations is required as not all are convinced that theater space operations can exist as an independent entity conceptually or practically separate from global space operations. Some argue that space, unlike other mediums, cannot be split along geographic boundaries and simply given to theater warfighters. As one Air Force officer wrote, "space power is inherently global in nature."[15] Joint doctrine has yet to work through this debate, leaning towards global control but leaving open the potential for theater operations. It benefits the US to address this fundamental question before systems such as JWS and Space Radar become operational. Clear agreement on the issue not only informs doctrine but also sets the stage for how Services organize, train, and equip for space warfare.

Limitations

Several limitations simplify the problem set associated with command and control of theater space operations. First, the paper is unclassified. As such, not all aspects of space in warfare can be addressed. The cases selected for analysis appear to represent a complete sample of issues, however, and while a consideration of classified materials

[15] Lt Col Brian E. Fredriksson, "Space Power in Joint Operations," *Air & Space Power Journal*, Summer 2004, 86.

would provide a more complete analysis; its absence does not compromise the usefulness of this paper.

Second, the focus of this paper is on military space operations. As described earlier, military operations have grown to depend on any number of non-military space systems, ranging from NRO spy satellites to commercial communication systems. While non-military systems are critical to military operations, analysis focused on military space has two benefits. First, it considers those space systems most likely to stress theater command and control in the near-term, the new generation of capabilities designed for theater operations. Second, military space systems represent the least complex case for command and control. Military commanders can have command authority over military space assets, not so for the non-military assets. Military doctrine, at a minimum, must address the effective command and control of military assets.

Third, the focus on military space operations narrows further to theater space operations. Of course, the need to mature space command and control goes beyond theater operations. Global space command and control continues to be vital to maintaining the US advantage in space. USSTRATCOM retains centralized control of most military space systems, providing support to every theater warfighter. The maturation of space warfare makes global command and control more complex than the past. Future global systems such as space radar introduce a new paradigm for USSTRATCOM, decentralizing control of global space systems across multiple theaters. The need to apportion and deconflict a finite set of orbiting space assets for theater control, in real-time and continuously across several theaters, introduces a new level of complexity in global command and control. While the specifics are not part of this analysis, there is recognition that continued maturation of global space command and control is important to effective integration of space into theater operations. If one accepts the notion of interdependent theater and global command and control constructs, there is a further need to integrate multiple theater constructs with the global construct to ensure a seamless approach to space warfare for the nation. A mature space command and control approach would address theater, global, and their interdependency. Global space command and control has been maturing for decades, giving it a foundation of experience, doctrine, and resources. Theater space operations do not appear to have the

same foundation to build upon. By focusing on joint doctrine for theater space operations, the author hopes to inform a small piece of a much larger command and control discussion – the need for a command and control approach that ensures US strategic advantage in space.

Finally, this is an examination of joint doctrine. As such, service doctrine is not considered. While the Services have their own doctrine, such as Air Force Doctrine Document 2-2, *Space Operations*, joint doctrine takes precedence over service doctrine.[16] It is joint doctrine that guides joint operations. Limiting analysis to the joint doctrine focuses discussion on the main concern of this study—that the US military needs to mature its command and control approach for space to best integrate the growing role of space in theater operations. The JFSCC construct offers an alternative to the Space Authority but by no means represents the only possible avenue to a more mature command and control approach. Other constructs are possible, such as assigning space command and control to an existing functional component commander, perhaps the joint force land component commander or joint force air component commander. However, the first step in establishing any alternative is to recognize the need for an alternative. Getting the joint community to agree that its current command and control approach is immature is a small but necessary step towards a more mature approach to theater space warfare, whatever its final form.

Changing Role of the Theater in Space Operations

The current approach to command and control of theater space operations is immature because it does not account for the changing role of the theater in space operations. Theater warfighters are no longer just consumers of space effects; they are producers of space effects. A simple analogy highlights the impact this evolution should have on command and control. Today, if one wished to consume a pizza, all that is required is a phone call to the local pizzeria. In a similar vein, if one were a consumer of

[16] According to the joint doctrine for space operations: "If conflicts arise between the contents of this publication and the contents of Service publications, this publication will take precedence for the activities of joint forces unless the Chairman of the Joint Chiefs of Staff, normally in coordination with the other members of the Joint Chiefs of Staff, has provided more current and specific guidance." (Joint Publication 3-14, *Joint Doctrine for Space Operations*, 9 August 2002, i).

space effects all that is required is a list of requirements sent to USSTRATCOM. If you were going to make the pizza yourself, you would need ingredients, utensils, a recipe, and an oven. Likewise, a producer of space effects needs equipment, processes, and personnel to produce and integrate those effects into operations, i.e. requires an effective approach to command and control. Theater operators, with the number of space systems in design or development for theater control, face a requirement to produce, as well as order, space effects. The three hypothetical situations discussed in this paper each highlight the evolving need for theaters to produce space effects by planning, conducting, and assessing space operations. Microsatellites and near-space assets transferred to theater with OPCON make the theater, not USSTRATCOM, responsible for producing the space effects from those systems. Countering adversary systems, such as GPS jammers, necessitates a theater ability to plan, conduct, and assess defensive counterspace operations to ensure theater space superiority. Finally, satellites such as space radar require theaters, in real-time and on a continuing basis, to collect tactical requirements from across the joint force, allocate finite satellite resources against priority requirements, and execute battlefield control of global space systems. As the theater evolves into a dependent consumer and an independent producer of space effects, the command and control approach must address the theater's changing role in space warfare.

Theater space warfare is emerging from two streams of evolution in military space: the role of space in joint operations and role of the theater in space operations. As the Department of Defense Executive Agent for Space, the Honorable Peter B. Teets observed: "Space warfare can be compartmented into two types – the kind we are fighting now, and the kind we may find ourselves fighting in the future."[17] The future may see weapons in space, but according to Mr. Teets: "Real world space warfare, the kind we're involved in right now, uses space systems to enable and enhance terrestrial fighting."[18] Space warfare is a priority for a joint force commander (JFC) dependent on space-enabled warfare, lest space becomes a weakness of the entire joint operation.[19]

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[17] The Honorable Peter B. Teets, Under Secretary of the Air Force, "Two Types of Space Warfare," address to the Space Warfare Symposium, Air Force Association Lance P. Sijan Chapter, Keystone CO, 29 June 2004.
[18] Ibid.
[19] A joint force commander is responsible for a particular theater operation. For example, the JFC during Operation IRAQI FREEDOM was General Tommy Franks.

Likewise, space warfare is a priority should the JFC receive space assets for theater use. Space warfare is coming to theater, having nothing to do with weapons in space, but everything to do with optimization of theater and global space across the joint force.

The realization that the theater has a role in space warfare seems to be missing from joint doctrine. Joint Publication 3-14, *Joint Doctrine for Space Operations*, is the authoritative guide for the US military concerning space operations, and provides "guidelines for planning and conducting joint space operations."[20] The guidelines are particularly one-sided, focusing almost exclusively on global space operations. While there is no doubt that effective command and control of global space operations is vital to the US military, the strategic mindset that drove space development for decades may be hindering a more effective approach to theater space operations. A theater command and control construct built on the premise of the theater as a simple consumer is not just dated, but provides the joint warfighter with a suboptimal approach to space warfare.

Outline of the Thesis

This study began by tracing the evolution of space in military operations. Over the last six decades, space has become an integral part of US military operations at all levels of warfare. Military space, focused on the strategic level of war throughout most of the Cold War, has refocused on the operational and tactical levels of war. Space has become so basic to warfare that military forces and doctrines are now built around space capabilities, such as the Global Positioning System (GPS) for precision and satellite communications for networked operations. Finally, space capabilities are evolving to become an organic part of theater operations. This evolution points to the need for joint doctrine to address the space piece of a JFC's campaign.

In Chapter 2, the historical background of space operations relevant to joint doctrine is summarized. In Chapter 3, the maturity of the current theater command and control approach—the Space Authority outlined in JP 3-14—is assessed against three hypothetical situations. The first situation includes two space systems (microsatellites and near-space assets) given to the theater for dedicated use. These assets transfer to theater with operational control, like other types of military assets provided to the theater,

[20] Joint Publication 3-14, *Joint Doctrine for Space Operations*, 9 August 2002, i.

making the theater responsible for their operation and integration into joint operations. The second case concerns theater space superiority.[21] The JFC faces a GPS jamming threat and has operational control of a satellite communications jamming system. Defensively, the theater must respond to the GPS jammer given the potential interference with combat operations. Offensively, the theater must operate its own jamming system against adversary communication satellites, to include processes for approval and deconfliction with friendly satellites. The final speculative case involves a future space radar system, a global constellation of radar satellites designed for battlefield tasking and control. A hybrid system, shared globally but with real-time control in theater, requires the theater to integrate a dynamic global system into theater operations. A brief analysis indicates that the Space Authority construct is inadequate from both an operational and doctrinal perspective.

In Chapter 4, a Joint Force Space Component Commander (JFSCC) is considered as an alternative approach to theater space warfare. A functional component of the joint force, the JFSCC construct offered for analysis parallels the Joint Force Air Component Commander (JFACC). The JFSCC is then tested against the same three situations as the Space Authority. Analysis indicates that the JFSCC is a more mature, though not complete, approach to theater space command and control.

In Chapter 5, several challenges to the JFSCC construct are discussed. First, the JFSCC highlights that the debate over global or theater command and control of space must be resolved, first in doctrine and then in practice. Second, there is a larger command and control debate concerning the allocation of global resources in distributed operations—a debate that may challenge traditional command and control notions such as Operational Control (OPCON) or Tactical Control (TACON). Third, the question of who should serve as the JFSCC may be a political challenge to the construct. Finally, resource and timing issues in the form of cost, work force, standardization, and the timing of an operational JFSCC are likely challenges to the proposed functional component for space.

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[21] JP 3-14 defines space superiority as "The degree of dominance in space of one force over another that permits the conduct of operations by the former and its related land, sea, air, space, and special operations forces at a given time and place without prohibitive interference by the opposing force." (Joint Publication 3-14, *Joint Doctrine for Space Operations*, 9 August 2002, GL-6.).

In the closing chapter, the need to mature theater space command and control is summarized in terms of the evolution of space in military operations and the role of the theater in space warfare. Results of the analysis of the two approaches to theater space operations, the Space Authority and the JFSCC, highlight that a functional component for space provides a more mature, though not perfect, approach to theater space command and control. Finally, the challenges of the JFSCC offer a range of issues, from roles and responsibilities to resources, which must eventually be addressed to optimize space for the joint warfighter.

Conclusion

Space has transformed over six decades, from a strategic asset to a conventional force multiplier to an enabler of warfare. As the US integrates space into every aspect of military operations, the theater warfighter can no longer be a passive consumer of space effects. There is a space piece of the Joint Force Commander's campaign, and it must be worked just like the air, land, and sea pieces. In other words, the theater must have a command and control approach that ensures effective use of space in military operations. As General White stated in 1957, control of space gives the capability to control earth's surface. The question almost 50 years later: is the US warfighter prepared to control space?

Chapter 2

Space in Military Operations

There is in every battlefield a decisive point the possession of which, more than any other, helps to secure victory by enabling its holder to make a proper application of the principles of war.

Antoine-Henri Jomini

A review of space in US military campaigns provides the context for the three central observations on space described in the opening to this chapter: the focus of military space has evolved from the strategic level of war to the operational/tactical level, future military forces are being designed around space, and space assets are an organic part of theater military operations. Together, these observations point to space-enabled warfare with the need for a more operational and tactical approach to space in US military operations.

Evolution of Military Space: From Strategic to Operational/Tactical Level

Historical examples from three periods show the focus of military space evolving from the strategic to the operational and tactical levels of war. These periods are the Cold War, Operation DESERT STORM, and Operation ENDURING FREEDOM (OEF)/Operation IRAQI FREEDOM (OIF). The following review broadly discusses space during each these periods, including its relevance to military operations of the time, and draws out trends in the integration of space into warfighting. The evolution of military space highlights an almost transparent integration of space into warfighting best

summarized by a Marine during OIF: "I don't know much about this space stuff. You just give me my rifle and my GPS and I'll go kick butt anywhere."[22]

The Cold War

Space grew up as an integral part of the conflict between the United States and the Soviet Union. The space agenda, like almost every aspect of the military in the Cold War, aimed at the ideological conflict between the US and the Soviet Union. Three aspects of the Cold War highlight the evolution of space: strategic nuclear war, America's Vietnam conflict, and preparations for conventional warfare.

Strategic Nuclear Warfare

The US focused on strategic nuclear war as its primary means for national security during the early part of the Cold War. Space became a part of the strategic nuclear equation in the 1950s, providing effects that underpinned nuclear deterrence in the Cold War. Space missions focused on the Soviets in four main areas: intelligence, missile warning, communication, and weather.

Space-based reconnaissance provided the foundation of military intelligence during the Cold War, given the closed nature of Soviet society. United States intelligence satellites became a national priority when President Eisenhower approved the Corona program in February 1958, less than four months after the launch of Sputnik.[23] Corona was a joint Air Force and Central Intelligence Agency program that, after 12 failed launches, took the first image from space on 18 August 1960.[24] For the next twelve years, Corona satellites provided unprecedented access to the Soviet Union with over 800,000 images on 2.1 million feet of film.[25]

The information Corona provided on Soviet activities proved vital to American plans. Concerned with a nuclear surprise attack, the priority for the first successful Corona satellite was the Soviet military, its Intercontinental Ballistic Missile (ICBM)

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[22] Cited by General John P. Jumper, Chief of Staff, US Air Force, address to the Air Force Association's National Symposium, Los Angles, CA, 21 Nov 2003.
[23] "Corona System Information," National Reconnaissance Office, n.p., on-line, Internet, 4 May 2005, available from http://www.nro.gov/corona/sysinfo2.html.
[24] "Corona Fact Sheet," National Reconnaissance Office, n.p., on-line, Internet, 4 May 2005, available from http://www.nro.gov/corona/facts.html.
[25] Ibid.

systems in particular.[26] National technical means—a broad term for American spy satellites—proved its strategic value by showing conclusively that there was no missile gap with the Soviet Union. Imagery satellites also provided vital targeting information should the US have to respond to Soviet aggression. Finally, imagery provided the US with indications and warnings by monitoring Soviet military activities over time. Other satellites would provide immediate warning of a surprise Soviet nuclear attack.

Space-based missile warning provided the US time to respond to a Soviet nuclear attack, and that fact was vital to American deterrence credibility. The Missile Defense Alarm System (MiDAS) became the first space-based missile warning system, with twelve MiDAS launches between 1960 and 1966.[27] The Defense Support Program (DSP) replaced MiDAS in 1970 and continues to provide missile warning today.[28] Missile warning would become a key piece of technology in the doctrine of Mutual Assured Destruction (MAD).[29] Deterrence of a Soviet nuclear attack depended on a retaliatory strategy, where the US could detect and respond to a Soviet attack before being crippled by the nuclear attack. Space-based missile warning added five to eight minutes to the warning provided by ground based radar, allowing more US bombers to get airborne.[30]

Satellite communications (SATCOM), connecting different parts of the world, started to come onto the operational scene in the early 1960s. Unlike the highly classified intelligence satellites or the highly specialized missile warning systems, satellite communications provided a capability that was available and useful to a wide range of military users. The policy debate in the early 1960s over separate or combined civilian and military communication satellites ultimately resolved that the military would have separate systems, but could also leverage commercial systems in times of need, a policy

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[26] William E. Burrows, *This New Ocean: The Story of the First Space Age* (New York, NY: The Modern Library, 1998), 235.
[27] Defense Support Program Fact Sheet, US Air Force, May 2000, n.p., on-line, Internet, 4 May 2005, available from http://www.losangeles.af.mil/SMC/PA/Fact_Sheets/dsp_fs.htm.
[28] David N. Spires, *Beyond Horizons: A Half Century of Air Force Space Leadership*, revised edition (Maxwell AFB, AL: Air University Press, 1998), 160.
[29] Burrows, 226.
[30] Curtis Peebles, *High Frontier: The United States Air Force and the Military Space Program* (Air Force History and Museums Program, 1997), 32.

the US follows today.[31] Because of its obvious utility, commercial industry took the SATCOM lead in the early 1960s, providing the first geostationary communications satellite in 1963.[32] The military developed counterparts, with the first of the Initial Defense Communication Satellite Program (IDCSP) launched in 1966.[33] ISCSP was fully operational in 1968, with each of 28 satellites providing the capacity for 10 voice circuits (or 1 Mbps of data) communicating with large ground stations.[34] Intended for strategic military communications between fixed bases, IDCSP provided service through the mid-70s.[35] A final aspect of early space, weather satellites, also focused on supporting strategic operations.

Weather satellites, too, were originally deployed for support to the strategic level of war. In particular, the state's imaging satellite needed timely meteorological assessment as they could not image through clouds.[36] An early civil/military debate over weather satellites, as with communications satellites, recognized a need for dedicated military weather satellites. The Defense Satellite Applications Program (DSAP), the first military weather satellite, launched in 1962 with four satellites placed in orbit over the next two years.[37] In 1973, the system would be unclassified and renamed the Defense Meteorological Satellite Program (DMSP). DMSP remains active today, providing weather support to US military operations.

Clearly, military space in the 1950s and 1960s was focused on the strategic nuclear level of war. Perhaps unfortunately, supporting policy and technical developments in the early 1960s continue to shape perceptions of space today. On the policy side, the classified nature of the early military space programs protected them from compromise, but tended to limit who had knowledge of and access to the benefits of the system. On the technology side, satellites were literally rocket science. These systems were each a one-of-a-kind creation that pushed the boundaries of technology. Policy and

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[31] Donald H. Martin, "A History of U.S. Military Satellite Communication Systems," *Crosslinks* 3, no.1 (Winter 2001/2002): 7, n.p. on-line, Internet, 4 May 2005, available from http://www.aero.org/publications/crosslink/winter2002/01.html.
[32] Burrows, 229.
[33] Martin. 8.
[34] Ibid. 9.
[35] Peebles, 47.
[36] Spires, 147.
[37] Burrows, 271.

technology combined to compartmentalize space at the strategic level of war, as specialized systems focused on solving the most pressing strategic issues. Unlike tanks and aircraft, battlefield use was not a priority for early satellite systems. This strategic mindset set a tone for space development and operations that remains largely unchanged today.

The relevance of the early US space program to the military campaign was vastly different between the levels of war. Space was highly relevant at the strategic nuclear level, providing a technical means for nuclear deterrence with intelligence and missile warning. However, due to compartmentalization and strategic mindset, space was almost non-existent at the operational and tactical levels of war. The Vietnam War offered an opportunity to see what space could offer to the warfighter on the battlefield.

Vietnam

With American involvement in Vietnam, the US military fought communism at two different levels of war: the on-going nuclear strategic campaign against the Soviet Union and a less than major conventional campaign in Southeast Asia. Space was a part of each campaign, though not in equal measure. Space capabilities evolved to the next generation of systems, improving performance of strategic assets and starting to address the operational and tactical use of space.

Space during the Vietnam conflict, though used operationally to some degree, remained primarily focused on the strategic nuclear campaign, and improvements to US space capabilities continued to support nuclear deterrence. Space-based missile warning improved when the geosynchronous Defense Support Program (DSP) replaced MiDAS in 1970.[38] Communication satellites also improved for the strategic user in 1971, with the introduction of second phase of the Defense Satellite Communications System (DSCS), increasing the number of voice circuits from 10 to 1300 per satellite.[39] US national technical means became part of the US/USSR arms control regime, as a methodology for verification of the 1972 SALT I accords.[40] Finally, day and nighttime performance of the

[38] Spires, 160.
[39] Ibid, 142.
[40] Paul B. Stares, *Space and National Security* (Washington D.C.: The Brookings Institution, 1987), 145.

DMSP weather satellites improved with new optics and sensors.[41] Though designed for strategic needs, these systems would increasingly benefit operations in Vietnam.

Space effects began to appear in theater military operations during this time, with the US leveraging communication and weather satellites at the operational level of war. Communication satellites enabled the theater to reachback to the Continental US (CONUS) for command and control, and for intelligence support. The military's Initial Defense Communications Satellite Program provided several circuits for voice and data, to include transmission of imagery intelligence from Washington, D.C. to Saigon.[42] The commercial Communications Satellite Corporation leased circuits for "routine administrative and logistical needs" within the theater of operations.[43] SATCOM to the tactical level (ships, aircraft, and land forces) got attention with the success of the TACSAT program. TACSAT, launched in 1969, was a single satellite at near-synchronous orbit that provided 40 UHF voice circuits working with ground antennas as small as three feet in diameter.[44] Weather satellites also provided battlespace awareness that shaped operations. Given the impact of poor weather on air operations, the DMSP weather satellite helped commanders optimize the use of airpower in response to the ever-changing environment.[45] Target selection, mission plans, and ordnance selection were based on DMPS data.[46] The Vietnam conflict did not integrate space into the cockpit or foxhole, but it did support the warfighter at operational level. A humble beginning, but it demonstrated the potential of space in theater warfighting.

The US space program during the Vietnam conflict remained highly relevant at the strategic nuclear level and demonstrated potential at the operational level of war. Vietnam, even with limited space integration, offered a glimpse into the potential of space at the operational level of war. This potential grew in importance as the US moved towards a major conventional approach to dealing military with the Soviet Union.

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[41] Spires, 148.
[42] Spires, 170.
[43] Ibid, 171.
[44] Ibid, 145.
[45] Ibid, 170.
[46] Peebles, 53.

Conventional Warfare

As US involvement in Vietnam winded down, the US shifted from a nuclear to a conventional approach to defeating the Soviet Union on the battlefield. Concepts such as Airland Battle, with the Air Force closely supporting the Army's ground operations, sought to provide a viable means of stopping a Soviet invasion of Europe without going nuclear. Space capabilities blossomed, providing vastly improved and even new space effects for military operations. Integration of space into all levels of war took on new emphasis, as the military sought any advantage to defeat large numbers of Soviet forces.

Space capabilities fielded after the Vietnam War reflected a maturing of existing technologies and the introduction of new systems for the warfighter. Intelligence satellites continued to monitor the Soviet Union. A new type of spy satellite, an electro-optical imaging satellite, went operational in 1977.[47] The NRO had produced "an electronic "eye" that was able to convert light waves into electrical signals that could be relayed to Earth in near-real time," a revolutionary improvement over the less responsive film-based Corona system.[48] Improved versions of the DSP satellite continued to provide missile early warning. Communication satellites grew in capability and capacity, with a third generation of DSCS providing more communication channels and improved security with jam-resistance and nuclear hardening.[49] Tactical SATCOM came to fruition, with the first FLTSATCOM going operational in 1977.[50] Congressional direction in 1976 and 1977 for the Department of Defense (DoD) to lease commercial satellite services resulted in the LEASAT program, intended to replace the FLTSATCOM program.[51] The dedicated military weather satellite, DMSP, was upgraded with new on-board computers and several new sensors.[52] The Global Positioning System (GPS) started to come on-line during the 1980s, with fifteen of the planned twenty-four satellites in-orbit by 1990.[53] This latter capability was designed to provide timing and navigation

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[47] National Commission for the Review of the National Reconnaissance Office, *The NRO at the Crossroads* (Washington D.C., 1 Nov 2000), 120.
[48] Ibid, 119. The older system required that film be returned to earth (deorbited) for retrieval and processing.
[49] Spires, 184.
[50] Martin, 11.
[51] Ibid.
[52] Spires, 186.
[53] Peebles, 58.

data for the DoD. In addition, new technologies developed during this period to challenge the notion of the unhindered use of space.

Anti-satellite and missile defense technology appeared in the late 1970s and 1980s, adding a new wrinkle to the military use of space. The Soviet Union tested an anti-satellite capability in 1976, raising the concern of the vulnerability of US satellites.[54] The US responded with the development of an anti-satellite capability launched from an F-15.[55] In the early 1980s, President Reagan's Strategic Defense Initiative, dubbed "Star Wars" by critics, was conceived to provide a space-based defense against strategic ballistic missiles. As with anti-satellite technology, the prospect of putting weapons into orbit challenged the notion of space for peaceful purposes. Militarization of space—the military use of space for intelligence, communications, and other purposes—had become accepted practice. Nonetheless, many hotly rejected even the notion of a military conflict in space. While the debate over space weaponization continues, anti-satellite and missile defense technologies did make one thing clear, the US could no longer assume the freedom to operate in space uncontested.

During the late 1970s and 1980s, the military began to focus technically and organizationally on getting space into the hands of the warfighter. On the technical side, programs such as the Tactical Exploitation of National Capabilities Program (TENCAP) sought to make national space capabilities available at the tactical level. A US Army program originally, Congress mandated a TENCAP program in every Service in 1977.[56] Army programs include deployable systems for in-theater processing and exploitation of signals and imagery intelligence.[57] The Navy also sought to exploit national systems with the Fleet Imagery Support Terminal (FIST). Deployed in the early 1980s, FIST provided a limited capability to download national imagery via communication satellite for shipboard exploitation.[58] Organizationally, the Air Force sought to normalize, or

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[54] Spires, 188.
[55] Stares, 99.
[56] US Army, *Army Space Reference Text*, n.p., on-line, 4 May 2005, available from http://www-tradoc.army.mil/dcscd/spaceweb/chap2_im.htm.
[57] William Messer, "Getting Space-Based ISR Data to the Warfighter," *Military Review*, November-December 2001, 42.
[58] Gary Federici, *From the Sea to the Stars: A History of U.S. Navy Space and Space-related Activities* (Washington D.C.: Naval History Center, June 1997), n.p., on-line, 4 May 2005, available from http://www.history.navy.mil/books/space/Chapter4.htm.

operationalize, space functions in order to better support the warfighter. Air Force Space Command (AFSPC) was established in 1982 as an "operational advocate and honest broker for USAF space systems."[59] Even with the stand up of AFSPC and TENCAP programs, space support to the warfighter remained a challenge. General Thomas Moorman, former Commander of Air Force Space Command, wrote regarding space operations in the 1980s: "Although space systems were used in operations Urgent Fury (Grenada), El Dorado Canyon (Libya), and Just Cause (Panama), the employment was incomplete and often ad hoc."[60] Operation DESERT STORM would be the litmus test for nearly two decades of tweaking strategic space systems to provide tactical effects on the battlefield.

As the Cold War ended, space was becoming more relevant at all levels of war. With the de-emphasis of strategic nuclear war, the space focus started to shift towards integration at operational and tactical levels of war. The Services sought to leverage space at the operational and tactical levels, making the best use of existing strategic systems, and using commercial systems to make up for military shortfalls. Organizational changes such as the creation of Air Force Space Command underlined the growing importance of space to military operations. In response, the military had spent the late 1970s and 1980s organizing and equipping space for the battlefield, and their efforts faced a tough test in the sands of Middle East in 1991.

Operation DESERT STORM

Operation DESERT STORM, the liberation of Kuwait in 1991, was widely touted as America's first "space war".[61] An unprecedented array of space systems was available to the warfighter, ranging from commercial imagery to missile warning. Battlefield integration, however, remained less than optimal. Numerous lessons learned highlighted the shortfalls and set the agenda for improvements to US space capabilities throughout the 1990s.

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[59] Spires, 205.
[60] Lt Gen Thomas Moorman, "Space: A New Strategic Frontier," *Airpower Journal*, Spring 1992, n.p., on-line, 4 May 2005, available from http://www.airpower.maxwell.af.mil/airchronicles/apj/moor.html.
[61] Department of Defense, *Operations DESERT SHIELD and DESERT STORM Assessment* (Colorado Springs, CO: US Space Command, January 1992), 2.

Desert Storm was the first US conflict in which space was broadly utilized at the operational and tactical levels of war. Space provided the military with a vital support infrastructure that was not available in theater. Military commanders would leverage weather and communications, as did their counterparts in Vietnam, but they also enjoyed access to space capabilities such as missile warning, commercial imagery, and navigation and timing. The existing space assets, designed primarily for the strategic nuclear campaign of the Cold War, required innovative approaches to provide space effects on the battlefield.

Weather, as had been the case in Vietnam, was a critical issue, and the military again turned to the DMSP satellite for the weather picture. Operation DESERT STORM experienced the worst local weather in 14 years, with poor visibility affecting air operations from delivery of laser guided bombs to battle damage assessment.[62] Space-derived weather data was so vital to the military campaign that the Joint Force Air Component Commander, responsible for air operations, kept "a light table next to his desk to review the latest DMSP data."[63] Even the Air Tasking Order (ATO), the daily plan for the air component of the war, waited on the latest DMSP data before finalization.[64] DMSP support to ground operations was equally important. DMSP showed sand storms and smoke from the burning oil fields. It even facilitated the famous "left hook," providing planners with data on the moisture content of the soil, thereby ensuring selected routes were able to carry the weight of the ground advance.[65] Space-based weather enabled planners and commanders to optimize military operations during Operation DESERT STORM.

Communication satellites took on a new importance in Operation DESERT STORM. According to the final DoD report: "For the first time in history, satellite communications for both inter- and intra-theater played a major role in the combat forces' deployment, support, and C2."[66] Inter-theater SATCOM provided over 90

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[62] Department of Defense, *Conduct of the Persian Gulf War: Final Report to Congress* (Washington D.C.: April 1992), 227-228.
[63] Ibid, 228.
[64] Ibid.
[65] Benjamin S. Lambeth, "The Synergy of Air and Space," *Aerospace Power Journal*, Summer 1998, n.p., on-line, Internet, 4 May 2005, available from http://www.airpower.maxwell.af.mil/airchronicles/apj/apj98/sum98/lambeth.html.
[66] DoD, *Conduct of the Persian Gulf War*, K-31.

percent of communications into theater, with commercial satellites providing 24 percent of that capability.[67] Long-haul communications facilitated reachback, obtaining out-of-theater support for issues such as logistics, command and control, and intelligence. Intra-theater SATCOM was also vital, given the lack of communications infrastructure in theater and the vast size of the theater operation, equivalent in size to half on the continental US.[68] The final DoD report found that military satellite communications (MILSATCOM) "formed the C2 backbone and highlighted the growing dependence on MILSATCOM."[69] DSCS provided 75 percent of the inter-theater communications.[70] FLTSATCOM provided approximately 95 percent of the Navy's message traffic. NATO and British military satellites, and several commercial satellites, also supported in-theater communications.[71] SATCOM connected the theater and ensured the effective command and control of a widely dispersed force. Ultimately, 10 different military and commercial satellite communication systems were integrated into all aspects of combat operations.[72]

For the first time, the Defense Support Program provided missile warning for theater operations. Originally designed to detect large intercontinental ballistic missiles, DSP proved capable against much smaller Iraqi Scud missiles in the Gulf War.[73] DSP played an important role as the primary Scud launch detection system, given the operational and political concerns with Iraqi Scuds.[74] Operationally, chemical weapon delivery against coalition troops was a major concern, and adequate warning would provide troops time to put on chemical gear. Politically, the viability of the coalition depended on Israel staying out of the conflict, translating into a battlefield need to prevent Scuds from reaching Israel. Missile warning provided Patriot antimissile batteries time to acquire and engage Scuds launched at Israel or coalition troops.[75] DSP also provided a launch location, helping Coalition airpower target the Scud launchers.

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[67] DoD, *Operations DESERT SHIELD and DESERT STORM Assessment*, 49.
[68] Ibid., 8.
[69] DoD, *Conduct of the Persian Gulf War*, K-31.
[70] Ibid, K-32.
[71] DoD, *Operations DESERT SHIELD and DESERT STORM Assessment*, 50.
[72] Ibid, 4.
[73] US Air Force, *Defense Support Program Fact Sheet*, May 2000, n.p., on-line, Internet, 4 May 2005, available from http://www.losangeles.af.mil/SMC/PA/Fact_Sheets/dsp_fs.htm.
[74] DoD, *Conduct of the Persian Gulf War*, 240.
[75] Ibid, K-49.

While requiring many procedural, software, and communication architecture changes, DSP ultimately proved its value to the warfighter on the battlefield.

Space-based intelligence from national and commercial satellites directly supported military operations during Operation DESERT STORM. While imagery was "vital to Coalition operations" for targeting (precision guided munitions) and battle damage assessment, the DoD reported that the theater's "insatiable appetite for imagery and imagery-derived products could not be met."[76] National systems provided detailed imagery, but covered only small areas with highly classified imagery that limited distribution.[77] Warfighters also leveraged commercial imagery for a variety of purposes, ranging from map production to planning and executing strike operations.[78] The Coalition used imagery from US owned LANDSAT and French owned SPOT satellites, which provided less detailed imagery but covered larger areas. The unclassified nature of LANDSAT and SPOT imagery eased distribution and use across the battlefield. Operation DESERT STORM demonstrated a growing integration of space-based intelligence capabilities, both national and commercial, onto the battlefield.

The Global Positioning System (GPS) provided space-based navigation and positioning data to all Coalition forces. The DoD found that GPS "played an important role in success of the overall operation."[79] Every warfighter leveraged GPS. For the land forces, GPS enabled navigation across the featureless desert. Air forces were able to bomb targets at night and in bad weather.[80] GPS improved the performance of the Navy's Tomahawk Land-Attack Missiles.[81] Special Operations forces even played GPS guide for the Army. During the first hours of Operation DESERT STORM, Army Apache attack helicopters followed GPS equipped Pave Low helicopters into Iraq to open a hole in the Iraqi air defense network by destroying two Iraqi radar sites.[82] GPS effects, integrated throughout the battlefield, translated into a combat advantage for Coalition forces.

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[76] Ibid, C-8.
[77] Spires, 263-264.
[78] DoD, *Operations DESERT SHIELD and DESERT STORM Assessment*, 4.
[79] DoD, *Conduct of the Persian Gulf War*, K-41.
[80] Department of Defense, *Desert Storm Hot Wash* (Colorado Springs, CO: Air Force Space Command, 12-13 July 1991), 4.
[81] DoD, *Conduct of the Persian Gulf War*, K-41.
[82] Spires, 257.

Coalition forces engaged in counterspace operations during Operation DESERT STORM, aimed at denying Iraqi use of space. The US and France agreed not to sell LANDSAT and SPOT imagery to Iraq.[83] Coalition aircraft targeted and destroyed Iraqi satellite ground stations, denying the Iraqi's access to satellite communications.[84] While Iraq had only modest access to space effects, the coalition understood that even modest access could provide military advantages. Space-based imagery forewarning deployments for the left hook maneuver, for example, would certainly been of value to the Iraqi military. Coalition actions to gain and maintain space superiority provided them a combat advantage throughout Operation DESERT STORM.

DESERT STORM highlighted several trends in space operations. First, there was a major challenge to get space effects into the tactical, battlefield users hands. Warfighters needed small, mobile ground systems with which to exploit the effects produced by the satellites in orbit. The limited number of weather terminals in theater were transportable, the size of tractor-trailers, but not small enough to be truly mobile. Therefore, Army and special operations units did not have direct access to DMSP weather data.[85] SATCOM often required large antennas, forcing maneuvering ground forces to go without SATCOM until they could stop and setup their antennas. Given a theater missile warning process was non-existent, a communication architecture had to be created to get missile warning data to the tactical users. A supplemental voice warning system, transmitted on a radio net, was necessary as not everyone had the required computer equipment to receive the warning.[86] A lack of SATCOM and incompatible imagery processing systems (each Service had their own systems) hindered electronic dissemination of national intelligence to tactical commanders.[87] Finally, troops arrived in theater without GPS receivers. The US government bought thousands of commercial, non-crypto capable GPS receivers, rushing them to combat units and ultimately equipping almost 90 percent of the force with commercial receivers.[88]

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[83] DoD, *Operations DESERT SHIELD and DESERT STORM Assessment*, 40.
[84] James M. Burlingame *et al*., *Grey Space and the Warfighter*, March 1997, n.p., on-line, Internet, 4 May 2005, available from http://www.au.af.mil/au/awc/awcgate/grayspc/index.htm#TOC.
[85] DoD, *Operations DESERT SHIELD and DESERT STORM Assessment*, 38.
[86] Ibid. 23.
[87] DoD, *Conduct of the Persian Gulf War*, C-9.
[88] Ibid. K-42.

The second trend highlighted by combat operations was the obvious fact that US military space systems were optimized for the strategic environment of the Cold War. For example, imagery intelligence provided by national systems did not satisfy the military's need for large area collection or dissemination to tactical users. While satellite shortfalls, equipment shortages, and incompatibilities are tangible signs of a strategic focus for space, less obvious is the cultural and operational impact. The approach to missile warning, for example, differs between the nuclear strategic mission and conventional theater operations. In the nuclear strategic mission, accuracy is paramount given the potential repercussions of an anomalous missile launch warning. In theater operations, where missile flight times are shorter and repercussions of an anomalous warning less severe, timeliness is paramount. The space operator had to accommodate these very different approaches. Likewise, after decades of treating space as a set of compartmentalized strategic assets, DESERT STORM challenged the military's mindset about space.

The final trend, in some measure a result of the first two, was the need to augment military space resources with commercial and civil systems. Commercial satellites, both US and foreign, were leveraged to provide imagery and communications for the warfighter. Commercial GPS receivers were perhaps too significant to the overwhelming success of GPS on the battlefield. While commercial augmentation provided needed capability, it also introduced challenges that continue in 2005. First, commercial systems, generally used in permissive environments, may be unable to resist jamming or disruption from an adversary. Fortunately, the Iraqis did not exploit these vulnerabilities. Secondly, the US put itself into the position of depending on nonmilitary resources to provide effects on the battlefield. Doing so raises questions of availability, reliability, and accountability. Given these assets reside outside of the traditional military chain of command, who is ultimately responsible for the effects they do or do not provide to the warfighter? Finally, Coalition use of commercial space systems raised concern over the Iraqi's use of the same capability. Steps were taken to maintain space superiority, informing the military that space was no longer a superpower privilege.

The US spent the 1990s addressing the trends observed during DESERT STORM. First, satellite communications focused on improving availability and bandwidth for the

warfighter. The MILSTAR satellite program, started in 1981 to provide communications in a nuclear exchange, refocused to provide secure, jam resistant communications to warfighters on the battlefield.[89] The need for higher capacity satellite communications to deployed tactical users with small antennas resulted in a new program, the Global Broadcast System (GBS).[90] GBS technology is similar to that used for commercial direct broadcast satellite television, such as DirecTV and Dish Network. Second, space-based missile warning focused on providing improved detection of smaller missiles, initially with improvements to ground processing systems. Acquisition began on a new generation of missile-warning satellite, the Space-Based Infrared System (SBIRS), designed with new sensors to better support the warfighter.[91] Third, the GPS satellite constellation was complete by 1994, providing improved navigation, position, and timing data across the globe.[92] Finally, given the success of commercial imagery during military operations, Congress passed a law in 1992 to ensure the development of another LANDSAT.[93] US space systems, after decades in the strategic domain, were being refocused to the operational and tactical levels of war.

As Operation DESERT STORM clearly demonstrated, space was increasingly more relevant to the conventional battlefield. Terms such as "major role" and "vital to Coalition operations" being used to describe various space effects in the DoD's final report on DESERT STORM set an expectation for space to be part of future major conventional and contingency operations. DESERT STORM foreshadowed space as the technical foundation for conventional military operations: MILSATCOM "formed the C2 backbone", military plans hinged on DMSP weather data, DSP was the primary means of missile warning, and GPS provided the entire force a reliable means of navigation. While space effects were useful on the battlefield, they were not optimized for the warfighter,

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[89] Alexander H. Levis, *The Limitless Sky: Air Force Science and Technology Contributions to the Nation* (Air Force History and Museums Program, 2004), 188-191.
[90] Ibid, 197.
[91] Air Force Space and Missile Center, *SBIRS Fact Sheet*, January 2005, n.p., on-line, Internet, 4 May 2005, available from http://www.losangeles.af.mil/SMC/is/pgs/downloads.html.
[92] Scott Page *et al*., *The Global Positioning System: Assessing National Policies*, RAND Report MR-614-OSTP (Santa Monica, CA: RAND, 1995), 246.
[93] *Land Remote Sensing Policy Act of 1992*, Public Law 555, 102d Cong., n.p., on-line, Internet, 4 May 2005, available from http://geo.arc.nasa.gov/sge/landsat/15USCch82.html.

particularly at the tactical level. Developments during the 1990s, focused on a tighter integration of space effects, were tested as the US returned to the theater in 2001.

Today's Global Infrastructure: Operation ENDURING FREEDOM / Operation IRAQI FREEDOM

The terrorist attacks of September 11, 2001, shocked the US and set in motion a new approach to national security. Deterrence, a strategy born of the Cold War, appeared less than effective in light of 3000-plus American deaths in the homeland. A policy of preemption, taking the fight to its enemies before they had the opportunity to strike, took center stage. Operation ENDURING FREEDOM (OEF) and Operation IRAQI FREEDOM (OIF) took the fight to the enemy, in Afghanistan and Iraq respectively. Space on the battlefield came of age in OEF/OIF, prompting Secretary of the Air Force James Roche to state: "For the first time in our history, space has become an equal partner with air-breathers."[94] Space, integrated into all aspects of combat operations, provided the technical underpinning for military operations. Space provides a global capability that is vital to today's national security, enabling preemptive military action wherever and whenever needed, from the remotest desert locations to crowded urban cities.

Integration of space effects, more than the satellites themselves, was the driving factor behind the success of space on the battlefield in OEF/OIF. The battlefield integration issue from DESERT STORM had been largely addressed through the 1990s, providing much improved space access for the warfighter that is being exploited in new ways. The following OEF/OIF examples suggest that space does more than support combat operations; it is an integral part of combat operations.

The Global Positioning System is the centerpiece of a precision revolution in US military operations. The Chairman of the Joint Chiefs of Staff, General Myers, told Congress in 2004 that "over the last decade, the success of combat operations was largely due to GPS-aided precision-guided munitions."[95] Precision-guided munitions, such as

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[94] The Honorable James G. Roche, Secretary of the Air Force, address to the 19th National Space Symposium, Colorado Springs, CO, 9 Apr 2003.

[95] Senate, *Statement by General Richard B Myers, USAF, Chairman of the Joint Chiefs of Staff, Senate Committee on Appropriations, Defense Subcommittee, Hearing on the President's FY05 Budget Request for the Department of Defense*, 12 May 2004.

the GPS-aided Joint Direct Attack Munition (JDAM), have ushered in a new era of airpower. Precision, according to an Air Force Air Combat Command briefing, "redefines the concept of mass."[96] Airmen no longer speak of the number of airplanes they will have to send to destroy a target. Instead, they talk about the number of targets one airplane will destroy. Further, GPS-guided precision munitions can make any airplane that can carry a bomb an all-weather, day/night capable weapon system. A B-52 flying at 15,000 feet and providing close air support to ground troops is a long-way from the days of carpet-bombing in Vietnam. The trend to precision warfare is astonishing in its ramifications. About 70 percent of OIF munitions were precision, compared to around 10 percent during DESERT STORM.[97] GPS was equally important to ground operations in OEF/OIF, with new capabilities such as Blue Force Tracking introduced across the battlefield. Blue Force Tracking, leveraging GPS and satellite communications, tracks the location of friendly forces to provide situational awareness, improve command and control, and minimize friendly fire incidents. Due to battlefield success during OIF, a Joint Blue Force Tracking architecture is being built to ensure interoperability across the US military.[98] The integration of GPS into numerous weapon systems reflects the US military's growing reliance on space systems.

Satellite communications were also integral to combat operations in OEF/OIF. Usage rates tell one story: OIF experienced an 800 percent increase in bandwidth compared with DESERT STORM.[99] The more interesting story is how that bandwidth provided combat effects in air and ground operations. The first anecdote comes from operations in OEF and highlights the global nature of space. A combat controller, horseback in Afghanistan, called for close air support using a laptop computer connected via SATCOM (and passing GPS coordinates). Overhead, a B-52 released a string of

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[96] Col Gray Crowder, Effects based operations briefing, 19 March 2003, n.p., on-line, Internet, 4 May 2005, available from http://www.defenselink.mil/news/Mar2003/g030318-D-9085.html.
[97] Levis, 19.
[98] Dawn Onley, "Army takes the lead on Blue Force Tracking system," *Government Computer News*, 20 May 2003, n.p., on-line, Internet, 4 May 2005, available from http://www.gcn.com/vol1_no1/daily-updates/22133-1.html.
[99] Peter B Teets, Undersecretary of the Air Force, "National Security Space in America's Strategic Space Forces," address to the Strategic Space 2003 Conference, Omaha NE, 3 Sept 2003.

bombs that killed 200 Al-Qaida.[100] Space, in the austere mountains of Afghanistan, provided the technical architecture for combat operations.

The success of SATCOM in ground operations, integrated at the tactical level, is equally revealing. Used in OIF, satellite communications made "long-distance, real-time coordination and conferencing possible and gave tactical commanders an increased degree of command and control over their units."[101] The US Army is even changing doctrine to capture the impact of satellite communications. According Lt Gen Boutelle, the US Army's Chief Information Officer: "Battle command doctrine is being shaped by the ability to have 'live' situational awareness while communicating and collaborating on-the-move via a space-based network."[102] Communication satellites, just like GPS, are opening new approaches to US warfighting. These new approaches, dependent on space, make the need to protect US access to space a priority for the theater warfighter.

Iraq directly challenged US space superiority with counterspace operations during OIF. Iraq deployed several Russian-built GPS jammers to deny Coalition forces access to GPS. Fortunately, like any jamming device, the systems were readily detected, and on the first day of OIF were destroyed with GPS-aided munitions from F-117 and B-1 aircraft.[103] Iraqi use of GPS jammers prompted the Secretary of the Air Force James Roche to comment, "the proverbial first shot of space warfare has been fired."[104] Iraq's unsophisticated counterspace efforts serve notice that an adversary will challenge US access to space—space superiority can no longer be assumed. The US military must be prepared to gain and maintain its access to space and deny the benefits of space to adversaries.

The battlefield role of space in OEF/OIF challenges the traditional view of space as a strategic asset. In the past, space systems were tweaked to provide surplus or spillover benefit to operational and tactical operations. Today, we see terrestrial combat systems designed around space. In Operation DESERT STORM, GPS often improved

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[100] General John P. Jumper, Chief of Staff, US Air Force, "Future Force: Joint Operations," address to the Air Armaments Summit VI, Sandestin, FL, 17 March 2004.
[101] AUSA Background Brief, "Army Space Forces – Enabling the Joint Warfighter," October 2004, 5.
[102] "Interview with Lt. Gen. Steven W. Boutelle, USA," CHIPS magazine, Fall 2003, 20, n.p., on-line, Internet, 4 May 2005, available from http://www.chips.navy.mil/archives/03_fall/PDF/boutelle.pdf.
[103] Levis, 20.
[104] James G. Roche, Secretary of the Air Force, address to the AFA National Symposia, Orlando, FL, 14 February 2003, n.p., on-line, Internet, 4 May 2005, available from http://www.aef.org/pub/roche203.asp.

combat effectiveness by getting the weapon system to the target area. In OEF/OIF, GPS improved combat effectiveness by being part of the weapon system. Communication satellites, once reserved for strategic users, are now providing real-time command and control of ground units at the tactical level. Adversary counterspace actions seek to disrupt US operational and tactical advantages from space. The evolution of space as a global infrastructure that is leveraged through all levels of US military operations makes space an organic part of combat operations. This requires a fundamental shift in how the military thinks about space. Space must become an equal partner in warfare so it does not become an asymmetric disadvantage to the US in the future.

The Future: Space-Enabled Warfare

Space-enabled warfare is about the integration of space into warfare. It is the *integration* of space capabilities into air, ground, and sea operations that is transforming how the US fights in those mediums. That fact alone will drive the military conflict into the space medium. As Air Force Major General Robert Kehler commented in 2003, "by the time you get to the 2000s and have come a dozen years from Desert Shield and Desert Storm, what we really are talking about is space-enabled warfare and not just using space as a force enhancer."[105] This assessment has profound implications for the US military. The most important is the absolute need to fight the space component of the military campaign.

The future of US space confirms the acceleration towards space-enabled warfare. The traditional missions of intelligence, missile warning, communications, weather, and navigation and timing continue to provide the global architecture for military operations. New capabilities, such as the counter communication system, allow the warfighter to focus combat effects into space. Systems in development, such as space radar, near space operations, and microsatellites, put space systems directly into the hands of the warfighter. Given this increased reliance and capability, adversaries will actively seek to leverage their own space benefits and to undermine US space advantage.

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[105] Maj Gen Robert Kehler, "Space Enabled Warfare," *RUSI Journal*, August 2003, n.p., on-line, Internet, 4 May 2005, available from http://www.findarticles.com/p/articles/mi_qa3727/is_200308/ai_n9241425.

First, the US military is leveraging the space global architecture to exploit a network approach to warfare. In a 2001 report to Congress, DoD stated: "In the future, the network will be the single most important contributor to combat power."[106] The Predator Unmanned Aerial Vehicle (UAV) is a prime example of this new approach. The Predator is flown from the US, imagery exploitation occurs in a second location in the US, and an in-theater Air Operations Center directs the tasking of the asset. The Predator, given this architecture, does not provide combat effects without space. It is dependant on SATCOM to integrate, in real-time, the various centers that operate interdependently to produce the combat effect. This construct, in doctrine, is termed distributed operations. It differs from the traditional view of SATCOM providing reachback. The reachback concept provides support from organizations not forward deployed, such as intelligence analysis.[107] Distributed operations, on the other hand, is a "process of conducting operations from independent or interdependent nodes in a teaming manner."[108] The US Army is also adapting to distributed operations. The Future Combat Systems (FCS), under development, will be the Army's tactical warfighting system. FCS is based on networked operations, with multiple platforms "connected via an advanced network architecture that will enable levels of joint connectivity, situational awareness and understanding, and synchronized operations heretofore unachievable."[109] This teaming approach is fundamental to the notion of networked warfare that is transforming the US military. And it is space that puts the network into networked warfare.

Second, the US military is prepared to take the fight into space with a new weapon system called the Counter Communication System (CounterComm). Fielded by Air Force Space Command in 2004, it provides the US with a dedicated Offensive Counterspace (OCS) capability.[110] OCS operations "preclude an adversary from

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[106] Department of Defense, *Report to Congress: Network Centric Warfare* (Washington D.C.: Assistant Secretary of Defense, Networks and Information Integration, September 2001), vii. n.p., on-line, Internet, 4 May 2005, available from http://www.dod.mil/nii/NCW/.
[107] Air Force Doctrine Document (AFDD) 2-8, *Command and Control*, 16 February 2001, 31.
[108] Ibid, 57.
[109] US Army, "Future Combat Systems Overview," 28 January 2005, n.p., on-line, Internet, 4 May 2005, available from http://www.army.mil/fcs/factfiles/overview.html.
[110] Adam J. Herbert, "Toward Supremacy in Space," *Air Force Magazine* 88, no. 1 (January 2005): 26, n.p., on-line, Internet, 4 May 2005, available from http://www.afa.org/magazine/Jan2005/0105space.asp.

exploiting space to their advantage."[111] CounterComm is a mobile ground antenna designed to jam enemy satellite communications. Designed for theater deployment, the system can directly provide combat effects to the warfighter. As a deployable system, CounterComm highlights a need for an effective theater command and control mechanism to integrate it into other theater operations.

Third, future space-enabled warfare will see an unprecedented level of space integration with space systems designed for battlefield commander control. Space radar, formerly called Space Based Radar (SBR), is designed to directly downlink ground moving target identification (GMTI) and imagery to the theater warfighter.[112] According to the Air Force fact sheet: "The system will incorporate battlefield tasking and control of the system to facilitate near real-time availability of SBR products to the theater."[113] A second capability termed near space looks to exploit the region between 65,000 and 325,000 feet, an area between the traditional operational environments of air and outer space.[114] Air Force Space Command is experimenting with balloons in near space to provide space effects such as communications and intelligence. A third capability, microsatellites, would provide small, tailored satellites that could be quickly launched to provide space effects on request of a theater commander.[115] Both near space and microsatellites are part of the Air Force's Joint Warfighting Space (JWS) concept. According to General Jumper, Air Force Chief of Staff: "JWS takes the next step in transforming capabilities by operationalizing space directly to the benefit of the warfighter with an agile, responsive, commander-oriented, combat space vision focused primarily at the tactical and operational levels of war, but able to integrate with the (National Security Space) architecture." [116] These new space systems raise an important

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[111] Air Force Doctrine Document (AFDD) 2-2.1, *Counterspace Operations*, 2 August 2004, 53.
[112] US Air Force, *Space Based Radar Fact Sheet*, June 2001, n.p., on-line, Internet, 4 May 2005, available from http://www.losangeles.af.mil/smc/pa/fact_sheets/sbr.htm.
[113] Ibid.
[114] House, *Statement by The Honorable Peter B. Teets, Under Secretary of the Air Force, Director of the National Reconnaissance Office, Department of Defense Executive Agent for Space, Hearings before the Committee on Armed Services, Strategic Forces Subcommittee*, 9 March 2005, 14.
[115] House, *Statement of General Lance W. Lord, Commander, Air Force Space Command, Hearings before the House Armed Services Committee, Subcommittee on Strategic Forces*, March 2005, 16.
[116] TSgt Jennifer Thibalt, "Near-space programs to provide persistent space capability," *Air Force Space Command News,* 8 March 2005, n.p., on-line, Internet, 4 May 2005, available from http://www.peterson.af.mil/hqafspc/News/News_Asp/nws_tmp.asp?storyid=05-069.

issue: how does the battlefield commander, now equipped with dedicated space systems, command and control those assets?

Finally, a look at the future must consider what part an adversary will play in space-enabled warfare. First, it seems likely that adversaries will integrate space into their own operations. Given the commercial market, adversaries do not have to have to own satellites to leverage the benefits of space. Adversaries can buy high-resolution commercial imagery and satellite communications. They may even exploit US space systems, as with commercial hand-held GPS receivers. It also seems likely that sophisticated adversaries will attempt to deny US access to space. An adversary with a GPS or SATCOM jammer would complicate the situation for a networked military force. In this way, even low-tech adversary space operations will directly affect the theater warfighter, driving the US to pursue space superiority.

Conclusion

The role of space in military operations changes in both nature and degree over time, highlighting the pressing need to maintain the US asymmetric advantage in space. First, the focus of military space has evolved from strategic nuclear war to the conventional battlefield. The Cold War space architecture has matured into a global architecture, whether leveraged by a horseback airman in Afghanistan or a Predator UAV in Iraq. Second, military success may depend on access to the space global architecture. From JDAMs and UAVs to blue force tracking, many combat systems simply do not work without space. Finally, future space assets are an organic part of theater operations. Space radar, near-space, and microsats will put an unprecedented degree of space at the disposal of the theater warfighter. Space-enabled warfare, the ultimate result of these trends, puts a premium on access to space and effective integration of space into military operations. From this context, one would expect to see a maturation of theater space operations to match the growing role of space at the operational and tactical levels of war.

Chapter 3

Current Joint Doctrine: Ready For Space Warfare?

Nothing in war is more important than unity of command.

Napoleon Bonaparte

This chapter consists of a review and analysis of the maturity of joint doctrine for theater command and control of space operations. A review of Joint Publication 3-14, *Joint Doctrine for Space Operations*, outlines the current command and control construct for theater space operations. Maturity of the current approach is assessed by applying three hypothetical situations against the construct: theater organic on-orbit space systems (microsatellites and near-space), the mission of space superiority, and battlefield control of the Space Radar system. A mature process should provide an effective command and control approach to each situation, ensuring access to, and effective integration of, space into theater war fighting. Finally, the author offers several observations on current joint doctrine in light of the three thought experiments.

Current Space Command and Control

Joint Publication 3-14 provides the principle joint doctrine for command and control of US space operations from a global and theater perspective.[117] Global command and control represents the bulk of the doctrine, with theater command and control receiving little attention. Nonetheless, understanding any notion of theater space

[117] Since publication of JP 3-14 in 2002, US Space Command (USSPACECOM) merged with US Strategic Command (USSTRATCOM), which now serves as the functional combatant commander for space operations. For purposes of this paper, USSTRATCOM replaces any reference to USSPACECOM in JP 3-14.

command and control starts with a basic understanding of the traditional global command and control approach.

Global Command and Control

The US has predominantly utilized a global command and control approach for its military space assets. Historically, most US military space assets have been strategically focused satellites providing effects for multiple users around the world. Since the creation of USSPACECOM in 1985, command and control of these assets has been through a combatant commander.[118] Today, Commander, USSTRATCOM (CDRUSSTRATCOM) has combatant command (COCOM) of all military space forces.[119] CDRUSSTRATCOM provides operational control (OPCON) of those service forces to the service components.[120] Air Force space systems, such as GPS and DSP, are OPCON to Air Force Space Command (AFSPC). Units working for AFSPC operate the satellites on a day-to-day basis. CDRUSSTRATCOM provides guidance to the service components via mission-type orders. Service components, in turn, provide operational guidance to the space units for day-to-day execution. The global command and control construct, providing a unity of command of USSTRATCOM's space assets, has effectively integrated space into military operations over the last two decades.[121]

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[118] David N. Spires, *Beyond Horizons: A Half Century of Air Force Space Leadership*, revised edition (Maxwell AFB, AL: Air University Press, 1998), 217.

[119] Combatant command is the command authority vested in combatant commanders over assigned forces. The Secretary of Defense (SecDef) assigns or attaches military forces to a combatant commander. The SecDef permanently assigns military forces dedicated to a combatant commander. When the SecDef temporarily transfers military forces from one combatant commander to another combatant commander, perhaps to support military operations in another part of the world, they are attached to the gaining combatant commander. The SecDef must specify the command authority, such as OPCON or TACON, provided to the gaining combatant commander. See Joint Publication 0-2, *Unified Action Armed Forces (UNAAF)*, 10 July 2001, xi.

[120] Operational control, inherent in COCOM, may be delegated to subordinate commanders. OPCON provides a subordinate commander the authority to organize and employ commands and forces, assign tasks, designate objectives, and give authoritative direction necessary to accomplish the mission, to include joint training. See Joint Publication 0-2, *Unified Action Armed Forces (UNAAF)*, 10 July 2001, III-7.

[121] Unity of command means, "All forces operate under a single commander with the requisite authority to direct all forces employed in pursuit of a common purpose." See Joint Publication 0-2, *Unified Action Armed Forces (UNAAF)*, 10 July 2001, III-1.

Theater Command and Control

The theater has traditionally leveraged space effects from USSTRATCOM's global space assets. The joint force commander (JFC) has a support relationship with CDRUSSTRATCOM, who provides requested space effects.[122] Unlike most other military forces, space forces have not historically transferred to the JFC. Therefore, the JFC has not normally exercised command over space assets via OPCON or Tactical Control (TACON).[123] Instead, the JFC provides USSTRATCOM with a list of space requirements that will support theater operations. Joint doctrine identifies a Space Authority that assists the JFC with space planning and integration. Of note, Air Force doctrine refers to the Space Authority as the Space Coordinating Authority (SCA). Given the traditional perspective on space, it is not surprising to see only a single paragraph on theater command and control of space in JP 3-14:

> **Theater Command and Control**. A supported JFC normally designates a single authority to coordinate joint theater space operations and integrate space capabilities. Based on the complexity and scope of operations, the JFC can either retain authority or designate a component commander to coordinate and integrate space operations. The JFC considers the mission, nature and duration of the operation, preponderance of space force capabilities, and the C2 capabilities (including reach-back) in selecting the appropriate option. The space authority will coordinate space operations, integrate space capabilities, and have primary responsibility for in-theater

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[122] Support is a unique command authority, establishing a relationship between two commanders. A support relationship, per the UNAAF, is "established by a superior commander between subordinate commanders when one organization should aid, protect, complement, or sustain another force." The UNAAF states that the "support command relationship is, by design, a somewhat vague but very flexible arrangement." Normally, a support command authority is utilized when forces are not transferred. For example, US Transportation Command (USTRANSCOM) was "in support" of US Central Command (USCENTCOM) during Operation Iraqi Freedom. USTRANSCOM provided USCENTCOM with tanker and airlift aircraft to support combat operations. Those aircraft remained under USTRANSCOM and were not attached to USCENTCOM (so OPCON was not passed). Instead, USCENTCOM exercised command of those USTRANSCOM assets through the support command authority. An establishing directive fleshes out the support relationship, to "specify the purpose of the support relationship, the effect desired, and the scope of the action to be taken." The support relationship, for many, is not the preferred command approach, as the assets are not transferred to the gaining commander. A transferred asset is "organic", belonging singularly to the gaining commander. Assets available through a support relationship tend to be shared assets, such as tanker aircraft or satellites. Access to shared assets is less sure, with the potential of being out-prioritized. See Joint Publication 0-2, *Unified Action Armed Forces (UNAAF)*, 10 July 2001, III-8-9.

[123] Tactical control, inherent in OPCON, may be delegated to any commander within the combatant command. TACON provides "sufficient authority for controlling and directing the application of force or tactical use of combat support assets within the assigned mission or task." See Joint Publication 0-2, *Unified Action Armed Forces (UNAAF)*, 10 July 2001, III-8.

> joint space operations planning. The space authority will normally be supported by a JSST and will coordinate with the component SSTs and/or embedded space operators. It gathers space requirements throughout the joint force. While the space authority may facilitate non-traditional uses of space assets, joint force staffs should utilize the established processes when planning traditional Space Force Enhancement missions — intelligence, surveillance and reconnaissance; integrated tactical warning and attack assessment; environmental monitoring; communications; and navigation and timing. Following coordination, the space authority provides to the JFC a prioritized list of recommended space requirements based on the joint force objectives. Upon JFC approval, the list is provided to Commander, [USSTRATCOM] and the geographic combatant commander if applicable. To ensure prompt and timely support, Commander, [USSTRATCOM] should authorize direct liaison between the space authority and Service components of [USSTRATCOM]. This does not restrict joint force Service component commands from communicating requirements directly to their counterpart Service space component commander. However, the space authority and the Commander, [USSTRATCOM] must be kept apprised of all such coordination activities to ensure that space activities are coordinated, deconflicted, integrated, and synchronized.[124]

The Space Authority construct fits the historical mold of the theater requesting space support from USSTRATCOM. The main function of the Space Authority is coordination across the joint force to produce a prioritized list of JFC space requirements. Given that no command authorities are discussed in the doctrine, the Space Authority leverages coordinating authority.[125] Coordinating authority is "the authority delegated to a commander or individual for coordinating specific functions and activities involving forces of two or more Military Departments, two or more joint force components, or two or more forces of the same Service."[126] Coordinating authority allows different forces to coordinate activities to facilitate unity of effort.[127] Joint Publication 0-2, *Unified Action*

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[124] Joint Publication 3-14, *Joint Doctrine for Space Operations*, 9 August 2002, III-1-2.

[125] Commanders exercise command through four authorities: combatant command, operational control, tactical control, and support. Each authority provides varying degrees of control over forces, greatest with COCOM and generally less with each subsequent command authority. Joint doctrine identifies three "other authorities": administrative control, coordinating authority, direct liaison authorized. None of these "other authorities" provides a command authority by which military operations may be directed. While "other authorities" help ensure unity of effort, they do not provide unity of command. See Joint Publication 0-2, *Unified Action Armed Forces (UNAAF)*, 10 July 2001, III-7-12.

[126] Joint Publication 0-2, *Unified Action Armed Forces (UNAAF)*, 10 July 2001, III-11.

[127] Unity of effort represents the idea that everyone involved in a given situation must work towards a common goal. Unity of effort allows for coordination but does not provide a military commander any

Armed Force (UNAAF), states that coordinating authority "is a consultation relationship between commanders, not an authority by which command may be exercised."[128] Forces can coordinate, but no one has the mandate to direct an action as there is no command authority specified. The UNAAF further states that coordinating authority "is more applicable to planning and similar activities than to operations."[129] Coordinating authority, then, provides a unity of effort across forces, geared towards planning-type activities. The Space Authority is a coordinating authority across the joint force.

Joint doctrine acknowledges the possible transfer of space forces to a JFC but does not lay out a theater process for command and control of the forces. JP 3-14 states that "at SecDef direction, Commander, [USSTRATCOM] will transfer space forces or capabilities to the supported combatant commander, subordinate JFC, and/or subordinate commander, depending on the nature of the operation and the specific space capability to be employed. The appropriate command relationships (OPCON, tactical control [TACON], etc.) will then be established."[130] Joint doctrine does not address who will command space forces transferred to theater. The Space Authority is empowered to coordinate, not command, so space forces would not transfer to that individual. Therefore, for purposes of analysis, any space asset transferred to theater is treated like other transferred forces. The JFC will receive OPCON of the forces and, in turn, provide OPCON to the perspective service component on the joint task force (e.g. the Commander of Air Force Forces given OPCON over Air Force units). The service component will be responsible for command and control of service space forces transferred to theater.

Based on today's doctrine, theater space command and control remains sketchy. Assumptions were required to provide some basic roles and responsibilities within theater. The Space Authority works the requirements from USSTRATCOM assets and theater service components will command any transferred space assets. The effectiveness of this arrangement is analyzed below.

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authority to direct an action to be taken. The military normally ensures unity of effort by having a unity of command when possible.

[128] Joint Publication 0-2, *Unified Action Armed Forces (UNAAF)*, 10 July 2001, III-12.

[129] Ibid.

[130] Joint Publication 3-14, *Joint Doctrine for Space Operations*, 9 August 2002, III-1.

Analysis

Effectiveness of the current approach to theater space command and control is considered through three hypothetical situations: theater organic on-orbit space systems (microsatellites and near-space), the mission of space superiority, and battlefield control of the Space Radar system. Each represents a unique aspect of theater operations that any command and control approach must be able to handle over the next ten to fifteen years.

Hypothetical Situations

In the first situation, the Joint Warfighting Space (JWS) concept has come to fruition with microsatellite and near-space assets made available to the theater warfighter. Initially, the joint force commander has operational control of a constellation of imagery microsatellites. As the microsatellites are dedicated to the JFC, the theater has the responsibility to operate the satellite. Assuming the Air Force, via Air Force Space Command, provided the microsatellites, the JFC transfers OPCON to the theater Commander of Air Force Forces (COMAFFOR). The COMAFFOR is responsible for operating the satellites but needs to know what targets to image. The Space Authority, as a coordinating authority, could collect the imaging requirements across the joint force, but only the JFC could approve them. With satellites passing overhead every ninety minutes, it seems rather infeasible for a JFC to approve imagery requests. More likely, imagery requests for the microsatellites will be part of the theater Intelligence, Surveillance, and Reconnaissance (IRS) process, which looks to leverage all available intelligence assets.[131] The command and control issue is how well the COMAFFOR integrates with the theater ISR process. Unfortunately, current joint doctrine falls short by not defining any sort of command and control process for transferred space assets. One can only assume that the theater will work something out. This seems a suspect approach to effective use of US space power.

As the other part of JWS, the JFC receives operational control of several Air Force and Army near-space imagery and communication systems. OPCON of the near-space assets are transferred to the respective service components of the joint force. A

[131] The theater collection management process is discussed in Joint Publication 2-01, *Joint and National Intelligence Support to Military Operations*, 7 October 2004.

lack of a joint process for theater space could lead to a suboptimal use of the near-space assets. There may be an opportunity cost to the entire joint force if near-space assets, controlled by individual service components, only serviced the needs of that component. For example, the JFC may need to focus all near-space imagery assets, regardless of which service component has OPCON, on the most active part of the battlefield. It is unclear how well theater organic space assets integrate across the joint force with a decentralized approach to command and control.

The second example concerns theater space superiority with the JFC facing a GPS jamming threat and given operational control of a CounterComm system. The notion of theater space superiority raises a fundamental question: who is responsible for counterspace operations? Joint space doctrine does not identify space superiority as a theater issue, much less recommend a command and control approach.[132] In terms of defensive counterspace, the Space Authority seems an inadequate vehicle for command and control as it does not have any authority or resources to accomplish the mission. A list of space requirements does little to help the JFC when GPS jammers are interfering with combat operations. Holding USSTRATCOM responsible makes little sense, as the theater will own the air or ground assets needed to take out the jammers. For offensive counterspace, the transfer of the CounterComm system gives the theater warfighter an organic capability to jam adversary communications. As the system would transfer to the COMAFFOR, it faces similar issues of integration and compartmentalization discussed above with microsatellites and near-space assets. An equally pressing issue is an adequate deconfliction process to prevent unintended consequences of use of the system. For example, potential interference on friendly or third party satellites must be addressed before the system is used. Any offensive counterspace system requires robust command and control given the potential strategic implications of use.[133] The current joint space doctrine offers little to assist the theater in gaining and maintaining space superiority.

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[132] This is not true of other mediums. For example, the counterair mission, to gain and maintain air superiority, is normally assigned to the Joint Force Air Component Commander (JFACC). See Joint Publication 3-30, *Command and Control for Joint Air Operations*, 5 June 2003.

[133] As with the Star Wars debate in the 1970s and 1980s, some consider the CounterComm system as a step towards space weaponization. For commentaries, see the Center for Defense Information, Space Security, website (www.cdi.org).

The Space Radar system is the third case. Space radar will "incorporate battlefield tasking and control of the system to facilitate near real-time availability of [SR] products to the theater." [134] Space radar represents a new approach to managing a global constellation of satellites. The theater is not in a reachback mode, requesting a space effect from USSSTRATCOM. Instead, the theater plays an integral part in creating the space effect. Battlefield tasking and control implies that the theater warfighter can change the tasking of a radar satellite as it flies overhead, switching in real-time from target to another. Therefore, the type of command and control historically performed by the global provider back in the US will have to be performed by the theater. Current joint doctrine provides no insight into this type of command and control. How will battlefield requirements be collected, in real-time, across the joint force? Who decides minute–by–minute which requirements are serviced? How is the satellite tasked by the theater? The Space Authority construct, appropriate for planning activities, is inadequate for real-time operations. Complicating the command and control issue is the need to integrate theater use of space radar with USSTRATCOM. Unlike the dedicated microsatellites in the JWS concept, multiple theaters will share the space radar satellites. Assuming AFSPC has overall command and control of the space radar constellation for USSTRATCOM, what type of command relationships are established between AFSPC and the theater to allow seamless transfer of command and control as satellites enter and leave a theater? Effectiveness of space radar for all users will depend on a dynamic inter-theater and intra-theater command and control process that today's joint space doctrine does not offer.

Observations

The three hypothetical situations suggest that there is a glaring hole in joint space doctrine. Theater space command and control gets a vague treatment and what is offered is inadequate for effective theater operations. Current doctrine does not address the changing role of the theater in space operations, fails to account for the changing nature of space capabilities, and does not address the evolving threat to space operations. The command and control construct offered is weak: a unity of effort, but not command,

[134] US Air Force, *Space Based Radar Fact Sheet*, June 2001, n.p., on-line, Internet, 4 May 2005, available from http://www.losangeles.af.mil/smc/pa/fact_sheets/sbr.htm.

through the Space Authority; decentralized control of transferred space assets via service components; and no identified control mechanisms. The hole in joint space doctrine appears to be the result of an unbalanced view of space operations.

JP 3-14 treats space operations from the historical strategic perspective, with several implicit assumptions about the nature of space operations driving the doctrinal vacuum on theater space operations. First, the assumed role of the theater is that of a user of USSTRATCOM's global space systems. There is little need of a robust theater process to request an effect from a GPS or DSP satellite. Once the requirement is identified, USSTRATCOM does the work to ensure the effect is delivered. The Space Authority seems adequate to assist the JFC in this user role. However, the evolving nature of space is changing this historical relationship. The theater is no longer just a consumer of space effects; it is a producer as well. Space systems designed for organic theater use, the need to ensure theater space superiority, and the demands of battlefield control of space systems give the theater an important role in space operations. Joint doctrine must acknowledge that there is a space piece of the JFC's campaign and a role for the theater in space operations.

Second, there is an historical assumption that only a small number of passive ground-based space assets will be transferred to theater. A few ground-based systems, such as one or two JTAGS, may be manageable by the JFC on a case-by-case basis. As the number of theater systems increase, effective use of the assets requires a more formal, rather than *ad hoc*, approach to command and control. Additionally, the nature of theater space assets is becoming more dynamic. CounterComm will produce real-time combat effects that should be coordinated and deconflicted to prevent unintended consequences. Microsatellites and near-space assets require an active command and control process to integrate them into joint operations and, more fundamentally, to keep them operational in space. Joint doctrine must recognize the changing nature of space capabilities and provide a formal command and control process that actively manages theater space resources.

Third, the assumption that USSTRATCOM can provide unhindered access to space is obsolete and dangerous. Space superiority, once the theoretically strategic realm of anti-satellite systems and lasers, has become an operational and tactical concern in

theater operations. Inexpensive GPS jammers may be the tip of the iceburg as adversaries look to disrupt US space-enable warfare. Given the growing dependence on space, it seems only logical that theater space operations include an effective process to ensure space superiority. Joint doctrine must recognize the changing nature of space threats and address a command and control approach to theater counterspace operations that ensures space superiority. While the joint doctrine is missing vital aspects of space operations, what the doctrine does offer is of equal concern to the author.

First, the Space Authority is an inadequate mechanism for command of theater space operations. With no command authority, the Space Authority can only provide a unity of effort in theater space operations. Unity of command, a guiding military principle, is the preferred approach whenever possible.[135] According to Joint Publication 3-0, *Doctrine for Joint Operations*, a JFC may assign missions to the components based on the scope of operations (too much work for the JFC's staff) or ensure a unity of command and effort when two or more Military Departments operate in the same medium (for example, a JFACC commands joint air operations). Theater space operations will certainly fit this description, on both counts, over the next decade. Oddly, while joint space doctrine does not provide guidance on how to ensure unity of command in theater, it does recommend it: "When space forces are transferred to geographic combatant commanders, care must be given to ensure that space forces are commanded through a single chain of command."[136] Joint doctrine should consider a unity of command approach to theater space operations that the current Space Authority cannot provide.

The second issue with existing doctrine concerns the method of control, centralized or decentralized. JP 3-14 does not recommend, or even discuss, a control method for theater space operations. Given there is no guidance, the default is a decentralized method with each component using its own space assets. This method of control may become problematic with microsats and near-space assets, given the potential of compartmentalizing assets that could provide effects across the joint force.

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[135] Unity of command is one of only nine principles of war, serving as an "enduring bedrock of US military doctrine" and as a guide to "warfighting at the strategic, operational, and tactical levels". See Joint Publication 0-2, *Unified Action Armed Forces (UNAAF)*, 10 July 2001, B-1.
[136] Joint Publication 3-14, *Joint Doctrine for Space Operations*, 9 August 2002, IV-4.

Similar to air power, decentralized control of space power may improve effectiveness for individuals but degrade overall effectiveness for the entire joint force. The UNAAF provides the following guidance in organizing joint forces, "centralized planning and direction is essential for controlling and coordinating the efforts of the forces. Decentralized execution is essential because no one commander can control the detailed actions of a large number of units or individuals." [137] Joint space doctrine should provide guidance on the best approach to control of theater space forces, with serious consideration given to centralized control to ensure the most effective use of space power in theater.

Finally, joint doctrine provides no meaningful guidance on control mechanisms for theater space operations, failing to discuss roles and responsibilities, processes, procedures, or infrastructure.[138] Other than a few words that the Space Authority should collect requirements, there is no mention of the details of theater space operations. In comparison, theater air has a stand-alone 98-page doctrine publication, JP 3-30, *Command and Control for Joint Air Operations*, and theater land has a stand-alone 111-page doctrine publication, JP 3-31, *Command and Control for Joint Land Operations*. This is not to argue that theater space needs a comparable stand-alone publication, but it needs more than a one-paragraph discussion in the only joint doctrine on space. Space doctrine should provide some minimal detail on control of theater operations, even for the Space Authority, and consider a robust set of mechanisms to ensure effective integration of space into the joint fight.

Conclusion

Joint Publication 3-14, *Joint Doctrine for Space Operations*, reflects an immature state of command and control of theater space operations. The military understands command and control of global space assets, given decades of experience with space as a strategic force. Unfortunately, joint doctrine does little, with a single paragraph on

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[137] Joint Publication 0-2, *Unified Action Armed Forces (UNAAF)*, 10 July 2001, V-2-3.

[138] Command is "the lawful authority of a commander" and control is "the regulation of forces and functions to accomplish the mission in accordance with the commander's intent." Control provides the mechanism to exercise command. See Joint Publication 0-2, Unified Action Armed Forces (UNAAF), 10 July 2001, xiii.

command and control, to address rapidly evolving theater space operations. Joint space doctrine needs to catch up with the changing nature of space in military operations. Theater space command and control must continue to coordinate space effects from global assets but must also fight the space piece of the JFC's campaign. While there are unique aspects to space, it as an equal partner with other forms of military power. Fundamental doctrinal concepts such as unity of command and centralized control are applicable to all forms of military operations, should they be air, land, sea or space. Space may have a grammar of its own, but not its own logic. The next chapter considers joint air operations as a model for joint space operations, looking to apply existing logic to inform and guide the development of a more mature approach to command and control of theater space operations.

Chapter 4

JFSCC: An Approach to Theater Space Warfare

Operationally, I will tell you that the pieces of this operation which have been successful would not have been so without space-based assets. It's just very simply a fact.

General Tommy Franks
Commander, US Central Command
Operation Enduring Freedom

The Joint Force Space Component Commander (JFSCC) provides a command and control approach to theater space operations that complements current practices in joint warfighting. Over the last two decades, the US military has adopted a functional, vice service, approach to integration of theater joint operations. Operation IRAQI FREEDOM utilized all four functional components currently recognized in joint doctrine: Joint Force Air Component Command (JFACC), Joint Force Land Component Commander (JFLCC), Joint Force Maritime Component Commander (JFMCC), and a Joint Force Special Operations Component Commander (JFSOCC). As with other operational mediums, space must integrate into the overall military campaign. The JFSCC, a functional component for space, offers one approach to integrating theater space into the joint force commander's campaign. Joint force experience with functional components, as captured in joint doctrine, provides a basic approach for a functional component for space. Use of the existing joint force air component commander construct offers an established point of departure for the JFSCC. First, a review of the JFACC construct provides a basic understanding of the approach to a functional component and some detail on its implementation. Next, a JFSCC construct is outlined based on the JFACC. Then, the proposed JFSCC construct is considered against the three hypothetical

situations introduced in Chapter 1. Finally, observations from analysis of the JFSCC construct provide a starting point for further discussion on a functional component for space. The JFSCC offers a more mature theater space command and control approach to effectively integrate space into joint operations as both a warfighting enabler and a unique warfighting competency.

Joint Force Fundamentals – JFSCC In Context

The Joint Force Air Component Commander is responsible for joint air operations. According to joint doctrine, the Joint Force Commander normally designates a JFACC as the functional component to "exploit the capabilities of joint air operations."[139] The following discussion lays out the basic construct of the JFACC, highlighting those aspects applicable to the JFSCC construct. A short discussion on functional components describes the intent behind their use in joint operations. Next, joint air operations explain how joint air power is organized at the operational level of war. A review of the JFACC's role and responsibilities demonstrates the wide range of activities required to execute the air piece of the JFC's campaign. Finally, joint air operations command and control lays out a potential method for command and control of joint space operations. The JFACC serves as a solid point of departure in the development of a functional component for space.

Functional Component Command

A functional component command, per joint doctrine, is "normally, but not necessarily, composed of forces of two or more Military Departments which may be established across the range of military operations to perform particular missions that may be of short duration or may extend over a period of time."[140] Functional components, such as the JFACC or JFLCC, are not required elements of a joint force (only service components are required) but the trend since Operation DESERT STORM reflects a growing acceptance of functional components (see figure 1). Doctrine offers that a JFC may establish a functional component to "integrate planning; reduce their span

[139] Joint Publication 3-30, *Command and Control for Joint Air Operations*, 5 June 2003, vii.
[140] Joint Publication, 0-2, *Unified Action Armed Forces (UNAAF)*, 10 July 2001, GL-7.

of control; and/or significantly improve combat efficiency, information flow, unity of effort, weapon systems management, component interaction, or control the scheme of maneuver."[141] Functional component commands are becoming the standard approach to organizing joint forces.

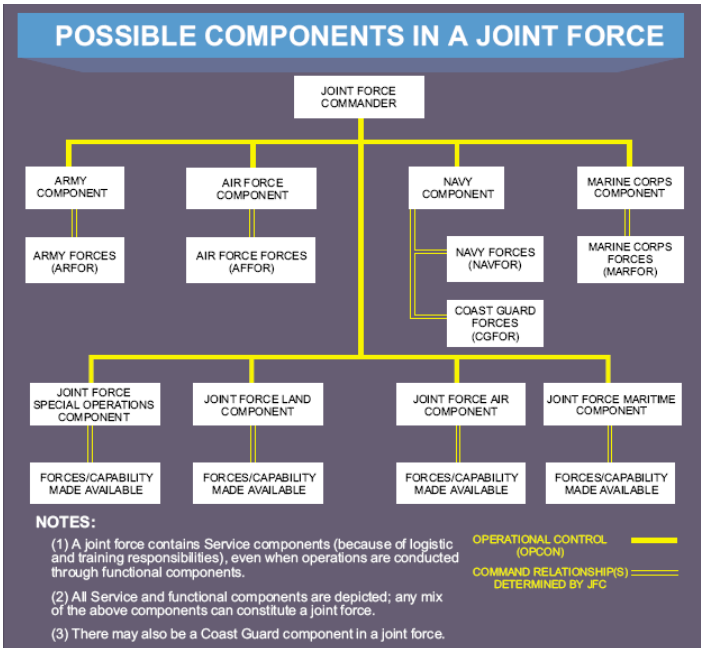

Figure 1: Possible Components in a Joint Force

SOURCE: JP 0-2, *Unified Action Armed Forces* (UNAAF), 2001.

The JFC assigns responsibilities and authorities to a functional component commander. Joint doctrine offers several general guidelines for functional components. First, the JFC must "designate the forces and/or military capability that will be made available for tasking."[142] Normally, service components will have OPCON of respective service forces. A functional component commander is given TACON over service forces that are "made available" by the JFC. Refer to the joint air command and control discussion below for an operational example of this process. Second, a functional

[141] Ibid, V-18.
[142] Ibid, V-19.

component does not affect the command relationship between a service component and the JFC. In other words, a functional commander cannot override a service commander. Only the JFC can resolve a disagreement between the two commanders. Third, the functional component commander "normally will be a Service component commander."[143] Normally, the service component with the preponderance of forces to be tasked is designated the functional component but the JFC also considers "the mission, nature and duration of the operation, force capabilities, and the C2 capabilities in selecting the commander."[144] Fourth, the functional component commander is "responsible for making recommendations to the establishing commander on the proper employment of the forces and/or military capability made available to accomplish the assigned responsibilities."[145] The JFC, not the component commanders, has the final decision on military operations. There is only one military campaign, the JFC's campaign, not separate air, land, maritime, space, and special operations campaigns. Finally, when a functional component command employs forces from multiple services, the commander's staff "should reflect the composition of the functional component command."[146] If a joint force land component is comprised of Army and Marine Corps forces, the JFLCC's staff needs both Army and Marine Corps personnel. Further detail on each respective functional component is available in joint doctrine operations series 3-0 publications.

Joint Air Operations

JP 3-30, *Command and Control of Joint Air Operations*, details joint air operations, the joint force air component, and the joint force air component commander. Joint air operations, per JP 3-30, are "performed with air capabilities/forces made available by components in support of the joint force commander's (JFC's) operation or campaign objectives, or in support of other components of the joint force."[147] Joint air operations provide the JFC "an operational level force capable of being employed as part

[143] Joint Publication 0-2, *Unified Action Armed Forces (UNAAF)*, 10 July 2001, V-19.
[144] Ibid, V-19.
[145] Ibid.
[146] Ibid.
[147] Joint Publication 3-30, *Command and Control for Joint Air Operations*, 5 June 2003, vii.

of a broader joint operation."[148] Components may conduct air operations as part of their own operations. For example, the Navy component may use its own organic air assets to provide defense of an aircraft carrier. Those naval aircraft are not "made available" for joint air operations so are not part of joint air operations. Only the JFC can "reassign, redirect, or reallocate a component's air capabilities/forces."[149] The JFACC tasks air capabilities/forces made available by component commanders "based on the JFC's air apportionment decision."[150] The apportionment decision provides the JFACC with the JFC's expectations for accomplishing joint air operations, normally expressed as a percentage or priority of effort against the assigned tasks. Like all components, the JFACC "conducts joint air operations in accordance with the JFC's intent and concept of operations."[151] The JFC's intent, concept of operations, and apportionment decision ensures there is only one military campaign, the joint force commander's campaign. Joint air operations are the air piece of the JFC's campaign.

JFACC Roles and Responsibilities

The joint force air component commander is responsible for the air piece of the JFC's campaign. JFACC responsibilities include "planning, coordinating, and monitoring joint air operations, and the allocation and tasking of joint air operations forces based on the JFC's CONOPS and apportionment decision."[152] Allocation is the "distribution of limited resources among competing requirement for employment."[153] The JFACC uses the limited resource of "made available" joint air forces to accomplish various missions assigned by the JFC. JP 3-30 recommends several mission areas: counterair, strategic air attack, airborne intelligence, surveillance, and reconnaissance (ISR), air interdiction, intratherater and intertheater air mobility, and close air support. The JFACC "synchronizes and integrates the actions of assigned, attached, and supporting air capabilities/forces in time, space, and purpose."[154]

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[148] Ibid.
[149] Ibid, viii.
[150] Ibid.
[151] Ibid, ix.
[152] Ibid, II-2.
[153] Joint Publication 3-30, *Command and Control for Joint Air Operations*, 5 June 2003, GL-4.
[154] Ibid, vii.

Joint Air Command and Control

Joint air operations are normally conducted using centralized control and decentralized execution. The JFACC provides centralized control, with execution authority delegated to subordinate commanders. The JFACC "typically exercises tactical control over air capabilities/forces made available for tasking."[155] Normally, a JFC receives OPCON of assigned or attached air assets. In turn, the JFC passes OPCON of air assets to the respective service component (for example, naval air to the Navy component). The Service component uses its organic air to accomplish missions as assigned by the JFC. The Navy component, as discussed above, can use naval air to provide for fleet defense. A component may "make available" any unused air assets to the JFACC, who receives TACON of component air assets for use in joint air operations. This process may sound somewhat complex but provides a flexible command organization that accommodates the organic air power needs of each component while ensuring a unity of command over joint air operations.

Joint air operations are normally conducted from a joint air operations center (JAOC), staffed with five main divisions and numerous liaison elements (see figure 2). The size of the JAOC depends on the level of activity required. The air operations center staffing in OEF was around 700 personnel, while in OIF the number was near 2000.[156] As the numbers indicate, the command and control of joint air operations requires a significant investment in personnel. Likewise, an air operations center can require major infrastructure investment. The air operations center for OEF, at Prince Sultan Air Base in Saudi Arabia, cost forty five million dollars to construct.[157] The JFACC, via the JAOC, utilizes several major processes to plan, execute, and assess joint air operations.

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[155] Ibid, viii.
[156] David A Brumbaugh, "The Parallel Air Tasking Order: Reducing the Size of the Air Operations Center," paper from 2004 Command and Control Research and Technology Symposium, 24 March 2004, 12, n.p., on-line, Internet, 6 May 2005, available from http://www.dodccrp.org/events/2004/CCRTS_San_Diego/CD/papers/131.pdf.
[157] "Most U.S. Forces Leaving S. Arabia," *CBS News*, 29 April 2003, n.p., on-line, Internet, 6 May 2005, available from http://www.cbsnews.com/stories/2003/04/27/iraq/main551262.shtml.

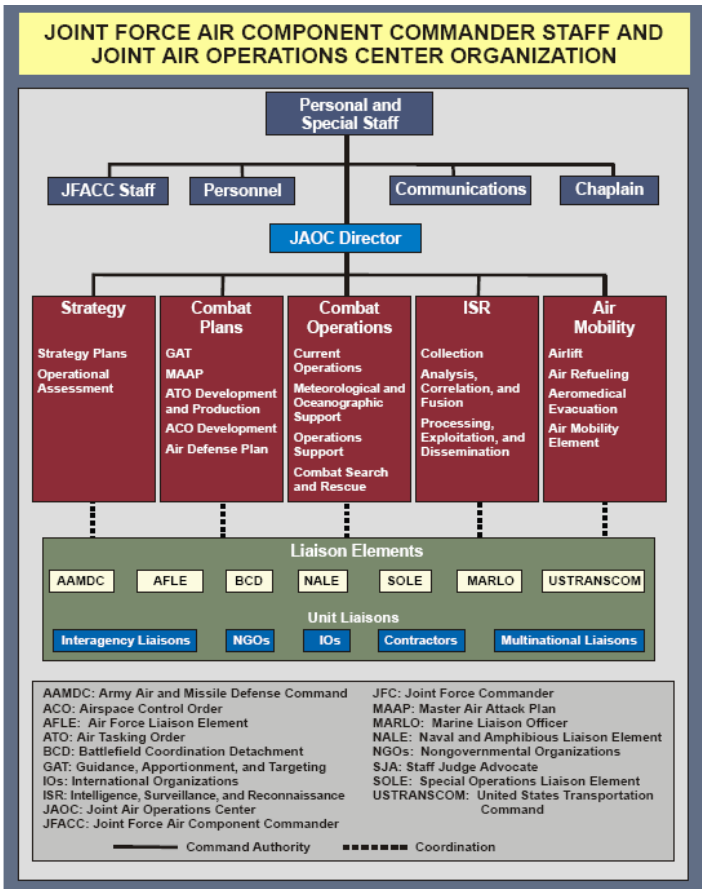

Figure 2: JFACC Staff and JAOC Organization

SOURCE: JP 3-30, *Command and Control for Joint Air Operations*, 2003.

The JFACC exploits the capabilities of joint air operations "through a cohesive joint air operations plan (JAOP) and a responsive and integrated control system."[158] The JAOP, a written plan, is the "JFACC's plan for integrating and coordinating joint air operations" and is the product of a six-phase Joint Air Estimate Process.[159] Similar to other joint estimate processes, the Joint Air Estimate Process goes through a logical analysis to determine how to best utilize joint air to meet the JFC's campaign objectives. Factors such as the JFC's objectives, friendly capabilities, enemy capabilities, and

[158] Joint Publication 3-30, *Command and Control for Joint Air Operations*, 5 June 2003, I-2.
[159] Ibid, III-2-4.

potential courses of action go into determining the JFACC's course of action. Once approved, the JFACC's staff fleshes out the details of the course of action in the Joint Air Operations Plan. The JAOP then serves as the baseline for the joint air operations targeting cycle.

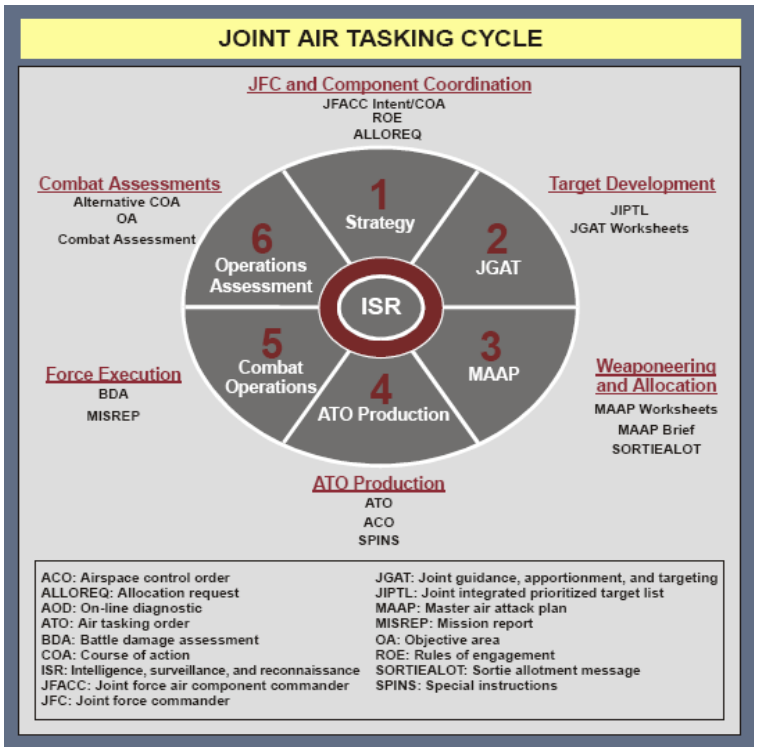

Figure 3: Joint Air Tasking Cycle

SOURCE: JP 3-30, *Command and Control for Joint Air Operations*, 2003.

The joint air operations targeting cycle produces the joint integrated prioritized target list (JIPTL) and a recommended JFC apportionment for joint air operations. The JIPTL is a prioritized list of targets to be attacked by joint air operations. JP 3-30 states: "Synchronization, integration, deconfliction, allocation of air capabilities/forces, and matching appropriate weapons against target vulnerabilities are essential targeting functions for the JFACC."[160] The air apportionment recommendation flows from the

[160] Ibid, III-17.

targets identified in the JIPTL. Once the JFC approves the JIPTL and the air apportionment, they feed into the joint air tasking cycle.

The joint air tasking cycle produces the air tasking order (ATO). The joint air tasking cycle provides "a repetitive process for the planning, coordination, allocation, and tasking of joint air missions/sorties with the guidance of the JFC."[161] As can be inferred by figure 3, the air tasking cycle is complex process requiring a large number of expert personnel to control joint air operations through strategy, targeting, tasking, combat operations, and assessment. The ATO is the one document that captures and summarizes joint air operations. It tasks joint air operations over time, usually for a 24-hour period, and contains other component's air operations, those not tasked by the JFACC, to ensure deconfliction and coordination of all air operations within the JFC's campaign.

Joint air operations command and control is a complex undertaking. This section has only brushed the surface of the 98-page joint publication on command and control for joint air operations, but serves to highlight the fact that there is substantive doctrinal guidance on air operations, discussing roles and responsibilities, processes, procedures, and infrastructure. A relatively new addition to joint doctrine, acceptance of the JFACC and other functional components, has grown since Operation DESERT STORM. With the overwhelming success of Operation IRAQI FREEDOM, the functional component approach to joint warfare seems well established. As an emerging medium in theater operations, the US military should consider a functional component approach to joint space operations.

Joint Space Operations

Joint space operations offer a conceptual approach to theater space that is consistent with joint warfare. Theater space fits the joint paradigm in several ways. First, like other military forces, future space assets transfer to the JFC for theater operations. In this paper, the JFC receives OPCON of microsatellites, near-space assets, and a CounterComm system. OPCON passes to the respective service components. The JFSCC may receive TACON of the assets designated for joint space operations. As with air power, service components may retain certain space capabilities for organic use. The

[161] Ibid, III-19.

second aspect of the joint approach concerns multiple service components operating in the same medium. Near-space assets seem strong candidates for operations in the same medium with the Air Force, Army, and Navy are all pursuing near-space assets.[162] Finally, theater space offers three unique missions that are suited to joint space operations: counterspace, theater force enhancement, and spaceborne ISR. Theater counterspace ensures space superiority for the entire joint force, not any one component. Theater force enhancement is concerned with effective integration of theater organic space assets, such as near-space communications, across the entire joint force. Finally, the spaceborne ISR mission includes planning, coordinating, allocating, and tasking assigned spaceborne ISR assets, such as imaging microsatellites, to meet JFC requirements. Given that theater space is consistent with the joint operations approach, a functional component for space appears an appropriate command and control approach for joint space operations.

A functional component for space offers the JFC several benefits highlighted in JP 0-2, *Unified Action Armed Forces (UNAAF)*. First, a JFSCC can integrate planning across the joint force. The theater's role as producer and consumer of space effects drives the need for a planning process that ensures effective integration of space into joint warfare. Joint space operations, if modeled after joint air operations, will have robust control mechanisms to include a joint planning process. Second, a JFSCC reduces the JFC's span of control. The growth of theater space from a handful of deployable trucks to numerous on-orbit assets and a ground-based counterspace system increases the JFC's span of control by orders of magnitude. The JFC can manage span of control issues and ensure unity of command by designating a commander at the operational level to lead the space piece of the theater campaign. As with joint air operations, the JFSCC can provide the JFC "an operational level force capable of being employed as part of a broader joint operation."[163] The JFSCC gives the JFC an ability to focus theater space where it is needed most. Finally, a JFSCC can "significantly improve combat efficiency, information flow, unity of effort, weapon systems management, component interaction,

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[162] The US Navy is working with Techsphere Systems International on a 21.7m-diameter high-altitude balloon. See Michael Sirak, "US Air Force Sees Promise in 'Near Space'," *Jane's Defense Weekly*, 13 October 2005.
[163] Joint Publication 3-30, *Command and Control for Joint Air Operations*, 5 June 2003, vii.

or control the scheme of maneuver."[164] A functional component for space will improve these aspects of operations as it provides a command and control approach to theater space warfare where none exists today. A JFSCC ensures joint space operations support the JFC's overall campaign.

JFSCC Roles and Responsibilities

The joint force space component commander is responsible for the space piece of the JFC's campaign. JFSCC responsibilities include planning, coordinating, and monitoring joint space operations, and the allocation and tasking of joint space operations forces based on the JFC's CONOPS and apportionment decision.[165] The JFSCC also assumes the coordination role of the existing Space Authority to collect space requirements for USSTRATCOM support. The JFC assigns three mission areas to the JFSCC: counterspace, theater force enhancement, and spaceborne ISR. The JFSCC is the commander responsible for joint space operations at the operational level of war.[166]

Joint Space Command and Control

Joint space operations are conducted using centralized control and decentralized execution. The JFSCC provides centralized control, with execution authority delegated to subordinate commanders. The JFSCC exercises tactical control over space capabilities/forces made available for tasking.[167] The JFSCC exercises command and control through a Joint Space Operations Center (JSOC) using procedures and processes consistent with joint warfighting doctrine.[168]

A joint space operations center conducts joint space air operations. The staffing arrangement is slightly different from the five main divisions of a joint air operations

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[164] Joint Publication 0-2, *Unified Action Armed Forces (UNAAF)*, 10 July 2001, V-18.
[165] Derived from JFACC responsibilities. See Joint Publication 3-30, *Command and Control for Joint Air Operations*, 5 June 2003, II-2.
[166] According to joint doctrine, the operational level of war is "The level of war at which campaigns and major operations are planned, conducted, and sustained to accomplish strategic objectives within theaters or other operational areas." See Joint Publication 3-0, *Doctrine for Joint Operations*, 10 September 2001, GL-15.
[167] JFSCC command and control approach based JFACC construct. See Joint Publication 3-30, *Command and Control for Joint Air Operations*, 5 June 2003, viii.
[168] Joint Publication 3-0, *Doctrine for Joint Operations*, 10 September 2001, is the keystone publication that "establishes the framework for our forces' ability to fight as a joint team." An authoritative document, it provides a "common perspective from which to plan and execute joint, interagency, and multinational operations."

center, dropping the mobility division, as there are currently no plans to provide theaters with organic spacelift capabilities.[169] The JSOC has four divisions: strategy, plans, operations, and ISR. The strategy division develops, refines, disseminates, and assesses the progress of the JFSCC's strategy.[170] Responsible for long-range planning, this division develops courses of action for joint space operations that support the JFC's campaign. The plans division is responsible for the near-term operations planning of joint space operations.[171] The division develops detailed plans for the application of theater space assets and produces the theater space tasking order (TSTO).[172] The operations division is responsible for monitoring and executing the current TSTO. The operations division makes decisions and takes actions on current operations. Finally, the Intelligence, Surveillance, and Reconnaissance (ISR) division supports the JFSCC in planning, coordinating, allocating, and tasking assigned spaceborne ISR assets to accomplish and fulfill JFC tasks and requirements.[173] The ISR division also provides ISR support to space planning and execution activities. The JSOC provides the JFSCC with an appropriate infrastructure, in terms of people and equipment, to command and control joint space operations. The JSOC utilizes procedures and processes to integrate theater space into joint operations.

The JFSCC exploits the theater space capabilities through a joint space operations plan (JSOP).[174] The JSOP is a written plan for integrating and coordinating joint space operations based on a joint space estimate process that determines how to best utilize joint space to meet the JFC's campaign objectives. Factors such as the JFC's objectives, friendly capabilities, enemy capabilities, and potential courses of action go into determining the JFSCC's course of action. Once approved, details of the course of action serve as the baseline for the joint space operations targeting cycle.

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[169] The current focus is on improving launch responsiveness and lowering cost, not providing theater launch systems. See Air Force Space Command, *Air Force Space Command Strategic Master Plan FY06 and Beyond* (Peterson AFB, CO: AFSPC/XPXP, 2003), 30.
[170] Parallels JAOC strategy division. See Joint Publication 3-30, *Command and Control for Joint Air Operations*, 5 June 2003, C-1.
[171] Ibid., C-2.
[172] The theater space tasking order is independent of the Space Tasking Order (STO) produced by Air Force Space Command's 14th Air Force. The author has used TSTO to delineate between the two products.
[173] Parallels joint air ISR operations. See Joint Publication 3-30, *Command and Control for Joint Air Operations*, 5 June 2003, III-29.
[174] Based on JFACC procedures. See Joint Publication 3-30, *Command and Control for Joint Air Operations*, 5 June 2003, I-2.

The joint space operations targeting cycle produces the joint space integrated prioritized target list (JSIPTL) and a recommended JFC apportionment for joint space operations. The JSIPTL is a prioritized list of targets to be serviced by joint space operations.[175] The JSIPTL also lists the theater requirements for USSTRATCOM global space support. The space apportionment recommendation flows from the targets identified in the JSIPTL. Once the JFC approves the JSIPTL and the space apportionment, they feed into the joint space tasking cycle.

The joint space tasking cycle produces the theater space tasking order (TSTO). The joint space tasking cycle provides a repetitive process for the planning, coordination, allocation, and tasking of joint space operations with the guidance of the JFC.[176] Based on the air tasking cycle, the space tasking cycle also steps though strategy, targeting, tasking, operations, and assessment. The TSTO is the one document that summarizes joint space operations. It tasks joint space operations over time, usually for a 24-hour period, and contains other component's space operations, those not tasked by the JFSCC, to ensure deconfliction and coordination of all space operations within the JFC's campaign.

The approach to joint space operations outlined above closely parallels joint air operations. Modifications were required to accommodate the non-kinetic nature of joint space operations and duplicate the role of the Space Authority in providing a list of requirement for USSTRATCOM support. Using this general model, the effectiveness of the JFSCC construct is considered in light of the three hypothetical situations.

Analysis

Effectiveness of the functional component for space approach to theater space command and control is considered through three situations: theater organic on-orbit space systems (microsatellites and near-space), the mission of space superiority, and

[175] JSIPTL, though derived from the joint air operations JIPTL, is likely to take a non-kinetic approach to targeting. In joint air operations the JIPTL is the list of adversary targets to be struck with airpower. The JSIPTL will include adversary targets for counterspace systems but also address integration of theater force enhancement capabilities by "targeting" space capabilities on friendly forces.

[176] Parallels the joint air tasking cycle. See Joint Publication 3-30, *Command and Control for Joint Air Operations*, 5 June 2003, III-19.

battlefield control of the Space Radar system. An effective command and control construct should provide a means to integrate space warfare into the JFC's campaign.

Hypothetical Situations

In the first situation, the SecDef transfers microsatellites and near-space assets to the JFC. There are two aspects to consider with the microsatellites: command relationships and control mechanisms. Microsatellite command relationships are similar to other functional forces. The JFC receives OPCON of a constellation of imagery microsatellites from Air Force Space Command and transfers OPCON to the theater Commander of Air Force Forces (COMAFFOR). The COMAFFOR is responsible for satellite bus operations with the JFSCC, assigned the spaceborne ISR mission, responsible for tasking the imaging sensors.[177] The JFSCC receives TACON of the microsatellites for planning, coordinating, allocating, and tasking of the imaging sensors. The JFSCC controls the microsatellites through the four divisions of the JSOC. The strategy division, for example, can determine when to request the microsatellites for a surge in organic ISR to support a certain phase of operations. The plans division, based on orbital mechanics, lays out microsatellite access and helps prioritize theater use of the imaging sensors for the next day in the TSTO. The operations division, in lockstep with the ISR division, tasks the imaging sensors based on joint force requirements. As the microsatellites pass overhead approximately every ninety minutes, the operations division needs to task each satellite sensor several times a day. The ISR division works closely with the theater collection manager and the entire JSOC to optimize the microsatellites to meet theater requirements.

The JFSCC also has command and control of several near-space assets. The command relationships flow from the JFC, who receives OPCON several Air Force and Army near-space imagery and communication systems. OPCON of the near-space assets is transferred to the respective service components of the joint force. The JFSCC, responsible for spaceborne ISR and theater force enhancement, receives TACON of some

[177] Satellites have two aspects to command and control, the bus and the payload. The satellite bus provides power, thermal management, and other functions that keep a satellite in orbit and operating. The payload is the portion of the satellite that produces the effect to be exploited, such as an imaging sensor or a communications relay.

but not all of the near-space systems. The Army retains control of two of the five communication systems for dedicated service component use. As with the microsatellites, the service component is responsible for command and control of the near-space bus while the JFSCC is responsible for the near-space payloads made available for joint space operations.

The control mechanisms for the imagery near-space systems will be similar to those discussed above for imaging microsatellites, so are not addressed here. The near-space communication systems falls under the JFSCC's theater force enhancement mission are controlled through the JSOC as well. The strategy division fits near-space communications into the joint space operations plan by considering friendly capabilities, adversary threats, and the JFC's objectives. Courses of action integrate near-space communications into the joint campaign, ensuring communications for the JFC's most pressing needs. The plans division, based on strategy division's course of action, produces the JSIPTL and a recommended JFC apportionment. The apportionment recommendation could ask for TACON of the two dedicated Army systems if they best serve the JFC as a joint space asset for a short period. In any case, once the JFC approves the apportionment of assets and who will be serviced by the communication systems, the plans division produces the TSTO. The TSTO integrates and tasks the near-space communication assets made available to the JFSCC and deconflicts their operation with the two Army systems. As service components may operate independently in near-space, the JFSCC provides someone to control the scheme of maneuver. Deconfliction, in the near-space communications example, ensures assets do not interfere with each other. The operations division responds to outages and emerging requirements during the execution of the TSTO. Finally, the strategy division assesses the effectiveness of near-space communications during the period of the TSTO, modifying strategy to optimize support to the joint force. With this feedback, the JFSCC's iterative control process begins again in the JSOC's strategy division.

The second situation addresses theater space superiority. The JFC faces a GPS jamming threat and has OPCON of a CounterComm system. The JFC assigns the counterspace mission to the JFSCC to include defensive and offensive counterspace operations. The JFSCC provides operational focus on gaining and maintaining space

superiority, ensuring joint force access to space and, as directed, denying the same to the adversary. Even before hostilities begin, the JSOC is working space superiority. The strategy and ISR divisions create a space intelligence preparation of the batttlespace and execute the joint space estimate process to gain insight into friendly vulnerabilities and adversary weaknesses. With this baseline, the joint space operations plan outlines courses of actions to minimize JFC vulnerabilities and exploit adversary weaknesses.

For defensive counterspace operations, JFSCC contingency plans address response options to an active GPS jammer. The JFSCC, through the JSOC, can request support from another theater functional component to kinetically destroy the jammer (the fate of GPS jammers in OIF) or request that USSTRATCOM burn through the jamming with increased power from the GPS III spot beam.[178] Whatever the course selected, the JSOC will track and assess status of the interference. If unresolved, the JFSCC can assist the other components in minimizing the operational impact while setting in motion further actions to negate the jamming.

For offensive counterspace operations, the JFC transfers OPCON of the CounterComm system to the COMAFFOR. The JFSCC, responsible for counterspace, receives TACON of the system. The JSOC, using its iterative planning and execution process, provides robust control of CounterComm system from strategy through assessment. The strategy division's joint space operations plan ensures offensive counterspace actions are consistent with national policy and theater rules of engagement. The plans division, through target development and weaponeering, places CounterComm targets on the JSIPTL for JFC approval. Once approved, plans division tasks the CounterComm system through the TSTO, ensuring to deconflict operations across the joint force. While possible, it seems unlikely that a JFC would allow service components to operate independent offensive counterspace operations. There may be a need, however, to deconflict JFC counterspace operations with external agencies, such as USSTRATCOM, to ensure other friendly operations are not impacted by the CounterComm system. The proposed JFSCC construct offers little insight on how to

[178] The next generation of GPS satellites, GPS III, are being designed with an antenna that can, according to the system program director, "provide a more tightly focused beam of higher power on a smaller area of the globe." See Harrison Donnelly, "Slamming the Jamming," *Military Aerospace Technology Online Edition* 3, issue 3 (15 November 2004) , n.p., on-line, Internet, 10 May 2005, available from http://www.military-aerospace-technology.com/print_article.cfm?DocID=685.

integrate theater operations into global operations, an observation addressed in the next section. The operations division monitors CounterComm execution of the TSTO. Finally, the strategy division assesses the effectiveness of the CounterComm operations. If required, and directed, the JSOC continues CounterComm operations to meet JFC objectives.

The final example calls for battlefield tasking and control of the space radar system. A global space system designed for theater control represents a new breed of space asset that challenges both the command and the control aspects of theater operations. Command relationships are the first challenge. The familiar pattern of OPCON to JFC, OPCON to service component, and TACON to JFSCC does not work with space radar. Unlike the microsatellites, space radar is not intended for any one theater's exclusive use so the JFC is unlikely to receive OPCON. TACON and Support are the two remaining command authorities. Support is the current command relationship between theaters and USSTRATCOM for global space assets, which does not fit the battlefield control paradigm. That leaves TACON, which does seem to fit battlefield control as it provides "sufficient authority for controlling and directing the application of force or tactical use of combat support assets within the assigned mission or task."[179] Now, instead of OPCON, the JFC receives TACON of global satellites for short periods continuously throughout the day. Who should receive TACON, the service component or the JFSCC? If the JFC is integrating Space Radar across the joint force, the logical choice is the JFSCC. Air Force Space Command, retaining OPCON, is responsible for satellite bus operations with the JFSCC, gaining TACON, responsible for tasking the payload. This command arrangement also complicates theater control of space radar.

Control of space radar may require JFC participation at two levels, global and theater. Globally, the shared nature of the space radar constellation is likely to require the JFC to participate in an allocation process run by an external organization, potentially USSTRATCOM. A global allocation process seems unavoidable given space radar is the

[179] Joint Publication 0-2, *Unified Action Armed Forces (UNAAF)*, 10 July 2001, III-8.

single radar satellite system to support all US military and US Intelligence Community operations.[180]

At the theater level, the JFC turns to the JFSCC to control individual space radar satellites made available during the global allocation process. The JFSCC must integrate a dynamic global system into theater operations. Assuming space radar is in low earth orbit, the JFSCC receives control of individual satellites for 10 to 15 minutes at a time. The numbers of satellites available to the JFC will change dynamically based on orbital mechanics, constellation health, and the global allocation process. Finally, real-time tasking of the satellites as they fly overhead requires a responsive control system that can coordinate across the joint force and task the satellite payload in seconds (satellite availability limited to 15 minutes at most). The JFSCC needs a dynamic JSOC to integrate space radar into the JFC's campaign.

The JSOC controls each space radar satellite by planning, coordinating, allocating, and tasking their payload. The strategy division will have to work both the global and theater aspects of space radar. The needs of competing organizations drive global allocation so the division must help the JFC make a strong argument for access to the system. In theater, a long-term strategy is needed to optimize space radar into the JFC's campaign. Which component needs priority access to the system? When? Will available satellites provide GMTI or imagery? These questions shape not only theater space courses of action but affect any joint force plan that includes space radar. The plans division lays out space radar availability and helps prioritize theater use of the payload, GMTI or imaging, for the next day in the TSTO. During execution of a space radar sortie, the ISR division coordinates in real-time with the theater ISR process to get requirements from across the joint force.[181] The operations division turns those requirements into real-time tasking for the space radar payload. This requirement / tasking cycle repeats throughout the 15-minute sortie. Based on the TSTO, the ISR and operations divisions may generate multiple space radar sorties on any given day. Finally, the strategy division assesses operations to improve the effectiveness of Space Radar in

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[180] House, *Statement by The Honorable Peter B. Teets, Under Secretary of the Air Force, Director of the National Reconnaissance Office, Department of Defense Executive Agent for Space, Hearings before the Committee on Armed Services, Strategic Forces Subcommittee*, 9 March 2005, 7.

[181] In air operations, a sortie equals an operational flight by one aircraft. The use of an individual satellite for a finite period suggests the term may fit space operations as well.

the joint operation. For as long as the theater gains access, the JFSCC continues to plan, execute and assess space radar operations through the JSOC.

Observations

The hypothetical situations demonstrate that the JFSCC offers an effective command and control approach to theater space operations from an operational and doctrinal perspective. Operationally, it recognizes the changing role of the theater in space operations, the changing nature of space capabilities, and addresses evolving threats to theater space superiority. Doctrinally, the functional component for space provides a unity of command in theater operations, centralized control of joint space forces, and offers a viable set of control mechanisms. While the focus of this paper is theater command and control, the analysis indicates that theater space will require a robust linkage between theater and global space operations that the JFSCC construct, as defined, does not provide. Overall, the JFSCC offers a more realistic view of how to integrate space into joint warfare.

A functional component for space is a step towards recognizing the independent role of the theater in space operations. Theaters produce, as well as consume, space effects. Like aircraft and tanks, space assets transferred to theater must be operated and integrated into the joint fight. The JFC needs space experts to effectively operate and integrate theater space. Just as the JFC does not turn to an infantry officer to lead joint air operations, the JFC needs experienced space operators to lead joint space operations. Finally, even a limited number of heuristic examples indicate that the JFC's span of control will be overwhelmed in future theater space operations. There is a space piece of the JFC's campaign that requires an operational commander, the JFSCC, to ensure the success of space-enabled warfare.

The JFSCC approach accommodates the changing nature of space capabilities. It establishes a formal structure, the JSOC, to actively command and control any number and type of space assets. The JSOC provides command and control of organic theater space systems like microsatellites, actively pursues theater space superiority, and works the global and theater aspects of systems such as space radar. While the construct described in this paper only offers a cursory examination of a functional component for

space, it points toward a command and control approach that can adapt to the dynamic operations of systems such as CounterComm, microsatellites, and space radar. The JFSCC provides the infrastructure and processes to integrate the next generation of space into joint warfighting.

Finally, the JFSCC construct addresses the growing concern with theater access to space. As the global infrastructure for modern combat, space is essential to successful operations across the joint force. As space-enabled warfare continues to evolve over the next decade, space superiority must be a high priority for the JFC. By assigning the counterspace mission to the JFSCC, the JFC ensures that there is an operational focus on gaining and maintaining theater space superiority. The JFSCC provides the expertise, infrastructure, and processes to work space superiority at the operational and tactical levels of war. In addition to operational strengths, a functional component for space offers several benefits from a doctrinal perspective.

First, the JFSCC provides unity of command for theater space operations with a commander, not a coordinating authority, at the operational level of war. The JFSCC is assigned missions such as counterspace and spaceborne ISR. To execute these missions, the functional component receives TACON of those space assets made available for joint space operations. Unity of command is more appropriate for joint space operations as the JFSCC is directing operations, not simply planning and coordinating USSTRATCOM support.

Second, the JFSCC approach provides centralized control for theater space operations. The JFSCC, responsible to the JFC for joint space operations, ensures that space is employed as part of the broader joint operation. First, centralized control prevents theater space assets, normally OPCON to the service components, from exclusively servicing service component requirements. The JFC does retain the flexibility, however, to allow service components to retain theater space assets, such as near-space, for dedicated use. Second, as multiple components may be operating space assets, centralization allows one commander to deconflict and synergize the overall scheme of maneuver. Lastly, centralization under the JFSCC improves component interaction by plugging theater space into the JFC's existing component structure.

Finally, the JFSCC offers a viable control mechanism for theater space operations through the JSOC. Unlike current theater space doctrine, the functional component approach outlines roles and responsibilities, processes, procedures, and infrastructure. While the details must be worked, such as non-kinetic targeting on the JSIPTL, the overall concept of a JSOC appears sound for operations internal to the theater. The JSOC, modeled after joint air, requires more work to address the interaction of theater and global space operations.

The JFSCC construct does not adequately address the interaction between theater and global space operations. The CounterComm and space radar systems highlight the interdependent nature of many future space capabilities that necessitates a command and control mechanism between a JFC and USSTRATCOM that goes beyond a list of space requirements. This weakness does not invalidate the JFSCC construct but points to the need for further research. As stated in Chapter 1, the focus of this paper is limited to the theater aspect of space command and control. Logically, if one wants to integrate theater and global operations, both must be defined. Adopting the JFSCC, or some other command and control approach, for theater operations is a necessary condition to defining the relationships between the JFC and USSTRATCOM. Ultimately, a mature space command and control approach must address theater operations, global operations, and their interdependency.

Conclusion

The joint force space component commander presents a more mature approach to theater space command and control. It fills a void in joint space doctrine by acknowledging that space is a part of theater operations. The JFSCC offers a means to command and control space assets transferred to the JFC, focus on theater space superiority, and dynamically integrate global space into theater operations. Consistent with the established framework for joint operations, the functional component for space will fit into the JFC's existing command structure. As with other functional components, it provides unity of command, centralization, and effective control mechanisms. Most importantly, from the author's perspective, the JFSCC represents a starting point for theater space warfare where none is found in doctrine today.

Chapter 5

Challenges of JFSCC

It must be considered that there is nothing more difficult to carry out, nor more doubtful of success, nor more dangerous to handle, than to initiate a new order of things.

Niccolo Machiavelli

The argument in this paper is that the US military needs to mature its command and control approach to space in order to best integrate the growing role of space in theater operations. The previous chapters have discussed the what (command and control), the where (theater), and the why (space-enabled warfare), and in addition compared the how (Space Authority vs. JFSCC). In this chapter, the who and the when of the JFSCC are explored as three challenges: doctrine, politics, and resources and timing. These two final aspects, who and when, may represent the most difficult part of the JFSCC concept because they suggest near-term change to the existing order of things. But it is also necessary. Space technology is evolving to offer new capabilities to the warfighter. Organizations must adapt to new capabilities and effectively integrate them into their operations. The tank, machine gun, and airplane were technical advances that redefined military operations. The adaptation of the world's militaries to these new technologies required significant change that some addressed better than others.[182] The author proposes that the US military must adapt to the new capabilities emerging in space. If space is the cornerstone of modern military operations, the issues of who and when of the JFSCC are challenges that must be addressed sooner rather than later.

[182] The 1939 invasion of Poland by Germany saw the Polish Calvary ineffective against the German's blitzkrieg. Horseback calvary was no match for German tanks.

Challenges of JFSCC

The joint force space component commander construct poses challenges in terms of doctrine, politics, resources, and time. The JFSCC drives doctrinal debate on who is responsible for space operations and who manages the global allocation process. Service politics, a second challenge, may be a roadblock to maturation of theater space command and control as consideration is given as to who will serve as the commander of the joint force space component. Finally, resources and timing highlight challenges of cost, work force, standardization, and the ever contentious when of JFSCC.

Doctrine

The future of space warfare tests joint doctrine from two perspectives: space operations, and command and control. From a space operations perspective, the doctrine debate over who is responsible for space, theater or USSTRATCOM, needs to be resolved. Joint Publication 3-14 confuses the issue by acknowledging that theaters may have organic space assets, but then provides no guidance on how to integrate them into joint operations. Even if space assets were never transferred to theater with OPCON or TACON, the next generation of capabilities, such as space radar, will still drive the need to integrate dynamic systems into theater operations. Where today is the theater command and control process to address the global and theater aspects of such systems? The debate over global *or* theater command and control of space is OBE (overcome by events). The relevant question now is how much of each. While many space assets will continue to serve the global infrastructure, some will be tailored for, and transferred to, theater commanders. Technology is evolving the tools of space, and operations must adapt to the change. US success on the battlefield requires that USSTRATCOM and the theaters fight space interdependently. It benefits the US military to address this doctrinal debate before systems such as JWS and Space Radar become operational. Clear agreement on the issue not only informs doctrine but also sets the stage for how Services organize, train, and equip for space warfare.

The second doctrine challenge of the JFSCC revolves around the allocation of global resources in distributed operations. This is a challenge not only to space but also to other warfighting mediums, as seen with the Predator UAV and the Army's Future

Combat Systems concept. The network approach to warfare that space enables blurs the lines of ownership that are at the foundation of the current approach to command and control. Unity of command is based on the four command relationships: COCOM, OPCON, TACON, and Support. Inherent in the first three is the notion that a commander has exclusive access to the asset, ownership if you will. Today's command and control doctrine is designed for rather non-dynamic interaction among the combatant commanders. Military assets from one combatant commander are transferred to another combatant commander for their exclusive use over a period. This transfer process may take weeks to months, with forces identified for transfer, shipped or flown to theater, used in theater operations for a period, then transferred back to back to the US or theater of origin. Space-based assets like space radar could see TACON of a single satellite passed from theater to theater numerous times in a single day—perhaps *every* day of the operation. Such dynamic global resources do not fit the current allocation process.

Today's global allocation process involves the Secretary of Defense who, as the common commander between combatant commanders, decides who gets access to military resources.[183] Given the nature of distributed operations, with resources shared among numerous users across multiple combatant commanders, the current allocation process seems unworkable in the future. Distributed operations, in the space arena alone, would quickly overwhelm the SecDef's span of control. Fortunately, a more dynamic process appears on the horizon. The DOD is transitioning to a global force management process that "will allow [the US] to source our force needs from a global, rather than regional, perspective."[184] According to the 2005 US National Defense Strategy, under this concept the "Combatant Commanders no longer 'own' forces in theaters. Forces are allocated to them as needed—sourced from anywhere in the world."[185] What this portends for command and control doctrine is unclear. Will the concept of COCOM be

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[183] The Secretary of Defense assigns or attaches military forces to a combatant commander. The SecDef permanently assigns military forces dedicated to a combatant commander. When the SecDef temporarily transfers military forces from one combatant commander to another combatant commander, perhaps to support military operations in another part of the world, they are attached to the gaining combatant commander. The SecDef must specify the command authority, such as OPCON or TACON, provided to the gaining combatant commander. See Joint Publication, 0-2, *Unified Action Armed Forces (UNAAF)*, 10 July 2001, x.

[184] Department of Defense, *The National Defense Strategy of The United States of America* (Washington DC: Office of the Secretary of Defense, March 2005), 20.

[185] Ibid.

retained now that Combatant Commanders no longer own forces? As the DOD develops this new approach to resource allocation, there is an opportunity to ensure dynamic global resources, such as next- generation space assets, are part of the global force management process.

Politics

Who should serve as the JFSCC is a political issue that may stand in the way of maturing space command and control. Joint doctrine provides general guidance on who should serve as a functional commander. The JFC designates all functional component commanders and, according to JP 0-2:

> Normally, the Service component commander with the preponderance of forces to be tasked will be designated as the functional component commander; however, the JFC will always consider the mission, nature and duration of the operation, force capabilities, and the C2 capabilities in selecting a commander.[186]

If there were a separate space service, the JFSCC would be a forgone conclusion. There is not, so the relevant question becomes which service commander to select as JFSCC. The service component with the preponderance of space forces has traditionally been the United States Air Force. Given this, it would seem a logical step to associate the Air Force with the position of the JFSCC. There appears, however, to be some contention over the Air Force's role in operational space. During coordination of the current version of JP 3-14, *Joint Doctrine for Space Operations*, the Air Force Doctrine Center offered a Joint Force Air and Space Component Commander (JFASCC) construct for inclusion in the document. Consistent with the Air Force's view of itself as the air and space service, the JFASCC would provide a functional component for theater joint air and space operations.[187] The joint community did not accept the JFASCC construct and settled on the Space Authority as a compromise. While better than nothing, the Space Authority offers an evolutionary step at best. Theaters will be commanding, not coordinating, space within the next decade; there must be an effective mechanism to

[186] Joint Publication 0-2, *Unified Action Armed Forces (UNAAF)*, 10 July 2001, V-19.
[187] It is interesting to note that the joint definition of JFACC only addresses air power (i.e., joint force air component commander). Air Force doctrine defines the JFACC as the "joint force air *and space* component commander (italics not in original). See Air Force Doctrine Document 1, *Air Force Basic Doctrine*, 17 November 2003, 92.

ensure that theater *and* global space is optimized for the warfighter. If the notion of a JFASCC is unacceptable, a dual-hat concept may be more palatable. One service commander could serve as multiple functional component commanders. For example, if the Army component provides the preponderance of space and ground forces, that component commander would serve as the JFSCC and JFLCC. The dual-hat approach may not be the final answer, but the US military must find a politically acceptable solution that moves theater space operations into the twenty-first century.

Resources and Timing

It will take resources and time to provide a sufficient command and control structure for theater space operations. Three aspects of resources that should be addressed as part of the JFSCC are cost, work force, and standardization. On the cost side, it seems foolish to spend billions of dollars on space hardware and then do space command and control on the cheap. Space-enabled warfare is about the integration of space into warfighting. It requires a robust command and control mechanism that compliments and combines with other aspects of joint operations. Yes, a joint space operations center might costs millions of dollars. Yes, the theater may require hundreds of personnel. But, what is the alternative? The cost of not having an effective command and control approach could be far more significant, ranging from lost opportunities to degradation of combat effectiveness to actual mission failure.

JFSCC staffing will be a vital matter, for the power of the JSOC is the people, not the machines. Theater space operations, as the author has argued, require a new mindset. A new generation of space operators needs to come with the next-generation of satellites. The US Air Force's Space Weapons School is a step in the right direction, training operators to integrate space into theater operations.[188] Unfortunately, less than 150 officers have attended the school over the last nine years.[189] The US Army has also made strides with its space cadre, creating an Army career field focused on supporting Army operations.[190] It's a start, but how many space operators will be needed in theater to

[188] Staff Sgt Jennifer Thibault, "Space integration crucial to fight, evident at weapons school," *Air Force Space Command News Service*, 15 December 2004.
[189] Ibid.
[190] US Army, *Space and Ballistic Missile Defense Forces*, n.p., on-line, Internet, 10 May 2005, available from http://www.smdc.army.mil/FactSheets/SBMDF.pdf.

operate and integrate microsatellites, near-space assets, CounterComm systems, and space radar? Machine-to-machine interfaces may help staffing, but it may take every weapons school officer ever produced to staff even one JSOC. Still, the theater needs trained space experts to integrate space into joint operations, to build strategies, to detail the plans, and to respond to real-time crisis. These space experts will not appear overnight. The US military must develop next-generation space operators to complement next-generation space systems – seamlessly integrated at the operational and tactical levels of war.

The final aspect of JFSCC resources concerns standardization. A standardized approach to theater space command and control provides efficiency and effectiveness for space warfare, logistically and operationally. A JFSCC establishes doctrine, processes, and infrastructure that the Services can use as a standard for organizing, training, and equipping their own space forces. This approach is consistent with the new global force management process, allowing the US military to move people and equipment around the globe. Space assets, like Army near-space communications, that integrate seamlessly into any theater operation make for efficient space capabilities. Near-space needs to take a lesson from unmanned aerial vehicles and ensure interoperability via standardization.[191] The JFSCC approach also provides effectiveness by establishing a basis for standardized interaction between global and theater space operations. Space radar, as discussed in Chapter 3, could require USSTRATCOM to coordinate and integrate the system into several on-going theater operations simultaneously and continuously. This will be a near impossible task if each theater takes a unique command and control approach to space radar. JFSCC offers a standard approach to theater space operations that provides for efficient and effective joint operations.

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[191] In October 2003, there were at least 138 military UAVs in production, prompting Air Force concern that "it will become increasingly difficult to manage and coordinate air combat operations, because each UAV system comes with it own unique software and mission-control stations." (Sandra I. Erwin, "UAV Programs need Common Standards, Says Industry Study," National Defense Magazine, October 2003, 1.) According to the DOD's 2002 UAV Roadmap, "Interoperability among UAV systems is critical in order to reduce acquisition costs, share sensor data among disparate users, ease issues of operational and tactical control (OPCON and TACCON), allow common operational procedures and reduce training requirements." (Department of Defense, *Unmanned Aerial Vehicles Roadmap: 2002-2027* (Washington D.C.: Office of the Secretary of Defense, 2002), 135.)

The question of when is the final challenge facing the JFSCC concept. Some may argue that it is too early to worry about a functional component for space; that the acquisition process takes years. While true, this argument misses that it takes years to develop the organization, people, and processes that must go with the new systems. Further than that, it seems that there are already too many "if onlys": if only the next-generation of systems wasn't so different…if only space wasn't so integrated into joint warfare…if only networking wasn't transforming the American way of war. If only. Similar sentiments were no doubt held regarding air power at one time. There is a growing need, created by technology and pressed by operational necessity, to command and control theater space operations at the operational level. The answer is plain. The when of the JFSCC is now.

Conclusion

The joint force space component commander calls for a change in the current order of US military space operations. Conceptual and organizational change is required to optimize the future capabilities that space brings to the fight. The Army's "space to mud" slogan emphasizes the integration of space into the operational and tactical levels of war. Joint doctrine must leave the Cold War behind and reflect this new reality. Likewise, as space capabilities push into theater there must be organizational change to ensure the space piece of a JFC's campaign is the equal of the air, land, maritime, and special operations components. As the 2001 Space Commission declared: "We are now on the threshold of a new era of the space age, devoted to mastering operations in space."[192] For theater operations the who is the JFSCC, and the when is now. The joint operator must leave politics to the Services and get on with the integration of space into the fight. It is time to initiate a new order of things.

[192] Honorable Duane P. Andrews et al., *The Report of the Commission to Assess United States National Security Space Management and Organization* (Washington D.C.: Commission to Assess United States National Security Space Management and Organization, 11 January 2001), 11.

Conclusion

The present extent of U.S. dependence on space, the rapid pace at which this dependence is increasing and the vulnerabilities it creates, all demand that U.S. national security space interests be recognized as a top national security priority.

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The United States military depends on space for an asymmetric combat advantage. As this dependence grows at the operational and tactical levels of war, there is corresponding need to optimize space for the joint force. Command and control of theater space operations is an important factor in doing so for the space component of a joint force commander's campaign. Unfortunately, joint doctrine does little to address the theater role in space operations. The current command and control approach, embodied by the Space Authority, proves operationally and doctrinally inadequate to the task of theater space operations. A joint force space component commander, modeled after existing functional components, offers a more mature command and control approach that allows the JFC to fight the space piece of the theater campaign. While there will be challenges to such an approach, it is a necessary step towards maintaining the military's asymmetric space advantage.

Space Warfare and the Theater

Theater space warfare is emerging from two streams of evolution in military space: the role of space in military operations and the role of the theater in space operations. The role of space in military operations has evolved since its inception. Indispensable at the strategic level throughout the Cold War, space is now proving indispensable at the operational and tactical level. The global space infrastructure not only enables US combat operations around the world but also enables new approaches to warfighting. It is the integration of space into other mediums that gives rise to

transformational capabilities such as precision airpower and networked ground operations. As the incorporation of space into warfare accelerates over the next decade, the concept of space-enabled warfare puts a premium on access to space and effective integration into joint operations. Just as theater warfighters are growing more dependent on space, space operations are becoming more dependent on theater warfighters.

The role of the theater in space operations is evolving from passive consumer to that of an active consumer *and* producer of space effects. Historically, theaters have been a consumer of space effects provided by a global provider such as USSTRATCOM. That paradigm is shifting with the introduction of space capabilities that require theaters to take an active role in space warfare. Space systems such as microsatellites and near-space assets provide theaters with organic space capabilities. CounterComm gives the theater an organic capability to project non-kinetic combat effects against adversary satellites. Threats such as GPS jammers require a warfighter response lest they interfere with joint operations. Next-generation systems, such as space radar, offer theaters battlefield control of global constellations for minute-by-minute integration into tactical operations. These capabilities, some existing and others in development, all necessitate active theater participation in space operations. Theater warfighters not only have a vital interest in space but also a vital role in space warfare.

Space Command and Control

The primary assertion in this study is that the US military needs to mature its command and control approach to space to best integrate the growing role of space in theater operations. Maturity of the current command and control approach to theater space operations was analyzed against three hypothetical situations: theater organic capabilities (microsatellites and near-space assets), a space superiority mission (adversary GPS jammer and theater organic CounterComm system), and battlefield control of the space radar system. Using the same situations, the maturity of a joint force space component commander, an alternate approach to theater space command and control was considered. As outlined below, the JFSCC provides a more operationally and doctrinally mature approach to theater space warfare.

Joint Publication 3-14, *Joint Doctrine for Space Operations*, provides an immature approach to command and control of theater space operations. In a single paragraph, the doctrine offers a Space Authority to command and control the space component of theater operations. The primary mechanism of this approach is a prioritized list of JFC space requirements that serve as the theater's request for space support from USSTRATCOM. The Space Authority, perhaps adequate when theaters were only consumers of global space effects, offers little as theaters take an active role in space operations. First, the Space Authority is an inadequate approach for command of theater space operations, offering a unity of effort construct that is appropriate for planning but not operations. Second, as theaters receive OPCON of various space capabilities, a decentralized approach to control of those assets may result in sub-optimized integration into joint operations. Finally, the absence of theater control mechanisms, such as processes, procedures, and infrastructure, provides no detail on how the Space Authority collects requirements much less integrates theater and global space into joint operations. JP 3-14, fixated on the global aspect of space operations, fails to offer a mature approach to theater space warfare that ensures access to, and integration of, space into US military operations.

The joint force space component commander construct offers a more mature approach to command and control of theater space operations. Modeled on the joint force air component commander, the JFSCC complements the functional component approach to joint warfare. Operationally, it accommodates the theater role of active consumer *and* producer of space effects. The JFSCC enables the JFC to command organic space systems, actively pursue space superiority, and integrate dynamic global space systems into joint operations. Doctrinally, the JFSCC provides unity of command, centralized control, and a set of viable control mechanisms. Unity of command is ensured with a commander, not a coordinating authority, responsible for the space piece of the JFC's campaign. Centralized control allows the JFC to exploit the capabilities of joint space operations across the entire joint force. Finally, the JFSCC construct addresses the mechanics of control, such as processes and infrastructure, which are necessary to effective integration of space into joint operations. The JFSCC provides a

more mature command and control approach by recognizing the theater's vital interest in space and codifying its vital role in space warfare.

Implications

There are three main implications in this study on theater space command and control. First, space has become vital to joint military operations at the operational and tactical levels of war. The largely transparent integration of space into warfare provides tremendous US advantage but also introduces potential vulnerabilities. Second, the theater has a vital role in space operations. There is a space component of a theater campaign, from organic assets to space superiority, which must be proactively integrated with the air, land, maritime, and special operations components of the JFC's campaign. Finally, the current approach to theater space command and control is woefully inadequate. The Space Authority offers an anemic approach to integrating global space into theater operations while largely ignoring the theater piece of space operations. These three implications highlight a significant disconnect in joint doctrine that translate into a less then optimum integration of space into US joint warfighting.

The following recommendations offer a departure point for a joint debate on maturing theater space command and control. First, the theaters must take an active role in the revision of JP 3-14, *Joint Doctrine for Space Operations*. It is the theaters, not the Services or Joint Staff, which have the most to gain or lose from theater space command and control. Second, the global space vs. theater space debate must be resolved. Ultimately, mature space command and control must address each as independent constructs that are interdependent. Finally, assuming the global vs. theater debate can be settled, the particulars of theater space command and control must be worked through. Analysis in this study strongly indicates that an alternative to the Space Authority is needed. Analysis further indicates that a functional component for space is a more mature approach to theater space command and control that merits both consideration and further research. Research into other approaches, such as assigning theater space operations to an existing functional component, is also warranted and can be facilitated by utilizing the framework outlined in this study.

Conclusion

The US military needs to reassess its joint playbook on space warfare. New space capabilities, a growing military dependence on space, and adversary threats are bringing the space fight to the theaters. The current approach to space command and control, focused on global operations, proves inadequate for theater space warfare. A more mature approach, such as the JFSCC, is required to optimize both global *and* theater space operations for US warfighters. If space is a priority for US national security, as suggested by the Space Commission in 2001, it behooves the joint community to make a realistic assessment of its space doctrine, recognize the role of the theater, and work through the challenges of making space a truly equal partner in joint operations.

Bibliography

Air Force Doctrine Document 1. *Air Force Basic Doctrine*. 17 November 2003.

Air Force Doctrine Document 2-2.1. *Counterspace Operations*. 2 August 2004.

Air Force Doctrine Document 2-8. *Command and Control*. 16 February 2001.

Air Force Space Command. *Air Force Space Command Strategic Master Plan FY06 and Beyond*. Peterson AFB, CO: AFSPC/XPXP, 2003.

Air Force Space and Missile Center. *SBIRS Fact Sheet*. January 2005. n.p. on-line. Internet. 4 May 2005. available from http://www.losangeles.af.mil/SMC/is/pgs/downloads.html.

Andrews, Duane P. *et al. The Report of the Commission to Assess United States National Security Space Management and Organization*. Washington D.C.: Commission to Assess United States National Security Space Management and Organization, 11 January 2001.

Army Field Manual 40-1. *Joint Tactical Ground Station Operations*. 9 September 1999.

AUSA Background Brief. "Army Space Forces – Enabling the Joint Warfighter." October 2004.

Brumbaugh, David A. "The Parallel Air Tasking Order: Reducing the Size of the Air Operations Center." paper from 2004 Command and Control Research and Technology Symposium. 24 March 2004. n.p. on-line. Internet. 6 May 2005. available from http://www.dodccrp.org/events/2004/CCRTS_San_Diego/CD/papers/131.pdf.

Burlingame, James M. *et al*. *Grey Space and the Warfighter*. March 1997. n.p. on-line. Internet. 4 May 2005. available from http://www.au.af.mil/au/awc/awcgate/grayspc/index.htm#TOC.

Burrows, William E. *This New Ocean: The Story of the First Space Age.* New York, NY: The Modern Library, 1998.

"Corona Fact Sheet." National Reconnaissance Office. n.p. on-line. Internet. 4 May 2005. available from http://www.nro.gov/corona/facts.html.

"Corona System Information." National Reconnaissance Office. n.p. on-line. Internet. 4 May 2005. available from http://www.nro.gov/corona/sysinfo2.html.

Crowder, Col Gray. Effects based operations briefing. 19 March 2003. n.p. on-line. Internet. 4 May 2005. available from http://www.defenselink.mil/news/Mar2003/g030318-D-9085.html.

Department of Defense. *Conduct of the Persian Gulf War: Final Report to Congress*. Washington D.C.: April 1992.

Department of Defense. *Desert Storm Hot Wash*. Colorado Springs, CO: Air Force Space Command, 12-13 July 1991.

Department of Defense. *FY04 Report to Congress on PRC Military Power.* Washington D.C., Office of the Secretary of Defense, 28 May 2004.

Department of Defense. *The National Defense Strategy of the United States of America.* Washington D.C., Office of the Secretary of Defense, March 2005.

Department of Defense. *Operations DESERT SHIELD and DESERT STORM Assessment*. Colorado Springs, CO: US Space Command, January 1992.

Department of Defense. *Report to Congress: Network Centric Warfare*. Washington D.C.: Assistant Secretary of Defense, Networks and Information Integration, September 2001. n.p. on-line. Internet. 4 May 2005. available from http://www.dod.mil/nii/NCW/.

Department of Defense. *Unmanned Aerial Vehicles Roadmap: 2002-2027*. Washington D.C.: Office of the Secretary of Defense, 2002.

Defense Support Program Fact Sheet. US Air Force. May 2000. n.p. on-line. Internet. 4 May 2005. available from http://www.losangeles.af.mil/ SMC/PA/Fact_Sheets/dsp_fs.htm.

Donnelly, Harrison. "Slamming the Jamming." *Military Aerospace Technology Online Edition* 3, issue 3. 15 November 2004. n.p. on-line. Internet. 10 May 2005. available from http://www.military-aerospace-technology.com/print_article.cfm?DocID=685.

Erwin, Sandra I. "UAV Programs need Common Standards, Says Industry Study." National Defense Magazine. October 2003.

Federici, Gary. *From the Sea to the Stars: A History of U.S. Navy Space and Space-related Activities*. Washington D.C.: Naval History Center, June 1997. n.p. on-line. 4 May 2005. available from http://www.history.navy.mil/books/space/Chapter4.htm.

Fredriksson, Lt Col Brian E. "Space Power in Joint Operations." *Air & Space Power Journal*. Summer 2004.

Gilmore, Gerry J. "Space, Missile Defense Essential to Defense, Rumsfeld Says." *American Forces Information Service*. 10 Dec 2003.

Grier, Peter. "Space – The Next 50 Years." *Air Force Magazine* 88, no. 2. February 2005. n.p. on-line. Internet. 4 May 2005. available from http://www.afa.org/magazine/Feb2005/0205space.html.

Herbert, Adam J. "Toward Supremacy in Space." *Air Force Magazine* 88, no. 1. January 2005. n.p. on-line. Internet. 4 May 2005. available from http://www.afa.org/magazine/Jan2005/0105space.asp.

House. *Statement by Lieutenant General Larry J. Dodgen, USA, Commanding General, U.S. Army Space and Missile Defense Command and U.S. Army Forces Strategic Command, Hearings before the Committee on Armed Services, Strategic Forces Subcommittee*. 9 March 2005.

House. *Statement of General Lance W. Lord, Commander, Air Force Space Command, Hearings before the House Armed Services Committee, Subcommittee on Strategic Forces*. March 2005.

House. *Statement by The Honorable Peter B. Teets, Under Secretary of the Air Force, Director of the National Reconnaissance Office, Department of Defense Executive Agent for Space, Hearings before the Committee on Armed Services, Strategic Forces Subcommittee*. 9 March 2005.

"Interview with Lt. Gen. Steven W. Boutelle, USA." CHIPS magazine. Fall 2003. n.p. on-line. Internet. 4 May 2005. available from http://www.chips.navy.mil/archives/03_fall/PDF/boutelle.pdf.

Joint Publication 0-2. *Unified Action Armed Forces (UNAAF)*. 10 July 2001.

Joint Publication 2-01. *Joint and National Intelligence Support to Military Operations*. 7 October 2004.

Joint Publication 3-0. *Doctrine for Joint Operations*. 10 September 2001.

Joint Publication 3-14. *Joint Doctrine for Space Operations*. 9 August 2002.

Joint Publication 3-30. *Command and Control for Joint Air Operations.* 5 June 2003.

Jumper, General John P. Chief of Staff. United States Air Force. address to the Air Force Association's National Symposium. Los Angles, CA. 21 Nov 2003.

Jumper, General John P. Chief of Staff, US Air Force. "Future Force: Joint Operations." address to the Air Armaments Summit VI. Sandestin, FL, 17 March 2004.

Kehler, Maj Gen Robert. "Space Enabled Warfare." *RUSI Journal*. August 2003. n.p. on-line. Internet. 4 May 2005. available from http://www.findarticles.com/p/articles/mi_qa3727/is_200308/ai_n9241425.

Lambeth, Benjamin S. "The Synergy of Air and Space." *Aerospace Power Journal*. Summer 1998. n.p. on-line. Internet. 4 May 2005. available from http://www.airpower.maxwell.af.mil/airchronicles/apj/apj98/sum98/lambeth.html.

Land Remote Sensing Policy Act of 1992. Public Law 555. 102d Cong. n.p. on-line. Internet. 4 May 2005. available from http://geo.arc.nasa.gov/sge/landsat/15USCch82.html.

Lane, Lt Col Richard. "Near-space Demo Aims to Prove Boost in Combat Communications Ability." *Air Force Space Command News*. 8 March 2005. n.p. on-line. Internet. 4 May 2004. available from http://www.peterson.af.mil/hqafspc/News/News_Asp/nws_tmp.asp?storyid=05-070

Lawlor, Maryann. "Satellite Modularity Soars to New Height." *SIGNAL Magazine.* February 2005. n.p. on-line. Internet. 4 May 2005. available from http://www.afcea.org/signal/articles/anmviewer.asp?a=628&print=yes.

Levis, Alexander H. *The Limitless Sky: Air Force Science and Technology Contributions to the Nation*. Air Force History and Museums Program, 2004.

Lord, General Lance W. "Responsive Capabilities for Joint Warfighting Space." address to the Air Force Association's Air Warfare Symposium. Orlando FL, 17 Feb 2005.

Martin, Donald H. "A History of U.S. Military Satellite Communication Systems." *Crosslinks* 3. no.1 (Winter 2001/2002): 7. n.p. on-line. Internet. 4 May 2005. available from http://www.aero.org/publications/crosslink/winter2002/01.html.

Messer, William. "Getting Space-Based ISR Data to the Warfighter." *Military Review.* November-December 2001.

Moorman, Lt Gen Thomas. "Space: A New Strategic Frontier." *Airpower Journal*. Spring 1992. n.p. on-line. 4 May 2005. available from http://www.airpower.maxwell.af.mil/airchronicles/apj/moor.html.

"Most U.S. Forces Leaving S. Arabia." *CBS News*. 29 April 2003. n.p. on-line. Internet. 6 May 2005. available from http://www.cbsnews.com/stories/2003/04/27/iraq /main551262.shtml.

National Commission for the Review of the National Reconnaissance Office. *The NRO at the Crossroads.* Washington D.C., 1 Nov 2000.

Onley, Dawn. "Army takes the lead on Blue Force Tracking system." *Government Computer News*. 20 May 2003. n.p. on-line. Internet. 4 May 2005. available from http://www.gcn.com/vol1_no1/daily-updates/22133-1.html.

Page, Scott *et al*. *The Global Positioning System: Assessing National Policies*. RAND Report MR-614-OSTP. Santa Monica, CA: RAND, 1995.

Peebles, Curtis. *High Frontier: The United States Air Force and the Military Space Program*. Air Force History and Museums Program, 1997.

Roche, James G. Secretary of the Air Force. address to the AFA National Symposia. Orlando, FL, 14 February 2003. n.p. on-line. Internet. 4 May 2005. available from http://www.aef.org/pub/roche203.asp.

Roche, James G. Secretary of the Air Force. address to the 19th National Space Symposium. Colorado Springs, CO, 9 Apr 2003.

Senate. *Statement by General Richard B Myers, USAF, Chairman of the Joint Chiefs of Staff, Senate Committee on Appropriations, Defense Subcommittee, Hearing on the President's FY05 Budget Request for the Department of Defense*. 12 May 2004.

Senate. *Statement of General Lance W. Lord, Commander, Air Force Space Command, Hearings before the Senate Armed Services Committee, Strategic Forces Subcommittee*. 16 March 2005.

Sirak, Michael. "US Air Force Sees Promise in 'Near Space'." *Jane's Defense Weekly.* 13 October 2005.

Spires, David N. *Beyond Horizons: A Half Century of Air Force Space Leadership.* revised edition. Maxwell AFB, AL: Air University Press, 1998.

Stares, Paul B. *Space and National Security.* Washington D.C.: The Brookings Institution, 1987.

Teets, Peter B. Undersecretary of the Air Force. "National Security Space in America's Strategic Space Forces." address to the Strategic Space 2003 Conference. Omaha NE, 3 Sept 2003.

Teets, Peter B. Under Secretary of the Air Force. "Two Types of Space Warfare." address to the Space Warfare Symposium. Air Force Association Lance P. Sijan Chapter. Keystone CO, 29 June 2004.

Thibalt, TSgt Jennifer. "Near-space programs to provide persistent space capability." *Air Force Space Command News.* 8 March 2005. n.p. on-line. Internet. 4 May 2005. available from http://www.peterson.af.mil/hqafspc/News/News_Asp/nws_tmp.asp?storyid=05-069.

Thibault, Staff Sgt Jennifer. "Space integration crucial to fight, evident at weapons school." *Air Force Space Command News Service*. 15 December 2004.

US Air Force. *Defense Support Program Fact Sheet*. May 2000. n.p. on-line. Internet. 4 May 2005, available from http://www.losangeles.af.mil/ SMC/PA/Fact_Sheets/dsp_fs.htm.

US Air Force. *Space Based Radar Fact Sheet*. June 2001. n.p. on-line. Internet. 4 May 2005. available from http://www.losangeles.af.mil/smc/pa/fact_sheets/sbr.htm.

US Army. *Army Space Reference Text.* n.p. on-line. 4 May 2005. available from http://www-tradoc.army.mil/dcscd/spaceweb/chap2_im.htm.

US Army. "Future Combat Systems Overview." 28 January 2005. n.p. on-line. Internet. 4 May 2005. available from http://www.army.mil/fcs/factfiles/overview.html.

US Army. *High Altitude Airship Fact Sheet*. n.p. on-line. Internet. 4 May 2005. available from http://www.smdc.army.mil/FactSheets/HAA.pdf.

US Army. *Space and Ballistic Missile Defense Forces*. n.p. on-line. Internet. 10 May 2005. available from http://www.smdc.army.mil/FactSheets/SBMDF.pdf.