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Air Manoeuvre Forces in European Large-Scale Combat Operations

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Executive Summary

Air manoeuvre – the movement of ground forces by air to gain advantage – is confronted today by the increasing sophistication and density of threats. Pervasive sensing, long-range fires and a large number of pop-up threats, against which it is hard to plan, threaten the viability of air manoeuvre operations in conventional war in the European theatre. Nevertheless, as many of these threat systems also pose a serious challenge for ground manoeuvre, the ability to move troops unimpeded by terrain arguably makes air manoeuvre more important – not less – if a commander is to be able to proactively alter battlefield geometry. It is therefore imperative to develop air manoeuvre forces so that they can operate against current and emerging threats.

The very technologies that pose challenges to air manoeuvre also offer opportunities to adapt the force to overcome them. This paper argues that:

- Assured connectivity and blue force tracking should allow air manoeuvre forces to plan and initiate operations from a dispersed posture, thereby mitigating the risk from long-range fires and increasing ambiguity as to where forces will be committed.
- Integrating launched effects into an air manoeuvre insertion package can enable the early stimulation, detection and suppression or destruction of pop-up threats, to enable the force to safely reach its target. Such a composite air-ground operation would need to fit beneath the corps fires plan and be synchronised with a composite air operation to suppress enemy air and long- to medium-range air defences.
- A major challenge for air manoeuvre forces is that an enemy can now concentrate fires against them without redeploying, because even platoon groups now have the means to deliver precise indirect fire out to 15 km of range. However, the same capabilities of ubiquitous precision strike can enable an air manoeuvre force to deny or interdict a target without having to physically occupy it, allowing the air manoeuvre force to instead deploy to a less defended area and harden its position, putting the onus on an enemy to displace them.

- Air manoeuvre forces can extend their endurance, despite a heightened threat environment, by using UAVs to continuously push supplies to them. Accepting that some of these supplies will be interdicted, the cost for suitable UAVs will limit range. Nevertheless, this can increase the ability of air manoeuvre forces to sustain operations over complex terrain.

For European air manoeuvre forces to be able to take advantage of these opportunities, it is recommended that:

- Air manoeuvre forces are made an organic asset of a corps, so that they can leverage the joint force in planning and execution and are employed across a large enough geographic area to properly exploit their range.
- Air manoeuvre forces are given organic 'middle strike' or launched effect elements that train to employ UAVs in conjunction with aviation and are persistently available to enable strike or resupply in support of an air manoeuvre element.
- Air manoeuvre forces are equipped with precision strike capabilities that are not susceptible to degradation by electronic warfare. This would range from wire-guided first-person view UAS to wire-guided anti-tank guided missiles, laser designators and laser guided bombs.
- Air manoeuvre forces must have a way of reliably passing targets to the main body in a contested electromagnetic spectrum and this demands investment in satellite communications and relays as well as a software layer to minimise the volume of data that need to be passed.
- Air manoeuvre forces must practise hardening their positions against persistent observation and fire and have deployable equipment to enable the erection of suitable force protection engineering. Air manoeuvre forces must also experiment to determine how they can ensure mutual support across an inserted force while in a dispersed posture.

Introduction

The failure of Russian forces to seize and hold Hostomel airfield in the opening days of Russia's full-scale invasion of Ukraine in 2022 has been a fulcrum for debate within militaries ever since over the utility and viability of air manoeuvre forces.[1] Detractors conflated the failure of the initial assault with the high rate of Russian helicopter losses over the early months of the war in order to argue that helicopters were insufficiently survivable against modern threats. Proponents of air manoeuvre pointed out that Russian forces were successfully inserted, in daylight, and that the failure of the operation stemmed from poor planning, too few forces being inserted, and the underperformance of Russian follow-on forces. The US's successful penetration of Venezuelan air defence – despite its clear limitations relative to those of Russia or China[2] – is posited as a demonstration of what can be achieved in well planned and enabled operations.[3] Today, amid intense debate within European defence ministries as to the balance of investment between capabilities while NATO seeks to regenerate combat power, this paper seeks to discuss the utility and viability of air manoeuvre forces in the contemporary and future operating environment.

This paper is solely concerned with the use of air manoeuvre forces in large-scale combat operations in the European theatre. Air manoeuvre – defined as 'the movement of land forces by air to positions of advantage'[4] – encompasses insertion by helicopter, parachute or plane, and in the future may also include insertion by personal mobility

1. Detractors include Sash Tusa, 'Opinion: The End of Air Assault?', *Aviation Week*, 10 May 2022, <https://aviationweek.com/defense/budget-policy-operations/opinion-end-air-assault>, accessed 12 November 2025. Opposing arguments have been made in Justin Bronk, 'Future Military Helicopters: Technological Innovation and Lessons Learned from Ukraine', in Alessandro Marrone and Giancarlo La Rocca (eds), *Future Military Helicopters: Technological Innovation and Lessons Learned from Ukraine* (Rome: Instituto Affari Internazionali, 2023). Much of the debate revolves around what is generalisable from a specific operation. See Declan Daly, 'The Alligator at War', *Antares*, 30 October 2024, <https://www.heliopsmag.com/antares/articles/the-alligator-at-war/>, accessed 12 November 2025.
2. Maria Abi-Habib, Eric Schmitt, Christiaan Triebert and Julian E Barnes, 'Russia's Fearsome Arsenal Fizzled in Venezuela. Here's Why', *New York Times*, 12 January 2026.
3. Eric Schmitt and Greg Jaffe, 'A Close Call for U.S. Commandos and an Emboldened Trump', *New York Times*, 7 January 2026.
4. Ministry of Defence (MoD), 'Joint Doctrine Note 1/20 Air Manoeuvre', June 2020, p. 1, <https://assets.publishing.service.gov.uk/media/5ef4bf17d3bf7f713849f3d7/20200616-doctrine_uk_air_manoeuvre_jdn_1_20.pdf>, accessed 11 November 2025.

systems which enable point-to-point individual transport. This paper is heavily weighted towards examination of insertion by helicopter. Insofar as concepts of employment for parachute insertion in high-intensity combat operations can be envisaged, they represent edge cases – and the base-case assumption is that this is not viable. The use of helicopters and infantry held at high readiness for contingency operations, from non-combatant evacuation operations to humanitarian and disaster relief activities, is unquestioned.[5] Similarly, it is evident that air manoeuvre forces have proven indispensable in expeditionary warfare against non-peer adversaries and are likely to remain of use in this context. As NATO endeavours to make its regional plans for deterring Russia executable, the question is how such capabilities can best be employed in fighting a war against a peer adversary.

This paper has three chapters. The first examines the history of air manoeuvre operations to identify the unique utility these capabilities have offered. The second chapter specifies what they must do and assesses how they may be challenged by existing and emerging threats. The third chapter considers how an air manoeuvre force might conceptually mitigate these emerging threats to deliver what commanders require. The fourth chapter provides deductions about necessary capability development within air manoeuvre forces to ensure they can execute the identified tasks.

Methodology

The paper is built on a literature review of existing doctrine, historical studies of air manoeuvre operations, and analyses of a broad range of concepts for future force employment across NATO militaries. Some of the authors also have operational experience in helicopters. In addition, the authors engaged with air manoeuvre forces from the UK, the US, Norway, Ukraine, Australia and Israel, informing this analysis with present-day considerations. The authors also engaged with most of the primary manufacturers in the military helicopters industry to assess the future capability and survivability of military aviation.

5. John Matsumura et al., *Lightning Over Water: Sharpening America's Light Forces for Rapid-Reaction Missions* (Santa Monica, CA: RAND, 2001), <https://www.rand.org/pubs/monograph_reports/MR1196z1.html>, accessed 11 November 2025.

The Unique Offer of Air Manoeuvre Forces

To determine whether a capability retains utility, it is first necessary to establish its unique contribution to the force. In order to judge whether missions remain viable, it is important to consider which effects are critical for a capability to be useful to a commander. This chapter surveys the history of air manoeuvre to examine how it has previously enabled militaries and then considers the evolution of the threat to air manoeuvre to contextualise contemporary challenges to its viability.

Air Manoeuvre's Offer to the Tactical Commander

Air manoeuvre began as a concept to bypass defences from the air flank, primarily through parachuting. The Soviet Union conceived of parachute drops as a component of deep battle.[6] German, British and US concepts emphasised the ability to vertically envelop the enemy by projecting over obstacles and enemy forces and occupying key terrain to undermine defences. This was successfully executed on D-Day in France,[7] but failed in Operation *Market Garden*.[8] In the wake of the Second World War, concepts shifted to the more dynamic possibilities presented by helicopters, to replicate what had previously been delivered by gliders at Eben-Emael[9] or during Operation *Deadstick*,[10] but with greater assurance.

6. « Вре́менный полево́й уста́в РККА 1936 (ПУ 36) » [*Provisional Field Regulations for the Red Army 1936*] (Moscow: People's Commissar for Defence of the USSR, 1936).
7. Max Hastings, *Overlord: An Authoritative History of D-Day and the Battle for Normandy 1944* (London: Macmillan, 2015), pp. 69–143.
8. Anthony Beevor, *Arnhem: The Battle for the Bridges, 1944* (New York, NY: Viking, 2018).
9. Fort Eben Emael, <https://fort-eben-emael.be/en/home>, accessed 8 January 2026.
10. Imperial War Museum, 'Operation Deadstick: The Airborne Assault on Pegasus Bridge', <https://www.iwm.org.uk/history/operation-deadstick-the-airborne-assault-on-pegasus-bridge>, accessed 8 January 2026.

US Field Manual 57-35 'Airmobile Operations', published in 1960, describes the unique value of air manoeuvre forces as allowing a commander to 'overcome distances and to bypass barriers and enemy defences' and 'extend radically the area over which he can exert his influence'.[11] In the early 1960s, US and Soviet air mobility and assault forces were preparing for the highest-intensity conventional (and potentially nuclear) conflict. The US envisioned heliborne brigades moving 100 km forward to disrupt enemy axes of advance or planned to parry enemy offensives by rapidly redeploying US combat power.[12] Speed and reach could thereby compensate for an enemy's first mover advantage. The resulting 'Air Cavalry' concept was wargamed against a Soviet invasion of Iran. It was thought to be useful in establishing blocking points against enemy forces advancing through the Zagros Mountains, where enemy movement would be canalised on roads, in turn allowing operational flexibility through rapid redeployment across complex terrain.[13]

Such wargames were validated through large-scale exercises in the US in severe weather, spanning several states and distances not dissimilar to those of present-day US exercises.[14] These were the forerunners of massed US heliborne air assaults in Vietnam. In turn, they inspired Soviet employment of aviation assault. As early as 1967, the Soviet's exercise *Dnieper* envisioned a phased attack using heliborne and paratrooper forces to seize objectives, before bringing reinforcement by air – an approach that remains a consistent element of Russian air manoeuvre doctrine as demonstrated at Hostomel in 2022.[15] The speed with which such forces could seize vital ground was thus perceived as one of the greatest attractions to commanders in both the US and the Soviet Union. It also allowed rapid movement of units along interior lines.[16]

Alongside speed and flexibility, air manoeuvre was identified as preserving a force's resilience by mitigating the determinism of terrain. The British military's experience in the Falkland Islands in 1982 aptly demonstrates both the positive and negative consequences of aviation's availability as a determinant of operational flexibility. The

11. US Army, 'FM57-35 Department of the Army Field Manual: Airmobile Operations', November 1960, <https://www.bits.de/NRANEU/others/amd-us-archive/FM57-35%2860%29.pdf#page=6>, accessed 17 September 2025.
12. Mark A Olinger, 'Conceptual Underpinnings of the Air Assault Concept: The Hogaboom, Rogers and Howze Boards', Institute of Land Warfare, 2006, <https://www.ausa.org/sites/default/files/LWP-60-Conceptual-Underpinnings-of-the-Air-Assault-Concept-The-Hogaboom-Rogers-and-Howze-Boards.pdf>, accessed 19 September 2025.
13. J A Stockfisch, *The 1962 Howze Board and Army Combat Developments* (Santa Monica, CA: RAND, 1994).
14. Thomas C Graves, 'Transforming the Force: The 11th Air Assault Division (Test) from 1963–1965', School of Advanced Military Studies, US Army Command and General Staff College, 1999, <https://apps.dtic.mil/sti/tr/pdf/ADA381779.pdf> accessed 17 September 2025.
15. David M Glantz, 'The Soviet Airborne Experience', Combat Studies Institute, November 1984, <https://www.armyupress.army.mil/Portals/7/combat-studies-institute/csi-books/glantz.pdf>, accessed 17 September 2025.
16. Francis J Huber, 'Force Design, the Airmobile Concept and Operational Art', US Army Command and General Staff College, 1999, <https://apps.dtic.mil/sti/html/tr/ADA382392/index.html>, accessed 20 December 2024.

British spent a protracted period building up forces at the San Carlos lodgement, under enemy air attack. This was critically dependent on support aviation, which not only increased the volume of materiel that could be moved from ship to shore at the time and place of the Task Force's choosing,[17] but also allowed units to be rapidly moved forward to occupy key terrain ahead of the eventual deliberate breakout, as on Mount Kent.[18] Indeed, the decision to land at San Carlos – attractive because it was defensible from counterattack despite its distance from British objectives – was premised on the ability to accelerate the breakout through the employment of aviation. The envisioned freedom from terrain would allow British forces to mitigate the risks of landing closer to Argentine defences.

Unfortunately, the *Atlantic Conveyor* was struck by an Exocet missile and sank three days later, with all but one of the Task Force's Ch-47 heavy lift helicopters destroyed by fire. The breakout from San Carlos was therefore executed on foot, with Commando and Parachute Regiment troops undertaking a 90-km march across the island, carrying up to 120 pounds of equipment per soldier over boggy and rocky terrain, averaging 1.6 km per hour.[19] 5th Brigade, among them the Welsh Guards, were not considered ready for the march and were moved by landing craft to Bluff Cove, a hasty operation to relieve the deteriorating condition of soldiers who had completed the cross-country march and were suffering high rates of non-freezing cold injuries.[20] These factors contributed to a concentration of forces whose landing ships were struck by Argentine aircraft on 8 June, killing 56; it was the worst loss of life in the British Army since the 1951 Battle of the Imjin River. The loss of mobility arising from a lack of aviation stripped British forces of operational choices, committing the force to one rather unfavourable course of action.[21] Fierce battles for the high ground around Stanley did not descend into a positional struggle, but this was not preordained, and as Ian Gardiner, a veteran from 3 Commando Brigade, has highlighted, the loss of *Atlantic Conveyor* would have greatly diminished operational flexibility in the event of stiffer resistance.

Contemporary US doctrine concurred with British assessments of the value of air manoeuvre. The 1982 doctrine of Airland Battle posited that 'air assault forces are

17. Max Hastings and Simon Jenkins, *The Battle for the Falklands* (London: Macmillan, 2010), pp. 251–93.
18. Cedric Delves, *Across an Angry Sea, The SAS in the Falklands War* (London: Hurst, 2018), pp. 237–58.
19. Robert S Krenzel Jr, 'A Sad and Bloody Business: Land Force Lessons from the Falklands, Forty Years On', *Military Review* (Vol. 103, No. 3, May–June 2023), pp. 58-66, <https://www.armyupress.army.mil/Portals/7/military-review/Archives/English/MJ-23/Sad-and-Bloody-Business/Sad-and-Bloody-Business-UA.pdf>, accessed 18 December 2025.
20. MoD, 'Report to the Commander in Chief, Fleet of the Board of Inquiry into the Loss of RFAs Sir Tristram & Sir Galahad in June 1982: Main Report Annex A–D', 23 September 1982, <https://falklandstimeline.wordpress.com/wp-content/uploads/2022/06/board-of-inquiry-report-into-the-loss-of-rfa-sir-tristram-and-rfa-sir-galahad-june-8-1982.pdf>, accessed 17 September 2025; Francis St Clair Golden et al., 'Lessons from History: Morbidity of Cold Injury in the Royal Marines During the Falklands Conflict of 1982', *Extreme Physiology and Medicine* (Vol. 2, No. 23, 2013).
21. Lawrence Freedman, *The Official History of the Falklands Campaign. Volume II, War and Diplomacy* (Abingdon: Routledge, 2005), p. 554.

uniquely valuable for conducting turning movements [moving around the sides of flanks]', but noted that 'because they have to fight beyond the supporting distance of other ground forces, they will require heavy and continuous air and/or naval support'.[22] This concept was tested in the Gulf War when various US Central Command and other US Department of Defense estimates projected that up to 7,000 Coalition troops could be killed in action in a frontal attack to liberate Kuwait with one Army Corps and a Marine Expeditionary Force. Consequently, Norman Schwarzkopf revised his planning to devise the 'left hook', part of which involved one of the largest air assaults – essentially a turning manoeuvre – in history.[23] The 101st Airborne Division undertook to establish Forward Operating Base Cobra deep within Iraq, eventually inserting 273 km forward to sever Highway 8, one of the main Baghdad–Kuwait roads. Operation *Rendezvous Destiny II*, as it was named, achieved its objective, forcing the Iraqi Army to have to fight in two directions. The operation was identified by one US veteran as a classic large-scale air assault, with high liquid logistical requirements and exquisite synchronisation in a contested environment.[24]

The effect of Operation *Rendezvous Destiny II* could not have been readily achieved by other means. A rapid ground assault over such a range would have faced terrain and logistical constraints: M1A1 tanks consume vast quantities of fuel and move more quickly than supporting vehicles such as M109 howitzers, slowing their advance. Dust was a major problem for ground force armoured operations, as it clogged air filters. Indeed, planners from the coalition were concerned that large areas of desert could consist of mobile sand, which is difficult for armour, as well as inland Sabkhas (salt flats with silt under a crust of saline sand), playas (periodically muddy and silty ground) or rocky desert that could throw tank tracks. US doctrine on desert warfare, FM 90-3, written two years after the First Gulf War, discusses these terrain limitations and posits that desert warfare depends largely on controlling or cutting valuable surfaced ground lines of communication (GLOCs).[25] The ability to cut those GLOCs using air manoeuvre, therefore, was of disproportionate value to the commander. The fundamental value proposition is for a commander to be able to reshape the geometry of the battlefield at short notice.

22. US Army, 'Field Manual 100-5 Operations', 1986, p. 103.
23. Rupert Smith, 'The Gulf War: The Land Battle', *RUSI Journal* (Vol. 137, No. 1, 1992), pp. 1–5.
24. Frank R Hancock, 'North to the Euphrates Part One. The Taking of FOB Cobra', US Army War College, 15 April 1993, <https://apps.dtic.mil/sti/tr/pdf/ADA265085.pdf>, accessed 20 December 2025.
25. US Army, *Desert Operations, FM 90-3* (Arlington, VA: Department of the Army, 2016).

In short, commanders have historically found disproportionate value in air manoeuvre capabilities because they allow a force to:

- Outpace the adversary to secure vital ground at the onset of conflict.
- Accelerate operations across complex terrain.
- Retain the ability to rapidly redeploy combat power, mitigating the risks of committing resources to a given axis.
- Divert enemy capacity by opening new axes on the flanks and posing multiple dilemmas on enemy commanders.
- Deny the enemy key logistical or support infrastructure.

There are trade-offs between these options that are relevant to British forces today. The use of air manoeuvre to outpace the adversary to secure vital ground, such as getting into a blocking position during phase zero of operations, necessarily commits the force and therefore prevents the commander from using it for the other tasks outlined. The second option, enabling manoeuvre across complex terrain by securing crossing points, passes and other obstacles, necessarily keeps the air manoeuvre force tethered to ground manoeuvre forces and therefore similarly reduces its flexibility as a commander's reserve. The latter three, meanwhile, present an enemy with the greatest number of dilemmas because they must account for the potential of air manoeuvre forces in any plan they implement until the force is committed. However, here the primary effect of the force is shaping enemy decision-making, rather than a direct impact on the battle. There is also the trade-off between the high-readiness character of air manoeuvre forces, making them a preferred option for rapid insertion to bolster political deterrence by denial, and the military logic of holding capability in reserve to better shape adversary military decision-making.

These options will remain attractive if air manoeuvre forces can assure commanders that they can viably execute these tasks under the anticipated threat. As shall be seen, discussions over risk have driven a persistent debate on whether these operations are sufficiently likely to succeed to justify the cost of maintaining dedicated forces.

Risk and Reward

Before discussing emerging threats to air manoeuvre and mitigations to them, it is necessary to reflect on the fact that air manoeuvre has been a high-risk course of action since its inception. It is important for any discussion of future utility to note that despite its persistent high-risk character, air manoeuvre and air assault have been repeatedly employed, even in high-intensity peer conflict against persistent surface-to-air missile (SAM) and anti-aircraft artillery (AAA) threats. Where air manoeuvre has failed, operations often neglected core principles of air manoeuvre doctrine, such as inadequate intelligence preparation of the battlefield, failed or absent suppression or

destruction of enemy air defences (SEAD/DEAD) and poor coordination between the air manoeuvre and ground manoeuvre elements.[26] Indeed, Russia's failure to seize Hostomel – despite being able to insert – was arguably a simple function of putting too few troops onto the objective: a failure of planning, not capability.

Within a decade of the first US doctrine on air mobile warfare being published in 1960, the threat environment changed radically with the introduction of man-portable air defence systems (MANPADS) and the proliferation of radar-guided multicannon air defence artillery, with the resulting prospect that air access could not be assured. FM 57-35 – the original US concept for air manoeuvre – anticipated the central challenge to these conceptually simple but practically complex operations, namely that 'airmobile forces are particularly vulnerable during landing and assembly'.[27] It included guidance on flight movement to 'take advantage of terrain' and fire support 'within or near the flight corridor'. FM 57-35 stated that 'detection and interference by the enemy will be influenced by the length of time the airmobile force is passing over enemy territory. Shuttling or moving a long air column over a single route may make the airmobile force too vulnerable to enemy detection and interference'. The manual therefore instructed that 'wherever practicable, aircraft will not fly over or near known enemy concentrations'.[28] It is precisely the complexity of planning and executing these operations, relative to their high pay-off, that has driven the use of specialised and dedicated units to train for and undertake them.

Another feature of risk calculations in air manoeuvre operations is that even when successful, they have historically incurred a high cost. Airborne and air landing operations during the Second World War had mixed results. Despite there being initial successful air assaults in the war – most of which still had high casualties, apart from Eben Emael – airborne and air landing operations (such as the German disasters at Crete, the British catastrophe at Arnhem, Operation *Varsity* in Germany and the Soviet airborne debacle at the Dnieper) led detractors to question air assault's tactical pay-off amid high risk.[29]

Similarly, these types of operations had a mixed record in Vietnam. Heavy helicopter losses in Operation *Lam Son 719* in 1971, the South Vietnamese attempt to cut the Ho Chi Minh supply lines in Laos, reignited questions around large-scale airmobile

26. Bruce A Brant, 'Battlefield Air Interdiction in the 1973 Middle East War and its Significance to Nato Air Operations', US Army Command and General Staff College, 1986, <https://apps.dtic.mil/sti/tr/pdf/ADA186417.pdf>, accessed 17 September 2025.
27. US Army, 'FM57-35 Department of the Army Field Manual: Airmobile Operations'.
28. *Ibid.*
29. Marc R Devore, *When Failure Thrives: Institutions and the Evolution of Postwar Airborne Forces* (Fort Leavenworth, KS: Army Press, 2015).

attacks.[30] The largest heliborne attack at the time (supported by 101st Airborne and partner forces), *Lam Son 719*, was marked by poor intelligence on enemy force disposition and air defences, which dissipated the attackers' preparatory fires, despite some initial successes. A detailed study of the operation revealed that where fires were insufficient, attacking forces suffered 40% higher losses of aircraft at helicopter landing sites (HLS).[31] *Lam Son 719* was described in the official 101st Airborne's report as a 'mid-intensity' attack, despite the fact that 544 aircraft were damaged or lost.[32] This highlighted a similar issue with previous large-scale air insertions in Vietnam, particularly in the rugged terrain of the Tay Nguyen mountains. Prior to Operation *Pegasus*, it was seen as critical for Cavalry Scout helicopters to conduct persistent low-level reconnaissance to identify 'cold' HLS and disrupt enemy troop concentrations. Conversely, weaker ISR during Operation *Delaware* in the A Shau Valley in 1968, where the valley reached elevations of up to 1,800 m, led US forces to take heavy ground fire at 'hot' HLS, including from 23-mm cannons, resulting in high losses.[33]

These setbacks did not dissuade influential Soviet observers in army aviation, including M I Belov, who wrote about successful employment of US air assaults.[34] The 101st Airborne's initial report of Operation *Lam Son 719* suggested it demonstrated 'the soundness and validity of the concept and principles of air mobility', and described the failure as a 'special case' in relation to the unique challenges facing the Army of the Republic of Vietnam (ARVN).[35] Less than a year later, ARVN Marines conducted successful localised air assaults to cut off advancing North Vietnamese forces on Route 506, during the second battle of Quang Tri, forcing them to resupply the city by boat. The ARVN missions were increasingly dangerous due to the presence of SA-7 MANPADS in the conflict.[36]

Sound force employment based on proper planning could overcome sophisticated threats to air manoeuvre. The Yom Kippur War of 1973 saw a significant elevated threat

30. Adam Thomas Givens, 'The Air Close to the Trees: Evolution and Innovation in U.S. Army Assault Helicopter Units During the Vietnam War', Wright State University, 2 June 2011, p. 87, <https://corescholar.libraries.wright.edu/cgi/viewcontent.cgi?article=1586&context=etd_all#page=87>, accessed 17 September 2025; Joseph Kristopher Keener, 'The Helicopter Innovation in United States Army Aviation', Working Paper, MIT Security Studies Program, 2001, <https://www.files.ethz.ch/isn/19742/Helicopter_Innovation.pdf>, accessed 17 September 2025.
31. Givens, 'The Air Close to the Trees'.
32. Headquarters of 101st Airborne Division, 'Combat After Action Report in Support of Airmobile Operations in Operation Lam Son 719 (101st Airborne Division) 8 February–6 April 1971: Volume 1', 1976, <https://apps.dtic.mil/sti/tr/pdf/AD0516603.pdf>, accessed 8 January 2026.
33. Shelby Stanton, *The 1st Cav in Vietnam: Anatomy of a Division* (Barnsley: Presidio Press, 1999), p. 89.
34. John R Lohmann, 'The Tactical Air Assault of the Soviet Ground Forces', US Army Russian Institute, 1981, p. 4, <https://apps.dtic.mil/sti/tr/pdf/ADA112640.pdf>, accessed 17 September 2025.
35. Headquarters of 101st Airborne Division, 'Combat After Action Report in Support of Airmobile Operations in Operation Lam Son 719 (101st Airborne Division) 8 February–6 April 1971: Volume 1'.
36. Charles D Melson, *Vietnam 1972: Quang Tri: The Easter Offensive Strikes the South* (Oxford: Osprey Publishing, 2021).

to aviation from ground defences and aircraft, yet both Israel and Syria conducted successful air assaults to capture key high ground. The Soviets, who had advised the Egyptians and influenced their doctrine, observed that there were many lessons that influenced subsequent employment of helicopter assault. This is notable because despite the Egyptians experiencing high helicopter losses in the opening stages of the war (mainly to F-4 Phantom jets), Israeli archival documents describe how Egyptian forces inflicted high casualties on them with their surviving air assault forces, and nearly captured Refidim (Bir Gifgafa) air base with a 250-troop force inserted by 12 Mi-8 helicopters.[37] Likewise, Syria's successful air assault onto Mount Hermon in the Golan Heights, where it held the critical terrain for two weeks before Israel conducted a counter air assault to reclaim it, showcased the utility of air assault. Both the Syrian and Israeli insertions saw a low number of casualties.

In the context of the future of air manoeuvre, these historical examples imply that proper planning by appropriately trained troops can overcome complex threats. This was recently demonstrated by Ukrainian forces who managed a helicopter insertion into the Pokrovsk pocket,[38] directly onto the main effort of a numerically superior Russian force.

Air manoeuvre will remain a high-risk option but also offers high rewards when undertaken at a scale commensurate with the objectives sought. The argument that planning and expert execution can mitigate threats, however, is challenged when threats are by their nature unpredictable. The high losses in Vietnam – where AAA could be concealed in dense vegetation, defying pre-mission detection – are important. Therefore, when considering the future viability of air manoeuvre in the emerging threat environment – as discussed in the next chapter – the extent to which threats can be accurately mapped and planned against prior to undertaking an air manoeuvre operation must be considered.

37. Kippur Center, 'The Egyptian Commandos in the Yom Kippur War - Information and Documents', <https://kippur-center.org/document-archive/egyptian-commando-yom-kippur/>, accessed 20 December 2025; Dario Leone, 'The Day Israeli F-4Es Shot Down 14 Egyptian Mi-8 Helicopters (One by Using Their Afterburner)', *Aviation Geek Club*, 15 July 2020, <https://theaviationgeekclub.com/the-day-israeli-f-4es-shot-down-14-egyptian-mi-8-helicopters-one-by-using-their-afterburner/>, accessed 17 September 2025.
38. Yuliia Dya and Tom Balmforth, 'Ukraine Lands Special Forces in Embattled Pokrovsk, Sources Say', *Reuters*, 31 October 2025.

Evolving Threats to Air Manoeuvre

Threats are emerging which affect each phase of an air manoeuvre operation. This chapter discusses how these threats manifest, to provide a basis to assess how air manoeuvre operations can be adapted to remain viable. Fielded and emerging capabilities present challenges to the assembly, insertion, survivability, resupply and support provided to an air manoeuvre force. These threats are characterised below.

Assembly

Assembling forces together to plan, prepare and initiate an operation is often critical to achieving coherence and synchronisation. The combination of dense and overlapping long-range reconnaissance – whether from space-based observation, long-range synthetic aperture radar imagery, electronic intelligence, human intelligence with real time reporting, or stand-in observation by UAVs – allows forces to detect groupings of personnel and equipment throughout operational depth.[39] When this is twinned with expanding arsenals of short-ranged ballistic missiles (SRBMs) with area effect warheads and precision guidance, it is possible to threaten assembly areas or forward arming and refuelling points (FARPs).[40] Although this is a threat to all forces that must come together to plan and prepare operations, the need for precise synchronisation of air manoeuvre operations makes the implications of pre-mission dispersal particularly challenging. This possibility for dynamic targeting of aviation has been confirmed in Ukraine, where FARPs have been hit by Iskander ballistic missiles up to 100 km from the Forward Line of Enemy Troops (FLET).[41] FARPs can be protected by keeping the

39. Jack Watling, *The Arms of the Future: Technology and Close Combat in the Twenty First Century* (London: Bloomsbury, 2023), Chapter 1.
40. Clair A Gill and Bridget I Day, 'FARP Operations: Sustaining the Chaos of LSCO', 11 August 2021, US Army, <https://www.army.mil/article/249254/farp_operations_sustaining_the_chaos_of_lsco>, accessed 4 October 2025.
41. David Axe, 'Three Ukrainian Helicopters Landed Near the Front Line a Russian Drone was Watching – and a Russian Strike Force was Ready', *Forbes*, 13 May 2024.

time on the ground below the latency of the enemy kill chain. This is much more difficult, however, for initial assembly and loading of heavier equipment for a large air manoeuvre operation. In the US, the answer has been to practise extremely long-range insertions.[42] This is a viable option but reduces underslung load capacity and necessitates rather than obviates the use of FARP and therefore a force's ability to insert with heavier equipment.

Insertion

Once an air manoeuvre force is assembled, embarked and in the air, it faces several emerging threats to its ability to safely insert. Historically, aviation has relied on a combination of night flying, intelligence-based route planning and terrain masking at low altitude to penetrate defended airspace.[43] Several emerging technologies, however, reduce the protection afforded by these techniques. First, the transition to AESA (active electronically scanned array) radar with modern computer processing in enemy aircraft, the increasing pursuit of range in air-to-air munitions, and growing concern about cruise missiles and powered bombs as a priority for defensive counter-air operations, mean that enemy air forces will field increasingly capable look-down/shoot-down capabilities.[44] These pose a significant threat to helicopters, and the reduction of radar cross-section for rotors from above remains a technological challenge.

Second, the evolution of SAM systems to increasingly favour networked development of target tracks, to fire missiles with active seekers, and to fire in a lofted profile such that the missile descends on its target from above, enables air defences to engage targets based on approximate tracks that can be achieved against low-flying objects, and allow engagement over terrain.[45]

Third, as UAS become a pervasive tool for ground forces, so will systems intended to detect, track and defeat them. Counter-UAS systems will see the battlefield seeded with

42. Dalton Worley, '101st Airborne Division (Air Assault) Conducts Long-Range, Large-Scale Air Assault', US Army, 25 January 2024, <https://www.army.mil/article/273195/101st_airborne_division_air_assault_conducts_long_range_large_scale_air_assault>, accessed 4 October 2025.
43. Smithsonian Channel, 'Actual Footage of Desert Storm's First Apache Strikes', YouTube, 22 May 2015, <https://www.youtube.com/watch?v=RhpgCaPoBaE>, accessed 11 November 2025.
44. This is not a new but rather an expanding threat. See US General Accounting Office, 'Operation Provide Comfort: Review of U.S. Air Force Investigation of Black Hawk Fratricide Incident', 5 November 1997, <https://www.gao.gov/assets/160/156037.pdf>, accessed 9 September 2020. Concerning this evolving threat, see Justin Bronk, 'Russian and Chinese Combat Air Trends: Current Capabilities and Future Threat Outlook', *RUSI Whitehall Report*, 3-20 (October 2020), pp. 26–29.
45. Justin Bronk, 'Modern Russian and Chinese Integrated Air Defence Systems: The Nature of the Threat, Growth Trajectory and Western Options', *RUSI Occasional Papers* (January 2020), <https://www.rusi.org/explore-our-research/publications/occasional-papers/modern-russian-and-chinese-integrated-air-defence-systems-nature-threat-growth-trajectory-and>, accessed 4 October 2025.

a high density of passive sensors optimised for detecting rotors and flying objects.[46] All echelons will also have munitions that, while not optimised to defeat helicopters, may pose a serious risk to them. The pop-up threat risk, therefore, extends far beyond MANPADS and self-propelled anti-aircraft guns.[47] Critically, these are not threats that can be easily mitigated through intelligence and planning. The density of threat systems that are difficult to map through intelligence will therefore increase significantly.

Survivability

A force that is successfully inserted must remain combat effective for a sufficient length of time to achieve its intended effect. Historically, speed and surprise have created ISR challenges in tracking and therefore countering airborne forces. The result has often been a disproportionate allocation of resources to contain landings. There are several challenges facing modern airborne troops.

First, pervasive ISR, especially in one's own rear, allows for highly efficient tracking of enemy troops and thus their systematic targeting with fires. Because all echelons now field beyond-line-of-sight precision fires, the ability of enemy reserves to begin converging fires against an inserted force without displacing from their positions means that there is an immediate threat upon landing that persists beyond the force dispersing.[48] Being able to set up passive defences to protect from these fires is feasible but takes time, requires materiel and equipment to be done effectively, and once dug, fix the force such that it becomes a bounded problem for the enemy that risks being isolated and bypassed, unless it is occupying vital ground. The Battle of Hostomel in Ukraine is a good example of this challenge. The Russian force successfully inserted itself with minimal losses, only to be fixed by Ukrainian troops on the objective and then destroyed by fires, which also denied a runway to Russian follow-on forces.[49]

46. Consider, for instance, the scale of German investment into CUAS, see Thomas Newdick, 'Germany to Bet Big on Skyranger Gun System to Address Growing Drone Threat', *The War Zone*, 12 August 2025, <https://www.twz.com/land/germany-to-bet-big-on-skyranger-gun-system-to-address-growing-drone-threat>, accessed 4 October 2025.
47. Kateryna Hodunova, 'Ukrainian FPV Drone Destroys Russian Mi-8 Helicopter, Military Says', *Kyiv Independent*, 29 September 2025, <https://kyivindependent.com/fpv-drone-destroys-russian-mi-28n-helicopter-military-says/>, accessed 4 October 2025.
48. Memphis Barker and Julian Simmonds, 'Dispatch: Ukraine Turns to Machines to Spare Troops from Drone-Infested "Grey Zone"', *The Telegraph*, 5 July 2025.
49. Liam Collins and John Spencer, 'Urban Warfare Project Case Study Series: Case Study #12, Kyiv', Modern War Institute, 21 February 2025, <https://mwi.westpoint.edu/urban-warfare-project-case-study-12-battle-of-kyiv/>, accessed 4 October 2025; Liam Collins, Michael Kofman and John Spencer, 'The Battle of Hostomel Airport: A Key Moment in Russia's Defeat in Kyiv', *War on the Rocks*, 10 August 2023, <https://warontherocks.com/2023/08/the-battle-of-hostomel-airport-a-key-moment-in-russias-defeat-in-kyiv/>, accessed 4 October 2025.

Resupply

The challenge for resupply of an air inserted force under modern and future conditions may be framed simply as the accumulated threats outlined above, compounded by the loss of surprise. Moreover, the timing of supply is driven by need, which is determined by the rate of consumption, a variable the enemy can heavily influence, and so it is hard to set conditions for resupply. Disaggregated initiation of operations or insertion over greater distance may also reduce the amount of equipment that can be initially inserted with the force. Not only is a route for resupply predictable, but the threat of pervasive observation being in place over the landing zone also significantly increases the likelihood that aviation attempting to deliver supplies or evacuate the wounded would be struck on the deck. Another challenge is the threat of precision fires against supplies once they are delivered, and these supplies must be transported to units and concealed. Resupply becomes harder as a force disperses for protection.

Support

One of the opportunities offered by modern capabilities is the capacity to support inserted air manoeuvre forces with a range of stand-off effects, including cyber and electromagnetic activities, long-range fires, planning resupply and situational awareness through intelligence.[50] The widespread deployment of electronic warfare equipment, however, threatens communications reach-back for critical requests and, therefore, the ability of the force to reliably draw on these capabilities. While not insurmountable, this poses significant constraints on the extent to which joint force capabilities can reduce vulnerabilities for inserted troops.

50. Brian J Dunn, 'Reachback for the Squad', *Infantry* (Vol. 105, No. 3, August-December 2016), pp. 14–17, , <https://www.benning.army.mil/infantry/Magazine/issues/2016/AUG-DEC/pdf/6)Dunn_Reachback.pdf>, accessed 4 October 2025.

Against the unique historical advantages of air manoeuvre forces identified previously, those advantages that are affected or not by the emerging threats can be outlined.

- **The ability to outpace the adversary to secure vital ground** will either occur imminently before hostilities commence or during their immediate initiation. In the former, none of the changes to the operating environment affect the ability to execute the air manoeuvre. In the latter, the intensity of initial manoeuvres necessary creates a chaotic environment where it is difficult for the capabilities to be brought to bear. Insertion under such conditions is likely to be dangerous but feasible. The complications identified regarding resupply and support are likely to solidify as the contours of the fighting are clarified, however.
- **Accelerating operations across complex terrain**, by contrast, will be constrained by two factors. The growing density of enemy sensors and beyond-line-of-sight effectors means that the distance the force must secure beyond complex terrain features to secure movement across it by ground forces is extended. Furthermore, insofar as this operation demands that air manoeuvre forces operate in close cooperation with ground manoeuvre forces, it necessarily exposes the former to a concentration of enemy pop-up threats.
- **Retaining the ability to rapidly redeploy combat power** across one's rear is minimally affected by the changes to the operating environment described, other than the general threat to assembly and concentration from fires, because the other threats identified will not reach into operational depth.
- **Diverting enemy capacity by opening new axes on the flanks** does require attackers to penetrate the FLETs, and to do so, forces employing air manoeuvre must contend with all the emergent problems outlined in this chapter. It should be noted that especially across an extended front – such as the NATO–Russia border – the density of defences will vary such that the force may identify easier routes for access. However, insofar as what the force attacks must be important enough to the enemy to cause the diversion of forces, so can the number of targets be identified by the enemy such that they will have some defences.
- **Denying the enemy key logistical or support infrastructure** with air manoeuvre forces similarly requires penetration of the FLETs, targeting objects that the enemy will have identified and is likely to be protecting. Therefore, air manoeuvres must take into account the full panoply of emerging threats identified above.

Emergent Concepts of Operation

Having determined what the unique contributions of air manoeuvre forces are to higher-tactical commanders and identified the emerging threats to the viability of conducting such operations, it becomes possible to discuss capability developments that can help air manoeuvre forces to deliver. This chapter details several concepts of operation – leveraging emerging technologies – to overcome the risks previously identified and extend the capabilities of air manoeuvre forces. These include dispersed assembly, the use of composite air-ground operations to enable insertion, stand-off denial of vital ground and the diversification of supply mechanisms.

Dispersed Assembly

The need to launch an air assault operation from a concentrated assembly point has historically been a result of three factors. First, a concentrated force is easier to sustain and can be brought up to the highest readiness, whereas a dispersed force, relying to a greater degree on its own enablers to maintain itself in the field, risks burning its readiness to hold its position. Second, the complexity of an air manoeuvre operation, in terms of the number of simultaneous actions that must be synchronised, is a major determinant of the success or failure of an operation, and therefore minimising the number of separate actions that must be synchronised reduces the operational risk.[51] A concentrated assembly renders the loading and embussing of the force into a single action, while synchronising flights from a single location reduces the effects of elements of the force being delayed en route. Third, briefing the troops on their mission and

51. George D Kramlinger, 'Synchronizing Airpower and Other Operational Fires – The Joint Force Commander's Role', Naval War College, 21 May 2003, <https://apps.dtic.mil/sti/tr/pdf/ADA417153.pdf>, accessed 4 October 2025.

working through the innumerable points of tactical detail between air crews, troops and enablers is a process which is significantly easier to conduct in person.[52]

The need to disperse all forces in the rear area has been rendered a tactical necessity by the density and fidelity of enemy ISR and the latency and lethality of long-range strike. This persistent threat means that sustainment arms will have to adapt to support forces from a dispersed posture. This adaptation does not create a unique cost for air manoeuvre forces, because it is priced in for the whole force. The resulting inefficiency must drive adaptation within sustainment arms.

The issues of synchronisation and planning do pose specific problems for air manoeuvre forces, when operating from a dispersed posture, however. Fortunately, these problems can be overcome by emerging technology. As real-time blue force tracking is now a reasonable expectation on the friendly side of the frontline[53] – whereby each element of the force can track one another, and therefore independently adjust their position to maintain synchronisation without requiring centralised direction – it is correspondingly easier for a dispersed force to converge.[54] The same capacity to pass data laterally across the force, and the assured connectivity of the force, also allow dispersed forces to plan and report back without having to physically concentrate. Missions may also be simulated remotely to aid in mission rehearsal.

One may, therefore, argue that it is reasonable for an aviation package projected from a protected airhead to fly to dispersed locations to embus their loads, and thereafter to move via diverse routes towards their intended HLS. In many respects, this projection of ground elements, independent of the air component, is already done by sustainment arms when they are sent out to establish FARPs. In this instance, it is likely that the infantry would already have moved into dispersed holding areas for their protection at an earlier stage, whether by road movement or air lift, but would be picked up from these locations rather than first being concentrated. These measures would reduce the risk of the assembly areas being struck and increase the ambiguity for the enemy as to the actual axis of operation, even if ISR determines that there are an unusually high number of aviation assets in the air at a given time.

52. George Fust and Michael Vance, 'Have We Forgotten the Rehearsal?', *NCO Journal* (August/September 2020), <https://www.armyupress.army.mil/Portals/7/nco-journal/images/2022/September/Rehearsal/Rehearsal.pdf>, accessed 4 October 2025.
53. Although hard to assure beyond the Forward Line of Own Troops where enemy electronic warfare gains a power and distance advantage, in the rear – and even in the close battle area under some conditions – blue force tracking is generally assured. Author observations in Ukraine, August 2025, and Israel/Gaza, March 2024.
54. Bryan Clark, Dan Patt and Harrison Schramm, 'Mosaic Warfare Exploiting Artificial Intelligence and Autonomous Systems to Implement Decision-Centric Operations', Center for Strategic and Budgetary Assessments, 2020, <https://csbaonline.org/uploads/documents/Mosaic_Warfare_Web.pdf>, accessed 4 October 2025.

The Composite Air–Ground Operation

The requirement for support from offensive counter air patrols to interdict enemy aircraft, strike missions for SEAD/DEAD and to exploit intelligence to avoid AAA sites is an established element of air manoeuvre doctrine.[55] It remains the case that an air manoeuvre operation tends to take place in synchronisation with a composite air operation (COMAO) generated by the air component to leverage the suppression of air defences integral to the latter's success. Indeed, today, such an undertaking must be a multidomain operation, converging effects from the air, space and the electromagnetic spectrum to create gaps in the layered defences. This exploitation by air manoeuvre forces of the theatre air campaign is likely to persist.

Considering that the air component is likely to plan its operations at the theatre level under NATO Air Command, while the NATO Corps is the ground echelon which will have the responsibility for joint integration, it is logical for air manoeuvre forces to be an organic asset of the corps echelon, to enable the relevant multidomain planning with as few intervening echelons as possible.[56] Moving air manoeuvre forces to the corps therefore increases the assurance that it can be properly enabled to succeed.

There is, however, an increased density of pop-up threats on the battlefield, and as previously detailed, many of these threats do not require line of sight to threaten either air or air manoeuvre forces. The need for ground forces to support the air component by contributing low-latency ground-based fires to suppress or destroy enemy air defences – whether using SRBMs or GMLRS-ER (extended-range guided multiple launch rocket systems) – has already been identified and validated.[57] Indeed, a corps joint air–ground integration cell would undoubtedly be tasked with the responsibility to coordinate corps and divisional fires, to open the corridor for a composite air operation.[58] There is a problem, however, with these capabilities being assigned to target pop-up threats against an air manoeuvre force. In the first instance, because of the altitude and speed difference between a COMAO's aircraft and an air manoeuvre force, the threats to the latter can be shorter range, use passive sensing, and are therefore difficult for the corps to pre-locate. They are also likely to be a poor target for prestige munitions. Moreover, there is a direct opportunity cost to cutting these

55. MoD, 'Joint Doctrine Publication 0-30 UK Air Power', Third Edition, September 2022, <https://assets.publishing.service.gov.uk/media/636baad0d3bf7f1649c4e36d/UK_Air_Power_JDP_0_30.pdf>, accessed 4 October 2025.
56. Jack Watling and Sean MacFarland, 'The Future of the NATO Corps', *RUSI Occasional Papers* (January 2021), <https://www.rusi.org/explore-our-research/publications/occasional-papers/future-nato-corps>, accessed 4 October 2025.
57. Justin Bronk and Jack Watling, 'Rebalancing European Joint Fires to Deter Russia', *RUSI Occasional Papers* (April 2025), <https://www.rusi.org/explore-our-research/publications/occasional-papers/rebalancing-european-joint-fires-deter-russia>, accessed 4 October 2025.
58. Author observation of UK corps joint air–ground integration cell operating at the NTC, March 2024 and US corps joint air–ground integration cell, operating in Europe, June 2025.

munitions to support air manoeuvre, as opposed to higher-priority targets for the joint force, given limited stockpiles. Planning the positioning and fires for corps fires takes time and thereby both increases the trade-off for the commander by pursuing an air manoeuvre operation and slows the pace at which the operation can be planned and executed. In short, making the air manoeuvre force entirely dependent on joint fires to insert risks making it a difficult to use burden, rather than a flexible opportunity for the commander.

The solution to the dense array of pop-up threats that an air manoeuvre force must be able to bypass or overcome, and for which it is inefficient to draw on corps or joint ISR and fires, is to assign organic capability to the air manoeuvre force for finding and countering these threats. Thus, if a COMAO protects the air manoeuvre force from enemy defensive counter air and long-range air defences as an incidental benefit of their activities, and the corps protects the air manoeuvre force from MRAD, through its essential support to the COMAO, then the air manoeuvre force must deal with short-range air defence en route. Although improvements in defensive aid suites (DAS) may help reduce the threat to aircraft, proactively targeting the threat is a more effective means of preventing DAS from being overwhelmed.

Fortunately, emerging capabilities are well suited to providing this active defence around an air manoeuvre package during insertion. The collection of UAVs associated with this task are collectively referred to as 'launched effects', ranging from ISR platforms to decoys, jammers and strike systems. These systems, whether ground or air launched, can be tasked with spreading out along an intended movement corridor to find and suppress threats along the route. Ukrainian forces, for example, have found that a brigade can organically open a corridor in a Russian Combined Arms Army's air defence against low-altitude targets, using approximately 120 launched effects fired by a dedicated company using systems with approximately 100 km of range.[59] Commanders in Ukraine using these tactics have emphasised that it works best when the launched effects are commanded by the manoeuvre force, and tends to work badly when they operate as an independent unit. In the context of an air manoeuvre, there must be very close cooperation during planning because the launched effects would need to be fired and fly within the same airspace as the insertion platforms. Such an operation must be deconflicted from a broader COMAO and air manoeuvre plan, forming a composite air-ground operation.[60] This is especially true when air manoeuvre elements are embussing personnel at dispersed locations and thus converging on multiple axes towards the corridor. It should be noted that these launched effects can also be used to persistently strike targets identified by the air manoeuvre force *after* insertion, whether to create corridors for resupply, or in

59. Author observation of Ukrainian regimental operations, Ukraine and Russia, August 2025.
60. Curtis V Neal, Robert B Green and Troy Caraway, 'Bridging the Gap from Coordination to Integration', *Joint Force Quarterly* (No. 67, 2012), pp. 97–100, https://ndupress.ndu.edu/portals/68/documents/jfq/jfq-67/jfq-67_97-99_neal-green-caraway.pdf, accessed 4 October 2025.

response to calls for fire. Such a technique could, therefore, allow the air manoeuvre force to insert with confidence that it would not suddenly overfly and be engaged by pop-up defences.

Stand-Off Denial

Air manoeuvre forces have generally sought to avoid inserting themselves onto a contested landing zone. This has often required that the force be inserted some distance from their objective, and to subsequently advance on foot to occupy or assault their objective. One of the challenges on the future battlefield will be that a force pushed significantly in front of any layered protection risks rapidly suffering losses from indirect precision fire. There are two aspects to resolving this problem. The first aspect is speed, and the ability of the force to insert itself with the means of covering ground quickly. The second and much more consequential aspect is that the same capabilities that threaten a force's freedom of manoeuvre once on the ground, allow a force to deny vital ground without physically occupying or even overlooking it.

The ability of a force to deny ground using stand-off effects also offers an avenue towards the protection of the force from enemy strikes. The lack of a requirement to advance to the objective buys time to prepare an area for defence. One can imagine, for example, that an enemy axis of advance depends upon an MSR through restricted terrain. The terrain around the road might be relatively open and overlooked by higher ground, but it could be unsuitable for heavy vehicle traffic to move offroad. The road itself may offer few points that are defensible if physically blocked by a manoeuvre force. Historically, an air manoeuvre force would have to work with these factors and choose a point to hold the road under direct observation and fire, such as during Operation *Rendezvous Destiny II*, described earlier. However, with platoons now fielding organic fires with a range of up to 20 km, it is plausible for a ground force to instead take up position in dense or complex terrain and to interdict targets along the length of the road from there. This can achieve two effects simultaneously. First, it can deny effective use of the MSR. Second, if the enemy wishes to open the MSR, they must now consider how to attack an enemy in complex defensible terrain that is not on their main axis and therefore redirect combat power away from their main effort.

Delivering stand-off denial, however, is not simply a case of being able to field weapons that can reach the target, but carrying enough munitions of an appropriate type to be able to engage and destroy the relevant classes of target in a variety of weather conditions, and furthermore, for this to be repeatable to the extent that the enemy considers using the targeted terrain as prohibitively costly. Moreover, since the air manoeuvre force would be separated from the main body, and thus have limited access to wider ISR feeds, it follows that the air manoeuvre force must also be able to maintain the targeted area under observation. In addition, ISR must be maintained in an

electromagnetic environment where the enemy has a much greater density of systems with a power and range advantage. The enemy could therefore potentially disrupt attempts to mutually support between the main body and the inserted force, due to the proximity of its electronic attack capability.

There are risks in attempting stand-off denial of an objective. If the enemy can emplace protection against the force's strike systems, and thereafter screen it, then it can mitigate its effects without diverting significant resources to the effort.[61] The advantage of being positioned on the objective is that it creates an imperative for the adversary to dislodge the force from it. For stand-off denial to be effective, beyond the ability to continue to find and strike targets, the force must also be survivable. The force must be able to erect defensive positions that are more dispersed and hardened than traditional infantry foxholes and dugouts. The question of dispersion raises the question of how the force is to maintain mutual support. Despite these complications, however, the concept of stand-off denial arguably makes it feasible for an air manoeuvre force to divert enemy effort or deny critical terrain, without overly exposing itself to the enemy.

Diversified Sustainment

As indicated above, an air manoeuvre force must be resupplied with munitions if it is to maintain stand-off denial, and there are major challenges to being able to assure resupply in the emerging threat environment. Before discussing solutions, however, it is important to understand the requirement. At Hostomel, Russian forces failed largely because they did not put enough troops onto the objective. In high-intensity combat operations, battalion and brigade operations are to be expected. The extant doctrinal planning assumptions for a battalion's daily consumption rate (what the force uses in 24 hours) is a good measure of the scale of the challenge.

A British Air Assault Battalion comprising a Headquarters Company, three Rifle Companies and a Support Company require 2.1 pallets of standard NATO rations, or 695 boxes for the same number of individuals, per day.[62] If water is not available, this must be shipped in pallets as well. Current doctrinal planning assumptions appear high, accounting for over 10,000 litres of water for individuals across a battalion, excluding centralised water supplies for purposes other than drinking. However, at the upper

61. Ukrainian operations in Krynky demonstrate how this risk can manifest, see Nate Ostiller and Martin Fornusek, 'With Krynky Lost, What Did the Perilous Operation Accomplish?', *Kyiv Independent*, 18 July 2024, <https://kyivindependent.com/with-krynky-lost-what-did-the-perilous-operation-accomplish/>, accessed 20 December 2025; Olha Kyrylenko, 'What Really Happened in Krynky. The Untold Story of the Marines' Landing on the Left Bank of the Dnipro River', *Ukrainian Pravda*, 18 November 2024, <https://www.pravda.com.ua/eng/articles/2024/11/18/7484985/>, accessed 4 October 2025; author interviews with participants, Ukraine, January 2025.
62. This and subsequent figures are from extant doctrinal planning assumptions.

bounds, if the average person needs to drink 8–12 litres of water per day when conducting a high level of physical activity in hot weather conditions and requires only a small amount for washing and other forms of personal administration, such volume may indeed be necessary. In addition, when conducting high-intensity operations, each Rifle Company is assumed to require 0.45 pallets of 5.56-mm ammunition for rifles, 0.58 pallets of 5.56-mm linked ammunition for light machine guns, 3.04 pallets of 7.62-mm linked ammunition for general purpose machine guns, and 1.34 pallets of Javelin ammunition, along with a smaller amount of other stores. These supplies are very heavy. Each pallet of six Javelin rounds weighs 287 kg. As for indirect fire support, the battalion's support company requires 4.2 pallets of 81-mm mortar ammunition. The Air Assault light gun Regiment supporting the battalions should have 12 light guns of 105-mm calibre split across two batteries of six guns each. Accounting for some divergences about whether current planning assumptions are realistic, each battery requires somewhere between 405 (11.25 pallets) and 720 (20 pallets) rounds of 105-mm HE ammunition for each day of high-intensity operations, with each pallet weighing 1,315 kg if packed with charge normal ammunition.[63]

These calculations do not include fuel and batteries, which constitute a high volume of any logistics effort, and which are likely to be necessary for generators, even if a large part of the force benefits from electrification, nor does it account for several other consumable stores. It is critical that the scale of supply requirements is realistic as to what can be achieved with emerging technologies. This is not a new problem. Resupply of air manoeuvre forces has historically faced issues of how to meet the required volume of stores and this has been one of the foremost constraints on these operations. It is destined to remain so.

Emerging technology using UAVs for resupply offers the opportunity to continue to push supplies via diversified routes, in a threat environment where the risk would not be justified with crewed aircraft. If the normal doctrinal assumption is that a force should be inserted with 72 hours of supplies, a resupply mission is consequently essential within this timeframe, unless the force is relieved. The use of expendable systems to push supplies, however, can commence as soon as the force is committed, such that there are 72 hours of steady inflow of materiel before the initial supplies of the force are consumed. It may not be the case that diversified supply can fully sustain the force, but by extending the timeline and limiting the classes of supply that must be pushed with aviation, such methods can shift the dynamics of resupply from a predictable necessity that the enemy can disrupt to an event which commanders can deliberately plan and execute, having set appropriate conditions on a periodic basis.

It must be crystal clear, however, that relying on UAS for resupply also imposes significant limitations on the range of the force and the weight of systems that can be sustained. If the logic is that UAS can be committed even if a proportion are shot

63. Royal Artillery Manual Volume 1 (Operations), Pamphlet No. 4, Issue 1 (March 2021), Chapter 9, pp. 3–4.

down, it follows that they must be more expendable than existing crewed lift platforms. This places UAS suitable for this mission within definable cost and therefore size, weight and range characteristics. This limit in weight has significant consequences for the equipment of the force, because heavy and rapidly consumed materiel such as artillery shells, as described above, are not likely to be replenishable via these means. This suggests that there is a need for a different basis for deployable support fires that is more efficient and lighter. However, even when factoring in a lower volume of materiel with a higher probability of kill per munition, an air manoeuvre force will still require several tonnes of stores per day. It must also have the troops to operate the resupply systems.

For the projection of an air manoeuvre force deep into enemy territory to divert enemy forces or race to vital ground, it is likely that resupply by UAS is inhibited simply by the limitations of range on UAV platforms that are any less expendable than their crewed equivalents. But in the context of enabling ground manoeuvre across complex terrain, for example, these methods show promise. Consider, for instance, an air manoeuvre operation to dislodge an enemy from approaching an intended crossing point of a wide wet gap. The force may only need to project 10–20 km and over these distances; therefore, a continual push of materiel via uncrewed systems offers an invaluable way of extending the endurance of the lodgement on the far side as the ground manoeuvre force emplaces the equipment to conduct a deliberate crossing.

In summary, therefore, embracing diversified supply offers the opportunity to reduce risk, expand tactical flexibility and preserve the utility of air manoeuvre forces, especially when resupply routes can be supported by the launched effects used to help insert the force. But this will also shape how air manoeuvre forces are used, and over what distances, creating new constraints that commanders must factor into operations.

Adapting the Force

For an air manoeuvre force to be able to execute the concepts outlined in the previous chapter, it is necessary for them to develop capabilities that are not currently fielded within NATO air manoeuvre formations today. This chapter discusses the implications of the emerging concepts identified for capability development and force design.

Planning Tools and Command and Control

To operate in a dispersed posture before and after insertion by air, and to maintain effective links between the operational headquarters and the inserted force, it is necessary to have a robust communications system. The critical capabilities in this respect appear to be satellite links distributed to the platoon level, in addition to local mobile ad hoc networks (MANET) used by the force to distribute and accumulate data.[64] The transmission of video must be managed separately, in all likelihood, and often ground-laid fibre-optic cable will be required to provide the bandwidth for accumulation and transmission.

At the headquarters, the ability to process higher-echelon ISR data for the purposes of planning operations can be turned into curated intelligence packages to disseminate to the inserted force. Conversely, the inserted force should prioritise the upload of time-sensitive detections and targeting data.[65] Beyond this traffic, forces must take into account other critical data for periodic rather than continuous transmission, namely the planning data required to conduct strikes including electromagnetic survey results and meteorological forecasts. In addition, for forces within the MANET, blue force tracking is also critical to maintain mutual support across a dispersed force.[66]

64. British Army, 'Army Signallers Test Cutting-Edge Radios in Jungle', <https://www.army.mod.uk/news/army-signallers-test-cutting-edge-radios-in-jungle/>, accessed 17 November 2025.
65. Bandwidth optimisation is being pursued in the UK Army through Project ASGARD. See Sam Cranny-Evans, 'Helsing and General Dynamics Detail AI for Bowman Network to Help Double Lethality', *Shephard Media*, 6 November 2024, <https://www.shephardmedia.com/news/landwarfareintl/helsing-and-general-dynamics-detail-ai-for-bowman-network-to-help-double-lethality/>, accessed 18 November 2025.
66. Jack Watling, 'Supporting Command and Control for Land Forces on a Data-Rich Battlefield', *RUSI Occasional Papers* (July 2023), <https://www.rusi.org/explore-our-research/publications/occasional-papers/supporting-command-and-control-land-forces-data-rich-battlefield>, accessed 17 November 2025.

One challenge for these systems is that once inserted beyond the FLOT, some communications nodes will inevitably fall into enemy hands. It is therefore necessary that the inserted force can only pull data from an assigned bucket for the mission, and that the equipment, once it is 'logged out', cannot be used to access the bucket or other capabilities. The ability to remotely wipe devices also seems highly reasonable. What's more, considering the inevitability that radio systems will be compromised, it is also necessary that the radio's software layer is agnostic of the bearer and the hardware – such that the force using this radio can have its equipment routinely updated, without needing to change the software tools or interface for interacting with critical data. Ensuring that air manoeuvre forces can plan while dispersed, coordinate mutual support once inserted, and direct supporting fires is a critical enabler of the concepts outlined in the previous chapter.

Launched Effects

Whether they are called 'one-way-effectors', 'powered-bombs', or 'launched effects', emerging cheap, long-range precision weapons and their capacity to deliver explosive, electronic or other payloads offer the prospect of tactical groups suppressing and saturating critical enemy systems.[67] These weapons should not be seen as a replacement for missiles and other conventional weapons systems, since launched effects have a comparably low probability of kill, and are easier to counter. In combination with missiles and artillery, however, these weapons can confront a defensive network with competing dilemmas. The ability to generate large salvos, repeatedly, makes these launched effects ideal tools to enable a force to manoeuvre prestige assets – like aviation – through contested airspace.[68] These systems also offer a cheap means of sustaining a persistent strike capability against targets that might otherwise fall beneath the targeting threshold for more complex weapons.

As discussed in the previous chapter, launched effects offer a means of creating a protective layer around air manoeuvre forces to enable insertion. It does not matter whether these effects are launched from the ground or from aviation. However, from a force design perspective there are some considerations. Attack aviation is likely to

67. Justin Bronk and Jack Watling, 'Mass Precision Strike: Designing UAV Complexes for Land Forces, *RUSI Occasional Papers* (April 2024), <https://www.rusi.org/explore-our-research/publications/occasional-papers/mass-precision-strike-designing-uav-complexes-land-forces>, accessed 4 October 2024; Brock Daugherty, 'Advancing Army Innovation: Special User Demonstration Highlights the Future of Launched Effects Technology', US Army, 30 September 2025, <https://www.army.mil/article/288835/advancing_army_innovation_special_user_demonstration_highlights_the_future_of_launched_effects_technology>, accessed 4 October 2025.
68. Air Force Research Laboratory, 'AFRL Successfully Completes Golden Horde Collaborative Small Diameter Bomb Flight Demonstrations', 26 May 2021, <https://www.afrl.af.mil/News/Article/2634538/afrl-successfully-completes-golden-horde-collaborative-small-diameter-bomb-flig/>, accessed 4 October 2025.

require launched effects as part of its arsenal in order to scout ahead to search for pop-up threats during its independent deep attack operations.[69] Insofar as the force is escorted by attack aviation, some launched effects may emanate from these platforms. However, this will not be sufficient in volume, given space on the pylons. There will also, therefore, need to be ground-launched systems that can fly ahead of the force. Considering that these will need to fly some distance and at a speed to enable synchronisation with the air manoeuvre force, it is likely that these will have small payloads. Contemporary evidence from the war in Ukraine, combined with considerations such as the balance of cost versus effect, suggest that a range of around 70–100 km is appropriate for these munitions, noting that this distance may be absorbed by the need to launch some distance from the FLOT, to approach targets indirectly, and by the need to loiter.

The need for these launched effects to be synchronised with the air manoeuvre, to route weapons intelligently to bypass defences, and thus to draw on intelligence, meteorological and electromagnetic surveys to plan strikes, suggests that the unit responsible for launching them should be part of a coherent unit, rather than being distributed across the force. This represents a significant shift from the established approach to fires within most Western artillery branches. It makes sense for tube artillery to be commanded centrally and thereafter allocated to support distinct lines of effort. Launched effects, however, which are going to become an enabler across the force, must use highly specialised approaches and equipment, depending on the targets they are tasked to engage or the forces they are assigned to support. It therefore makes more sense for launched effects units to be assigned to consistently conduct specific tasks. For those that are assigned to support a manoeuvre element, they should be integral to that force. Thus, air manoeuvre forces should include a launched effects component.

Utility Lift

The aviation used to carry air manoeuvre forces varies considerably, from light and medium, to heavy lift helicopters. Since these airframes are used for an array of tasks beyond air manoeuvre operations, this paper does not extensively address the detailed requirements for them, which will be the subject of a separate paper. However, from the point of view of air manoeuvre, several points should be emphasised. First, successful air manoeuvres have been carried out in the face of highly effective modern air defences using very simple Mi-8/17 helicopters. Beyond continued investment in defensive aid suites, the key question for whether the air frames can get through is the

69. Jack Watling and Justin Bronk, 'Maximising the Utility of the British Army's Combat Aviation', *RUSI Occasional Papers* (April 2021), <https://www.rusi.org/explore-our-research/publications/occasional-papers/maximising-utility-british-armys-combat-aviation>, accessed 19 November 2025.

enablement supporting them, rather than the sophistication of the lift platform itself. On balance, serviceability and availability appear disproportionately important characteristics. Noting, however, that the success or failure of an air manoeuvre operation is heavily dependent on how many personnel can be inserted within a time-bound gap in defences, heavy lift platforms seem of disproportionate utility, because fewer platforms can move more and heavier materiel. Although the loss of one of these airframes means the loss of more troops and equipment, relative to a medium lift aircraft, the balance of evidence suggests that if the enabling operations have been properly carried out, no aircraft should be lost. And if they have not, then distributing the load over more airframes will not necessarily reduce losses.

Accepting, however, that there will be few windows in which aviation can be committed, the previous chapter outlines the value of UAS in pushing supplies to the force. Noting that these lift operations involve many of the same planning considerations as the launched effects detailed previously, it follows that the operation of uncrewed resupply systems may best be assigned to the same troops.

The limitations of uncrewed aerial resupply, however, arise from airframe constraints. A UAV capable of moving up to 180 kg of load can be expected to fly with around 15–20 km of range.[70] If this load is lowered to 100 kg, a UAV could fly 30–40 km, depending on its design. Although it is feasible to build a UAV that can carry more payload over a greater distance, the cost of such a platform would begin to restrict the extent to which it can be exposed to threats.

These range limitations on uncrewed resupply dovetail with the range at which an air manoeuvre force can be readily supported by joint fires. Indeed, enabling joint fires may be one reason to insert an air manoeuvre force. The range beyond the FLET of GMLRS – assuming 70 km range with the launcher a third of its range behind the FLOT – would be 40–50 km. If the force uses its ISR out to 16 km to direct GMLRS strikes, then one may estimate that the inserted force is likely to reach around 30 km of depth before it is too deep to be supported.

To examine the question in terms of terrain rather than relative to the enemy, consider the previously used example of a force inserted to disrupt an enemy defending a wet gap. If it is necessary to push the enemy beyond the distance where it can keep the crossing under persistent threat from lower echelon ISR capabilities and fires, then the range of tactical systems involved will realistically be around 17–30 km, and thus the air manoeuvre force would need to insert to this depth to disrupt the enemy's ability to contest a crossing.

70. This is based on planning assumptions for existing high-end lift UAVs that fall below the approximate price bracket where their loss can be risked on an ongoing basis. These figures are derived from author discussions with manufacturers. The figures should be read as approximate.

Furthermore, assuming that resupply UAVs tend to be reloaded with batteries or fuel at a FARP in the battalion battle area before insertion, and that forces may wish to manoeuvre these UAVs to their 'link up' point, it follows that optimising the UAV's load to travel up to 40 km range while carrying 100 kg of weight is a reasonable capability target. This does not mean that a force cannot be projected beyond 30 km from the FLOT. It simply means that to do so, a force needs to be recovered or relieved before its own supplies or munitions and rations run out.

If the force can organically charge batteries with generators or have additional power packs resupplied, it follows that UAVs pushed to a position with supplies can either return – potentially with casualties – or be used on the position for ISR, bombing and other tasks. UAVs can also be used for redistributing supplies within the force so that a dispersed force can keep personnel on the positions and not expose themselves through movement.[71]

UAVs do not offer a complete replacement for aviation. There is a significant difference in the size and weight constraints in what they can resupply. The critical contribution of UAVs, however, is to lower the risk of pushing materiel and to give the aviation component time and flexibility in creating the conditions for resupply flights, rather than tie a mission to the rate at which the force consumes materiel. The integration of utility UAVs into an air manoeuvre force, therefore, extends its endurance and thus the persistence of the effect it can have on the enemy.

Fire Support

If air manoeuvre forces are to achieve stand-off denial of vital ground, it follows that they should have a significant ability to engage the enemy beyond line of sight. Traditional indirect fires comprising light howitzers are not well suited to this, because light howitzers were already heavily restricted by logistics, and the challenges of resupplying such heavy and bulky materiel appears to be worsening.

Considering the characteristics of the current war in Ukraine, it is tempting to advocate for forces to be equipped with radio frequency-controlled first person view (FPV) UAVs as their primary means of stand-off destruction. While this weapon system should be used by all infantry units, a more detailed examination of the evidence from Ukraine suggests that this is not an ideal match for air manoeuvre forces. There are several problems with overreliance on RF-FPVs in this role. These problems include the fact that the force will be inserted into enemy-held territory where the enemy will have a disproportionate influence on the electromagnetic environment, significantly reducing

71. These tactics have now become ubiquitous in Ukraine. See Sam Cranny-Evans, 'Ukraine Doubles Down on UGVs With New ARX Robotics Order', *Calibre Defence*, 20 November 2025, <https://www.calibredefence.co.uk/ukraine-doubles-down-on-ugvs-with-new-arx-robotics-order/, accessed 21 November 2025.

the efficiency of UAV operations. FPVs have also been generally found to be inadequate for effectively engaging a wide range of targets due to their limited velocity and payload.[72] Concerning targets that can be defeated with large numbers of successive hits, this presents challenges for a force that is inserted onto enemy territory, because the force lacks the magazine depth to allocate dozens of munitions per target or the depth of defence to buy the time to strike targets multiple times as they approach their positions. Latency in FPV launch and time in flight is long, during which an enemy armoured vehicle can cover a lot of ground. Furthermore, the projection of air manoeuvre forces is likely to be conducted during windows of poor weather – reducing the threat to the attacking force – which are also the conditions in which FPVs and other cheap UAVs struggle to operate. Another challenge to FPVs is that forces are increasingly investing in the triangulation and targeting of FPV operators. For a force operating behind the frontline, located in prepared positions and supported by layers of defence, this threat can be mitigated, but it is much harder for a force to protect FPV operators when it is inserted over the line. As FPVs become a universal weapon system for infantry, units will increase the density of countermeasures, such that their efficiency is likely to decline.

The solution for air manoeuvre forces should be to employ a high–low mix of fire support, relying on munitions that are not susceptible to jamming. This would probably comprise wire-guided UAVs at the 'low' end, and a capability equivalent to Spike-NLOS with a dedicated anti-armour warhead at the 'high' end. Air manoeuvre forces can also periodically direct and enable fires from their supporting aviation or identify targets for higher echelon fires such as GMLRS. The launched effects element of the air manoeuvre force can also strike targets identified by the inserted troops.

Wielding an assortment of indirect fire weapons would allow an air manoeuvre force to have mass and precision and provide it with options to deliver a higher payload against moving armoured or point targets. This would also give the inserted force a reliable effective range of some 16 km, and the capacity to strike out to 30 km under certain conditions. The insertion of Spike-NLOS teams into Iran by the Israel Defence Forces during Operation *Rising Lion* demonstrates that these systems can be supported by light and mobile forces, operating at reach.[73]

72. Author observations of Ukrainian units with large numbers of detected targets for which they had no weapons match, Ukraine, August 2025.
73. Howard Altman, 'Spike Missiles that Destroyed Air Defenses from Inside Iran Were Remotely Operated', *The War Zone*, 16 June 2025, <https://www.twz.com/news-features/spike-missiles-that-destroyed-air-defenses-from-inside-iran-were-remotely-operated>, accessed 4 October 2025.

Support Fires and Force Protection

When an air manoeuvre force uses fires to proactively deny key terrain or degrade enemy forces, these munitions are not generally optimised for the protection of the air manoeuvre force or the suppression of enemy fighting positions in support of assault actions. Moreover, since the inserted force must disperse to improve survivability, the need to have call on fires to prevent positions being overwhelmed and to discourage the enemy from concentrating is critical. These fires must be available when the enemy attacks, a moment which is likely to coincide with bad weather, and so this is not a task for which drones are well suited.

Considering these requirements, it seems reasonable to conclude that the infantry mortar will remain a vital weapon system for air manoeuvre forces. The 120-mm mortar, while a useful weapon, suffers from the same problem as the light gun, having 120-mm bombs that, like 105-mm shells, weigh between 15 and 18 kg and thus are too heavy to be resupplied in meaningful quantities. By contrast, 81-mm mortar bombs, which weigh between 3 and 5 kg, can be moved in sufficiently large volume to keep the force fighting. Automatic grenade launchers are similarly a highly lethal weapon with an indirect fire capability that can be supported once inserted.

Heavy machine guns also represent a relevant capability for air manoeuvre forces to suppress enemy infantry, to engage light vehicles or structures, and if given proper gyros and sights, to engage UAVs.[74] Protecting the inserted force from UAVs will be an important task, and the distribution of appropriately stabilised heavy machine guns is an important layer of a force's ability to protect itself from above. Interceptor UAVs are also a protection against both UAVs and helicopters that are light enough to be pushed to an inserted force.[75]

If a force inserted by air manoeuvre is to avoid being isolated and defeated in detail, it must establish protected fighting positions. Digging will remain the first and foundational stage of force protection, but this is insufficient. While air manoeuvre forces were inserted into Iraq with 50 sandbags in each Blackhawk helicopter during Operation *Rendezvous Destiny II*, today, netting and wire are just as important. Wood can be sourced locally, depending on the environment, but this would require chainsaws and other equipment to be pushed forward to be exploited efficiently. Wire is harder to source and so it is more likely to be inserted with the force.

74. Illia Kabachynskyi, 'AI-Powered Turret That Hunts Russian Missiles and Drones? Meet Sky Sentinel, Ukraine's New Air Defense', *United24 Media*, updated 3 July 2025, <https://united24media.com/war-in-ukraine/ai-powered-turret-that-hunts-russian-drones-meet-sky-sentinel-ukraines-new-air-defense-8589>, accessed 4 October 2025; author observation of this system in operation, Ukraine, January 2025.
75. Jack Watling and Noah Sylvia, 'Competitive Electronic Warfare in Modern Land Operations', *RUSI Occasional Papers* (January 2025), <https://www.rusi.org/explore-our-research/publications/occasional-papers/competitive-electronic-warfare-modern-land-operations>, accessed 4 October 2025.

Such passive defensive measures should be supplemented by electronic protection. In the first instance, this should include the ability to jam navigational and control frequencies. The basis for such a capability would be distributed antennas, connected by wire and powered by generators, with EW control boxes at the centre. The force also needs EW and other passive means of detecting threats over its positions – especially UAVs – to alert troops to the threats they cannot see.[76]

Beyond deploying passive and 'soft kill' defences, the force must have a robust air defence capability. Defeating enemy fast air is probably a task for offensive counter air support from the air component. Enemy helicopters and UAVs are the most significant threats to inserted forces. Against FPVs and 'one-way effectors', machine guns with appropriate mounts and sights are probably the most efficient means of destruction. For helicopters, SACLOS MANPADS remain the most credible weapons system. To counter enemy reconnaissance or higher altitude UAS, interceptor UAVs are the most economical munition. This latter capability can also play an offensive role by denying air corridors around the inserted force to enemy reconnaissance orbits.[77]

Finally, almost all an inserted force's firepower and protection, as articulated above, relies on electrical power. The efficient management of available energy and its generation is therefore a critical concern of the sustainment of a force and its combat effectiveness. This requires defensive systems and sensors to be carefully managed, to minimise energy consumption. It also requires a deployed force to coordinate the use, collection and charging of batteries. While solar panels and other methods can be used to gain some charge, generators remain the most efficient means of charging large battery packs at scale. Fuel remains the easiest means of storing and transporting energy for electrical generation at the edge.[78] As the force electrifies, air manoeuvre forces must be creative in ensuring how they manage and track energy across a formation and understand how they can move energy within an inserted force, rather than immediately demand resupply. Collectively, the capabilities articulated above are vital for an air manoeuvre force to be able to extend the duration over which it can contest ground, divert enemy resources, and survive.

76. *Ibid.*
77. Jack Watling and Justin Bronk, 'Protecting the Force from Uncrewed Aerial Systems', *RUSI Occasional Papers* (October 2024), <https://www.rusi.org/explore-our-research/publications/occasional-papers/protecting-force-uncrewed-aerial-systems>, accessed 4 October 2025.
78. DSTL has carried out extensive research into this question, having gathered live data by monitoring the experimental battlegroup 2 R Yorks in exercise. Author observation, NTC, March 2024.

The Enduring Centrality of Infantry

While an air manoeuvre force may need a range of novel supporting capabilities to be effective, as outlined above, this does not invalidate the fact that the basic building block of a force is its infantry and their professionalism, its aggressive ethos, and its expertise. Infantry are critical for taking and holding vital ground. They are the ultimate backstop against the fires elements being overrun, and they should not remain passive on a defensive perimeter. In some cases, it may be entirely feasible to have infantry directly contest vital ground. Where this is not possible, raiding and having an active defence can drastically complicate the enemy's ability to contain and defeat the force.

While proficiency in battle drills will remain the backbone of an infantry's competence, they will need to evolve to reflect changes in how the force deploys and fights. Dispersion of the force means that infantry must become better at operating in smaller groups. They must develop tactics, techniques and procedures for supporting one another beyond their line of sight and must coordinate with precision indirect fires. There is also the need for an infantry force to locally protect itself from above during tactical movements. In Ukraine, between a third and a half of infantry in a moving element are tasked with tracking threats from above.[79] Ukrainian battle drills are not necessarily the best models to emulate, but through experimentation, forces can learn to manage the same threats.

Proficiency in urban operations is important for infantry. There is, however, a need to transition from the style of urban warfare which was pre-eminent in counterinsurgency, and which was heavily influenced by drills developed for hostage rescue by special forces, towards approaches optimised for high-intensity warfare. The latter approaches involve lower force densities and a much greater use of explosives. If an enemy can be isolated in a structure, the structure can be destroyed, rather than cleared. Infantry forces must also train and prepare to operate in heavily degraded urban environments.[80]

It can be deduced that while the emerging operating environment requires adaptations to air manoeuvre force structures and tactics, there is also continuity, and it is important that existing areas of excellence are not undermined by reform. It is also essential that the legacy capabilities that retain relevance are able integrate new capabilities outlined in this chapter into their training, so that they can work out how to function as combined arms forces. Ultimately, air manoeuvre will endure, but air manoeuvre forces must adapt to succeed.

79. Jack Watling, 'Emergent Approaches to Combined Arms Manoeuvre in Ukraine', *RUSI Insights Papers* (October 2025), <https://www.rusi.org/explore-our-research/publications/insights-papers/emergent-approaches-combined-arms-manoeuvre-ukraine>, accessed 21 November 2025.
80. John Spencer and Rich Hinman, 'Enter and Clear a Room: The History of Battle Drill 6, and Why the Army Needs More Tactical Training Like It – Not Less', Modern War Institute, 21 July 2021, <https://mwi.westpoint.edu/enter-and-clear-a-room-the-history-of-battle-drill-6-and-why-the-army-needs-more-tactical-training-like-it-not-less/>, accessed 4 October 2025.

Conclusion

Air manoeuvre operations have, since their inception, been 'high-risk and high reward' affairs. The current changing threat environment presents new challenges at each stage of air manoeuvre operations. Nevertheless, the challenges to the wider force when trying to manoeuvre on a transparent battlefield mean that the flexibility, speed and reach offered by an air manoeuvre force makes its unique attributes even more attractive to commanders.

To assure the viability of air manoeuvre in the emerging threat environment, it is necessary for air manoeuvre forces to adapt their concepts of operation and adopt new capabilities.

For one, multidomain operations can allow air manoeuvre forces to be inserted, despite the growing complexity of defensive systems. New options for stand-off denial can also enable air manoeuvre units to deploy into defensible terrain while simultaneously contesting vital ground on the offensive. In turn, the operational value of these forces is their ability to rapidly alter battlefield geometry by creating threats on the flank, irrespective of the constraints normally imposed on a force by terrain. In a context where an enemy has pervasive observation and fires, moving independently of terrain is even more important, to enable ground forces to cross wet gaps or manoeuvre through canalising ground, whether from elevation, dense forests or swamps. Conversely, a force lacking air manoeuvre capabilities will always have to guard against an adversary that has such capabilities in reserve.

Despite their continued utility, the capabilities and battle drills of an air manoeuvre force must therefore evolve to encompass the modern threat environment. Counter-unmanned aerial systems and electronic protection are critical, as are infantry tactics that allow for successful tactical actions by dispersed forces. Arguably the greatest challenge for the force, however, is that once inserted, it must manage its energy sources. Almost all emerging capabilities and their ability to mitigate threats depend on electrical power, and considering corresponding threats to sustainment, the ability to recharge batteries and conserve energy will be a major determinant of how far a force can be projected, and how long it can operate before relief.

It is also important that air manoeuvre forces are held at, and have relations with, the right echelons. It is a conceit of most manoeuvre formations to assume that they will be

the supported element in any operation they are committed to. In the case of air manoeuvre forces, while they need the overwatch from the air component to inert, they will not be the air component's priority. Similarly, given the limited availability of higher echelon ground-based fires, these are more likely to be assigned to support the air component than to enable air manoeuvre. Air manoeuvre operations are more likely to be initiated if they can incidentally benefit from joint fires, rather than be supported directly by them. Furthermore, in terms of battlespace, air manoeuvre forces need a corps frontage to have the freedom to prepare, plan and execute operations. It is therefore best if these forces are held at the corps level, and thereby sit at the intersection between land, air and space capabilities.

This paper has been predominantly concerned with the tactical utility of dedicated air manoeuvre forces. One of the quandaries that armies will have to address in the future is that since such forces are usually held at high readiness, are highly professional and are easily deployed, there can be a proclivity to commit them early in a crisis. Under such circumstances, however, air manoeuvre forces essentially become glorified light infantry with limited support capabilities. Convincing policymakers to commit line infantry early – even if they are inserted using aviation – and to retain air manoeuvre forces as part of the operational reserve is often in contradiction with the foremost justification provided for maintaining such forces in peacetime, namely their responsiveness to policy demands.

The final consideration arising from this paper is that if the ability to turn a flank or deny enemy resupply by inserting air manoeuvre troops is invaluable for enabling the crossing of complex terrain, it follows that a commander will wish to use such a force repeatedly, placing them at risk. Yet, one of the consistent themes of this paper has been survivability. Air manoeuvre forces have often been seen as a 'one shot' or at least a 'high-risk, high reward' capability. This paper argues that in following the principles outlined above, and notably by occupying defensible terrain from which an air manoeuvre force can project denial, armies may reduce their losses. As a result, armies can increase the likelihood that air manoeuvre forces can be reused to enable manoeuvre across successive terrain features, even if the depth to which they can be projected is reduced by the emerging threats described.

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