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Issue brief Rethinking combined arms for modern warfare

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To conduct all-domain operations, modern warfare requires a new approach to combined arms. The US military should reassess the future composition of its forces, integrating high-end manned platforms with low-end, attritable vehicles.

Bottom lines up front

- Combined arms operations integrate fire and maneuver to consistently place an enemy on the horns of a dilemma, forcing them to choose between two undesirable outcomes.
- Traditionally, combined arms involved coordinating infantry, armor, artillery, and aviation to achieve tactical advantage. However, today's operational environment demands a different approach.
- The next National Defense Strategy should define the combined arms team of the future as an all-domain force composed of a high-low mix, where advanced manned platforms command swarms of low-cost, autonomous, and attritable or expendable vehicles to deliver firepower and maneuverability.

What is combined arms warfare?

Combined arms refers to an approach that, when implemented well, creates a decisive tactical advantage for one's military. For instance, Alexander the Great won many battles by combining heavy infantry with fast cavalry, creating tactical dilemmas that his enemies could not easily resolve. The modern notion of combined arms emerged in the early twentieth century, particularly during World War I, as militaries learned to synchronize infantry, artillery, armor, and aviation to overcome tactical challenges.

The essence of combined arms lies in striking an adversary in multiple ways so that responding to one kind of attack exposes vulnerabilities to another. This is usually discussed in terms of fire and maneuver. For example, consider the basic combination of infantry, armor, and artillery. Artillery fire forces the enemy to disperse, but if this fire is combined with an infantry and armor advance, then the enemy must regroup to defend against all elements. This is one example of a dilemma that effective combined arms can produce: The enemy cannot opt for a low-risk tactical option but is instead forced to accept increased risk from either artillery or the infantry-armor combination. Today, combined arms remains essential to achieving tactical success on the battlefield.

Why discuss combined arms instead of JADO?

In the last five years, the Department of Defense (DoD) has coalesced around an operational theory for future joint force employment: Joint All-Domain Operations (JADO), an evolution of more service-spe-

cific theories such as the US Army's and US Marine Corps' Multi-Domain Battle. JADO is a sound theory that emphasizes combining "mutually supporting joint capabilities that outperform and outmaneuver the enemy."[1]

For several decades, the US military set the standard for joint operations largely by synchronizing operations at combatant command or sometimes joint task force headquarters. Combatant commanders assigned missions and tasks to domain-focused subordinate leaders who led forces that usually came predominantly from the leader's service. Domain-specific forces accomplished their missions with only some support from other domains. JADO aims to push this detailed integration lower in the chain of command.

JADO is a high-level joint concept intended to guide the services' force development, so it rightly focuses on the operational dimension of war—the level at which combatant commanders and joint task force commanders operate. This level is mostly cognitive: Success there means understanding strategic goals and the environment and then weaving tactical actions together into campaigns to achieve those goals. As a result, JADO primarily concerns understanding the environment (observing and sensing) and planning to integrate joint effects, whether through fires or maneuver (orienting and deciding).[2] This is why most joint discussions today about all-domain operations revolve around command and control rather than other functions like fires and maneuver (hence the evolved emphasis on investing in Joint All-Domain Command and Control, JADC2). JADO is not about creating new tactical forces; rather, it connects existing and future forces to more robust sensors and enables joint force commanders to better integrate effects from those forces across domains. At the combatant command and joint task force level, therefore, focusing on command-and-control tools is the most effective means to realize the JADO idea.

However, tactical forces—the units fighting the battles—need the right tools as well. While the DoD and the services are moving forward to implement JADO through JADC2, the services are struggling to embrace the implications of the changing character of war at the tactical level. To some degree, JADO is about better applying the idea of combined arms at the operational level. Nevertheless, the combined arms concept remains essential at the tactical level to achieve this vision. The best JADC2 capabilities are meaningless if the frontline units are unable to execute the missions assigned to them. Designing and fielding forces suited to the new tactical realities facing the US military should be as high a priority in the next National Defense Strategy (NDS) as JADO.[3]

What is changing?

Over the last two centuries, military capabilities have significantly evolved across four key variables: speed, range, sensing, and accuracy of fires.[4] Another such transformation is underway today, with two considerable implications for combined arms. First, dramatic improvements in computational power, epitomized by artificial intelligence (AI), greatly increase the amount of data that can be processed in headquarters at all levels. Second, autonomy and advanced missile technology—combined with this enhanced computational power—increase both the range and volume of accurate firepower (whether through swarming autonomous vehicles, massed missile volleys, or other means) and improve the protective capabilities of forces, such as defensive missiles and even directed-energy systems.

These changing characteristics of warfare present key considerations for the DoD. First, the reconnaissance-strike complex, the previously unrivaled ability of the US military to find, fix, and precisely strike targets, is now possessed by some of its great-power adversaries—and it will only be a matter of time before virtually all state actors can employ this capability. The US monopoly on theater-wide precision-strike capability is over. Therefore, the battle for information—both to secure an information advantage and deny it to the enemy—will be critical.[5] Second, both offensive and defensive firepower

1. The Joint Staff, JP 3-0 Appendix D, *Fundamentals of Joint All-Domain Operations*, https://jdeis.js.mil/jdeis/new_pubs/jp30app_d.pdf, D-3.
2. "Summary of the Joint All-Domain Command & Control (JADC2) Strategy," US Department of Defense, March 2022, https://media.defense.gov/2022/Mar/17/2002958406/-1/-1/1/SUMMARY-OF-THE-JOINT-ALL-DOMAIN-COMMAND-AND-CONTROL-STRATEGY.pdf.
3. The National Military Strategy might seem a more appropriate guidance document for this subject matter, especially given its inherently more operational focus, as opposed to the NDS's orientation toward policy. However, the NDS typically provides force development guidance in one form or another. Notably, both the 2018 and 2022 NDS included guidance to the military departments on specific attributes for force development. This issue brief advocates continuing this practice and suggests that the force development guidance in the next NDS could be more specific than in previous iterations.
4. Andrew F. Krepinevich, Jr., *The Origins of Military Victory: How Disruptive Military Innovation Determines the Fates of Great Powers* (New Haven, CT: Yale University Press, 2024), 41.
5. Matthew G. Glavy and Eric X. Schaner, "21st-Century Combined Arms: Gaining Advantage through the Combined Effects of Fires, Maneuver, and Information," *Marine Corps Gazette*, September 2022, 6, www.mca-marines.org/wp-content/uploads/21st-Century-Combined-Arms-1.pdf.

have increased substantially in terms of volume and accuracy. Massing weapons with different characteristics, supported by electromagnetic capabilities, and striking from multiple axes, will be critical to overcoming defensive firepower[6]—and it will become increasingly challenging to defeat similarly designed enemy strikes. Third, commanders and staffs will be able to rapidly process vast amounts of information, and they will face adversaries equally adept at processing and understanding information relevant to US strategy and operations. Command-and-control functions may enable commanders to observe, orient, and decide at rates previously unimaginable, increasing the lethality and scale of reconnaissance-strike complexes.

Returning to the basic conceptualization of combined arms as the practice of synchronizing fire and maneuver to place the enemy into dilemmas, the chief issue seems to be: How can US forces effectively maneuver in an environment so heavily dominated by firepower? An inability to maneuver by either side transforms a campaign into competing fires complexes hurling salvoes back and forth—a situation reminiscent of the trenches of World War I, which originally inspired the modern concept of combined arms.

The tools needed for twenty-first-century combined arms

The logic of combined arms, much like the nature of warfare, remains unchanged. The goal is still to force the enemy onto the horns of a dilemma by employing different but integrated and complementary means. Tactical force designs also need to embrace the changing character of warfare—changes that suggest different approaches to both platform design and overall force structure. In this new environment, combined arms demands tactical forces across all domains that can:

1. fight for information and decision advantage, and fight to prevent the enemy from obtaining information;
2. deliver (and absorb) large amounts of firepower; and
3. maintain the ability to close "organic" kill chains to ensure that maneuver remains part of the tactical and operational playbook. Combined arms requires the combination of fires and maneuver to create dilemmas, not exclusive reliance on long-range firepower.

In some ways, the US military services themselves are caught in an "organize, train, and equip" dilemma as they seek to adapt to the new tactical realities. On the one hand, services need to provide forces today, which means sustaining and modernizing current platforms and weapons. On the other hand, service leaders know they need to adapt to a changing environment. Both of these challenges require significant resources. Moreover, the services sometimes struggle to embrace truly transformative systems, as entrenched interests across the DoD, Congress, military services, and the defense industry incentivize exquisite platforms over other possible investments. The NDS alone cannot solve these problems, but clear, unequivocal strategic guidance can provide the mandate for leadership to make bold choices and pursue some of the aggressive changes needed to improve US force development.

The model that should be embraced by all the services to create this force can be termed the "high-low mix."[7] This idea is often discussed but does not represent a specific force construct. Rather, it should be considered a more refined set of attributes for force development. Much like how the 2018 and 2022 NDS provided attributes for force development, the forthcoming NDS should provide force development guidance that goes beyond broad characteristics like "lethal" or "resilient," to instead define the force of the future as a new combined arms team relying on high-end, exquisite, manned platforms whose primary purpose is to control large groups of low-end, autonomous, expendable, and attritable systems.

The high-low mix should be understood as an uneven balance between exquisite "high-end" and "low-end" platforms and weapons. High-end systems are characterized by exceptional (and therefore often expensive) capabilities designed to control both space and masses of low-end systems, which are inexpensive, attritable, or expendable, and usually autonomous. As the services develop the next generations of platforms and weapons, this high-low mix should be central to platform, weapon, and overall force design.

6. Dmitry Filipoff, "Fighting DMO, Pt. 6: Naval Platform Advantages and Combined Arms Roles," Center for International Maritime Security, April 10, 2023, https://cimsec.org/fighting-dmo-pt-6-platform-roles-attributes-and-tactics.
7. Michael Horowitz and Joshua Schwartz, "Stealth and Scale: Quality, Quantity, and Modern Military Power," War on the Rocks, December 18, 2024, https://warontherocks.com/2024/12/stealth-and-scale-quality-quantity-and-modern-military-power.

Design the high end for autonomous control and survivability

High-end systems are designed to survive and operate in highly contested environments. To survive, these systems should employ a variety of stealth and non-kinetic tools to hide from enemy sensors and disrupt enemy kill chains. Operating, however, requires a major shift in traditional platform design thinking. New systems should be optimized to control autonomous vehicles, potentially even across domains. To a degree, leaders should consider the weapons these high-end platforms carry as self-defense weapons—to be used primarily for survival.

These high-end platforms are the backbone of the new combined arms system. They provide both firepower and maneuver, depending on the types and quantities of weapons or autonomous vehicles they control on a given mission. They are the critical forward nodes in a dense command-and-control network that connects across the theater. When deployed, they should provide formidable tactical capabilities that other major powers cannot match. However, the main purpose of these systems is to control autonomous vehicles that serve as their primary weapons. New platforms, like the B-21, *Constellation*-class frigate, the updated Abrams tank, and the announced F-55, should prioritize these characteristics.

Keep the low end low-cost, attritable, or expendable

Low-end systems should be designed to be inexpensive and attritable, or expendable. These systems should be considered the weapons of high-end platforms—each time a high-end, crewed platform sorties, it should either carry or be accompanied by an array of low-end, autonomous vehicles. These vehicles should serve a variety of functions. They may provide firepower either through their own onboard weapons or by acting as a weapon themselves. They enhance the survivability of either the entire package or the high-end platform by providing non-kinetic support and defensive firepower.

Autonomous capabilities (of the sort envisioned here) have yet to prove themselves operationally, but the potential is high. For example, a number of recent Defense Advanced Research Projects Agency efforts, such as LongShot, the OFFensive Swarm-Enabled Tactics (OFFSET) program, and the No Manning Required Ship (NOMARS) program, offer glimpses into a near-term future of capable autonomous vehicles commanded by humans.[8] Increased investment in these capabilities is likely to pay large dividends in the near- to medium-term.

Designing low-end systems requires, first and foremost, that their cost is kept low. While many US low-end weapons may not be as cheap as the quadcopter drones seen in Ukraine today, ensuring that these systems are available in large numbers and are easily replaced mandates that they be roughly commensurate in cost with munitions. For example, the current Standard Missile-6 or Patriot PAC-3 missiles cost about $3.8 million per missile.[9] For an autonomous vehicle to be considered expendable, it likely needs to cost no more than this amount. To be considered an attritable vehicle, it should likely be no more than half the cost of a roughly comparable current platform, if not less. For low-end capabilities, all else being equal, it is better to have many of something that is pretty good rather than a few of something that is exquisite.

Implementation risks

Transitioning from the current force to one that embraces these new tactical realities will be challenging. While there are many risks, the two most significant can be classified as sustainment and basing risks, on the one hand, and imbalance risks, on the other.

Organizing and equipping units into this new combined arms model still requires sustainment and secure bases to operate from. The high-end portion of the team should be inherently small. While potent during combat, these platforms are vulnerable while at bases or during resupply. The best place to destroy an aircraft is at an airbase, for example. Bases need to be in relatively secure positions and both defended and kept supplied. The low-end force, too, requires sustainment. By its very nature, the low-end portion of the force should suffer heavy attrition. Even those systems that survive will need to be repaired or cannibalized to continue fighting. Supply lines must be established with redundancy in mind and protected to keep both parts of the new combined arms team fighting.

The other major risk in this force development effort is an imbalance between the high and low ends. Too many high-end platforms would likely be very costly, meaning that high-end platforms could come at the expense of low-end capabilities,

8. "LongShot," US Defense Advanced Research Agency, last visited July 7, 2025, https://www.darpa.mil/research/programs/longshot; "OFFSET: OFFensive Swarm-Enabled Technology," US Defense Advanced Research Agency, last visited July 7, 2025, https://www.darpa.mil/research/programs/offensive-swarm-enabled-tactics; "NOMARS: No Manning Required Ship," US Defense Advanced Research Agency, last visited July 7, 2025, https://www.darpa.mil/research/programs/no-manning-required-ship.
9. "Missile Interceptors by Cost," Missile Defense Advocacy Alliance, last updated February 2024, https://missiledefenseadvocacy.org/missile-defense-systems-2/missile-defense-systems/missile-interceptors-by-cost.

sustainment or protection capabilities, or some other part of the overall system. Ultimately, in this scenario, the force could be too small to conduct both fire and maneuver effectively, resulting in unsustainable attrition rates. Eventually, the high-end-heavy force collapses due to attrition.

Similarly, fielding too many low-end systems is also risky. Without the high-end capabilities to command and control fire and maneuver, the overly low-end force would rapidly lose operational coherence. While the low-end force may conduct some powerful strikes early on, the lack of high-end support means it would be challenging to connect widely spread forces into powerful strike packages. Instead, small forces throughout the theater might strike as they are able, or high-level headquarters might send autonomous packages into battle with only limited ability to adjust or adapt in the heat of a fight, since they would be controlling the package from great distances. The low-end-heavy system could induce disorder in itself by either decentralizing to far too low a level or aggregating command and control at far too high a level—the ability to command and control integrated force packages might not exist.

Avoiding these two risks requires careful joint force design, providing specific guidance to the services. The services know best how to deliver tactical capabilities through their domains, but it requires DoD and joint oversight to ensure that the overall joint force is properly developed for the Indo-Pacific tactical fight.

Developing a twenty-first century combined arms team

The changing character of warfare in the twenty-first century demands a new model for a combined arms team, but the logic of combined arms remains the same. To execute JADO, the DoD needs a joint, combined arms, team that can deliver fire and maneuver in a highly contested environment. Achieving that vision requires a carefully designed force comprised of high-end and low-end systems. The high-end systems should be exquisite, highly capable platforms fundamentally designed to control groups of low-end, autonomous vehicles while connecting to JADC2 networks and surviving in highly contested environments. The low-end systems should be autonomous, attritable, or expendable vehicles and/or weapons capable of providing a variety of functions to flesh out the formations with firepower, mass for maneuver, and enabling effects for both.

The NDS can set the DoD marching on this path, thereby posturing the United States to recapture a position of military advantage relative to adversaries in the future.

Author biography

E. Aaron Brady is a US Air Force officer and A-10 instructor pilot with more than 2,500 flight hours, currently serving as a national defense fellow at the Atlantic Council. The views expressed in this brief represent the personal views of the author and are not necessarily the views of the Department of Defense, the Department of the Air Force, the Air University, or any other US government agency.