

Air Power

The Air-Ground Littoral and the Army

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Current military trends are challenging how control of the air is exploited to achieve air-land integration. The air-ground littoral (AGL) offers a concept to exploit and coordinate the lower altitudes of the air domain for land manoeuvre. This fills a gap in theory for how both air forces and armies employ airpower contributions. The AGL is prominent in the emerging reconnaissance-strike tactics regime that is shaping modern land warfare. The AGL is applicable to Australia's context in the Indo-Pacific, noting the region's geographic and threat considerations. Australia should continue to explore the AGL as a concept for improving air-land integration.

Introduction

Current military trends are splitting the air domain between higher and lower altitudes. This is leading to the emergence of the air-ground littoral (AGL) as a distinct sub-region within the air domain focused on supporting land operations. In contributing to both air and land power theory, the AGL helps frame the interaction between and within domains to better employ military power. This essay argues the air-ground littoral is a useful concept for enhancing air-land integration on the modern battlefield and is applicable to Australia's operational context in the Indo-Pacific. Specifically, the AGL fills a gap in airpower theory that relates to the employment of airpower by armies.

Air-land integration has been a key feature of airpower since its inception in the early 20th century (Watling, 2023). During World War I, aircraft were first used for reconnaissance and artillery spotting before fighters were developed to counter those missions (Higham, 2009). The offensive air support role also emerged during World War I but was rudimentary in comparison to later forms (Higham, 2009). Offensive air support developed during the interwar period and reached a significant level of capability and coordination by the end of World War II.

Since World War II, despite differences in prioritising air-land integration (McCarthy, 2009; Orange, 2009; Overy, 2009), air-land integration has progressively become a central airpower contribution pursued by air forces as well as armies. David Giffen, a United States (US) Army officer, posits that the principal airpower contributions sought by ground commanders are interdiction and close air support, though he acknowledges the essential contributions to joint airspace management; intelligence, surveillance, target acquisition and reconnaissance (ISTAR); mobility; and electronic warfare (EW) as well (Giffen, 2024). Air-land integration enables both air and land power to operate in either domain, either on independent or combined missions as reflected in the Australian doctrine (Australian Defence Force [ADF], 2023).

Is control of the air a pre-requisite?

Historically, achieving air-land integration has been contingent on control of the air (Kennedy, 2013). The importance of control of the air traces back to early airpower theorists, notably Marshal of the Royal Air Force Hugh Trenchard and Royal Australian Air Force Air Vice-Marshal Henry Wrigley. Both theorists saw control of the air as a necessary prerequisite to subsequent air operations, such as air strike, support to surface operations or other operations, by ensuring friendly freedom of air manoeuvre (Air and Space Power Centre, 2022). An enduring assumption is that control of the air at medium and higher altitudes translates to control of all altitudes within a given geographic area (Bremer & Grieco, 2021). Current definitions of air superiority and air supremacy, emphasising lateral and temporal factors over altitude, reflect this assumption (Australian Defence Force, 2023). Though The Air Power Manual (Air and Space Power Centre, 2022) suggests the possibility of differing levels of control of the air at differing altitudes, it does not address this in detail. Two trends within the air domain, however, are realising this possibility.

Since the end of the Korean War, Western militaries have regularly been able to achieve air superiority across all altitudes in the conflicts in which they have participated (Australian Defence Force, 2023; Douhet, 2019; Giffen, 2024). The historical cost of investing in high-end aviation capabilities to contest this superiority has been beyond the reach of most adversaries over the last 70 years. This has led to actual and potential adversaries seeking ways and means to bypass the West's control of the air. Recent technologies – such as drones, loitering munitions and cruise missiles – are enabling this goal (Bremer & Grieco, 2021). These technologies are comparatively cheap and available when compared to traditional aviation capabilities, allowing more actors to exploit the benefits of airpower, especially air-land integration. Many of these new capabilities are smaller, more numerous and operate at lower altitudes

than traditional offensive counter air assets. These qualities enable the exploitation of airpower without being contingent upon air superiority at higher altitudes.

In addition to bypassing Western control of the air, adversaries are developing increasingly sophisticated integrated air and missile defence (IAMD) networks to contest this control (Bronk, 2020). This potentially forces aircraft to operate from stand-off ranges until conducting comprehensive suppression/destruction of enemy air defence campaigns. Though windows of opportunity for penetrative air missions may arise through joint operations and effects (Bronk, 2020; Watling, 2023), it is likely that the normal condition at higher altitudes will be parity or mutual air denial. Ukraine is demonstrating this parity as neither side has been able to achieve air superiority through traditional airpower (Bronk, 2025). Thus, the threats of adversary IAMD networks are driving air forces to focus on control of the air for their own freedom of manoeuvre rather than for supporting other domains (Watling, 2023).

These two trends – bypassing and contesting control of the air – are changing how control of the air is exploited to achieve air-land integration. The former decouples control of the air between altitudes while the latter reduces the capacity for traditional airpower to support ground forces. These trends are bifurcating the air domain into two parallel challenges for airpower, distinguished vertically rather than laterally or temporally. This vertical distinction separates the higher altitudes of traditional air operations from the lower altitudes of the air-ground littoral (Grieco & Bremer, 2024). The AGL addresses the gap in airpower theory produced by the above trends and has been defined as:

the area from the Coordinating Altitude to the Earth's surface, which must be controlled to support land and maritime operations and can be supported and defended from the air and/or the surface (Bremer & Grieco, 2021, p. 68).

Though imperfect, this definition is a useful starting point to understanding the AGL and its utility. This definition emphasises the purpose of the AGL – to support land and maritime operations – and highlights the interaction between domains to achieve this. In stressing the AGL's multi-domain nature, the definition, despite referencing the coordinating altitude, also reveals the nebulousness of the borders between domains and altitudes. The problem with including a control measure such as the coordinating altitude is that its usage implies a strict boundary between AGL and the rest of the air domain, but no definitive boundary exists.

Instead, the AGL is 'both a threshold and a transition space' separating land and air domains (Gulick, 2024, p. 67). This liminality equally applies to the blurry vertical boundaries of air domain, where the AGL ends and the air domain's higher altitudes begin. This liminality can '[confuse] the traditional roles of airpower and landpower and [blur] the lines of responsibility between them' (Gulick, 2024, p. 69). The liminality, complexity and congestion of the airspace demand a framework to identify and address the challenges of operating in that airspace. This is the utility

of the AGL as its core: it frames a critical challenge for both air and land power.

The AGL does not fundamentally change the logic of airpower. Whether in the AGL or higher altitudes, airpower will still be beholden to the constraints and limitations of the air domain's nature, attributes and characteristics. In this way, and noting the history of air-land integration, the AGL is a case of 'old wine in new wineskins'. It is fundamentally an evolution of airpower, not a revolution. Nonetheless, the growing recognition of the AGL as a distinct sub-region of the air domain is useful for understanding new applications of airpower and air-land integration, particularly the use of small, cheap and numerous systems. Such systems are prolific within the AGL, but they do not exclusively define it. Instead, these systems are enabling armies to achieve their own airpower effects, independent of traditional air forces – a capability increasingly essential to land warfare. In practice, the AGL is a key point of domain convergence and therefore a joint problem at its core. It is thus necessary to understand the AGL from the perspective of other domains – in this case, the land domain.

Reconnaissance-strike tactics

Like the air domain, decade-long trends have reached critical mass in recent years to dramatically change land warfare. These trends include battlefield transparency and pervasive surveillance; precision mass and concentration of effects; protection and concentration of forces; and vulnerability of enablers and logistics (Hammes, 2025; Watling, 2023). The on-going Russo-Ukrainian war is the starkest example of these trends. As such, a new tactical regime has emerged: reconnaissance-strike tactics (RST) (Friedman, 2024). No singular definition exists for RST; however, by amalgamating several descriptions, one definition is the fusion of ISTAR capabilities with precision fires and EW capabilities to create opportunities for manoeuvre forces (Friedman, 2024; Hammes, 2021, 2025; Kagan et al., 2024; Watling, 2023, 2025).

RST is challenging established approaches to combined arms manoeuvre. As one report notes, the result in Ukraine is the loss of manoeuvre, with 'relatively static frontlines and regular combat that produces little movement'. (Kagan et al., 2024, p. 19) Overcoming these challenges and exploiting RST requires novel approaches on how to organise, integrate and employ the relevant technologies and trends to reinvigorate combined arms manoeuvre. The Armed Forces of Ukraine (AFU) are developing such approaches, as described by Dr Jack Watling (2025).

Watling's description and analysis of Ukraine's emerging approaches consistently highlight the role played by the AGL, though Watling does not use this term or conceptual framing (Watling, 2025). Based on his interviews with current AFU officers, Watling provides 'a synthesis of how multiple officers described their approach' to combined arms manoeuvre in Ukraine rather than verbatim doctrine (Watling, 2025, p. 6). This synthesis focuses on the offense, though it is easy to understand its application in the defence. There are seven phases to this emerging approach: survey, isolate, degrade, fix, suppress, close and destroy,

and consolidate. The AGL is prominent throughout all phases, including the employment of friendly ISTAR assets; the defeat of adversary reconnaissance assets; the use of drones, loitering munitions, and joint fires to isolate, fix and suppress enemy positions; aerial mining and resupply via uncrewed air systems (UAS); and air defence, including counter UAS (CUAS) (Watling, 2025). These examples are not exhaustive but are illustrative of the ubiquity of the AGL in land operations – meaning armies must expand their conception of airpower and control of the air. The AGL aids armies in conceiving the airspace needed for modern land manoeuvre and expands traditional land power conceptions of control of the air.

Exploiting the AGL is vital to land warfare under the RST regime. Pervasive surveillance, enabled in large part by UAS operating in the AGL, is described as the ‘single most transformative element of warfare in Ukraine’ (Watling, 2025, p. 11). This pervasive surveillance enables fires and manoeuvre planning, which in turn exploit the AGL further for manoeuvre execution. Thus, the AGL, in practical terms, is decisive terrain for land forces to achieve manoeuvre. Yet these actions rest on being able to achieve air superiority – by definition, constrained by geography and time (Australian Defence Force, 2023) – within the AGL to degrade and deny adversary ISTAR, fires and manoeuvre while simultaneously enabling friendly pervasive surveillance and fires dominance. Failure to achieve this, or otherwise disrupt the adversary’s reconnaissance-strike capabilities, leads to a failure of manoeuvre and a turn to positional warfare – as observed in Ukraine since 2022 (Kagan et al., 2024).

Airpower for the army

Recent technologies are enabling armies to organically provide airpower contributions as well as contest control of the AGL. This has been seen in Ukraine with drones (for example, first person view drones, ISTAR), loitering munitions, long-range missiles, and precision-enabled artillery providing the airpower contributions sought by armies discussed earlier (Watling, 2025). Armies also need to defend against these capabilities and contest the AGL through ground-based IAMD systems. Alongside long-range IAMD systems, such as the National Advanced Surface-to-Air Missile System, CUAS is essential to protecting land forces and other high-value targets (including vulnerable airbases and supply lines) (Ryan, 2025b). These capabilities are also changing how rotary-wing aviation operates in combat. For example, AFU are using rotary-wing aviation in counter air actions against Russian drones (Allard & Post, 2025). Accordingly, armies will need to improve their conception of airpower, requiring armies to move beyond their traditional approach to control of the air, what Bremer and Grieco (2021, p. 68) describe as ‘localized persistent occupation’, to better incorporate the responsive presence employed by air forces. The AGL provides armies with a useful framework for applying organic airpower more comprehensively in liminal, complex and congested airspace. Thus, the AGL fills a gap in airpower theory, one specifically about organic airpower in armies.

Despite the growing capabilities of armies, traditional airpower will still have a place within the AGL, across the range of airpower contributions. The AGL does not replace air power theory as it relates to air forces but provides a framework for land power to apply air power. Therefore, air forces must still be prepared to project power through the AGL, even if they choose only to do this sparingly. This means armies and air forces must approach the AGL together, rather than separately – especially given the AGL is the intersection between air and land domains. Coordination is the keystone to the AGL’s exploitation for air-land integration and other purposes, like joint fires. Crucially, this coordination must extend to IAMD networks to prevent fratricide and effectively protect land forces and other land-based assets. Coordinating the AGL may require increasingly distributed control to keep up with the tempo and dynamism of modern operations (Bremer & Grieco, 2021; Giffen, 2024) – something at odds with traditional airpower notions of centralised control and decentralised execution (Air and Space Power Centre, 2022). By recognising the AGL as a joint space, the AGL can be a useful concept to enhancing air-land integration across the Joint Force to enable land manoeuvre, IAMD and agile operations among other activities (Jackson & Arrol, 2024).

AGLs in the Indo-Pacific

Despite the utility established so far, many observations relating to the AGL (and RST) are emerging from Ukraine and the Middle East. There is risk that such observations do not apply beyond these contexts or, if they do, require modification. It is therefore necessary to examine the AGL in view of the Indo-Pacific and Australia’s northern approaches. There are several considerations that are relevant to the AGL; however, the chief considerations for this paper are geography and threat.

The Indo-Pacific encompasses a vast area of the Earth’s surface, making distance a key characteristic. Much of this area is ocean, interspersed with occasional islands, in contrast to the contiguous landmasses of Ukraine and the Middle East. Still, the area to Australia’s north is characterised by archipelagos – ‘a series of interconnected littoral spaces whose defining feature is the relative ratio of land to water’ (Dean, 2023, p. 9). These archipelagos can feature much shorter distances between landmasses than other parts of the Indo-Pacific. As Professor Peter Dean, the incumbent General Sir Francis Hasset Chair of Military Studies at the Australian Defence College, notes, the shorter distances of archipelagos mean that aerial systems can be operated at a higher rate to achieve what Ryan describes as ‘condensed drone operations’. (Dean, 2023; Ryan, 2025a, p. 25) As a result, the theatre AGL will potentially be a series of AGLs localised to the ground forces exploiting a particular area, whether land or maritime littoral.

The key threats of the Indo-Pacific support the notion of localised, opposed to theatre-wide, AGLs. Anti-Access/Area Denial (A2AD) systems dominate the Indo-Pacific, intending to prevent and disrupt access to and within a given area. The range and density of these systems, combined with RST, has driven the development of ‘stand-in’ concepts to

address a requirement for sustained operations within an adversary's A2AD zone (Kilcullen, 2023). Dr David Kilcullen articulated the essential features of a stand-in concept, noting it must be distributed, self-sufficient and effective across multiple domains among other features (Kilcullen, 2023). These features drive localised AGLs due to stand-in forces possibly being unable to rely on access to traditional airpower or other higher echeloned capabilities yet must still contest the AGL as part of their own offensive and defensive actions.

Additionally, Kilcullen suggests that the ability to operate in a space and cyber degraded environment is an essential feature to stand-in forces (Kilcullen, 2023). Adversaries will seek to degrade several space-based and cyber capabilities essential to coordination, such as communications; position, navigation and timing; and sensing (Ryan, 2025a). This will also drive localised AGLs as coordination over greater areas may not be sufficiently responsive to the dynamism of modern warfare, especially in a space and cyber degraded environment.

The localised nature of the Indo-Pacific's AGLs suggests the concept is more useful in the Indo-Pacific than in Ukraine as theatre-wide coordination may not be possible. As such, the need to frame both the physical and cognitive space of the AGL is vital to dispersed land forces generating the airpower needed for RST. The AGL, in framing the problem, can aid developing theory, doctrine, tactics, equipment and more to fight and win against an adversary across the Indo-Pacific.

Conclusion

This paper has argued the AGL presents a useful concept for enhancing air-land integration on the modern battlefield. The AGL fits into larger conceptions of both air and

land domains. Similar trends alter both domains, driven ultimately by the aim of defeating the West's advantages and enabled by capabilities that are cheap, accessible and numerous. For armies, the AGL can help expand thinking about airpower, especially in the context of RST, to achieve manoeuvre and other effects on the battlefield and across the theatre. The AGL is essential to manoeuvre as armies seek to seize and hold terrain to project long-range fires and IAMD systems. This aligns with the Australian Army's focus on littoral operations, which seeks to exploit the maritime littoral and shorter distances of the South-West Pacific Area's archipelagos as a manoeuvre space for ground combat, area denial and long-range strike operations (Nash, 2023). For air forces, the AGL is useful to conceptualising the decoupling of control of the air at higher and lower altitudes that is occurring.

The AGL, and its impact of air-land integration, is worthy of further examination. Militaries must seriously discuss and resolve the challenges of the AGL, from theory and doctrine through coordination to counter threat, to improve their battlefield effectiveness. Addressing such challenges prior to conflict can improve effective operations in the opening moves of a war and provide a base for adaptation as a war progresses. This starts by recognising the utility of the AGL to enhancing air-land integration and its applicability to Australia.

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