

Applying Operational Art in the Space Domain

A Monograph

by

Major Z. Walter Jackim

United States Air Force



School of Advanced Military Studies

United States Army Command and General Staff College

Fort Leavenworth, Kansas

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Major Z. Walter Jackim, USAF

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Approved by:

_____	Monograph Director
Robert W. Tomlinson, Ph.D. (ABD)	

_____	Monograph Reader
Joseph S. McLamb, LTC, IN	

_____	Monograph Reader
Stephen A. Bourque, Ph.D.	

_____	Director, School of Advanced Military Studies
Wayne W. Grigsby, COL, IN	

_____	Director, Graduate Degree Programs
Robert F. Baumann, Ph.D.	

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Abstract

APPLYING OPERATIONAL ART IN THE SPACE DOMAIN by Major Z. Walter Jackim, USAF, 59 pages.

Terms such as “operational art” and “operational level” are prevalent in US military space doctrine. However, no research exists that analyzes the applicability of operational art in the space domain. The use of operational terms in US military space doctrine is an ancestor of the operational theory the US Army developed for Cold War land warfare in Central Europe. Since its original codification, the lexicon migrated through US Army, US Air Force, and US Joint doctrine manuals and schools until it reached space doctrine. This monograph traces the historic evolution of operational theory prior to its implementation in Cold War US Army field manuals in order to distill essential attributes of operational art. The paper compares these attributes with the current context of US military space operations to determine if any of the attributes of operational art are applicable in the space domain.

This monograph has six major sections. The introduction sets the foundational question of this monograph, “Is operational art applicable in the space domain?” and describes the knowledge gap between the historic development of operational theory and its application in the space domain. The first main section evaluates three historic periods for context and operational responses. This evaluation shows that nine historic attributes of operational art evolved between its emergence in the Napoleonic period and its full maturity in the post-World War I Soviet Union. The second section describes the context of Cold War Central Europe and demonstrates why Soviet operational theory was useful to the US Army in developing new operational concepts. The codification of an operational lexicon in US Army field manuals, primed the concept for transfer into other US doctrinal manuals. This migration is the subject of the third section, which shows how a Cold War land concept eventually came to contemporary space doctrine. The final section discusses which of the historic attributes of operational art are applicable in the space domain. The conclusion reviews the specific application of each attribute of operational art within the space domain and draws general inferences from the data.

Although the origins of operational art occurred centuries ago in the Napoleonic era, many of the historic attributes of operational art are applicable in the contemporary space domain. Those attributes that are applicable were responses to increasingly larger forces and battle areas. The attributes that do not transfer into the space domain tend to be those developed for force application. As the numbers of space forces continue to grow, operational art will continue to be a necessary and useful concept in the space domain. However, unless space undergoes large-scale weaponization, the utility of operational art will continue to be limited.

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Introduction

Military concepts and theories have histories. They do not magically emerge into books, lectures, and doctrine manuals. Rather, they develop through the confluence of previous ideas, the current environment, and military necessity. The concept of operational art is not an exception to this rule. Its development was dynamic and its form has changed over time based on environmental context and application. The current United States (US) military doctrinal understanding of operational art differs from its historic forms. However, it retains identifiable and essential characteristics that are traceable throughout the history of land warfare. Within the last few decades, the concept of operational art has spread outside its origins in the land domain. Several doctrine manuals and scholarly articles articulate the utility of operational art in the domains of sea, air, space, and cyberspace. While the application of operational art outside the land domain may yield positive results, the excessive generalization or misapplication of operational art can also reduce its utility to the point where it is more harmful than beneficial. This monograph explores the application of operational art in the space domain to answer the question, “Is operational art applicable in the space domain?”

This paper maintains operational art is applicable in the space domain. This assertion rests on four basic premises. First, historic study reveals there are essential and timeless qualities of operational art. The first section of this monograph addresses this point by evaluating three critical periods in the emergence and evolution of operational art in the land domain. These periods include the Napoleonic Era, the Franco-Prussian Wars, and the Soviet Interwar Period. The second premise is the post-Vietnam United States (US) Army incorporated the concept of operational art into US military doctrine because it was useful for understanding and planning Cold War military operations in Central Europe. The second section of this monograph will discuss why the application of operational art was appropriate within this context. The third premise is the US Army’s concept of operational art expanded outside the land domain and

spread throughout US aerospace doctrine without a scholarly debate. The ultimate form of this expansion is now evident in the operational references found within the current space doctrinal manuals of *Joint Publication 3-14, Joint Space Operations (JP 3-14)* and *Air Force Doctrine Document 2-2, Space Operations (AFDD 2-2)*. The third section of this monograph explores this expansion of operational theory into domains and analyzes potential weaknesses in its propagation. The final premise of this monograph is the essential attributes of operational art are relevant in the contemporary space environment. This premise is the subject of the final section, which compares the historic essential attributes of operational art with their current application within the space domain. This comparison highlights opportunities for the beneficial use of operational art in space as well as the areas where its application might be harmful or inefficient. Together, these four premises tell the story of how an idea created on a Napoleonic battlefield two hundred years ago is useful in a domain that, in the early 19th Century, was inconceivable and why that concept is still useful today.

Definitions

Establishing a common lexicon to discuss operational theory is a necessary foundation to this paper. US joint and service doctrine manuals all contain definitions of the operational level of war and operational art. These definitions have underlying histories and assumptions that make them too specific for use within this paper. Since this monograph researches the application of operational theory over several decades and from foreign perspectives, more generalized definitions are necessary. For the purpose of this paper, the term “operational level of war” defines a tangible and identifiable stratum of organization, battle area, or scale. This stratum is an intermediary between higher strategic strata and detailed tactical strata. “Operational art” is the totality of processes and methods used by commanders and staffs responsible for the operational level. These processes differ from the processes and methods used at the strategic and tactical levels in order to be operational art.

Common definitions of space and space assets are also necessary for further discussion. In this monograph, the space domain is the area surrounding the earth, bounded by the nearest altitude at which a satellite can complete one full orbit of the earth and the farthest altitude at which there is a useful military purpose. This domain forms a hollow sphere with the earth at its center. A space asset is a military, civil, or commercial unit used for a military purpose that predominantly uses the domain of space to achieve an effect. Satellites are space assets since they reside in the domain of space. Satellite ground stations, tracking stations, and launch facilities are space assets since the preponderance of their functions achieve space effects. Space assets include ground-based counterspace weapons. Aircraft, naval ships, land vehicles, intercontinental ballistic missiles, etc. are not space assets even though they use space services or traverse the space domain because the preponderance of their effort is in another domain.

The Discussion of Operational Art in Space

This paper is one voice in the on-going discussion of the applicability of operational art in the space domain. The following section describes the scholarship and perspectives already established within this discussion.

Primary Texts on Operational Art

The most noteworthy point about the books written on operational art is the dearth of substantive discussion about the space domain. Collections such as *Historical Perspectives of the Operational Art*, *On Operational Art*, and *Operational Warfare* do not contain any sections focusing on the space domain. The few mentions that do occur are cursory. Lieutenant Colonel (USAF) Price T. Bingham's article, "Aerospace Operational Art," only addresses the advantages

space provides to operations in other domains via enhanced communications and navigation.¹ The article also reflects a now obsolete view that aerospace is a seamless domain stretching from the earth's surface into outer space. This differs from the contemporary view of air and space as two unique domains. Milan Vego also mentions space in his book, *Operational Warfare*, but only as a component of joint and combined operations. Like Lt Col Bingham, Dr. Vego did not address the theory or details of an operation predominantly conducted within space or for an operational objective in the space domain.² The lack of discussion regarding operational art in the space domain stands in stark contrast to the volumes written on the application of operational art in the land, sea, and air domains. This implies this study is far less mature than the discussions about the other domains. It also means there is no published consensus about how operational art applies to space..

Primary Articles on Operational Art in the Space Domain

The primary arena for dialogue regarding operational art in space has been papers written at military graduate colleges. The earnest discussion of the operational art in space began in the late 1990's due to the notoriety space effects received during the 1991 Gulf War. Major Robert Newberry, USAF, discussed the elements of space operational art in his 1997 article titled "Space Doctrine for the 21st Century." He argued that operational art was a doctrinal concept derived from the doctrinal development process. This process begins by applying the principles of war within a specific domain. The product of this application yields the domain's tenets of power.³ In the second step of the process, doctrine writers combine these tenets of power with operational

¹ Price T. Bingham, "Aerospace Operational Art," in *On Operational Art*, ed. Clayton R. Newell and Michael D. Krause (Washington D.C.: U.S. Government Printing Office, 1994), 75.

² Milan N. Vego, *Operational Warfare* (Newport, RI: Naval War College, 2000), 7.

³ Robert D. Newberry, "Space Doctrine for the 21st Century" (master's thesis, Air Command and Staff College, 1997), 18.

experience to produce that domain's operational art.⁴ Maj Newberry evaluated this process for the space domain and developed fourteen elements to describe operational art in space. These elements included observation management, autonomy, space surveillance, and launch on demand.⁵ In this framework, commanders apply operational art by using these operational elements to create procurement and execution strategies. Maj Newberry's article is one of the first artifacts of the discussion of operational art in space and shows the tendency to develop space doctrine by looking to other domains for formatting and general principles. However, Maj Newberry refrained from "cutting and pasting" section of doctrine from other manuals and developed an operational art construct unique to the space domain. By applying the unique characteristics and operational experience of the space domain, Maj Newberry's product differed from the other domains. This method yielded a far different result than copying air doctrine and substituting the word "air" for "space." Maj Newberry's methodology of reducing an idea or a process to its essential attributes and then applying those attributes to the space domain is the same methodology used in this paper.

In 1998, Major Leonard Jansen, USAF, wrote a paper arguing operational art emerged in the space domain during the 1991 Gulf War.⁶ Maj Jansen used Dr. Milan Vego's theoretical criteria for the emergence of operational as a framework for his argument. He documented changes in the conduct of war, military organization, training, and education that were particular to the space domain. According to Maj Jansen, these changes showed the space domain went through transformations indicative of the emergence of operational art.⁷ He loosely defined

⁴ Newberry, "Space Doctrine," 20.

⁵ Newberry, "Space Doctrine," 44.

⁶ Leonard J. Jansen, "The Emergence of Operational Art for Space: Is It Time for Another Mitchell or Mahan?" (master's thesis, Naval War College, 1998), 1.

⁷ Jansen, "Emergence of Operational Art," 5.

operational art as a component of military art between strategy and tactics.⁸ This definition is consistent with current military doctrine and highlights one of the enduring gaps in the discussion of operational art, namely, it fails to define the essential characteristics of operational art. This article develops the idea that a domain goes through hierarchical advancements in operational utility and that space is only in the earliest levels of this advancement. He further posits space will probably not mature beyond this entry-level stage. This is particularly insightful since it asserts operational art and utility in space may look strikingly different from the other domains and that space may not grow or mature to the scales needed to apply all of the aspects of operational art.

Lt Col Richard Patenaude, USAF, wrote a paper in 2001 outlining five necessary steps to institutionalize space superiority in the US Air Force.⁹ This paper highlighted a gap in operational-level air force space doctrine. He noted that, while there was basic doctrine to describe the space environment and tactical doctrine describing the tactics, techniques, and procedures of space assets, there was no doctrine describing how to write a campaign plan to achieve space superiority.¹⁰ Lt Col Patenaude recognized the need to develop space-specific campaign plans to achieve operational space objectives (space superiority). He also demonstrated that the combination of many tactical space actions, such as halting the flow of commercial imagery via diplomatic means or by purchasing all of the imagery from a commercial source, could lead to higher order effects like denial of intelligence. This notion of aligning tactical space actions to achieve campaign effects is critical in the discussion of operational art.

In 2006, Maj George Tromba, USAF, published a paper titled, “Operational Art for Space Control: Do the Principles of War Apply?” This paper attributed the inefficient provision

⁸ Jansen, “Emergence of Operational Art,” 2.

⁹ Richard M. Patenaude, “How to Institutionalize Space Superiority in the United States Air Force” (master’s thesis, United States Air Force Air War College, 2001), 1, in Air War College Gateway, <http://www.au.af.mil/au/awc/awcgate/awc/patenaude.pdf> (accessed September 13, 2010).

¹⁰ Patenaude, “How to Institutionalize Space Superiority,” 4.

of space services during Operation DESERT SHIELD to the poor application of operational art. Maj Tromba suggests the application of the nine principles of war; particularly objective, offensive, and security; are a “key component” of operational art.¹¹ He posits an operational commander applies operational art through the effective use of the principles of war.¹² This paper is noteworthy because it attributes a real-world deficiency in space force application to a lack of operational art. Maj Tromba demonstrates there is a cost for not thinking at the operational level.

State of the Discussion of Operational Art in Space

There are some consistent elements within this on-going discussion of the operational art in space. The most notable point of agreement is space is a uniquely separate domain that requires independent analysis. However, in the few artifacts that discuss space operational art, there is more divergence than consensus. The methodologies used to evaluate operational art’s utility vary widely. The loose doctrinal definitions of operational art and the lack of consensus on the characteristics of operational art allow these disparate and often mutually exclusive arguments to occur. A good place to start building organizational consensus on the meaning of operational art is the study of its history. An understanding built on historic consistency reduces the subjectivity of the idea and may provide new and fertile fields for this discussion to plow.

Historical Characteristics of Operational Art

The concept of operational art took several decades to reach maturity. The earliest historic claim for the emergence of operational art is the development of the Napoleonic corps. The latest claim attributes the emergence of operational art to the development of Soviet operational theory during the period between World War I and World War II. The difference

¹¹ George E. Tromba, “Operational Art for Space Control: Do the Principles of War Apply?” (master’s thesis, Naval War College, 2006), ii.

¹² Tromba, “Operational Art for Space Control,” 1.

between these and many other intermediary claims is not a dispute of historical accuracy, but an academic dispute over evaluation criteria. Those historians that evaluate operational art based on initial changes in force size and battle area mark the emergence of operational art earlier than those historians who define operational art based on the full development of operational organizations, approaches, and theories. Taken together, these historic accounts trace the development of operational thought from its origins in the Napoleonic corps to its full maturation in Soviet operational theory. Further, the historians' evaluation criteria provide signposts that mark the emergence of novel operational attributes within the overarching story of operational art's development.

Operational art developed most rapidly within three historic periods. The first period encompassed the development of the Napoleonic army corps, a large-scale combined arms formation (force). The second period, the Franco-Prussian Wars,¹³ demonstrate the continued expansion of force size along with increases in the theater of war (area) and the duration of the operations (time).¹⁴ The final era, the Soviet interwar period, introduces the emergence of operational thought. Each of these periods contains an identifiable and tangible operational level of war with an associated method of operational art that consisted of specific concepts and approaches to manage that level. This monograph derives the essential qualities of operational art

¹³ The American Civil War is a suitable alternative case study to the Franco-Prussian War. Dr. James Schneider makes a compelling case in his article, "The Loose Marble – and the Origins of Operational Art" that operational art emerged within the Union Army during the latter part of the American Civil War. This monograph uses the Franco-Prussian War as a case study instead of the American Civil War for two reasons. First, both war periods demonstrate the concepts of time, space, and sequencing equally well. Second, the Soviet scholars that developed operational theory during the interwar period referenced the Prussian Army, but did not refer to the American Army. Therefore, using the American Civil War as a case study breaks the continuity of operational thought. See James J. Schneider, "The Loose Marble -- and the Origins of Operational Art," *Parameters* 19, no. 1 (March 1989): 85-99.

¹⁴ Milan Vego characterizes operational warfare as different from tactical warfare based on "larger dimensions of forces, time, and space." "Area" is substituted for "space" in this paper to reduce confusion with the space domain. See Vego, *Operational Warfare*, 10.

from the environmental and cognitive developments within these periods. These essential attributes provide the framework to evaluate the applicability of operational art in space.

Operational Art – Response to Increases in Force and Area

The first historic driver of operational art was a marked increase in the size of the military force and the subsequent size of the battlefield (area). In this case, operational art fulfilled the need to provide command, control, and logistics for increasingly larger units dispersed across larger fronts. The case study for this driver is the French Army in the Napoleonic Era.

Case Study - The Napoleonic Era

The Napoleonic Era was a watershed period in military thought.¹⁵ The combination of innovative French military thought, the French Revolution, and the generalship of Napoleon Bonaparte fundamentally changed the structure and conduct of military operations that dated back to antiquity. The wars of Ancient Greece, the Roman Empire, the Persian Empire, and the European Dark Ages share fundamental similarities. Despite the geographic and temporal variance of these wars, the structure of the armies was similar. A single leader commanded the entirety of the army, which rarely exceeded 50,000 to 60,000 men. Additionally, there was no intermediate staff between the field commander and the regiment.¹⁶ The army fought as a single element, sometimes attacking the enemy directly, but usually trying to turn the opposing army to attack the weaker flanks. Further, the commander saw the entirety of the battlefield and directed actions personally. These battles were rarely decisive. An army general in a disadvantageous

¹⁵ I am grateful to Dr. Robert M. Epstein, author of *Napoleon's Last Victory and the Emergence of Modern War* and Professor at the School of Advance Military Studies, who generously shared his time and ideas with me. The ideas formulated in this section derive from his excellent historic work and through our discourse on the nature of operational art.

¹⁶ Robert M. Epstein, *Napoleon's Last Victory and the Emergence of Modern War* (Lawrence, KS: University Press Of Kansas, 1995), pp. 9-10.

situation would simply deny battle through retreat. This led to protracted conflicts that spanned multiple campaigning seasons.

The French changed this enduring organization structure throughout the mid-Eighteenth Century by creating a multi-regimental organization called the division. The division concept formed slowly, but, by 1763, the French Division consisted of four total regiments of cavalry and infantry with supporting artillery.¹⁷ The creation of this organization allowed French General Pierre de Bourcet to generate a novel and critical component in the development of operational art. Instead of breaking the army into divisions solely to expedite travel, de Bourcet realized the divisions could also fight with some autonomy on the battlefield.¹⁸ Further, employing these divisions along a broad front would deny the enemy the ability to refrain from battle.¹⁹ Since these divisions were semi-autonomous, the commanders required an overarching campaign plan to inform their actions. The plan linked the political and strategic goals of the Emperor to the tactical employment of the regiments.²⁰

Napoleon Bonaparte took de Bourcet's theory a step further by creating the multi-divisional organization called the corps. The Napoleonic corps was a combined arms unit capable of attacking larger field armies for short periods.²¹ These units, working together or separately, could penetrate the enemy in the flanks or take advantage of weakened positions. Over time, the

¹⁷ Epstein, *Napoleon's Last Victory*, 11.

¹⁸ Robert A. Doughty, "French Operational Art: 1888-1940." In *Historical Perspectives of the Operational Art*, ed. Michael D. Krause and R. Cody Philips (Washington, DC: Center of Military History, 2007), 70.

¹⁹ Epstein, *Napoleon's Last Victory*, 11.

²⁰ This link between strategy and tactics forms the foundation for the modern US doctrinal definition of the operational level of war. *Joint Publication 3-0* describes the operational level of war in the following way, "The operational level links the tactical employment of forces to national and military strategic objectives. The focus at this level is on the design and conduct of operations using operational art." See US Joint Chiefs of Staff, *Joint Publication 3-0: Joint Operations* (Washington D.C.: Chairman of the Joint Chiefs of Staff, 17 September 2006), II-6). and Epstein, *Napoleon's Last Victory*, 11.

²¹ Doughty, "French Operational Art: 1888-1940," 70.

corps commanders became more adept in maneuver and engagement, which provided operational flexibility for the larger army. The large French formations forced battle on their adversaries and, along with it, defeat. The ability to force an opponent into a decisive engagement required the defeated opponent to sue for peace and gave strategic victory for the French.²² The cognitive connection Napoleon made between defeating his opponent's army in the field (tactical successes) using his corps formations (grand tactics)²³ to achieve favorable treaty terms or land control (strategic aims) is an early demonstration of operational art.

Napoleonic Attributes of Operational Art

Though some authors disagree that Napoleon was the first general to apply operational art, there is wide agreement that the French, at least, established important precursors for operational art's eventual development. These operational attributes include the use of large-scale maneuver units, the creation of intermediate staffs, developing distinct operational objectives, and the use of "distributed maneuver." The French Army's construction of units larger than the regiment demonstrates the first historic attribute of operational art. The Napoleonic corps and division are the first examples of large-scale operational formations. These echelons are still visible in contemporary armies throughout the world. Second, the French developed robust corps- and division-level staffs. Originally, these units received skeletal staffing. However, by the time Napoleon was fighting his way across Europe these staffs included logistics, maneuver, intelligence, ordinance, and medical branches.²⁴ The ability to control an army of over 200,000

²² Epstein, *Napoleon's Last Victory*, 17-18.

²³ The terms grand tactics and operational art are not necessarily synonymous. Many authors, including Kelly and Doughty; consider Jomini's use of the phrase "grand tactics" to mean exactly small unit tactics applied to larger formations. These grand tactics are separate and distinct from operational art. See Mike Brennan and Justin Kelly, *Alien: How Operational Art Devoured Strategy* (Fort Leavenworth, KS: Strategic Studies Institute, 2009), 13 and Doughty, "French Operational Art: 1888-1940," 69.

²⁴ Epstein, *Napoleon's Last Victory*, 24.

men through these staffs shows a marked contrast against the pre-Napoleonic armies of 50,000 men.²⁵ A third characteristic is the development of nested objectives. The capability to decisively fix and destroy an army set an intermediate objective between strategy and tactics that was previously unrealized. Non-decisive engagements in protracted campaigns either failed to achieve strategic results or lowered the strategic aims to realistic levels. The capability to destroy an entire field army created an intermediate objective that was greater than winning tactical engagements, but less than achieving the strategic aims. “Distributed maneuver” is the final operational attribute developed during the Napoleonic era. Dr. Epstein²⁶ defines distributed maneuver as, “the movement of *major formations* over a *wide area* according to broadly conceived, but *flexible plan*.”²⁷ This concept identifies two characteristics of operational art, scale and flexible planning. Not only did the size of the organizations increase, the length of the battlefield also increased. At times, Napoleon had his army spread over a 140-mile front, well beyond his capability to survey the entire battlefield.²⁸ Since no one person could command the entire front, plans had to be general and flexible. The plan needed to have enough detail to provide unity of effort and to sequence events for an operational or strategic objective, yet be sufficiently non-prescriptive to allow operational commanders the ability to exploit opportunities

Napoleon and his field commanders did not apply operational art at arbitrary levels. In the Napoleonic era, the operational level equated to the corps and division. Field army commanders and corps commanders performed operational art through the maneuver of corps and divisions. Commanders at divisions and below performed tactics. This separation shows a clear

²⁵ Epstein, *Napoleon’s Last Victory*, 24.

²⁶ Dr. Robert M. Epstein is the author of *Napoleon’s Last Victory and the Emergence of Modern War* and is a Professor at the School of Advance Military Studies, Fort Leavenworth, Kansas.

²⁷ Epstein, *Napoleon’s Last Victory*, 26. (emphasis added)

²⁸ Epstein, *Napoleon’s Last Victory*, 26.

distinction between the operational and tactical level. However, Napoleon provides a strange dilemma in the distinction between strategy and operations. Since Napoleon was both the head of state and commander of the army, he was simultaneously responsible for both strategic and operational art. This dilemma is a reason why many historians choose later dates for the emergence of operational art.

Operational Art – Response to Scales of Time and Sequence

The continued growth of forces and battle areas characterizes the second historic period of study, along with new operational developments. These unique developments included a “deepening” of the campaign area. While the battlefields continued the linear expansion noted during the Napoleonic period, the operational commander also became responsible for developing a series of operations in depth. Since even large armies could not penetrate these depths in one major operation, the operational commander had to sequence operations into campaigns. The case study for this period of development is the Franco-Prussian War.

Case Study - Moltke and the Franco-Prussian War

On August 2, 1870, six French divisions marched into the Prussian town of Saarbrücken. The superior training and marksmanship of the French army gave them a distinct advantage over their Prussian adversaries and continued victory seemed certain.²⁹ Within four days, however, the Prussians had handed the French army stunning defeats in the Alsace towns of Wissembourg and Spicheren and the Prussian Army was poised to overrun French Marshal MacMahon’s I Corps.³⁰ By October, the Prussians had counterattacked, had felled the French city

²⁹ Geoffrey Wawro, *The Franco-Prussian War: The German Conquest of France in 1870-1871* (New York: Cambridge University Press, 2005), 96.

³⁰ Wawro, *The Franco-Prussian War*, pp. 95, 119.

of Sedan, had received the surrender of the 133,000 men and 600 guns of besieged Metz, and had surrounded Paris.³¹ Many historians credit the defeat of the French army to Prussian Field Marshal Helmuth von Moltke and his use of operational art.

The French defeat was a watershed event for operational art. Prior to the Franco-Prussian War, the defeat of the adversary field armies forced the desired political objectives. A sovereign without an army to protect his territory accepted the political terms to stop further losses and destruction within his territory. This changed in the Franco-Prussian War as shown by Prussia's need to continue campaigning all the way to Paris despite the capture of the majority of the French Army in Sedan. The failure of the French nation to capitulate after the capture of the main elements of their army shows the first disconnect between decisive military battle and the achievement of political aims and the need for additional attributes of operational art.

Prussian Attributes of Operational Art

Field Marshal von Molke utilized and enhanced the Napoleonic-era characteristics of operational art during the Franco-Prussian War. The Prussians learned from Napoleon's organizational structure and developed corps- and division-level combined arms units.³² The corps and division structures allowed the Prussians, relying heavily on its reserve components, to mobilize and control an army of over one million men,³³ a five-fold increase over the size of the Napoleonic army. This massive army enhanced the ability to achieve decisive battle. The million-man Prussian Army relied on overt mass to achieve strategic and operational success. The size of the Prussian Army reflected their attrition strategy and the belief that overwhelming the enemy army would set the conditions to achieve their strategic aims.

³¹ Wawro, *The Franco-Prussian War*, 250.

³² Wawro, *The Franco-Prussian War*, 123.

³³ Wawro, *The Franco-Prussian War*, 41.

Moltke combined the Napoleonic idea of distributed maneuver with technological advancements in transportation and communication to develop an updated concept called “operational direction.” The advent of the railroad and the telegraph allowed the Prussian Army to mobilize its reserves from distant regions and then mass these forces at decisive locations. Further, the telegraph enabled commanders and logisticians the capability to coordinate these geographically disparate movements. The telegraph also enabled intelligence flow from unobservable parts of the field to the headquarters staff. The combination of these advancements allowed greater operational flexibility.

Moltke used operational flexibility to overcome uncertainty on the battlefield. The Field Marshal was a student of another Prussian soldier, Carl von Clausewitz,³⁴ and shared his worldview that war was a chaotic and indeterminate endeavor. Since the outcome of battle would ultimately lie in the ability of field commanders to deal with their particular situation, Moltke directed units toward their operational goal, but did not provide specific tactical direction.³⁵ Moving large units in the general direction of the operational objective, but leaving the specific direction to the field commanders is the essence of operational direction, a term coined by Moltke in his writings.³⁶ The development of operational direction demonstrates the enduring quality of operation art’s attributes. While the employment of operational direction was dissimilar from Napoleonic distributed maneuver because of force sizes and available technology, its essence of providing guidance with enough specificity to unify effort yet with enough flexibility to deal with the chaotic battlefield is the same.

³⁴ Clausewitz does not make the distinction of a separate operational level of war. However, he does define the term “tactics” as “the use of armed forces in engagements” and the term “strategy” as “the use of engagements for the object of the war.” See Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton, N.J.: Princeton University Press, 1989), 128.

³⁵ Michael D. Krause, “Moltke and the Origins of the Operational Level of War” in *On Operational Art*, ed. Clayton R. Newell and Michael D. Krause (Washington, DC: U.S. Government Printing Office, 1994), 145.

³⁶ Krause, “Moltke and the Origins of the Operational Level of War,” 114.

The Franco-Prussian War also yielded unique ideas regarding operational art. The Prussian King, Wilhelm I, retained the role of army commander during the Franco-Prussian War. However, Wilhelm I authorized Moltke to issue military directives in his name.³⁷ This authorization split political and military responsibilities between two different people, unlike the Napoleonic era in which Napoleon Bonaparte embodied both the state and the military. It created hierarchical levels of responsibility in which the king developed policy and strategy and the field marshal subordinately planned and executed military operations. This delegation of authority remains a hallmark of modern Western governments and an attribute of operational art.

A second unique characteristic of operational art was the sequence of operations to achieve a strategic goal. The Napoleonic Era ended an era of military art centered on “single point strategy,” which relied on long marches to a battlefield followed by a relatively brief battle.³⁸ The destruction of the opposing army left the territory undefended and forced the defeated government to sue for peace. The Franco-Prussian War marks a transition from the single point epoch to the linear strategy epoch.³⁹ This epoch has two main characteristics. First, the ability to move and support large formations via railroad increased the lines of battle well outside the oversight of the field commanders. This generated a need for commanders to synchronize battles along the expanded front. The second characteristic of this epoch was the shift to sequential operations. In Napoleon’s era, the defeat of the enemy army led to strategic success. After the French Revolution, however, the lack of a monarchic sovereign complicated the ability to sue for peace. This meant the defeat of a particular field army did not necessarily lead to success. This forced Moltke to commit his forces into sequential major operations against

³⁷ Krause, “Moltke and the Origins of the Operational Level of War,” 140.

³⁸ G. S. Isserson, *The Evolution of Operational Art*, 2nd ed., trans. Bruce W. Menning (Moscow: The State Military Publishing House of the USSR People's Defense Commissariat, 1937), 10 – 14.

³⁹ Isserson, *The Evolution of Operational Art*, 10–14.

Wissembourg – Metz – Sedan – Paris.⁴⁰ The need to synchronize operations both along an extended front and along decisive points in depth is an attribute of operational art.

Some historians credit the unique operational principles developed by Moltke as the birth of operational art.⁴¹ Napoleonic principles such as large maneuver units, intermediate staffs, and distributed maneuver undoubtedly continued in the Franco-Prussian War. However, both the separation strategic and operational responsibilities and the need to develop coordinated and operational plans within an overarching campaign were innovative. The study of the Franco-Prussian War reinforces the previously established attributes of operational art and adds two novel attributes to the list.

The study of the Franco-Prussian War also shows a shift in the operational level of war. In the Napoleon Era, the operational level resided with the corps and division echelons. In the Franco-Prussian War, the operational level became the enemy territory behind the tactical engagement area. This shift is notable for two reasons. First, this shift is still consistent with the definition of operational level. In the Napoleonic Era, the operational level was an echelon-based stratum in which the corps and division resided between the field army and regiment levels. In the Franco-Prussian Era, the operational stratum was geographic, i.e., an area behind the tactical engagement area, but in front of the enemy's strategic depth. Both definitions describe large-scale of military action, but do so with different units of measurement. The shift is also notable because the Soviet Army used this geographic approach, as seen in the next historic case study.

⁴⁰ Kelly, *Alien: How Operational Art Devoured Strategy*, 18 and Wawro, *The Franco-Prussian War*, 85 – 259.

⁴¹ Kelly, *Alien: How Operational Art Devoured Strategy*, 18.

Operational Art – Response to Cognitive Necessity

The final period of operational development marks the point in history where the concept of operational art is recognized, named, studied, and applied. Until this point, attributing the actions of a military commander to operational art is anachronistic. While Napoleon's and Moltke's actions are consistent with the attributes of operational art, there was no operational theory to guide these actions. The Soviets studied these periods as precursors in the development of their operational theory. This operational theory formed the foundation for the development of their operational concepts, specifically the Deep Battle concept. The formation of this operational theory forms the case study for this period.

Case Study - The Soviet Interwar Period

The years between 1917 and 1921 were tumultuous both militarily and politically for the Soviets. The Russian Army fighting in the Great War (World War I) already had taken over 6 million casualties by January 1917, many of whom were the professionally trained "old army."⁴² This left a fractured military system in place to both fight the Germans and to quell growing unrest in Russia. The army was unable due to losses, allegiances, and mutiny to defend the monarchy. The Tsar abdicated power to Grand Duke Michael on March 15, 1917 starting a four-year civil war that would leave an additional three- to six-million dead due to fighting, disease, and starvation.⁴³

The resulting post-war period ushered in an environment of new Soviet thought. The static fighting lines, enormous death tolls, and technological advances experienced in the Great War caused the Soviets to reevaluate their linear strategy. Further, the Russian Civil War resulted

⁴² Ian F.W. Beckett, *The Great War: 1914-1918* (Malaysia, KVP: Pearson Education Limited, 2001), 361.

⁴³ Beckett, *The Great War*, 378.

in radical shifts of political, scientific, and social thought, which provided reductionist tools for analyzing military art.⁴⁴

The Soviets, dismayed by the previous thinking on military operations, believed they were in a novel place in history. As Soviet Brigade Commander Isserson⁴⁵ wrote in 1936, “We would be powerless to achieve the aims of the present if we failed to go beyond the limits of historical experience, if we failed to reassess it from the perspective of the new conditions of our era, and if we did not mercilessly discard all that was time-worn and stale.”⁴⁶ The result of this new way of thinking was the development and codification of a new operational concept called “Deep Battle.”

The development of Deep Battle resolved two Soviet needs; developing a way of warfare to replace the linear strategy utilized in the Great War and closing the gap between strategy and tactics.⁴⁷ Developing the concept of the operational level satisfied the latter need. The Soviets perceived a gap between strategy and tactics because they elevated the meaning of strategy to include the high-level planning, objective development, and resourcing that guide the development of subordinate military operations.⁴⁸ This left the responsibility to plan and execute large-scale operations at an intermediate and previously undefined level. Additionally, Soviet scientific thinking leaned heavily on reductionism and empiricism. Therefore, the Soviet

⁴⁴ I. Mariyevsky, “Formation and Development of the Theory of Operational Art (1918 – 1938)” in *Selected Readings in the History of Soviet Operational Art*, trans. Harold S. Orenstein (Fort Leavenworth, KS: Soviet Army Studies Office), 10. See bibliography for original publishing information.

⁴⁵ Brigade Commander Isserson’s staff positions in the 1930s included the Chief of the Operations Department at the Frunze Military Academy and the chief of the Department of Operational Art at the General Staff Academy. See G. Isserson, G. “The Development of the Theory of Soviet Operational Art in the 1930s.” in *Selected Readings in the History of Soviet Operational Art*, trans. Harold S. Orenstein (Fort Leavenworth, KS: Soviet Army Studies Office), Endnote 1, 45. See bibliography for original publishing information.

⁴⁶ Isserson, *The Evolution of Operational Art*, vii.

⁴⁷ Isserson, *The Evolution of Operational Art*, 8.

⁴⁸ Burce W. Menning, “Operational Art’s Origins” in *Historical Perspectives of the Operational Art*, ed. Michael D. Krause and R. Cody Phillips (Washington, DC: Center of Military History, 2007), 7.

deconstruction of “military art” as a subsection of “military science” and “operational art” as a subsection of “military art” provided a logical solution to fill the gap.⁴⁹

The concept of Deep Battle satisfied the prior need to replace linear strategy. The Deep Battle called for a penetrating offensive using all forms of air and land forces and through the depth of the enemy lines. Soviet authors repeatedly referenced Deep Battle as “our” operational art.⁵⁰ These references show Soviet’s understanding of the term “operational art” to be what the US military now calls an “operational concept.”

Soviet Attributes of Operational Art

Some military scholars, especially Soviet scholars, associate the emergence of operational art with the development of Soviet operational theory. Isserson claims Field Marshal von Moltke did not apply operational art because he only faced problems related to the deployment of units into France.⁵¹ Once Moltke directed his troops into the desired area, there was no operational control of the battles. Isserson also claims the Germans lacked operational art in the Great War because all large-scale German formations followed the strategic Schlieffen Plan. Since corps and division commanders had no flexibility to deviate from the plan, there was no room for operational art.⁵²

The correctness of Soviet claims to the development operational art is less important than the attributes of operational art revealed by their discourse. Scholars that recognize the Soviets as the creators of operational art base the argument on three points. First, the Soviets were the first to establish a lexicon that created and defined terms such as operational art, the operational level

⁴⁹ Kelly, *Alien: How Operational Art Devoured Strategy*, 41.

⁵⁰ Isserson, *The Evolution of Operational Art*, 42.

⁵¹ Isserson, *The Evolution of Operational Art*, 6.

⁵² Kelly, *Alien: How Operational Art Devoured Strategy*, 29.

of war, and operational concept. Second, the Soviets identified a need for commanders to think and plan at the operational level. They noted the variables and scales of time, area, and forces at this operational level were distinctly separate from strategic and tactical thinking. The output of this thinking was the operational concept. For the Soviets, Deep Battle was their operational concept. It was not a strategy to achieve political aims because it solely focused on military operations within a sector commander's area of operations. Neither was Deep Battle a tactic, since it required intellectual skills separate and distinct from those utilized in tactical battles. Third, the Soviets introduced the idea of operational control as a necessity of operational art. Isserson described the modern commander being equipped with "radio and television communications," "aircraft at his disposal," and "a powerful staff."⁵³ All of these resources actively control the operation's execution instead of relegating operational art to planning on a map.

The Soviet operational developments created three new attributes of operational art. These attributes include an operational lexicon, the need for commanders to think in terms of operational scales and variables, and the need for a commander to have operational control over subordinate units. However, their claim for sole credit in developing operational art deserves closer inspection. While Soviet operational theory marks the emergence of a mature and complete system of thought, it did not come without precedent. The Soviets described the operational level in terms of battlefield depth, which is similar to the Prussian operational level. Further, Isserson states a "powerful staff" is necessary for operational control. This creation of intermediate staffs shows clear connections to the Napoleonic period. Further, the need for operational commanders to develop flexible guidance and to sequence operations again shows connections to the Franco-

⁵³ Isserson, *The Evolution of Operational Art*, 78.

Prussian War. While Soviets may have developed the completed version of operational art, they were arguably only putting the capstone on a concept that started a century earlier.

The Historic Attributes of Operational Art

The historic case studies demonstrate nine essential and enduring attributes of operational art.

These attributes are:

1. Development of large-scale combined arms units
2. Presence of intermediate-level staffs
3. Defining distinct operational objectives
4. Producing flexible operations plans (This attribute encapsulates the concepts of distributed maneuver and operational direction.)
5. Separation of strategic and operational responsibilities
6. Operations sequenced in time, area, and purpose within an overarching campaign plan
7. Codification of an operational lexicon
8. Operational cognition (the ability to think in terms of operational scales and variables)
9. Operational control over subordinate units

These attributes describe the essential organizational characteristics, processes, and cognition necessary to apply operational art at an operational level. Although derived from land operations, they are sufficiently general for application in other domains. The application of these characteristics in the space domain provides the framework for evaluating the utility of operational art in space.

Operational Need

Although it is not an attribute of operational art, there is a separate concept derived from these historic studies that warrants discussion. This concept is operational need. Operational need is an environmental characteristic seen in all three historic periods and constitutes a place in time

where previous models, process, ideas, and thoughts are insufficient to deal with current circumstances. Operational need was the driver for the development of the attributes of operational art. The Napoleonic attributes of operational art reflect the challenges and response to controlling an army of previously impossible size. The Prussian attributes of operational art are the response to a change in the environment where destroying a portion of the adversaries army in a single battle was insufficient to achieve strategic aims. The Soviets developed their unique attributes of operational art because previous doctrines, strategies, and terms were insufficient to describe and plan for the threats they faced. Additionally, it was operational need that created the conditions for operational art's transition from Soviet doctrine to the doctrine of the US Army.

Development of Operational Theory in the US Military

This section marks a turning point in this monograph. While the previous section discussed the precursors and development of operational theory, the next sections describe the how and why the US military applied this theory within and outside the land domain. The purpose of the next sections is to show the operational terms used in contemporary space doctrine are ancestors of Soviet operational theory and, therefore, should share the attributes of operational art.

The US military has used the term “operations” to describe large-scale military activities for decades. Operation TORCH, Operation NOMAD, and Operation LINEBACKER are three of the many examples of US and Allied military operations that occurred during and after World War II. However, the terms “operational level of war” and “operational art” did not exist in English doctrine manuals prior to 1982.⁵⁴ The distinction between these terms is the difference between a general description of a large military activity (an operation) and the application of a conceptual framework for military planning and execution (operational art). It was not until the

⁵⁴ Menning, “Operational Art’s Origins,” 15.

post-Vietnam US Army grappled with the Soviet threat to Central Europe that the need to apply an operational framework emerged. It is within the context of the Cold War that the US military realized an operational need to apply Soviet operational theory into their doctrine and operational concepts. These concepts eventually migrated into space doctrine.

The Emergence of US Operational Theory in the Post-Vietnam Army

In 1981, the Massachusetts Institute of Technology Press printed an article in *International Security* titled “The Operational Level of War.”⁵⁵ This may be the first English document to advocate for the existence of an intermediate level of war between strategy and tactics. The author of the article, Edward Luttwak, observed that the lack of an English word for “schemes of warfare such as blitzkrieg or defense in depth” was not due to a failure to define such schemes, but a failure of military leaders to think in this intermediate dimension.⁵⁶ He attributed this failure to a military predisposition towards attrition-style operations instead pursuing alternative courses of success such as “relational-maneuver,” or, what B.H. Liddell Hart might have called, the indirect approach.⁵⁷

The operational context facing the US and the North Atlantic Treaty Organization in the early 1980’s is remarkably similar to the Soviet’s position during the interwar period. Both organizations found themselves threatened by large land forces, both had recently endured failed and costly military operations, and both were searching for new concepts that would overcome the shortcomings of their current paradigms. Both parties, therefore, shared the same operational need.

⁵⁵ Edward N. Luttwak, “The Operational Level of War,” *International Security* 5, no. 3 (Winter, 1980-1981): 61, <http://www.jstor.org/stable/2538420> (accessed April 3, 2010).

⁵⁶ Luttwak, “The Operational Level of War,” 61.

⁵⁷ Luttwak, “The Operational Level of War,” 64 and B. H. Liddell Hart, *Strategy* (New York: Signet, 1974), 146.

Although Luttwak does not reference any Soviet sources, his recommendations are fundamentally an argument for NATO to apply the historic attributes of operational art. First, he develops a lexicon for a cognitive space between strategy and tactics that he called the “operational level of war.” Further, he implicitly describes operational attributes within his case studies of Germany’s blitzkrieg offensive scheme and Finland’s (then contemporary) relational-maneuver defensive scheme. Both of these studies included the presence of large scale maneuver forces (size, forces), large fronts (area), a manner of thinking different from strategy or tactics (cognition), and the achievement of results that were greater than the sum of the tactical actions (operational objectives).

Luttwak’s article provides insight into why the US Army found Soviet operational theory useful. The US Army was in a similar operational context that required similar operational processes to solve similar operational needs. The US Army was open to new ideas and theories due to the demoralizing effects of the Vietnam War and the realization that their Central Europe strategy hinged on false assumptions. Specifically, their attritional-style approach would only be successful against a materially inferior opponent. This was not the case if NATO forces fought against the materially superior Warsaw Pact.⁵⁸ It is uncertain whether this article was the seed crystal for US operational theory or merely published the thoughts contained in contemporary military discussions. However, it is certain that a year and a half later, the term “operational level of war” made its doctrinal debut in US Army publication *FM 100-5*.

The 1982 revision of *FM 100-5, Operations*, marks the introduction of US operational theory within the US military because it codifies the intermediate level of war in a coordinated doctrine manual for the first time.⁵⁹ The field manual loosely defined the

⁵⁸ Luttwak, “The Operational Level of War,” 79.

⁵⁹ Menning, “Operational Art’s Origins,” 15.

characteristics of the operational level by the planning and conduct of campaigns and the use of “larger units” to achieve theater strategic goals.⁶⁰ The US Army also introduced a new operational scheme called AirLand Battle. This replaced the previous operational concept called Active Defense, an attritional-concept that researchers such as Edward Luttwak and military wargamers proved to be an insufficient method for halting a Soviet invasion into Central Europe.⁶¹ Although the US Army developed a new operational scheme, they did not shift away from an attrition mentality. *FM 100-5* states the object of all operations is the destruction of the opposing force.⁶² Although Luttwak advocated for a new relational-maneuver concept of operations, the US Army instead developed a novel attritional scheme, AirLand Battle, in which air force assets attacked Soviet echelons behind the front line of battle. This active role of sister services in the army’s AirLand Battle, created the need for the air force to address this new operational concept and the operational theory behind it. This link created a conduit for land-based operational theory to shift into other domains, but operational theory needed another catalyst before its true transference.

The release of another revision of *FM 100-5* and the passage of the Goldwater Nichols Department of Defense Reorganization Act made 1986 a critical year for US operational theory’s eventual transition to the space domain. The 1986 version of *FM 100-5* introduced the term

⁶⁰ US Army, *Field Manual 100-5: Operations* (Washington, DC: Headquarters, US Army, 1982), 2-3, <http://cgsc.contentdm.oclc.org/cdm4/document.php?CISOROOT=/p4013coll9&CISOPTR=48&REC=15> (accessed September 16, 2010).

⁶¹ In Active Defense, the US/NATO Army Corps would array in a long line against the echelons of Soviet mechanized forces. Given the advantage found in defense, the US Army would defeat the first echelon of Soviet troops and then reset positions prior to the arrival of the second echelon. Further studies indicated the next Soviet echelon would arrive prior to resetting the US lines. To counter this problem, the US Army developed the concept of Air Land Battle in which the army would defeat the first echelon of troops while the air force and army deep attack elements simultaneously attacked and defeated the follow-on echelons.

⁶² US Army, *FM 100-5, 1982 edition*, 2-1.

“operational art” into the military lexicon.⁶³ While the term “operational level” remained in the text of the manual, it continued to lack specific definition. The 1986 version replaced the levels of war with three structures of activity: strategy, operational art, and tactics. It also defined operational art as, “the employment of military forces to attain strategic goals in a theater of war or theater of operations through the design, organization, and conduct of campaigns and major operations.”⁶⁴ The revision provided a clear distinction between operations and tactics. The conduct of campaigns and major operations were specific to operational art, while the conduct of battles and engagements were strictly in the tactical realm. Additionally, echelons of command received specific categorization, in which, army groups, field armies, and joint major commands conducted operational art; divisions and below conducted tactics; and corps were responsible for the transition.⁶⁵ The definition of operational art, the specification of command echelons, and the inclusion of joint operations primed the concept for transition into other services and domains. The Goldwater-Nichols Act provided the final bridge for operational theory to transition into other domains. The law assigned certain responsibilities to the Chairman of the Joint Chiefs of Staff (CJCS) to include, “Developing doctrine for the joint employment of the armed forces.”⁶⁶ Some of the tangible products from this legislation were Joint Publications (JP)s such as *JP 3-0, Doctrine for Joint Operations* and *JP 5-0, Doctrine for Planning Joint Operations*. The inclusion of operational constructs in these joint doctrines and the requirement for subordinate service

⁶³ US Army, *Field Manual 100-5: Operations* (Washington, DC: Headquarters, US Army, 1986), 10.

⁶⁴ US Army, *FM 100-5, 1986 edition*, 10.

⁶⁵ William M. Richardson, “FM 100-5 The AirLand Battle in 1986,” *Military Review* (March 1986): 10 and US Army, *FM 100-5, 1986 edition*, Appendix C, 183-7.

⁶⁶ US Congress, *Public Law 99-433—Oct 1, 1986 100STAT. 1008*, 18, <https://digitalndulibrary.ndu.edu/cdm4/document.php?CISOROOT=%2Fgoldwater&CISOPTR=956&REC=0&CISOBOX=doctrine> (accessed September 4, 2010).

doctrine manuals to be consistent with joint doctrine manuals assured operational art's transference to the aerospace domain.

Operational Theory Expands to Joint, Air, and Space Doctrine

US Army operational theory was fully mature by 1986; however, operational theory was just gaining intellectual traction in the air and space domains. In 1990, the US Air Force began to lend its voice to the discussion of operational art. General Charles Donnelly, former commander of US Air Forces in Europe (USAFE) and former NATO Commander for Allied Air Forces Central Europe (COMAAFCF) published an article in *Military Review* that described the roles and responsibilities of an air force operational commander. General Donnelly characterized the operational commander as a person who could modify campaign plans and move air power between tactical air forces, but could not “affect the events of today’s and tomorrow’s battle.”⁶⁷ Further, the operational air commander established priorities for operational effects such as air defense, offensive counterair, and air interdiction.⁶⁸ This article provides the first translation of operational theory into a new domain. Consistent with army doctrine, the focus of the operational level is on campaign planning and the destruction of the enemy in depths behind the line of battle. Additionally, General Donnelly states the unified commander and the Commander, Air Force Forces (COMAF) are the appropriate levels for operational command.⁶⁹

The first joint operational publication, *Joint Publication (JP) 3-0, Doctrine for Joint Operations*, was published in 1993, as was an updated version of *FM 100-5*. The introduction to *FM 100-5* notes the strategic objectives of the United States changed following the end of the

⁶⁷ Charles L. Donnelly Jr., “An Air Commander's View of Operational Art,” *Military Review* 70, no. 9 (September 1990):80 – 81.

⁶⁸ Donnelly Jr., “An Air Commander's View of Operational Art,” 80 – 81.

⁶⁹ Donnelly Jr., “An Air Commander's View of Operational Art,” 80 – 81.

Cold War based on new threats and AirLand Battle had to change with it.⁷⁰ This was certainly a response to a change in perceived threats following the 1991 Gulf War, which gained the title of “the first space war” based on the well-documented use of precision munitions, hand-held navigation devices, and satellite communication. The interest in the space domain and its integration in campaign planning are evident in the introduction to *JP 3-0*, which states the publication’s purpose to, “provide the bases that guide the employment of the joint air, land, sea and space team.”⁷¹ Included in the first joint publication are the three levels of war and the concept of operational art. Although *JP 3-0* does not list *FM 100-5 (1986 version)* as a primary source, *JP 3-0*’s definitions for the operational level of war and operational art are nearly identical.⁷² The similarity of definitions and thought shows the clear influence land-based doctrine had on joint doctrine. The fact that the first joint doctrine contained a mature operational theory instead of a novel joint operational theory or the complete lack of operational discussion supports the claim that joint operational theory was a direct lift from the Army’s Cold War doctrine. Ironically, as other doctrine manuals were adapting their doctrine to include the campaign-centric operational level of war, the 1993 publication of *FM 100-5* already began to soften the definitions of the operational level based on the perceived changes in national security threats. These changes included disconnecting the operational level from specific command echelons, adding a theater-strategic level as the fourth level of war, and incorporating the design

⁷⁰ US Army, *Field Manual 100-5: Operations* (Washington, DC: Headquarters, US Army, 1993), vi.

⁷¹ US Joint Chiefs of Staff, *Doctrine for Joint Operations* (Washington DC: Chairman of the Joint Chiefs of Staff, 1993), page 3.

⁷² *Joint Publication 3-0* defines operational art as, “Operational art—the use of military forces to achieve strategic goals through the design, organization, and execution of campaigns and major operations.” *Field Manual 100-5* defines operational art as, “Operational art is the employment of military forces to attain strategic goals in a theater of war or theater of operations through the design, organization, and conduct of campaigns and major operations.” US Joint Chiefs of Staff, *JP 3-0, 1993 edition*, II-3 and US Army, *FM 100-5, 1993 edition*, 10.

of both theater strategies and battles into operational art.⁷³ This softened definition is similar to the current joint definition of operational art, further showing how land doctrine played a leading role in the formation of joint doctrine.

The inclusion of operational terms in joint capstone doctrine manuals led to the eventual spread of the concepts into subordinate JPs, such as *JP 3-14, Space Operations* and into the doctrinal manuals of the sister services. The US Air Force subsequently developed an entire series of manuals, the *Air Force Doctrine Document 2-X* series, which, “describes how the USAF organizes and employs air and space power at the operational level across the range of military operations.”⁷⁴ A derivation of this series is *Air Force Doctrine Document (AFDD) 2-2, Space Operations*.⁷⁵ The development of *JP 3-14* and *AFDD 2-2* mark the transition of operational art into the space domain.

Now that the links between operational theory and the space domain are established, it is important to make two points. First, the transfer of operational theory into the space domain occurred without an open and scholarly debate. The lack of books and articles written about the application of operational art in the space domain validates this assertion. This deficit stands in stark contrast to the wide range of books and articles that argued the merits and drawbacks of operational art within the Cold War US Army. Had a similar vigorous debate occurred for the space domain, there would have been similar written artifacts in air force journals, books, and papers. Further, the very few studies that did address operational art in space defined operational art from a previously established doctrinal definition, a subjective understanding of the term, or a

⁷³ US Army, *FM 100-5, 1993 edition*, 6-2.

⁷⁴ US Air Force, *Air Force Doctrine Document 2 (AFDD 2): Organization and Employment of Aerospace Power* (Washington DC: Headquarters, US Air Force, 2007), Foreword, 3.

⁷⁵ The US Air Force changed the nomenclature of its doctrine manual series when this monograph was in the final draft stages. As of 11 October 2010, AFDD 2 retained its nomenclature, but AFDD 2-2 is now AFDD 3-14. The AF only changed the document title, the content is the same. See current USAF publication listings at <http://www.cadre.maxwell.af.mil/main.htm>.

distillation of operational characteristics from non-historic sources. Second, the doctrinal descriptions of operational art continue to vary away from the clearest and most historically accurate description published in the 1986 publication of *FM 100-5*. A comparison of the description of operational art found in joint, air, and space doctrine highlights these differences and shows the divergence of current doctrinal descriptions from the historically essential characteristics of operational art.⁷⁶

A Joint Perspective on Operational Art

The lack of clarity and definitive phrases within joint doctrine highlights the need to use the historic attributes of operational art when applying operational art to the space domain. The current joint definitions state,

“The operational level [of war] links the tactical employment of forces to national and military strategic objectives. The focus at this level is on the design and conduct of operations using operational art—the application of creative imagination by commanders and staffs— supported by their skill, knowledge, and experience—to design strategies, campaigns, and major operations and organize and employ military forces. Operational art governs the deployment of those forces, their commitment to or withdrawal from battle, and the arrangement of battles and major operations to achieve operational and strategic objectives.”⁷⁷

In this definition, the operational level of war is a conceptual intermediary between tactics and strategy. Joint doctrine does not assign Air Operations Centers (AOC)s, corps headquarters, or any other organizational echelon the responsibility for operational planning vice tactical planning or strategy development. Defining the operational level conceptually differs from the original

⁷⁶ This section, “A Joint Perspective on Operational Art,” provides specific references and definitions from Joint publications. Because *US Army Field Manual 3-0* and *Marine Corps Doctrinal Publication 1-2* are nearly identical to the Joint publications regarding operational art, they are not specifically addressed or referenced in this monograph. See US Army, *Field Manual 3-0: Operations* (Washington, DC: Headquarters, US Army, 2008), 6-1 to 6-2 and US Marine Corps, *Marine Corps Doctrinal Publication 1-2: Campaigning* (Washington, DC: Headquarters, US Marine Corps, 1997), pp. 7-9.

⁷⁷ US Joint Chiefs of Staff, *Joint Publication 3-0: Joint Operations*, II-2.

field manual definition, which attributed the operational level to campaigns and major operations. The definition of operational art reestablishes connections to campaigns and major operations, but adds strategies and military force employment. The current definition is so inclusive; it is difficult to determine if any military activity does not require operational art. This means any action in the space domain is a product of operational art, which eliminates the utility of making a distinction at all.

The broad characteristics of operational art further muddy any distinction between the operational art, strategy, and tactics. Joint doctrine defines operational art by personal characteristics such as creativity, skill, knowledge, experience, intelligence, boldness, and character.⁷⁸ These are admirable traits for all military professionals and are universally desirable. Skill, experience, and creativity are just as necessary in tactical and strategic applications as they are in campaigns. This broad definition, again, calls into question the need to make any distinction at all.

Air Force Doctrine

Air Force (AF) doctrine is sufficiently divergent from joint doctrine to warrant a separate discussion of AF operational art. This divergence is insightful for the discussion of operational art in space because operational art's transference occurred when the air force considered the air and space mediums to be one seamless aerospace domain. Therefore, the transfer of operational concepts from land to air occurred and land to space. Further, the disparate elements of force size, rates of travel, and agility over the battle area required the AF to "translate" operational concepts into something meaningful for their unique domains. This translation shifted operational concepts from an input-based to an effects-based approach.

⁷⁸ US Joint Chiefs of Staff, *Joint Publication 3-0: Joint Operations*, IV-3.

AFDD-2, Operations and Organizations, states, “Operational art takes the ends, ways, means, and risk considerations derived from overall strategy and conceptually links them to operational level effects in campaign plans and similar planning products.”⁷⁹ The term “operational level effects” in this definition highlights the difference between land and air doctrine. While operational art in land doctrine is input-based and focused on large-scale combined arms maneuver, air doctrine focuses on output-based effects. For example, a single aircraft destroying a series of bridges might ultimately keep an enemy division from capturing key terrain.⁸⁰ Otherwise, a corps or division sized ground force might need to generate the same effect. Unlike land-based operations, in which campaigns and major operations are generally the purview of army groups and army corps, the AF’s effects based approach to operations (EBAO) does not require large-scale operations. An operational success might not require any more sorties or planning than a tactical success within this methodology. Recognizing the AF’s effects based approach is necessary when discussing the operational level of war and operational art in space because current joint and AF space doctrine reference this type of approach.

Space Doctrine

Contemporary thought on the application of operational art in space is concentrated in two doctrine documents, *JP 3-14, Space Operations*, and *AFDD 2-2, Space Operations*. *JP 3-14* is the overarching document and focuses on the integration of space leadership and capabilities into an operational joint force structure. The most important ideas from *JP 3-14* are the establishment of Space Coordinating Authority (SCA) and the direction to the Joint Force

⁷⁹ US Air Force, *Air Force Doctrine Document 2 (AFDD 2)*, 8.

⁸⁰ US Air Force, *Air Force Doctrine Document 2 (AFDD 2)*, 4.

Component Commander – Space (JFCC-Space) to conduct operational-level command and control of assigned forces.⁸¹

Space Coordinating Authority is a responsibility assigned to the senior space officer on a Joint Force Commander's staff (usually the Joint Force Air Component Commander). This responsibility entails coordinating joint force operations and integrating space effects.⁸² The detailed planning and integration of space forces is usually further delegated to the Director of Space Forces (DIRSPACEFOR). This authority establishes a link between the operational level and space, but does not necessarily require a need for operational art in space. The expected situation portrayed in *JP 3-14* is a large-scale land operation in which space effects subordately are integrated and synchronized with the Joint Force Commander's campaign plan.⁸³ This expectation is both expected and practical, but it reduces the role of space to solving technical rational problems such as bandwidth availability and Global Positioning System (GPS) precision instead of the creative and complex planning indicative of operational art.

The JFCC-Space is responsible for operational-level C2 for all assigned assets and reports to the USSTRATCOM Commander. Unlike the theater DIRSPACEFOR, the JFCC-Space's focus is on global operations as opposed to theater-centric operations. Additionally, *JP 3-14* assigns the Joint Space Operations Center (JSpOC) the responsibility of operational-level C2 support. The assignment of operational-level responsibilities to the JSpOC is interesting because it conflicts with *JP 3-0*'s guidance that neither the level of command nor the size, number or type

⁸¹ US Joint Chiefs of Staff, *Joint Publication 3-14: Space Operations* (Washington, DC: Chairman of the Joint Chiefs of Staff, 2009), pp. xii and IV-3.

⁸² US Air Force, *Air Force Doctrine Document 2-2 (AFDD 2-2): Space Operations* (Washington, DC: Headquarters, US Air Force, 2006), 13.

⁸³ US Joint Chiefs of Staff, *Joint Publication 3-0*, V-2.

of equipment determines the level of war.⁸⁴ Further, assignment of operational responsibilities does not necessarily equate with necessity of operational art.

Air Force Doctrine Document 2-2's description of operational art in space reflects the responsibilities previously mentioned in joint doctrine. *AFDD 2-2* adds a third important idea, which is an "operational space effect." Since *AFDD 2-2* is a subordinate document to *AFDD 2*, it is not surprising the effects based operational approach leapt to the space domain. In an effects based approach, any space action projected to have an operational effect is inherently at the operational level. As previously described with air operations, this effects-based interpretation is also independent of force size. In this case, a satellite communications jammer disrupting the command processes of an enemy battalion generates a tactical effect, while the same jammer similarly disrupting an enemy corps command processes generates an operational effect.

Operational Art's Application to the Space Domain

This section provides the synthesis of the two main ideas presented in this monograph. The first idea is there is an objective theory of operations that is evident from historic study. The second main idea is US military doctrine manuals reflect the application of this theory in the space domain. Further, no research validates the applicability of this land-based theory in space. This section revisits the three historic periods of operational art's development, looks for similarities in context, searches for current applications of the historic attributes of operational art, and suggests where there are opportunities or pitfalls in the applications.

Increases in Space Forces and the Operational Attributes of Scale

The historic case study of the Napoleonic French Army showed the emergence of operational art as a contextual response to the problems of increasingly larger forces and

⁸⁴ US Joint Chiefs of Staff, *Joint Publication 3-0*, II-1.

battlefields (increases in scale). The case study also showed there were four specific operational attributes developed within this context: development of large-scale maneuver units, presence of intermediate-level staffs, definitive objectives for each levels of war, and production of flexible operations plans. If operational theory is necessary in space domain as a response to scale, there should be similar increases in force sizes and similar applications of operational attributes.

The study of the current space force structure shows a significant increase in space force personnel and assets over the last half century. Although the total number of US Air Force personnel actually decreased over the last fifteen years,⁸⁵ the space component of the air force, as defined by the number of civilians and active duty members assigned to Air Force Space Command, increased over the last decade. Specifically, Air Force Space Command (AFSPC) grew from approximately 22,000 personnel in FY 00 to 29,000 personnel in FY 10.⁸⁶ These numbers show impressive growth for an organization established as recently 1982.⁸⁷

Air Force Space Command's growth represents a larger trend both inside and outside the US Air Force. New missions at the National Reconnaissance Office, new sections in higher echelon staffs, and new joint opportunities on component staffs led to increased force sizes outside AFSPC. Personnel increases within the Joint Space Operations Center, the US Strategic Command (USSTRATCOM) Global Operations Center, the US Army Space and Missile Defense Command (SMDC), and the US Navy's Naval Space and Systems Warfare Command all

⁸⁵ In FY 94, the air force employed approximately 623,000 active duty and civilian personnel. In FY 04, this number decreased to 539,000 and in FY 10 the number of active duty and civilian personnel reached fell to 506,000 people. *Air Force Magazine*, Air Force Almanac, May 2000, 54 and *Air Force Magazine*, Air Force Almanac, May 2010, 52.

⁸⁶ *Air Force Magazine*, Air Force Almanac, May 2000, 56 and *Air Force Magazine*, Air Force Almanac, May 2010, 54.

⁸⁷ Earl S. Van Inwegen, "The Air Force Develops an Operational Organization for Space," in *The U.S. Air Force in Space, 1945 to the Twenty-First Century: Proceedings: 1945 to the 21st Century*, ed. R. Cargill Hall and Jacob Neufeld (Washington, DC: Department of the Air Force, 1998), 135-43.

continue to fuel growth. These commands may never reach the size of a Napoleonic field army, individually. However, the rapid growth in forces is certainly similar to the Napoleonic context.

Personnel growth is not the only way to measure a change in force. Increases in the number of space assets also indicate a need for an intermediate level of coordination.⁸⁸ Except for a handful of deployable systems, most space assets are either on-orbit satellites or fixed ground stations. The number of fixed ground stations; as represented by the Air Force Satellite Control network, phased array radar stations, and the dedicated Global Positioning System network; remained relatively constant over the last decade. However, the number of on-orbit satellites has increased over the last decade from 35 to 52.⁸⁹ This number is a subset of an increasingly larger number of space assets available to US military forces. These include coalition, civil, and commercial satellites and space assets used for imaging, meteorology, science, and communications. The increases in the numbers of space forces and space assets indicate the context is correct for the application of historic operational attributes.

Applying the first operational attribute, the development of large-scale combined arms units, in the space domain shows both promise and weakness. The promise of combined arms space units comes from the development of operational-level organizations. This operational responsibility has shifted over the last two decades. Air Force Space Command and US Space Command provided the first operational space organizations in 1982.⁹⁰ Some of this responsibility later shifted to 14th Air Force, the space-dedicated numbered air force, under the Warfighting Headquarters construct. This responsibility shifted again to the Commander, US

⁸⁸ As a reminder, a space asset is a military unit or a civil or commercial unit used for a military purpose that predominantly uses the domain of space to achieve an effect. See page 3 of this monograph for the entire definition.

⁸⁹ This number only represents the unclassified satellite systems operated under Air Force Space Command.

⁹⁰ Van Inwegen, "The Air Force Develops an Operational Organization for Space," 142.

Strategic Command, the Joint Functional Component Commander-Space (JFCC-Space), and the Joint Space Operations Center (JSpOC).⁹¹ Aligning the squadrons responsible for satellite operations, space lift, space surveillance, and early warning under these organizations shows the development of a combined arms unit. However, there is a weakness in calling this organization a “combined arms unit” that highlights a difference between space and the other domains. A quality of combined arms units is the capability to generate an “emergent effect,” or an effect that is greater than the sum of the individual component contributions. The carrier strike group is an excellent example of a combined arms unit in which submarines provide defense, cruisers provide deep strike capability, support ships provide logistics, destroyers provide sea and air defense, and the carrier provides defense and deep strike capability. Each component of this group could perform its functions individually, but would also have unguarded weaknesses. The combination of these units working together covers the weakness of one component with the strength of another. This is also true of air force strike packages and the army’s combination of modular brigades consisting of armor, infantry, fires, engineers, and support. Space capabilities do not generate the same type of emergent combined arms properties. It is true that early warning and surveillance systems use communications satellites to transmit information and that many space systems use GPS for timing and synchronization. However, these are examples of system interdependence and not a combined arms effect. In total, the attribution of large-scale combined arms units in space has mixed results. While space now has combined arms units in response to increases in force size, these units generate little to no synergistic combined arms effects.

Space leaders have excelled at applying the second operational attribute, development of intermediate staffs. There were no operational or unified space commands thirty years ago.

⁹¹ While this section discusses “shifts” in operational responsibility, there was little personnel transfer. The AFSPC/CC also held the position of CINC USSPACECOM and the 14AF/CC also holds the position of JFCC-Space.

Today, the space domain includes an organizational structure that equals that of the other domains. Unified responsibility for space shifted from USSPACECOM to USSTRATCOM in 2002. The USSTRATCOM staff and their Global Operations Center provide operational level control for space. Further, USSTRATCOM receives support from their operational level service components: Air Force Space Command, Space and Missile Defense Command, Naval Space and Systems Warfare Command. Each of these commands has a robust staff to support space operations. Additionally, USSTRATCOM breaks their operations into subordinate functional commands. JFCC-Space is one of these commands, offering another support staff for space operations and a command and control node in the Joint Space Operations Center. USSTRATCOM, JFCC-Space, and the service components also receive direct support from numerous contracted offices, battle labs, testing facilities, and academia. Together the proliferation of operational level space staffs demonstrates the earnest application of the second operational attribute⁹².

The third attribute of operational art, developing intermediate operational objectives, shows both promise and weakness for the space domain. The development of the concept of space superiority demonstrates an operational objective for the space domain. *AFDD 2-2* defines space superiority as, “that degree of space advantage of one force over another that permits conduct of operations at a given time and place without *prohibitive* interference by the opposing force.”⁹³ The concept of space superiority provides an intermediate objective that is greater than a tactical effect, but short of a strategic objective.

⁹² The development of Space Control Authority and the Director of Space Forces is also noteworthy in the development of operational-level space staffs. These authorities and positions integrate into the COCOM and JTF staff construct. They do not receive further discussion in this monograph because these staffs focus on integrating space effects to support land, sea, and air operations within their geographic command and not generating global space effects.

⁹³ US Air Force, *Air Force Doctrine Document 2-2 (AFDD 2-2)*, 7.

The characteristics of the space domain limit the ability to develop additional operational-level objectives. This limitation is evident when comparing land, air, and space operations. In the Franco-Prussian War case study, the cities of Wissembourg, Sedan and Metz were all operational objectives of the Prussian Army. The capture of any one of these cities was insufficient to achieve strategic objectives, but too difficult to be left to small unit tactics. Establishing operational objectives along their main geographic axis of advance allowed the Prussians to move incrementally toward their strategic goal. This example shows how land operations are more conducive to the development of intermediate operational objectives than space operations. The Prussians had to set Sedan and Metz as operational objectives because the cities were geographically between their army and their strategic objective of Paris. This is unlike the space domain, in which, counterspace forces readily have access to any portion of space. For example, a satellite communications jammer does not need satellite interceptors to clear all satellites out of low altitude orbits before it can jam a satellite at a high altitude. This operational reach is strength of space forces and eliminates the need to set geographic intermediary objectives. Air operations are also conducive to the development of intermediate operational objectives. Obtaining air superiority, disrupting strategic and operational leadership, and destroying operational forces are all intermediate objectives that support the achievement of strategic goals. The air force's ability to target land and sea forces after they achieve air superiority allows the pursuit of additional operational objectives in other domains. Unlike the air force, space forces cannot actively attack air, land, or sea objectives. This constrains space forces to objectives within the space domain. These key differences show the limitations of developing operational objectives in the space domain.

The last attribute of operational art derived from increased force size is the development of flexible operational plans. This attribute also shows both promise and weakness in its application to the space domain. However, since this attribute reached maturity under Moltke in the Franco-Prussian War, the discussion of this attribute will follow in the next section.

Sequencing Complex Space Operations

The case study of the Franco-Prussian War demonstrated the continued application of Napoleonic attributes of operational and offered three new attributes for further study. The Prussians employed the older attributes to counter the Napoleonic problem of increased forces and battle areas. The new attributes overcome additional problems when the destruction of the enemy's main force no longer led to strategic settlement. These additional problems further complicated the already chaotic nature of land warfare. Since the operational attributes derived from the Franco-Prussian War are a response to increasingly complex operations, the section will review the most complicated military space operation, Operation Burnt Frost, for similarities in context with the Franco-Prussian campaigns. In comparison to any other military space operation, Operation Burnt Frost stands out as the most complicated.⁹⁴ As such, it is a bellwether for future space operations. The Burnt Frost case study also serves as a foil to compare the application of the Franco-Prussian attributes of operational art in the space domain.

Operation Burnt Frost

On 14 December 2006, USA-193 launched from Vandenberg Air Force Base in California.⁹⁵ The launch vehicle carried a 5,000 lb satellite operated by the National

⁹⁴ This claim deserves clarification since integrating space support into Operation Enduring Freedom (OEF) and Operation Iraqi Freedom (OIF) are far more complicated space endeavors than Operation Burnt Frost (OBF). The difference between OEF/OIF and OBF is who is responsible for the operational art. In OEF/OIF, the main effort is ground-based and is developed through Central Command, International Security Forces Afghanistan, and Multinational Forces – Iraq , and subordinates staffs. In OBF, the main effort is space-based and guided predominantly by space doctrine, expertise, and experience.

⁹⁵ National Aeronautics and Space Administration, "Spacecraft - Details," National Space Science Data Center, <http://nssdc.gsfc.nasa.gov/nmc/spacecraftDisplay.do?id=2006-057A> (accessed August 17, 2010).

Reconnaissance Office (NRO).⁹⁶ Sometime after entering orbit, the satellite, NROL-21, experienced a total systems failure. Without any command and control, the spacecraft began a slow descent back into the Earth's atmosphere. Thousands of pieces of natural and man-made debris enter the atmosphere every year without national interest. However, the 1,000 lbs of satellite fuel on-board NROL-21 became a source of concern for President Bush's Administration. The satellite was both sufficiently large and durable for portions to survive reentry. Had the fuel system reentered intact, it had the potential to spill hazardous hydrazine satellite fuel around the point of impact. On 27 January 2008, the Bush Administration allowed the US Navy to work with Raytheon Missile Systems and Lockheed Martin Corporation, to assess the feasibility of destroying the satellite in-orbit.⁹⁷ Within a month space operators, naval planners, contractors, and over two dozen federal agencies developed a plan to destroy NROL-21 prior to it reentering the Earth's atmosphere. A modified US Navy Standard Missile 3 destroyed the spacecraft on 20 February 2008.⁹⁸ As space and naval operators made the final preparations for the missile intercept, a Joint Task Force (JTF) of 130 personnel was on alert at McGuire Air Force Base, New Jersey to deploy, if necessary, to recover spacecraft debris or contain any

⁹⁶ Kristin Roberts, "Pentagon Plans to Shoot Down Disabled Satellite," Reuters, <http://www.reuters.com/assets/print?aid=USN1447206620080214> (accessed August 16, 2010).

⁹⁷ P.J. Blount, "USA-193 Timeline," in "Special Topics in Aerospace Law Series, No. 1," *Journal of Space Law* (2009): 1-2, <http://www.spacelaw.olemiss.edu/publications/USA193%20Selected%20Documents.pdf> (accessed August 16, 2010).

⁹⁸ Angela Webb, "Joint Effort Made Satellite Success Possible," *Air Force Print News*, February 26, 2008. http://www.af.mil/news/story_print.asp?id=123087750 (accessed August 16, 2010).

hazardous spills. Colonel Jay Raymond, Commander of the 21st Space Wing,⁹⁹ stated, “Putting together an operation of this complexity on such short notice was simply amazing.”¹⁰⁰

Franco-Prussian Attributes of Operational Art in Space

The fourth historic operational attribute, the development of flexible operational plans, shows little utility in current space operations. Understanding the context in which von Moltke developed this plan helps explain why flexible planning is not indelible in space planning processes. Von Moltke created operational direction to deal with the complexity of moving large forces against an agile and adaptive enemy. Employing operational direction has two characteristic phases. The first phase is highly technical, scientific, and rationale. For the Prussians, this phase consisted of notifying the reserves to assemble, outfitting the reserves at certain collection points, and transporting the soldiers, logistics, and material to the warfighting assembly area. The general staff made detailed and rigid plans for this mobilization that drove numeric calculations such as railroad schedules, rates of transportation, and logistics requirements. The rigid plans of the first phase ended with the flexible operational plans of the second phase. Once the staff fielded the armies, the army commanders led their armies forward based on their assessment of the operational environment. Since it was (and is) impossible to predict adversary movement, adversary strength, weather, and terrain obstacles; there was little utility in trying to develop rigid and detailed execution plans at the operational level.

Employing the attribute of flexible operational orders in space should show the same characteristics of von Moltke’s concept. Operational direction in space would start with a highly

⁹⁹ The 21st Space Wing operates the network of space sensors used to track satellites and orbital debris.

¹⁰⁰ Jay Raymond, “Operations Group Blazes New Trail During Operation Burnt Frost,” *Air Force Print News*, March 11, 2008. http://www.peterson.af.mil/news/story_print.asp?id=123089765 (accessed August 16, 2010).

technical and detailed plan for space operations that would transition to flexible planning once the staff transitioned space forces over to the tactical commander. However, the two phases of operational direction are only partially evident in the study of Operation Burnt Frost.

The Operation Burnt Frost plan was both highly detailed and a good example of first phase planning. The 21st Space Wing and the Joint Space Operations Center developed a sensor plan to track the satellite prior to the missile launch, pass the data to the navy cruisers to aid in targeting, and developed a follow-on plan to track the debris after the satellite's destruction. Likewise, the US Navy developed detailed plans for modifying their ships and missiles, moving the ships to the optimum locations, and executing the launch. There was also detailed planning in the form of notifications to foreign governments, establishing the satellite recovery task force, and creating the communications architecture to command and control the operation. There is a high degree of first phase detailed planning in the Operation Burnt Frost operation, but there is little second phase flexible planning. The idea that the missiles might miss the satellite or that a large portion of the satellite might survive reentry did generate a branch plan within the overall mission plan. The product of this branch was the JTF mobilized at McGuire AFB, NJ. Since the JTF did not deploy, it is counterfactual to draw conclusions about its efficacy for consequence management. Nevertheless, the assembly of the task force personnel and a C-17 full of necessary equipment created the capacity to meet their tactical objectives.¹⁰¹ Not knowing where the debris might land did create some flexibility in the plan, hence the use of strategic airlift. However, even the branch plan was more technical than flexible. Although the cleanup operation might occur anywhere in the world, the operational commander did not have a choice in where it would occur. Circumstances would dictate the cleanup location. This is different from the Prussian operational

¹⁰¹ Rebekah Phy, "McGuire Supports JTF OBF," *Air Force Print News*, February 26, 2008. http://www.mcguire.af.mil/news/story_print.asp?id=123087805 (accessed August 16, 2010).

commander who had the option to send the army along multiple avenues of advance. Further, the decision criteria to deploy the JTF were a part of the initial plan. Once the appropriate conditions occurred, the subordinate JTF commander could deploy without additional action from the operational commander.

The current Space Tasking Order (STO) cycle also reinforces the tendency to direct operations specifically vice flexibly. The only flexible products in this cycle are the Joint Space Operations Plan (JSOP) and the Strategic Operations Directive (SOD). The JSOP prioritizes space requests and the SOD provides guidance for the space planning team. The process that produces these products is roughly equivalent to mission analysis steps within the army's Military Decision Making Process. The flexibility of these products is constrained by several factors. First, they can only be as flexible as their inputs. Operations orders or Fragmentary Orders that specify a course of action contain scant opportunity for flexible planning. Repositioning a communications satellite might generate this specific type of OPORD. If the Defense Information Services Agency needs to deliver additional satellite communications to an area of operations, they provide specific movement direction.¹⁰² USSTRATCOM will receive a request to move a particular satellite, to a particular location, by a particular time. The subsequent FRAGO leaves little room for flexible planning. Likewise, the operational environment often dictates specific courses of action. As was the case in Operation Burnt Frost, once President Bush determined the risk of destroying a satellite in-orbit outweighed the risk of a hydrazine spill, there was no room for flexible planning.

The fifth historic attribute of operational art, the separation of strategic and operational responsibilities, is one of the most applicable attributes within the space domain. This separation

¹⁰² This example comes from personal experience moving Defense Satellite Communications System B-14 over Europe to support Operation Iraqi Freedom deployments.

of strategic and operational responsibilities is evident in the many levels of command and bureaucracy characteristic of the US government. The President, the Congress, the Cabinet members, and their staffs develop and codify national strategic aims; while the combatant commanders develop theater strategies and campaigns to reach those aims. The publication of the National Space Policy¹⁰³ on 28 Jul 2010 exemplifies the separation of strategy and operations in the space domain. It establishes guidance for peer and subordinate strategic documents such as the National Security Strategy, the National Security Space Strategy, and the National Military Strategy. These strategies inform the decisions and intent of geographic combatant commanders at the operational level.

The necessity for the separation of policy from strategy is clear in the case of Operation Burnt Frost. Unlike Emperor Napoleon, who was able to oversee the conduct of the Battle of Jena from a hilltop, President Bush was not able to oversee and direct the military and diplomatic actions associated with Operation Burnt Frost. The functions of the US Government bureaucracy are too large and diverse for the Commander-In-Chief to manage personally. Hence, the President gives broad guidance to commanders with the expectation they develop strategies to meet those guidelines. Highlighting the separation of strategic and operational responsibilities within the current US government draws on the obvious and may seem pedantic. However, it is important to remember that the separation of the head of state and field commander roles is a relatively recent innovation and worth noting based on its continued relevance to the space domain.

The sixth historic attribute of operational art is sequencing operations in time, area, and purpose within an overarching campaign plan. This attribute is noticeably lacking in Operation Burnt Frost. Unlike the Prussians, who had to march all the way to Paris to force a political

¹⁰³ The White House, *National Space Policy of the United States of America* (Washington, DC: The White House, 2010), 1-18, http://www.whitehouse.gov/sites/default/files/national_space_policy_6-28-10.pdf (accessed October 11, 2010).

settlement, the United States Government had the necessary tools to achieve its political aims in one operation. In Operation Burnt Frost, the political objective was to minimize the risk of injury caused by the reentry of NROL-21. Destroying the satellite with the Standard Missile-3 met this political objective in one operation. Had the missile shot failed, the recovery JTF would have deployed for consequence management to minimize human health risks through consequence management. Although the JTF deployment was a sequential action within the operation, it was not a major sequential operation alone. Sequential operations are separate in time, space, and/or purpose to the previous operation. The deployment of the JTF was an inclusive branch within the overall operation. Major operations typically have branches and sequels for preplanned decision points within the operation.¹⁰⁴ These branches do not represent sequential operations.

Space Cognition

The Soviet case study of the interwar period provides the final chapters in the development of operational theory. The Soviets continued to use the operational attributes developed in the Napoleonic and Franco-Prussian eras. The requirement to communicate, teach, and employ these attributes provided the context necessary to develop the final three historic attributes of operational art: codification of an operational lexicon, operational cognition (the ability to think in terms of operational scales and variables), and operational control over subordinate units

The codification of an operational lexicon is the seventh historic attribute of operational art and is evident within space doctrine. The use of terms like operational level of war, space operational effects, operational concepts, and operational art in the doctrine manuals of *JP 3-14* and *AFDD 2-2* provides this evidence. Like the attribute of separation of strategic and operational

¹⁰⁴ US Joint Chiefs of Staff, *Joint Publication 3-0*, IV-21.

responsibilities, the inclusion of an operational lexicon in space doctrine is obvious. However, there are two reasons why a brief discussion is noteworthy. First, it serves as a reminder that the presence of an operational lexicon, though obvious today, was non-existent a century ago. Second, it allows an opportunity to review the utility of the lexicon. *AFDD2-2*, for example, defines the operational level by “the level at which campaigns and major operations are planned, executed, and assessed;” by “enabling horizontal and vertical integration;” and by “synchronization of military operations to achieve a commander’s objectives.”¹⁰⁵ The first description is most consistent with historic operational theory and joint doctrine and receives the most amplification through the document. The discussion of an operational-level in space demonstrates the use of operational lexicon, but its wide and inconsistent use calls into question its overall utility. In another example, *JP 3-14* states, “space forces capabilities can support and enable operational art and design.”¹⁰⁶ The paragraph following this statement consists of a list of the joint elements of operational design and ways in which space capabilities might support those elements. In this example, the operational terms do not describe a holistic operational approach or an operational concept for space. This use is inconsistent with the context and intent of the Soviet lexicon, which they developed in order to communicate operational-level plans and concepts.

The development of operational cognition, the eighth historic element of operational art, is partially perceptible in the space domain. Operational cognition is the ability to think, plan, and execute on large scales. The consolidation of space forces under operational headquarters demonstrates is an example of organizational cognition because it created a headquarters capable of directing the actions of thousands of space personnel and dozens of space assets. However, other facets of operational space cognition require additional advancements.

¹⁰⁵ US Air Force, *Air Force Doctrine Document 2-2 (AFDD 2-2)*, 3-4.

¹⁰⁶ US Joint Chiefs of Staff, *Joint Publication 3-14*, V-2.

One facet of operational cognition that shows promise for the space domain is the development of an operational art or an operational concept for space. Shimon Naveh describes operational art as a bridge between abstract goals and aims and mechanistic actions.¹⁰⁷ The Soviet's operational art was the concept of deep battle,¹⁰⁸ in which the combination of mechanistic combined arms and aircraft attacks developed the context that yielded the ultimate political aim. The US Army developed Air Land Battle in 1982 as an operational concept that linked the mechanistic use of coalition military forces with abstract political objectives. The development Soviet Deep Battle and US Air Land Battle, were responses to a cognitive need to think differently about the modern battlefield. Specifically, they felt their doctrinal and operational preferences were inadequate for their environment and needed to adapt novel concepts to ensure future successes.

Space operators share a similar cognitive need with their Soviet and US Army predecessors to think above the tactical employment of space assets and develop the holistic operational concepts needed to achieve strategic space objectives. The US Air Force's Effects Based Approach to Operations (EBAO) has been the starting point for developing a space concept of operations.¹⁰⁹ EBAO describes a methodology in which the space planner views the opposing force as a systemic organism. This organism adapts, behaves, and functions based on its environment and its hierarchical structure of subcomponents. By properly understanding the opposing system, the space operator can create a series of tactical direct or indirect effects that will cause follow-on operational and strategic effects. In this approach, all operational and

¹⁰⁷ Shimon Naveh, *In Pursuit of Military Excellence: The Evolution of Operational Theory* (Abingdon: Frank Cass Publishers, 1997), 306.

¹⁰⁸ What the Soviets originally described as operational art is what the US military now refers to as an operational concept.

¹⁰⁹ US Air Force, *Air Force Doctrine Document 2-2 (AFDD 2-2)*, 31.

strategic objectives are the result of indirect effects from tactical actions.¹¹⁰ This effects based approach satisfies Naveh's direction to establish an operational bridge between the abstract and the mechanical since it links tactical actions to achieving political aims. The approach also offers a bridge between mechanistic tactical actions and the abstract political aims found in the National Space Policy and the National Security Strategy. While EBAO provides a good initial framework for an operational concept for space, it is not a panacea. Historically, no concept has proven perfectly transferrable between domains. This means space operators still need to develop their own concept of operations for space.

The final historic attribute of operational art, operational control over subordinate units, is evident in the space command and control structure. The Soviets considered the presence of an operational level commander with the capability to control operational forces mandatory for their operational concept. Space doctrine is in alignment with this mandate. Space doctrine splits operational command between theater and global responsibilities. In a geographic theater, operational control of assigned space forces resides with the commander possessing Space Coordinating Authority (SCA). This authority normally belongs to the Joint Forces Air Component Commander supported by the Director of Space Forces (DIRSPACEFOR).¹¹¹ Globally, the Joint Force Component Commander – Space (JFCC-Space) retains operational control of space forces.¹¹²

The Air Operations Center (AOC) construct provides the necessary control mechanism to command space forces at the operational level. At the theater level, the regional AOC provides control of assigned space forces. The commander with Space Control Authority, the DIRSPACEFOR, and the AOC's space cell have reachback capability to USSTRATCOM and the

¹¹⁰ US Air Force, *Air Force Doctrine Document 2 (AFDD 2)*, 89.

¹¹¹ US Joint Chiefs of Staff, *Joint Publication 3-14*, IV-11.

¹¹² US Joint Chiefs of Staff, *Joint Publication 3-14*, V-11.

JSpOC to request space services. They additionally have the necessary communications equipment to space units within the theater. The JSpOC provides a mirrored-system of the air-based operations center. It is broken into strategy, plans, operations, and intelligence divisions; produces a Space Tasking Order (the mirror of the Air Tasking Order); and executes planning and analysis processes with near similarity to its air counterpart. The Space Tasking Order directs tactical space actions synchronized in task and purpose to CDRUSSTRATCOM's and JFCC-Space's operational objectives. This tasking order process provides global operational control of space forces.

Conclusion

This monograph makes the assertion that operational art is applicable in the space domain. This final section revisits that assertion in three ways. First, it examines the validity of the initial question, "Is operational art applicable in the space domain?" Next, it shows the nuanced ways in which operational theory both applies and does not apply to the space domain. Finally, it draws broad conclusions about the nature of the space domain and its relationship to the doctrine of other domains.

This monograph posed the question, "Is operational art applicable in the space domain?" The structure of this question suggests the answer should be either "yes" or "no." However, the arguments and positions previously established in the body of this work suggest the answer requires a more nuanced answer. While some attributes of operational art are both necessary and important in the space domain, other attributes have little to no utility. This understanding suggests the questions of "*How* is operational art applicable in the space domain?" or "*In what ways* is operational art applicable?" more accurately frame the knowledge gap.

Operational art is applicable to the space domain, but only in certain attributes and contexts. The metaphor of square pegs and round holes appropriately demonstrates the application of operational art in space. The question, "Is operational art applicable in space"

assumes operational art is either a “round peg” that fits perfectly within the domain of space or is a “square peg,” in which there is no fit. In actuality, operational art is a “cone-shaped peg.” The nose of the cone fits neatly into the round hole of the space domain, but the base of the cone cannot pass through.

Certain historic attributes of operational art are fully applicable and demonstrated in the space domain. The attribute of intermediate staffs is notable. USSTRATCOM, service component commands, and the Joint Space Operations are all examples of operational-level organizations. Additionally, the attributes of separation of strategic and operational responsibilities, the codification of an operational lexicon, and operational control over subordinate units are also observable within the space domain. The applicability of some of these attributes is both interesting and surprising. The separation of strategic and operational responsibilities is a hallmark of US military operations, so its presence is not surprising. The applicability of operational control in space is also not surprising since the US Air Force merely applied their previously formalized system of tasking orders to the space domain. The codification of an operational lexicon is interesting, but not surprising because the operational terms carried over from previous doctrine manuals. The interest in these terms relates to their durability. Despite their origins in Napoleonic land battles and multiple doctrinal revisions, the operational terms used in space doctrine manuals are both relevant to the domain and true to their historic roots. Of the four applicable attributes, the development of intermediate-level staffs is the most interesting. The development of intermediate level staffs is unique among these attributes because it required large amounts of resources and effort. Although the relative number of military space assets grew considerably over the last few decades, their total numbers are still relatively modest. Despite these modest numbers, each AF space asset has three levels of tactical command (squadron, group, and wing) and two levels of operational control (JSpOC and unified command). The resources expended for the creation of the billets, work centers, and support systems is staggering considering how few assets are controlled. The vigorous development of intermediate space staffs

over the last two decades is both interesting and surprising given the relatively modest number of space assets.

The developments of large-scale combined arms units and operational cognition are necessary in the space domain, but only partially applied. The development of large-space units has reached its current potential, but lacks combined arms capability. USSTRATCOM controls a relatively large number of space assets through the JSpOC. Service components also organize space forces in relatively large numbers. However, the nature of the space domain places limits on the ability to operate these forces as combined arms units. Space assets support or enhance other platforms increasing their accuracy, range, endurance, efficiency, or capability. Theater commanders often need space communications, early warning, and imaging simultaneously to provide these enhancements, but their combination does not yield novel emergent properties. In the future, the development of space weapons may allow the application of combined arms effects. For example, ground-based satellite interceptors, lasers, and jammers combined with space-based mines could threaten any satellite system at any altitude. Separately, they cannot. A ground-based interceptor can only destroy satellites at low altitudes and a jammer is only effective against communications satellites. Mines are only useful in orbital bands heavily populated with satellites. However, if employed together within an operational plan, the strengths of each system overcome the weaknesses in others leading to a combined arms effect that can control all assets and regions in space.

Operational cognition is the attribute most needed for application in the space domain. As discussed, space doctrine describes operational terms and processes, as well as the need to integrate space effects into the campaigns and major operations of the geographic combatant commanders. However, there is little to no discussion about operational effects in and from the space domain. If the US military is or becomes dependent on space systems, space becomes a strategic or operational vulnerability. Operational cognition in space, therefore, is the ability to understand where space systems are operationally vulnerable, to attack or recommend for attack

enemy vulnerabilities, and to defend friendly vulnerabilities.¹¹³ For example, precision guided munitions allow pilots and operators the capability to destroy targets with fewer sorties than using “dumb bombs.” Since the Air Force can achieve operational results with fewer sorties, it purchases fewer aircraft. However, if the precision weapons are dependent upon space systems and if the enemy destroys the space system, the air force suddenly lacks the necessary mass to generate the required operational effect. This causes the US Air Force to culminate without the destruction of a single aircraft.¹¹⁴ Another example of an operational space effect might be the destruction of a blue force tracking satellite. This satellite collects signals from tracking devices attached to tanks, aircraft, trucks, etc. and displays the information on the US Army’s Force XXI Battle Command Brigade and Below (FBCB2) system. The destruction of this satellite interrupts the only real-time command and control system in the corps or division commander’s area of responsibility, causing the commander to lose visualization of the situation, and disrupting the corps command and control processes. This disruption either slows the operational tempo of the corps or causes culmination. Both of these cases are hypothetical, but practical examples of space dependence. Operational cognition for space is the ability to understand when and how a space event might cause an operational effect. This may lead to an operations plan to attack that vulnerability, an operations plan for its defense, or an acquisition plan for its mitigation.¹¹⁵

The last two attributes of operational art may be applicable to the space domain in the future, but currently lack practical applications. These attributes include producing flexible

¹¹³ US Joint Chiefs of Staff, *Joint Publication 5-0: Joint Operation Planning* (Washington, DC: Chairman of the Joint Chiefs of Staff, 2006), IV -2.

¹¹⁴ JP 5-0 defines culmination as, “the point in time and space at which an attacker’s combat power no longer exceeds that of the defender.” US Joint Chiefs of Staff, *Joint Publication 5-0*, IV-29.

¹¹⁵ Studying operational cognition helps define what not operational art is. In particular, strategy-to-task matrixes that correlate a tactical task to a strategic objective are not examples of operational art. Since there is no intermediary between strategy and tactics, strategy-to-task matrixes completely skip the operational level.

operations plans and sequencing space operations within an overarching campaign plan. Flexible operations plan are unnecessary because of robust command and control systems and because the assets in the space environment are relatively predictable. Both causes reduce the need for individual space initiative. The purpose of flexible plans is to move necessary forces into an area where the operational commander has little tactical understanding. This gives the tactical commander the discretion to employ forces based on the enemy and the terrain and to exploit opportunities. In the space domain, the operational commanders have a far greater understanding of the environment than the tactical commanders do. This gap between operational-level understanding and tactical-level understanding will continue to diminish as USSTRATCOM and the JSpOC continue to pursue space situational awareness programs.¹¹⁶

Sequencing space operations within an overarching campaign plan has not had practical application in the space domain, yet, but may in the future. Sequential operations become necessary when a friendly force lacks the overall strength to achieve their strategic or operational objectives immediately and must reach the objective incrementally. The lack of sequential operations in space may be a function of the open and vulnerable nature of the space environment. This is apparent when compared to its counterpoint, the layered air and ground defenses found on modern battlefields. To capture an enemy's capital city, an army will need to penetrate the nation's border defenses, set up security and supply centers at decisive points, and defeat the adversary army before reaching its strategic objective of the capital. Space is completely dissimilar. Jammers, lasers, and other electro-magnetic devices can affect satellites at the highest altitudes without having to penetrate any enemy defenses. The situation is different if the targeted space asset is ground-based, like a laser or jammer complex. Its destruction might

¹¹⁶ Space Situational Awareness is defined by *JP 3-14* as, "characterizing, as completely as necessary, the space capabilities operating within the terrestrial environment and the space domain. It includes components of ISR; environmental monitoring, analysis, and reporting; and warning functions." See US Joint Chiefs of Staff, *Joint Publication 3-14*, II-7.

require a sequenced campaign. However, the geographic combatant commander will develop that plan using air, sea, and land forces. This reduces the need for operational art in the space domain to the recognition of the vulnerability and the recommendation of a counterspace operation to the responsible combatant commander. One future event that could cause a sequenced space operation would be insufficient counterspace forces to achieve operational objectives. This might occur if political constraints continue to limit the development and numbers of counterspace weapons. If this limitation continues, any major space effort would require several incremental steps for achievement.

The specific conclusions reached regarding the application of the historic attributes of operational art in the space domain reveal two general conclusions about the nature of the space domain and its doctrinal relation to the other domains. The first general conclusion is operational art in space will not advance to its fullest maturity or broadest application unless the United States develops space-based weapons.¹¹⁷ This conclusion is evident in which attributes were and were not applicable in space. The attributes that were applicable to space, such as intermediate-level staffs and operational control, reflect changes in the organizational and doctrinal growth of space forces. While the less applicable attributes, such as sequenced operations and combined arms units, are functions of force application. This disparity is a function of imbalanced growth between the rapid development of organizations and administrations and the slow development of space force capability. The second general conclusion poses a warning about the wholesale copy of doctrinal material from one domain to another. US Air Force doctrine tends to treat all domains the same. It will include a term for air/space/cyber superiority, air/space/cyber supremacy, it will include the need to generate effects at the strategic, operational, and tactical

¹¹⁷ This conclusion fully support Major Jansen's conclusion that space power will not advance beyond the second stage of Colin Gray's four stages of military utility. See Leonard J. Jansen, "The Emergence of Operational Art," 7-12.

levels; and it will relate air/space/cyber to the principles of war. The recent publication of Air Force Doctrine Document 3-12 Cyberspace Operations reinforces this trend.¹¹⁸ While this approach might be useful as a point of departure, it does not reflect critical thought about the nature and differences of the domains. Continuing to develop doctrine by substituting “space” for “air” or substituting “cyberspace” for “space” creates confusion, dilutes the meaning of terms, applies theories outside their appropriate context, and disconnects the doctrine from its historic application.

Applying operational art in the space domain will grow in importance as more countries enter the space arena and as space-based technologies develop. The US dependence on space has the potential to tip the balance of a campaign between victory and defeat. The difference may lie in the proficiency of space operational artists.

¹¹⁸ US Air Force, *Air Force Doctrine Document 3-12: Cyberspace Operations* (Washington, DC: Headquarters, US Air Force, 2010), 16-20, <http://www.e-publishing.af.mil/shared/media/epubs/AFDD3-12.pdf> (accessed October 11, 2010).

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