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UNDERSTANDING AIRPOWER IN DRONE AND MISSILE AGE: EVOLVING TACTICS WITHIN ENDURING PRINCIPLES OF AIRPOWER

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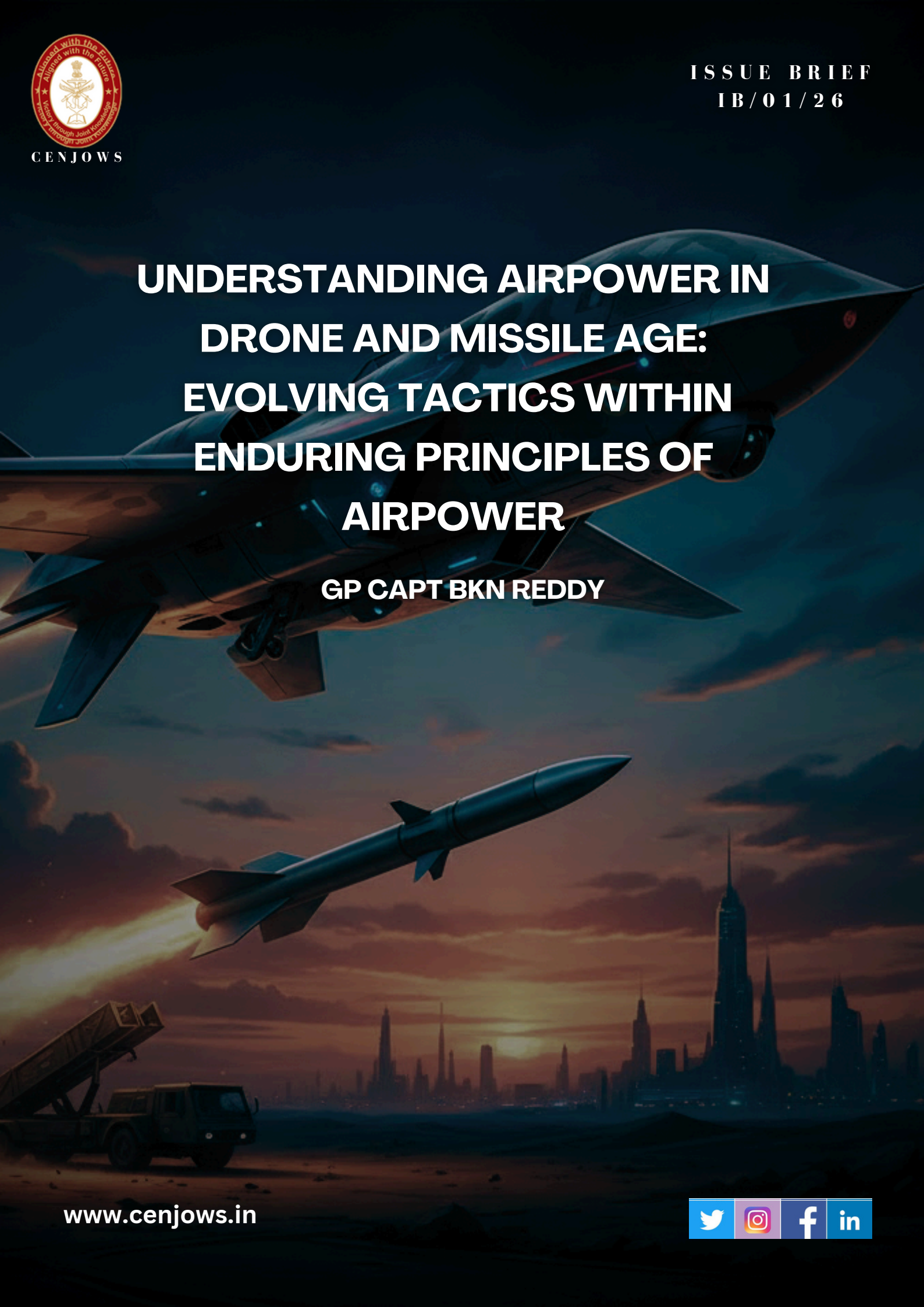

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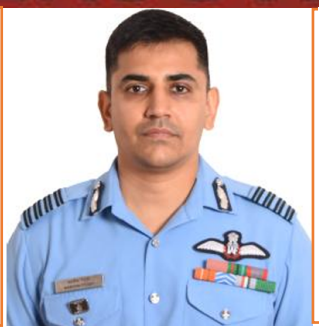
UNDERSTANDING AIRPOWER IN DRONE AND MISSILE AGE: EVOLVING TACTICS WITHIN ENDURING PRINCIPLES OF AIRPOWER



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Abstract

When we have a cursory look at the contemporary conflicts like India's Operation Sindoor, the Russo-Ukraine War and the War in Israel, drones and missiles seem to emerge as the new paradigm in the application of airpower, requiring changes in its basic tenets. However, this hypothesis requires a deeper investigation! This article aims to examine the rapid proliferation of drones and precision missiles in modern warfare and analyse their effects on the basic tenets of airpower, especially the requirement of Control of Air. The paper argues that although drones and missiles have transformed the tactical battlefield by enabling accelerated kill chains through persistent ISR and precision strikes, they have not replaced the decisive role of conventional air forces. Through historical and contemporary case studies, the paper shows that drones and missiles, in spite of their significant advantages, cannot independently achieve strategic breakthroughs or enable decisive manoeuvres without control of the air.

The article also brings out the dynamics of achieving dominance in a limited conflict, where militaries are increasingly relying on the use of standoff weapons and expendable drones to balance political restraint with military effect. Even in such

scenarios, superiority in conventional airpower becomes essential for escalation control and strategic messaging. The article reemphasises that only integrated and tailored application of airpower by an air-minded practitioner, grounded in its basic tenets, can secure strategic outcomes. The study emphasises that for India, building up a comprehensive capability for conventional offensive air dominance (the highest degree of control of air) is necessary to preserve freedom of action in future conflicts against a multitude of threats emerging from its adversaries.

Keywords: Freedom of action, Manoeuvre, Airpower, Drones, Missiles, Control of the Air, Close Air Support (CAS), Conventional airpower, Reusable airpower, Integration, Escalation dominance and control, Strategic signalling, Operation Sindoor, Cruise Missiles, Hypersonic Missiles.

Introduction

In a conflict, freedom of action is achieved by balancing the factors of time, space and force.[1] The relative weight of these factors, however, varies across domains. On land, the employment of large formations requires deliberate orchestration based on terrain and logistics, making force the dominant factor. At sea, operations unfold across vast expanses of the oceans. Here, the ability to control or deny space becomes decisive. In contrast, the air and space domains are characterised by speed, reach, and minimal friction. In these environments, time - expressed through timing and tempo, becomes the critical factor enabling rapid concentration of force for strategic effects. While tactical actions using air and space can be executed by any service, the formulation of strategy demands domain-specific insight. In the aerial domain, this insight resides with an airman.

The Indian Air Force (IAF) doctrine (IAP 2000-22) defines airpower as “the ability of a nation to assert its will through the medium of air” and identifies its sources as extending beyond the assets of the air force to include the air arms of the Sister Services, as well as the civil aviation and space capabilities. Building on this comprehensive foundation, the paper examines current developments in drone and missile technologies, along with their application in recent conflicts, to argue that “While the character of airpower is evolving rapidly, its nature, grounded in its enduring principle of the *Control of Air*, remains unchanged. ” Airmen, shaped by a distinct operational environment and imbued with air-mindedness, are therefore uniquely equipped to conceptualise, integrate, and employ airpower most effectively. To begin, it is necessary to assess how drones and missiles are reshaping the dynamics of the land battlefield.

The Effect on Ground Battle

The contest in the land domain has historically oscillated between the primacy of firepower and manoeuvre. The First World War epitomised the ascendancy of firepower, as the lethality of machine guns and massed artillery entrenched armies in attritional trench warfare.[2] This deadlock was eventually disrupted in 1917 when the Allied forces employed tanks in their offensives at Marne, Amiens and Cambrai, breaching the German defensive lines and reintroducing mobility to the battlefield.[3] Tanks subsequently shifted the balance back toward manoeuvre, though always in symbiosis with firepower. Throughout the 20th century, armoured warfare became the centrepiece of land operations, embodying the indirect approach by seeking to encircle, outflank, or sever enemy forces, rather than engaging in costly tank-on-tank confrontations.[4]

The contemporary introduction of drones and precision missiles onto the tactical battlefield provides manoeuvre-based ground forces with an organic airpower element. When integrated with offensive armoured thrusts, such capabilities can generate decisive operational effects. The Luftwaffe's doctrine of *OperativerLuftkrieg* drew directly from the army's concept of *Bewegungskrieg* - Manoeuvre Warfare. Integrating airpower with mechanised thrusts, aimed to paralyse command, disrupt cohesion, and induce shock, producing the rapid dislocation that defined Germany's early victories in 1939-40.[5] Equally, the "third domain" can serve in a defensive capacity when offensive manoeuvre is constrained, either by operational realities or political objectives. During the Korean War, once the front stabilised, repeated North Korean and Chinese offensives were repelled largely through American airpower employed in Close Air Support (CAS) role.[6] The inability of North Korean forces to mount a comparable air effort critically limited their offensive potential which was later acknowledged by the CPV commander Gen. Peng Duhai.[7] By analogy, the employment of drones and missiles today mirrors these historical cases, where one side's inability to contest the air or to field effective air defences ceded decisive advantage in tactical engagements to the other.

However, once both sides adapt to the evolving threat and develop countermeasures to contest air control and employ tactical airpower, victory ultimately rests with the side able to wrest the control of air and employ airpower strategically across all domains to break the deadlock. After the Allied landings in Normandy and the liberation of France, Germany still possessed vast armoured forces backed by strong tactical air support. The Allies, however, in addition to the tactical use of airpower, concentrated the 8th and 15th Air Forces for strategic bombing, striking critical Nazi industry in pursuit of decisive results.[8] Yet, even with such immense resources, a breakthrough proved elusive until the introduction of the P-51 Mustang as a long-range escort, which secured air superiority, enhancing the effectiveness of strategic bombing, which in turn enabled advances at the tactical level.[9] A modern echo can be seen in Ukraine, where, despite extensive use of drones and missile strikes, the

conflict has settled into attrition due to the absence of control of the air and a strategic air campaign.[10] Thus, while drones and missiles significantly enhance the tactical strength of ground forces, they remain unlikely to deliver a decisive outcome. It is still the conventional application of airpower, founded on the principle of control of the air, which will provide a strategic breakthrough.

Ground and naval forces must develop the tactical ability both to exploit and to counter the growing threat from drones and missiles, while recognising that decisive outcomes still depend on control of air. Despite the rise of UAVs, artillery remains the most-used arm in Ukraine: Ukraine has fired roughly 7,000 shells a day at times, and Russian rates have exceeded 20,000 shells per day.[11] Drones have proved valuable for ISR, target acquisition and communications that enhance artillery effectiveness, but their raw firepower is still tiny compared with traditional systems. Nevertheless, drones are driving disruptive, leapfrog changes on the battlefield that demand urgent adaptation.

The Urgent vs. the Important

While understanding the primacy of control of the air remains essential there are urgent contemporary considerations on the battlefield that demand attention. Drones and missiles now pose a critical challenge to the ground forces, with the potential to inflict defeat if not adequately catered for.

Drones reduce the possibility of surprise by enabling continuous real-time observation (Persistent ISR). They perform the dull and repetitive tasks associated with ISR efficiently. In Ukraine, quadcopters and Bayraktar TB2s have constantly monitored Russian troop movements, forcing the units to conceal or disperse, thereby halting decisive manoeuvres.[12] When this persistent ISR is coupled with precision strike, it can accurately engage high-value assets, complementing traditional firepower. During the 2020 Nagorno-Karabakh conflict, Azerbaijan's use of Harop loitering munitions and TB2 drones systematically destroyed Armenian armour and air defence systems, paving the way for manoeuvre forces.[13] The lesson is that real-time intelligence combined with precision strike can achieve disproportionate effects.

Manoeuvre forces rely on concentration at the point of contact. However, under the persistent threat of drones, they are forced to disperse, making decisive action difficult. Russian armoured columns in the early stages of the Ukraine war, were attacked simultaneously by drone-directed artillery and ATGM ambushes. This forced the Russians to adopt smaller, dispersed formations. Russian forces have since turned to layered counter-UAS systems along with networked manoeuvre concepts that allow for smaller dispersed units to remain operationally effective.[14]

Long-range missiles can extend the tactical battlefield into the enemy's rear. Russian strikes on Ukrainian rail networks and power grids are an example of how tactical missile employment can shape operational depth.[15] Drone-enabled ISR accelerates targeting and strike cycles by compressing the OODA (Observe, Orient, Decide and Act) loop. Ukrainian HIMARS attacks, often cued by drones, have destroyed Russian logistic depots and command posts within minutes of detection.

At sea, drones and precision missiles are challenging the survivability of even capital warships. Ukraine's 2022 sinking of the Russian cruiser *Moskva* using Neptune missiles, guided by drones, demonstrated the lethality of low-cost precision systems.[16] Constant drone presence increases stress and reduces troop morale. Ukrainian and Russian troops reported heightened anxiety from drones hovering overhead, mirroring the shock introduced by V2 rockets over Britain in World War II. In addition to the cognitive stress, low-cost drones also impose a disproportionate economic burden. A Shahed-136, costing roughly $20,000, can trigger a response involving multi-million-dollar surface-to-air missiles, creating resource asymmetries over time.

Together, Drones and precision missiles have transformed the tactical battlefield by enabling persistent ISR and precision strikes that accelerate the kill chain and challenge traditional defences.

Tactical Counter Measures

To address the urgent, militaries need to invest in robust tactical countermeasures that preserve surprise, manoeuvre, initiative and morale. The aim should be to operate within the shrunk decision cycles of the enemy ISR – strike complex to achieve decisive action. Some of the recommended are:

- To counter persistent ISR, militaries must adopt **layered counter-UAS architectures** that integrate electronic warfare, directed-energy weapons, decoys, and low-cost interceptors alongside traditional air defences. This cost-imposition approach prevents inexpensive drone and loitering munition attacks from exhausting high-end interceptor stockpiles.[17]

- **Survivability measures,** including hardening critical assets, dispersing and frequently relocating command posts, employing decoys, and enhancing tactical mobility, are essential to dilute the effectiveness of loitering munitions, missile strikes, and swarm attacks while disrupting enemy targeting cycles.

- Forces must be trained to operate under **decentralised command and mission-type orders**, enabling rapid adaptation within compressed kill chains.[18] Russian layered counter-UAS employment and networked manoeuvre concepts in Ukraine illustrate how dispersed units can retain operational effectiveness under persistent surveillance. [19]

- **Naval forces**, particularly in littoral environments, require integrated defences combining CIWS, electronic warfare, and unmanned surface and subsurface systems. Doctrine must explicitly account for drone-enabled targeting and saturation strikes against surface combatants.

- Training and equipping units with **organic jamming, decoys, and counter-UAS tools**, combined with psychological resilience training, is essential to sustain morale and initiative under continuous observation and threat

Having seen the urgent implications and countermeasures, the deeper question is whether such systems merely complicate tactics or fundamentally alter the enduring principles of airpower. To answer this, it is necessary to shift focus from the immediate battlefield to the broader structural changes they introduce into air operations and strategy.

What has actually changed?

The control of air is rightly recognised as the pre-requisite for any military operation from the inception of IAF doctrine in 1995 to its latest iteration in 2022. Since its inception, airpower has faced three principal limitations: its reliance on advanced technology, high operational costs, and base dependency. In recent years, drones paired with missiles have increasingly been referred to as the "Poor man's Air Force", offering a seemingly cost-effective alternative that boasts rapid technological upgradeability and operational flexibility, particularly due to their ability to be employed from remote or dispersed locations.[20] However, a closer examination reveals that the operational promise of these systems often diverges from their actual capabilities.

Drones

Not all drones have similar operational capabilities. For analytical clarity, drones are best understood across a spectrum ranging from high-end, reusable platforms to low-cost, expendable systems optimised for mass rather than survivability.

Reusable Drones are characterised by long endurance, large payloads, advanced sensors, and secure data-links, which can conduct complex surveillance and strike missions without putting aircrew at risk.[21] Yet their advantages come with high costs. An MQ-9 Reaper costs $35 to 45 million, an RQ-4 Global Hawk about $130 million.[22] Sustaining these UAS (Unmanned Aerial Systems) fleets also requires steady funding and logistics chains on par with manned aircraft. Despite these burdens, high-end UAS excel at the "dull, dirty, and dangerous" tasks of ISR and search and strike missions. They can be used to replace or complement manned platforms by providing persistence. These platforms reduce human risk and cognitive strain while

multiplying force effectiveness. However, because of their high cost and vulnerability to electronic warfare, cyber-attack, and kinetic losses, their use demands strict cost-benefit analysis, especially against capable air defences.

Expendable Drones prioritise mass and low cost over survivability. Between September 2022 and December 2024, Russia launched over 14,700 Shahed-type expendable drones into Ukraine, each carrying approximately 40 kg of high-explosive payload.[23] Despite the relatively low unit cost of about US$35,000 per drone, less than 10 percent of these drones successfully reached and damaged their intended targets.[24] High attrition increases the effective cost per successful strike dramatically to around US$350,000. When expressed in terms of cost per payload, the cost per kilogram reaches approximately US$8,750/kg.[25]

This example highlights how low unit prices for expendable drones can be misleading in isolation. By contrast, a manned strike sortie by F-35A demonstrates far greater efficiency per kilogram of ordnance delivered. Program data for the F-35 indicate a flying-hour cost of approximately US$33,600 (constant dollars, 2014–22).[26] Assuming a typical 3-hour long-range strike mission armed with two 500-lb JDAMs (totalling 454 kg of payload and unit cost of US$40,000) and accounting for a conservative probability of success of 0.9, the effective cost per successful strike is approximately US $200,900, with a corresponding cost per kilogram of just US$443/kg.[27] Even under a lower probability of success of 0.75, the cost per strike and per kilogram remains substantially lower than that of the Shahed drones, at US$ 241,066 and US$ 531/kg, respectively.[28]

These comparisons show that expendable drones, though cheap per unit, are costly and inefficient in practice for comparable effects.

Manned precision platforms like the F-35 deliver ordnance more reliably and at far lower cost per kilogram, especially against high-value targets. Thus, the true value of low-cost drones must be judged by operational effectiveness and cost-efficiency and not by unit price alone. However, this balance shifts once we factor in the attrition of these high-tech platforms. Even a negligible 1% loss rate for an F-35 (valued at $90 million) raises the delivery cost to about $2,645/kg, while a 5% attrition rate drives it to $11,456/kg.[29] Such levels of attrition can be expected even for stealth platforms when they operate against modern air defences.

Counter UAS (C-UAS) Systems. Since 2023, Ukraine's AD has faced millions of first-person view (FPV) unmanned aerial systems (UAS) and thousands of one-way attack (OWA) drones, yet only a small fraction of those inflict decisive damage. Russia also has rapidly matured its C-UAS capabilities, integrating dedicated electronic warfare systems, short-range air defence (SHORAD), infantry-level weapons adapted for drone defence, netting, spaced armour, and hardened infrastructure to counter the FPV/OWA threat across all levels of its ground forces.

Ukrainian production alone for 2024 included over 2 million FPV drones and 100,000 long-range OWA drones, with a target of 4.5 million UAS in 2025, yet these massed numbers have not translated into decisive operational outcomes.[30] The layered defensive architecture implemented by Russia significantly limits the concentration and lethality of Ukrainian drones. This data suggests that while C-UAS systems do not neutralise the UAS threat entirely, they impose steep penalties in attrition and operational effectiveness that constrain the transformative potential of massed drone employment without concurrent strength in traditional firepower and air control.

Takeaways

- Low-cost, single-use drones in their current form are vulnerable to countermeasures and suffer low survivability. However, when these drones are reinforced with reliable electronics and effective hard/soft kill countermeasures their costs increase exponentially.

- High-tech manned and reusable UAS platforms offer greater payload and higher probability of success, but even modest attrition can rapidly invert their cost advantage. Therefore, the optimal approach is a balanced mix of using stealth, EW and attritable/saturating drones to suppress defences and create windows for conventional reusable platforms to operate effectively.

Missiles

Cruise missiles like the Tomahawk and BrahMos combine accuracy, range, and survivability to penetrate layered defences and strike high-value infrastructure. Their versatility makes them central to integrated strike packages. However, their relatively high unit cost of US$2 to 5 million per missile restricts their employment to carefully selected targets of operational or strategic significance. Moreover, cruise missiles are becoming increasingly vulnerable to the modern integrated air defence systems (IADS). Cruise missiles remain indispensable for degrading critical enemy capabilities. They are most effective when employed in synergy with other reusable aerial and electronic assets.[31]

Hypersonic missiles combine speeds in excess of Mach 5 with manoeuvrability and precision. Weapons such as Russia's Kinzhal or China's DF-17 pose significant challenges to current missile defence systems, as their high velocity and ability to manoeuvre mid-course complicates interception.[32] The perceived "unblockable" quality of these missiles enhances their coercive ability. Estimated at US$8 to 10 million per missile, high costs presently limit their use to strategic targets. In practice, hypersonics are niche strategic enablers effective for striking critical, time-sensitive, or heavily defended targets. Therefore, they must not be considered as substitutes for reusable airpower in sustained operations.

Takeaways

- Existing and emerging missile technologies need to be used in consonance with traditional airpower to achieve control of air, which forms a prerequisite for coordinated joint campaigns.

From the above analysis it comes out that single-use drones and missiles cannot be employed as a standalone solution and must be used in consonance with reusable manned and unmanned platforms for decisive effects. While the preceding analysis highlighted the tactical implications of drones and missiles on the battlefield, let us now look at their effects on coercion dynamics inherent in a limited conflict.

A Curious Case of Limited Conflicts

In a limited conflict, political aims are tightly constrained and escalation must be carefully managed. The political aim may be to deter, coerce, or punish an adversary without triggering full-scale war. Such contests typically feature rapid, decisive strikes followed by extended periods of strategic communication and political messaging. India's Operation Sindoor in May 2025, for instance, involved precision air strikes on militant infrastructure in Pakistan as a punitive yet time-bound action designed to signal resolve while avoiding wider escalation.[33] Similarly, Israel's large-scale air campaigns on Iranian targets in Oct 24 and Jun 25, and Iran's calibrated missile and drone retaliation, illustrate how airpower can be used for carefully managing escalation thresholds.[34] In each case, airpower, enabled escalation management as the aerial footprint is transitory and does not involve prolonged violation of sovereignty as compare to a land incursion.

In limited engagements the priority is to accomplish political and military objectives with a high degree of assurance while minimising risk and own losses that can undermine the intended narrative. In this context, expendable UAS (including massed loitering munitions) and standoff cruise and hypersonic missiles become attractive as they can impose effects at minimal risks. When employed in unison, these systems can overwhelm AD through mass (attrition-by-numbers) or by compressing reaction windows (reduced detection and engagement time). Russia's massed Shahed campaigns in Ukraine, the repeated use of cruise and Kinzhal hypersonic missile strikes illustrates how these weapon classes create options for coercion and punishment that are time-sensitive, relatively transient in footprint, and costly for defenders to counter.[35]

The critical issue lies in the outlook: whether Russia perceives the war in Ukraine as a single, comprehensive campaign aimed at securing overarching strategic objectives, or as a sequence of limited engagements punctuated by operational pauses designed to accumulate incremental tactical gains. The answer remains

uncertain, and only the passage of time will reveal the trajectory of this evolving conflict and its effect on our perception of drones and missiles.

The scope of action in limited conflicts will depend on the assessed capabilities of the conventional forces. Superiority in conventional airpower therefore remains a decisive constraint shaping the adversary's manoeuvre space within the escalation matrix. The side that enjoys such superiority can impose limits on its opponent's options without crossing the threshold into open war. Yet this advantage does not rest on material strength alone; it must be reinforced by controlling the strategic narrative and by calibrating force posture in a way that reduces ambiguity, sustains credibility, and preserves the initiative throughout the conflict.[36]

In this manner, airpower serves not only as the instrument of rapid precision strike but also as the enabler of escalation control, deterrence, and the retainer of political leverage at the culmination of hostilities.

Contrasting Perspectives

While this paper lays emphasis on the enduring primacy of conventional airpower, an opposing school of thought argues that the proliferation of drones and missiles is eroding traditional advantages and levelling the battle space, narrowing the gap between technologically superior conventional forces and asymmetric actors. Swarming expendable drones impose disproportionate costs on advanced air forces by saturating air defences.[37] Ukraine's successful long-range drone strikes on Russian airbases at Engels, Pskov, and Soltsy further demonstrated how relatively inexpensive systems, when used in conjunction with covert/irregular operations, could damage strategic assets and expose vulnerabilities.[38]

These operations, together with the growing reliance on cheap attritable systems, have led some analysts to suggest that persistent attrition rather than decisive manoeuvre may increasingly shape victory conditions in modern war. Others contend that denial strategies built around drones and missiles may prevent technologically superior forces from achieving uncontested air dominance.[39] Taken together, these perspectives challenge the assumption that conventional airpower will always deliver decisive outcomes. These arguments further highlight the need to adapt doctrine and capabilities to counter adversaries' asymmetric methods, which seek to redefine success through denial and protracted attrition. A balanced approach integrating spread-spectrum capabilities is necessary to blunt such threats. The conventional superiority will then provide the necessary control of the air essential to ensure the dominance of manoeuvre in pursuit of swift, decisive outcomes.

Conclusion

The contemporary battle space, shaped by the rapid proliferation of drones and precision missile systems, underscores once again the enduring primacy of the aerial domain. This study has shown that while the nature of airpower based on control of air and capacity to shape the operational environment remains constant, its character continues to evolve with technological innovation, adversary adaptation, and the demands of limited conflict.

As both tactical and strategic targets come under sustained threat from increasingly integrated ISR–strike complexes, the compression of the timelines has narrowed the decision space for commanders. This risks driving ground forces back into positional, attrition-based warfare. In such an environment, traditional manoeuvre can become decisive only when it is enabled by credible control of the air. Historical cases, from World War I to recent operations in Ukraine, the Middle East, and India highlight that it is the side that establishes control of air that dictates the tempo and controls escalation while retaining strategic initiative.

For India, countering the drone–missile complex cannot be achieved by defensive measures alone; it demands conventional offensive capabilities that can impose costs and restore freedom of manoeuvre. This requires modernisation focused on integrated capabilities across the spectrum from expendable drones to hi-tech aircraft and missiles. Only conventional air superiority can secure control of the air through which Indian forces break tactical deadlocks, maintain escalation dominance and exploit the shrinking decision cycles of modern conflicts. Airpower thus enabled will remain a decisive instrument and enabler of strategic outcomes in the missile and drone-saturated battlefield of the future.

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