THE CONCEPTS OF MASS AND SURPRISE IN FUTURE AIR WARS

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While contemporary air tactics seem to necessitate an approach firmly rooted in the conventional principle of mass, the advent of new technologies and the availability of increasingly effective non-kinetic capabilities call into question the efficacy of such an approach against today's dense integrated air defense systems and the current force composition. Through an analysis of the concepts of mass, surprise, and technological innovation in airpower theory and the case study of the First Gulf War, this article argues that to prepare for future conflict with peer adversaries, Western air forces need a paradigm shift toward utilizing advanced, low-observable weapon systems supported by comprehensive all-domain non-kinetic effects, ensuring air superiority by neutralizing the enemy's targeting capabilities.

Securing air superiority in potential future conventional conflicts among peer adversaries is the primary strategic objective for the air forces of Western nations. Following the dissolution of the Soviet bloc, the free Western powers maintained a significant advantage derived from a considerable capability disparity. Yet, over the past two decades, Russia has directed substantial resources toward narrowing this technological disparity while concurrently expanding its operational experience, thereby fostering the development of novel systems now proliferating among numerous aligned actors. At the same time, China has made notable technological strides, enhancing its integrated air defense system (IADS) and thereby compelling the United States and its Allies to reassess the operational landscape under the rubric of anti-access/area denial (A2/AD).[1] The new A2/AD construct represents a challenging obstacle for Western powers because it now includes stealth fighters, some of the world's most advanced air-to-air and surface-to-air missiles, and multi-spectral sensors to track airborne targets.[2]

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1. Alessandro Podestà, "The Concepts of Mass and Surprise in Future Air Wars—Literature Review" (master's thesis, Kenney Airpower Strategy Seminar [KASS], Air War College [AWC], 2024).

2. Mark A. Gunzinger, Lawrence A. Stutzriem, and Bill Sweetman, *The Need for Collaborative Combat Aircraft* [CCA] *for Disruptive Air Warfare* (Mitchell Institute for Aerospace Studies, 16 February 2023), 3, https://mitchellaerospacepower.org/.

How can the United States and its Allies generate effects inside such dense A2/AD environments with these premises?

In 2023, the US Air Force formulated the *Air Force Future Operating Concept* in response to this strategic stalemate.[3] This framework promotes a strategic posture focused on the innovative concept of operations known as agile combat employment (ACE).[4] This approach envisions the employment of "joint force in pulses" as a pivotal course of action.[5] Airmen will achieve victory by applying "pulsed airpower," the deliberate concentration of airpower in specific temporal and spatial domains to create strategic windows of opportunity that the broader force can leverage to achieve operational objectives.[6] Yet the dimensions of the pulse, both in breadth and depth, have yet to be rigorously defined within scholarly discourse and declassified literature.

Contemporary tactics necessitate an approach firmly rooted in the principle of mass, intending to maximize the impact exerted by the Joint force within the pulse and bolster its survivability by overwhelming technologically sophisticated enemy defenses through saturation. Nonetheless, it is imperative to evaluate whether this approach is optimal. Considering the advent of new technologies and the availability of increasingly effective non-kinetic capabilities, one must question whether the conventional strategy of force packaging remains suitable for operating within densely fortified environments. Furthermore, force composition must be considered. Is mass still dominant in force composition, or are alternative factors, such as technology and surprise, gaining preeminence in contemporary operational paradigms?

This article questions the efficacy of the conventional approach of employing force packaging—even in pulses—against dense, modern IADS to overwhelm and saturate enemy defenses. Instead, it argues a paradigm shift toward utilizing advanced, low-observable weapon systems supported by comprehensive all-domain non-kinetic effects is needed. This combination is expected to effectively breach A2/AD structures, ensuring air superiority by neutralizing the enemy's targeting capabilities.

By examining the significance of mass and surprise in the context of traditional Western war culture and analyzing airpower theory's original approach to these concepts, this article offers a new perspective on the issue of force composition. Through the case study of the First Gulf War, the article extracts essential principles for defining optimal force composition in future air warfare scenarios, focusing on the pivotal role of technological innovation in reshaping the nature of aerial combat. These principles, paired with emerging capabilities stemming from advancements in combat domains, form a perspective through which Western air forces can meet the challenges of future air warfare.

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3. *Air Force Future Operating Concept Executive Summary* (Department of the Air Force [DAF], 6 March 2023), 1, https://www.af.mil/.

4. *Agile Combat Employment*, Air Force Doctrine Note (AFDN) 1-21 (Curtis LeMay Center for Doctrine Development and Education [LeMay Center], 23 March 2022), 1, https://www.doctrine.af.mil/.

5. "Agile Combat Employment," Jones Auditorium, Air War College, 18 October 2023.

6. *Future Operating Concept*, 1.

A Different Approach to Warfare

The current strategic environment requires a shift from strategies centered on mass over mass toward approaches that prioritize force multipliers, indirect strategies, and strategic maneuvering. The former approach is perhaps best elucidated in Carl von Clausewitz's *On War,* which encapsulates nearly 2,000 years of Western military tradition, emphasizing force and mass as the decisive keys to conflicts. Clausewitz notes that "each side is driven to outdo the other, which sets up an interaction," emphasizing the highest and simplest law of strategy is "keeping one's forces concentrated . . . to be very strong; first in general, and that at the decisive point."[7] Surprise, although considered a "universal desire" and "the means to achieve superiority," is more applicable at the tactical level and increasingly difficult to achieve at higher levels of warfare.[8] Clausewitz notes that "the greater the scheme of preparations, the smaller the chances to achieve surprise," stating that "it does require favorable conditions, which are not often present, and can rarely be created by the general."[9]

Currently, the arsenals of the Western world need more critical mass. Forces are outnumbered, and reserves are scarce and continuously depleted by secondary priority scenarios.[10] Furthermore, future conflict with Russia or China will subject the West to the "tyranny of distance." In such a situation of numerical, physical, and geographical disadvantage, responding to force with force and concentrating mass against mass is an ineffective, flawed strategy, because the attrition resulting from such a large-scale confrontation would be unsustainable for Western democracies and their Allies in Asia. Therefore, the West must seek alternative solutions to meeting force with yet more force.

One potential approach is to adopt a strategic mindset similar to China. Strategies traditionally adopted by Chinese armed forces echo the need to create a critical mass capable of challenging Western dominance in conflict—certainly in terms of numbers if not intrinsic capabilities.[11] Sun Tzu's *Art of War* clearly states that in war one ideally should seek a military solution through nonmaterial "force multipliers" that will facilitate victory with minimal use of force.[12] The leader at war strives to create situations where "the force applied is minute but the results enormous."[13] Sun Tzu advocates as force multipliers a strong emphasis on intelligence, the strategic employment of deception and diversionary tactics to attain surprise, the adoption of an "indirect approach,"

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7. Carl von Clausewitz, *On War*, ed. and trans. Michael Howard and Peter Paret (Princeton University Press, 1976), 585, 204; and Michael I. Handel, *Sun Tzu and Clausewitz:* The Art of War *and* On War *Compared* (US Army War College, 1991), 24, https://apps.dtic.mil/.

8. Clausewitz, 198.

9. Clausewitz, 200, 210.

10. Gunzinger, Stutzriem, and Sweetman, *CCA*, 3.

11. Yu Tiejun, "The Western Master and Bible of War: Clausewitz and His *On War* in China," in *Clausewitz Goes Global: Carl Von Clausewitz in the 21st Century,* ed. Reiner Pommerin (Carola Hartmann Miles-Verlag, 2011), 43.

12. Handel, *Sun Tzu*, 3, 24.

13. Sun Tzu, *The Art of War*, trans. Ralph Sawyer (Westview, 1994), 85.

and the utilization of psychological methods to diminish the adversary's resolve for combat and strategic maneuvering.[14]

This approach can be exemplified by amplifying the asymmetric advantage evoked by the US Department of Defense's so-called "third offset strategy"—formulated in 2014 in response to China's and Russia's military advancement—which seeks capabilities to offset a peer adversary's superior combat mass and proximity to the battlespace.[15] Similar but expanded proposals are offered by the new "Offset-X," a "technology-centered, competitive defense strategy that lays the groundwork for maintaining or re-gaining our military-technological superiority over all potential adversaries," based on "lessons learned" from past offset strategies and US socioeconomic and technological strengths.[16] The proposed required capabilities deriving from technology and innovation can produce outcomes aimed at mitigating the numerical superiority inherent in the competitors. Emphasis should be placed on quality over quantity when determining force composition, and technology can also ensure surprise.

Mass, Surprise, and Technology in Early Airpower Theory

To transition to this particular approach, it is essential to examine the concepts of mass, surprise, and technological innovation and their significance in air warfare as elucidated by early airpower theorists.

Mass and Surprise in Douhet's Command of the Air

Italian Army General Giulio Douhet's work provides an initial framework for understanding the concepts of mass, surprise, and the pivotal role of technology. As the first recognized airpower theorist, Douhet articulated the necessity for an independent air force to operate in mass, executing surprise attacks.[17] As per surface commanders, air commanders should perpetrate attacks in mass because piecemeal attacks were counterproductive, given the inherent capabilities of the aerial means.[18] That is the core of Douhet's theory because it permits the command of the air: "To gain command of the air is to be able to attack with impunity any point of the enemy's body."[19] Here, mass refers to the capability to assemble aircraft in concentrated formations over critical enemy vital centers in the aerial dimension. Command of the air enables the maneuvering of this mass to deliver unexpected blows to the adversary, leveraging the rapidity

14. Handel, *Sun Tzu*, 25.

15. Gunzinger, Stutzriem, and Sweetman, *CCA*, 4.

16. Justin Lynch et al., *Offset-X: Closing the Deterrence Gap and Building the Future Joint Force* (Special Competitive Studies Project, May 2023), 1, https://www.scsp.ai/.

17. Giulio Douhet, *The Command of the Air*, trans. Dino Ferrari (Air University Press [AUP], 2019), 45, https://www.airuniversity.af.edu/.

18. Phillip S. Meilinger, "Giulio Douhet and the Origins of Airpower Theory," in *The Paths of Heaven: The Evolution of Airpower Theory*, ed. Meilinger (AUP, 1997), 14, https://media.defense.gov/.

19. Meilinger, 4.

of these mass strikes; Douhet considered it essential to victory.[20] Historical examples support his thesis, demonstrating that control of the air is often a decisive factor in the outcome of conflicts, enabling more effective and flexible application of military power across all domains.

The element of surprise is made possible by the aircraft's speed relative to the ground forces and by the ubiquity—namely, the ability to be in different places in short periods—of aerial assets, allowing them to move swiftly between different locations.[21] Yet technological advancements, such as the introduction of the radar, have altered the dynamics of air warfare, posing challenges to achieving surprise. The concept is worth mentioning, although disputed, that air assets can reach their targets uncontested by attacking several targets simultaneously in mass formations at high altitudes, thanks to the aircraft's speed and range, a capability that aligns with the contemporary concept of "parallel operations."[22]

As Douhet emphasizes, technology plays a crucial role in enabling such simultaneous operations against multiple targets at both strategic and tactical levels. He credited technology's decisive power as the solution to the trench warfare brutality witnessed in World War I. Douhet's theories on strategic bombardment are thought to have first influenced Brigadier General Billy Mitchell and then consequently formed the theoretical basis of the US Army's Air Corps Tactical School (ACTS).[23]

Technology for the ACTS

The ACTS theorists played a pivotal role in shaping the evolution of aerial warfare doctrines during the interwar period of the twentieth century. Their insights heavily influenced the strategic outlook of air forces during World War II and laid the groundwork for establishing the US Air Force as an independent service branch. Central to their doctrine was the concept of air superiority achieved through offensive airpower, with an emphasis on the role of bomber aircraft. They advocated for the mass deployment of bombers to execute "vigorous aerial assaults" aimed at undermining enemy morale and incapacitating their societal infrastructure.[24]

This strategy targeted population centers, supply systems, and other rearward objectives deemed critical to an adversary's resilience. Echoing the principles set forth by Douhet, ACTS theorists proposed the development of a new type of aircraft: the long-range, four-engine bomber named the *flying fortress*. This technologically advanced platform was envisioned to operate unescorted and in concentrated formations, delivering precision strategic bombing against enemy targets. Those ideas were encapsulated

20. Meilinger, 10.

21. Meilinger, 9.

22. Meilinger, 15.

23. Meilinger.

24. Peter Faber, "Interwar US Army Aviation and the Air Corps Tactical School: Incubators of American Airpower," in *Paths of Heaven*, 216.

in a series of concepts in 1932: "Massed air strike forces can penetrate air defenses without unacceptable losses and destroy selected targets."[25]

Furthermore, the ACTS elaborated on the concept of unescorted high-altitude precision daylight bombardment, which involved targeting critical nodes within an adversary's industrial-economic infrastructure or "spider web."[26] This strategy aimed to expedite victory by crippling the enemy's ability to sustain war efforts through targeted attacks on vital industrial hubs. Emphasizing long-range bombing appeared to offer the prospect that the next war could be won more quickly and decisively than the last through innovative technology.[27]

While they did not advocate for the use of psychological warfare tactics such as gas bombs against civilian centers, the theorists formulated a doctrine emphasizing high-altitude, daylight, precision, and formation bombing of industrial targets.[28] The pinnacle of their envisioned aerial force was the B-17 Flying Fortress, capable of executing formation bombing runs with impunity, projecting power through massed aerial assaults.[29] In essence, the ACTS theorists leveraged technological innovation to operationalize Douhet's principles of surprise and mass and to actualize the capability of precision bombing, envisioning a future where airpower would decisively shape the outcome of conflicts through strategic bombing campaigns. The element of surprise arises from the impossibility of counteraction, while mass derives from the capacity to concentrate force; however, afterward, technology played another pivotal role in changing the character of the air war.

The Evolution of Mass and Surprise

The notion of mass encapsulates the cumulative impact of numerous aircraft with their bomb loads, emphasizing the capability to aggregate effects by concentrating aircraft in the air.[30] Importantly, as long as these effects can be achieved, the massing of aircraft becomes optional, even though having command of the air enables it.[31] In past military campaigns, achieving desired effects required a focus on mass, influenced by strategic thinking traced back to Clausewitz's concept of the center of gravity and prevailing technological capabilities.

Two considerations contributed to departing from this paradigmatic approach: one related to targeting considerations and the other to technological advances. In the late 1980s, John Warden's " Five Rings Model" advanced a shift in targeting philosophy,

25. Faber, 217.

26. Faber, 186.

27. Karl P. Mueller, "Air Power," in *International Studies Encyclopedia*, vol. 1, ed. Robert A. Denemark, web-only reprint (Wiley-Blackwell, 2010), RAND, 2, https://www.rand.org/.

28. Philip S. Meilinger, "Winged Defence: Answering the Critics of Airpower," *Royal Air Force Air Power Review* 5, no. 4 (Winter 2022): 41, https://www.raf.mod.uk/.

29. Faber, "Interwar," 216.

30. Meilinger, "Douhet," 15.

31. John Andreas Olsen, ed., *Air Commanders*, 1st ed. (Potomac Books, 2013), 377.

prioritizing the identifying of targets based on their potential political effects rather than purely physical destruction.[32] Nearly two decades later, David Deptula then elaborated and expanded on these concepts: "Crucial principles defining parallel warfare are how time and space are exploited in terms of what effects are desired, and for what purpose, at each level of war—the essence of effects-based operations."[33] Focusing on an attack's effects rather than on the target's destruction starkly contrasts with the AirLand Battle doctrine, which was widely embraced within the US Air Force's Tactical Air Command community. This doctrine, prevalent in the late 1980s, primarily envisioned a war of attrition centered on achieving air superiority by targeting Soviet airfields, forces, and supplies.[34]

Technological innovation is the other factor that contributed to moving from the concept of mass forces to the focus on effects. One of the most noteworthy technological improvements was the introduction of precision-guided weapons. In 1996, historian Phillip Meilinger theorized that these weapons "redefined" mass: "Precise-guided munitions drastically reduced the need to back up the bombs required to strike a specific target. Given an IADS, the sorties necessary to achieve the same effects on the target diminished considerably."[35]

A clear example, most probably the first in history, of this new paradigm shift was the May 1972 bombing of the "Dragon's Jaw" bridge in Thanh Hoa, North Vietnam, where four flights of four F-4 Phantoms destroyed the bridge after hundreds of ineffective sorties, thanks to the utilization of precision-guided munitions in combat. US Air Force technicians estimated that 33 times as many unguided bombs would have been required to achieve the same result.[36] Such astonishing results led to an initial shift in force composition; now smaller numbers of fighters could exert more significant influence over larger areas.[37]

The First Gulf War in the Evolution of Aerial Warfare

Although its outcomes in the air were somewhat predetermined by the disparity between the involved air forces and equipment, the First Gulf War can be considered as the most compelling demonstration of this change in force composition due to new technologies' potential and innovative power.[38] In the execution of the air war, force concentration was still the predominant trend in force composition but only following

32. John Andreas Olsen, *Strategic Air Power in Desert Storm* (Frank Cass, 2003), 85.

33. David A. Deptula, *Effects-Based Operations: Change in the Nature of Warfare* (Aerospace Education Foundation, 2001), 5, https://www.airandspaceforces.com/.

34. Olsen, *Strategic Air Power*, 83.

35. Phillip S. Meilinger, "Ten Propositions Regarding Airpower," *Air & Space Power Journal* (1996), https://www.airuniversity.af.edu/.

36. Barrett Tillman and Stephen Coonts, "First Laser Bombs Bust the Dragon's Jaw," *Invention & Technology* 27, no. 1 (Summer 2021), https://www.inventionandtech.com/.

37. Mueller, "Air Power," 4.

38. Meilinger, "Douhet," 24.

waves of independent, small, undetected assets. On the first night of the war, low-observable platforms made possible by the new and secret stealth technologies were the keystones of coalition attacks against the Iraqi air defense system, leadership, and communications targets, even in heavily defended areas.[39] Throughout the war, the F-117 Nighthawk stealth fighter, the Tomahawk Land Attack Missile, and the Conventional Air-Launched Cruise Missile launched by B-52s served the coalition by disabling the enemy defenses, thus offering otherwise unattainable freedom of action.[40] In the past, air forces fought defenses and accepted losses on their way to the target or rolled those defenses back. In the Gulf War, the coalition could strike Iraqi air defenses immediately with unprecedented accuracy.[41]

Moreover, stealth platforms attacked with complete surprise and were nearly impervious to Iraqi air defenses.[42] It was what Douhet had precisely predicted.[43] Specifically, his formula for victory—gaining command of the air, neutralizing the enemy's strategic centers of gravity, and maintaining the defensive on the ground while conducting the offensive in the air—underpinned coalition strategies, made possible thanks to new technologies.[44]

A New Effects-Based Approach

Force composition was, therefore, adapted to exploit those innovations. The process of adaptation, though, has not been immediate. During the planning phases for the first strikes over Iraq, then-Lieutenant Colonel Deptula and his team initially treated the F-117, a highly secretive aircraft at the time, as per old historical force packaging paradigms and aimed to maximize damage on hardened targets. Specifically, since the F-117 could carry two precision-guided munitions, intelligence allocated them against only two critical command and control (C2) centers, utilizing then all of the 16 available F-117s.[45] Deptula reasoned that one weapon per air defense target could render them ineffective, allowing the remaining F-117s to target a broader range of objectives and potentially delivering a decisive blow to the adversary.

Applying this concept led to a significantly different air campaign than previous wars, as demonstrated during the first night of the Gulf War. Deptula's team outlined a master attack plan comprising 152 discrete targets, including Iraqi army forces and surface-to-air missile sites for the initial 24-hour period, a remarkable departure from

39. Thomas A. Keaney and Eliot A. Cohen, *Gulf War Air Power Survey: Summary Report* (US Government Printing Office, 1993), 224.

40. Keaney and Cohen, 224.

41. Gunzinger, Stutzriem, and Sweetman, *CCA*, 12.

42. Keaney and Cohen, *Gulf War*, 224.

43. Meilinger, "Douhet," 24.

44. Meilinger, 1.

45. John Andreas Olsen, ed., *Airpower Pioneers: From Billy Mitchell to Dave Deptula*, 1st ed. (Naval Institute Press, 2023), 377.

past practices, with more targets designated for attack in a single day than those struck by the entire Eighth Air Force throughout 1942 and 1943 combined.[46]

This shift toward a more effects-based approach marked a significant evolution in the conduct of air warfare. The planners and commanding officers had comprehended the unparalleled advantages of stealth and surprise, relying on technological and training superiority. For the type of air war it was intended to conduct, based on "parallel attacks" and a strategy of "decapitation," they emphasized the "time-compressed convergence of technology and strategy" as the key to success.[47] The air war was successful in achieving air dominance, but modern literature raises doubts, particularly when analyzing airpower's actual contribution to the overall outcome of the war. For example, one foreign policy expert contends that "air power contributed to the coalition's effort, but the air campaign was neither sufficient nor necessary for the very one-sided victory."[48]

A crucial reason to avoid physical concentration of mass is that force postured in mass is highly vulnerable to attacks.[49] The tactical airpower theory, valid for ground forces, can be easily translated and applied to air forces: forces are highly vulnerable to air attack when they are concentrated in mass before maneuvering and while they maneuver.[50] Therefore, this principle also applies to amassing and maneuvering forces in pulses, as they will be vulnerable to attacks.

Technology Pivotal for Success

The amalgamation of mass as a concert of effects, surprise as an inexorable prerequisite, and innovation as the primary driving force emerge as the three paramount elements to consider when formulating an effective force posture. Technology changed the character of the air war. Considering also the importance given to technology by US Air Force General Charles Albert Horner, commander of the US and Allied air operation during Operation Desert Storm, a focus on future capabilities is now required to make a valid parallel with the past.[51]

A New Force Composition

The First Gulf War prompted a meticulous examination of operational methodologies and doctrines as well as of technological advancements and associated tactics. Notably, enemy air defenses' unforeseen downing of an F-117 stealth bomber during

46. Deptula, *Effects-Based Operations*, 2.

47. Olsen, *Strategic Air Power*, 111.

48. Daryl G. Press, "The Myth of Air Power in the Persian Gulf War and the Future of Warfare," *International Security* 26, no. 2 (Fall 2001): 7; and see Robert Anthony Pape, *Bombing to Win: Air Power and Coercion in War* (Cornell University Press, 1996), 253.

49. Deptula, *Effects-Based Operations*, 19.

50. Phil M. Haun, lecture, 5 February 2024, KASS, AWC; and *Tactical Air Power and the Vietnam War: Explaining Effectiveness in Modern Air Warfare* (Cambridge University Press, 2023), 202.

51. Olsen, *Air Commanders*.

Operation Allied Force in 1999 underscored the evolving nature of aerial warfare.[52] The rapid progression of stealth and counter-stealth technologies emphasizes the necessity for continuous adaptation, potentially exerting constraints on the composition and availability of military forces in forthcoming conflicts.

Force Multipliers and the Required Technological Advantage

The lessons learned can be paired with enabling emerging capabilities in combat domains, which can guarantee asymmetric technological offset. These capabilities are the new generation weapon systems, new C2, and increased non-kinetic support through space and cyberspace domains. Each asymmetric advantage in capabilities follows a spiral pattern of escalation, with the anticipation of countermeasures to emerging technologies. As evidenced by historical precedent, the dynamic equilibrium of military capabilities has perpetually evolved through a cyclical process of challenge and response.[53]

Consequently, within the current resource framework, envisioning a force predominantly reliant on low-observable aircraft, bombers, and sophisticated cruise missiles poses a formidable challenge because they may not become available in the required numbers for years.[54] This challenge is particularly magnified when confronting the imperative of engaging a diverse spectrum of targets across all levels of warfare, necessitating a proportional deployment of required capabilities. In such circumstances, the principle of mass assumes paramount significance because it is intended as a numerical strength/combat force dimension essential for effectively engaging the multitude of targets rather than concentrating solely on the numerical saturation of adversary defenses.

Indeed, the configuration of military forces presents a formidable challenge for Western powers. The imperative of sustaining preeminence by possessing cutting-edge capabilities in adequate quantities to offset any competitor's force and capability imposes an enduring burden on resources and time. Such an imperative, coupled with the acknowledgment of the "tyranny of costs," is inevitable if global preeminence is to be maintained. Emphasizing technological advancements, non-kinetic support, and innovative tactics will result in more economically and technically feasible solutions. These approaches are more cost-effective and attainable compared to the traditional mindset of amassing forces to counteract opposing masses, particularly in light of the foreseeable challenges of the future.

The Imperative of Breaching A2/AD Defenses

Another imperative is to recognize that the most significant operational challenge lies in effectively infiltrating that mass within the A2/AD system.[55] Even if stealth technology is hard to maintain and gives a time-limited advantage, it must represent the base

52. Olsen.

53. John Andreas Olsen, ed., *A History of Air Warfare*, 1st ed. (Potomac Books, 2010), 153.

54. Gunzinger, Stutzriem, and Sweetman, *CCA*, 4.

55. Harry Foster, Bob Martinage, and Jim Thomas, *Toward a New Targeting Approach for Great Power Competition* (Telemus Group, 2019), 2.

for future weapon systems. Those platforms will represent the asymmetric air superiority capabilities and include fifth- and sixth-generation aircraft complemented by a family of uncrewed collaborative combat aircraft (CCA).[56] Fifth-generation fighters will represent the backbone of the force composition, but in about a decade, the new sixth-generation platforms will contribute to the winning fight. Systems like the American Next Generation Air Dominance or the allied Global Combat Air Programme will dominate the sky, bringing the new "family of systems" (or "system of systems") philosophy into combat: this new concept embraces crewed platforms teamed with uncrewed air combat aircraft, the connectivity systems between those platforms, the sensors that support them, the suite of weapons the platforms can carry, and more.[57] This innovative fighter's concept will incorporate cutting-edge technologies that have the potential to revolutionize combat tactics, and most importantly, it will possess the agility to adapt to evolving technologies and threats swiftly, keeping pace with the competitors.[58]

While sixth-generation fighters will bring new stealth capabilities, longer ranges, and larger payloads to the fight, CCA with autonomy and artificial intelligence/machine learning (AI/ML) technologies will act as force multipliers in terms of combat utility and cost-effectiveness. CCA or "loyal wingmen" will bring to the fight more weapons for achieving air superiority, together with new integrated sensors, which will permit the crewed platform to stay at range, diminish the overall mission and force risk, and increase the density of weapons and sensors to be projected into highly contested environments.[59] As per current doctrine, air superiority will be achieved in windows of opportunity in which new platforms like the B-21 Raider will bring destructive power to achieve the effects inside those windows. This is not merely an arms race to achieve precision through mass but a vital effort to deliver the necessary effects precisely where and when they are needed.

C2, Space, and Cyber Effects as the Non-Kinetic Cover for the Force

To battle manage the joint force, Western powers need a new C2 system to maximize their capabilities and efficiently coordinate their technological advantages. Initiatives such as the US DOD Joint All-Domain Command and Control (JADC2) or the NATO Cross-Domain Command exemplify proactive steps in this direction.[60] The

56. Gunzinger, Stutzriem, and Sweetman, *CCA*, 21.

57. DAF, "Operational Imperatives," infographic, 2023, https://www.af.mil/; and "Global Combat Air Programme (GCAP)," Leonardo (website), accessed 28 March 2024, https://www.leonardo.com/.

58. *Air Force, Force Structure and Modernization Programs, Hearing Before the Senate Armed Services Committee Subcommittee on Airland*, 118th Cong. 10 (2023), https://www.armed-services.senate.gov/.

59. Gunzinger, Stutzriem, and Sweetman, *CCA*.

60. *Department of the Air Force Posture Statement Fiscal Year 2022, Hearing Before the Committees and Subcommittees of the United States Senate and the House of Representatives* 117th Cong. 9 (statements of Acting Secretary of the Air Force John P. Roth, Chief of Staff of the Air Force General Charles Q. Brown Jr., and US Space Force Chief of Space Operations General John W. Raymond), https://www.af.mil/; and Paolo Giordano, "Next Generation Command and Control," NATO Allied Command Transformation, 6 December 2023, https://www.act.nato.int/.

goal is to "gain and maintain information and decision advantage against global adversaries throughout the competition continuum."[61] This will be possible when aircraft, spacecraft, and cyber nodes seamlessly share and connect data, increasing a commander's ability to control the fight while complicating an enemy's ability to defend themselves.[62] Notably, the JADC2 strategy states that "JADC2 provides an approach for developing the warfighting capability to sense, make sense, and act at all levels and phases of war, across all domains, and with partners, to deliver information advantage at the speed of relevance."[63]

Once the force is allocated and ready to be managed, non-kinetic effects aimed at negating the enemy's targeting will provide adequate cover for the Joint force. Significant contributions are anticipated from the space domain, which is now acknowledged as a warfighting arena incorporating the principles of Joint warfare.[64]

Peer competitors, notably China, have conducted extensive analyses of US military reliance on space and its implications for warfare strategy.[65] As a result, they are actively developing and deploying a comprehensive range of counterspace capabilities to exploit vulnerabilities within the US space infrastructure, with the objective of preemptively and offensively extending conflict into space.[66] This militarization of space by both China and Russia serves to diminish the military efficacy of Western allies while contesting their freedom of action within this domain.[67] Among the capabilities acquired by these nations are anti-satellite weapons (ASAT); alternative constellations of positioning, navigation, and timing satellites; mobile jamming devices; multiple ground-based directed energy weapons as well as new communication; intelligence, surveillance, and reconnaissance; and electronic warfare satellites.[68] They intend to exploit space as a facilitator domain for their joint military operations.[69]

In response, the United States and its Allies must aim to leverage their technological edge, deploying similar capabilities to "cover" the pulsed joint force in the so-created windows of opportunity. While the specifics of US military capabilities in the space domain remain undisclosed for security reasons, plausible conjectures can be made. These include possessing co-orbital ASAT and direct-ascent ASAT missile capabilities; operational electronic warfare systems such as the Counter Communica-

61. *Summary of the Joint All-Domain Command & Control (JADC2) Strategy* (Department of Defense [DOD], March 2022), 2, https://media.defense.gov/.

62. Justin Reynolds, "Multi-Domain Command and Control Is Coming," US Air Force, 25 September 2018, https://www.af.mil/.

63. *JADC2 Strategy*, 3.

64. *2020 Defense Space Strategy Summary* (DOD, June 2020), https://media.defense.gov/.

65. Jiemin Hou, "Offensive Defense: People's Liberation Army Logic of Preemption in Space," *Æther: A Journal of Strategic Airpower and Spacepower* 1, no. 4 (2022), https://www.airuniversity.af.edu/.

66. Hou, 5; and *Defense Space Strategy*, 1.

67. *Defense Space Strategy*, 1.

68. *2022 Challenges to Security in Space: Space Reliance in an Era of Competition and Expansion* (Defense Intelligence Agency [DIA], March 2022), https://www.dia.mil/.

69. DIA, 9.

tions System, capable of uplink jamming against geostationary communications satellites (though no public evidence exists currently of space-based directed-energy weapon capability); the capability to jam and interfere with global navigation satellite services signals, ground-based high-energy lasers for counterspace applications, and low-power laser systems for dazzling and potentially blinding Earth observation imaging satellites; as well as a robust and redundant space situational awareness infrastructure.[70] Negating the enemy's space contribution to long-range fires and enabling allied space capabilities for beyond-line-of-sight targeting is a crucial goal of the US Space Force, along with the ability to counter the enemy's targeting of the stealth Joint force.[71] The US Defense Department is committed to creating a robust and capable Space Force to "enable national, joint, and combined operations in any domain through sustained, comprehensive space military advantages."[72] This resolute commitment aligns well with the proposed force posture based on effects aimed to negate the enemy's targeting against the Joint force.

Furthermore, contemporary warfare recognizes cyberspace as a pivotal domain due to its ubiquitous presence across all societal domains, including military operations.[73] China and Russia have already emphasized cyberspace's offensive potential, considering it a significant component of integrated warfare and employing it to support military operations against space-based assets. Targeting examples include network-based command, control, communication, computers, intelligence, surveillance, reconnaissance (C4ISR); ground sites; infrastructure supporting space operations; logistic networks; and commercial activities.[74] Given these criticalities, it is clear that in the initial phase, significant efforts should be focused on enhancing cyber defense mechanisms and system resilience. Achieving this goal would mark a significant accomplishment by allowing the resumption of routine operations.

Subsequently, if the capacity to sustain offensive operations is achieved, leveraging residual efforts and resources will enable the ability to undertake offensive operations, representing a complete restoration of strategic advantage. Effects deriving from offensive cyberspace operations (OCOs) are increasingly recognized for their potential to yield strategic outcomes.[75] At the operational level, coordinating OCOs alongside joint force maneuvers is essential for creating advantageous windows of opportunity. This coordination demands sophisticated technological capabilities, substantial time investment, meticulous intelligence gathering, comprehensive planning, and collaborative efforts among various joint force components.

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70. Brian Weeden and Victoria Samson, eds., *Global Counterspace Capabilities: An Open Source Assessment* (Secure World Foundation, April 2023), https://swfound.org/.

71. Brigadier General Jacob Middleton, question and answer session to Seminar 4, AWC, 26 March 2024.

72. *Space Strategy Summary*, 2, 7.

73. Aggelos Chorianopoulos, "Next War Battlegrounds: Earth, Space or Cyberspace?," Karve (website), 9 January 2024, https://www.karveinternational.com/.

74. DIA, *Challenges*.

75. Jacquelyn Schneider et al., *Ten Years In: Implementing Strategic Approaches to Cyberspace*, Newport Papers (US Naval War College Press, 2020), 26, https://digital-commons.usnwc.edu/.

Nevertheless, the impact of such coordination can be decisive, serving as a force multiplier for conventional military operations.[76] Pursuing cross-domain effects during large-scale combat operations is then a paramount objective for the joint force.[77] For instance, OCOs can target enemy air defenses, facilitating air strikes. Additionally, they can contribute to the erosion of the enemy's overall capability, impeding their ability to mount a cohesive defense. Indirect cyberattacks, such as communication disruptions or manipulation of enemy operation timing, can instigate confusion and delays, thereby undermining the efficacy of the combined enemy's defense. Communication disruptions and other forms of interference exacerbate organizational friction within adversary entities, undermining their operational efficiency against the joint force's operations in pulses.[78]

A similar conceptualization of employing the joint force in future air wars can be found in the following case study. As stated, ACE has not yet defined the pulses for operating the Joint force in an academic and unclassified context.[79] To address this gap and delineate the future force composition, Deptula proposes implementing a "combat cloud" to integrate diverse capabilities into a unified "weapons system." This combat cloud will then conduct disaggregated, distributed operations across an entire operational area. Massed, non-stealthy strike packages will evolve into more distributed force packages, with increased low-observable features and greater reliance on automated systems.[80] Cyber and space effects enable the realization of disaggregated and distributed operations and amplify them through predominantly non-kinetic capabilities.

Negating the Enemy's Targeting: The Aim Beyond Saturation

As early airpower theorists speculated, the centrality to airpower of the concepts of mass of effects—kinetic supported by non-kinetic—and surprise will persist in future conventional air wars against peer competitors. In addition, the paramount role of technology cannot be understated in the effort to delineate the future winning joint force. The case study of the First Gulf War and the relative dissertation on how to conduct the war and choose the most effective targeting have shown that mass must be intended as a collective of effects, while superior technology employed in a multidomain approach will augment and guarantee surprise.

The strategic deployment of airpower in pulses, which creates strategic windows of opportunity for the joint force, becomes crucial in an evolved scenario where Western supremacy has been contested in recent years. Low-observable, new-generation weapon systems will constitute the pulse and synergically unify effects. The overarching objective

76. Schneider et al., 81.

77. *2023 Department of Defense Cyber Strategy* (DOD, 2023), 10.

78. Schneider et al., *Ten Years In*, 86.

79. *Future Operating Concept*, 1.

80. David A. Deptula, "Evolving Technologies and Warfare in the 21st Century: Introducing the 'Combat Cloud,' " Mitchell Institute for Aerospace Studies, 16 September 2016, 3, https://mitchellaerospacepower.org/.

of posturing airpower should be to negate effective targeting by the adversary, avoiding complications in targeting or creating dilemmas.[81] Such options would expose the joint force to potential targeting by the adversary, a scenario that must be prevented.

Steering clear of a force posture oriented toward saturation, air forces in future conflicts should aim for "invisibility," achievable through a combination of technological reach, non-kinetic support, and advanced tactics. Specifically, new non-kinetic effects in the space and cyberspace domains will support the new-generation weapon systems—which will constitute the necessary physical mass—covering their posture in pulses and generating windows of opportunities for the joint force.

This article advocates for a posture focused on "circumventing or overcoming A2/AD complexes" instead of attempting to roll them back as an initial response, utilizing a legacy massed push of airpower.[82] To avoid saturation in force posturing, Western air forces should prioritize asymmetric capabilities aimed at disrupting competitor forces rather than engaging in a futile attempt to outmatch them in sheer force.[83]

To achieve success in upcoming conventional conflicts against peer adversaries, Western air forces should consider the following recommendations:

- Invest in advanced technologies, prioritizing funding and development of low-observable, new-generation weapon systems (constituting the mass) and non-kinetic capabilities, especially in the cyber and space domains (enabling surprise);
- Continue to develop a multidomain approach to integrate capabilities across domains to enhance surprise and effectiveness of the joint force;
- Emphasize asymmetric warfare, focusing on disrupting adversary forces and avoiding direct, force-on-force engagements; and
- Keep on enhancing pulse operations to create windows of opportunity and maintain operational flexibility.

These guiding principles will lay the foundation for success in future wars, where airpower remains pivotal. Æ

81. John Warden, lecture, KASS, AWC, 19 March 2024.
82. Foster, Martinage, and Thomas, *New Targeting Approach*, 2.
83. Gunzinger, Stutzriem, and Sweetman, *CCA*, 21.