Domain Integration at the Tactical Edge: The US Air Force's Support to Ground Forces Through the Employment of Air, Space, and Cyber

A Monograph

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The United States faces challenges to the warfighting domains which it has traditionally dominated due to advances in technology and the proliferation thereof. The US Air Force's significant capabilities within air, space, and cyber are commonly considered strategic capabilities to be employed independent of the ground scheme of maneuver. This monograph examines ways in which the Air Force can provide full-spectrum support to ground forces, beyond its traditional role of close air support and air interdiction. Through a review of US military's theoretical framework, historical examples of air-ground integration challenges, and contemporary integration challenges to inform an approach as to how the service can best use its assets to support ground forces.

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Abstract

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The United States faces challenges to the warfighting domains which it has traditionally dominated due to advances in technology and the proliferation thereof. The US Air Force's significant capabilities within air, space, and cyber are commonly considered strategic capabilities to be employed independent of the ground scheme of maneuver. This monograph examines ways in which the Air Force can provide full-spectrum support to ground forces, beyond its traditional role of close air support and air interdiction. Through a review of US military's theoretical framework, historical examples of air-ground integration challenges, and contemporary integration challenges to inform an approach as to how the service can best use its assets to support ground forces.

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Acronyms

AAGS	Army Air Ground System
ACC	Air Combat Command
AI	Air Interdiction
AOC	Air and Space Operations Center
ASOC	Air Support Operations Center
BCD	Battlefield Coordination Detachment
CAS	Close Air Support
C2	Command and Control
DASC	Direct Air Support Center
DoD	Department of Defense
EBO	Effects Based Operations
FAC	Forward Air Control
FM	Field Manual
JAGIC	Joint Air-Ground Integration Center
JOC	Joint Operations Center
JTAR	Joint Tactical Airstrike Request
LCC	Land Component Commander
LSCO	Large Scale Combat Operations
MDO	Multi-Domain Operations
MDC2	Multi-Domain Command and Control
NATO	North Atlantic Treaty Organization
TAC	Tactical Air Command
TACP	Tactical Air Control Party
TACS	Theater Air Control System
TRADOC	Training and Doctrine Command
USSR	Union of Soviet Socialist Republics

Introduction

The information revolution is altering the character of conflict across the spectrum. This revolution favors and is strengthening network forms of organizations, over those which are hierarchical, such as the US military and its command and control structure. As these changes deepen and supplant traditional advantages, the conduct and outcome of conflicts will increasingly depend on information and communication.

With the advancements and proliferation of technology, barriers to entry are reduced and access is near ubiquitous. Because of these encroachments, the United States also faces challenges to the warfighting domains which it has traditionally dominated. These newfound means can increasingly be used to asymmetrically counter US advantages, particularly by using capabilities traditionally associated with one warfighting domain to impact another, or cross-domain operations. Accordingly, the US military is shifting to build and modernize a force to both stand sentry against competitors in a domain-contested environment and leverage these capabilities in an integrated fashion. The Department of Defense has undertaken a massive effort to reconsider the way it fights, in preparation for the anticipated large-scale conflict of the future.[1]

In particular, ground forces continue to look for ways to bring these competencies to bear to provide any battlefield advantage possible. The 20th century saw the advent of the use of airpower to impact operations on the ground. At the tactical level, airpower has been typically integrated to support ground forces through an Air Support Operations Center (ASOC) collocated with the land component commander (LCC), with terminal attack controllers at each subordinate brigade and below to call-in air support requests. However, to meet the challenges of the 21st century and better leverage the emergent capabilities of space and cyber, the United States must

[1] US Department of the Army, *Field Manual (FM) 3-0, Operations* (Washington, DC: Government Printing Office, 2017), 7.

evolve the way it fights to better integrate capabilities beyond air support to land forces. Of these capabilities, the Department of the Air Force controls a significant portion of the assets within the air, space, and cyber portfolios, yet does not fully leverage them in support of a land-based campaign, instead viewing them as separate aptitudes to provide independent effects, exclusive from a supporting role. This hastens the research question of this monograph: "On the battlefield, what does the Air Force need to do to provide multi-domain support to ground forces?"

From electronic warfare with the EC-130H Compass Call airframe, to space control using the service's vast satellite network which orbits Earth, to telephony and network exploitation using cyberspace infrastructure, the Air Force retains substantial competency for warfighting and to create tactical effects beyond mere close air support (CAS). Moving forward, these capabilities need to be better leveraged and integrated in support of a ground scheme of maneuver – as adversaries develop ways to themselves maneuver to counter longstanding US advantages within each domain. Gone are the days where US air, space, and cyber superiority can be depended on.

The expectation for domain-contested environments and unpredictable warfare have caused US military leaders to ponder ways to better integrate capabilities from across domains at all levels. Influential Prussian military theorist Carl von Clausewitz mused that war is a human endeavor and unchanging in its nature, or a clash of wills ultimately fought between people; this belief is echoed throughout US military doctrine today.[2] Acknowledging that all warfighting domains must ultimately focus their effects on impacting humans, the next logical step is to better develop means to integrate domain capabilities to provide options to those physically waging war – the preponderance of whom will always be land-based. A prevailing argument today in the US military is that certain technological capabilities within emergent domains are so strategic in

[2] Carl von Clausewitz, Michael Howard, Peter Paret, and Bernard Brodie. *On War* (Princeton, NJ: Princeton University Press, 1989), 88; US Army, *FM 3-0* (2017), iv.

nature and should be kept in reserve, to prevent future more threatening adversaries from becoming aware of them, thus giving them the opportunity to developing countermeasures and defenses. Yet there exist ways to leverage domains for both real-time tactical effects and retain their clout for strategic benefit.

The US Army and US Air Force, through the Army's Training and Doctrine Command (TRADOC) and the Air Force's Air Combat Command (ACC), are engaged in advanced discussions towards developing doctrine which details the concept of conducting command and control (C2) of Multi-Domain Operations (MDO) between the two services. The capabilities across the warfighting domains to execute MDO already exist, but it is the C2 and integration thereof that lags behind, as evidenced by the services' continued challenges in integrating airpower into a ground scheme of maneuver. Over the past half-century of uncontested air superiority, both services have struggled with how best to integrate tactical airpower into the scheme of maneuver during Phase III operations. To this day, air superiority and the prodigy of non-kinetic effects are often taken for granted during wargaming exercises. The challenges encountered by both services with air integration embody those more recently encountered with non-kinetic effects. The Army and Air Force are linked by the long-established doctrine of Air-Land Battle, which was the preeminent guiding blueprint for the Army during the Cold War, but began much earlier in practice, during World War II and the initial machinations of air-ground integration. The purpose of Air-Land Battle was to develop and harness combat power through the air domain to impact and provide effects in support of forces engaged in land warfare. Yet the ideas and practices of Air-Land Battle from the past are far more similar to today's efforts at effectively integrating domains executing MDO than many believe.

This monograph identifies how the Air Force can best provide support to ground forces across all domains within its span of control, to include the command and control thereof, by analyzing past examples of the service's integration with ground forces, especially including air-

ground integration for CAS and air interdiction (AI). The monograph will review the theory and doctrine through which domain integration has been framed by both the Army and the Air Force, analyzing the specified roles of the military departments, service-centric cultures, and the introduction of new capabilities to warfare. The monograph will also analyze ways the Air Force can expand its role in supporting ground forces beyond CAS and AI, through an examination of successes and failures of air-ground integration encountered by US military personnel during previous conflicts dating back to World War II. Though not comprehensive, these historical cases are representative of air-ground integration challenges that inform considerations on how to C2 across the more emergent domains of space and cyber, while questioning the paradigms under which these views and actions were formed. Additionally, the monograph examines contemporary Air Force and Army integration challenges, including an illustrative example from the early days of the Afghanistan conflict, while addressing the designated roles of the Air Support Operations Center (ASOC) and Joint Air-Ground Integration Center (JAGIC) at a division headquarters. Finally, the monograph offers observations and recommendations on how the Air Force can better integrate its significant air, space, and cyber capabilities in support of counterland operations.

Chapter One reviews the US Department of Defense's theoretical framework for domain integration through the lens of joint organization and responsibilities, service-centric culture concerns, and an examination of the introduction of airpower proved a challenge in the 20th century. Chapter One also investigates past approaches to both joint warfighting and effects-based operations (EBO), difficulties faced therein, and how they can inform MDO. Chapter Two discusses specific instances of air-ground integration from the past, from World War I and II to the 1991 Gulf War, and highlights their successes and challenges. Continuing chronologically, the third chapter explores the challenges of integration during Operation Anaconda in the initial days of the post-9/11 Global War on Terrorism, while examining the contemporary ASOC, its

current doctrinal organization, and role within the new JAGIC framework. Chapter Three also provides a summary of how the US military has recently sought to integrate the emergent domains of space and cyber. Finally, Chapter Four summarizes the previous chapters and draws from anecdotes therein to provide observations and recommendations on how the Air Force can integrate all its domain responsibilities in support of ground forces.

Airmen who provide close air support to troops in contact or drop munitions in support of a ground scheme of maneuver have executed an air domain action in support of a land domain effort; yet Air-Land Battle typically is not thought of as multi-domain or cross-domain operations, because the term more typically is thought of as actions within space or cyberspace. Still, as our adversaries become more sophisticated and obtain the ability to contest and counter traditional US advantages, the need for forces on-the-ground to leverage all available military capabilities has become apparent. Now is the right time for the Air Force to expand its role and more broadly support ground forces with the Air Force's significant air, space, and cyberspace capabilities. Despite the changing character of warfare itself, this can be accomplished through existing weapon systems and platforms without altering the character of how either the US Air Force or US Army conduct war.

Chapter One: Theoretical Framework

To best determine how the Air Force can better integrate air, space, and cyber capabilities in support of ground forces, it is critical to understand the framework for how the US military and the military departments view their respective roles in joint warfighting. The Key West Agreement, Goldwater-Nichols Act, and establishment of functional combatant commands for space and cyber, offer glimpses into how those roles have developed. The military departments each have service-centric approaches and cultures which inform their outlook on and approach to warfighting, including their methods for command and control and the use of emergent for technology more for service support than combat support. To consider how to integrate the more emergent capabilities of space and cyber, it is essential to analyze how the introduction of airpower proved a challenge in the 20th century.

The idea of combined or cross-domain warfighting is not new. It existed as far back as the Peloponnesian War and during the Battle of Guadalcanal, which despite success following experimentation, exposed the need for a coherent cross-domain doctrine. To best understand the concept of MDO in modern terms, though, it is important to first understand the concept of joint warfighting. Militaries throughout the world have long practiced combined operations, but generally did not begin to codify it until the mid-20th century, when the usefulness of aircraft in combat became apparent. This monograph will document the advent of Air-Land Battle and challenges surrounding early air-ground integration during conflict, but the US military took several steps to further clarify the distinct roles of its Armed Forces in the years that followed World War II and Vietnam.

Joint Warfighting

The Key West Agreement was the central document produced by a meeting held by the first Secretary of Defense, James Forrestal, with the three uniformed service chiefs – Army, Air

Force, and Navy – less than six months after the Air Force became an independent service in 1947. The gathering sought to outline which services would perform which functions, and of note, the Air Force retained the role of strategic air warfare and close air support, but the Navy and Army were also permitted to keep aircraft for service-specific functions.[3] Though there might be some overlap in capability between the components, Forrestal and the service chiefs recognized that mission synergy demanded at least some redundancy. The Key West Agreement framed how each service viewed its role and the seams that knit the warfighting domains of land, air, and maritime together, but has not been revisited in the decades since to define how each service should be responsible within space and cyberspace, leading to often conflicting views of responsibilities within war. These roles remained largely unchanged throughout Korea and Vietnam, but after coordination challenges during US intervention in Grenada and following the Eagle Claw disaster in Iran, the Congress took steps to force the military services to better work together.

Later, the Goldwater-Nichols Act of 1986 reorganized the Department of Defense to focus on improving interoperability and jointness, significantly changing the way it operates. It took operational control of personnel and equipment away from the service chiefs and placed it with the Combatant Commanders. The shift led the services to more aptly focus on organizing, training, and equipping (OT&E) their personnel – through service components – to ensure adequate support to the combatant commanders. At the time it became law, the United States was a superpower in a bipolar world, challenged only by the Soviet Union (USSR). The United States had by that time established itself as the unsurpassed leader in technology, with the most advanced military force in the world. The space race was over and the technology explosion that would lead to a ubiquitous internet was still nearly a decade away. The service chiefs have

[3] Forrestal, James V. Forrestal. *Functions of the Armed Forces and the Joint Chiefs of Staff* (Fort Leavenworth, KS: Combined Arms Research Library, 1948) 3-12.

continued to approach their OT&E responsibilities through the prism of those lanes outlined in the Key West Agreement, despite technological advances that allow for greater user of space and cyber. This has led to conflict and confusion as to who is responsible for "what" within these domains – as each service has sought to develop the domains for service support rather than combat support. Or in the instances where they have developed space and cyber to generate warfighting effects, they have not adequately developed the capabilities for cross-domain operations, instead focusing on developing them to support their own warfighting responsibilities within the Key West Agreement.

Service-centric Cultural Identities

When considering emerging technological capabilities within space and cyberspace, the development thereof is often service-centric. That is, the Air Force approaches the development of these competencies to aid in air campaigns while the Army seeks to aid soldiers on the ground. For example, the Army has not deeply considered how its ground forces might use the emergent domains to aid the Air Force, just as the Air Force has not considered how it might use them to aid ground forces. Despite a shared history rooted in Air-Land Battle, the Army and Air Force continue to operate under different service paradigms, or models by which they conduct war. They stick to what they know: Airmen tend to gravitate towards strategic effects, while soldiers often become focused on the tactical actions.

This is further borne out in how the services organize and command and control their forces. The Air Force organizes its forces through an Air Operations Center arm for operational C2. An Air Tasking Order is centrally generated, published, and then executed by aircraft distributed across multiple bases. This is done without inputs from subordinate commanders, who are responsible solely for the OT&E of their units, not operational effects. The service has chosen to OT&E and C2 its space and cyber forces using the same model. The Army, on the

other hand, fights in echelon – with commanders at each level implementing orders from higher headquarters and fulfilling their own share of the task. The Army refers to this as "mission command" – with subordinate leaders exercising initiative within the constraints of their own higher commander's intent.[4] Air effects are coordinated with land forces at the operational-level, but this through deliberate planning and not time-sensitive targeting.

To be responsive to dynamic threats, the convergence of domains must occur at the tactical level to produce effects. Reflective of their doctrine and vulnerability within a close fight, the Army is pursuing OT&E methods that seek to build Multi-Domain formations which present options for warfighting capabilities across the spectrum. The Air Force, on the other hand, is seeking ways to develop a means for Multi-Domain Command and Control rather than maintain units which control weapon systems that operate in different domain, reflective of its retention of capabilities with global reach that can be leveraged around-the-world when called upon. The Air Force's ASOC is the tactical air integrator aligned to Army forces, which as of recently, is now nested within the new Joint Air Ground Integration Center (JAGIC) – along with an Army division's artillery experts to better coordinate fires between the two services. Importantly, these conceptual differences are evident in how the services approach organizing their forces for a Multi-Domain fight, as the JAGIC has not explored how to integrate Air Force capabilities beyond air, such as space and cyber.

While the land domain is not necessarily supreme over others, ground forces are required for a military to consolidate gains achieved through any domain during conflict, while the reverse cannot be true. For example, enemy fortifications may be rebuilt after a bombing campaign and territory reclaimed by forces who have fled from an air strafing. But the permanence of these

[4] US Army, *Army Doctrine Publication (ADP) 6-0, Mission Command* (Washington, DC: Government Printing Office, 2012), 1.

actions is only secured through manpower obtaining and holding terrain, by establishing its own physical control of an area.[5] Much as early airpower scholar Bill Sherman noted the ability of airpower to, in essence, deliver heavy artillery across time and space to extend the reach and effectiveness of a ground force, so too can space and cyber be leveraged in support of a land-based scheme of maneuver.[6] Though airpower does have a strategic role to play – as do space and cyber – these attacks must be sustained if they are to achieve major results. The ability of a force to sustain such an effort is dependent on its survivability.[7] Conversely, though the need to integrate and C2 locally may be needed, non-kinetic actions in support of a maneuvering ground force do not need to be sustained for long periods of time – and if they do, can be often be executed remotely, thus enhancing their survivability.

Just as the Air Force has in the past sought to minimize its involvement in providing tactical air support for ground forces, the service risks doing the same today with space and cyber. The Army has prominently taken strides to not just OT&E cyber forces to present to United States Cyber Command (USCYBERCOM), but also provide impactful cyber options for battlefield commanders to use in real-time, through a program called Cyber Support to Corps and Below.[8] The Army recognizes that it must keep pace with the changing character of war, and has invested heavily in developing localized cyber, electronic warfare, swarming, and backpack-sized unmanned aerial systems (UAS), all in support of its tactical maneuver brigades and the ground scheme of maneuver. On the other hand, the Air Force's service-retained cyber forces are nearly exclusively *defensive*, organized to help defend against potential threats and vulnerabilities to its

[5] US Army, *FM 3-0* (2017), 4-24.

[6] William C. Sherman, *Air Warfare* (New York: The Ronald Press Company, 1926), 179.

[7] Andrew G. B. Vallance, *The Air Weapon* (New York, NY: St. Martin's Press, 1996), 120.

[8] Isaac R. Porche III, Christopher Paul, Chad C. Serena, Colin P. Clarke, Erin-Elizabeth Johnson, Drew Herrick. *Tactical Cyber: Building a Strategy for Cyber Support to Corps and Below.* (Santa Monica, CA: RAND Corporation, 2017), iii.

fleet of 5th generation aircraft. The service should also take steps to invest in service-retained offensive cyber capabilities to support a land component. Though likely years away, the Air Force is investing in service-unique cyber capabilities that are air- and space-enabled. These competencies need to be developed not within a vacuum, but mindful of how they might support a ground scheme of maneuver.

Introduction of Airpower to Warfare

The introduction of air power to support the ground scheme of proved a challenge in the 20th century. Leveraging the use of air power for military conflict has confounded historians because of its mystique, vocabulary, and relative newness when compared to the long, documented history of naval and land battles.[9] The remoteness of mission and isolation experienced by a bomber pilot in past wars is not relatable to most scholars unless they have had comparable experiences, an empathy challenge which exists today in the emergent domains of space and cyber. Without a common acceptance of words and their meaning, there can be no distinct operational understanding to prevent ambiguity. This is evident in the definition of *strategic* vs. *tactical*. Strategic bombing has been implied by various military historians to mean a wide range of things, from purposefully burning civilians in total war to deep battle – or long-range interdiction sorties launched from a continent away.[10] Tactical airpower is most typified as that surrounding close air support or efforts supporting ground forces engaged against the enemy, with anything not associated with that narrow definition described as strategic. Thus, military leaders often associate electromagnetic spectrum capabilities as strategic in nature, because it is difficult to trace their effects to a tactical action in support of counterland operations. More

[9] Peter Paret, Gordon Alexander Craig, and Felix Gilbert. *Makers of Modern Strategy: From Machiavelli to the Nuclear Age* (Princeton, NJ: Princeton University Press, 1986), 625.

[10] David R. Mets, *The Air Campaign: John Warden and the Classical Airpower Theorists* (Maxwell AFB, AL: Air University Press), 7.

precisely, these competencies have not consistently been applied in support of a land component because of disaggregated C2 channels and a failure to deeply understand how to integrate in support of operations which occur in other domains. War in the air is not immune from the friction and uncertainty experienced by those who conduct war on land or sea, but it is devoid of the terrestrial framework that is evident in these media. Within the air battle, the idea of territory gained does not correlate well and quickly devolves into the smallest common denominator, often leaving its participants without the situational awareness to discern overall effectiveness because of the chaos and speed inherent to aerial combat.[11]

While the US military is organized in a Department of Defense, its force is largely expeditionary and offensive in nature. The United States enjoys non-threatening relationships with its comparatively weaker northern and southern neighbors and has two vast oceans as buffers to its east and west. The United States' advanced fighter and bomber aircraft, buoyed by a capable air refueling capacity and blue water aircraft carriers, allow for American aircraft to project power to every corner of the world. Yet, to this day, airpower's perceptibility challenges are mirrored by those who seek to demystify space and cyberspace to create tangible effects that can be integrated across domains. This demonstrates why integrating cyber and space has shown to be difficult, as well.

Integration of Emergent Domains

Today, the Air Force operates under a similar paradigm as the Army did with the advent of airpower for military use. Some military scholars believe that emergent domains like space and cyber deserve to be separate, independent services – pointing to the Air Force's establishment in 1947. Though space and cyber operations have a near endless limit to their potential effects

[11] Williamson Murray and Allan R. Millet. *Military Innovation in the Interwar Period* (Cambridge, NY: Cambridge University Press, 2009), 99.

and impact, they are also often viewed by the Air Force as supporting capabilities to the service's namesake: air operations. Indeed, some witnesses to Congressional testimony following World War II claimed that the Army's failure to integrate tactical air power with ground forces was a contributing factor to the creation of an autonomous Air Force, an argument that could be made today about space and cyber power, to better integrate in support of all domains.[12] As the US military's domain advantages erode, the synchronization of all domains together will become increasingly important. As early Army Air Corps theorist Bill Sherman understood in 1926, the then-emerging domain of airpower had the capacity to reinforce the principles of war proposed by Clausewitz – as applied to ground forces.[13] Rather than facing an adversary ground force directly, the credible integration of other domains could, for instance, could shape or alter an opposing land commander's planning activity, for fear of an asymmetric cross-domain action that may deny that force freedom of movement or security. Much like within the air, the cognitive effects of a cyber or space action on surface forces are often out of all proportion to any physical destruction that might be caused.[14] Focusing the utility of a domain towards combat support instead of mere service support instantly changes the perspective and broadens its usefulness within warfare.

Effects-Based Operations as a Precursor to MDO

Following the 1991 Gulf War, the advanced technology which led to the dominant use of airpower within that conflict, began to be recognized as means by which to deliver effects rather than simple force-on-force platforms. Military strategists, especially within the Air Force, started to acknowledge that the United States could no longer conduct wars of attrition or annihilation

[12] John Schlight, *Help From Above: Air Force Close Air Support of the Army, 1946-1973.* Air Force Histories and Museum Program (Washington, DC: Air Force Historical Studies Office, 2003), 71.

[13] William C. Sherman, *Air Warfare* (New York: The Ronald Press Company, 1926), 13.

[14] Andrew G. B. Vallance, *The Air Weapon* (New York, NY: St. Martin's Press, 1996), 109.

and must adapt to maneuver through EBO. This concept built upon the work of airpower theorist John Warden's five rings principle, which focused on enemy centers of gravity. EBO was further championed by now retired Air Force Lt. Gen. David Deptula, who promoted the belief that the nature of war had itself changed because of advancements in technology. Deptula postulated, "strategies of annihilation and attrition rely on sequential, individual target destruction as the ultimate method of success and measure of progress—generally measured in terms of forces applied, or input. Using [EBO], the determinant of success is effective control of systems that the enemy relies upon to exert influence—output. Changing the way we think about the application of force may produce more effective use of force."[15] Deptula believed that precision munitions and the effective use of technological superiority could compel adversaries in ways unseen before.

Though Deptula overstated technology's role in problem-solving and incorrectly challenged the unchanging nature of war, he captured the essence of what now makes the C2 of MDO so critical, thanks to more emergent warfighting domains: an integrated application of effects to impact a system. In 2008, joint doctrine defined EBO as, "a set of actions planned, executed, and assessed with a systems perspective that considers the effects needed to achieve policy aims via the integrated application of various instruments of power."[16] EBO provided a credible concept which encouraged systems thinking across services – though poorly executed at the time – which set the stage for looking at warfare through the lens of interconnected warfighting domains which can be maneuvered through to produce desired effects on the battlefield – the underlying concept for MDO.

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[15] David A. Deptula, *Effects-Based Operations: Change in the Nature of Warfare* (Arlington, VA: Aerospace Education Foundation, 2001), 18.

[16] Phillip S. Meilinger, "The Origins of Effects-Based Operations." *Joint Force Quarterly, Edition 34.* (National Defense University, October 2004), 116.

In the intervening years, disruptive technology has changed the character of war – requiring the US military to adapt and change the way it fights to win in future conflicts. Air-Land Battle doctrine was highly successful way to wage war against technologically inferior opponents, but this new technology has created new challenges for military leaders. The time opportunity for warfighters, both friend and foe, to use the OODA loop – orient, observe, decide, and act – will be greatly diminished in a multi-domain fight. Adversaries will be less technologically-outmatched than in conflicts past and will be able to attack asymmetrically to combine effects from multiple domains to disrupt decision-making and disorient. Utilizing effective C2 across all domains to synchronize effects can help disrupt the cognitive abilities of an adversary and interrupt their ability to pointedly use different domains within their own system to either defend against or generate combat power.

These advancements in the character of warfare are not endorsements of space and cyber as being supreme, or so powerful and advantageous to time and decision-making space. Rather, it is the combined advancements of the technology to better leverage these capabilities aggregated with the ability to synchronize effects across domains that will keep adversaries off-balance. No domain or weapon is predominant, but the capacity to integrate *all* available competencies provides the best possible advantage to the warfighter.

Chapter Two: Historical Context of Air-Ground Integration

World War I and II

While airpower was present during World War I, it was generally not well-harnessed in support of ground commanders' objectives until World War II. World War I military leaders were interested in this new capability but did not invest significant time towards developing relevant operational concepts or trying to overcome the significant technological limitations at hand, as they were focused on the logistics and weaponry required for the more palpable and anticipated land war that became a war of movement aided by trench warfare.[17] Not until the interwar period in the aftermath of the Great War did military leaders begin to conceptualize airpower's potential in war. Beginning in the 1920s, Army leaders sought to incorporate lessons learned from the war. However, they proclaimed the infantry as the preeminent arena of warfare, as the 1923 Field Service Regulations stated that the "mission of the infantry is the general mission of the entire force."[18] In the Army's service-centric view, all other services and capabilities were present only to aid the infantry.

The concept of close air support initially appeared in Army doctrine in 1942. Field Manual (FM) 31-35, *Aviation in Support of Ground Forces*, was the first time that the Army addressed support of ground forces by air forces. This document created the concept of Air Support Parties (ASPs), which would soon become known as Tactical Air Control Parties (TACP), to embed with ground personnel and direct requests for air support using ground signals with arrows pointing at targets, along with smoke, tracers, and pyrotechnics.[19] Radio

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[17] Holger H. Herwig, *The Marne, 1914: The Opening of World War I and the Battle that Changed the World* (New York: Random House, 2011), 216.

[18] US War Department, *Field Service Regulations, United States Army* (Washington, DC: Government Printing Office, 1924), 11.

[19] Ibid, 35.

communications were still considered unreliable, and the manual prohibited radio sets for air-ground communications below the division-level.

During the Second World War, German Field Marshall Erwin Rommel led Hitler's elite Panzer Divisions into North Africa and pushed British forces back to their last strongpoint before the Nile River, placing control of Egypt and the Nile River at risk. Winston Churchill pleaded for immediate American air reinforcements to push back Rommel's forces. In 1942 following the official entrance of the United States into the war, President Franklin Roosevelt finally relented – setting into motion the first employment of coordinated air-ground operations.[20] During Operation Torch, the US Army Air Corps' Ninth Air Force, consisting of several heavy and medium bomber aircraft, pounded Rommel's Afrika Korps out of Egypt, demonstrating the power and effectiveness that direct aerial attacks on enemy forces, their supplies, and lines of communication could have on ground forces. Historians regard this North African campaign as the inaugural instance where airpower was deliberately utilized as a cross-domain capability in support of a land scheme of maneuver, amplifying the effectiveness of the advancing Allied armies.[21]

But teamwork during Operation Torch still proved a challenge, as the air forces were unable to keep pace with Patton's advancing Third Army. The Tactical Air Command (TAC) had to move its headquarters five times during a single month, sputtering along, disorganized and unable to deliberately plan, let alone hastily plan – often taking off and landing near cities where German belligerents were left behind by a quickly advancing Third Army.[22] The ad hoc

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[20] James F. Sunderman, *World War II in the Air: Europe (*New York: Braumhall House, 1963), 100.

[21] David Ian Hall. *Learning How to Fight Together: The British Experience with Joint Air-Land Warfare.* (Maxwell AFB, AL: Air Force Research Institute, 2009), 4.

[22] US Army Air Forces, *Air-Ground Teamwork on the Western Front, The Role of the XIX Tactical Air Command during August 1944* (Washington, DC: HQ AAF, 1945), 1.

relationship and poor coordination between the land and air components did not allow for well-synchronized efforts, as aircraft pilots sought to deliver the same effects they had in Europe, but their supported soldiers wanted different effects to more appropriately aid the quickly advancing scheme of maneuver.[23] Though Third Army was successful at advancing quickly, and TAC airmen very adaptive to the changing character of war, the uncalibrated coordination between the two did not allow for proper time to assess air strikes and plan for force advancements accordingly. In essence, despite their victory, there was no combined learning loop that informed how to reorient and fight together effectively, as later airpower theorist John Boyd would propose through his "OODA loop." Though separate lessons were learned throughout the constantly changing operational environment, the battlefield was not sufficiently complex to challenge the adaptability of the airmen and ground forces.[24] They experienced a winner's bias that did not encourage readdressing coordination challenges, but these trials would prove even more critical as technology continued to increase the lethality and shorten warfighters' decision-making time on the battlefield.

Later, Gen. Elwood "Pete" Quesada would command the Ninth Air Force and pioneered much of the use of airpower in support of ground forces. During the war, Quesada had to overcome a healthy skepticism of the value of airpower from his ground commander counterparts. Though capable of ground attack and dive-bombing, Ninth Air Force employed its two formidable P-38 fighter groups almost exclusively towards armed reconnaissance. Army leaders were unconvinced that these aircraft could provide timely close air support to troops in contact. Quesada found that despite his efforts to move his airbases closer to the front lines,

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[23] US Army Air Forces, *Air-Ground Teamwork on the Western Front, The Role of the XIX Tactical Air Command during August 1944* (Washington, DC: HQ AAF, 1945), 10.

[24] Ibid, 10.

Army logisticians would not allocate necessary resources towards this mission. Instead, they reasoned that those reserves were better allocated to light infantrymen and tank drivers.[25] Though within the same service at the time, this early vestige of parochialism and mistrust for capabilities within other domains, appears time and again throughout US military history. Even Omar Bradley's chief of staff at the time remarked, "the air cannot hope to be everything to us, and I am included to count on less help from them in the future."[26] To this day, despite their garrison and deployed collocation, Air Force organizations embedded with ground forces, such as ASOCs, are sometimes given lesser sustainment and signal support by their supported divisions. This is commonly done for service-centric reasons, as the Army either misunderstands that Air Force unit's requirements or they place a lower priority on its needs, in favor of its own personnel and units.

Quesada was frustrated at his forces' inability to conduct close air support and interdiction at night, and so his airmen resorted to gimmicks as a way to compensate. Planes would equip delayed fuses to the largest bombs they had available and drop them along roadsides before sunset, in hopes that the bombs would explode after dark and create the impression of a night air raid.[27] This early example of initiative and experimentation in cross-domain operations effectively disoriented the enemy and paved the way for future innovations. This tactic, used as a way to surmount a shortfall in capability, still provides a lesson on how to use cognitively shape an adversary's perception of reality – by manipulating their acuity of time and space. Cross-

[25] Thomas A. Hughes, *Over Lord: General Pete Quesada and the Triumph of Tactical Air Power in World War II (*New York: The Free Press, 1995), 265.

[26] Ibid, 264.

[27] John Schlight, *Help From Above: Air Force Close Air Support of the Army, 1946-1973,* Air Force Histories and Museum Program (Washington, DC: Air Force Historical Studies Office, 2003), 47.

domain operations, when effectively carried out, can deceive an adversary's battlefield awareness.

With Japanese surrender following the atomic bomb drop on Nagasaki, Japan in 1945, the US military did not place much emphasis on air-ground integration in the aftermath of World War II. In 1947, the Air Corps became its own separate service and the new Air Force focused largely on developing a strategic force that would employ these new atomic weapons. The Tactical Air Command (TAC) was reduced in budget and staff, its own leadership believing that the command would only be pertinent in the event that an atomic attack had failed – and even then, a conventional air-to-ground attack unlikely.[28] Air Force leaders believed that tactical air units were not relevant until after a strategic air offensive had been completed, and they favored maintaining a small TAC that could be expanded after mobilization had occurred.[29]

Korea and Vietnam

This change was short-lived, however, and the Air Force reevaluated its strategic policy thanks to the Soviet Union's demonstrated atomic capability in 1949 coupled with North Korea's invasion of South Korea in 1950.[30] The Air Force's decision was not entirely altruistic, though, as the service reinvested in TAC to prevent the Army from gaining control over its tactical air assets. But while acknowledging the need to field a tactical force, Air Force leaders made a distinction between delivery methods, with Gen. Curtis LeMay, then commander of Strategic Air Command, saying, "If you have to employ strategic air power against tactical targets, you are not

[28] Robert F. Futrell, *A History of Basic Thinking in the United States Air Force* (Maxwell AFB, AL: Air University Press, 1989), 123.

[29] Ibid, 202.

[30] Jeremy W. Siegel, *The Debate is Over: Close Air Support in Korea and Vietnam* (Quantico, VA: Marine Corps University, 2011), 7.

getting the full use of the weapon."[31] However, this token effort was minimal and the Air Force did not put much thought into air-ground integration or tactical proficiency, in favor of strategic doctrine to counter the growing threat that a nuclear-capable USSR posed.

The Air Force entered the Korean War using multi-role jet aircraft for close air support missions. These jets, usually F-80s, had poor approach times for troops in contact, due to poor fuel consumption and an inability to carry a sufficient payload required for tactical bombing. The War Department revised the earlier version of FM 31-35 to incorporate lessons learned from World War II, including Air Force-retained control of tactical air and unified action with the Army. This led to the expansion of air-ground operations beyond the ASPs, to include a C2 structure for CAS collocated with the Army – now known as the Army Air-Ground System, or AAGS – and a parallel C2 structure with the Air Force, called the Theater Air Control System, or TACS.[32] The two systems were linked together through an operational-level Joint Operations Center (JOC), but with multiple echelons of commanders between their ability to coordinate.

This updated doctrine was applied during the Korean War, and the Air Force's side was deemed unresponsive by Army leaders. Not only was the tactical C2 process to bureaucratic, having to pass through so many layers, but Army representation at the JOC was non-existent. This was representative of the Air Force's poor emphasis on tactical air integration manifested in an understrength TACP career field with no presence below the division-level, was poorly integration, and insufficient communications equipment.[33] These shortfalls led to the deaths of

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[31] Robert F. Futrell, *A History of Basic Thinking in the United States Air Force* (Maxwell AFB, AL: Air University Press, 1989), 155.

[32] US War Department, *Field Manual (FM) 31-35, Aviation in Support of Ground Forces* (Washington, DC: Government Printing Office, 1942), 62.

[33] Jeremy W. Siegel, *The Debate is Over: Close Air Support in Korea and Vietnam* (Quantico, VA: Marine Corps University, 2011), 11.

several TACP personnel and their supported ground forces. Though the services recognized these shortfalls afterwards, they did not take significant steps to address until after the Korean War Armistice.[34] Still, the actions were largely just a reorganization of C2 mechanisms and would not be tested again in combat for another decade.

The Vietnam War was the first conflict in which the US military established an air component commander which would integrate aircraft in support of the ground scheme of maneuver. But this war also exposed unique challenges concerning air support operations which persist today. During Vietnam, the Theater Air-Ground System saturated the theater with aircraft dispersed across the operating area to help provide near continuous overhead coverage and shorten response time, but as in Korea, management of these air assets remained centrally controlled, which inhibited their ability to directly communicate with ground forces in need of their help.[35] The Air Force sought to adjust and mitigate risk by placing its terminal controllers at radar sites, and later, by utilizing airborne Forward Air Control (FAC), believing that these methods would be more accurate and timely. All of Southeast Asia was divided into seven major geographic sectors, with each area of operations independently controlled. As requests for air support were funneled through the DASC. Instead, this C2 method was also ineffective, and indicative of a pilot-centric mindset which underscored the services' different approaches and reflected the Air Force's unprioritized approach to helping ground forces, leaving them under protected.[36] Despite a much smaller geographical area and a vastly different conflict, the primary means of C2 used for airpower during the Vietnam War was the same as World War II.

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[34] Jeremy W. Siegel, *The Debate is Over: Close Air Support in Korea and Vietnam* (Quantico, VA: Marine Corps University, 2011), 11.

[35] Benjamin F. Cooling, *Case Studies in the Development of Close Air Support* (Washington, DC: Office of Air Force History, 1990), 459.

[36] John Schlight, *Help From Above: Air Force Close Air Support of the Army, 1946-1973.* Air Force Histories and Museum Program (Washington, DC: Air Force Historical Studies Office, 2003), 323.

The Joint Staff did not attempt to define close air support until 1964, until then relying on the individual services to define their specific roles. The question of air-ground integration had long been a flashpoint of disagreement, especially between the Army and Air Force, with the Navy and Marine Corps less interested, as they retained their own organic aircraft to provide CAS in support of Marines on the ground. *Joint Publication 1, Joint Warfare of the Armed Forces of the United States,* tried to bridge these disagreements, labelling CAS as "air action against hostile targets which are in close proximity to friendly forces and which require detailed integration of each air mission with the fire and movement of those forces."[37] The Joint Staff sought to impress the need for integration rather than deconfliction of fires. Prior to this, the services typically had diverging viewpoints – with the Army viewing CAS similar to air-based artillery rather than part of an overall air campaign along with interdiction and air supremacy. Similarly, the Air Force often viewed CAS as a component of an air campaign instead of an effect that could potentially be achieved by several different ground support weapon systems.[38]

The Army's *Field Manual 100-26, The Air-Ground Operations System*, first introduced the term 'air support operations center' in 1973, as an alternate to the more-common Direct Air Support Center (DASC), which the Marine Corps still uses today. The FM described the DASC as a "fast reaction capability [for] immediate requests from Army forces for tactical air support."[39] This unit's designated role was to re-vector available sorties to provide CAS for troops in contact, via a mobile capability that could move in concert with a Corps headquarters, while advising Corps leadership and staff about air capabilities and coordinate with controllers

[37] John Schlight, *Help From Above: Air Force Close Air Support of the Army, 1946-1973.* Air Force Histories and Museum Program (Washington, DC: Air Force Historical Studies Office, 2003, xi.

[38] Ibid, xi.

[39] US Army, *Field Manual (FM) 100-26, The Air Ground Operations System* (Washington, DC: Government Printing Office), 39.

attached to lower echelons about available air assets. Before the decade was over, the Air Force would re-name its DASC units to ASOCs, to more closely align with terminology used by the North Atlantic Treaty Organization (NATO), which had adopted the term as a proper noun.[40]

In the years following Vietnam, the Cold War intensified and the Army codified its practiced Air-Land Battle doctrine, through *Field Manual 100-5, Operations*, a precursor to Army's contemporary operations-focused field manual. *Field Manual 100-25*, released in 1982, described the tenets of Air-Land Battle as initiative, agility, depth, and synchronization.[41] The service further described the criticality of the "entire force thoroughly understanding the commander's intent," to develop opportunities for exploitation of the enemy.[42] Throughout the Reagan Administration, the Army and Air Force continued to exercise and refine this doctrine, often noting that the ASOC lagged behind other Air Force C2 weapon systems in terms of both technology needed to quickly process air requests and communications equipment to improve interaction between TACPs in the field, the ASOC, AOC, and Army Fires.[43] The Air Force noted that the system which existed to accomplish the ASOC mission in the late 1980s had not been upgraded in more than two decades, and implemented a ten-year plan to upgrade the weapon system's capabilities, to include datalink and battlefield awareness platforms.[44]

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[40] Seth D. Spidahl, *The Once and Future Air Support Operations Center: A Critical Reflection on Developments in Air-to-Ground Command and Control* (Maxwell AFB, AL: Air University Press, 2016), 34.

[41] US Army, *Field Manual (FM) 100-5, Operations*. Washington, DC: Government Printing Office, 1982), 2-1.

[42] Ibid, 2-1.

[43] Seth D. Spidahl, *The Once and Future Air Support Operations Center: A Critical Reflection on Developments in Air-to-Ground Command and Control* (Maxwell AFB, AL: Air University Press, 2016), 35.

[44] Peter W. Hoak, *Adaptive Design of a Decision Support System for Dynamic Retasking of CAS and BAI Assets* (Wright-Patterson AFB, OH: Air Force Institute of Technology, 1987), 11.

The Gulf War

These new systems and equipment were put to the test years later when an ASOC deployed to Saudi Arabia in support of Operation Desert Storm in 1991. Though Army leadership expressed satisfaction with how the Air Force's ASOC had performed, each service noted that they were not familiar with the systems that their counterparts used and that they lacked interoperability. Similarly, the ASOC's communication equipment used was not mobile enough to support dislocated operations and headquarters movements in a timely manner. Reflecting on this experience, then 1st Cavalry Division commander, Maj. Gen. Tommy Franks, stated, "My biggest frustration, was in getting the targets or groups of targets struck that I thought were most important to the success of the operation in my sector of responsibility… take a different scenario, different enemy, different air availability. Take an early entry scenario where your land force may be outnumbered. Then it becomes very important to have a tight dialogue between the land force commander, given responsibility for a mission on the land, and the support forces, either coming from the sea or from the air."[45] Even then after a significant upgrade in capabilities, warfighters recognized the gaps between how each service viewed, equipped, and trained for conflict with their units for Air-Land Battle.

The Gulf War Air Power Survey completed at the end of the conflict revealed that the coalition had adequately planned for and achieved initiative, agility, depth, and synchronization – purposely avoiding a battle of attrition and seeking to constantly maintain tempo.[46] However successful and effective actions were within the Air-Land Battle construct, these efforts could only take place once air supremacy had been achieved. After the upgrades to the ASOC weapon

[45] Richard B.H. Lewis, *JFACC Problems Associated with Battlefield Preparation in Desert Storm. Airpower Journal* (Maxwell AFB, AL: Air University, Spring 1994), 8.

[46] Eliot A. Cohen, *Gulf War Air Power Survey* (Washington, DC: Government Printing Office, 1993), 606.

system in the early 1990s, the Army and Air Force did not make significant upgrades in the intervening decade between Desert Storm and the initial deployment of US combat troops to Afghanistan and Iraq, despite continued air-ground integration challenges noted during exercises.[47]

The lessons learned from past conflicts concerning air-ground integration are applicable to the Air Force's challenge today of both continuing to improve air-ground integration as well as integrating space and cyber operations in support of ground forces.

[47] Curtis V. Neal, Robert B. Green, and Troy Caraway. "Bridging the Gap from Coordination to Integration." *Joint Force Quarterly, Edition 67* (Washington, DC: National Defense University, 2012), 98.

Chapter Three: Contemporary Domain Integration Challenges

Operation Anaconda

The first large-scale ground combat operation in Afghanistan was Operation Anaconda in the Kot Valley. It is perhaps the most illustrative example from the war of the need for competent and integrated tactical C2 in that it revealed significant operational problems related to the ASOC. Not only was the Air Force not incorporated into the planning process for the ground scheme of maneuver of the operation until less than two weeks before execution, but integration during the operation was poor. This was due in large part to the ASOC's inability to obtain battlefield awareness without its communication systems, which were too bulky and immobile to accompany the Task Force's headquarters.[48] Up until Anaconda, an ASOC had not been required during the five months the United States had been active with forces on-the-ground in Afghanistan, as the majority of forces had been Special Operators and there was not an Army Corps headquarters present in-country. The establishment of an ASOC to deconflict CAS and Fires was an afterthought, until the fight became intense and it was needed – yet the organization was unfit to provide a complete air and ground picture.[49] Additional reports about the operation indicate that the conventional Army commander that was in the region had been disapproved from bringing their division-aligned TACP squadron with them, under the rationale that they and their equipment would increase the US military footprint in the region and that the division's defensive posture did not warrant tactical airpower C2 specialists.[50]

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[48] Michael W. Isherwood, "Five Years After Operation Anaconda: Challenges and Opportunities." *Joint Force Quarterly, Edition 47* (National Defense University, October 2007), 143.

[49] US Air Force, *Operation Anaconda: An Air Power Perspective* (Washington, DC: AF/XOL, 2005), 44.

[50] Benjamin S. Lambeth, *Air Power Against Terror: America's Conduct of Operation Enduring Freedom* (Santa Monica, CA: RAND Corporation, 2005), 173.

ASOC and JAGIC

Today, the last vestiges of Air-Land Battle can be found within the ASOC, or the tactical convergence of the Army Air-Ground System (AAGS) and the Theater Air Control System (TACS). The ASOC is the apex at which traditional Air-Land Battle is conducted at the tactical level and the history of the TACS delivers lessons on how to confront modern-day domain integration challenges. For decades, the ASOC's role and place at the Army's senior tactical echelon had remained unchanged, as the Army could reliably depend upon the Air Force to provide counterland support when required against militaries incapable of challenging US air superiority. As the Department of Defense has renewed its focus towards large-scale combat operations (LSCO) with a near-peer competitor, the ASOC's organization, technology, and execution processes have not kept pace, built for uncontested airspace.

Hard-fought lessons from the initial Iraq campaign led the Army to create modular Brigade Combat Teams (BCTs), which could be easily interchanged and compiled to mass the appropriate combat power for any situation. This led to the Army shifting its senior tactical echelon from the corps down to the division-level. As the ASOC had long been designated to support that echelon, the Air Force committed to expanding its number of ASOCs to support the ten Army divisions. In his capacity as commander of the Multi-National Force – Iraq (MNF-I) in 2008, GEN Ray Odierno authored an article in *Joint Forces Quarterly*, which outlined his view that conventional forces needed to be more like Special Operations Forces, in that it was important to decentralize most assets down to the lowest possible echelon, especially air assets such as ISR and UAS, to empower commanders with "mission execution across the spectrum of tasks." Odierno favored this, "because a higher or more distant command and control node cannot act quickly enough or with sufficient insight into the implications of its decision-making

process."[51] It was these experiences that later led Odierno, upon becoming Army Chief of Staff, to more swiftly implement the modular transformational shift to make the division the Army's primary tactical headquarters.

Also as a result of lessons learned from the initial years of the Global War on Terrorism, then Air Force Chief of Staff, Gen. T. Michael Moseley, who had been the Air Component Commander for the wars during that timeframe, signed an Enabling Concept which defined the mission, functions, and responsibilities of the ASOC.[52] This document, signed in 2006, sought to improve the relationship between the ASOC and the Air Operations Center (AOC), which serves as the Air Force's operational C2 arm, highlighting the air-ground integration challenges experienced since 9/11. It directed that the "ASOC must effectively command and control combat air and space power at the time and place needed to achieve land and air component commander objectives," though it did not provide any additional guidance concerning the organization, training, and equipment required to include the tactical C2 of space forces or effects in support of a land component.[53] From an Air Force perspective, the ASOC Enabling Concept was critical to the development of the JAGIC that exists today. It emphasized the need to integrate joint fires rather than simply deconflict.[54]

The Army also was interested in better supporting ground operations with joint fires. The service's Field Artillery leaders sought to build upon lessons learned in Iraq and Afghanistan, with a notable interest in employing joint fires in support of targeting and deconflicting airspace

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[51] Raymond T. Odierno, Nichoel T. Brooks, and Francesco P. Mastracchio, "ISR Evolution in the Iraqi Theater." *Joint Force Quarterly, Edition 50* (Washington, DC: National Defense University, September 2008), 54.

[52] T. Michael Moseley, *United States Air Force Air Support Operations Center Enabling Concept* (n.p., 2006), iv.

[53] Ibid, iv.

[54] Ibid, iv.

above ground forces.[55] The two services jointly endorsed the concept formally at the 2009 Army-Air Force Warfighter Talks. The JAGIC concept is popular among both Army and Air Force leaders, because in a resource-constrained environment, it provides a manpower-neutral reorganization of the division operations cell, by physically collocating the Army's existing Fires, Air Defense and airspace management, and aviation cells with the Air Force's ASOC.[56] This endeavor has been a forcing function to synergize and encourage each contributor to consider the effects and systems of their counterparts, though the training has not been executed in wartime environment. Unlike when an ASOC was aligned with a corps, there is always a chance that the JAGIC and division-aligned ASOC may be competing with other divisions for the same assets, and will have to coordinate with higher headquarters accordingly. This could pose an additional problem when integrating non-kinetic effects, as the employment of their capabilities also need to be coordinated, for risk of creating an unintended effect beyond the supported commander's battlespace. Contemporary air-ground integration practices have not adequately considered the advancements that Air Force service-specific capabilities such as offensive space control and offensive cyberspace operations can bring to bear in support of counterland operations. In fact, the doctrinal definition of counterland operations has not been updated to reflect airpower capabilities beyond CAS and AI.[57]

Space and Cyber

Mindful of its experiences in the Middle East and with an eye towards the future, the US Army released an updated Field Manual 3-0, *Operations*, in late 2017. This document lays the

[55] James P. Kane, Jr., *JAGIC 101 – An Army Leader's Guide* (eArmor Journal, October 2016), 2.

[56] Daryl Youngman, "The Future of Fires," *Fires Magazine, United States Army* (Fort Sill, OK: Fires Center of Excellence, March 2014), 21.

[57] US Air Force, *Annex 3-03 Counterland Operations* (Montgomery, AL: Lemay Center for Doctrine, 2017), 2.

foundational groundwork for how the Army intends to organize, fight, and conduct MDO. Yet the document broadly argues that the service must be able to do *everything* across the warfighting spectrum. It implies that there are no seams, or a separation of responsibility for certain fires or domain-specific space that the Key West Agreement settled, and that the Army cannot necessarily count on its sister services in a LSCO fight. Despite its stated goal of describing "how Army forces, as part of a joint team, shape operational environments, prevent conflict, conduct large-scale ground combat, and consolidate gains against a peer threat," the document does not mention the Air Force, air-ground integration, or its division-aligned ASOC or JAGIC once.[58] Instead, it reflects the service's traditional doubt that it will be able to rely upon the assistance of fixed-wing airpower or any other cross-domain capabilities from its sister services. Without acknowledging the specific roles that each service plays in major combat operations, the picture painted by this foundational document is incomplete at best.

Under current joint doctrine, an ASOC does not conduct operations until Phase III of a conflict, when air superiority has presumably already been achieved, thus allowing CAS platforms to patrol their respective sectors unchallenged, and even then, are not typically prioritized until Phase IV – once enemy surface-to-air and air-to-air threats have been eliminated. This AOC is responsible for assignment of aircraft sorties prior to Phase III and does have a mechanism for including non-kinetic effects, but these are also not responsive to immediate requirements. During Operation Enduring Freedom, it was not until counterinsurgency and stability operations – again, Phase IV – that air requests from ground forces were prioritized.[59] Acting as purely an operations center and not a planning center, the ASOC is designed exclusively to task airpower or revector sorties in response to troops-in-contact based upon

[58] US Army, *FM 3-0* (2017), vii.

[59] Michael W. Isherwood, "Five Years After Operation Anaconda: Challenges and Opportunities." *Joint Force Quarterly, Edition 47* (National Defense University, October 2007), 142.

presented aircraft. All services submit a DoD Form 1972 called at JTAR – or Joint Tactical Airstrike Request for CAS actions. These forms provide the ASOC visibility on battlefield requirements, which allows its controllers to choose a proper solution from available assets in real-time. The JTAR allows for effects-based prioritization of aircraft, but the ingenuity of these requests is directly related to battlefield awareness; for instance, a brigade commander may not know that they have an airborne electronic warfare asset available to request through the JTAC, without a proactive heads-up from the Army's Battlefield Coordination Detachment (BCD), which sits at the AOC.

However, a LSCO fight may place a division headquarters and its collocated ASOC engaged in a conflict that aircraft – friendly or otherwise – cannot reach. Alternately, the corresponding AOC for the conflict may face preemptive targeting from adversary forces, rendering it ineffective. Or there may be reason to keep the ASOC geographically separate from its supported ground force. Thus, the need to consider tactical integration of service capabilities absent a functional, deliberately planned Air Tasking Order (ATO), including space and cyber. Despite major advancements surrounding domain integration and convergence within the last half century, challenges persist. Air-ground integration continues to evolve, as both the Air Force and Army adapt their warfighting approaches – seeking to be more lean, mobile, and fast. The technological advances that have enabled better control of space and cyberspace continue to develop, and will need to be integrated with the existing air-ground system.

Present-day Air Force doctrine states that the service plans for and conducts operations by using an effects-based approach, or a comprehensive way of thinking about operations as an integral whole.[60] There is no correct or perfect solution to a problem; only more or less optimal ways to achieve an objective or end state. This doctrinal document declares that, "It may be

[60] US Air Force, *Annex 3-0 Operations and Planning* (Montgomery, AL: Lemay Center for Doctrine, 2016), 1.

easier to defeat adversaries in a domain where they are strong through operations in another domain where they are weak. By exploiting airpower's speed, range, and flexibility, precision, tempo, and lethality, commanders can also gain significant temporal advantages over an adversary, as when pacing operations faster than the adversary can adapt in order to cause psychological shock and paralysis."[61] The service has staked out mission-space to exploit the "vertical dimension," the electromagnetic spectrum, and time to create effects within the air, space, and cyber domains that other US military forces cannot.[62] This includes already existent offensive and defensive space control capabilities using Department of Defense-operated satellites, but also the development of additional cross-domain solutions to create effects within cyberspace enabled by air and space.[63] Many of these capabilities are highly classified to protect carefully-cultivated access and preparation of the environment and so as not to expose methods and are managed by special technical operations.

All of the branches of the US military have sought ways to separately utilize and exploit space and cyber for their own core missions, functions, and competencies – that is, using these capabilities for their service's contributions to the joint fight, just as they do for more traditional C2. The Air Force is exploring ways to command and control its forces in a multi-domain environment, to dominate the air, space, and cyber domains. But the service does not acknowledge that it already operates in a multi-domain environment when providing support to ground forces. In effect, Air Force leaders are only thinking as a service component to a Joint Force Commander when they seek to C2 air, space, and cyber. In reality, service insularity inhibits a holistic approach to command and control. True MDO requires us to think post joint to begin to look at how to C2 forces holistically – not merely from service-centric or component-

[61] US Air Force, *Annex 3-0 Operations and Planning* (Montgomery, AL: Lemay Center for Doctrine, 2016), 1.

[62] Ibid, 1.

[63] US Department of Defense, *Joint Publication (JP) 3-14, Space Operations*, ix.

specific paradigms. These issues have become institutionalized within the military services, because there was no standardized joint terminology until recently, the developmental paths for military professionals within different domains rarely intersect, and there have been no lines "drawn in the sand" to definitively state which service will provide what capability within space and cyber.

Former Chairman of the Joint Chiefs of Staff, Gen. Martin Dempsey, encouraged military personnel to think not in terms of joint, or what the warfighting capabilities the individual services provided to a combatant commander or task force commander, but instead focus on cross-domain solutions.[64] The US military has substantial capability within each of the warfighting domains, but a half century of dominance has caused complacency and a tendency to think of engagements in a force-on-force model; that is, by only considering offensive and defensive options within the same domain for exercises, wargaming, and problem-solving. However, the military branches have not entirely heeded Dempsey's vector, as they follow parallel approaches to building service-organized and equipped Multi-Domain formations to employ effects across the spectrum. Concurrently, the geographic combatant command (GCCs) that are led by those who actually possess warfighting authority do not have uniform C2 practices for non-kinetic effects, concerning who retains the authority or where those capabilities come from. This is especially problematic as conflicts extend beyond the boundaries of a single command, and forces may find themselves supporting a GCC whose C2 practices are unfamiliar to them.

[64] Dempsey, Martin, as cited in "Multidomain Operations: A Subtle but Significant Transition in Military Thought," by Jeffrey M. Reilly, *Air and Space Power Journal 30* (Maxwell AFB, AL: Air University Press, Spring 2016), 71.

Chapter Four: Observations and Recommendations

The multi-domain integration challenges encountered today by the Air Force and Army echo those experienced during previous conflicts. As the services continue to seek ways to improve air-ground integration, these difficulties are compounded by the addition of space and cyber. To better provide multi-domain support to ground forces, the Air Force should build interoperable C2 systems, develop mobile communications equipment, OT&E to allow the flexibility for more scalable C2 organizations that can be custom-built to the conflict at hand, and ultimately, adapt its vision of what C2 is.

Redefining C2

Perhaps most radically, the military must cognitively challenge the idea of what it views as command and control. Traditional C2 is usually explained through flow charts and hierarchical diagrams and this monograph explained the different approaches the Army and Air Force have taken towards organizing Multi-Domain capabilities. The US military will shift echelons of organizations and assign a degree of control with an understood meaning – such as COCOM, OPCON, and TACON – to a given commander, so that all involved parties understand who has what authority in warfighting situations. Where interests intersect, especially thanks to emergent domains, the joint community has created new terminology. These designs compartmentalize capabilities thought of as "strategic," with the delegation thereof and echelon retained at, varying widely between each GCC. The 2018 National Defense Strategy has sought to better standardize and integrate these capabilities, however, designating the Chairman of the Joint Chiefs of Staff as a global integrator to better utilize all forces across domains, and in

particular, make decisions at "the speed of relevance," unencumbered by bureaucratic red tape.[65] Though there is risk of compromising these sensitive capabilities for a near-peer by using them prematurely against an inferior adversary, this challenge can be overcome through proper intelligence preparation of the battlespace. Military professionals who provide tactical C2 could instead receive a "restaurant menu" that essentially provides them with constraints and summarizes – or again, demystifies – the effects that can be provided. This would help tear-down barriers to collaboration, such as reducing the presence of separate physical information networks and compartmentalized special technical operations (STO) offices, which often syphon a key piece of valuable battlefield awareness away from decision-makers.

Interoperable C2 Systems

These separate information networks are not merely for classification reasons, either. Despite a shared heritage and decades fighting alongside each other, the Army and the Air Force do not have completely interoperable systems. The battlefield awareness suites and software that are part of the TACS and AAGS do not have reciprocity for both Army and Air Force networks and require separate approval waiver processes. The Army and Air Force should honor the systems approval processes of one another to break-down barriers to collaboration and C2. Where able, the military needs to link communications systems and enhance battlefield awareness through standardized common operating pictures, across branches of service and domains to create a shared understanding both in training environments and while deployed. Similarly, the TACS and AAGS should be used as a guide to integrate space and cyber at the tactical level, rather than a reinvention of integration simply because the character of war has evolved.

[65] Jim Garamone. *"Global Integration Seeks to Buy Leaders Decision Time, Increase 'Speed of Relevance.'" DoD News.* (Washington, DC: Defense Media Activity, 2018), 2.

There are two different approaches which the Army and Air Force should consider towards pursuing space and cyber. First, work with the new combatant commands – US Space Command and US Cyber Command – to build a new, parallel C2 system that can interoperate with the TACS and AAGS, via common operating pictures. Alternately, the services can continue along parallel yet expensive paths to develop service-retained capabilities to support their primary missions. However, it may also make sense to revisit the Key West Agreement to identify those areas within space and cyber that the military services need to divide amongst themselves, to both save on redundancy and financial consideration as well as develop a clearer understanding of where the military wants to head as joint warfighting organization within the Defense Department. This can be done through either a parallel system to both the TACS and the AAGS, to separately integrate non-kinetic effects, or through the Army and Air Force's service-retained capabilities leveraged through their respective fires cells. The latter is preferred simply because it will not create a new, separate system to integrate, but the former may be required as the space and cyber domains continue to mature, begin to separate from their respective services, and develop their own cultural identities and paradigms for warfighting. The US military's non-kinetic effects infrastructure remains robust and highly effective, yet the respective combatant commands for these effects will likely remain reticent to share this infrastructure or build a separate, parallel one.

Mobile Communications Equipment

As discovered during Operation Torch, Desert Storm, and the early days of the Global War on Terrorism, the communication equipment used by tactical air C2 experts could not keep up with a rapidly advancing ground force. The equipment takes too long to assemble and disassemble and is not conducive to a military that needs to constantly maneuver, as is expected to counter asymmetric threats during a Multi-Domain fight. The Air Force needs to invest in easily transportable, high-bandwidth systems that can be set-up at a moment's notice or

continually operated on-the-go, to keep up with a maneuvering force. The service's air, space, and cyber capabilities maintain global reach, but to be effective tactically, must be commanded and controlled by operators who have battlefield awareness. There is no need for tactical-level multi-domain formations because of the reach of these global assets, but there does exist a need for competent tactical MDC2, which can only be gained through experience.

LSCO with an advanced adversary will likely be met with degraded or denied C2, inhibiting the timely delegation of authorities from a hierarchical chain-of-command. Even lesser-capable competitors view disruption of the United States' C2 structure as a way to asymmetrically counter its dominance in other domains. This new threat has appeared, despite aging communications systems that are incompatible between the TACS and the AAGS. Much as it has done with its other powerful C2 aircraft platforms, including its AOCs, the Air Force should consider creating an Air Support Networks Squadron to specialize in and manage the unique requirements of an ASOC or tactical C2 weapon system. This squadron could also provide the critical mission assurance role within cyberspace to protect friendly C2 access, deny adversary visibility, and protect the integrity of the systems' data. Having a TACS-focused Air Force communications unit to liaise with its counterparts at an AAGS-focused Army signal battalion will promote a common language understanding and increase system interoperability, providing better specialization and permitting the operators to focus on controlling, not technical nuances of their support systems.

Scalable C2 Organization

The US military already has the capabilities needed to exploit across each of the different warfighting domains, when aggregated, but has not yet effectively integrated and synchronized them. The ongoing expansion of the ASOC to support ten active duty divisions provides an opportunity for the Air Force and Army to capitalize on these evolutions to adapt the ASOC

weapon system for modern major combat operations, leveraging capabilities across multiple domains – from both services – to support ground forces.

Though ground-based units can conduct cross-domain operations as part of Special Reconnaissance or Advanced Force Operations missions, these assets remain high-demand and low-density, with a high risk of failure and possible intelligence compromise if caught. These special operations capabilities were employed heavily during the early days of the Global War on Terrorism and maintain the type of capabilities that GEN Odierno stated that conventional forces need to develop. Efforts to include multi-domain capabilities beyond localized cyber, EW, and space control capabilities within conventional units are not efficient for tactical maneuver to possess, however, unless designed for close-range combat or immediate defensive purposes, as evidenced by the previous conflicts. Instead, the Army has relied on the Air Force to more adeptly provide cross-domain solutions via a nested C2 node: the ASOC.

The ASOC must evolve from a standardized "take it or leave it" crew, and instead become a scalable organization that can grow or shrink in size, depending on the character and complexity of the fight. To support small units with airpower, TACP or an ASOC-like capability may only consist of a handful of people directing aircraft – using the aforementioned mobile C2 equipment. In a larger-scale conflict, it may be a more traditional 9-person crew or larger, while in a multi-domain fight, the ASOC might pull-in experts from different competencies who have been trained on Multi-Domain warfighting.

As experienced with the early challenges of airpower, there is a struggle to understand space and cyber operations among those who do not have experience within those domains. These comprehension challenges are heightened by the over-functionalization of operations personnel within the Air Force, as those officers who specialize in an airframe, weapon system, space, or cyber – not to mention the air liaison officers who embed with Army units – do not cross paths operationally until they are perhaps graduated squadron commanders or colonels. In

and of itself, this is fine for operations – as the US military's multi-domain capabilities are robust, when aggregated at the Joint level.

The Air Force has taken a great first step by establishing the Multi-Domain Operations career field to build a path to develop a proficient understanding of capabilities and how to employ them across each of the domains; however, this career field is only expected to serve at the operational level within AOCs. The service should reflect upon ways to gain MDO understanding for C2 at the tactical-level, perhaps by leveraging units where TACP personnel are assigned nearby the commands that oversee other domains, such as a Colorado Springs for Air Forces Space and San Antonio for Air Forces Cyber. The Army is better off than the Air Force in this regard, as many of its officers transition into non-kinetic or support specialties after one or two assignments in a combat arms or maneuver career field, and because the preponderance of its officer force has served in a direct support role for a combat unit in some capacity, unlike most airmen.

To more effectively fight and win wars and synchronize effects on the battlefield, the Air Force needs to better integrate its vast air, space, and cyber capabilities to support ground forces. Both the Air Force and Army have considerable examples of challenges with air-ground integration over the last century of warfare from which to draw lessons for the integration of air, space, and cyber. The unchanging nature of war demands that humans continue to find ways to exploit the advantages of their adversaries; the emergence of new domains has changed the character of war and leveled the playing field, but the Air Force and Army need to continue to adapt to conduct combined maneuver effectively. It is now more important than ever that the Air Force develops flexible C2 practices and scalable platforms capable of integrating and synchronizing the service's air, space, and cyber effects to maintain initiative, control tempo, and help sustain an advantage over competitors.

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