

## DEFENDING AND DOMINATING THE AIR LITTORAL

KEVIN L. JACKSON  
MATTHEW R. ARROL

Controlling the air littoral requires not only specialized equipment but also tailored doctrine and close coordination among US forces occupying both sides of the domain divide as well as the transition space to the sea to meet operational objectives. It is a Joint problem, and protecting American forces will require a commensurate level of effort and Joint solutions. The US military must break out of its service parochialism and address domain challenges from a Joint perspective that builds on a littoral mindset for tactical, operational, and strategic advantage. Lessons learned in Russia's war in Ukraine yields recommendations for the area air defense commander, tasked with defeating the threat of air-borne systems, to protect service members operating in the air littoral.

From the charnel houses of Ukraine to the South China Sea, militaries everywhere are rapidly coming to the realization that they can lose a war in the air below 10,000 feet. This space, described by some as the *air littoral*, represents a highly dynamic, increasingly congested and contested subregion of the air domain.<sup>1</sup> Like its maritime counterpart, effective operations in the air littoral require not only specialized equipment but also tailored doctrine and close coordination between the friendly forces which occupy both sides of the domain divide. Without achieving this, forces in both domains operate at risk and may fail to meet their operational objectives, increasing the likelihood of a strategic defeat.

Forces operating astride the air littoral, whether airborne or surface-based, have a vested interest in its security and control. While the persistent presence of ground forces in large-scale combat operations makes the Army acutely sensitive and vocal about its exposure to air attack, the air component is likewise at risk from the proliferation of sophisticated surface-to-air missiles operating in this space as well as airborne

---

*Colonel Kevin Jackson, USA, currently serves as the chief of staff for V Corps at Fort Knox, Kentucky. He holds a master of arts in national security policy studies from the National Defense University and a master of arts in organizational leadership from Webster University.*

*Lieutenant Colonel Matthew Arrol, USA, Retired, most recently served as commandant of the US Army Joint Support Team at Hurlburt Field, Florida. He holds a master of business administration from Eastern Michigan University.*

---

1. Kelly A. Grieco and Maximilian K. Bremer, "Contesting the Air Littoral," *Æther: A Journal of Strategic Airpower and Spacepower* [Æther] 3, no. 3 (2024), <https://www.airuniversity.af.edu/>.

asymmetric threats that seek to deny the Air Force sanctuary at its air bases and in the skies. Furthermore, the limited number of fifth-generation fighters with advanced stealth capability implies that the vast majority of the Air Force's assets will either be sidelined or will operate at a disadvantage, attempting to create freedom of maneuver by leveraging the congested littoral in an effort to avoid detection and targeting through terrain masking.

The Navy and Marine Corps are similarly threatened from the air littoral in its relation to the sea, with the added complication that those services must also address a treacherous subsurface transition space as well. Thus, control of the air littoral is not solely an Air Force problem any more than it is not only an Army, Navy, or Marine Corps problem: it is a Joint problem.

In discussing the nature of littoral regions, this article highlights lessons that can be derived from the comparison between the air littoral and the maritime littoral to improve command and control (C2) and operations in this environment and how to build a littoral mindset to deal constructively with the challenges faced in a dynamic region. An analysis of Russia's current war in Ukraine ascertains how each side's efforts to exploit the seam in the air/ground divide has resulted in an intractable deadlock broken only through joint integration and combined arms. The Joint community must therefore better integrate air littoral operations and develop the specialized equipment and processes necessary for success in the near and long term.

## **The New Challenge of the Air Littoral**

It should be stated that control of the air littoral has not always been a prerequisite for air superiority and the advantages it brings. Historically, manned aircraft and the relatively unsophisticated and imprecise nature of munitions allowed this space to be controlled from above or below. Yet after more than a century of flight, which has observed a near-constant struggle between manned-airborne platforms and air defense for control of the open skies, the battle overhead has entered a new and highly lethal phase which has brought the contest closer to Earth than it has been since the dawn of the jet age.

What has changed? Simply put, an asymmetric threat, driven by technological innovations in robotics, miniaturization, and mass production, has expanded the scope and scale of the fight for air superiority into more of the available airspace. Within the air littoral at present, this asymmetric threat comes from the proliferation of unmanned aerial systems (UAS) and loitering munitions. The threat from these systems is multifaceted.

First, they present persistent intelligence, surveillance, and reconnaissance (ISR), which supports the enemy's kill web by rendering the battlefield targetable by other systems to the depth these sensors are employed. Second, by design or modification, they have the ability to deliver lethal and non-lethal effects at remarkably low cost. Lastly, these systems may enhance enemy command and control by expanding line-of-sight communications far beyond what would be achievable from the terrestrial layer. Notably, in terms of defending friendly troops in the air littoral, the characteristics of these

systems bear a striking resemblance to the threat posed by improvised explosive devices during the Global War on Terror in terms of their ubiquity, lethality, and return on investment. This suggests that protecting American forces will require a commensurate level of effort and Joint solutions.

This dilemma has progressively worsened as their success on the battlefield has led to improvements yielding much greater range, lethality, and maneuverability than earlier generations. As these systems are airborne, defeating this threat is a task that falls to the area air defense commander (AADC), who as Joint doctrine states is appointed by the Joint Force commander and is “responsible for the defensive counterair operations, which include the integrated air defense system of the joint operations area.”<sup>2</sup> This Joint mandate does not speak to whether the threats are small or whether they happen to operate in an area that is inconvenient and inherently hazardous. The expectations of the AADC are unconstrained by depth, duration, or level-of-war.

The expanding scope of this mission in the contemporary operating environment has called into question how the Air Force qualifies the term *air superiority*, not only from outside of the service but also from its own top leadership.<sup>3</sup> This multifaceted dilemma for the AADC creates two distinct fights, with one focused on the air littoral—increasingly dominated by UAS and cruise missiles—and a second focused on the more traditional fight at higher altitudes with manned fighters/bombers, ballistic missiles, and emerging hypersonic threats. The Air Force cannot address both dilemmas simultaneously, which is why the Army’s air and missile defense commander is normally appointed as the deputy area air defense commander (D/AADC).

The mission of the AADC is a Joint function which requires Joint solutions, and new roles and capabilities must be developed and integrated to provide protection for the military. These solutions require that the military break out of its service parochialism and address these domain challenges from a Joint perspective. The fusion and exercise of activities from both the D/AADC and AADC are key to protecting US service members operating in the littoral.

Operations in littoral regions are historically challenging for Joint integration—done poorly, they create opportunities that the enemy can exploit for tactical, operational, and strategic advantage. But they are not without solutions. As the military looks to firm up US multidomain dominance, it should remember that control of any domain does not depend solely on the forces best designed and postured to operate in that domain but also on the contributions and support of the Joint force whose reinforcing and complementary

---

2. *Joint Air Operations*, Joint Publication (JP) 3-30 (Chairman of the Joint Chiefs of Staff [CJCS], 25 July 2019, validated on 17 September 2021).

3. David Barno and Nora Bensahel, “Drones, the Air Littoral, and the Looming Irrelevance of the U.S. Air Force,” *War on the Rocks*, 6 March 2024, <https://warontherocks.com/>; Chris Gordon, “Air Force Must Rethink How to Achieve Air Superiority, Chief Says,” *Air & Space Forces Magazine*, 29 February 2024, <https://www.airandspaceforces.com/>; James B. Hecker, “Air Superiority: A Renewed Vision,” *Æther* 3, no. 3 (2024), <https://www.airuniversity.af.edu/>; and Chris Gordon, “Small Drones Force New Thinking on Air Superiority, Slife Says,” *Air & Space Forces Magazine*, 31 July 2024, <https://www.airandspaceforces.com/>.

efforts provide the means and methods to mitigate structural gaps of any one service. Nowhere is this more evident or important than at the domain periphery.

## The Nature of Littoral Regions

Within the Joint community, members of the maritime component generally cringe when they hear other components speak about littoral regions not associated with the sea. From their vantage point this is understandable—control of the maritime littoral is one of the hardest tasks they pursue and one which they have dedicated themselves to mastering for the entirety of their existence. Over the years, they have met this challenge with varying degrees of success, evolving organizations, materiel, doctrine, and tactics to address the growing complexity of the land-sea environment. Though this is a never-ending endeavor and there have been setbacks—most notably the ill-fated example of the littoral combat ship—there has been genuine and continuous effort by the Department of the Navy to figuratively bridge the land-sea divide to enable the operations of Soldiers and Marines ashore from the Navy afloat.<sup>4</sup> Understanding the nature of the traditional littoral region is therefore useful in applying its concepts to other domains.

The *US Marine Corps Supplement to the DOD Dictionary* defines *littoral* in terms of its relation to the sea, stating that it is a “zone of military operations along a coastline, consisting of the seaward approaches from the open ocean to the shore, which must be controlled to support operations ashore, as well as the landward approaches to the shore that can be supported and defended directly from the sea.”<sup>5</sup> Thus, conceptually, the littoral is a domain boundary, characterized by a state of constant flux and being acted upon, defended, and supported by at least two services. From a ground-based perspective, this would be akin to maneuver control measure boundaries between adjacent units, shifting constantly and dramatically, while each unit coordinates C2 to provide uninterrupted mutual support and defense across the divide.

This is complex—even within a single service using the same approaches and methods of C2—and history is littered with examples where gaps and seams have afforded enemies epic opportunities for exploitation. Based on this reality, to state that the air littoral dividing the land and air domain is as dynamic and complex as the maritime littoral—with its subsurface considerations and environmental states—is an oversimplification and simply not accurate. Still, by characterizing the littoral in more broad terms, as a main transitional space, the lessons and thought processes of managing the maritime littoral can be informative, particularly since at just over 100 years old, the Air/Land Integration problem is still relatively young when one considers that military theorists have worked to perfect amphibious operations for several millennia.

---

4. Joaquin Sapient, “The Inside Story on How the Navy Spent Billions on the ‘Little Crappy Ship,’” *Pro-Publica*, 7 September 2023, <https://www.propublica.org/>.

5. *Marine Corps Supplement to the DOD Dictionary of Military and Associated Terms*, MCRP 5-12C (Department of the Navy, as amended through 10 September 2020), II-45, <https://www.marines.mil/>.

For example, it should not be overlooked that the complexities of the maritime littoral have essentially forced the US Navy to formally consider dividing itself into two different organizations broadly recognized as the blue-water Navy and the green-water Navy—with equipment, doctrine, and C2 to support operations in coastal waters—while maintaining sea control and power projection in the broad ocean areas.<sup>6</sup> Beginning in the 2000s, the Navy pursued such efforts to make this distinction more pronounced. Reenvisioning what air superiority looks like going forward, US military planners may consider this bifurcated model, with corresponding macro-airspace and micro-airspace requiring different tools and techniques to achieve the requisite level of control and dominance.

### **Building a Littoral Mindset**

Beyond concerns of structure, procedure, and design, there are philosophical considerations that need to be addressed to approach the problem of the air littoral from a more Joint mindset. While not always perfect, and assisted by a unified departmental chain of command, the green-water Navy functions in the littoral because of the trust built between its forces and the Marine landing force it supports. This mutual understanding is sometimes absent in the relationship between the Army and the Air Force because the Army does not always view the surface of the Earth as a domain boundary.

Yet it is just that—requiring coordination no different from moving one ground unit into another ground unit's area of operations. Within the multidomain operating concept the Army delivers effects and executes operations in multiple domains with integration sometimes a secondary concern to expediency when it comes to enhancing landpower.<sup>7</sup> That this approach is justified, based on the scale of activities in the land domain, that the preponderance of the enemy's forces exists in the land domain, and that most wars have historically been decided in the land domain, do not negate the corrosiveness of this mindset on mutual trust and cooperation between the services. The unfortunate result of this is that when challenges emerge in the air littoral, such as UAS and loitering munitions, the Air Force and the Army conveniently point to each other to solve their collective problem.<sup>8</sup>

Mutually agreed upon and practical procedural solutions like the coordination level and coordinating altitude may help define the edges of the littoral, but they do

---

6. Wayne P. Hughes Jr. et al., *The New Navy Fighting Machine: A Study of the Connections Between Contemporary Policy, Strategy, Sea Power, Naval Operations, and the Composition of the United States Fleet*, NPS-OR-09-002-PR (Director of Net Assessment, Office of the Secretary of Defense, 2009), <https://calhoun.nps.edu/>; and Wayne P. Hughes, "Build a Green-Water Fleet," *Proceedings* (June 2018), <https://www.usni.org/>.

7. *Operations*, Field Manual (FM) 3-0 (Headquarters, Department of the Army, 22 October 2022), <https://armypubs.army.mil/>.

8. Greg Hadley, "Army Air and Missile Defense Growing to Meet Air Force Demand," *Air & Space Forces Magazine*, 15 October 2024, <https://www.airandspaceforces.com/>; Ken Klippenstein, "American Base in Jordan Where Drone Killed 3 U.S. Troops Dogged by Inadequate Air Defenses," *The Intercept*, 6 February 2024, <https://theintercept.com/>; and Barno and Bensahel, "Drones."

not obviate Joint roles and responsibilities which persist throughout the totality of the air domain, and they certainly do not regulate the actions of the enemy along that divide. The area air defense commander is still the AADC below the coordination level—and may just have to rely more on the D/AADC, a Soldier with Army assets, to take on that particular problem set.

Air superiority and its maintenance are thus the responsibility of all airspace users, just as land dominance cannot be achieved if adjacent formations do not fulfill their responsibilities on the other side of a unit boundary. Arriving at a common understanding about operations in the air littoral requires increased dialogue between the services and an appreciation for what each service brings to the fight in the transition space and how it will be integrated to mutual benefit. To build the requisite trust, the components must increase support for each other's exercises to attain more repetitions and sets each year working together in the littoral. If this does not occur through the expansion of Joint airspace training, schooling, and academics, it will most certainly occur on the battlefield with a much harsher teacher.

## **The Ukrainian Air Littoral and the Lessons of Kursk 2024**

Russia's war with Ukraine continues to provide valuable insights into future warfare, especially in the air littoral. There are three main areas that can be highlighted as particularly relevant to success; they are component integration in support of joint combined arms maneuver, protection, and mass. To understand why these principles are so important one needs to briefly focus on the environment in which the combatants are operating.

On the ground, the battlefield in Ukraine is littered with integrated air defense systems that can both detect and destroy airborne assets at extended ranges.<sup>9</sup> In the surface-to-surface fight, long-range shooters exist at a density that the United States has not experienced in modern warfare.<sup>10</sup> In the electromagnetic spectrum, electronic warfare (EW) is being used extensively for attack, defense, and targeting on both sides. Two years into the war, above the air littoral, aerial combat—that is, dogfighting—is relatively rare. At high altitude, aside from the notable exception of the two Russian A-50s that were brought down in early 2024, neither side appears to want to contest the area over Ukraine, preferring to operate from sanctuary at reduced effectiveness.<sup>11</sup> Far more aircraft are being destroyed on the ground at their airbases than are being shot down.

Meanwhile, war in the air domain is raging below 10,000 feet, with fixed-wing and rotary-wing assets regularly falling prey to man-portable air defense systems

---

9. Christopher Koeltzow, Brent Peterson, and Eric Williams, *F-16s Unleashed: How They Will Impact Ukraine's War* (Center for Strategic and International Studies [CSIS], June 2024), <https://www.csis.org/>.

10. Vikram Mittal, "Artillery Is Still the King of Battle in the Russia-Ukraine War," *Forbes*, updated 17 July 2024, <https://www.forbes.com/>

11. Phelan Chatterjee, "Ukraine Says It Has Downed Second Russian A-50 Spy Plane in Weeks," *BBC News*, 23 February 2024, <https://www.bbc.com/>.

(MANPADS) and sharing space with a plethora of loitering munitions and UAS which seem to be filling an ever-expanding set of roles.<sup>12</sup> This UAS mission set now spans traditional ISR and bomber missions to pursuit/fighter missions, and most recently, incendiary attacks.<sup>13</sup> The lack of air superiority on either side has impacted the ability of the combatants to engage in traditional fire and maneuver and prevented them from successfully pursuing a war of annihilation, driving both sides to a grinding attrition-based model. This has generally been the status quo across much of the country, except where targeted planning, coordination, and synchronization of combined arms have broken this stalemate.

Such was the case at Kursk, where in August of 2024, Ukraine demonstrated what could be accomplished by pulsing joint integrated combat power into the air littoral to establish local air superiority through combined arms, making notable use of electronic warfare and air defense in close coordination with micro-airpower.<sup>14</sup> Unlike previous efforts, this attack was highly focused and coordinated, and targeted a seemingly forgotten part of the line in eastern Ukraine following an extensive intelligence preparation of the operating environment that included a detailed analysis of enemy frequencies and collection capabilities.

This is a major lesson. Beyond the vertical dimension, the air littoral obviously has a breadth to it as well. Despite the massive number of troops on both sides, large-scale combat operations in Ukraine significantly stretched the ability of the combatants to defend such a wide frontage. At many places along the line, defenders are relatively thin and susceptible to isolation, connected only by interlocking fields of fire and drones providing overhead ISR to truncated kill chains. At Kursk, the Ukrainians proved that the battlefield was not yet quite as transparent as many believed and successfully masked their movements and intentions by systematically downing the picket line of Russian early-warning and ISR drones through EW, short-range air defense, and air-to-air drone combat.<sup>15</sup> After rapidly massing forces and positioning air defense and EW assets in the breach to prevent the refill of Russian sensors and enemy drones, Ukrainian forces punched a hole in the Russian line and drove deep.

---

12. Isabel van Brugen, "Ukraine Shoots Down Russian Su-25 Jet in MANPADS Strike," *Newsweek*, 28 August 2024, <https://www.newsweek.com/>.

13. Brad Lendon, "Ukraine's 'Dragon Drones' Rain Molten Metal on Russian Positions in Latest Terrifying Battlefield Innovation," *CNN*, updated 7 September 2024, <https://www.cnn.com/>; Jason Bellini, "Dogfighting Drones Open a New Chapter in Ukraine's Aerial War Against Russia," *Scripps News*, 3 September 2024, <https://www.scrippsnews.com/>; "The Battle Between Drones and Helicopters in Ukraine," *The Economist*, 4 September 2024, <https://www.economist.com/>; and Jason Sherman, "Drone-on-Drone Combat in Ukraine Marks a New Era of Aerial Warfare," *Scientific American*, 20 February 2024, <https://www.scientificamerican.com/>.

14. Erica Nitschke, "Ukraine's Week-Old Incursion into Russia Has Embarrassed Putin. How Will It Affect the War?," *Portland Press Herald*, 13 August 2024, <https://www.pressherald.com/>.

15. Matthew R. Arrol, Jason C. Slider, and Milford Beagle, "The Graveyard of Command Posts: What Chornobaivka Should Teach Us About Command and Control in Large-Scale Combat Operations," *Military Review* (May–June 2023), <https://www.armyupress.army.mil/>; and David Hambling, "Could Small Drones Really Replace Artillery?," *Forbes*, 17 August 2023, <https://www.forbes.com/>.

In a model of multidomain operations, the Ukrainians effectively penetrated the Russian bubble of protection, disintegrated Russian C2, and exploited the gap created by rapidly pushing forces and capability into the void. Part of the exploitation phase of this offensive since has included massive drone swarms that have targeted Russian airfields in what can best be described as concentrated offensive counterair from the air littoral.<sup>16</sup>

While component integration enabling combined arms maneuver will hold the secret to breaking the stalemate, Ukraine is also teaching the West that the protection warfighting function is paramount to ensuring the military retains the combat power necessary for exploiting success. To achieve this, the area air defense commander must support and comprehensively employ both active and passive protection measures. The ability to protect friendly forces requires a layered approach to ensure the Joint force understands the whole air and missile defense picture. Integrated air defense design, down to the micro-level which nests both ground-based air defense assets and aerial-based air and missile defense, will allow commanders to better understand risk to force and risk to mission. To assist, leaders in the land domain must develop a deeper understanding of defensive counterair—which often consumes the availability and loadout of multirole aircraft—and acknowledge that the resources required to provide defensive counterair will limit assets available for air interdiction or close air support missions. Simultaneously, the force must be prepared for the temporary loss of air littoral control and emphasize the importance of passive measures as well.

This concern impacts a variety of areas. It affects the way the United States commands and controls its forces and drives the Joint force to move from static tactical operations centers to more mobile, hardened, or austere hiding-in-plain-sight C2 options; this is a trend that has also been seen in Ukraine.<sup>17</sup> It increases the importance of terrain management, to enable distributed operations and facilitate the survivability of systems, lines of communications, and sustainment nodes. It increases the need for discipline in masking signatures and physically hardening position areas. For the air component, beyond C2, this implies positioning forces to maximize survivability and changing their operating concept to a more expeditionary approach along the tenets of agile combat employment.<sup>18</sup> Ukraine has taught the United States and its Allies that only through adopting a protection-based mindset will the Joint force be successful in the congested/contested air littoral.

The final lesson of Ukraine involves the concept of mass as a principle of warfare. Western militaries are often enamored with joint long-range fires, in the belief that

---

16. Martin Fornusek and the Kyiv Independent News Desk, “Drone Swarms Play Key Role in Ukraine’s Kursk Incursion, Times Reports,” *The Kyiv Independent*, 17 September 2024, <https://kyivindependent.com/>.

17. Siegfried Ullrich and Sean Moriarty, *Lessons Learned from the Ukrainian Territorial Defense Forces: Command Post Survivability*, ed. Zack Shelby (Center for Army Lessons Learned, 6 February 2024), <https://www.army.mil/>.

18. Benjamin Hagart, “Artificial Intelligence and Agile Combat Employment,” *Military Review* (May–June 2024), <https://www.armyupress.army.mil/>.



precision and range will accomplish operational objectives more efficiently without having to resort to brute force and mass in the intimate close fight. Historically, however, the will and resilience of America's enemies to the limited quantities of operational and strategic fires available suggest that the ability to clear airspace and fire massive amounts of conventional artillery and mortars is what wins wars and that activity profoundly impacts the air littoral.<sup>19</sup> In this context, quantity has a quality of its own, and mass delivers both a physical and a psychological effect that should not be discounted.<sup>20</sup>

What is somewhat new in Ukraine is that mass and precision appear to be combined through the ubiquity of low-cost drones and loitering munitions which offer a high return on investment. If loitering munitions, drones, and specifically drone swarms are ascendant as an additive form of mass alongside artillery, which appears to be the case, it makes sense to deliver that mass as efficiently and continuously as possible.<sup>21</sup> The congested air littoral may create conditions that cause difficulty for long-range assets, but the necessity always exists to close with and destroy the enemy in the last 100 yards. Therefore, in delivering mass within the air littoral, in all its forms, the Joint force must consider how to optimize the space available to deliver the desired effect.

This article has listed a couple of examples of clear takeaways that can be derived from the evolution of operations in the Ukrainian air littoral. These lessons should inform how the United States tackles its own Joint challenges in this space going forward.

## **Recommendations for the Joint Force: Dominating in the Air Littoral**

This article thus recommends some of the ways to turn these observations into practical solutions to improve Joint performance in the littoral space. Control of the air littoral is a counterair mission in a subregion of the air domain. One could consider the counterair framework in the air littoral as micro-offensive counterair and micro-defensive counterair. Like all counterair missions, they are inherently Joint and interdependent. What is being observed in Ukraine, and especially in the Kursk operation, is the rapid tailoring of these traditional concepts with specialized subdomain specific equipment, improvised C2, and tactics and techniques proliferated through organizational learning. As the US Joint Force looks at the air littoral supremacy challenge from a doctrine, organization, training, materiel, leadership and education, personnel, and facilities standpoint, the doctrine is largely already there—one need only to apply it to a new environment and consider its implications.

Other recommendations to organizational, materiel, doctrine, and training aspects of air littoral-focused operations are as follows. Organizationally, counterair operations

---

19. Tami Davis Biddle, *Rhetoric and Reality in Air Warfare: The Evolution of British and American Ideas about Strategic Bombing, 1914–1945* (Princeton University Press, 2009); and Mittal, “Artillery.”

20. Sergio Miller, “The Russian Army Death Cult,” *Wavell Room*, 16 May 2024, <https://wavelldroom.com/>.

21. Hambling, “Small Drones.”

in the littoral are going to affect the theater air-ground system, and this phenomenon is already playing out in certain areas.<sup>22</sup> For example, in the US Central Command area of responsibility, the 4th Battlefield Coordination Detachment (BCD)—the Army organization purpose-built for air-land integration at the theater level—has stood up a counter UAS cell to support operations in the region and increase coordination at the air operations center between Army forces and the Joint Force air component command on efforts in the air littoral.<sup>23</sup> Despite not being staffed or designed for this mission, 4th BCD is doing this out of necessity.

Building on this idea, a reasonable recommendation for the area air defense commander would be to expand this concept into other elements of the tactical air control system, the air component's contribution to the theater air-ground system. One possibility might be to expand the control reporting center which often acts as a regional air defense commander to manage the air littoral fight in a region. Staffing and equipping this organization with the ability and mandate to focus on, coordinate, and synchronize micro-offensive counterair/micro-defensive counterair would facilitate unified AADC command and control at echelon. Alternatively, on the Army air-ground system side of the theater air-ground system, this could occur at the division Joint air-ground integration center or at the corps, the echelon intended to facilitate convergence. Returning for a moment to the maritime littoral example, this approach would be not unlike establishing a brown-water Air Force and a metaphorical commander of the air littoral force to manage it.

In the material space, the evolution of manned flight in warfare seems to be repeating itself in the unmanned arena as militaries around the world seek to dominate the air littoral. What started as UAS providing ISR capabilities, with the widespread use of RQ-2s in the Gulf War, progressed to bomber-like capabilities and has now evolved, democratized, and proliferated to the point where first-person view and pursuit/fighter drones are now being improvised in Ukraine and purpose-built elsewhere.<sup>24</sup> These new air-to-air drones will be instrumental to fulfill the sweep mission of micro-offensive counterair and were already employed in this approach in the lead-up to Kursk.

Furthermore, a new generation of systems that are being referred to as launched effects—which include the Raytheon Coyote and Anduril's Altius-700 and Roadrunner vertical takeoff and landing systems—represents a natural evolution to control the air littoral and offers an array of multi-mission, single-use, or recoverable air- and

---

22. "Appendix A: Theater Air Ground System," in *Multi-service Tactics, Techniques, and Procedures for Theater Air Ground System*, Army Technical Publication (ATP) 3-52.2/Marine Corps Reference Publication (MCRP) 3-20.1/Navy Tactics, Techniques, and Procedures (NTTP) 3-56.2/Air Force Tactics, Techniques, and Procedures (AFTTP) 3-2.17 (Air Land Sea Space Application Center, 22 August 2024), 53, <https://armypubs.army.mil/>.

23. Col Johannes Castro, commander, 4th Battlefield Coordination Detachment, personal discussions with Matthew Arrol on counter unmanned aircraft systems, 6 May 2024.

24. "Pioneer RQ-2A UAV," National Air and Space Museum, accessed 11 October 2024, <https://airandspace.si.edu/>.

ground-launched versions.<sup>25</sup> Not every solution needs to be high-end and expensive; the Ukrainians are having success hunting drones from propeller-driven aircraft, indicating that there may be broader missions for low-end aircraft like the AT-802 Sky Warden or new air-to-air roles for Army attack aviation in high intensity conflict.<sup>26</sup>

Regardless, both services astride the air littoral need to invest in these types of capabilities. Given the breadth of the battlefield and the air littoral in large-scale operations, the ground force cannot defend everywhere in strength. To avoid the experience seen in Ukraine, the air component needs to leverage its flexibility, versatility, and persistence to seed launched effects in areas where ground forces are thin. Furthermore, within the framework of Combined Joint All Domain Command and Control, launched effects and future drone forces need flexibility within an open C2 architecture to allow them to be controlled by a wide variety of Joint C2 nodes and the ability to be used in an aggregated fashion as swarms or as individual sentinels.<sup>27</sup> Additionally, this sensing capability needs to be tailored and layered to the airborne threat in the littoral where targets are often too small to be observed with traditional radar. The Ukrainians are having some initial success with a low-cost federated sensor net, which the West could learn from and build on.<sup>28</sup>

Doctrinally, the Joint force should also consider how it characterizes the multidomain aspects of the air littoral environment to ascertain what the level of air superiority actually is in that subdomain. In doing so, the Joint force should ask certain questions to define the level of control: What is the relative combat power, density, and correlation of drone forces within a given area? What is the electromagnetic environment like? How diverse are the signals? What is the level of air defense integration, and how deep and diverse is the defense design? What is the quality of enemy troops in the area?

Additionally, Joint and multi-service doctrine should articulate roles and responsibilities for the coordinated employment of launched effects, EW employment, and robotic air-to-air combat at various altitudes within the air littoral. Not everything requires governance, but the military must optimize its resources to align the best shooters, sensors, and C2 nodes.

---

25. "Coyote," Raytheon RTX (website), accessed 11 October 2024, <https://www.rtx.com/>; Anduril Industries, "Altius-700m Hits All Targets in Successful Test of Largest Loitering Munition on the Market," Anduril, 14 March 2024, <https://www.anduril.com/>; and Ashley Roque, "Anduril Unveils VTOL Roadrunner-Munition for Aerial Defense, One US Customer Buying In," *Breaking Defense*, 1 December 2023, <https://breakingdefense.com/>.

26. David Axe, "Ukraine Is Mobilizing More Propeller Planes to Shoot Down Russian Drones, World War I Style," *Forbes*, 8 July 2024, <https://www.forbes.com/>; and "Sky Warden" ISR Strike Aircraft," L3Harris® Fast. Forward., accessed 11 October 2024, <https://www.l3harris.com/>.

27. Brandi Vincent, "What's Next for the New CJADC2 Minimum Viable Capability," *DefenseScoop*, 26 February 2024, <https://defensescoop.com/>.

28. Tyler Rogoway and Howard Altman, "Ukraine's Acoustic Drone Detection Network Eyed by U.S. as Low-Cost Air Defense Option," *The War Zone*, 24 July 2024, <https://www.twz.com/>.

Lastly, the Joint force needs to continue to refine its subdomain awareness and progress its methods of control within the littoral from reliable but inefficient procedural methodologies to more refined machine learning and artificial intelligence (AI)-based models that blend positive control with predictive techniques. One such project to accomplish this is the Defense Advanced Research Projects Agency Air Space Total Awareness for Rapid Tactical Execution software suite, an automated flightpath planning capability which uses AI to accelerate the creation of safe air route alternatives by rapidly ingesting environmental and user-generated data and quickly producing optimized mission planning products.<sup>29</sup> This, and C2 enhancements like it, will be critical to achieving an information and operational advantage against America's adversaries in the air littoral of the future.

Finally, there is no substitute for experience, and as previously stated, the military must train Jointly for the air littoral before operating in it in combat. The nature of future threats in the air littoral will inherently be Joint, and both Army and Air Force leaders should train future commanders for these threats, with courses like the Joint Air Operations Command and Control Course and the Echelons Above Brigade Air-space Course.<sup>30</sup>

On the Army side, there has been extensive work done to better prepare for the air littoral by incorporating UAS and drone swarms at the major maneuver centers like the National Training Center. That good work in the dirt should continue at the tactical level. Unfortunately, that opportunity has not been fully embraced in major command post exercises at the operational level, where convergence opportunities reveal themselves and can be exploited. While the Army must do more to address the environment in its corps warfighters, the Air Force especially needs to more accurately represent the fight in the air littoral at its premiere C2 event, Blue Flag, where achieving air superiority still equates to sweeping the skies of the enemy's manned aircraft—which, while necessary, is not sufficient on the modern battlefield. In order to practically control the air littoral, the Joint Force air component commander/AADC must have the tools, techniques, and procedures to gain awareness of that space and direct actions within it. Only in conjunction with Blue Flag will incorporating air littoral considerations into a force-on-force event like Red Flag yield persistent and integrated results. This requires greater involvement from Army partners in these activities.

Together the Joint force needs to do a better job of replicating this environment and putting stress on the AADC and the D/AADC to illustrate the consequences of failure in this subdomain. This may mean that the Joint force has to adjust its simulations and models to better represent the complexity, congestion, and lethality of the airspace below 10,000 feet. Only by doing this will the United States be able to experi-

---

29. "Air Force, Army Battle Labs Work with DARPA on ASTARTE, New C2 Capability," US Air Force, 31 August 2023, <https://www.af.mil/>.

30. 505th Command and Control Wing Public Affairs, "505th Training Squadron," USAF, 19 September 2023, <https://www.af.mil/>; and "Army Joint Support Team (AJST)," US Army CAC, accessed 11 October 2024, <https://usacac.army.mil/>.

ment with and show the utility of new organizational designs and doctrine aimed at achieving a competitive advantage against a near-peer adversary unable to visualize, train, and wargame in this environment.

## **Conclusion**

If it is true that America and its Allies could lose a war in the air littoral, then its corollary—that they could win a war in the air littoral—is also true. If the Joint force protects its seams and dominates the transition space between the surface and where traditional airpower has historically operated, then it can deliver operational and strategic effects in both the land and air domain. This requires working together to provide appropriate command and control through the establishment of organizations designed to focus on the unique attributes of this subdomain. It further demands that the Joint force adapt tactics, techniques, and procedures to execute Joint counterair operations at the micro-level and continue to develop and field materially low-cost/high-volume solutions designed to integrate into a kill web that will function at scale and deliver a positive return on investment.

If the military is able to do this, it may spare America the attritional stalemate that has plagued Russia's war in Ukraine and return combined arms maneuver to the battlefield, just as Ukraine was able to do at Kursk in early August 2024. Establishing superiority in the air littoral will enable information advantage, mask friendly intentions, and achieve tactical surprise, allowing the United States and its Allies to act decisively and converge effects to deliver the operational objectives sought.

While the focus here was on the immediate threats to air superiority and the way and means by which the area air defense commander and their Joint team could establish control in the air littoral, it is important to pause before closing to consider the next logical implications of littoral regions outside of the maritime and air domain previously discussed.

If the evolution of asymmetric threats into the air littoral is any indication, then it is reasonable to expect that future asymmetric threats will similarly appear at the periphery of other domains. For example, the ongoing development of high-altitude capabilities simultaneous with the increased utilization of satellites in persistent low Earth orbit would suggest that the next fight may be over the space littoral with the air domain. The criticality of the space domain makes this a fight the Joint force can ill afford to lose and one in which the air component may be the supporting command to the space component.

Alternatively, at some point in the future, at the opposite end of the spectrum from space, the military may have to concern itself with defending against bioweapons and nanotechnology that threaten friendly forces at the molecular level. Fortunately, the fight over the molecular littoral will be consigned to science fiction for the foreseeable future—but it is another area that requires monitoring from a science and technology standpoint.

As the United States moves forward in this strategic environment of great power competition, the Joint force should be mindful of the precept that its past success on

the battlefield entitles it to nothing in the future. Control in every domain will be fought over and contested relentlessly by America's enemies, who will study its victories, seek to exploit its hubris, and take advantage of any seam they can find to undermine the Western way of war and exact costs in an effort to inflict a strategic defeat. The United States must be prepared to meet them in whatever domain or subdomain they choose, negate their asymmetric threats, seize the initiative, and leverage its experience in Joint and multidomain operations to deny, degrade, and defeat them in a war of annihilation. Æ

### **Disclaimer and Copyright**

The views and opinions in *Æther* are those of the authors and are not officially sanctioned by any agency or department of the US government. This document and trademark(s) contained herein are protected by law and provided for noncommercial use only. Any reproduction is subject to the Copyright Act of 1976 and applicable treaties of the United States. The authors retain all rights granted under 17 U.S.C. §106. Any reproduction requires author permission and a standard source credit line. Contact the *Æther* editor for assistance: [aether-journal@au.af.edu](mailto:aether-journal@au.af.edu).