ERSTWHILE SANCTUARY:
OPERATIONAL COMMAND AND CONTROL OF SPACE OPERATIONS

BY

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APPROVAL

The undersigned certify that this thesis meets master's-level standard of research, argumentation, and expression.

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DISCLAIMER

The conclusion and opinions expressed in this document are those of the author. They do not reflect the official positon of the US Government, Department of Defense, the United States Air Force, or Air University.

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ABSTRACT

Exploring ways to optimize operational command and control for space operations reveals two major lines of effort, each with unique command and control challenges. The first line of effort—force enhancement—is comprised of space effects that support joint forces. Examples include intelligence, surveillance, and reconnaissance (ISR), military satellite communications, positioning, navigation, and timing (PNT), and environmental monitoring. The second line of effort is national security. Nuclear operations and a variety of civil applications link space operations to national defense. Approaching these two mission areas as lines of effort allows strategists to optimize operational command and control for each line of effort.

Force enhancement requires little coordination from a central operational command and control node. As effects are generated for theater commanders, it is personnel in the supported unified combatant command (UCC) who are in the best position to coordinate effects from space-based capabilities.

National security introduces the need for unity of effort regarding defense and coordination of on-orbit systems. The variety of inter-agency, civil, commercial, and foreign stakeholders which form the national security space enterprise make unity of command impractical, and add complexity to achieving unity of effort. Given the increase in threats to space systems, and the likelihood that future conflict will involve space systems being at risk, it is worthwhile to explore optimal operational command and control arrangements for space operations.

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Introduction

Argument

In *The Air Campaign*, Col John Warden lamented what he perceived as a lack of scholarly discussion on the operational level of air warfare. Warden believed that perhaps some combination of the inherent difficulties in linking the grand strategic and tactical levels and the attention paid to nuclear weapons meant the massing and employment of conventional forces were cast aside.[1] This research explores and offers insights into the operational level of war for space operations.

The research seeks to identify considerations associated with the operational level of war and explore ways to optimize operational command and control. Colonel Warden elaborated "Many current problems over the uses of the various Armed Services stem from a lack of coherent doctrine on how they should be used individually and collectively in an operational campaign to secure some strategic end."[2]

Exploring ways to optimize operational command and control for space operations reveals two major lines of effort, each with unique operational command and control concerns. The first line of effort—force enhancement—is comprised of space effects that support joint operations. Examples include intelligence, surveillance, and reconnaissance (ISR); military satellite communications; positioning, navigation, and timing (PNT); and environmental monitoring. The second line of effort is national security. Nuclear operations and a variety of civil and military applications link space operations to national defense. Approaching these two mission areas as lines of effort allows strategists to optimize operational command and control for each line of effort.

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[1] Col John Warden, *The Air Campaign*, (Lincoln NE: toExcel Press, 2000), 3.
[2] Warden, *The Air Campaign*, 3.

Force enhancement requires little coordination from a central operational command and control node. As effects are generated for theater commanders, personnel in the supported unified combatant command (UCC) are in the best position to coordinate effects from space-based capabilities. National security introduces the need for unity of effort regarding defense and coordination of on-orbit systems. The variety of inter-agency, civil, commercial, and foreign stakeholders which form the national security space enterprise makes unity of command impractical and adds complexity to achieving unity of effort.[3] Given the increase in threats to space systems and the likelihood that future conflict will involve space systems being at risk, it is worthwhile to explore optimal operational command and control arrangements for space operations.

International relations benefit from a whole-of-government approach regarding the proper use of outer space. Cooperation with partners and allies, a strong industrial base, and a robust national security capability coupled with norms that limit offensive action represent elements of an effective whole-of-government approach. The National Security Space Strategy (NSSS) of 2011 recognizes the importance of space and its link to national security. The document's preface declares "Space capabilities provide the United States and our allies unprecedented advantages in national decision-making, military operations, and homeland security."[4] Such military advantages and the United States' increasing reliance upon them is cause for concern as potential adversaries seek to undermine those advantages by threatening space capabilities.

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[3] The term national security space enterprise is used as a generic term to refer to the stakeholders such as the DOD, NRO, and any inter-agency partners as applicable.

[4] United States Department of Defense, "National Security Space Strategy", 2011, 1.

The inclusion of capable defense through military action is an essential component of a whole-of-government approach to international relations. A strong defense establishment adds credibility to diplomatic, economic, and other inter-agency efforts by acting as an enforcement mechanism when external actors do not respond to appeals to values or norms.

Introducing a desire and means of adequate protection of space systems adds a level of seriousness to any prospective actors seeking to enter the realm of space exploration and exploitation. Such prospects are good for the international order when intentions are virtuous, and a commitment to military strength demonstrated by effective grand strategy promotes an environment in which space can represent the positive attributes of humanity.

Organization

The central argument of Chapter 1 is that space operations fall into two main lines of effort: force enhancement and national security. Establishing these lines of effort (LOE) allows for separate and more effective approaches to command and control for space operations. Chapter 1 defines the operational level of war for space operations and provides the background discussion of the quest by senior space leadership, especially from the US Air Force (USAF) and US Strategic Command (USSTRATCOM), for a transition in mindset for space operations from operating in an uncontested environment to establishing space as a warfighting domain.

Chapter 1 also introduces the concept of unity of effort and why it is important for space command and control considerations. It describes the challenges of achieving unity of effort, the most important of which is the inability to achieve unity of command because of the different organizations involved in national security space operations.

Chapter 2 explores the force enhancement line of effort. Drawing parallels to air power employment during the First World War, the central claim is that space based effects are the primary concern of space force enhancement. Therefore, a centralized execution model, as currently organized by the Joint Space Operations Center (JSpOC) is inefficient. The chapter recommends a theater-focused command and control (C2) structure for executing force enhancement operations.

Chapter 3 describes the national security LOE and recommends a further subdivision of the LOE into lines of operation (LOO). Chapter 3 will explore the mission sets and units that contribute to the national security line of effort and recommend ways to optimize the operational level C2 of these units. The chapter draws parallels between space operations and multi-national operations to illustrate the considerations associated with the integration of the multiple stakeholders in the national space security enterprise into a common C2 structure.

The concluding chapter explores practical considerations of the findings and offers broad recommendations. An important point for the concluding chapter and for the entire thesis is that the optimizing operational command and control for space operations does not require formal doctrine changes or the creation of new or additional organizations. While doctrine changes or alternate organizations might be an answer, innovative and thoughtful leadership leveraging existing doctrine and organizational structures can attain unity of effort.

Description of Terms

The following section provides definitions of important terms from the *DOD Dictionary of Military and Associated Terms* and a short explanation of their relevance to this thesis.[5]

Unity of Effort: "Coordination and cooperation toward common objectives, even if the participants are not necessarily part of the same command or organization, which is the product of successful unified action."[6] Unity of effort is a critical concept to command and control of space operations because there are multiple organizations and stakeholders, each with unique lines of command, which contribute to space operations. These multiple organizations make unity of command impractical, which provides a significant challenge to achieving unity of effort. Therefore, optimizing command and control for space operations must focus on achieving unity of effort.

Unity of Command: "The operation of all forces under a single responsible commander who has the requisite authority to direct and employ those forces in pursuit of a common purpose."[7] A lack of unity of command makes achieving unity of effort, and therefore optimizing command and control for space operations challenging.

Line of Effort: "In the context of planning, using the purpose (cause and effect) to focus efforts toward establishing operational and strategic conditions by linking multiple tasks and missions. Also called LOE."[8] This thesis argues that the range of activities comprising space operations fall into one of two lines of effort: force enhancement and

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[5] Office of the Chairman, Joint Chiefs of Staff, *DOD Dictionary of Military and Associated Terms.* Washington, DC: 2018.
[6] Joint Chiefs of Staff, *DOD Dictionary of Military and Associated Terms,* 240.
[7] Joint Chiefs of Staff, *DOD Dictionary of Military and Associated Terms*, 240.
[8] Joint Chiefs of Staff, *DOD Dictionary of Military and Associated Terms*, 141.

national security. Each line of effort has distinct operational command and control considerations.

Line of Operation: "A line that defines the interior or exterior orientation of the force in relation to the enemy or that connects actions on nodes and/or decisive points related in time and space to an objective(s). Also called LOO."[9] The national security LOE can be further divided into LOO for strategic deterrence, space control, space situational awareness, and civil, commercial, and allied integration. Each LOO has unique but related command and control considerations.

[9] Joint Chiefs of Staff, *DOD Dictionary of Military and Associated Terms*, 141.

Chapter 1

Revisiting Space Mission Areas

Space Operations: Lines of Effort

Two lines of effort describe overall space operations: force enhancement and national security. The description of space mission areas in JP 3-14 is sufficient under the paradigm that space is an uncontested domain. However, a contested environment like the one the current national and space leadership anticipates requires a re-examination of the mission areas, and a revised outlook regarding the functions and tasks space operations provides and subsequent alteration in the methods of command and control of those functions. Joint Publication 5-0, *Joint Planning* defines lines of effort: "A [line of effort] LOE links multiple tasks and missions using the logic of purpose—cause and effect—to focus efforts toward establishing operational and strategic conditions."[1] This terminology is useful as both LOE contain multiple mission sets and are focused for a common purpose distinct from the other and, more importantly, have different implications for operational command and control.

Line of Effort 1: Force Enhancement

The force enhancement LOE represents effects generated by space-based operations for commanders in Geographic Combatant Commands (GCC).[2] For example, Global Positioning System (GPS) satellites provide forces with navigation and precision strike capability, various Intelligence

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[1] Joint Publication 5-0, *Joint Planning*, (Washington, DC: 2017), xxxiii.
[2] A geographic combatant command is a unified combatant command with a specific area of responsibility, such as US Central Command. Other UCCs, such as US Transportation Command and US Strategic Command are known as functional combatant commands.

Surveillance and Reconnaissance (ISR) satellites provide commanders with enemy orders of battle, and Space Based Infrared System (SBIRS) satellites provide missile warning and defense capabilities, just to name a few. As noted above, in an operational environment shifting more frequently to irregular warfare engagements, capabilities such as precision strike; ISR, tactical communications; and remotely piloted aircraft (RPA) operations become significantly more important. All of these capabilities are enabled by space-based operations and assets.

Line of Effort 2: National Security

It is no understatement that space-based assets are a foundation of national security. In addition to the commercial and civil applications described above, space-based capabilities are the backbone of the US's nuclear command and control enterprise, national intelligence capabilities, missile defense, and strategic warning. It is important to separate these functions from the force enhancement functions because they are inherently linked to national security concerns and do not change the priority for given joint operations. The implications for command and control considerations are that the separate lines of effort can follow separate command and control structures.

Attaching the national security LOE with the nation's nuclear deterrence capabilities attaches the appropriate level of importance to the defense of on-orbit assets, such as MILSTAR, which directly support national communications and nuclear forces. Former Deputy Secretary of Defense, Robert Work described the contribution of space capabilities to national defense as "our ability to project decisive military power across transoceanic distances—the very essence of our conventional

deterrence."[3] Recognizing the national security LOE is the first step in recognizing these capabilities as a vital part of the national defense structure, as important to national security as it is to supporting joint operations. Admiral Cecil Haney elaborates, "To deter adversaries—and potential adversaries—from threatening our space capabilities, we must also understand their capabilities and their intent and make it clear that no adversary will gain the advantage they seek by attacking us in space. We must apply all instruments of power and elements of deterrence."[4]

Defining Operational Level Command and Control

The operational level of war for space operations is important because it is so closely related to the strategic and tactical levels. In some cases, operational level command and control is virtually identical to strategic level operations *and* tactical level operations. For example, tactical operators sending commands to satellites affect national security and force enhancement missions simultaneously. An operational level concern is the status of on-going operations in multiple theaters. Coordinating and de-conflicting these concerns is the realm of operational C2.

United States Air Force doctrine defines the operational level of war as the level at which "campaigns and major operations are designed, planned, conducted, sustained, assessed, and adapted to accomplish strategic goals within theaters or areas of operations."[5] Operational-level

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[3] Jennifer Hlad, "Making Space More Military", *Air Force Magazine*, August 2016, 32.
[4] Jim Garamone, "Stratcom Chief: U.S. Must Maintain Space Dominance", DOD News, 6 February 2015, http://archive.defense.gov/news/newsarticle.aspx?id=128130 Accessed 21 December 2017.
[5] Air Force Basic Doctrine, Volume 1, http://www.doctrine.af.mil/Portals/61/documents/Volume_1/V1-D34-Levels-of-War.pdf, Accessed 27 November 2017.

commanders typically execute command and control of air operations at the component level through the Air Operations Center. USAF doctrine further describes operational level considerations: “Operational effects such as air superiority, space superiority, cyberspace superiority, defeat of enemy surface forces, isolation of enemy forces in the battlespace, and disruption or destruction of enemy leadership functions are the means with which the operational commander supports the overall strategy. Planning at the operational level of war determines *what* we will affect, with *what* courses of action, in *what* order, for *what* duration, and with *what resources*.”[6]

Drawing a parallel between space operations and air operations for understanding operational-level command and control is useful but incomplete. As described above, operational-level command and control is usually in support of a campaign or operation and involves forces under the control of a theater commander. Space operations, with a few exceptions, generate effects for theater commanders (in the case of force enhancement operations) and national security concerns while remaining in-garrison. This arrangement is sometimes described as "deployed in place." Because of this distinction, considering the best command and control options for both lines of effort will focus primarily on the effects generated by those systems, as opposed to the direct control (for example maneuver or deployment) of actual forces. Chapters 2 and 3 will revisit the concept of operational level command and control and present recommendations for optimal command and control arrangements, drawing on parallels as applicable.

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[6] Air Force Basic Doctrine, Volume 1 http://www.doctrine.af.mil/Portals/61/documents/Volume_1/V1-D34-Levels-of-War.pdf, emphasis in the original. Accessed 27 November 2017.

Military space operations take place in an environment which has transitioned from a sanctuary to one that is "contested, degraded and operationally limited."[7] What this actually means is that the US expects its adversaries to attempt to deny any advantage by attacking US space systems. Senior space leaders, especially within the US Air Force (USAF), Air Force Space Command (AFSPC), and US Strategic Command (USSTRATCOM), have sought to change the culture of the national security space enterprise into a warfighting culture, in which one should assume on-orbit assets are threatened and vulnerable. The various policy and organizational changes are important but have done little to change actual operations and make on-orbit assets any safer.

The categorization of space mission areas, as described in current doctrine, and consequently the service and combatant command approach to space operations, represents a disparate grouping of loosely-related functions. This categorization affects everything from the structure of the career field to the methods of command and control related to the mission areas. An analysis of the mission areas reveals two lines of effort for space operations: national security and support to joint operations. Operational command and control is the appropriate echelon to create a more responsive and war-fighting culture. Command and control of effects generated in-theater should be the responsibility of regional combatant commanders.

Generally accepted norms, supported by various treaties and agreements, support the view of space as an uncontested domain. As

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[7] Air Force Space Command Public Affairs, "Details of Space Mission Force Now Available From AF Space Command", 15 July 2016, http://www.afspc.af.mil/News/Article-Display/Article/841797/details-of-space-mission-force-now-available-from-af-space-command/. Accessed 3 January 2018.

space-based capabilities have evolved, the range of ideas on the proper use of space has likewise evolved, revealing an interesting spectrum. Some, such as Cassandra Steer, view space as a global commons, free from weapons and military concerns that supports cooperation and strengthens the liberal democratic order.[8] Others, such as space policy scholar Everett Carl Dolman, understand space as the ultimate high ground, to which great powers must control access, and from which a great power can project irresistible military force.[9] Of course, activities in space reflect relations and activities in any other domain. Michael Sheehan, in his book *The International Politics of Space,* describes this phenomenon*:* "humanity has brought its frontiers with it into space, replicating the political divisions and tensions that characterize global politics."[10] Those divisions create the challenge of protecting space systems to ensure their availability.

The origins of space exploration recall the Sputnik launch in 1957. The launch was a seminal event, viewed by the United States as an existential threat as the Soviet Union demonstrated the capability to strike anywhere on the planet. Despite the military implications, President Eisenhower supported the idea of space as a sanctuary. David Spires, in *Beyond Horizons: A Half Century of Air Force Space Leadership* recalls, "the Eisenhower administration established a 'freedom of space' policy that promoted unrestricted overflight to allow the free passage of military reconnaissance satellites. This meant establishing civil

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[8] Cassandra Steer, "Global Commons, Cosmic Commons: Implications of Military and Security Uses of Outer Space", Georgetown Journal of International Affairs, vol 18(1), 9.
[9] Everett Carl Dolman, "New Frontiers, Old Realities", Strategic Studies Quarterly, Spring 2012, 78, accessed 16 April 2018.
[10] Michael Sheehan, *The International Politics of Space* (Abingdon: Routledge, Oxon, 2007), 183.

spaceflight and prohibiting the deployment of space-based weapons."[11] Even then, for the US, the sanctuary mindset was not universal. United States Air Force leadership, seeking to establish organizational and national leadership in military space, saw President Eisenhower's policy as "dangerous and self-defeating."[12]

The Air Force would continue its pursuit and development of military uses for space, under the thinly veiled label of "defense support." Naturally, satellites that support military activities of any kind can become valid military targets. The argument between "militarization" and "weaponization" seems to be largely one of semantics, and the idea of space as a sanctuary seems implausible. Thus, regardless of one's political view or desire for space to be uncontested, or a sanctuary, the militarization of space has already occurred. Once the US demonstrated a significant reliance on space systems, countering threats to those systems became a priority.

Threats

The United States has enjoyed a relatively uncontested advantage operating in space. The international community has long considered space a sanctuary, and international norms have prohibited any actual or implied "weaponization" of space. However, potential adversaries of the United States and its allies seek to deny the asymmetric advantage provided by space and to develop space capabilities of their own.[13] For

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[11] David Spires, *Beyond Horizons: A Half Century of Air Force Space Leadership*, (Maxwell AFB, AL: Air University Press, 1998), 272.
[12] Spires, *Beyond Horizons*, 272.
[13] US Department of Defense, *New Joint Interagency Combined Space Operations Center to be Established*, September 2015, http://www.defense.gov/News/News-Releases/News-Release-View/Article/616969/new-joint-interagency-combined-space-operations-center-to-be-established, Accessed 27 November 2017.

example, China warrants particular consideration as the state with the most advanced and ambitious military space program of any potential adversaries. Bert Chapman, in an article published in *Astropolitics*, states "China is steadily increasing its civilian and military space capabilities with their most likely targets to be US and allied militaries and strategic assets in the western Pacific Ocean and space. Space control is a core geopolitical goal of China's strategic aspirations."[14]

In congressional testimony, the former Commander of Air Force Space Command, General William Shelton stated, “nations are now actively testing methods to deny [the United States] continued use of space services during conflict. They have developed a full quiver of these methods, ranging from satellite signal jamming to outright destruction of satellites via a kill vehicle, such as that successfully tested by China in 2007. The pace of these counterspace efforts appears to be accelerating, and the impact of the use of counterspace capabilities likely would be felt by all sectors of the space community.”[15]

Other practical considerations, such as debris and the difficulty of responding to an attack once it is in progress, increase the potential impact of an attack on space assets. Kinetic attacks against space-based assets—attacks which physically damage or destroy satellites—can create a debris field affecting all other objects in orbit. Continuing collisions caused by the debris or subsequent attacks on other satellites create more debris, eventually rendering space unusable by anyone. Also, even as it is technically possible to maneuver a satellite out of

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[14] Bert Chapman, "Chinese Military Space Power: US Department of Defense Annual Reports," *Astropolitics* 14, no. 1 (2016): 84, doi:10.1080/14777622.2016.1148464, Accessed 27 November 2017.
[15] *House Armed Services Subcommittee on Strategic Forces and House Homeland Security Subcommittee on Emergency Preparedness, Response and Communications* (2016) (testimony of William Shelton, General (Ret) USAF), 3. Accessed 12 October 2017.

harm's way, once an adversary has deployed an anti-satellite weapon, such a tactic is impractical.

The timeline from an anti-satellite (ASAT) launch to impact is a matter of hours. A satellite maneuver can take days or even weeks to plan and execute. Once a satellite is moved to safety, it is then out of position and unable to perform its mission. Most satellites are part of a constellation, and moving one usually means the remaining satellites in the constellation must be reconfigured. The effect, at least temporarily, on the mission is the same as if the satellite had been hit. Kinetic attacks on space assets also represent a unique problem as any retaliatory or escalatory actions which target adversary space assets compound the problem of creating a degraded environment in space due to debris.

According to the 2016 National Security Space Defense and Protection Report, "The list of human activities that are dependent on space systems contains most of the major functions that are vital to modern society, including trade and commerce; banking and financial transactions; personal, corporate, and government communications; agriculture and food production and distribution; power and water systems; transportation; news gathering and distribution; weather assessment and prediction; health care and entertainment. Were the world to suddenly be 'without space,' these would all seriously degrade or shut down entirely."[16] These statements reveal that space-based assets are far more than a means to support theater operations. Indeed, the space enterprise is an instrument of national security, even a metaphor for the US and Western way of life. Again General Shelton elaborates:

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[16] *House Armed Services Subcommittee on Strategic Forces and House Homeland Security Subcommittee on Emergency Preparedness, Response and Communications* (2016) (testimony of William Shelton, General (Ret) USAF), 2, Accessed 12 October 2017.

"Warfare in space is in no one's best interest, and the level of the United States' dependence on space means we have the most to lose. Every action we contemplate should cause us to ask ourselves if said action dissuades and deters potential adversaries from nefarious activity."[17]

An examination of the space mission areas as defined in Joint Publication 3-14, *Space Operations,* and of the methods of command and control reveals methods which, despite rhetoric claiming a new war-fighting ethos, still represent a bygone era of space as an uncontested domain.

Changing the Culture

In February of 2015, Admiral Cecil D. Haney, then the Commander of United States Strategic Command (USSTRATCOM), discussed the changing operational environment in space. Admiral Haney noted "US national security space systems are facing a serious growing threat….multiple countries have developed and are frequently using military jamming capabilities designed to interfere with satellite communications and global positioning systems. [China and Russia] have advanced directed energy capabilities that could be used to track or blind satellites—disrupting key operations—and both have demonstrated the ability to perform complex maneuvers in space."[18]

The perceived need for a cultural transition has been a primary driver of policy, planning, and organization as the threat environment to

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[17] *House Armed Services Subcommittee on Strategic Forces and House Homeland Security Subcommittee on Emergency Preparedness, Response and Communications* (2016) (testimony of William Shelton, General (Ret) USAF), 2, Accessed 12 October 2017.

[18] Jim Garamone, "Stratcom Chief: U.S. Must Maintain Space Dominance", DOD News, 6 February 2015, http://archive.defense.gov/news/newsarticle.aspx?id=128130 Accessed 21 December 2017.

space-based assets has evolved, and especially since 2007 when the Chinese demonstrated the ability and willingness to perform a kinetic attack against on-orbit assets.[19]

In 2016, General John Hyten, then Commander, Air Force Space Command (AFSPC), introduced the concept of Space Mission Force (SMF), described by AFSPC as an "initiative to prepare and present space forces as a ready force capable of operating in a contested, degraded and operationally-limited environment… [it is] the new standard for space operators to increase preparedness to operate their weapon systems and respond to the increasing threats to those same systems."[20] In his commander's intent General Hyten describes his goal: "to transform our culture by implementing the Space Mission Force (SMF), a new advanced training and force presentation model that prepares our space forces to meet the challenges of today's space domain, while ensuring we continue to provide vital space capabilities for the Joint Force now and in the future.[21] As Commander, USSTRATCOM, the Unified Combatant Command (UCC) responsible for space operations per the Unified Command Plan (UCP), Gen Hyten has reorganized the command, replacing the functional component commands with service-level

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[19] In 2007 China used an anti-satellite (ASAT) weapon to destroy one of its weather satellites in low earth orbit (LEO). The event was a watershed moment especially for the national security space organizations, introducing new security problems such as likely attack of on-orbit assets, as well as dangerous debris that such an attack would cause.

[20] Air Force Space Command Public Affairs, "Details of Space Mission Force Now Available From AF Space Command", 15 July 2016, http://www.afspc.af.mil/News/Article-Display/Article/841797/details-of-space-mission-force-now-available-from-af-space-command/. Accessed 3 January 2018.

[21] General John Hyten, "Space Mission Force: Developing Space Warfighters for Tomorrow", Air Force Space Command White Paper, 29 June 2016, 2, Accessed 3 January 2018.

component commands, to include the Joint Force Space Component Command (JFSCC).[22]

General John Raymond, the current commander of AFSPC, and now dual-hatted as the Joint Functional Space Component Commander, explains "This is a significant milestone, we are now focused on further integrating space . . . on taking tried and proven methods of joint warfighting, and applying them to the space domain to ensure normalization across all mission sets."[23] The quest to transform the culture even includes a continuing discussion on the inevitability of weapons in space and the need to establish an independent space organization.

Drawing a parallel between the quest for an independent air service by such advocates as Brigadier General William "Billy" Mitchell, Air Force Col Michael C. Whittington explains, "Space separatists firmly believe that in order for military space to reach its potential, those who command Air Force space organizations must be experienced space operators who have risen within the rank and file of the space community and, therefore, clearly understand this new dimension of warfare."[24] Others still, such as Air Force Lt Col Peter C. Norsky, see

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[22] Prior to the reorganization, USSTRATCOM was comprised of functional component commands. These components were typically commanded by a three-star general who were dual hatted as a numbered Air Force (or joint equivalent). The commander of Joint Force Functional Component for Space (JFCC-Space) was also the commander of 14th Air Force. In this dual hatted role, CDR JFCC Space answered to the service component, Air Force Space Command and the warfighting component, USSTRATCOM.

[23] Air Force Space Command Public Affairs, "AFSPC Commander Becomes JFSCC, Joint Space Forces Restructure", 3 December 2017, http://www.afspc.af.mil/News/Article-Display/Article/1386530/afspc-commander-becomes-jfscc-joint-space-forces-restructure/, Accessed 2 January 2018.

[24] Col Michael Whittington, *A Separate Space Force: An 80-Year-Old Argument.* Maxwell Paper No. 20, (Maxwell AFB, AL: Air University Press, 2000), 2.

similar technological and contextual developments in the evolution of airpower and space power and thus consider a separate space service inevitable, writing in 2016 “The rise of the USAF from the US Army Air Corps not only resulted from technological developments, but also from many contextual conditions that made the situation ripe for the birth of a new branch of service within the [DOD]. Thus, to deny the inevitability of an independent Space Force would be to deny the same logic and rationale that gave rise to an independent Air Force nearly 70 years ago.”[25]

The top-down approach to a culture change, with its various reorganizations, name-changes, and attempts to look into the future of the organization of the armed forces produces an interesting and much-needed discussion regarding contemporary space power theory. The policy and organizational approaches discussed above are admirable and necessary changes that communicate leadership's understanding of the importance of changing the mindset and focusing on protecting on-orbit assets. However, they are at best an incomplete solution. With the standup of the JFSCC, very little actually changes regarding operations. Gen Raymond explains, "What has occurred here today–the creation of a Joint Force Space Component Commander–will help change the collective mindset of space forces from providers of space capabilities to warfighters."[26]

A change in mindset does not equate to a change in how an organization conducts operations. Space-based capabilities face real

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[25] Lt Col Peter C. Norsky, “The United States Space Force: Not If But When”, School of Advanced Air and Space Studies, June 2016, 1.
[26] Air Force Space Command Public Affairs, “AFSPC commander becomes JFSCC, Joint Space Forces Restructure”, 3 December 2017, http://www.afspc.af.mil/News/Article-Display/Article/1386530/afspc-commander-becomes-jfscc-joint-space-forces-restructure/, Accessed 2 January 2018.

threats and potential impacts to real operations. Thus the real issue and challenge is finding ways to protect space-based capabilities using an operational and organizational infrastructure that was never designed to do so. The challenges associated with integrating and coordinating among the various and disparate organizations within the national security space enterprise are numerous; senior space leaders in the DOD, intelligence community (IC) and other stakeholders currently are attempting to address these challenges by ensuring unity of effort throughout the national security space enterprise. It is this concept and its corresponding command and control mechanisms that provide the clearest and most readily available solutions to achieving the objectives inherent in the policy and organizational efforts discussed above: protecting on-orbit assets and conducting space operations in a contested environment. To frame the problem set, it is important to define unity of effort as it relates to space operations, identify the challenges to achieving unity of effort, and provide an overview of the proposed actions to overcome these challenges.

Unity of Effort

The problem of conducting space operations in a contested and potentially degraded environment is a matter of integrating and coordinating among the various stakeholders that comprise the national security space enterprise. Because of the various organizations, it is impractical to pursue a unity of command approach, presumably with the Commander, US Strategic Command (CDRUSSTRATCOM) acting as the unified commander of all space assets and operations contributing to national security. For example, CDRUSSTRATCOM, per the Unified Command Plan, is responsible for conducting military space operations. This implies the defense of all on-orbit assets contributing to joint operations and national security. However, CDRUSSTRATCOM does not

have the authority to maneuver non-DOD satellites, such as certain ISR, weather, commercial, and civil spacecraft.

Integration of Allied and Combined Assets

Achieving unity of effort includes integration of allied and combined partners. Support to joint and combined operations involves force enhancement considerations, as well as a national security focus for the United States and for allied partners as space represents a national and global strategic asset. Globalization has created a society with virtually unlimited connections in terms of commerce, information, and communications. This connectedness has an impact on the type of conflict in which the United States is to engage and, therefore, an impact on the importance of space operations in two ways. The first is a likelihood that the United States will continue to find itself engaged in irregular warfare. As Robert Kilcullen describes, "[T]he deep structure of American engagement with the world, over at least the last 150 years, has meant that the military ends up doing [irregular warfare engagements, despite policy preferences], much more often than it does conventional state on state wars."[27] The second is an increased reliance on technological solutions as a means to avoid the sometimes politically untenable aspect of a large troop presence—"boots on the ground"—in these engagements. Again Kilcullen states, "these technologies may make policy makers *more* likely to intervene in future conflicts, because they offer the tempting possibility of fewer troops deployed, fewer body bags coming home, and less political controversy, through the promise of a lighter footprint."[28]

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[27] David Kilcullen, *Out of the Mountains: The Coming Age of the Urban Guerrilla* (New York, NY: Oxford University Press, 2015), 25.
[28] Kilcullen, *Out of the Mountains*, 25, emphasis in the original.

The implication for space operations is not only that US-based assets will support allied operations on the ground, but that integrating allied assets in space will support the national security efforts of the United States. Thus, a significant part of the unity of effort challenge is the integration of allied and combined assets into joint operations, deterring attack against them, and assuring allies of their protection.

Schriever War Game (SWG) in 2016 for the first time included representatives from France and Germany. The war game is an annual policy-focused exercise, hosted by Air Force Space Command. Its purpose is to examine issues related to space operations at the national and strategic levels and provide vital lessons and war gaming scenarios that attempt to focus on the current and future threat environment. The lessons from SWG are incorporated into doctrine, strategic plans, and tactics, techniques, and procedures (TTP). The 2016 SWG scenario demonstrated the impact on combined operations from both force enhancement and national security perspectives as it included a loss of and degradation to the Global Positioning Satellite (GPS) constellation.[29] GPS provides positioning data that is essential for the entire spectrum of combined operations. Ground forces rely on GPS for navigation. For airpower, precision-guided munitions (PGM) have effectively changed the way wars are fought by limiting collateral damage and reducing the number of weapons necessary to generate desired effects. On-orbit systems rely on positional data from GPS for orbital maintenance. Thus, loss of GPS would represent a catastrophic impact on position, navigation, and timing (PNT) operations vital to national security and to supporting forward US and allied forces alike.

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[29] Pat Host, *Schriever War Game 2016 Focuses on Loss of Credible GPS Information*, Defense Daily, June 1, 2016, http://www.defensedaily.com/schriever-wargame-2016-focuses-on-loss-of-credible-gps-information/, Accessed 3 January 2018.

One avenue forward in space operations is to create new opportunities for cooperation with allies and enhance those agreements already in place. Deputy Assistant Secretary of Defense (DASD) Douglas Loverro provides the following perspective on the importance of allied integration: "We always viewed all conflict as international, combined arms operations with our allies, but we had never done it in space."[30] Mr. Loverro's ideas concerning cooperation have obvious policy and strategy implications but also implications for command and control of space forces. Combined operations create a shared responsibility concerning providing space-based capabilities and generating space-based effects. This level of cooperation also enhances national security as it adds a level of resilience and therefore deterrence to any adversary looking to deny space-based capabilities to allied forces.

Security presents a significant challenge to integrating allied partners and creating a truly combined focus on operations. Many of the systems and information required for space control operations are not releasable to foreign partners. Despite these challenges, it is of paramount importance for military and national leadership to make every practical attempt to eliminate these barriers. According to USSTRATCOM "This multinational space collaboration effort will expand space cooperation and information sharing efforts beyond the Combined Space Operations initiative…Participants in the Multinational Space Collaboration effort will explore methods for increased sharing, cooperation, and collaboration to preserve the safety of spaceflight, and

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[30] Phillip Swarts, *Allies the Key to Future US Space Policy, Loverro Says*, Space News, November 2016, http://spacenews.com/allies-the-key-to-future-u-s-space-policy-loverro-says/#sthash.yebTpGRP.dpuf, Accessed 27 November 2017.

enhance mutual security."[31] The USSTRATCOM article elaborates: "According to Lt. Gen. David Buck, JFCC Space commander, 'while the Multinational Space Collaboration effort does not yet include combined operations, we are optimistic that increased collaboration with ally and partner nations could lead to appropriate levels of combined space operations in the future.'"[32]

Mission Areas

Joint Publication 3-14, *Space Operations*, defines five separate space mission areas: space control, space situational awareness, space force enhancement, space force application, and space support.[33] Given the rhetoric as described above regarding the change to a war-fighting culture and the importance of protecting space-based assets critical to national security, it would seem that the enterprise would be organized toward this end. However, a quick examination of the mission areas from JP 3-14 reveals that protection of space assets is the function of Defensive Space Control (DSC), a sub-mission area under the broader discipline of Space Control.

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[31] U.S. Strategic Command and National Reconnaissance Office Public Affairs, "Space operations center gets new name, USSTRATCOM begins expanded multinational space effort", 5 April 2017, http://www.stratcom.mil/Media/News/News-Article-View/Article/1141112/space-operations-center-gets-new-name-usstratcom-begins-expanded-multinational/, Accessed 27 November 2017.

[32] U.S. Strategic Command and National Reconnaissance Office Public Affairs, "Space operations center gets new name, USSTRATCOM begins expanded multinational space effort", 5 April 2017,, http://www.stratcom.mil/Media/News/News-Article-View/Article/1141112/space-operations-center-gets-new-name-usstratcom-begins-expanded-multinational/, Accessed 27 November 2017.

[33] Joint Publication 3-14, *Space Operations*, (Washington, DC: 2013), II-4-II-9. Please see the Appendix for a full definition of the mission areas from JP 3-14.

Joint doctrine describes DSC as "operations conducted to preserve the ability to exploit space capabilities via active and passive actions while protecting friendly space capabilities from attack, interference, or unintentional hazards."[34] Johnson-Freese explains, "When considering how to defend US space systems, or attack an adversary's systems, it is important to recognize the three segments involved: the ground segment, controlling the system operations; the space segment; and the electromagnetic links connecting the ground and space segments."[35] JP 3-14 implies that DSC operations protect all of these segments, but a closer examination of what actually constitutes DSC operations as described in the doctrine are active and passive measures such as physical hardening of structures, redundancy built into the space or ground segments, or even denial and deception operations.[36] It would seem the nature of DSC operations are limited only by the imagination, and one can interpret DSC operations as an inherent responsibility in all other mission areas. This is not without merit, as security is important in all operations, but given the threat environment, it would seem that more resources would be dedicated to the discipline.

Drawing a parallel between space systems and bomber/escort systems during the early days of strategic bombing, one can equate the satellites with the bombers. The space equivalent of fighter escort would certainly be considered DSC operations. However, no equivalent exists. One would also expect a mission area of such professed importance to be a primary organizing principle for space forces, in the same way that entire wings are devoted to fighter (defensive counter-air) aircraft.

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[34] JP 3-14, *Space Operations*, II-9.
[35] Joan Johnson-Freese, *Space as a Strategic Asset* (New York, NY: Columbia University Press, 2007), 91.
[36] Johnson-Freese, *Space as a Strategic Asset,* 92.

However, current AFSPC organization has one squadron dedicated to defensive space control, the 16th Space Control Squadron (16 SPCS), which resides in the 21st Space Wing (21 SW), along with missile warning radars and other units marginally related to space control.[37] The mission of the 16 SPCS is "to detect, characterize, geolocate and report sources of electromagnetic interference (EMI) on US military and commercial satellites in direct support of combatant commanders."[38] A worthwhile mission to be sure, but only one piece of the large and complex puzzle that comprises the entirety of defensive space control. This does not necessarily demonstrate a need for fighter escort satellites; it simply highlights the fact that despite the varied and sundry initiatives aiming to change the space enterprise into a warfighting culture, DSC operations remain an afterthought in doctrine and actual practice. It is out of the scope of this research to recommend acquisition initiatives. Therefore, the question remains how best to categorize the space mission areas and then exercise operational command and control to reflect the desired change in culture and, more importantly, to protect on-orbit assets and to operate in a contested space environment. The solution begins with a breakdown of the actual tasks performed by space operations and a simplification of mission area groupings.

Conclusion

The body of work describing "space" as essential to all aspects of civil and military affairs, responsible for an asymmetric advantage, and vulnerable to attack by adversaries is extensive. For the United States,

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[37] 16th Space Control Squadron Fact Sheet, Air Force Space Command, http://www.peterson.af.mil/About/Fact-Sheets/Display/Article/326205/16th-space-control-squadron/, Accessed 20 December 2017.
[38] 16th Space Control Squadron Fact Sheet, Air Force Space Command http://www.peterson.af.mil/About/Fact-Sheets/Display/Article/326205/16th-space-control-squadron/, Accessed 20 December 2017.

on-orbit capabilities are ubiquitous in military operations. Military hostilities with a near-peer adversary such as China or Russia would likely result in those assets being at risk of attack. Assured access to space-based capabilities creates an asymmetric advantage for the US and enables or supports virtually every aspect of joint operations. These capabilities are also a vital component of the civilian and international economy.

Beyond the rhetoric, space represents a variety of loosely related capabilities and mission areas. Protecting assured access to space has become a top priority for US government and military leaders. This effort has intensified in recent years as potential adversary states recognized the US's dependence on space and sought to develop capabilities and techniques to exploit or counter that advantage. The research continues the evolution of space operations by recommending a new concept for grouping space mission areas and then examining possible structures for command and control at the operational level for both groups of mission areas. The result of optimizing the operational command and control method will be to achieve and achieve unity of effort.

Chapter 2

Force Enhancement

Overview

Force enhancement (FE) is the first of two lines of effort in which it is useful to group space operations. A premium on force enhancement capabilities and the force enhancement mission suggests that separating force enhancement from the technical and "systems-based" focus of space operations units into a line of effort with applicable command and control is preferable to maintaining a centralized command and centralized execution of the SFE mission as it is currently organized.

Force enhancement operations support geographic and functional combatant commanders through a variety of mission areas originating from associated space units. The current method of centralized execution of FE operations is inconsistent with the Air Force doctrine concept of decentralized execution. It adds time and complexity to processes for which extra seconds can potentially mean lives lost on the battlefield. Joint doctrine designates the theater commander as Space Coordinating Authority (SCA). The doctrine states the SCA "gathers operational requirements that may be satisfied by space capabilities and facilitates the use of established processes by joint force staffs *to plan and conduct space operations*."[1] The operational level command and control for FE operations is at the functional component level, typically the Joint Air Functional Component Commander (JFACC).

Notable parallels exist between space force enhancement (SFE) capabilities and early uses of airpower for FE during the First World War. These parallels demonstrate possible command and control relationships

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[1] Joint Publication 3-14, *Space Operations*, (Washington, DC: 2013), III-2, emphasis added.

between theater commanders, through the AOC, and the effects generated by on-orbit assets.

Leveraging existing processes and expertise with the AOC to execute the SFE mission by interfacing directly with space operations experts eliminates unnecessary procedures and bureaucracy of the JSpOC in the SFE mission. This method optimizes coordination of FE activities and ensures the success of future operations. Implications include further innovations to multi-domain operations and multi-domain command and control (MDC2). For multi-domain operations to be successful, separate domains must be able to integrate and complement each other with the minimum amount of seams and with the most efficient and timely methods possible.

Current Operational Command and Control for Force Enhancement

The JSpOC executes the Space Force Enhancement mission on behalf of CDRUSSTRATCOM. The mission of the JSpOC is to "Execute operational command and control of space forces to achieve theater and global objectives."[2] Constructed using a traditional AOC as a model, the JSpOC is comprised of a Strategy and Plans Division, Combat Operations division, and Intelligence, Surveillance, and Reconnaissance Division (ISRD).[3] Conceptually, this construct appears to create seams and delays by centralizing execution of the mission set, separating theater space integration experts from primary responsibility of the SFE mission, and hindering the ability of joint planners in other Unified Combatant Commands (UCC) to synchronize and integrate SFE with theater

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[2] Joint Force Space Component Command, JSpOC Mission Brief, 2018, slide 2. Accessed 1 March 2018.
[3] The JSpOC is a joint organization under USSTRATCOM. The Air Force component of the JSpOC is the 614 AOC. The JSpOC is also comprised of the 614th Combat Training Squadron and the 614th Air and Space Communications Squadron.

operations. The JSpOC as the primary coordinator and executor of SFE creates an unnecessary operational-level C2 node. The additional node adds a layer of complexity, redundancy, and lack of expertise regarding theater operations.

SFE is the responsibility of the Force Enhancement Branch of the Combat Operations Division. The Force Enhancement Branch is responsible to "ensure that space services are delivered in a timely and accurate fashion" for all of the Unified Combatant Commands.[4] The language contained in the doctrine, specifically the term "deliver," demonstrates the "space push" mentality as opposed to the "operator pull" mentality needed to optimize integration of force enhancement capabilities. This is a clear example of centralized execution and inconsistent with USAF doctrine.

Air Force Doctrine Document 1, *Basic Doctrine*, states that "centralized control and decentralized execution is critical to effective employment of airpower…the flexibility to take advantage of tactical opportunities and to effectively respond to shifting local circumstances can only be achieved through decentralized execution."[5] Even if those assigned to the Force Enhancement Branch are adequately trained and knowledgeable concerning theater plans and operations (which they typically are not), it is unrealistic to expect a small team assigned to the JSpOC to maintain the situational awareness of on-going operations for potentially all Unified Commands worldwide. To do so would require multiple teams assigned to each theater with battle rhythms synchronized to those of the supported theaters. While not an

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[4] Office of the Secretary of the Air Force, Air Force Tactics, Techniques, and Procedures 3-3.AOC, *Operational Employment: Air Operations Center*, (Washington, DC: 2016), 9-17.
[5] Office of the Secretary of the Air Force, Air Force Doctrine Volume 1, *Basic Doctrine,* (Washington, DC: 2015), 67.

inconceivable prospect, it still adds an unnecessary layer of coordination. Given that theater AOCs have space integration experts assigned, force enhancement at the JSpOC is redundant.

In practice, the FE branch is a reach-back organization. In a generic scenario, theater forces contact the JSpOC with a request or a problem, and the JSpOC coordinates resolution along with the appropriate space operations units, usually a space support squadron. For example, a ground unit in a theater having an issue with GPS would contact the AOC, who is usually the space focal point in the theater. Space personnel assigned to the AOC would then contact the JSpOC FE branch. The JSpOC would then contact the 2d Space Operations Squadron—the unit responsible for command and control of the GPS constellation—who would ultimately resolve the issue. There is no apparent advantage for space personnel in theater to route force enhancement issues through the JSpOC; the JSpOC is little more than a relay, adding unnecessary time and processes to the SFE mission.

Attempts at coordination between space personnel assigned to US European Command and personnel assigned to the JSpOC during Operation Odyssey Dawn illustrates how bureaucratic stagecraft disguised as support to joint operations invariably adds fog and friction where neither is needed. Robert C. Owen describes the relationship in *Precision and Purpose: Airpower in the Libyan Civil War*: “the space team at [USEUCOM/USAFRICOM] Ramstein voiced several concerns regarding the support they received from CONUS. First, they emphasized the challenge of getting augmentation personnel in a timely manner. While they perceived that other commands, such as ACC and AMC, sent out planners on a preemptive basis, they felt that [USSTRATCOM] and

AFSPC held fast to formal RFF procedures that were too slow for the pace of events."[6]

Sending personnel to augment theater space forces is an interesting example for a discussion of force enhancement. While it would seem less of an operational matter than one of organizing, training, and equipping, the apparent lack of appreciation for operational needs and the adherence to a procedure at the cost of effective support to theater illustrates one of the deficiencies of centralized execution of the SFE mission. Specifically related to performing the SFE mission, which is theoretically the mission of the JSpOC, Owen continues, "Some Ramstein team members also reported their sense that JFCC Space and the JSpOC were neither as sensitive to their specific support requirements nor as flexible in providing the support they needed. When, for example, the Space Cell requested that the JSpOC tailor its daily report on GPS availability to the theater's specific needs, it received a response that they would have to take the general report sent to all theaters and do its own analysis. Also, when the JSpOC seemed slow in adjusting its overhead persistent infrared (OPIR) watch boxes over Libya to match unfolding operations, the Space Cell felt obliged to make an end run directly to the unit operating the system. This serious violation of JFCC procedures resulted in further friction with the JSpOC. When all of these limitations were considered they acknowledged the ability to cover special requests for tailored reports and OPIR watch box adjustments likely fell short of theater desires."[7]

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[6] Robert C. Owen, "The U.S. Experience: National Strategy and Campaign Support," in *Precision and Purpose: Airpower in the Libyan Civil War,* ed. Dr. Karl P. Mueller, (Santa Monica, CA: RAND, 2015), 99.
[7] Owen, "The U.S. Experience", 99.

For adequately trained space professionals, tailoring GPS availability reports and coordinating OPIR watch boxes should be a relatively simple matter.[8] At first glance, the JSpOC's failure to give anything other than simple support seems inexplicable, especially given their mission statement and objectives. A closer look, considering Allison and Zelikow's Organizational Behavior Model, reveals the JSpOC's actions to be a reasonable and expected outcome of the centralized nature of mission execution and given organizational structure.[9] As force enhancement gains in importance and operational timelines shorten, these problems are sure to intensify.

Looking ahead to the environment in which joint operations are likely to take place, one is sure to find examples of how any deficiency in SFE will impact future operations. One example is the increased use of and reliance on remotely piloted aircraft (RPA). This increased tempo places even greater importance on the satellite communications (SATCOM) links and PNT capabilities that are critical to RPA operations. Furthermore, trends which point to a continuing threat from violent extremist organizations with access to increasingly sophisticated weapons systems suggest that future military engagements will have an increased need for ISR and tactical OPIR capabilities. As military operations become less about large conventional forces and more about smaller engagements on a continually changing battlefield, force enhancement capabilities will operate on an ever-decreasing timeline.[10]

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[8] A simple example would be representatives in the GCC providing coordinates directly to OPIR operators to create an area of enhanced coverage. Normally the process requires GCC personnel to create a space support request (SSR) and route it through the JSpOC who then provides the request to the OPIR units.
[9] Graham T. Allison and Philip Zelikow, *Essence of Decision: Explaining the Cuban Missile Crisis* (New York, NY: Longman, 2010), 143.
[10] David Kilcullen, *Out of the Mountains: The Coming Age of the Urban Guerrilla* (New York, NY: Oxford University Press, 2015), 50.

Johnson-Freese states that "All these [FE capabilities] help the military break through the fog of war and have been increasingly incorporated into US military operations since the 1991 Gulf War."[11] This trend shows no signs of slowing down. The deficiency of centrally executed SFE operations from the JSpOC, coupled with an increasing need for these capabilities in future operations, suggest an adverse impact on operations in all domains.

Operational Command and Control of Force Enhancement from the Theater

Force enhancement is best understood and best executed from the theater supported. SFE is essential among the space mission sets described in JP 3-14 as it justifies the existence of the space enterprise by generating effects to support national objectives and providing support to joint operations. For example, it would make little sense to discuss acquiring, launching, operating and protecting the GPS constellation outside of the context of providing PNT signals to users. Therefore, it is essential that those executing the SFE mission understand the theater operations they are supporting, regarding requirements, timing, and tempo and integrating with other operations.

Lt Col Todd Zachary, in *Space OPCON: Who's Watching Zeus?* presents a case for command and control of space assets by theater commanders: "High ground advocates favor full weaponization of space with space control being an essential prerequisite. From a DOD perspective, given the recent 2006 Quadrennial Defense Report (QDR), this appears to be the long-range road ahead and offers the greatest

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[11] Joan Johnson-Freese, *Space as a Strategic Asset* (New York, NY: Columbia University Press, 2007), 90.

potential for, and argument in favor of, theater control of space-based assets."[12]

The idea of theater control as described by Zachary pertains to command and control of forces.[13] For the force enhancement line of effort, such a step is unnecessary as theater commanders can still execute the FE mission under the existing command and control structure. An important point regarding operational-level command and control for the force enhancement line of effort is that C2 can apply to effects and not necessarily to moving and maneuvering satellites. Shifting the responsibility for SFE execution and coordination to the UCC through its operational-level command and control mechanism—typically the Air Operations Center (AOC)—removes this unnecessary and cumbersome link in the chain. Resident space operations expertise in the AOC and existing doctrine is best suited to execute this mission. Operations will improve by decreasing timelines and removing seams associated with SFE coordination and execution, facilitating relationships between systems experts in the space operations squadrons and theater space personnel.

Command and control of the force enhancement line of effort has impacts beyond theater effects. Centralized execution of SFE operations influences aspects of space operations across the spectrum of conflict and from the tactical to the strategic levels. MAJCOM and service organization of the space operations career field is centered on the JSpOC as the operational-level C2 and execution mechanism for the Joint Functional Space Component Commander. This construct is a

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[12] Lt Col Todd Zachary, "Space OPCON: Who's Watching Zeus?," (Newport, RI: Naval War College, 2006), 11.

[13] Lt Col Zachary does not argue for theater control, but this quote illustrates one idea about command and control of forces. The argument for this line of effort is focused on effects rather than forces.

primary factor in career development and leads to organizational inefficiencies. Space force enhancement operations are then viewed as a war-fighting enterprise in and of themselves as opposed to their true nature, as described in JP 3-14 as "significant force multipliers when integrated into military operations."[14] This continues into the combatant command (CCMD) staff level and even has strategic effects as planners struggle with applying space operations to deterrence and assurance campaigns. The solution to decentralizing SFE operations lies in the theater-based space operations planners and experts, typically assigned to the AOC.

Space Operations Specialty Teams (SOST) perform the SFE mission in the AOC. Air Force Tactics, Techniques and Procedures 3-3.AOC, *Operational Employment, Air Operations Center,* (AFTTP 3-3.AOC) describes the SOST as "responsible for directing space warfare operations and assessing space warfare effectiveness."[15] Examples of SOST tasks include "Monitoring space environmental impacts and advising affected users; integrating national space support into theater PR operations; and support to Integrated Missile Defense."[16] Concerning executing the SFE mission, there is no meaningful difference between tasks of the SOST and the Force Enhancement Branch in the JSpOC. The advantage of the SOST is that they understand how best to employ space capabilities because they are directly involved with day-to-day theater operations. The limiting factor for the SOST is that they are required to interface with the JSpOC to coordinate the SFE mission. On rare occasions, the JSpOC grants authorization to directly liaise (DIRLAUTH) between the AOC and relevant space units, such as 2 SOPS, as discussed in the GPS example above. However, normal practice is limited by the requirement for the

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[14] JP 3-14, *Space Operations*, I-1.
[15] AFTTP 3-3.AOC, *Air Operations Center*, 8-20.
[16] AFTTP 3-3.AOC, *Air Operations Center*, 8-22.

JSpOC Force Enhancement Branch to be the office of primary responsibility.

Operational command and control of SFE in the theater will ensure that execution of SFE operations is decentralized and that the personnel best organized, trained, and equipped to integrate space capabilities into joint operations are allowed to do so. Moving the SFE role from the JSpOC to theater AOCs ensures timely integration of space capabilities regarding the timing and tempo of the supported UCC's battle rhythm and with the necessary expertise regarding theater operations and at the operational space units.

The global nature of space operations invites an alternative view that centralized execution is preferred to allowing theater commanders to execute the SFE mission. In *Ten Propositions Regarding Space Power*, M. V. Smith notices "an increasing effort by the Air Force to coordinate and control space support [SFE] and [space control] operations for the entire theater, a job arguably best left to the combined or joint staff because it involves coordinating space support for all theater components from [USSTRATCOM]."[17] Smith compares the idea of allowing theater commanders to coordinate space operations with ground commanders coordinating air power in North Africa during Operation Torch with less than optimal results.[18] Conceptually, the argument has merit; space-based assets are indeed available to forces around the globe and certainly have global implications. It is also worth noting that Smith includes the space control mission area as well as the control of the actual satellites in his discussion of space operations.

Both space control and space support are indeed subject to different command and control considerations, best viewed as part of the

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[17] Major M. V. Smith, *Ten Propositions Regarding Space Power,* Fairchild Paper, (Maxwell AFB, AL: Air University Press, 2002), 55.
[18] Smith, *Ten Propositions Regarding Space Power,* 53-54.

national security line of effort. However, Smith includes “space support” to the theater, which implies SFE, and precisely which SFE mission areas are global in the sense that they are finite, overlapping theaters, or otherwise in need of centralized oversight is a matter worth further discussion. In the case of PNT, missile warning, and environmental monitoring, with a few specialized exceptions, neither the JSpOC nor the units themselves have any active role in apportioning or controlling the signals coming from the satellites and interacting with receivers on the ground.

SFE capabilities are virtually unlimited for theater commanders' use, and space professionals within theater are best prepared to coordinate their use. On the other hand, ISR and SATCOM bandwidth are undoubtedly finite resources subject to competing demands by multiple theater commanders, with no way to satisfy every need. However, pre-planned and coordinated priorities govern the allocation of these resources. Even real-time coordination to support multiple theaters simultaneously is a relatively simple matter for tactical ISR or SATCOM units, given the pre-established priorities and coordination plans discussed above.

Improving the timeliness and efficiency of SFE execution ensures that critical space capabilities will continue to be available even as adversaries attempt to deny joint forces the advantages provided by space capabilities. In the case of missile warning, area air defense planners in the AOC will be able to coordinate directly with missile warning units, such as the 2d Space Warning Squadron (2 SWS) to optimize overhead asset coverage concerning relevant threats. The SOST will work directly with tactical SATCOM units to ensure optimization of SATCOM configurations and effects to support requirements. For time-sensitive ISR requirements, SOST personnel can either work directly with the National Reconnaissance Office (NRO) or facilitate coordination between the NRO and affected joint forces. In all cases, the timeliness

associated with generating effects via space capabilities will be dramatically diminished by eliminating seams and inefficiencies in the current model.

Arriving at a Concept of Force Enhancement

Joint Publication 3-0, *Joint Operations* (JP 3-0), defines "joint operations" as "Military actions conducted by joint forces and those Service forces employed in specified command relationships with each other, which of themselves, do not establish joint forces."[19] The doctrinal definition concerns operations involving two or more services. For most practical purposes, joint operations is a generic term that refers to virtually any military activity and can include multinational partners.[20] The distinction is important because outside of the context of support to joint operations, force enhancement has no purpose. A popular colloquialism within the military space community is "space for space's sake," which refers to the unfortunate tendency of space operators to think of space-based capabilities as necessary in their own right and not a supporting aspect of joint operations.

Space-based capabilities generate effects that directly support joint operations through the mission area of Space Force Enhancement (SFE).[21] Joint Publication 3-14, *Space Operations* (JP 3-14) defines SFE as operations which "increase joint force effectiveness by increasing the combat potential of that force, enhancing operational awareness, and

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[19] Joint Publication 3-0, *Joint Operations*, (Washington, DC: 2017), GL-11.
[20] Other popular terms include "warfighter support" and are dependent on personalities. Operations with multinational partners are "combined operations."
[21] The choice of "force enhancement" as a label for the first line of effort is made partly to avoid confusion with the doctrinal term "Space Force Enhancement," which refers to specific activities as noted.

providing critical joint force support."[22] JP 3-14 defines the components of SFE to include missile warning, SATCOM, PNT, ISR, and environmental monitoring.[23]

Analysis of the definition of SFE in joint and air force doctrine reveals a list that is not all-inclusive.[24] Admittedly, most force enhancement activities could fall under a reasonable interpretation of one of the mission areas listed. However, focusing on theater commander objectives, as opposed to labels from the joint or service doctrine, allows force enhancement professionals a higher degree of creativity and offers force enhancement as a discipline not restricted to space professionals. This is a subtle point, but the inclusion allows a more effective integration of space capabilities into other areas. Offering a broader definition of force enhancement, Joan Johnson-Freese states "Force enhancement capabilities are those that, when added to and employed by a combat force, significantly increase the combat potential of that force, and thus enhance the probability of a successful mission."[25]

The force enhancement line of effort is not limited to the functions defined by JP 3-14, nor is it limited to enabling air operations. As Lambeth describes, "Specific enhancement functions might include monitoring sea states and enemy naval movements, locating in real time enemy artillery and armor on the move, identifying and determining preferred routes of ground forces to keep them from inadvertent encounters with enemy fire."[26] Integration of force enhancement

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[22] Joint Staff, *Joint Publication 3-14*, *Space Operations*, (Washington, DC: 2013), xi.
[23] JP 3-14, *Space Operations*, xi.
[24] Current Air Force Doctrine uses the name from Global Mission Support Operations instead of SFE.
[25] Johnson-Freese, *Space as a Strategic Asset*, 90.
[26] Benjamin S. Lambeth, *The Transformation of American Air Power* (Ithaca, NY: Cornell University Press, 2000), 243.

capabilities into offensive operations allow for a greater degree of precision. Lambeth elaborates, "Although still in early adolescence compared to the now-mature US air posture, space power has nevertheless become an enabler that largely makes routinely possible the new strategy of precision engagement."[27] Johnson-Freese offers a specific example, "attaching GPS packages to bombs to create joint direct attack munitions is an example of force enhancement."[28] It is notable that in these instances, the focus is on the effect generated, as opposed to the capability provided. The difference is to link force enhancement to precision engagement, instead of asking how PNT can contribute to joint operations. Lambeth refers to these mindsets as "operator pull" and "space push" respectively. Choosing the appropriate mindset will result in a more effective way to execute the force enhancement mission and inform the operational command and control for this line of effort.

The importance of force enhancement operations from space-based capabilities is difficult to overstate. It is arguable that space-based assets are so integral to the concept of precision engagement, that this capability has single-handedly shaped the evolution of airpower into an instrument of diplomacy and coercion. Lambeth offers this interesting, and perhaps dramatic insight into the importance of force enhancement from space: "Aside from the windfall collapse of the Soviet threat in 1992, the unprecedented focus that has been placed on bringing together US air and space capabilities since Desert Storm may have been the most pivotal development behind making American military power so preeminent in the world today."[29]

A theater-centric focus also allows for greater integration of space capabilities into joint operations because it removes the barrier

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[27] Lambeth, *Transformation of American Air Power*, 248.
[28] Johnson-Freese, *Space as a Strategic Asset,* 90.
[29] Lambeth, *Transformation of American Air Power,* 250.

associated with space and traditional operations career fields. Lambeth points to this barrier as a by-product of the historically technical mindset of the space operator and the so-called warrior culture associated with the rated operations world, and offers the following in the way of resolution: "There is every reason to expect a similar withering away of today's demarcations between 'air' and 'space', both conceptual and organizational, as working in the medium of space toward the application of air and space power toward terrestrial joint-force objectives becomes second nature to operators, whether or not they wear wings."[30] Space personnel assigned to the AOC and other forward units help to instill the warrior mindset in space professionals and gives credibility to the space professional in the eyes of the traditional war-fighters as a contributor to operations. Lambeth comments on this idea: "A functional or operational, as opposed to a systems, approach to thinking about space power application should make the difference between orbital and atmospheric operations irrelevant."[31] Lambeth was referring to force enhancement as integrating space capabilities into air operations, but the idea applies to all manner of operations supporting theater objectives.

Parallels to Early Airpower

Airpower in the First World War (WWI) offers an enlightening example of force enhancement and demonstrates why it is appropriate to consider effects instead of systems for command and control at the operational level. Useful examples of airpower as a force enhancement tool during WWI include aerial observation and artillery spotting, which have analogs in contemporary operations in ISR and PNT, respectively. While WWI typically conjures images of trench warfare and stagnant

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[30] Lambeth, *Transformation of American Air Power,* 259.
[31] Lambeth, *Transformation of American Air Power,* 258.

front lines, the contributions of airpower as force enhancement certainly have a place. Indeed, both sides benefited from the new technology. Commenting on the contribution of the German Air Service to the German victory over the Russians at Tannenberg, Field Marshal von Hindenburg stated: "Without the airmen no Tannenberg."[32] The French proceeded to the Marne in September 1914 upon observing—aided by aerial reconnaissance—the movement of German forces.[33]

In addition to specific examples of airpower success, efforts on all sides to fortify air capabilities through procurement of additional aircraft and introduction of new air units provide indications of a growing utility and reliance on airpower effects.[34] Along the trenches of the Western Front, one was sure to see lines of balloons, sometimes in the hundreds, providing aerial reconnaissance and coordinating artillery fires.[35] Less important than the platform or domain in which it operated was the purpose and effect of airpower operations. Lambeth draws a direct connection between early use of airpower and use of space power in Operation Desert Storm: "With their application limited solely to combat support through overhead reconnaissance and command and control enhancement, US space assets arguably contributed to joint operations in Desert Storm much in the same way that fledgling air power did when it was employed by the Italians against the Turks in Libya in 1911.

Today, military space activities are a close analog of air power in its infancy during World War I."[36] Admittedly, the use of airpower included offensive operations that would evolve into strategic bombing. However,

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[32] Lee B. Kennett, *The First Air War, 1914-1918* (New York, NY: Free Press, 1999), 31.
[33] Kennett, *First Air War*, 32.
[34] Kennett, *First Air War,* 32.
[35] Kennett, *First Air War,* 23.
[36] Lambeth, *Transformation of American Air Power,* 257-8.

force enhancement was and remains an important concept concerning command and control.

Operational command and control of air forces did not pose much of a challenge during WWI as the airplanes and balloons were attached to the ground units they supported. However, the comparison of contemporary space force enhancement to airpower during WWI is still meaningful because it adheres to similar principles.

In WWI, the ground commander was primarily a theater commander, in charge of his portion of a campaign. The need for higher level or inter-theater coordination was not applicable. As stated above, the principle that connects both eras is the effects generated by the air and space capabilities. In this sense, there was a direct connection between the theater supported by force enhancement operations, and the forces executing the tactical portion. Even if one imagines air units available to multiple ground commanders during WWI, it seems that preplanned coordination and priorities would be sufficient to resolve any conflicts. In the case of modern SFE operations, the equivalent method of C2 would be theater commanders—such as a JFACC—directing and coordinating, or executing, SFE operations. From the space unit, the critical distinction is between C2 of SFE operations, such as generating PNT availability analysis, and C2 of space support or space control functions such as maneuvering a satellite.

The Importance of Establishing a Separate Line of Effort for Force Enhancement

Establishing force enhancement as a distinct line of effort distinguishes it from space support, space control, space force application, and any other mission areas that support the national security line of effort. This separation, more importantly, allows for a separate approach to command and control for both lines of effort. Because of the doctrinal treatment of Space Force Enhancement as one

of five mission areas, force enhancement duties fall primarily to space operations units in Air Force Space Command. The consequence of this mindset is the centralized method of execution through the JSpOC. Despite an impressive amount of rhetoric associated with “supporting the warfighter,” SFE is an afterthought. Within the space operations career field in the United States Air Force, there is no formal discipline relating to force enhancement. This is important to note because even though no such analog exists for other mission areas, such as pilots or air battle managers, planning and employment of those platforms occurs in the AOC, on behalf of the theater commander. While space operations personnel are assigned to a theater, typically in an AOC, the responsibility for executing the SFE mission lies with the JSpOC.

Given the historical focus of space systems as enablers of the nuclear enterprise and the technical background of space operators, it is not surprising that a focus on support to joint operations is unnatural. Lambeth offers insight on this tendency, "Throughout most of the cold war, military space systems were devoted almost exclusively to supporting the nation's nuclear readiness posture and intelligence collection requirements. Today, they have become indispensable in providing added leverage to US and allied military forces across the board."[37] The establishment of the FE line of effort puts it on equal footing with the national security line of effort and creates a clear separation between the technical expertise required to operate, maintain, and defend on-orbit systems and the familiarity with theater plans and forces required to leverage those systems in support of joint operations.

Lambeth offers an interesting example of the types of considerations associated with the force enhancement line of effort: “For the immediate years ahead, the most effective leveraging of space will

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[37] Lambeth, *Transformation of American Air Power*, 242.

come from seeking synergy through closer integration of existing forces, such as tying together in real time inputs from space systems and UAVs to cue a B-1, B-2, or F-15E loaded with accurate, through-the-weather conventional munitions."[38] Lambeth is discussing force enhancement as it relates to air power, but it offers an insight that applies to all domains and activities of a joint operations in theater.

The expertise necessary to integrate the systems Lambeth describes is typically available in theater. Indeed, within the Combat Plans division of an AOC, a normal Master Air Attack Plan (MAAP) team will feature weapons system experts who integrate their platform according to theater objectives. Air Force Tactics, Techniques, and Procedures 3-3.AOC, *Operational Employment: Air Operations Center* (AFTTP 3-3.AOC) describes the organization of the MAAP: "Each theater MAAP team applies its own organizational structure uniquely tailored to meet specific requirements. Typical methods of organizing are by mission area (e.g., force application, force enhancement), mission type (e.g., air interdiction, strategic attack, close air support), or aircraft/weapons system type (e.g., fighter, bomber, stealth).[39] Of course, a key difference between most integration experts and space force enhancement personnel is that essentially all space forces are assigned to USSTRATCOM, and not to the theater commander. Space-based capabilities are thought of as providing global support to multiple theaters simultaneously.

Except for rare instances when conflicting needs of combatant commanders may require arbitration above the theater level, SFE effects are readily available at all times to all theaters. Cases that require coordination between theater and space forces, or which require some

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[38] Lambeth, *Transformation of American Air Power*, 252.
[39] AFTTP 3-3.AOC, *Air Operations Center*, 4-25.

optimization of the satellite constellation, are best understood and leveraged by space experts already assigned to the theater, as will be discussed below. Furthermore, traditional operational command and control of forces as described in joint and service doctrine, whereby commanders employ or maneuver forces, does not apply to space force enhancement operations.[40]

A more appropriate vision of operational command and control for the force enhancement line of effort is one that focuses on effects. As Lambeth notes "the real question, at least for the near term, should be what tomorrow's joint-force commanders will need in principle by way of ISR support and how best to meet those needs irrespective of the medium."[41] Lambeth's example of ISR applies to any form of force enhancement requirement a theater commander may have. Focusing on the effect and how best to generate it is an example of "operator pull" and provides a more compelling case for moving C2 of the SFE mission out of a centralized location and into applicable theaters.

Conclusion

Two separate notions regarding the space domain should accompany the two space lines of effort. For the space force enhancement line of effort, it is useful to view space as an extension of the vertical dimension. As Lambeth contends, "After all, just as air power was the cradle of space exploration, so exploiting space as a part of the vertical dimension will be crucial to the continued transformation of air power."[42] As more qualified space integration experts become more involved, lessons learned will lead to new efficiencies. As space units

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[40] However, this type of C2 is indeed relevant for the national security line of effort, as discussed in Chapter 3.
[41] Lambeth, *Transformation of American Air Power*, 252.
[42] Lambeth, *Transformation of American Air Power*, 258.

interface directly with theater forces instead of going through an artificial level of operational command and control, stakeholders will gain a better appreciation for what effects are most effective and identify opportunities for greater coordination. Furthermore, documenting these relationships will allow for an increased focus concerning the protection of on-orbit assets. A direct link between theater and space forces will highlight UCC priorities and allow CDRUSSTRATCOM valuable insights into how best to prioritize the protection of space assets by Unified Command Plan (UCP) responsibilities.

The two lines of effort make it possible to treat space operations as both an extension of the vertical dimension and a separate warfighting domain. Space Force Enhancement refers specifically to those effects space-based capabilities generate to support theater commanders. The establishment of the second line of effort for national security ensures not only force enhancement capabilities are available, but also recognizes space-based assets as instruments vital to national and strategic objectives. Johnson-Freese underscores this relationship: "Having the most and the most quickly available information is a nearly insurmountable advantage in warfare…The United States both has the highest capabilities and is the most dependent on those capabilities. That makes protecting those capabilities imperative."[43]

Protecting space-based capabilities and ensuring their availability to national leadership for the national security line of effort and theater commanders for the space force enhancement line of effort are the business of the space control, space situational awareness, and space support mission areas. Among these, worth noting here is the mission area of space control. According to JP 3-14 "space control supports

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[43] Johnson-Freese, *Space as a Strategic Asset*, 91.

freedom of action in space for friendly forces, and when necessary, defeats adversary efforts that interfere with or attack US or allied space systems and negates adversary space capabilities."[44] The establishment of the National Space Defense Center (NDSC) represents the initial steps in establishing operational command and control of the national security line of effort.[45] Chief among the objectives of this undertaking is achieving unity of effort among national level stakeholders of the national space security enterprise. Former Deputy Secretary of Defense Robert O. Work states "the [NSDC] is part of an effort to improve battle management command and control and will help 'more fully integrate DOD space operations with those of the Intelligence Community."[46] This demonstrates senior leadership awareness of the deficiency in integrating space assets into the theater as well as the need to defense on-orbit assets. Defense of on orbit-assets is one of many tasks under the national security line of effort, the subject of the next chapter.

[44] JP 3-14, *Space Operations,* xi.
[45] The NSDC was originally called the Joint Intelligence Combined Space Operations Center (JICSpOC) and is referred to as such in older references.
[46] Jennifer Hlad, "Making Space More Military", *Air Force Magazine*, August 2016, 32.

Chapter 3

National Security

> *These airmen, from different services and with different capabilities but bound together by mutual respect, can act as their country's shield. The sacrifices and experiences of their predecessors will teach them that unity grows stronger as one moves closer to the sound of guns, and that in the future the country cannot afford to wait for that sound to achieve that unity.*
>
> - James Winnefeld and Dana Johnson, 1993

Overview

The challenge of achieving unity of effort is an ongoing theme for air operations since the very beginning of air power employment. The challenge has evolved from joint air operations, in which forces from different services seek ways to employ together effectively, to the current difficulties facing space professionals charged with achieving unity of effort for multiple services, non-DOD organizations, civil, commercial, and multinational contributors and stakeholders. In the cases facing the brave soldiers, sailors, Marines, and those airmen Winnefeld and Johnson refer to in the quote above, the scenarios were local, usually confined to a theater. But the lessons remain applicable to the challenges the space enterprise faces today. Space operations supporting national security involve hundreds of systems operating with global effects and implications. A look at historical cases of joint air operations and multinational command and control challenges offers approaches to achieving unity of effort when unity of command is not feasible.

The national security line of effort for space operations is distinct from force enhancement. The responsibilities of this line include support to the nuclear enterprise and civil applications that have an impact on

the global economy. The mission areas from Joint Publication 3-14, *Space Operations* of space control, space situational awareness, space support and space force application all contribute to the national security line of effort. Operational command and control for this line of effort includes lines of operation as noted above and is similar to a JFC or functional component commander.

The primary challenge of operational command and control of the national security LOE is achieving unity of effort. The threats to national space systems create a need for a command and control solution that protects on-orbit assets and ensures optimal execution of the lines of operation. Joan Johnson-Freese explains the complexity of coordinating space operations toward a common purpose, "[The history of space activity for humans] is marked by mixed motivations, developmental anomalies, interdisciplinary requirements, organizational compartmentalization, and international cooperation and competition issues."[1] The quote covers a broad range of considerations, not just the military uses of space. However, as space systems become more ubiquitous, and humans' reliance on those systems becomes more pronounced, the larger story of space exploration and technology begins to merge with the story of space as an instrument of national security. The obstacles and considerations Johnson-Freese mentions thus apply to the problem of unity of effort for the national space security enterprise. According to the Unified Command Plan (UCP), Commander, United States Strategic Command (CDRUSSTRATCOM) is responsible for planning and executing space operations. Implied in that task is protecting and coordinating space-based assets which contribute to national security objectives. The systems included are owned and

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[1] Joan Johnson-Freese, *Space as a Strategic Asset*, (New York, NY, Columbia University Press, 2007), 9.

operated by DOD, civil, commercial, and allied partners outside the command of USSTRATCOM, making unity of command impractical, if not impossible.

Historical accounts of joint air operations from the Second World War (WWII) to Operation Desert Storm as analyzed by James Winnefeld and Dana Johnson offer insights into overcoming the challenges posed by multi-service operations. The examples are joint air operations, and the lessons apply to the challenges of unity of effort for the national security line of effort. The challenges commanders face in achieving unity of effort are more than simply accounting for the protection of on-orbit assets from a growing threat. National security operations must also be optimized for deterrence and assurance operations, assured access to the space domain for civil applications, and integrating with the Force Enhancement line of effort to assure unhindered support to joint operations.

The National Security Line of Effort

The national security line of effort includes operating and protecting the on-orbit systems which enable and contribute to national defense missions such as nuclear command and control and communications (NC3), strategic warning, and global civil applications. It is tempting to think of this as a form of national force enhancement, and in some ways, this is a fair assessment. However, as Worden and Shaw dramatically but correctly declare, "Space power is intricately woven into the tapestry of modern civilization."[2] National security differs from force enhancement in that while joint and combined operations would suffer

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[2] Brig Gen Simon P. Worden and Maj John E. Shaw, *Whither Space Power?: Forging a Strategy for the New Century*, Fairchild Paper, (Maxwell AFB, AL: Air University Press, 2002), xv.

dramatically from a loss of Space Force Enhancement (SFE) capabilities, the US and allied forces regularly train and prepare for operations with limited or denied access to space capabilities and would still be expected to accomplish the mission.[3] Loss of space-based support to national security considerations represents a much more significant threat.

Removing space-based capabilities from the national security applications would result in virtual crippling of the national defense posture and the global economy. A report published in 2010 by the Center for Strategic and International Studies (CSIS) explains, "Many space technologies have reached such a level of maturity that some of their applications, such as telecommunications, automated teller machines, meteorology, navigation, stock market data, and transport control, are now an integral part of the daily lives of millions of US residents."[4] M.V. Smith describes space power as a center of gravity for the United States, not only because it is a force multiplier for military operations, but also because space assets "have spheres of effectiveness that overlap in sectors of civil, commercial, military, and intelligence activities."[5] As an instrument of national policy, the ability to project power in, from, and through space is a critical aspect of deterring adversaries and assuring allies.

More than protecting and exploiting the assets as they orbit the earth, the national security line of effort protects the national security advantages and prestige that the United States enjoys as a result of its military, scientific, and economic interests related to the space domain.[6]

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[3] Major M. V. Smith, *Ten Propositions Regarding Space Power,* Fairchild Paper, (Maxwell AFB, AL: Air University Press, 2002, 69.
[4] David Berteau, et al., "National Security and the Commercial Space Sector: An Analysis and Evaluation of Options Improving Commercial Access to Space," Center for Strategic and International Studies, July 2010, 4.
[5] Smith, *Ten Propositions Regarding Space Power,* 65.
[6] Johnson-Freese, *Space as a Strategic Asset*, 2 and 7.

Integrating the national security mission areas from JP 3-14 for multiple stakeholders, including military services, other DOD organizations, commercial space organizations, civil space organizations and multinational partners is the fundamental task.[7]

National Security Mission Areas: Lines of Operation

The space support, space control, space situational awareness, and space force application mission areas form the basis for the lines of operation within the national security line of effort. In practical terms, these doctrinal mission areas encompass activities associated with launching, maintaining, and defending friendly space systems; and tracking, identifying, assessing, and attacking adversary systems.[8]

A survey of these mission areas and units involved will allow for the formulation of multiple lines of operations (LOO). According to JP 5-0, "LOOs describe and connect a series of decisive actions that lead to control of a geographic or force-oriented objective."[9] Identifying the contributions to national security as noted above and establishing them as LOO allows commanders to focus and synchronize activities, simplifies command and control when units contribute to multiple activities, and demonstrates sound doctrinal thinking by using established terminology and concepts.[10]

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[7] Berteau, "Commercial Space", 5.
[8] As of this writing, the only Space Force Application capabilities are intercontinental ballistic missiles (ICBM). However, other force application capabilities considerations are worth noting and will be addressed as future considerations in chapter 4.
[9] Joint Staff, Joint Publication 5-0, *Joint Planning*, (Washington, DC: 2017), IV-28.
[10] An assumption is that the USAF, specifically Air Force Space Command, will continue to be the DOD's lead organization for military space operations. Following joint doctrine and demonstrating a commitment to the joint force—as directed by the CSAF, Gen Goldfein—is a primary consideration.

Drawing from the stated objectives for USSTRATCOM, AFSPC, and the JSpOC, LOO are established for the following objectives: Strategic Deterrence, Civil and Commercial integration, Space Control, and Space Situational Awareness. A more detailed look at these prospective lines of operation is warranted.

Strategic Deterrence

The history of US space power is connected to the development of the nation's nuclear deterrence capabilities. As Walter McDougall explains in *The Heavens and the Earth: A Political History of the Space Age*, "From 1945 to 1949 American leaders searched for a counterweight to Soviet conventional might…after the A-bomb would come the race for the H-bomb, then the race for long-range rockets, and after that—a race for space."[11] USSTRATCOM and AFSPC, the combatant and service commands for space, respectively, take different approaches to their support to the nuclear enterprise. USSTRATCOM "deters strategic attack and employs forces, as directed, to guarantee the security of our nation and our allies," and its priority is strategic deterrence.[12] As of 2018, AFSPC's mission statement is "to provide resilient and affordable space and cyberspace capabilities for the Joint Force and the Nation."[13]

It is an interesting omission—from the mission statement and AFSPC's public fact sheet—of the nation's nuclear capability as it would seem to undermine space power's link to national security and present space as a utility. Perhaps the omission is an understandable but short-

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[11] Walter A. McDougall, *The Heavens and the Earth: A Political History of the Space Age*, (Baltimore, MD: The Johns Hopkins University Press, 1985), 96.
[12] USSTRATCOM web page, http://www.stratcom.mil/About/Mission/, accessed 17 April 2018.
[13] Air Force Space Command Fact Sheet, 2018, http://www.afspc.af.mil/About-Us/Fact-Sheets/Display/Article/249014/air-force-space-command/, accessed 17 April 2018.

sighted attempt to draw attention away from the nuclear enterprise and make space systems less vulnerable to attack. Despite the command's message, the reality is that the most important missions of the space enterprise remain linked to national security through strategic deterrence. Communications satellites, such as MILSTAR, provide national leadership with a survivable means to monitor, communicate with, and even launch ICBMs. Space and ground-based sensors, such as the Defense Support Program (DSP) and Perimeter Acquisition Radar Attack Characterization System (PARCS) provide early warning of strategic threats to the United States and its allies.[14]

Including strategic deterrence as an LOO, and as an operational command and control consideration, serves multiple purposes of strategic messaging and optimizing command and control for the space enterprise. As a strategic messaging component, recognizing the link between space systems and national security enhances deterrence operations by demonstrating a robust nuclear capability and introducing the risk of escalation if an adversary attacks space systems. Admittedly, this runs counter to a disaggregation strategy, in which strategic systems are separate from tactical systems, allowing adversaries to discriminate targets and avoid attacking strategic systems.[15] However, if effective operations are the goal, messaging to US space operators is as important as shaping adversary perceptions. Including strategic deterrence as an

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[14] Only strategic missile warning is included here as theater missile warning is typically the responsibility of the Joint Force Air Component Commander. Space support to theater missile warning is considered Space Force Enhancement in joint doctrine and is accounted for in the Force Enhancement LOE as proposed previously.

[15] Air Force Space Command "Resiliency and Disaggregated Space Architectures," White Paper, http://www.afspc.af.mil/Portals/3/documents/AFD-130821-034.pdf?ver=2016-04-14-154819-347, Accessed 17 April 2018.

LOO is consistent with national priorities and returns the space enterprise from a utility to a guarantor of national security.

Civil, Commercial, and Allied Partner Integration

Leveraging and integrating non-DOD partners is an essential aspect of national security. Examples of activities in this LOO include civil user support for services such as GPS, facilitating partnerships with allies, and working with commercial partners. Douglas Loverro stated: "the strength of the US commercial/entrepreneurial space sector was a key ingredient in the DOD's strategy to deter aggression in space and to defeat those threats if they were ever used."[16] In addition to the national policy-level encouragement of commercial space activities, an LOO under the national security LOE integrates commercial space assets into military operations and ensures their safety and thus encourages their participation. According to the CSIS report: "The US Government now relies on commercial satellite providers for 80 percent of its total capacity to meet mission requirements, and according to multiple sources, up to 96 percent of satellite communications for the military in battle arenas such as Iraq and Afghanistan are provided by commercial communications satellites."[17] Thus, failing to integrate applicable commercial satellite providers into military planning and command and control is inexplicable.

Space Control

Defending on-orbit assets against a variety of threats and denying adversary use of space-based capabilities comprise the main activities of the space control LOO. This LOO, particularly defensive space control

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[16] *House Committee on Science and Technology, Subcommittee on Science* (2017) (testimony of former DASD Douglas Loverro), 4. Accessed 21 March 2018.
[17] Berteau, "Commercial Space", 7.

(DSC), will likely require a higher weight of effort due to an increasing threat environment and a number of command and control challenges related to the lack of unity of command.

Space control includes protecting space capabilities to ensure their availability for achieving national security objectives. Joint Publication 3-14, *Space Operations* (JP 3-14) defines defensive space control (DSC) as "operations conducted to preserve the ability to exploit space capabilities via active and passive actions, while protecting friendly space capabilities from attack, interference, or unintentional hazards."[18] A challenge of DSC is responding to adversary threats to on-orbit systems during a conflict.[19] ASAT threats include direct ascent, co-orbital, directed energy and jamming.[20]

Space Control operations ensure the ability to generate effects from space systems despite the threat environment. An assumption for planning and executing space control operations is that critical space systems are vulnerable and likely to be targeted. Elbridge Colby, in a report for the Center for a New American Security titled *From Sanctuary to Battlefield: A Framework for a U.S. Defense and Deterrence Strategy for Space*, writes, "the United States is likely to face – and indeed is already facing – adversaries that can do serious damage to what is a vital component of U.S. military posture."[21]

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[18] Joint Staff, *Joint Publication 3-14*, *Space Operations*, (Washington, DC: 2013), II-9.
[19] JP 3-14, *Space Operations*, II-9.
[20] Brian D. Green, "Space Situational Awareness Data Sharing: Safety Tool or Security Threat?" The Air Force Law Review, Vol 75, 64.
[21] Elbridge Colby, "From Sanctuary to Battlefield: A Framework for a US Defense and Deterrence Strategy for Space", (Washington, DC: Center for a New American Security, 2016), 17.

Space Situational Awareness

JP 3-14 describes Space Situational Awareness (SSA) as "the requisite current and predictive knowledge of the space environment and the [operating environment] upon which space operations depend."[22] As a separate LOO, SSA relies on efforts from the Civil, Commercial, and Allied Partner Integration LOO regarding potential SSA data from non-DOD sensors, and supports the remaining LOO by providing the sight picture and helping to define the operating environment for space. The 2011 National Security Space Strategy states, "Our military and intelligence capabilities must be prepared to 'fight through' a degraded environment and defeat attacks targeted at our space systems and supporting infrastructure."[23]

One of the primary goals of any unity of effort initiative is to integrate the space control and space situational awareness LOOs to the highest degree possible. JP 3-14 describes this aspect of space control as "built on several elements including capabilities to detect and characterize an attack, ability to attribute an attack to an adversary, ability to defeat the attack, and the ability to operate through or deter an attack."[24] Detecting and characterizing an attack is a profoundly important aspect of space control. The physical environment of space, fuel limitations, and the slow reaction time of spacecraft relative to kinetic threats make real-time maneuver in response to a ground-based ASAT weapon a practical impossibility.

The timelines associated with preparing and executing a satellite maneuver are typically days if not weeks. A kinetic ASAT weapon, once launched, arrives at its target in a matter of hours, if not minutes. Thus,

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[22] JP 3-14, *Space Operations*, II-1.
[23] United States Department of Defense, "National Security Space Strategy", 2011, 11.
[24] JP 3-14, *Space Operations*, II-9.

the ability to detect, characterize, and therefore predict an attack on space systems allows satellite operators to increase their operational timelines and include the period *before* an ASAT weapon launches when a maneuver or contingency plan has a better chance at disrupting ASAT targeting and protecting friendly space systems.

Defining Operational Level Command and Control for the National Security Line of Effort

Operational command and control is a concern for commanders at the operational level of war. Colonel John Warden describes the operational level of war as "concerned with how to achieve the strategic ends with the forces allotted. It is the level at which plans are made for the actual employment of land, sea, and air forces, and the level where these forces are used in the course of a campaign."[25] Winnefeld and Johnson describe command and control: "Strategic command and control: getting the forces to the right place at the right time with the right orders. Operational and tactical levels of [command and control]: coordinating the efforts of the forces once they are in place."[26]

In the case of the national security LOE, the operational level is difficult to distinguish from the tactical level because the campaign is an ongoing matter, and the LOO are continuous. It is still important to make the distinction to allow optimal planning and command and control at the right levels and organization. Tactical-level units include the space operations squadrons, such as the 10th Space Warning Squadron (10 SWS), which performs the ground-based missile defense mission. Thus, tactical-level planning and operations would include

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[25] Col John Warden, *The Air Campaign*, (Lincoln NE: toExcel Press, 2000), 2.
[26] Dana Johnson and James Winnefeld, *Joint Air Operations: Pursuit of Unity in Command and Control, 1942-1991*, (Annapolis, MD: Naval Institute Press, 1993), 13.

tracking and warning of inbound threats from the individual site, while operational-level command and control would include coordinating maintenance for the radar sites to ensure optimization of missile warning coverage.

Air Force doctrine states "Forces should be organized around the principle of unity of command. Clear lines of authority, with clearly identified commanders at appropriate echelons exercising appropriate control, are essential to achieving unity of effort, reducing confusion, and maintaining priorities."[27] The Joint Force Space Component Commander (JFSC) exercises operational-level command and control on behalf of CDRUSSTRATCOM. Coordinating and integrating various non-DOD organizations are the challenges to achieving unity of effort. The recommended lines of effort and lines of operation represent the first step in achieving unity of effort for the national security space enterprise.

Achieving Unity of Effort for the National Security LOE

Military unity of effort is enabled by unity of command. However, national security space operations involve multiple stakeholders which require an approach similar to that used by the Department of State (DOS) and described in Joint Publication 3-0, Joint Operations (JP 3-0), which "defines unity of effort as a cooperative concept that refers to coordination and communication among USG organizations toward the same common goals for success."[28] Baker states "unity of effort does not only apply to military forces but includes non-military organizations. These non-military organizations encompass intergovernmental (IGO) and non-governmental (NGO) organizations. All of these entities not only

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[27] US Air Force Doctrine Annex 3-30, Command and Control, (Maxwell AFB, AL: Curtis E. LeMay Center for Doctrine Development and Education, 2014), 2.
[28] Joint Publication 3-0, *Joint Operations* (Washington DC: 2017), I-9.

have their own established procedures, but in turn have their own objectives which may or may not align with the established military objectives."[29]

Joint Publication 3-0, Joint Operations says "Asymmetric attacks can be countered with well-planned joint operations synchronized with actions of interagency partners, international organizations, NGOs, multinational forces, and elements of the private sector. Achieving unity of effort with these partners requires coordination, cooperation, and a comprehensive approach to achieve common objectives."[30]

Reliance on space-based assets and capabilities has created vulnerabilities that potential adversaries have noticed and are sure to attempt to exploit or attack. While the robustness of adversary threat capabilities and the likelihood of a catastrophic attack on space systems is the subject of some debate, there is a reasonable level of agreement that the sanctuary mindset is not valid for protecting and assuring access to space systems.[31] Cassandra Steer, space policy scholar, in *Global Commons, Cosmic Commons: Implications of Military and Security Uses of Outer Space* notes "China, Russia, and the United States have demonstrated antisatellite weapon (ASAT) capabilities, and active space defense has entered the policy rhetoric in India, Israel, and Japan. The most technologically advanced states have the most to lose if their space assets are disabled or targeted—if [the US loses] the satellite systems that listen and observe, we are severely inhibited."[32] Thus, a whole-of-

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[29] MAJ John E. Baker, *Effective Multinational C2: Five Essential Variables*, (Ft Leavenworth, KS: School of Advanced Military Studies, 2009), 4.
[30] JP 3-0, *Joint Operations*, I-4.
[31] Elbridge Colby, "From Sanctuary to Battlefield: A Framework for a US Defense and Deterrence Strategy for Space", (Washington, DC: Center for a New American Security, 2016), 8.
[32] Cassandra Steer, "Global Commons, Cosmic Commons: Implications of Military and Security Uses of Outer Space", Georgetown Journal of International Affairs, vol 18(1), 9.

government approach to preserving access to space-based capabilities includes diplomacy, cooperation, shared interests in space as a global commons, and military considerations. For defense and military strategists, the primary concern is assuring access to space-based capabilities by protecting on-orbit assets from threats and optimizing space-systems' capabilities to support national objectives. Addressing that concern through operational-level command and control of assets involving myriad stakeholders and authorities establishes the requirement of achieving unity of effort.

Defense of on-orbit assets presents challenges for command and control and achieving unity of effort. One of the primary challenges to achieving unity of effort is the lack of unity of command. Achieving unity of command is difficult and likely impractical given the variety of services and organizations which comprise the security space enterprise. Baker offers the following on the challenges of multinational command and control "Differences in national interests, culture, and incompatibilities in operating procedures, technologies, training and operational capabilities add to the tension posed by multinational operations. A multinational commander, faced with these issues, can barely hope to establish a functional, let alone optimal, C2 arrangement or structure."[33] Baker's examples pertain to multinational operations but also apply to the unity of effort problem facing defense of on-orbit assets.

The issue of competing interests is interesting as it provides a link to the issue of changing the culture to a warrior mindset. In describing the challenges to achieving unity of effort in the Solomon Islands Campaign of 1942-1944, Johnson and Winnefeld state, "Survival and the desire to win when the issue is in doubt are major incentives to put

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[33] Baker, *Effective Multinational C2*, 1.

lesser concerns aside."[34] But current threats to space systems are a fry cry from threats to allied air operations in the Pacific theater in WWII. The authors point out that "Air commanders have not faced similar challenges in subsequent wars."[35] One can thus describe the space enterprise's culture as lacking a sense of urgency regarding the major incentives Johnson and Winnefeld describe. One approach is to attempt to change the culture through rhetoric and symbolism. The other is to normalize command and control operations to achieve unity of effort.

In evaluating the degree of unity of effort for various joint air campaigns from 1942 to 1991, Johnson and Winnefeld established four elements of criteria: Command arrangements, quality of operations, exploiting unique capabilities, and readiness and tactical compatibility.[36] These criteria demonstrate the advantages or outcomes of achieving unity of effort for joint air operations. They are worth exploring as they pertain to space operations. The goal is to establish unity of effort for each LOO, consolidating notional command and control structures as appropriate.

Command Arrangements/Quality of Operations

The optimal operational command and control model must address the issue of command arrangements. Command arrangements and, therefore, unity of effort for space operations in a benign environment are well-established. What makes the command arrangement challenging is the emerging threat environment and the need to protect space systems that contribute to national security. The challenges to unity of effort that arise from the variety of stakeholders are similar to the challenges of

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[34] Johnson and Winnefeld, *Joint Air Operations*, 34.
[35] Johnson and Winnefeld, *Joint Air Operations*, 34.
[36] Johnson and Winnefeld, *Joint Air Operations*, 2.

multinational operations described by Baker. In his study of command and control for multinational operations, Baker describes five key variables to achieve unity of effort: unity of purpose, unity of command, cultural understanding, combined training, and interoperable communications and information architecture.[37] The common aspect of each of these variables is the deliberate involvement of representatives from each stakeholder agency. The choice of forum and mechanisms for agreement or enforcement are limited only by the imagination.

Coordination of non-DOD and non-US partners, such as that which occurs in the nuclear mission, is an important aspect of unity of effort. If establishing unity of command is not a practical solution, given the reluctance of other stakeholders to relinquish control of their assets, then that understanding must be explicit in a charter or some document at the national level. Establishing LOOs is helpful as it allows the strategist to identify applicable cases within each LOO to determine an appropriate command structure. In identifying similar contention among the services, Johnson and Winnefeld established questions on unity of command for joint air operations.[38] Those questions are updated below for relevance to unity of command for space operations:

1. What degree of unity of command is required to achieve unity of effort?
2. When is unity of command not essential to effective operations? When is there no need for a single commander to control all space assets?
3. When do capabilities not have to be under the control of their original commander?
4. When can forces from one organization be placed under the control or command of another organization?

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[37] Baker, *Multinational C2*, 1-2.
[38] Johnson and Winnefeld, *Joint Air Operations*, 11-12.

Recalling that unity of effort is the goal, not necessarily unity of command, commanders and planners must be prepared to consider alternatives to formal command and control. As Baker notes, "Despite unity of command being the ideal means to achieve unity of effort, there are instances where it may not be possible to establish unity of command. This does not mean that unity of effort cannot be achieved. Instead, multinational commanders can establish coordination cells and liaisons between participating forces to ensure that unity of effort is achieved."[39] Addressing the questions above for each LOO and specific mission sets within each LOO offers a framework for optimizing operational command and control.

Exploiting Unique Capabilities/Readiness and Tactical Compatibility

The breadth of space capabilities is impressive in scale. Missile warning radars utilized for SSA and strategic warning assets utilized for battlespace awareness give only a small fraction of the available possibilities. Unity of effort thus ensures "optimization across a range of threats, across theaters, and over time."[40] Unfortunately, the evolution of the enterprise has involved a "stove piping" of related and potentially complementary systems. Likewise, the case for disaggregation creates additional organizational stovepipes. Formal barriers, such as security compartmentalization, and informal barriers, such as cultural and organizational interests keep attempts to capitalize on exploiting unique capabilities outside of their originally intended purpose. Johnson and Winnefeld identify a similar trend in joint air operations as "The differences among air services are based on the diverse missions that are the reason for their separate existence. Attempts to harness these air

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[39] Baker, *Multinational C2*, 6.
[40] Johnson and Winnefeld, *Joint Air Operations*, 12.

services in a joint endeavor are often perceived as a threat to that existence."[41] A link to unity of purpose is evident regarding this challenge to unity of effort. As different stakeholders find common ground in a shared purpose, barriers will erode. As Johnson and Winnefeld note "The command and control hallmarks of the Solomons air campaign were a willingness to improvise, a subordination of service doctrine and mission biases to urgent operational demands, and the emergence of a truly joint air operations organization."[42]

Conclusion

The national security line of effort represents a distinct set of missions that are separate from the utility role provided by force enhancement and links space operations directly to national security and interests. Further recognizing lines of operation related to strategic deterrence, civil, commercial, and allied integration, space control, and space situational awareness allows for different approaches to achieving unity of effort for effective operational command and control.

A focus on unity of effort for the national security space enterprise is a direct result of the need to change the character of operational command and control as it relates to conducting space operations in an increasingly contested environment. The problem of unity of effort for different organizations within the DOD and the national security space enterprise is similar to achieving unity of effort for joint air operations as described by Johnson and Winnefeld, and for multinational operations as described by Baker. The space enterprise is comprised of a variety of stakeholders, each with distinct "priorities, sensitivities and incentives for cross-service cooperation or integration."[43]

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[41] Johnson and Winnefeld, *Joint Air Operations,* 7.
[42] Johnson and Winnefeld, *Joint Air Operations*, 33.
[43] Johnson and Winnefeld, *Joint Air Operations*, 6.

Specific challenges related to Space Control include employing resilient space systems, the ability to counter or avoid attacks on space systems, and the ability to withstand an attack and mitigate the effects. An effective approach to operational command and control for the space control LOO addresses these fundamental aspects. The concluding chapter explores the implications and findings of the challenges related to unity of effort for both LOEs.

Chapter 4

Findings and Conclusion

Overview

An examination of the space operations mission areas as described in joint doctrine reveals two lines of effort for space operations: force enhancement and national security. The force enhancement line of effort generates effects from space-based capabilities which enable joint forces in-theater to accomplish objectives. The national security line of effort further divides into several lines of operation: strategic deterrence, civil, commercial, and allied partner integration, space control, and space situational awareness. Recognizing the lines of effort and lines of operation supports the possible formal reorganization of doctrine and mission areas but is not critical to effective space operations. A more practical application of the LOE approach to space operations and the associated research findings is optimizing operational command and control for each line of effort and operation.

For force enhancement, case studies and doctrine suggest that an optimal operational command and control arrangement, focused on the effects generated by space capabilities, is to maximize control for the supported theater commander. Critical aspects of optimal force enhancement operations include understanding supported theater plans and operations, the ability to monitor and respond to changes in theater operations, and the authority to coordinate directly with applicable force enhancement providers, which are typically the tactical space operations squadrons. Cases that require adjudication or approval from USSTRATCOM leadership should be accounted for in existing plans to the greatest possible extent to allow for timely implementation.

Operational command and control for the national security line of effort requires a separate analysis for each line of operation. To achieve

unity of effort, LOOs can be combined in whole or in part as applicable. For example, the space situational awareness (SSA) LOO supports all other LOOs. Certain aspects of SSA, such as conjunction assessment, primarily support civil, commercial and allied integration. Other aspects of SSA, such as characterization, support targeting for space control operations. When unity of command is not possible, or when coordination among multiple command centers are necessary, planners and commanders should anticipate, plan, and train those situations to the extent possible.[1]

The evolution of the space environment from a perceived sanctuary to a contested environment presents unique challenges to operational command and control. The reason for the enterprise-wide effort to transition space operations from a technical to a war-fighting culture is the need to protect on-orbit capabilities.[2] The primary challenge is achieving unity of effort without unity of command. This challenge is similar to those for joint air operations and multinational operations. The Unified Command Plan directs the Commander, United States Strategic Command (CDRUSSTRATCOM) to plan and execute space operations. Implied in the guidance is coordinating among national, civil, commercial, and multinational partners operating space systems that support national security. Lessons learned from joint air and multinational operations regarding unity of effort offer suggestions for achieving unity of effort for the national security space enterprise with its various organizations and stakeholders.

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[1] MAJ John E. Baker, *Effective Multinational C2: Five Essential Variables*, (Ft Leavenworth, KS: School of Advanced Military Studies, 2009), 40.
[2] For a riveting study of the tactical considerations of defensive space control see Maj Brandon Davenport, "Beyond the Air Domain: Battle Management in Space Operations", (Maxwell AFB, AL: School of Advanced Air and Space Studies, 2018).

Practical Applications of the Findings

Force Enhancement Considerations

Space force enhancement operations are optimized when space operators or force enhancement professionals in the supported theater have the highest degree of freedom to determine force enhancement requirements and coordinate directly with tactical squadrons. Executing force enhancement for multiple combatant commands (CCMD) from a centralized command and control node is doctrinally unsound and adds unnecessary time coordination to generated desired effects. Collecting and coordinating force enhancement requirements from the theater is an effective means of tracking and reporting requirements and activity for service component leadership. However, it is not an effective device for command and control and would serve better as a reporting mechanism from the tactical units after coordinating directly with the theater to execute force enhancement operations. Furthermore, if one assumes that contemporary challenges of personnel and retention will endure if not worsen in the foreseeable future, then removing the façade of force enhancement from a centralized command and control function liberates scarce resources for matters such as commercial and multinational integration or other legitimate activities.

Framework for Unity of Effort for National Security

Existing organizations, such as the Joint Space Operations Center (JSpOC), National Space Defense Center (NSDC), North American Aerospace Defense Command (NORAD) Missile Warning Center (MWC), and USSTRATCOM Global Operations Center (GOC) execute different aspects of operational command and control for national security LOO. The challenge is recognizing which processes are unique to certain LOO and where there are opportunities to eliminate redundancies. In the case of strategic deterrence, integrating the mission sets of sensor

management for early warning and command and control of offensive strategic capabilities—perhaps at the JSpOC or GOC, provides a centralized command framework which supports unity of effort and enables defensive space control for on-orbit NC3 assets such as MILSTAR and SBIRS.

Joint Publication 3-16*, Multinational Operations*, defines multinational unified action as "the synergistic application of all elements of national and multinational power; it includes the actions of non-military organizations as well as military forces."[3] The definition holds true for interagency, civil, commercial stakeholders. Integration of these partners and their interests into the wider national security space enterprise is a fledgling effort at the JSpOC.[4] While not a formal LOO, the command center is shifting focus to "improved integration of allied partners into operations, planning, and strategy as well as enhancing security agreements and communication frameworks to improve information sharing, and expanding access to allied space capabilities to support space operations."[5] The LOO also has important implications for defensive space control in the space control LOO. From the standpoint of resilience, integration of commercial partners is one means of effective defensive space control. As noted by David Berteau in a study for the Center for Strategic and International Studies, "Commercial space assets and services are critical to US national security and economic health and, because commercial space is critical, assured access to space for commercial payloads should be an important US national security

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[3] Joint Publication 3-16, *Multinational Operations*, 7 March 2007, III-12.
[4] In July of 2018 the JSpOC will change its name to the Combined Space Operations Center (CSpOC).
[5] Joint Force Space Component Command, "CSpOC Director's Intent," 2018. Accessed 1 March 2018.

policy."[6] In addition to creating a more robust and resilient enterprise, integrating commercial assets into a unity of effort concept protects national security capabilities by widening the aperture through which national security space can learn and incorporate best practices related to technical, organizational, and cultural aspects.

The challenges associated with achieving unity of effort is greatest for the space control LOO, specifically for defensive space control operations. Maneuvers or other defensive countermeasures require some degree of command and control of those assets. Lessons from joint air operations in the Korean War offer insights adapted below for achieving unity of effort for space control, or any LOO, that commanders and leaders should consider:

1. The need for a central operations center to broker requirements and resources in a tactical campaign.
2. The usefulness of combined training, planning, and doctrine formulation in peacetime.
3. The importance of flexibility in hardware, tactics, and command and control modalities, particularly in communications.
4. The continuing utility of so-called obsolete hardware when facing an enemy with less than modern forces.
5. The significance of personal involvement by senior commanders in promoting unity of purpose and resolving issues among interservice, interagency and multinational partners.[7]

Unity of effort in joint air operations during WWII involved the "coordination of carrier- and land-based air attacks" and "coordination between the land- and sea-based components mounting the attacks."[8]

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[6] David Berteau, et al. "National Security and the Commercial Space Sector: An Analysis and Evaluation of Options Improving Commercial Access to Space," Center for Strategic and International Studies, July 2010, 1.
[7] Dana Johnson and James Winnefeld, *Joint Air Operations: Pursuit of Unity in Command and Control, 1942-1991*, (Annapolis, MD: Naval Institute Press, 1993), 61.
[8] Johnson and Winnefeld, *Joint Air Operations*, 15.

For space operations, a possible equivalent of a tactical air campaign is coordinating assets to counter or mitigate the effects of an attack. Command and control authorities required for defensive action should be specific and formalized prior to engagement.

The National Space Defense Center (NSDC) began as an organization that conducted experiments and exercises to achieve unity of effort for the national security space enterprise. The center is joint organization under the Joint Force Space Component Commander (JFSCC) and seeks to leverage and integrate capabilities from the intelligence community and other inter-agency partners. It was fully activated as an operational center in 2017. It uses an Air Operations Center (AOC) as a starting point for the organization and essentially replaces the U.S. Air Force's Joint Space Operations Center (JSpOC) as the operational command and control node for space operations. A press release from AFSPC Public Affairs states "The NSDC directly supports space defense unity of effort and expands information sharing in space defense operations among the DOD, National Reconnaissance Office (NRO), and other interagency partners."[9]

For the national security line of effort, existing organizations such as the NSDC can act as an effective command and control node while allowing tactical squadrons to plan and execute defensive space control operations. Considerations include authorities based on orbital regime, affected LOO, preponderance of forces, and supported theater commander.

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[9] Shellie-Anne Espinosa, Air Force Space Command Public Affairs, "National Space Defense Center transitions to 24/7 operations", 26 January 2018 http://www.afspc.af.mil/News/Article-Display/Article/1423932/national-space-defense-center-transitions-to-247-operations/, Accessed 27 February 2018.

Conclusion: Leadership and a Warfighting Culture for Space

Lessons learned from joint air, and multinational efforts primarily focus on organizational and technical aspects of military operations. The focus on lines of effort and optimizing operational command and control methods leave little room for discussion on the importance of leadership to the process. However, concluding thoughts provide an opportunity to reflect on the research findings and consider the personal leadership considerations any commander, planner, or strategist will face when seeking to implement these or any lessons to an organization. Johnson and Winnefeld list six lessons learned from the effort in Korea to achieve effective joint air operations. One of those lessons—applicable to achieving unity of effort for operational command and control for space operations—is "the significance of personal involvement by senior commanders in resolving interservice issues or at least narrowing the gaps between the different perspectives."[10] Implementing any portion of the findings presented within this research represent a considerable leadership challenge.

Leaders in the space enterprise will need to create and reinforce a culture and an environment which understands the implications of the threat situation for space operations. Whatever the character of the organization, it will require long-term and significant change. The lack of an existential threat makes such a change difficult to implement. Change for the sake of change and extra effort equate to wasted time if it is not justified. For the vast majority of space professionals, even during conflict, day-to-day operations do not involve fighting per se but do adhere to cultural norms. Stephen Rosen explains "Military organizations plan and prepare for war, but they do not fight. Instead of being routinely

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[10] Johnson and Winnefeld, *Joint Air Operations*, 61.

'in business' and learning from ongoing experience, they must anticipate wars that may or may not occur."[11]

Specific methods will vary for each organization, but a general awareness of the need to create such a culture is important. Leaders should also seek ways to communicate the grander objectives that are often lost in the organization's day-to-day administrative business. Barry Posen recalls the lessons of Clausewitz and places significant importance on tying an organization's efforts to political objectives, as well as the importance of innovation. Posen explains "the integration of grand strategy—the reconciliation of military doctrine with political ends—can affect the security of states…Innovation within military doctrine can affect the security of states. Stagnant doctrines may lead to disintegration. They may also simply lead to defeat on the battlefield."[12]

A leader or decision-maker must be willing and able to make decisions to overcome barriers to innovation. While this may seem intuitive, it is usually this lack of decision-making that grinds even the most motivated and innovation-seeking organizations to a halt. Leaders must be willing to make decisions regarding the progress of even the most seemingly mundane or administrative projects. Thomas Hughes states "the present-day preeminence of the United States in the creation of large systems arises in large part because of its managerial prowess."[13]

Overcoming resistance to change requires a means to demonstrate to the organization that new ideas will be not only considered but acted upon and advanced. To illustrate, it is useful to consider a major

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[11] Stephen Peter Rosen, *Winning the Next War: Innovation and the Modern Military* (Ithaca, NY: Cornell Univ. Press, 1991), 8.
[12] Barry R. Posen, *the Sources of Military Doctrine France, Britain, and Germany Between the World Wars* (Ithaca, NY: Cornell University Press, 2014), 221.
[13] Thomas P. Hughes, *Rescuing Prometheus* (New York, NY: Pantheon Books, 1998), 5.

project—such as writing a concept plan (CONPLAN) for US Strategic Command. To be involved in a project such as this is to see Allison and Zelikow's Model III personified, as "players who act in terms of no consistent set of strategic objectives but rather according to various conceptions of national, organizational, and personal goals; players who make government decisions not by a single rational choice, but by the pulling and hauling that is politics."[14]

Organizations that lack decisive leaders also risk creating a climate devoid of trust. Lt Col Raj Agrawal, Commander of the 20th Space Control Squadron, notes the importance of trust in any organization, "Trust is fundamental to leadership, followership, and teamwork. As leaders, our subordinates need to trust that we will give them top cover when they innovate, take risks, or debrief errors."[15] Effective leadership through timely, sound, and confident decision-making allows organizations to thrive in a culture that actively seeks meaningful innovation and leverages the expertise of its members, which is the inherent strength of any bureaucracy. Changing the culture of the national security space enterprise to achieve unity of purpose and practice effective operational command and control will require such leadership.

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[14] Graham T. Allison and Philip Zelikow, *Essence of Decision: Explaining the Cuban Missile Crisis* (New York, NY: Longman, 2010), 255.
[15] Lt Col Raj Agrawal, "Trust is the Currency of Leadership", (Peterson AFB, CO, 2016), http://www.peterson.af.mil/News/Commentaries/Display/Article/924517/trust-is-the-currency-of-leadership/, Accessed 10 April 2018.

Appendix

Mission Areas

Space situational awareness (SSA) involves characterizing, as completely as necessary, the space capabilities operating within the terrestrial environment and the space domain. SSA is dependent on integrating space surveillance, collection, and processing; environmental monitoring, processing and analysis; status of US and cooperative satellite systems; collection of US and multinational space readiness; and analysis of the space domain. It also incorporates the use of intelligence sources to provide insight into adversary use of space capabilities and their threats to our space capabilities while in turn contributing to the JFC's ability to understand adversary intent.[1]

Space support includes the essential capabilities, functions, activities, and tasks necessary to operate and sustain all elements of space forces throughout the range of military operations. Components of space support include spacelift, satellite operations, and reconstitution of space forces.[2]

Space force application is combat operations in, through, and from space to influence the course and outcome of conflict by holding terrestrial targets at risk. The space force application mission area includes ballistic missile defense and force projection capabilities such as intercontinental ballistic missiles.[3]

Space force enhancement operations increase joint force effectiveness by increasing the combat potential of that force, enhancing operational awareness, and providing critical joint force support. Space

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[1] Joint Publication 3-14, *Space Operations*, (Washington, DC: 2013), II-2.
[2] JP 3-14, *Space Operations*, II-6.
[3] JP 3-14, *Space Operations*, II-9.

force enhancement is composed of ISR; missile warning, environmental monitoring; satellite communications (SATCOM); and PNT.[4]

Space control supports freedom of action in space for friendly forces, and when necessary, defeats adversary efforts that interfere with or attack US or allied space systems and negates adversary space capabilities. It consists of offensive space control (OSC) and defensive space control (DSC). OSC are measures taken to prevent an adversary's hostile use of US/third-party space capabilities or offensive operations to negate an adversary's space capabilities used to interfere with or attack US/allied space systems. DSC are operations conducted to preserve the ability to exploit space capabilities via active and passive actions, while protecting friendly space capabilities from attack, interference, or unintentional hazards.[5]

[4] JP 3-14, *Space Operations*, II-4.
[5] JP 3-14, *Space Operations*, II-8.

Glossary

AFSPC – Air Force Space Command

AOC – Air Operations Center

ASAT – Anti-satellite

CDRUSSTRATCOM – Commander, United States Strategic Command

DSC – Defensive Space Control

DSP – Defense Support Program

FE – Force enhancement

GCC – Geographic Combatant Command

GOC – Global Operations Center

ISR – Intelligence, surveillance, and reconnaissance

JFACC – Joint Functional Air Component Commander

JFSCC – Joint Functional Space Component Commander

JSpOC – Joint Space Operations Center

LOO – Line of operation

LOE – Line of effort

MAAP – Master Air Attack Plan

NSDC – National Space Defense Center

OSC – Offensive Space Control

PNT – Position, navigation, and timing

SBIRS – Space-based infra-red system

SCA – Space Coordinating Authority

SFE – Space force enhancement

SMF – Space Mission Force

SOST – Space Operations Specialty Team

SSA – Space Situational Awareness

SWG – Schriever War Game

UCC – Unified Combatant Command

UCP – Unified Command Plan

USSTRATCOM – United States Strategic Command

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