



LIMINALITY

Opportunities in the Transition Space of the Air Littoral

BRANDEN W. GULICK

Through a multidisciplinary approach using folklore and anthropology, psychology, and war theory, this article defines the air littoral as a liminal space—a threshold and transition between air and space—that is more cognitive than physical. This not only creates challenges but also offers opportunities for exploitation and power projection. Irregular warfare theory and systems thinking around design for complexity connect the disparate fields to demonstrate how to operate in this space and outmaneuver adversaries, building a framework for the US Air Force to exploit the problems inherent in the air littoral. In this way, operators will gain advantage in what is ultimately a cognitive fight.

The air littoral is emerging as a contested environment as the parallel technologies of small-unmanned aircraft systems (sUAS) and artificial intelligence (AI) converge. The US Army is beginning to stake its claim in the air littoral due to its closer proximity to the land domain, the historical precedence of smaller, airborne weapon systems, and the reluctance of the US Air Force to engage in spaces with less defined roles for traditional airpower. The air littoral is liminal in nature: it is both a threshold and a transition space between traditional, ground-based assets and dedicated air assets for which the Air Force is responsible. As such, the air littoral—characterized by nebulous borders—carries with it feelings of unease and a lack of definition that make operating within it difficult under the best of circumstances.

Research from folklore and anthropology provides the contours and understanding of the enduring qualities of liminal spaces. The field of psychology offers further detail on why liminality is so disturbing to rational thought. War theory, including principles of war, then illustrate the context of the air littoral's liminal space. This framing of the air littoral is less about the physical domain in which it exists, nestled between the land and the air, and more about the cognitive space in which it resides, which is the linkage between liminality and exploitation.

Finally, irregular warfare theory and systems thinking around design for complexity connect these disparate fields together to provide the tools not only to operate in

Lieutenant Colonel Branden Gulick, USAF, is the operations officer, 821 Contingency Response Squadron, Travis Air Force Base, and holds a master of military operational art and science from Air Command and Staff College and a master of philosophy in military strategy from the School of Advanced Air and Space Studies.

this space but also to outmaneuver adversaries. This article argues this multidisciplinary approach across such disparate fields builds a framework for understanding the problems and exploiting the gaps inherent in the liminal spaces of the air littoral to gain advantage in what is ultimately a cognitive fight.

Defining Liminality and its Psychology

Before delving into the air littoral and its practical implications, a discussion on liminality helps explore the themes of this space to understand the true nature of the air littoral more fully. Anthropologists and folklorists examine the realm of liminality due to its pervasive role in rituals and mythology. As Joseph Campbell opined in his study of the hero's journey in mythic narratives, the world is "bound . . . in the four directions . . . standing for the limits of the hero's present sphere, or life horizon," stating that "beyond them is darkness, the unknown, and danger . . . beyond the protection of his society is danger to the member of the tribe."¹ Campbell described this liminal space as a threshold that a hero must cross to emerge changed and ready for the trials to come. Liminality itself refers to "a very long threshold, a corridor almost," where objects and people are "betwixt-and-between established states of politico-jural structure."²

Most striking for the purpose of this article is how one anthropologist describes liminal spaces as "evad[ing] ordinary cognitive classification, too, for they are neither-this-nor-that, here-nor-there, one-thing-not-the-other."³ The disconcerting nature of liminality comes from this lack of definition, representing a deeply unsettling state of change. And yet, it is an experience of every human being. Teenage years are a liminality, marking one's transition between child and adult, having resonances and characteristics of both but never quite being either. The purpose of rituals of adulthood is to define the transition from childhood, complete with a change in responsibilities and expectations, all of which can be scary for those preparing to cross the proverbial threshold.

Above all, the liminal space is a transition, and it carries deep emotional resonance most often characterized by uncertainty, anxiety, and fear. These emotions, which challenge human cognition, are key to tying together the notion of liminality to the air littoral. Moreover, the resulting interplay of chaos and sensemaking is essentially what comprises consciousness.⁴ Humans learn by interacting with a chaotic environment and making sense of what they see, processing the result as memory to create pathways of understanding that can be referenced when faced with future experiences.

As is seen in coming-of-age stories and experiences across cultures, when these interactions are especially powerful or overwhelming, they generate a trauma, through which

1. Joseph Campbell, *The Hero with a Thousand Faces*, 3rd ed., Bollingen Series XVII (Novato, CA: New World Library, 2008), 64.

2. Victor Turner, "Chapter III: Variations on a Theme of Liminality," in *Secular Ritual*, ed. Sally F. Moore and Barbara Myerhoff (Assen, Netherlands: Van Gorcum, 1977), 37, <https://sites.tufts.edu/>.

3. Turner, 37.

4. Robert Berezin, "Consciousness Encompasses and Reflects Chaos and Order," *Psychology Today* [blog], July 15, 2024, <https://www.psychologytoday.com/>.

a new pathway eventually opens to process and handle this new experience.⁵ These traumatic lived experiences can, in some cases, help individuals grow and develop within the context and understanding of the broader culture and society. Liminality creates trauma by being unsettling, forcing one to either choose to embrace the space or reject it entirely. There are consequences for both actions, but this forcible choice—this coercive experience—can be a means of exploitation given the right framing because of the role it plays in human cognition and how it undermines logical or rational responses. For that framing, it is prudent to turn to more traditional war theory.

Liminality in War Theory

The Army has made the initial claim to the air littoral, creating educational and training courses, developing platforms, and integrating the capability into planning, perhaps sensing a more traditional-minded Air Force's trepidation toward and resistance to unmanned systems, that sees only tenuous associations to longstanding notions of airpower.⁶ Yet, this is a land-based mentality, focused (as it should be) on occupying space—owning the territory while protecting land-based assets from air attack.

The ethereal nature of the air precludes long-term ownership; one cannot occupy the air definitively or in any enduring fashion. The air is itself a liminal space, marking the boundary and transition of the terrestrial habitat of humanity from the greater cosmos that has figured into human desire and oral tradition since prehistory. Technology advances opened further vistas in the skies, providing greater reach and distance, all while normalizing flight as an almost mundane experience. The Wright Flyer appears as a flimsy contraption next to the SR-71 Blackbird, and they are only separated by six decades. Yet, each milestone along this technological advancement increased the ceiling, distance, and speed that aircraft could traverse, further changing humanity's conception of what "flight" meant.

The rise of drones is unique in that it has not opened new territory. Instead, this technology has thinly sliced the greater sky into much smaller segments, the air littoral, where traditional airpower has moved away in the name of higher, faster, and longer. The air littoral is both an emergent aspect of the fusion of technology and the ecosystem of the air domain and an enduring quality of the air itself as a liminal space.

This thin slicing of the air into the air littoral exacerbates air's liminality, confusing the traditional roles of airpower and landpower and blurring the lines of responsibility between them. This is the epitome of liminality, being both familiar in terms of airpower and generating feelings of uncertainty because of the novel approaches sUAS present to the Joint force. Airpower theory, for all its faults, has traditionally understood the inherent flexibility of the domain, embracing the way it flips the narrative by

5. Berezin.

6. See, for example, Maximilian K. Bremer and Kelly A. Grieco, "The Air Littoral: Another Look," *Parameters* 51, no. 4 (Winter 2021–22); and David Barno and Nora Bensahel, "Drones, the Air Littoral, and the Looming Irrelevance of the U.S. Air Force," *War on the Rocks*, March 7, 2024, <https://warontherocks.com/>.

ignoring distance and thinking in terms of time and increasing the scale of operations.⁷ This theme of a shift in thinking is key to discovering the means of framing how the air littoral can be exploited, which can be ascertained using traditional war theory.

Maneuver and Tempo

War, like all human activity, is an enduring characteristic of human interaction and a means for executing conflict. Traditionally, principles of war evolved from experiential learning by commanders and generals sensing patterns or means of fighting. One of the most basic principles is that of maneuver, defined as the “place[ment] of the enemy in a position of disadvantage through the flexible application of combat power.”⁸ It must be pointed out that maneuver, thought of in traditional movement of forces, is in fact a play to outmaneuver an opponent not only in the field, but also in the mind.

Military historian and strategist Martin van Creveld took this notion of maneuver and explicitly applied it to airpower. Of the six elements he defined that comprised maneuver—tempo, *Schwerpunkt* (“focal effort at the center of gravity”), surprise, flexibility, combined arms, and decentralized command—the most applicable to the air littoral and liminality is tempo.⁹ Tempo, as he indicated, is at the heart of John Boyd’s orient, observe, decide, act (OODA) loop, which focuses on creating, exploiting, and magnifying flaws in the enemy’s activity or, more crucially, in their thought process.¹⁰ Unlike speed, tempo involves pace, and controlling it focuses on accelerating or slowing down engagements by working inside of decision-making processes to increasingly break down cohesion until one can paralyze the enemy.¹¹

Maneuver through the control of tempo is focused on the adversary, the fight taking place in the mind as much as in the physical battlespace. As Boyd argued, “Terrain does not fight wars. Machines do not fight wars. People fight wars. It is in the minds of men that war must be fought.”¹² Even if sUAS in the air littoral will eventually be guided by AI systems, the ultimate arbiter of the engagement is still a human adversary. The fight must be won in the cognitive space of the adversary. This understanding establishes the framework of liminality that enables the exploitation of the air littoral via tempo control, making it the perfect place to exploit an adversary. For this reason, the previous argument concerning liminality is vital to dominating in the space.

7. Phillip S. Meilinger, *10 Propositions regarding Air Power* (Maxwell AFB, AL: Air Force History and Museum Program, 1995), <https://media.defense.gov/>.

8. *The Air Force*, Air Force Doctrine Publication 1 (AFDP-1) (Maxwell AFB, AL: Curtis LeMay Center for Doctrine Development and Education [LeMay Center], 2021), <https://www.doctrine.af.mil/>.

9. Martin van Creveld, *Air Power and Maneuver Warfare*, 7th ed. (Maxwell AFB, AL: Air University Press, 1994), 3–7.

10. Van Creveld, 3; and John Boyd, *Patterns of Conflict: A Discourse on Winning and Losing*, ed. Grant T. Hammond (Maxwell AFB, AL: LeMay Center, 2018), 135.

11. Van Creveld, 3.

12. Boyd, *Patterns*, 9.

Trauma

The liminal space that is the air littoral increases complexity as it is home to nebulous points of interaction that lead to emergent, dynamic environmental conditions. It is a deeply uncomfortable place for humans to operate within and can create the conditions for generating trauma. In Russia's war with Ukraine, this trauma is apparent in the ubiquitous nature of quadcopters raining down grenades on hapless troops in the trenches or suicide first-person view drones chasing infantry around support vehicles.

Humans are not accustomed to being prey, especially from the sky; this only exacerbates the trauma and is reminiscent of the advent of industrial artillery and machine guns and the rise of shell shock, now known as post-traumatic stress disorder, during World War I. Further evidence of this trauma can be seen in Iraqi troops during the First Gulf War and today in the videos of troops killing themselves or requesting their fellow troops kill them when they are injured and being stalked by drones in the fields of Ukraine.¹³

The prevailing assumption that placing autonomous systems to fight within the air littoral obviates or mitigates such trauma ignores that a human will be fighting on the ground or in the air as well as conducting the campaign through some means of command and control. Humans will have to engage with a complex cognitive space that will seem chaotic and may induce the types of traumas that trigger poor decision-making.¹⁴ The use of mental schema, patterns of behavior that help create order and predictability, increases humanity's susceptibility to these occurrences.¹⁵ Contradicting mental schema, such as the realities of a liminal space, make it far more likely that a person will disregard the information at hand, as in the case of some intelligence failures.¹⁶

This situation creates the perfect environment for cognitive dissonance, whereby a person must confront contradictory beliefs or choices, which is all but guaranteed in liminal spaces. Further complicating this process is the tendency for people to seek justification for choices, an unfortunate byproduct being the subsequent dismissal of

13. Tracy Wilkinson, "Iraqi POWs Tell of War's Terror and Fear of Future: Military: They Are Gradually Going Home, but What Awaits Them Is Potentially as Deadly as the Conflict," *Los Angeles Times*, April 8, 1991, <https://www.latimes.com/>; and Systema, Current Time, and Yelizaveta Surnacheva, "Drone Footage Shows Russian Soldier Killing Wounded Comrade, Investigation Finds," *RadioFreeEurope/RadioLiberty*, July 18, 2024, <https://www.rferl.org/>.

14. Elliot Atkins and Evan R. Seamone, "Remote Combat Exposure and Moral Injury from Drone Operations: The Cost of a New Form of Warfare," in *Preventing and Treating the Invisible Wounds of War: Combat Trauma, Moral Injury, and Psychological Health*, ed. Justin T. McDaniel et al. (Oxford, UK: Oxford University Press, 2023), <https://doi.org/>; and Rajiv Kumar Saini, M. S. V. K. Raju, and Amit Chail, "Cry in the Sky: Psychological Impact on Drone Operators," *Industrial Psychology Journal* 30, suppl. 1 (October 2021), <https://www.ncbi.nlm.nih.gov/>.

15. Yuen Foong Khong, *Analogies at War: Korea, Munich, Dien Bien Phu, and the Vietnam Decisions of 1965* (Princeton: Princeton University Press, 1992).

16. Khong, 257.

new information that would promote better understanding or even overturning the previous decision or convictions.¹⁷

Given these realities, the difficulties of operating in the liminal space become apparent, proving daunting even for those willing to embrace the opportunity for exploitation. Fortunately, there is a branch of warfare that is far more comfortable dealing with ambiguous spaces filled with ill-defined enemies dispersed in complex environments: irregular warfare. Irregular warfare is defined as “a struggle among state and non-state actors to influence populations and affect legitimacy.”¹⁸ This type of warfare, as it relates to the difficulties of the liminal spaces in warfare, provides further guidance for building out the framework for understanding the air littoral.

Irregular Warfare, the Liminal Space between War and Peace

Irregular warfare’s approach in dealing with ambiguity among combatants, the populace, and the environment provides the means of exploiting the liminality of the air littoral. Irregular warfare, called the “graduate level of war” by its practitioners, is conducted in conflicts featuring combatants with varying degrees of support living among a larger civilian populace and fighting against a superior, traditional military force, typically belonging to a state.¹⁹

Because the combatants rarely form large fighting forces, strike from the shadows, and hide among populations, defeating them is challenging. Not only does combat require consummate martial skill, but it also requires a deft understanding of politics and cultural sensitivities. Irregular warfare requires a different mindset, a shift from the conventional means of conducting war to an altogether dissimilar paradigm.

Irregular warfare is itself a liminal space, a nebulous transition between war and peace. As such, irregular war practitioners have developed principles such as complexity and context-dependent operations and tools focusing on mental agility and empowerment that are critical for dealing with this liminality.²⁰ These approaches to navigating irregular warfare provide useful frameworks for understanding the battlespace, operating within it, and ultimately for exploiting advantages it can provide to operators.

Irregular warfare requires embracing ambiguities in a way that complicates traditional displays of power and state-sponsored violence, providing a guide for how to negotiate the liminal space of the air littoral. Participants in irregular warfare have a distinct advantage in that time is almost always on their side; this, coupled with the

17. Robert Jervis, *Perception and Misperception in International Politics*, New ed. (Princeton: Princeton University Press, 2017).

18. *Joint Warfighting*, Joint Publication 1 (Washington, DC: Chairman of the Joint Chiefs of Staff, 2020), GL-4.

19. David S. Maxwell, “Is Counterinsurgency the Graduate Level of War?: Some Random Thoughts on COIN Today,” *Small Wars Journal* (blog), July 20, 2008, <https://smallwarsjournal.com/>.

20. James D. Kiras, “Irregular Warfare,” in *Understanding Modern Warfare*, by David Jordan et al. (Cambridge, UK: Cambridge University Press, 2016).

fact that they simply avoid losing as opposed to trying to achieve a decisive win, provides greater strategic flexibility against superior forces.

Irregular warfare's liminality lies in the space between nation-states conducting overt war and subgroups seeking political change, revolution, or opposing a foreign power. Because the fight is not dictated by states owning a monopoly on violence, a new set of rules comes into play, often at the behest of the irregular forces. As one irregular warfare expert points out, these forces have the distinct advantage of fighting in their own way, with their own rules, and within the context of their fight.²¹ In other words, they force their enemies to adapt to them, often gaining the initiative and exponentially increasing the difficulty of the fight.

This requires a mind shift for traditional forces seeking to engage irregular fighters on their home turf, which is why traditional forces often lose—as seen with the recent struggles of the US military during the Global War on Terror and the recent French experiences in Mali, Chad, and other former colonies. Being in this ambiguity is deeply uncomfortable and, as stated previously, creates the space cognitively for problems to occur. This is where irregular warfare specialists shine in terms of theory and where planners for the air littoral must explore to find the means for exploitation of the liminal space.

By understanding the context of fighting in ambiguous spaces, one can better understand the universal characteristics that apply to the air littoral. On the surface, irregulars seem to have the advantage of initiative and an air of mystique as they routinely rout and confound superior, state-organized traditional forces. Yet, this frame ignores the underlying logic of irregular warfare. Adversaries that employ irregular warfare do not do so by choice; they are forced to adapt due to a lack of resources.²² They adapt to the conditions of the engagement. When superior forces do not adjust similarly or attempt to apply straight doctrine as if they were hard-set rules, they often fail.²³

Oversimplifying problems and ignoring the realities and their nuances are at the heart of failure for conventional forces. As one military strategist argues, approaches to fighting should be seen as tools, reliant on the context and place in which they were and could be used, and that “confusion stems from the belief that operational approaches . . . are comprehensive solutions rather than tools.”²⁴

This is the danger for operators in the air littoral. They must understand the type of war they are fighting, including the context in which it takes place, to ensure that whatever means can and should be utilized to achieve their desired ends.²⁵ The air littoral is its own physical and cognitive space, couched in the ambiguities of liminality that require their own means of approach and operation. The conditions of the air littoral—a

21. Kiras.

22. Kiras.

23. Kiras, 261.

24. Emile Simpson, *War from the Ground Up: Twenty-First Century Combat as Politics* (New York: Oxford University Press, 2018), 153.

25. Kiras, “Irregular Warfare,” 268.

dynamic, ill-defined environment—will rapidly evolve through time, demanding that operators adjust with these conditions and the concomitant problems of emergence and chaos. This approach may require recognizing intertwined threads precluding set formulas or defined rules.²⁶

Instead of “working around” the air littoral, operators should embed themselves within it, using the terrain to their advantage.²⁷ Adversaries will also face these difficulties, providing opportunities for operators willing to embrace the essence of the liminal space, adapt to its changing conditions, and evolve in tandem with its emergent properties.²⁸ This final piece, handling complexity, helps resolve the air littoral puzzle before bringing it all together.

Complexity and Systems Thinking

The human mind struggles with adapting to the complexity of a dynamic world. According to systems theory, to compensate, humans rely on mental models that simplify reality, which can lead to problems in some cases. In the quest for sensemaking, humans tend to resolve phenomena into internal narratives, schema upon which consciousness is built.²⁹ One of the byproducts of this is the tendency toward apophenia, or the making of connections between random occurrences.³⁰

While rationality is something to be prized, it was never meant to be the sole arbiter of judgment. Intuition is instinctual for a reason. As one systems thinker points out, “Working with systems, on the computer, in nature, among people, in organizations, constantly reminds me of how incomplete my mental models are, how complex the world is, and how much I don’t know.”³¹ In a world filled with this measure of complexity, the smart thing to do is to take one’s time, probe with small experiments, and employ “constant monitoring, and a willingness to change course as you find out more about where it’s leading.”³² This observation is nothing new.

Carl von Clausewitz recognized this phenomenon when he proposed his ideas concerning fog and friction. In his mind, the two concepts encapsulated the random phenomena that distinguished war in the abstract from actual combat, which led to making even the simple things about war difficult.³³ More troubling is the realization

26. Kiras, 270.

27. Simpson, *War from the Ground Up*, 169, 175.

28. Valérie Gauriat, “Two Years On: How Is Ukraine Adapting to a Long-Term War?” Euronews, March 22, 2024, <https://www.euronews.com/>; and Vikram Mittal, “Russia and Ukraine Are Adapting for the Next Phase of the War,” *Forbes*, April 20, 2024, <https://www.forbes.com/>.

29. Khong, *Analogies at War*.

30. “Apophenia,” *Psychology Today*, undated, accessed August 8, 2024, <https://www.psychologytoday.com/>.

31. Donella H. Meadows and Diana Wright, *Thinking in Systems: A Primer* (White River Junction, VT: Chelsea Green, 2011), 180.

32. Meadows and Wright, 180.

33. Carl von Clausewitz, *On War*, ed. and trans. Michael Eliot Howard and Peter Paret, rev. ed. (Princeton: Princeton University Press, 1989).

that these limitations are inescapable and humans are hardwired to simplify thought to the point of error. One psychologist suggests “this need to economize—to save time and effort—underlies any of the failings in our thought processes.”³⁴ Systems thinking, however, requires a different method of approaching this pitfall—indeed, reducing every thought to mental shortcuts and making careless leaps in logic purely on predictive or causal factors does not work in an emergent, dynamic environment. A person must understand that actions have ripple effects, some of which may show up much later in ways that one might not expect.³⁵

In systems thinking, grappling with complexity has striking similarities to dealing with irregular warfare. Context is essential, both to understand and from which to frame possible problems. Complexity requires a family or network of capabilities, tools that are adaptable and flexible in application. Rigidity and prescription are the enemy of the design space in dealing with complexity. This is how one must deal with liminality in the air littoral. This article thus brings all these concepts together into one approach, connecting the notion of liminality to the cognitive aspects of maneuver when engaging in the liminal space of the air littoral.

A New Framework

Maneuvering forces to offset the adversary in the air littoral can certainly occur with mass as drone swarms overwhelm this liminal space and complicate airpower and landpower projection. Yet, regardless of how much AI is used to control drone swarms or any other forces on the battlefield, such physical forms of maneuver neglect the ever-present cognitive aspects of fighting that are ever present. Command and control in the air littoral will continue to involve humans in addition to the more conventional forces operating aircraft or pushing forward on the ground.

Maneuver in this case then refers to psychologically positioning the adversary, which is where the previous discussion of tempo comes into play. If the adversary is placed off balance by being forced to contend with the liminality of the air littoral, then psychological mistakes—driven by mental schema, cognitive dissonance, and other biases—become the dominant factor for success. Accelerating this tendency is the possibility of pushing adversaries further into the depths of the air littoral and liminal space to compete, especially if they are using AI decision systems that do not handle the complex boundary conditions particularly well.

One means of manipulating this sense of unease is through exploiting mass within the air littoral, overloading sensory information and data collection efforts as the mass projects apparent chaos across the operating area with interdependencies, ripple effects, and emergent behaviors of the system. Then, the operator can dictate tempo by

34. Dietrich Dörner, *The Logic of Failure: Recognizing and Avoiding Error in Complex Situations*, rev. ed. (Reading, MA: Basic Books, 1997), 186.

35. Dörner, 198.

speeding up or slowing down operations, operating within the adversary OODA loop until the adversary experiences decisional paralysis.

The critical factor for the operator is being able to engage in this cognitive liminal space just as the practitioners of irregular warfare do without succumbing to the same cognitive impairments of their opponents. This requires embracing the complexities of the environment, understanding the tools available without having to deploy them in an overly prescriptive manner, and being able to adapt as the circumstances and context shift. This is fundamentally a systems approach to a dynamic, evolving ecosystem of players, weapons platforms, and the environment.

Challenges remain. Each element on its own is extremely difficult to manage and takes time to master. Moreover, these elements require intensive study, training, and consideration to produce the types of operators capable of dealing with rapidly fluctuating conditions. This is why the air littoral will be difficult to operate within, but embracing that difficulty also provides an opportunity for exploitation and dominance, all of which rests on comprehending the air littoral as the liminal space it occupies, utilizing cross-discipline methodologies to build a strategic framework for approaching this space. This completed framework provides the practical elements for preparing operators for the air littoral.

Develop sUAS Drone Capabilities

To reduce the feelings of unease in liminal spaces, people must expose themselves to the condition. At one point, most bases across the Air Force had an aero club, which not only helped encourage an air-centric mentality, but also improved the basic flight skills of many on base.³⁶ While expenses and other issues sunset the aero clubs, there is an heir apparent—drone clubs.

Far less expensive, drone clubs involve lower operating costs than the maintenance costs and upkeep for an aero club. Combined with the nearly ubiquitous Spark Cells—sectors on Air Force bases that foster innovation and problem solving—that have significant 3D printing capability, the possibilities are endless.³⁷ Ukrainian operators can provide plenty of tips, blueprints, and ideas that can be rapidly tested in bases across the country and the world.

These refashioned aero clubs would not only familiarize individuals with drones, thus reducing the cognitive problems from encountering the liminal air littoral, but would also develop operators. Airmen in many ways have become divorced from the core mission of the Air Force, projecting airpower.³⁸ These aero clubs can reconnect Airmen to the purpose of the service while reinforcing the airmindedness that has been lost during the years of the Global War on Terror. Unfortunately, drone swarms

36. Mh53eflyguy, “Where Have All the Aero Clubs Gone?,” thread post, AirWarriors, Naval Aviator’s Forum, “Navy/Air Force Aero Clubs,” November 8, 2007, <https://www.airwarriors.com/>.

37. “Spark Cells,” AFWERX, undated, accessed August 8, 2024, <https://afwerx.com/>.

38. Shawn Cochran et al., *The Forces We Need: Building Multi-Capable Airmen to Enable Agile Combat Employment*, RR A1746-1 (Santa Monica, CA: RAND Corporation, 2023), <https://www.rand.org/>.

are coming, and the Air Force must create individuals knowledgeable in the operation, construction, and capability of drones. A more positive aspect would be the establishment of a strong community, which can be protective for the effects of moral injury and combat exposure experienced by drone operators.³⁹

Wargaming and Emerging AI

Wargames powered by AI systems acting as adversaries will further expose operators to the complex environment of the air littoral. One of the hallmarks of systems thinking as it concerns complexity is the idea of probing and experimentation. As noted above, actions taken in complex environments cause ripple effects, many of which are unpredictable.⁴⁰ Probing, sensing, and experimenting are vital elements of maneuvering in this complexity.

Operational planners and individuals manning whatever evolves from the current air operations center futurization efforts will need to have experience contending with these complexities, which will only worsen as drone swarms begin to enter the battlespace. AI can act as adversaries, exposing operators to complex conditions that evolve as the operator makes decisions and takes actions. Along the way, operators will learn how they manage such conditions, receiving feedback and tools for dealing with them as well as providing opportunities for experimentation.

Further, operators may reveal synergistic learning between the machine and the operator as they develop novel strategies for employing capabilities in the air littoral. All the while, operators will focus on understanding the environment and learning the limitations of capabilities in the air littoral, providing areas of exploitation against adversaries who may not have the same level of training or ability.

Training and Exercises

The Air Force must integrate drones into basic training and exercises to enable full exploitation of the air littoral. Whether officer or enlisted, every Airmen should have some exposure to the different aspects of drones at every level of accessions and education. While the Air Force has focused on improving the use of M4 shooting across the service, getting drones in the hands of at least some individuals may be more important. Exercises should fundamentally incorporate drones to prepare the service to integrate and defend against these capabilities.

Moreover, rather than focus only on defenses such as electronic warfare spectrum jamming or laser weapons, the Air Force should work on developing offensive drone capabilities that can meet everything from quadcopters to suicide drones, manned and unmanned.⁴¹ Flooding the service with a drone mentality would decrease the

39. Atkins and Seamone, "Remote Combat Exposure"; and Saini, Raju, and Chail, "Cry in the Sky."

40. Dörner, *Logic of Failure*, 198.

41. John Knowles, "Air Mobility Command Ponders 'On Aircraft' Counter Drone Capability," *Journal of Electromagnetic Dominance*, July 16, 2024, <https://www.jedonline.com/>.

likelihood of the Air Force falling prey to the cognitive problems inherent in the air littoral, as familiarity can help to eliminate or at least reduce the ambiguity that causes anxiety and indecision in this liminal space.

Power of People

As China is one of the primary focuses of great power competition, the air littoral is the perfect place to find advantages against it. The American military largely succeeds not only due to its incredible assets but arguably more so due to its talented, empowered people. Fighting against the People's Liberation Army (PLA) will require every ounce of this strength that begins and ends with people. As stated previously, the war in the air littoral will be fought primarily in the mind. The PLA, with explicit loyalty to the People's Republic of China (PRC), will not have the same flexibility of thought necessary to fight in a complex, dynamic space. Political commissars and other mechanisms for controlling decision-making slow down the ability of operators to engage, assess, and take initiative on their own. This violates the best practices of mission command, which require decentralizing decision-making and empowering lower levels of execution authority to the point of being uncomfortable.⁴²

A lack of a competent noncommissioned officer corps is another key weakness. Pushing the PLA into the liminal space of the air littoral aggravates these problems while playing into the fundamental strengths of the United States. Even with the use of AI, China will struggle when the air littoral expands into boundary conditions that have no defined solutions or predetermined, predictive outcomes.⁴³ This will sow seeds of doubt and hesitancy, making the deep cognitive responses of being in liminal spaces nearly overwhelming. The United States can push decision-making to higher levels by openly questioning the PRC's control of the PLA, impairing its initiative. Yet, this will only be possible if the United States and specifically the Air Force embrace the air littoral, build on the framework described in this article, and inculcate an air-mindedness focused on drones.

Conclusion

The air littoral will continue to advance as sUAS and AI merge to create a truly formidable capability that is rapidly changing the character of war for both the air and land domains. The liminality of the air littoral is as intimidating as it is complex, requiring a restructuring of the way operators approach the battlespace. In reframing the engagement with a cognitive focus, operators embrace the complexity of liminality that includes the physical and the mental.

42. "Mission Command," Insights and Best Practices Focus Paper, 2nd ed. (Washington, DC: Joint Staff J7, January 2020), <https://www.jcs.mil/>.

43. Amit Ranjan Alok, "Turmoil and Transformation: The Reconfiguration of China's Military under Xi Jinping," *Australian Outlook*, Australian Institute of International Affairs, August 6, 2024, <https://www.internationalaffairs.org.au/>.

Further, recognizing this reality provides the opportunity for exploitation through pushing opponents into the boundary conditions that challenge human cognition—let alone AI decision-making programs that may be assisting them. Operators must be ready and willing to adapt to a dynamic system, exposing the emergent qualities of the environment. Controlling tempo and utilizing maneuver is but one means of accomplishing this task, but it is certainly not the only means of doing so.

Operators should see liminality itself as a condition of existence and enter the proverbial threshold, ready to change and grow to succeed. As Campbell notes, “The hero is the champion of things becoming, not of things become, because he is.” He goes on to quote Ovid’s *Metamorphoses*, “Nothing retains its own form; but Nature, the greater renewer, ever makes up forms from forms. Be sure that nothing perishes in the whole universe; it does but vary and renew its form.”⁴⁴ The critical aspect is being able and willing to master the liminal space, something the Air Force and its operators should consider as they ponder the future of airpower in the air littoral. Æ

44. Campbell, *Hero*, 209; and Ovid, *Metamorphoses Book XV* (Loeb Classical Library, Public Domain), 383, as qtd. in Campbell.

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.