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Cover image: Australian Army sappers from 1st Combat Engineer Regiment conduct littoral operations from a Contracted Military Vessel off the Tiwi Islands during Exercise Predator's Run.
(Source: Defence image gallery)

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Foreword

James Davis, Director General Future Land Warfare

Command is central to the Army profession. The Australian Defence Glossary defines command as 'the authority which a commander in the military lawfully exercises over subordinates by virtue of rank or assignment.' It notes that command also includes responsibility for resources, coordination and control of military forces, and the health, welfare, morale and discipline of assigned personnel.

How leaders command changes with the character of war. Lawrence Freedman observes in *Command on War* that there is no universal balance between the political and the military, between speed and security or the hundred other tensions that bedevil the practice of command. Professional military knowledge includes a working knowledge of these tensions and the extent to which the character of any war might aggravate them. This edition of the Army Journal deals with how command interacts with artificial intelligence and new battlefield geometries and environments. Using the Armed Forces of Ukraine as a model, Dr Jack Watling emphasises lateral, rather than vertical integration of force elements and the consequences for mission command. He articulates the impacts of battlefield transparency, contested and congested electromagnetic spectrum, mass precision strike, dispersion of forces and complex terrain with a clarity and fidelity that means this is a must read for company commanders, force structure and capability planners.

Two authors discuss command challenges of robotic, autonomous and artificial intelligence (RAS-AI) capabilities. Dr Zena Assaad explores how the application of human-machine teaming in battle requires careful understanding of the

defined framework and interdependencies between the systems, inclusive of ‘the human in the loop’, to execute effective mission command. She asks if robots are ‘teammates’ or ‘tools’, and the social implications this has for commanders. Thinking about this issue matters more than the answer.

In one of two articles from our colleagues in the British Army, Major Iain Robinson concludes that RAS-AI technologies will not replace human decision-making but rather ‘augment C2 through human-machine teaming, allowing commanders to make more informed decisions, with greater speed’. He suggests that in the long term, emerging technologies may fundamentally transform the future of warfare. No doubt, they will; they always have; additive to what armies already use and know.

Our second British author, Major Harry Busby argues that while the theory of command; evident in robust command structures, unity of command and clear communication remain unchanging requirements; the predominance of multinational alliances across multiple domains means the practice of command must evolve to accommodate decentralised command, remote command posts and the integration of technology. Dr Ian Langford’s article is, I suspect, a little known case study of disaggregated command and control over a low-signature, mobile and survivable force elements in the north of Australian and region beyond. It is interesting to note that the Unit in question was commanded by political advisor and anthropologist William Stanner, who had little military experience but based this experiment on his study of German and South African army operations in Africa.

The book reviews in this edition cover Second World War history and new thought in military studies including Dr Jack Watling’s book ‘The Arms of the Future’. We have been privileged to have Dr Watling as the Army Keogh Chair in 2024 and I thank him for his contributions and thought leadership. I am similarly grateful for the articles from Dr Charles Miller and Dr Mark O’Neil on Ukraine and Australia’s strategic policy respectively, Dr Colin Cockroft and Dr Jamie Vovrosh for explaining the need for private and public investment in quantum technology for Army, and Dr Andrew Maher for his examination of proxy war in Yemen. Finally, Major Gabrielle Taylor's thinking on future Prisoner of War, Internee and Detainee Activities is an important contribution to the preparedness and command accountability considerations.

Happy reading! Please contact the AARC team if you want to take the next step as a contributor.

The Australian Defence Force and Future Prisoner of War, Internee and Detainee Activities

Gabrielle Taylor

Introduction

The 2023 Defence Strategic Review (DSR) brought Australia's strategic context into sharp focus. As a rising power, China is challenging the rules-based global order, and great power competition threatens Australia's national interests. Australia faces the most challenging set of strategic circumstances since the Second World War, making the potential for short-warning large-scale combat operations (LSCO) in the Indo-Pacific a real possibility.[1] The 2024 National Defence Strategy (NDS) sought to action the recommendations of the DSR and to clarify the Army's role as the integrated force's experts in land combat—a force that must be prepared to project and sustain land forces into the littoral regions to Australia's north.[2] Despite increasing dialogue around the likelihood of conflict in the region, and shifting force structure and posture to meet the threat, a significant gap remains in literature and practice concerning prisoner of war, internee and detainee (PWID) activities. While PWID activities have been an enduring aspect of war throughout human history, and recognised as strategically important, there has been a continual under-prioritisation by the Australian Defence Force (ADF) for the preparation and conduct of effective PWID activities.[3] To succeed in completing the missions and

tasks set out in the DSR and the NDS, the ADF, and specifically the Army, should plan and prepare for PWID activities in a forward-deployed context. Such preparations must consider all phases of operations from the point of capture through to repatriation and how this will be achieved in conjunction with allies and partners.

'PWID activities' refers to the process of depriving individuals of their liberty during conflict.[4] These activities play a critical role in combat because they remove enemy troops from the battlefield, thus supporting the maintenance of operational tempo. They enable the collection of information to produce intelligence and ensure the security and humane treatment of PWIDs.[5] Credible PWID activities support post-conflict repatriation and reintegration, and pave the way for a return to normality and long-term stability. Further, PWID activities set the conditions for the investigation and prosecution of enemy combatants suspected of war crimes. Effective PWID activities require significant force preparation, planning, synchronisation and resources to overcome operational friction while ensuring compliance with the law of armed conflict (LOAC).

Poorly planned and executed PWID activities present several risks, ranging from the tactical to strategic levels. Insufficient LOAC training, confusing rules of engagement and inadequate tactics, techniques and procedures threaten the efficiency of PWID activities at the point of capture—the time that carries the most tactical risk to individuals and the mission due to fog and friction. At the operational level, LOAC breaches can have ramifications for the force protection of Australian forces and partners because adversaries may seek retribution on similarly detained personnel.[6] Adherence to LOAC is a strategic imperative for the enduring legitimacy of military operations.[7] If operational-level considerations such as theatre-level detention facilities, movements and logistics are not accounted for, the ability to clear PWIDs from the battlefield at the tactical level will be compromised. Lastly, a lack of planning and preparation at the strategic level for PWID activities, such as inadequate or non-existent legal frameworks or policies, can have direct and dire impacts from the strategic through to the tactical. Poorly managed PWID activities can threaten an operation's domestic and international legitimacy through the loss of public trust and confidence in the ADF, and the degradation of strategic cohesion between allies and partners.[8]

This paper explores the ADF's capacity and potential to contribute to PWID activities in future warfare. It draws upon Australian and United States operational experiences over the past 25 years to elucidate the challenges of implementing effective PWID activities. These lessons are then overlayed with current doctrine and practice to provide the basis for the article's practical recommendations concerning how the ADF might better prepare to contribute to PWID activities in future warfare.

Strengthening the ADF's preparedness for PWID activities will not only treat a present risk. It will also reinforce Australia's strategic legitimacy and operational effectiveness in times of conflict. Thus, the risk is not just one for the ADF but one for the wider Department of Defence and ultimately the Australian Government. While past experiences of PWID activities have tested the ADF's capacity for planning and challenged the legitimacy of Australia and our partners when processes have been neglected, these experiences nevertheless offer valuable lessons. By considering these lessons in force design, updating and refining doctrine, embedding lessons learned in the training continuum, and practising them in routine training and exercises with international partners, the ADF can improve its capacity to conduct credible and effective PWID activities. As Defence reorients to address the challenges posed by a peer adversary, timely reform is essential.

Australia's PWID Activities—East Timor and Afghanistan, and the US Experience in Iraq

Australia has a long and little-understood history in PWID activities. Throughout the conflicts that Australia has participated in, the ADF has (for the most part) handed over personnel after capture and initial processing. Such handover has been to detention facilities run by partners, allies or host nations. This practice has its genesis in Australian participation in the Boer War and World War I, where personnel captured by Australian forces were placed into the British Army run prisoner camps. During the Korean War, captured North Korean and Chinese soldiers were housed in United Nations Command camps, most notably at Geoje-do. During the Vietnam War, captured enemy personnel were held in camps run by the South Vietnamese with US advisors. The varying styles of detention for captured enemy combatants during the Global War on Terror (GWOT) will be examined later in this article, but ultimately involved the ADF handover of

captured personnel to other forces for longer-term detention. While these experiences have all differed to some degree, the common thread is that primary responsibility for PWID activities has been undertaken by another force. The result is that Australia has little recent practical experience in theatre-level detention operations. The notable exceptions have been the Second World War and, more recently, the Australian experience in East Timor.

Australia's experience when leading the International Force East Timor (INTERFET) offers operational lessons for the conduct of PWID activities in future conflicts within our region, particularly where Australia has a leadership role. The INTERFET example serves as the first of three case studies considered in this article. INTERFET was raised in response to the degrading security situation in East Timor after the UN-supported referendum for East Timor's independence from Indonesia. The initial deployment was broadly considered successful, with one exception—there is little evidence that the ADF had adequately planned or prepared for PWID activities.[9] PWID activities were not considered in detail when formulating the operation's legal framework, force composition and disposition, and processes and procedures.[10] ADF forces deployed to East Timor on 20 September 1999 and commenced patrolling activities without a detention management framework.[11] On reflection, former Commander of the 3rd Brigade Brigadier Mark Evans recalled that PWID activities were 'probably something we had not thought through enough'.[12]

Upon commencing operations, the ADF encountered complex human terrain typical of stability operations in urban environments. Tensions ran high as militia activities increased, and reports of missing and murdered civilians and discoveries of mass graves flooded in.[13] In the degraded security environment, ADF forces found it necessary to detain suspected militia members.[14] INTERFET initially transferred detainees to the Indonesian civil authorities; however, this approach soon proved unsatisfactory. Due to the collapse of the civil judicial system, Indonesian police usually released detainees soon after receiving them, as there was no capacity, and minimal desire, to investigate or adjudicate crimes.[15] As no planning for dedicated facilities or adequate processes existed, hastily improvised brigade detention centres were established by the ADF.[16] These measures quickly proved insufficient, with two detainees attempting to escape on 21 September 1999, resulting in ADF troops illegally firing on them.[17] The incident demonstrated a lack of proficiency in PWID activities,

a poor understanding of LOAC and an incorrect interpretation of rules of engagement.

In response to the demand for greater control, a series of orders were given to establish facilities, govern PWID activities and adjudicate crimes committed within the area of operations. Commander INTERFET Major General Peter Cosgrove struck 'Orders for the Force Detention Centres' on 21 October 1999, a month into the operation.[18] These orders established the Force Detention Centre (FDC) and directed that it would be administered in line with the Fourth Geneva Convention—the Convention Relative to the Protection of Civilian Persons in Time of War.[19] The order provided that detainees' families would be notified of their detention and would be allowed to visit, clarified the duties of the officer in charge and visiting officer, and ensured detainees' access to the International Committee of the Red Cross (ICRC) including its medical, legal and chaplaincy services.[20] On 28 October 1999 the Detention Management Unit was raised to review the detention of captured personnel, as there was no existing judiciary.[21] The unit could determine the grounds upon which the accused could be detained but it could not try cases.[22]

As the mission progressed, it became clear that INTERFET needed to be structured to conduct PWID activities on a more extensive scale. The extant force could not address violations of local law, investigate allegations of crimes against humanity or conduct crime scene exploitation.[23] The Military Police (MP) element was stretched between investigatory work and the FDC, though it was deficient in both functions as it had few personnel with forensic expertise, and limited experience conducting PWID activities.[24] The MP had prioritised law enforcement training and were unclear on their role in the intelligence collection process.[25] The lack of adequate PWID activity training permeated the force, with up to 96 per cent of captured personnel not being tactically questioned at the point of capture.[26] Consequently, the ADF missed valuable opportunities to collect information that could inform ongoing operations. The shock of capture was lost by the time detainees were processed into the FDC, and detainees were less likely to provide such information.[27]

The ADF's subsequent operational commitment to Afghanistan provides an alternative case study in recent Australian PWID activities. It is more complicated than the INTERFET example due to Australia's legal mandate

in the country and its relationships with both host country officials and allies.[28] The US deployed to Afghanistan in October 2001 in response to the September 11 terrorist attacks. Australia quickly followed suit, deploying troops under the Special Forces Task Group to work alongside the US 'to seek out and destroy Al Qaeda and ensure that Afghanistan can never again serve as a base from which terrorists can operate'.[29]

Similar to the experience in East Timor, in the early phases of the ADF's deployment to Afghanistan it became apparent that PWID activities had not been thoroughly considered. Specifically, ADF planners had made two assumptions: the US would consider captured Taliban and al-Qaeda to be prisoners of war under the relevant Geneva Convention, and there was no need for an ADF PWID framework as the US would take responsibility for all captured personnel.[30] These assumptions were proven incorrect. Primarily as a legal convenience, the US considered Taliban and al-Qaeda forces to be unlawful combatants, and accordingly they would not be afforded the protections of prisoner-of-war status provided by the Geneva Conventions.[31] These US policies rendered the ADF legally and practically constrained. Captured personnel could not be transferred to the US as this would breach the Geneva Conventions, and they could not be detained because the ADF did not have the resources to accommodate them. These conditions threatened the ADF's capacity to achieve its mission. Chief of the Defence Force Admiral Chris Barrie communicated these risks to Minister of Defence, Robert Hill, on 25 February 2002, stating:

> There is currently no clear government policy on the handling of personnel who may be captured by the ADF on Operation Slipper... Defence, and in particular, ADF commanders are currently accepting risk flowing from the lack of government policy.[32]

The minister questioned why he 'didn't get this brief before the Afghanistan operation. We clearly should have sorted out this issue with the US as leader of the Coalition months ago'.[33]

Following this admonishment, in June 2002 an arrangement was made allowing ADF troops to continue operations. This was achieved by augmenting ADF patrols with one US soldier, meaning that the US continued to act as the 'detaining power' of any captured personnel.[34] As the ADF was not the capturing force, no transfer between Australia and the US need occur, negating Australia's obligations under the Geneva Convention.

During this time, ADF operations occurred throughout Afghanistan and were not centred in a single province. After three rotations, the Special Forces Task Group was withdrawn from Afghanistan in December 2002. Just three years later, in 2005, and amid a deteriorating security situation, Australia once again committed significant forces to Afghanistan. From 2006, Australia commenced stability operations in Uruzgan Province as a junior partner to the provincial security and detention lead, the Netherlands. As part of this arrangement, individuals were transferred by Australian troops to the Dutch-operated Initial Screening Area (ISA) at Kamp Holland in Tarin Kot. In 2010, Australia accepted increased responsibility for PWID activities. The ADF assumed command of the ISA from withdrawing Dutch forces and negotiated renewed arrangements for the transfer of criminal detainees to the fledgling Afghan authorities for prosecution, and detainees of high intelligence value to the US-run Parwan Detention Facility at Bagram Airbase.[35]

The conduct of Australia's PWID activities in Afghanistan as the lead for the ISA in Tarin Kot was fundamentally influenced by the US experience in Iraq—specifically, the atrocities that occurred at Abu Ghraib Prison in 2003. The exposure of human rights abuses at Abu Ghraib Prison made headlines worldwide, including in Australia, by placing PWID activities into the forefront of strategic and political conversations. This saw PWID activities gain a high level of attention from Australian defence and political leaders, with focus on governance, procedures and legitimacy. The US experience at Abu Ghraib has had a significant and lasting impact on how Western nations plan, prepare for, and conduct PWID activities. It has served as an exemplar, and oft-cited case study, of the importance of effective detention operations for maintaining legitimacy in the pursuit of strategic goals.[36]

The official investigation (AR 15-6 Investigation of the Abu Ghraib Prison and 205th Military Intelligence Brigade (205 MI Bde)) into the abuses at Abu Ghraib, as well as the subsequent review (Independent Panel to Review Department of Defense Detention Operations) sought to identify systemic and situational causes of the abuse and make recommendations to prevent reoccurrence.[37] The review identified a range of deficiencies in the legal framework, lack of operational planning, inadequate command oversight and outdated doctrine that contributed to the human rights abuses at Abu Ghraib Prison.[38]

The investigation and review identified that legal complexities were a fundamental contributor affecting how detainees were treated. The US classified the GWOT as neither an international nor non-international armed conflict.[39] As previously noted, this resulted in al-Qaeda and Taliban personnel being considered unlawful combatants and thus not afforded the protections of LOAC. Despite this, US Secretary of State Colin Powell, Secretary of Defense Donald Rumsfeld, and Chairman of the Joint Chiefs of Staff General Richard Myers maintained that detainees would be given a standard of care consistent with the Geneva Conventions.[40] The review found that ambiguity at the strategic level confused operations at the tactical level across multiple theatres. The guard force and interrogators were left without clarifying guidance and were uncertain about what interrogation techniques were approved for use in Iraq and how they should conduct PWID activities.[41] The scant guidance given to guards at Abu Ghraib Prison amounted to the sentiment that 'after 9/11, the gloves come off'.[42]

Significant oversights in operational planning severely hindered the US ability to manage the escalating demands of Operation Iraqi Freedom. Combined Joint Task Force 7, which led the operation from May 2003 to June 2004, was not sufficiently staffed to meet the scale and complexity of its mission.[43] The operational staffing document was approved six months after the initial deployment, leaving the contingent understaffed by approximately 900 personnel.[44] Additionally, mid-2003 saw an escalation in combat operations in Iraq; however, the requirement for more MP personnel relative to the projected number of detainees was not considered.[45] At the height of hostilities in October 2003, the Abu Ghraib Prison guard force consisted of 90 personnel from 320 Military Police Battalion (320 MP Bn) who were responsible for guarding approximately 7,000 detainees—a ratio of approximately 1:75.[46] The capacity issues impacted the mission's intelligence collection goals, with some detainees held for up to 90 days before their first interrogation.[47] One of the key findings of the review was that planning figures for expected detainees are almost always underestimated.[48] Workload pressures resulted in the forces conducting PWID activities having the lowest reported morale of all deployed troops in the Middle East theatre. This was attributed to a perceived lack of support from their hierarchy and a belief that their senior leaders did not care.[49]

The investigation and review found that commanders from platoon to brigade level failed to exercise adequate command, contributing to systemic abuse at Abu Ghraib Prison. Commanders were found to have failed to prepare soldiers to conduct large-scale, protracted detention operations and to have failed to provide suitable oversight to ensure processes were compliant with LOAC.[50] Although 320 MP Bn had one year to prepare for deployment, key force preparation activities were cancelled due to competing priorities and troop availability. There was no theatre- or mission-specific training, or training on how to manage non-compliant detainees.[51] The unpractised and unclear command structures between 320 MP Bn and 205 MI Bde contributed to the lack of command oversight.[52] The commanders of 205 MI Bde and 320 MP Bn at Abu Ghraib Prison were found to have failed to adequately train and control their soldiers or establish a culture of accountability.[53] This negligence fostered a sense of approval for abusive behaviour and generated a dysfunctional command climate.[54] Lessons learned from earlier experiences in the Middle East theatre highlighted the need for more effective integration of MP and intelligence capabilities, and more cogency within the command structure. However, these recommendations were not actioned.[55] Suspected contraventions of LOAC were highlighted during an October 2003 visit by the ICRC; however, recommendations to rectify shortfalls were not implemented.[56]

Force structure and doctrinal approaches to PWID activities were also found to be inappropriate for the Iraq theatre.[57] US detention procedures in 2003 remained based on World War II and Cold War scenarios, where captured personnel were usually enemy soldiers, and the battlefield geometry was generally linear.[58] The MP force elements were designed to generate tempo in combat operations by quickly removing detainees from the battlefield and moving them to rear holding facilities.[59] This force structure and doctrine had yet to be adapted or updated to account for GWOT detainee classifications.[60] Further, it did not account for the nature of the contemporary operating environment, which had no clear forward or rear areas. The inappropriate force structures and doctrinal processes resulted in increased detainee holding times and an associated loss of operational tempo. Specifically, combat unit holding times of 12 to 24 hours increased to 72 hours, and corps-level detainee collection points extended from three days to 30 to 45 days. Such protracted processing negated the intelligence value that could be gleaned from detainees. Further, it was found that one-third of reported abuse occurred at the point of capture.[61]

As the prospect of LSCO in the Indo-Pacific continues to heighten, the ADF must be prepared to conduct PWID activities of a scale and duration not experienced since World War II. Thus, taking on recent lessons from a major ally with analogous doctrinal underpinnings is not only prudent but essential to ensure that known risks are treated and the ADF is as prepared as possible.

Lessons for the Future

A review of PWID activities in East Timor and the Middle East reveals several recurring themes relevant to the ADF's preparation for future conflict. These include the strategic importance of legitimacy throughout all phases of operations, the importance of applying a legal framework and adherence to LOAC, and the necessity for forces to adequately plan and prepare to conduct PWID activities.

A core purpose of conducting credible and effective PWID activities is to maintain the mission's legitimacy. US doctrine notes:

> Legitimacy maintains legal and moral authority in the conduct of operations. Legitimacy is based on the actual and perceived legality, morality, and rightness of actions from the perspectives of interested audiences.[62]

This concept is reflected in ADF doctrine, which agrees that the maintenance of legitimacy is critical to the success of military operations.[63] In conflict and post-conflict phases, legitimacy can be viewed through two distinctive frames. The first considers legitimacy as a subjective and relational matter. This perspective considers legitimacy as it might be perceived by a target audience, influenced by their individual and societal standards. In modern conflict, a target audience may assess the legitimacy of their government in pursuing conflict based on their understanding of the threat and the actions of their national and adversary forces. In the context of PWID activities, the public will form a perception around the 'morality and rightness of actions' based on how their forces and the adversary treat captured personnel.[64] The second frame considers legitimacy as an objective matter that can be assessed with reference to the operational mission's demonstrated consistency with predetermined or universally accepted standards.[65] In modern conflict, legitimacy may be assessed based on a

force's adherence to international laws and regulations, both when entering conflict (*jus ad bellum*) and in its actions in conflict (*jus in bello*).[66] The point of reference against which such standards are judged will likely include LOAC and other relevant protocols such as the Geneva Conventions. While both frames are valid and valuable lenses through which to view legitimacy, it is important to note they can sometimes be in tension with one another. To maintain legitimacy, forces should strive to satisfy both frames through practising transparency and operating in accordance with international laws and regulations.

A key theme throughout all three case studies is the correlation between how detainees are legally classified and how they are treated. In the GWOT, the US classification of Taliban and al-Qaeda fighters as 'unlawful combatants' rather than 'prisoners of war' resulted in friction from strategic to tactical levels and degraded the legitimacy of both the US and Australia.[67] This contrived classification stripped away the protections afforded to prisoners of war by the Geneva Conventions and resulted in ambiguity concerning the acceptable treatment of detainees.[68] In Iraq, this classification led to the application of tactics, techniques and procedures from other US facilities, including Guantanamo Bay.[69] Combined with several other factors, the result was that captors' behaviour towards (and treatment of) detainees degraded to the point of abuse. Photographs depicting gross mistreatment at Abu Ghraib Prison caused a significant loss of subjective legitimacy for US operations in Iraq.[70] The actions of a relatively small number of US troops at the tactical level had resounding strategic impacts across the coalition. In Afghanistan, differences in detainee classification between the US and Australia highlighted deficiencies in the ADF's strategic understanding of the task and its operational planning. Rather than reconsidering Australia's commitment to the operation or reinforcing the Australian contingent with additional personnel and resources, Australia sought to temper its obligations under the Geneva Conventions through negotiated arrangements with the US.

Conversely, in East Timor, Australia's clear direction on the treatment of captured personnel served to maintain the legitimacy of INTERFET in the eyes of the Australian public and the broader international community. The ADF conceded that LOAC did not legally apply to INTERFET due to the absence of international armed conflict between Australia and Indonesia, and the militia failing to meet the criteria of an organised military force.

Despite this, the ADF determined to adhere to LOAC as 'best practice'. This direction was distributed throughout the force and reinforced by Commander INTERFET's visits around the theatre, including to the FDC.[71] The benefits of this decision were evident, as there were no reported breaches of LOAC within the FDC.[72] Australia's emphasis on adhering to the principles of LOAC maintained and reinforced the force's objective legitimacy.

Insufficient operational planning and preparation hampered all three operations, with the common factors comprising planning culture, arrangement of operations, command priorities, and how forces prepare for PWID activities through training and exercises. Operation Desert Storm (1990–1991) saw the US capture approximately 70,000 prisoners of war over four days.[73] This experience influenced the calculation of detainee planning figures for Operation Iraqi Freedom, with the original order of battle providing ample MP for the task.[74] Poor coordination at the operational level, however, led to significant delays in projecting personnel into the theatre, resulting in an insufficient guard force to detainee ratio. A further lack of foresight and synchronisation of planning resulted in mandated conditions of service-related rotations out of the theatre, leaving Abu Ghraib Prison critically short-staffed. Noting the degree of US influence in the development of ADF doctrine, drawing on the lessons learned by the US and addressing doctrinal shortfalls is particularly prescient when considering the prospect of LSCO in Australia's near region. As the Pacific Campaign of World War II demonstrated, high numbers of detainees are likely, which will be made more complex by the expanse of the maritime theatre.

The ADF deployed to East Timor and commenced operations without detailed planning for all tasks within the mission profile.[75] Limited consideration was given to the complexities of conducting PWID activities, and it was assumed that detainees taken on by ADF troops would be transferred to Indonesian civil authorities.[76] Insufficient emphasis on understanding the operating environment resulted in friction that could have otherwise been avoided or at least minimised.

Stability operations are generally conducted when the host nation cannot provide a secure environment because organic law enforcement is ineffective, resulting in loss of the rule of law and increased likelihood of criminality.[77] Given this scenario, it is reasonable to conclude that local law enforcement agencies will generally have a limited capacity to conduct

patrolling activities or to accommodate and administer detainees. In the case of East Timor, the degraded security situation resulted in a significant law enforcement challenge for the UN and Australia to manage. While the ADF may not have anticipated high numbers of captured personnel in a traditional sense, they did find it necessary to detain volumes of militia and criminal detainees and accommodate some security internees. Secondly, the prospect of transferring suspected militia members to the Indonesians was ill-considered given the context of the conflict and the collapsed civil judicial system.

While planning Australia's initial contribution to Afghanistan, the ADF neglected to consider PWID activities as a task they would conduct or be responsible for. ADF planning failed to take on the lessons from East Timor in that it assumed there would be limited, if any, captured personnel arising from ADF mission profiles and that, if there were, they would be transferred to another force.[78] Negotiated arrangements resulted in consternation at the strategic level and legal manoeuvring to remain compliant with LOAC. The maintenance of Australia's subjective legitimacy was a constant concern, evidenced by correspondence from the Australian theatre commander to the Chief of the Defence Force highlighting a media report that incorrectly attributed the capture of enemy forces to ADF troops.[79]

In both East Timor and the Middle East, Australian strategic, operational and tactical level decision-makers misunderstood and misinterpreted LOAC. In East Timor, once the absence of a detention framework was identified as a problem, it was addressed from the operational level with increased resources and renewed command oversight. The results were clear—objective and subjective legitimacy for the operation was retained, and no LOAC breaches in the FDC were reported.[80] For US forces in Iraq, their lack of understanding and misinterpretation of LOAC had disastrous consequences. Commanders were found culpable for failing to prepare their troops and provide adequate command oversight. Further, commanders were unaware of the importance of engaging with the ICRC to maintain objective legitimacy. Commanders were reluctant to allow ICRC representatives to access their facilities and unwilling to implement recommendations to improve compliance.[81] The events at Abu Ghraib Prison resulted in a loss of both objective and subjective legitimacy, with public support for the war in the US dropping below 50 per cent for the first time since the war began.[82]

The Reasons for Change

Experience demonstrates that a failure to adequately plan for detainees on operations results in suboptimal solutions. This situation was exemplified by Australia's planning to hand over detainees to an ill-functioning civil power in East Timor, and abrogating its proper responsibilities to avoid being a 'detaining power' in Afghanistan. At their worst, these conditions could lead to the kinds of atrocities that unfolded at Abu Ghraib Prison. Australia and the ADF will continue to carry significant strategic and operational risk until they adequately prepare for PWID activities, including aspects relevant to command, planning, training, doctrine and capability.

While the nature of war remains constant, its character is evolving at an accelerated pace. This evolution is becoming ever more consequential for the ADF when it operates in the Indo-Pacific due to two major factors: the increasing economic prosperity and urbanisation of the population, and the rapid advancement and proliferation of technology. Together, these factors result in an increasingly 'transparent' battlefield. The existence of more people with access to more advanced technologies (such as sensors and cameras) increases the volume of information available to adversaries and to the public. Within this environment, the ADF must be prepared to conduct effective PWID activities under public and legal scrutiny.

Understanding that legitimacy is judged through objective and subjective lenses, the ADF's strategic leaders need to reinforce the importance of international law and LOAC on operations. This strategic approach to PWID activities should be embedded in internal messaging to the ADF, and in external messaging to the Australian population, allies and partners. In practice, this would mean the inclusion of LOAC and PWID activity training when planning operations, activities and investments in the region, when participating in large-scale PWID exercises, and when promoting these initiatives through official and social media channels. Doing so would further underscore Australia's strategic legitimacy by demonstrating this nation's commitment to international law and LOAC, promoting behaviours within the ADF and participating forces that are consistent with that commitment, and reinforcing the ADF's reputation as a trusted partner in the region.

The ADF's understanding and application of LOAC at the tactical level requires some further refinement. ADF LOAC training consists of access to available doctrine, an online course and instruction. This instruction

consists of legal officers delivering theoretical training, and MP delivering tactical training in capturing and processing detainees at the point of capture. However, access to this training at unit level is subject to individual command priorities. Experience on recent operations has brought a renewed focus to the importance of understanding LOAC. Theoretical LOAC training now extends past the unit level and consists of a graduated continuum beginning with basic principles during ab initio training, and introducing the increased responsibilities of commanders through career promotion courses.[83] Further improvement could be gained. Critically, LOAC should be discussed during advanced planning courses and tested on collective training exercises. To improve awareness and consistency in training, LOAC considerations should be embedded in routine training, much as the Army's Combat Behaviours are already.[84] This could be further enhanced by developing a program that improves retention of LOAC considerations, similar to the US Army's Soldier Rules.[85]

The ADF draws many of its planning frameworks and force structures from the US, and PWID activities are no exception. ADF and US MP serve similar functions—law enforcement, security, mobility and manoeuvre support, as well as PWID activities. Both ADF and US MP are intended to provide close support to combat forces and general support within the theatre of operations. The most significant difference is in scale. Due to their size, the ADF MP have limited capacity to provide both close and general support concurrently. Understanding that there is limited scope to grow the ADF's MP capability, even more emphasis must be placed on all-corps training for dealing with personnel at the point of capture. Future conflict in Australia's near region has the potential to generate high volumes of detainees requiring processing and removal from the battlefield—a process likely to be prolonged by the logistical challenges of operating in littoral environments. These delays risk the loss of key information collected at the point of capture and diminish the ability of commanders to act on time-critical information. This risk could be treated by increasing the number of personnel qualified in tactical questioning, to ensure timely and effective information collection.

PWID activities are inevitable in all operations and should be included in combined arms and joint exercises. Unfortunately, field exercises are typically constrained by role-players and timelines, preventing thorough testing of PWID processes. This leads to unrealistically low numbers of

captured personnel, causing exercises to proceed with unlikely speed and unsustainable tempo in the advance. Rearward logistic chains remain unburdened, role-players arrive at detention facilities without the required documentation and, after cursory in-processing, are swiftly re-roled and returned to the exercise area for further serials. As a result, personnel and processes at all levels go untested. There is also little focus on the practicalities of PWID activities in tabletop or simulation-focused exercises. The cumulative effect is that PWID activities remain under-prioritised in force structure reviews, and the responsibility for operational planning is relegated to the logistic elements of brigade and divisional headquarters rather than being a close consideration of the manoeuvre plan. To remedy this, PWID activities should be an integral planning consideration, and included in doctrine such as Intelligence in Operations,[86] Decision Making and Planning Processes,[87] and the Staff Officers' Guide.[88] Further, PWID activities should be exercised from the point of capture through to repatriation. These serials should be appropriately resourced, with enough time allocated to ensure training outcomes are met. International partners should be included as often as possible to reinforce the importance of LOAC and rehearse detainee transfer. The ICRC should be regularly invited to participate and provide feedback on the ADF's processes to demonstrate transparency and ensure best practice. Properly executed, these activities should be routinely assessed and certified as part of the ADF's preparedness for conflict. Appropriate emphasis on training for PWID activities and guidance on its execution should be included in ADF-I-5 Exercise Planning and Conduct.

The ADF currently experiences the same doctrinal frictions that US forces faced during Operation Iraq Freedom. The ADF's doctrinal PWID planning considerations do not account for the complexities of contemporary operations; they assume linear land-based battlefield geometry, simple human terrain, and uncontested rear areas. ADF PWID doctrine should be updated to account for the intricacies of operating in a littoral environment, with consideration to how the integrated force will work together to ensure credible PWID management in all phases of operations.

The ADF's operational experience suggests that Australia's responsibility for detention operations will fall into one of two categories: where Australian forces capture personnel and accommodate them in an Australian detention facility, or where Australian forces capture personnel and transfer them to an alternative facility. Noting these limited possibilities, ADF PWID

doctrine should be updated to include standing detention frameworks for each of these scenarios. Current ADF doctrine does not include a standardised detention framework, stating that 'frameworks are tailored to the operation' and 'how they [detainees] are treated, who is responsible for monitoring their treatment, and their release, transfer, or handover—will be founded on strategic and operational-level direction'. It goes on to state that 'while such a framework is not predefined, it will have operational, legal and policy aspects that are similar in each operation'.[89] This situation could be immediately improved by drafting two frameworks that are realistic enough to support training and operational certification, and appropriate in the absence of further guidance on operations.

Conclusion

The ADF's capacity for PWID activities is a critical yet often overlooked aspect of Defence preparedness. The ADF's experiences in East Timor and Afghanistan, alongside the US experience in Iraq, demonstrate that PWID activities are a complex task with serious implications. Poorly executed PWID activities can pose significant risks to the force and the mission, ranging from increased risk to personnel at the point of capture, to operational friction, tension between partner forces, and loss of strategic legitimacy. The three case studies presented in this article highlight that credible PWID activities are essential for maintaining strategic legitimacy and operational effectiveness.

The DSR and NDS focused Australia's attention on the potential for LSCO in the Indo-Pacific region. In this context, comprehensive planning and preparation for the two detention scenarios that will govern PWID activities is crucial—where Australian forces capture personnel and accommodate them in an Australian-led detention facility, or where Australian forces capture personnel and transfer them to a partner-led detention facility. To do either of these tasks without significant risk to strategic legitimacy and operational effectiveness requires the ADF to renew its focus on PWID activities. Revisions should be rigorous and consist of clear legal frameworks, robust planning tools, renewed training priorities, and refreshed doctrine.

Learning from past experiences is vital for improving the ADF's likelihood of success in future operations. The urgency of implementing these lessons cannot be overstated, given the current strategic environment outlined in the DSR and the lack of strategic warning time. Strengthening the ADF's capacity for PWID activities will mitigate existing risks, enhance its operational effectiveness and support the maintenance of strategic legitimacy. By addressing these concerns now, the ADF can ensure it is prepared for the complex operational challenges of the future in an increasingly contested Indo-Pacific region.

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Conceptually Adrift in the Littoral

Mark O'Neill

> *Discussions of strategy too often descend rapidly from framing and defining the 'ends' to single-minded discourse on 'means'. Indeed, the focus is often almost exclusively on 'means' … with 'means' being synonymous with vehicles and equipment.*[1]
>
> Chief of the Australian Army, 15 May 2024

Introduction

In this article I find a conceptual gap in Defence strategic policy directing the Australian Defence Force (ADF) to conduct littoral manoeuvre in Australia's northern approaches.[2] After an earlier career as a combat engineer, I retain a fascination with gaps, physical or metaphorical, and ways of breaching or reducing them. A primary role for the sapper is to enable the force's mobility so it can manoeuvre for advantage. My aim here is to mobilise thought about this intellectual challenge so that the ADF might develop a position of advantage moving forward. This article identifies an approach to treating the conceptual gap found. A forthcoming Australian Army Research Centre Occasional Paper, *In Denial: The ADF and Littoral Manoeuvre*, is a companion piece. It frames in detail the issues a littoral warfare manoeuvre concept will need to address, proposing principles to guide such a concept.

The 2023 Defence Strategic Review (DSR) directs the ADF to have the capacity to 'deter through denial any adversary's attempt to project power

against Australia through our northern approaches'.[3] A nested direction for the Australian Army is to be 'optimised for littoral operations in our northern land and maritime spaces and provide a long-range strike capability'.[4] This is a clear instruction on where the Army is to plan to fight, and what a primary Army task will be.

Thomas Schelling noted in the preface of the 2008 edition of *Arms and Influence* 'We have seen that deterrence, even nuclear deterrence, doesn't always work'.[5] Notwithstanding Australian policy's deterrent intent, if deterrence fails then Army's destiny is to fight as part of an integrated force across the littorals of Australia's primary area of military interest (PAMI).[6] Within this plausible sequitur things become interesting.

In 1989, Art Lykke defined military strategy using the formula 'strategy = ends + ways + means'.[7] While this approach has attracted criticism for being 'narrow-minded' and 'flawed', it endures as an introductory code for understanding strategy.[8] It also provides a framing device for this article to highlight the perceived gap in strategic policy direction.

Extant strategic policy guidance identifies *tasks* which are effectively the pseudo 'ends' sought by policy.[9] Concurrently, the 2024 Integrated Investment Program (IIP) makes provision for some of the 'means' required to achieve a denial effect within the PAMI.[10] A concern arises, however, from the lack of Defence guidance available concerning the 'ways' to employ the means available to meet policy's ends.

This creates a vacuum between the 'means' and the 'ends' which have been set for ADF littoral operations in the northern approaches. We know what the ADF is expected to do (the 'ends'). We also know the capabilities available to meet the mission (the 'means').[11] Absent is a concept describing how the ADF will firstly achieve a 'strategy of deterrence by denial', then fight if deterrence fails. Strategy without 'ways' is inchoate—in fact, it is not strategy at all.[12] In Australia's case it is an aspirational vision statement with a capability shopping list attached. The conceptual task for the ADF (and Defence more broadly) is to move beyond policy platitudes and capability acquisition lists—these alone will neither deter nor deny.

The challenge is to articulate a littoral warfare concept with a theory of victory that meets strategic intent within the means available.[13] I use the term 'theory of victory' in the sense offered by Jakobsen: 'a persuasive

argument that the chosen combination of ways and means is likely to produce the desired ends without excessive costs and risks'.[14] Failure to address this risks Army, and Defence more broadly, being conceptually adrift in the littorals of Australia's northern approaches. While the task of developing the required littoral warfare concept is rightfully one for the Vice Chief of Defence Force (VCDF) Group, Army's advocacy and thought leadership to achieve this ambition will be crucial.[15]

This article begins by confirming that a 'ways gap' exists by reviewing and analysing extant strategic policy direction, and the Australian Army's response to it. After examining the scant guidance available in relevant Australian Defence concepts, I look at other sources of guidance in the wider Australian literature. This is followed by a brief look at the approach being taken to addressing 'ways' by the US, Australia's principal ally and coalition partner. The decision to focus on the US over other examples is deliberate. The US is Australia's primary ally and collaborator, with a shared regional focus and levels of interoperability with the ADF that are unmatched by any other partner.[16] The scene is then set for consideration of some key issues that will need to be addressed by a suitable concept. I conclude the article by proposing a way forward for Defence.

Defining the Gap

Strategic Direction

The gap concerning the ways Australia will conduct littoral warfare begins with the 2024 National Defence Strategy (NDS).[17] At its core, this is a policy document with a policy narrative focusing on *ends* and *means*, rather than a strategy with *ways* underpinned by a theory of victory. In this sense, the NDS continues a long-established Australian practice for Defence white papers (DWPs) and Defence Updates. The NDS serves a useful purpose for government, Defence and the nation in setting the policy parameters for national defence. But, as Colin Gray reminds us, strategy is a *practical subject*.[18] The NDS does not adequately explain either the causal logic of how a strategy of 'deterrence by denial' within Australia's northern approaches will secure Australia or how this direction will be enacted to secure success. The NDS is captured in what Hew Strachan describes as the muddle between strategy as the use of war for the purposes of policy, and strategy as the use of battle for the purposes of war.[19] It is through the

latter sense of strategy that the conceptual ways for ADF littoral operations are most likely to be found.

The NDS, building upon the DSR, asserts Defence tasking and capability development policy direction. It names five tasks for the ADF:

- Defend Australia and our immediate region.
- Deter through denial any potential adversary's attempts to project power against Australia through our northern approaches.
- Protect Australia's economic connection to our region and the world.
- Contribute with our partners to the collective security of the Indo-Pacific.
- Contribute with our partners to the maintenance of the global rules-based order.[20]

These tasks are sensible, uncontroversial and, to a large degree, expected policy direction. They align with traditional conceptions of protecting Australian national interests which have endured for decades. They are also broad, lacking any specificity as to any method the government may prefer the ADF to adopt in achieving them. This is consistent with every Australian DWP since 1987's *The Defence of Australia,* apart from 1994's *Defending Australia*, which uniquely detailed nine 'roles' the ADF was expected to perform to meet the directed defence posture.[21]

The NDS goes on to name six 'key capability effects' to be kept or developed in support of ADF force structure to achieve the directed tasks:

- Project force.
- Hold a potential adversary's forces at risk.
- Protect ADF forces and supporting critical infrastructure in Australia.
- Sustain protracted combat operations.
- Maintain persistent situational awareness in our PAMI.
- Achieve decision advantage.[22]

Like the five ADF tasks previously examined, the six key capability effects are sound, obvious and uncontroversial. They treat or make important inferences for related force design and capability acquisition, and the development of *means* to meet policy *ends*. These are built upon and drawn out in the later chapters of the NDS.[23] While some intuitive inferences may be drawn about how the NDS vision may be met (especially with

respect to Chapter 7: 'International Partnerships'), none are explicit. Specific direction about how the deterrence mission in the PAMI's littorals will be achieved is absent. For the purposes of the argument here it is useful to examine explanations that occur elsewhere in publicly available Defence guidance. Specifically, it is logical to look to Army for this purpose as, surprisingly given the multi-domain nature of littoral warfare, it is the only service tasked by the NDS with any specific littoral responsibility.[24]

The Australian Army's Response to Strategic Direction

The Army's public response to the NDS, *The Australian Army Contribution to the National Defence Strategy 2024*, does not illuminate how Army will conduct littoral operations as part of the integrated, focused force.[25] NDS direction to Army on what it must deliver is distilled by Army as:

The Army is to optimise for littoral manoeuvre with a long-range land and maritime strike capability.[26] It must be able to:

- Deploy and sustain land forces in Australia's primary area of military interest.
- Deploy a strike capability with the range to protect Australia's northern approaches.
- Progressively increase increments of Precision Strike Missiles to extend the range and variety of targets that can be struck with land based long-range fires.
- Increase stockpiles of long-range missiles including through domestic manufacturing.
- Invest in a combined-arms land system that can secure and control strategic land positions and provide protection for the ADF.[27]

These are clear tasks, and it does not require any special military or operational insight to understand how their achievement may have utility for littoral operations. But tasks are not ways. Nor does the term 'littoral manoeuvre' itself provide the necessary detail as to how the force might achieve its mission.[28] The tasks simply lack sufficient context to derive feasible, acceptable and suitable operational methods for littoral operations. Similar to the NDS, Army is silent here about ways; nor are they dealt with elsewhere in an otherwise relatively detailed publication. It is therefore left to the imagination how these things come together, and in what manner, combination and sequencing, to meet the ends of policy. In the Army, and the ADF more broadly, imagination is the realm of concepts and

their development. It is right therefore to see if they offer any support in addressing our perceived gap.

Australian Defence Concepts

The lead author of the ADF's capstone concept tells us: 'A concept assists the ADF to iteratively create, experiment, learn, innovate, prepare, and fight'.[29] To help readers better understand the concept, he also provides the Australian Defence Glossary definition of the authorised term 'joint concept', which states:

> Identifies and frames a joint military problem, its proposed solution, and the characteristics and attributes of capabilities required to implement the proposed solution. Note: joint concepts provide the interpretive layer from strategic guidance to provide amplifying detail on Defence posture.[30]

The ADF's capstone doctrine, *Australian Military Power*, elaborates: 'Concepts support the continual improvement of doctrine by deliberately testing the boundaries of current military understanding'.[31] By their nature and design, then, joint concepts are forward leaning. It is clear from this explanation that we should not expect *definitive* direction on ways from an ADF concept treating the subject of littoral operations. Any definitive direction would only arise after validation of conceptual guidance through processes such as wargaming, experimentation and other forms of analytical evaluation. Nevertheless, the availability of *amplifying* guidance on the nature of littoral operations, no matter how hypothetical, would be an advance on existing strategic guidance.

Army may well have a classified single-service concept for littoral operations. If so, it is not visible to the writer (and could not be discussed in this article). Yet even if such a concept were to exist, it would have limited utility for the task at hand, as the issue is in no way a single-service problem alone.

A truth that appears from understanding the organisation, force structure, command, control and financing of the ADF is that there is no such thing as an 'Army' fight. The same is true of the Navy and Air Force. Each service needs to integrate into the heart of its warfighting tasks the support delivered by the others. Further to the forcing function of the ADF's design as an integrated force, the realities of contemporary warfare dictate it. The Chief of Army made this exact point at an allied land power conference in 2024: 'Integration is vital. It means that the ADF must be able to apply

military force across all five environments.'[32] When you consider the complexities arising from generating or treating operational effects across the five recognised domains (land, sea, air, space and cyber) you quickly realise that only joint concepts will suffice.

Disappointingly, a review of the publicly available information on ADF joint concepts does not help anyone seeking a hypothesis of how littoral operations will achieve a strategy of denial. The ADF's capstone concept, *Apex: Integrated Campaigning for Deterrence*, covers a scope similar in many respects to the *Australian Military Power* doctrine.[33] It also echoes many of the blandishments in the NDS about deterrence, without any adding any useful information about the possible ways to achieve it.

Aspire: The Australian Defence Force's Theatre Concept seeks to explain how the ADF will mobilise and apply military power in an operational theatre.[34] Publicly available information tells us Aspire describes how the ADF will achieve missions through the focused and asymmetric application of military power, aiming to impose costs so that adversaries are deterred from, or cease, activities counter to Australia's interests.[35] Three principles—focus, asymmetry and cost imposition—offer a logical frame that an operational method might be developed from in a given context, but they still fall short of providing a suitable and feasible way. David Fryer, one of few defence analysts who have examined Aspire in the public domain, offered this criticism:

> [T]he principles of ASPIRE, while adversarial focused, remain too generic, providing a wide aperture for interpretation and undermining its direct applicability to shape future force structure or posture effectively. It advocates for the generalities of manoeuvre warfare without acknowledging the known capabilities and advantages of the adversary.[36]

Fryer's critique is mildly damning when held against the Defence Glossary's previously described note about how joint concepts provide 'the interpretive layer from strategic guidance to provide amplifying detail'.[37] It is, unfortunately, also consistent with the broader themes regarding 'ways' guidance in our review so far. The paucity or absence of such guidance in published Defence policy and conceptual guidance leads to the question of whether it is available elsewhere.

Other Literature and Sources

Unsurprisingly, the Australian Army's 'new' task of littoral operations identified in the DSR and NDS has led to an uptick in interest in and writing about the subject.[38] In 2023 the Chief of Army History Conference addressed the theme 'In Brown and Green Waters: Australian Army Operations in the Littoral', reflecting on Army's historical experience in littoral and amphibious operations. The Chief of Army said in his opening address to the conference that 'it is not conceited to claim that littoral operations are in our DNA. Our Army's meta-narrative—that of the ANZAC landings at Gallipoli was born amid a contested amphibious assault'.[39] All of that is true. Chris Smith reminds us that 'Many elements of 21st-century warfare echo those of the 20th century. The nature of war as a brutal and fundamentally human endeavour has endured'.[40] The proceedings of the 2023 Chief of Army History Conference equally draw our attention to continuities and discontinuities with respect to littoral operations, a useful but ultimately non-definitive guide to considering the present-day problem.[41] A point that needs to be made here is that in the proceedings of the 2023 conference, not one speaker draws an inference regarding how past littoral operations can or will inform the contemporary challenge of deterrence by denial assigned to Army's present and emerging littoral capability.

The contemporary literature is also relatively light on recognising that littoral operations are inextricably tied up in considerations of maritime strategy. This disassociation reflects the presumption in the NDS that littoral operations is an Army task. It does lead to some loss of nuance and understanding about the wider problem set which may otherwise have been achieved through the long-established theoretical lens of maritime strategy. Richard Bushby highlights the enduring importance of *amphibious operations* within a broader conception of maritime strategy, but he does not go on to draw any substantive inferences for the conduct of contemporary littoral operations.[42] The Royal Australian Navy Sea Power Centre's contemporary (and decades long) commitment to advancing thought and debate about maritime strategy for our island continent is valuable for this framing.[43]

Useful thinking about the relationship between maritime strategy and DSR tasking can be found in the work of Richard Dunley and Ash Zimmerlie. Dunley makes the case that conceptions of maritime strategy remain vital,

even in an age of long-range land-based anti-ship missiles and associated sea-denial concepts such as anti-access and area denial (A2AD).[44] Zimmerlie makes a detailed case that use of Julian Corbett's thinking would allow Australian Defence planners 'to treat Australia's risks, provide meaningful and credible support to its allies, preserve defence sovereignty, and systematically fuse land and sea power to align strategic ends, ways, and means'.[45] The idea that maritime strategy provides a useful intellectual departure point for thinking about the Australian Army's role in the defence of Australia is not something which has just arisen since the release of the NDS.

The Defence White Paper 2013 (DWP 2013) stated:

> Australia's geography requires a maritime strategy for deterring and defeating attacks against Australia and contributing to the security of our immediate neighbourhood and the wider region. Our ability to generate a joint force for this strategy critically depends on the Royal Australian Navy, the Australian Army and the Royal Australian Air Force, supported by the full range of defence capabilities.[46]

The Australian Army was quickly out of the blocks in response to this direction. In 2014 the Army Research Centre published a discussion paper *Army in a Joint Archipelagic Manoeuvre Concept*.[47] The paper addressed the direction in DWP 2013, building upon a foundation laid over a decade before in Army's manoeuvre operations in the littoral environment (MOLE) concept.[48] Australia's strategic circumstances in 2002 were different to those today. MOLE was not about meeting the challenge of deterrence by denial; it was about answering the question about Army's utility in the strategic context of the time. This is evident in remarks offered by the then Chief of Army, Lieutenant General Peter Leahy: 'This concept envisages that our land forces will be capable of achieving strategic reach through entry from the air and sea' and 'land forces structured for littoral manoeuvre will possess the ingredients for military success across any likely spectrum of future conflict, ranging from terrorism to conventional warfare'.[49]

Army's 2014 discussion paper built upon the conceptual space opened up by MOLE but, significantly, introduced A2AD considerations within the region into its threat assessment.[50] Also worthy of note is the paper's suggested ways in which joint archipelagic manoeuvre could be conducted.[51] Two years later, Smith and Palazzo built upon these ideas in

Coming to Terms with the Modern Way of War: Precision Missiles and the Land Component of Australia's Joint Force.[52]

Within the scope of the literature examined for this article, it is possible to discern emergent glimpses of a 'way' or possible green shoots of a 'method' of conducting littoral operations. In one of his two posts addressing 'What Is Littoral Manoeuvre' published on the Army's Land Power Forum, Mark Mankowski suggests:

> Once in an advantageous position, Army vessels associated with littoral manoeuvre can project Army's long-range strike platforms to deny key routes within a maritime archipelagic environment or sustain Australia's forward partnerships to defend our immediate region.[53]

This scenario clearly envisages the development and use of an Australian A2AD system. Detail about how this happy operational situation might practically arise is absent from Mankowski's writing, although understandably given the format. Similarly, an observation by the Chief of the Army at the Land Forces Pacific Symposium, while not direct guidance, is illustrative of an emerging Australian A2AD approach with obvious links to some of the ideas in Concept Aspire and Smith and Palazzo's paper:

> By being present and persistent in key terrain, we can place the burden of aggression on our adversaries. In particular the enhancement of anti-access area denial capabilities, especially land-based maritime strike, provides conventional and forces and special forces with lethal asymmetric capabilities.[54]

A brief look at the how the US, Australia's primary military ally, is approaching similar issues illuminates some factors in conceptualising how Australia might conduct littoral operations.

US Approaches

Australian thinking, as highlighted by the excerpts from Mankowski and the Chief of Army in the earlier paragraphs, reflects Australia's preoccupation with A2AD as a primarily defensive measure. Given the US's geo-strategic circumstances in the Indo-Pacific, the US approach tends to look at the (arguably) more difficult challenge of manoeuvring in the face of an adversary's anti-access envelope.[55]

The US's primary concern is with the prospect of dealing with an A2AD zone that the People's Republic of China may develop or impose in case of a conflict in the Indo-Pacific. Such an approach is the other side of the same coin, and bears examination by Australia—particularly given the rise of the circumstances described by Smith and Palazzo.[56] Understanding the US approach to this issue makes sense considering that, if the ADF is either late or unlucky in seeking to establish its own A2AD system in the northern approaches, it too may have to manoeuvre within an enemy anti-access envelope.

This issue is clearly at the forefront of US minds and has been for over a decade. The then Chair of the Joint Chiefs of Staff, General Martin Dempsey, said in 2012: 'A2AD strategies are a defining characteristic of today's operational environment. Confronting this challenge will require more integration—across all domains and at all echelons—than ever before'.[57] The problems the US expects to face, and the location and context envisaged, are sufficiently analogous to the context(s) implied or foreshadowed in the NDS as to make US conceptual responses useful. A crucial point to keep in mind, however, is that while the problem set, context and operational environment are similar, the resources and scale that the US can bring to bear in any response (either conceptual or actual) are vastly greater than Australia's sovereign capabilities.

The United States Marine Corps (USMC) has been on the front foot of thinking about littoral warfare. From 1996's *Operational Maneuver from the Sea* through to 2021's *A Concept for Stand-in Forces* and the Commandant's *Force Design 2030*, the USMC is simultaneously making arguments to justify its ongoing role (and budget), and examining ways it can contribute to the US joint force inside the contested spaces of the Indo-Pacific.[58] It is useful to develop an understanding of some of these ideas. Specifically, the *Concept for Stand-in Forces* is a good place to begin thinking about littoral operations.

'Stand-in forces' (SIF) are defined in the concept as:

> small but lethal, low signature, mobile, relatively simple to maintain and sustain forces designed to operate across the competition continuum within a contested area as the leading edge of a maritime defense-in-depth in order to intentionally disrupt the plans of a potential or actual adversary. Depending on the situation, stand-in

> forces are composed of elements from the Marine Corps, Navy, Coast Guard, special operations forces, interagency, and allies and partners.[59]

The fact that SIF are joint (and, by implication, integrated), combined, and intended to work within either a weapons engagement zone or an A2AD system, suggests why such a conceptual approach could have utility for the ADF. The Commandant of the Marine Corps says the SIF will 'conduct sea denial in designated areas' and will 'disrupt an adversary's plans at every point on the competition continuum'.

Building upon the SIF concept, the USMC has developed two more operational support concepts. *Littoral Operations in a Contested Environment* describes the integrated application capabilities to overcome emerging threats within littoral areas that are 'rapidly expanding in operational depth, complexity, and lethality'.[60] The second concept, 'expeditionary advanced base operations', detailed in the *Tentative Manual for Expeditionary Advanced Base Operations*, is summarised as:[61]

> a form of expeditionary warfare that involve the employment of mobile, low signature, persistent, and relatively easy to maintain and sustain naval expeditionary forces from a series of austere, temporary locations ashore or inshore within a contested or potentially contested maritime area in order to conduct sea denial, support sea control, or enable fleet sustainment.[62]

The USMC's parent service is less preoccupied with the littoral per se but is grappling with the implications of the sophisticated technologies implicit in A2AD on naval and joint force operations in the Indo-Pacific. This has seen intellectual investment by the United States Navy in its 'distributed lethality' concept, largely focused on the conduct of naval surface warfare.[63] The US Army's 'multi-domain operations' concept similarly faces up to the issue of A2AD, unsurprisingly placing the Army and the land domain at the centre of the conceptual solution to the joint force's perceived problem.[64] The conceptual concern with the ability to manoeuvre within the Indo-Pacific is wider than the single services.

The US Joint Staff's interest has long reflected and built upon the single services' concerns and approaches, reflected in the publication of concepts such as the joint concept for entry operations.[65] The wider US Department

of Defense has also been engaged in relevant thought and research. An example is the work of the Defense Advanced Research Projects Agency (DARPA) on mosaic warfare.[66]

None of the US examples cited fully address the precise context of Australia's conduct of littoral operations in the PAMI, but many of the arising issues overlap. However, it is worth noting that their treatment of the ways to approach the issues is more substantive than what we have seen Australian publications to date. For that reason alone, understanding US thought on the issue is useful when thinking about possible Australian approaches. Consideration of the strong alliance relationship between Australia and the US, and the probability that combined operations would be conducted in response to regional conflict, further makes the case to think about how integration and alignment of approaches may be beneficial. Finally, understanding how the US joint force thinks about approaching, working within and destroying an adversary's A2AD system may usefully inform design and thinking about a method Australia develops to employ in its northern approaches. This is one of several issues germane to the development and consideration of a suitable approach to address the 'ways gap'.

Issues

The Use of History

We see in the Australian Army's approach to the challenge of littoral warfare a fondness, bordering on nostalgia and hubris, for the record of past achievement. Military history provides a valuable guide to understanding, but only when context is considered. It cannot and does not provide a blueprint for the future. As David Lowenthal reminds us, the past is a foreign country; it is something we can never fully know or understand.[67] Many of the 'lessons' proffered about the littoral experience in the region during the Second World War do not bear detailed scrutiny given the differences in today's context. Considerations such as contemporary patterns of regional sovereignty, demography and commerce; the elevated level of military technology deployed in and next to the region; and the vastly different structure and size of the ADF today cannot be simply dismissed. The technological changes provide illustrative example of how varied context may compromise history's lessons.

During the Pacific war, radar technology was relatively short ranged and unsophisticated. Operations would be planned and conducted across the vastness of the operational area safe in the knowledge that surveillance of manoeuvre needed proximity for effective observation and interdiction. Today, technological developments (including space-based surveillance and Australia's Jindalee Operational Radar Network (JORN)) make remaining undetected and unseen a vastly different proposition.[68] Similarly, the advent of long-range precision strike missile systems has greatly increased the risks associated with being seen. The impact of this on 'historical lessons' becomes apparent looking at the Guadalcanal and Milne Bay operations in 1943, and the lessons learned (by both sides) about conducting both manoeuvre and resupply at night.[69] There would be a far different outcome if this approach were followed today without other protective measures, deception or tactics in place. The matter of the changed geo-political situation within the PAMI since the mid-20th century also gives rise to another issue crucial for the ways in which Australia might conduct littoral operations.

Regional Sovereignty

A common factor in writing about littoral operations and putative A2AD systems within the PAMI is the presumption that there exists a modern-day terra nullius as it relates to regional sovereignty and governance. This presumption is clear in contemporary texts that treat the archipelagic environment to Australia's north as if it were freely 'available' to the ADF, irrespective of the states there.

An example of this thinking is seen in Peter Dean's acknowledgment of the archipelagic states to Australia's north.[70] He asserts 'Archipelagos have, and will, dominate how Australia thinks about and conducts military operations in its immediate area'.[71] Yet no inference is drawn or raised about the likelihood that states in the region will have concerns about Australian military operations in or adjacent to their territory. Dean's example is illustrative, but he is not alone. Others also treat the region as a form of 'free manoeuvre area' unencumbered by the need to consider others' concerns beyond the common (and vague) platitude of 'working with partners'.[72]

Nothing could be further from reality. The nations comprising the Association of Southeast Asian Nations and the Pacific Islands Forum literally fill the space under consideration. These nations are proudly

sovereign and are committed to the global rules-based order and the principle of non-intervention. Australia's close and friendly relationships with these nations means it cannot approach either the preparation for or the conduct of military operations in the PAMI in the manner of the Allies between 1942 and 1945, when either Japanese forces occupied the region or today's states were subject to Western colonial possession. The development of any way to conduct littoral manoeuvre will require careful thought and treatment about the issue of access, basing and overflight in relation to regional neighbours.

The NDS does explicitly acknowledge the importance of regional engagement.[73] However, there is quite a gap between the vagaries of *engagement* and the sort of *agreement* whereby a war may be fought from, through or across another nation's sovereign territory. Any workable littoral manoeuvre concept for deterrence by denial within Australia's northern approaches will have to get the necessary agreement from the region. A wider point also appears—one which is outside the scope of this article to address—about strategic policy's general approach to issues of regional sovereignty. A clearer exposition in strategic policy documents that accounts for different sovereign approaches and policy positions may heighten understanding of the constraints and limitations inherent in the regional geo-political environment.

The Deterrence Question

Littoral operations are conducted for the purpose of achieving deterrence by denial. Therefore, any manoeuvre concept must address the causal logic of how it contributes to both deterrence and denial. This is a significant challenge. Albert Palazzo, building upon his exploration of the impact of long-range precision fires with Chris Smith, wrote in 2020:

> Through Land 8113 the ADF will progressively acquire a land-based long-range strike capability, allowing it to create a killing zone throughout the approaches to its territory. This offers Australia the opportunity to create an independent deterrence capability across all domains.[74]

Palazzo's idea of the ability to create a 'killing zone' is doubtless correct—at least for as long as the provision of strike munitions can be sustained. The idea that such a capability can 'create an independent deterrence capability across all domains' is, however, a contestable one that borders on fanciful.

The key issue is the object of this deterrence. It seems doubtful that any determined adversary with the credible capability and military capacity to coerce Australia by challenging our northern approaches would be deterred by such a potentially meagre threat. Ash Zimmerlie further treats this issue:

> As a deterrent strategy, high-tech, missile-rich, counter-anti-access concepts act as a 'big stick' but have thus far proven ineffective at discouraging small-scale Chinese maritime aggrandisement— what Thomas Schelling called 'salami slicing' or 'tactics of erosion'.[75]

Given Australia's relative strategic weight, the credibility of any deterrence effect will really hinge on the credibility of the ADF's ability to *deny* rather than its ability to *punish* (a typical means of creating deterrence effect). Such a denial effect will necessarily need to be manifest across all the domains.

The Multi-domain Issue

> Discrete domains do not exist in the continuity of nature. To hunt in the air, on the land, or in the water, an eagle seamlessly integrates domains because its information processing is unified. It has one mind that decides how it functions in three different physical environments, and it intuitively grasps its capabilities and limitations in all of them.[76]

A challenge that must be met is to work out how the five recognised domains are to be unified and integrated to support manoeuvre in the littoral. While this question exists as a broader general issue for the ADF and its allies, it is particularly germane to developing a littoral concept. This is because the domain environmental operations considerations arising from the littoral inconveniently sit at the centre of any Venn diagram depicting the relationship between the five domains. The trouble with looking at historical examples is that we readily get caught up in focusing on the domains predominant in those conflicts. Technology has changed the environment, creating new and potentially decisive domains for warfare. The modern littoral embraces and subsumes all new technological means across all five domains. Littoral concepts focusing on the intersection of jungle, boats, mud and so-called 'brown water' alone have a wrong frame in mind, engendering vulnerability. They will create blind spots an adversary can exploit. Any workable conceptual way to conduct littoral operations in Australia's northern approaches must, necessarily, fully and explicitly address all five domains.

Australia has long been at the forefront of innovation, adoption and integration of 'new' domains, so the challenge of meeting the 'new' littoral situation has precedent. The 1st AIF was an early adopter of air warfare during the First World War. Then less than three years after that war the Royal Australian Air Force (RAAF) was formed, becoming only the second independent air force in the world. In the Second World War a leading innovator in developing cross-domain integration between the air and land was an Australian, Arthur Coningham, raised in New Zealand and serving in the Royal Air Force. His work led to the development of Allied close air support and joint tactical air operations doctrine, and still informs the basis of modern airpower doctrine concerning support to other domains.[77]

Over the last 50 years, technological advances have significantly increased the reach of each service's land, sea, air, space and cyberspace capabilities, and largely erased the geographic distinctions that once delineated each service's operational domain.[78] The origin of these delineations reflects both historical use and the fact that 'Humans created domain-centric approaches to warfare to compensate for cognitive and physical limitations, which make it impossible for any individual to be expert at everything'.[79] While these are enduring truths, Australia and its allies have to ensure they don't become an enduring limitation on our ability and thinking about warfighting in the 21st century. A US Air Force colonel highlighted the case for change in the US in 2017: 'as long as the [US] military approaches the application of military forces from the fractured perspective of discrete domains, then true integration will be stunted'.

The littoral environment is perhaps a unique opportunity to have a 'testbed' for ADF domain integration. Advantage will accrue in Australia's northern approaches to those who can successfully and seamlessly orchestrate warfighting *across* and *through* all the domains. This means the ADF cannot continue to engage with cross-domain issues from within what Neller and Richardson labelled 'segregated specialisations'.[80] This is not a new idea in 2025, but the realisation of domain integration and orchestration within the littoral environment must be treated as a priority capability development task.

Logistics and Sustainment

Another key question that needs an answer is how to achieve logistic sustainment of the integrated force in the PAMI littoral in an era of persistent surveillance and precision long-range strike. While this is a serious enough challenge, an even more pertinent question is where the necessary platforms will come from. By the end of the Second World War, Australia had a sizeable military force. The Royal Australian Navy had over 300 vessels and the RAAF was the world's fourth-largest air force, comprising over 50 squadrons with at least 3,000 operational combat aircraft. Furthermore, on occasion, Australian forces could draw upon a large pool of Allied support. The utility of such capability is illustrated in the amphibious assault on Balikpapan on 1 July 1945. The 2nd AIF's 7th Division, and many corps troops, were safely put ashore via an Allied fleet of over 150 ships, supported by Allied sea- and land-based aircraft.[81]

The logistic and shipping requirement to support the NDS-directed 'single armoured combined-arms brigade, able to meet the most demanding land challenges in our region' will likely be less than that required at Balikpapan. Yet there are remarkably fewer resources available now or envisaged for the future. The IIP does not make provision for the two multi-role sea-lift and replenishment vessels previously planned to replace HMAS *Choules* that were detailed in Defence's 2020 Force Structure Plan.[82] When launching the IIP on 17 April 2024 the Minister for Defence said:

> Defence had planned to acquire two large support vessels to increase the capacity of our Navy's sea lift and refuelling support. The focus on improving our maritime lethality means these support vessels are no longer a priority. This action will generate savings of $120 million over the next four years and $4.1 billion over the decade.[83]

Oddly, this decision suggests that maritime lethality can be improved without more logistic support. In reality, it creates a deficiency gap between achieving the stipulated tasks of the integrated force and the planned IIP capability acquisitions. The IIP is also silent regarding other capabilities essential to future warfare within the littorals of the PAMI.[84] This is problematic because, as noted by Jennifer Parker:

> The ability to prevail in such a conflict depends not just on major warships and submarines but also on the enabling capabilities that underpin maritime operations: replenishment, hydrography, mine warfare and other niche but vital domains.[85]

In the absence of suitable or sufficient means, the force will have to default to innovating new concepts (ways) to compensate and address these challenges.

Another challenge to conceptual innovation involves the link between logistics sustainment and the broader issue of operating against adversary A2AD. This issue is captured by Chris Smith:

> Rather than dismiss or ignore the problem of transportation, critics and advocates should turn their attention to resolving how to manoeuvre naval and land forces and all their supplies and other logistical needs across no-man's-lands encompassing both sea and land. It is an all-domain problem and solving it would go a long way towards building confidence that the ADF and potential partners can manoeuvre in the Indo-Pacific at all.[86]

Addressing Adversary A2AD

A universal truth is that A2AD, and any strategy to employ an A2AD system, is a two-way street. Hoffman sums this up for us:

> Competitive strategies seek to frame the contest to our advantage rather than play by someone else's rules. To craft a strategy that is competitive recognizes that it must operate in an adversarial setting and reflect the reality that strategy and war are reciprocal, as well as involve an interactive series of action, response, and counteraction.[87]

If the ADF (and its partners and allies) think they can create an A2AD effect, then they must also fully expect that any adversary worthy of deterring and denying may, and will, do the same.

John Nash notes a specific concern arising from this in a 2024 essay: 'littoral maneuver will almost certainly involve moving in and out of an enemy weapons engagement zone'.[88] A core requirement of any littoral operations concept must provide Australia's integrated force with a suitable method not merely to survive but to operate, thrive and win within a hostile A2AD zone. Again, the Deputy Chief of Army summarises the requirement and the risk:

> This is important, as the increasing range of emerging land-based strike systems will make the sea a very dangerous place for warships, including ships carrying units of the combined-arms

> land system. As an Australian force crossed the water to make a landing, it and friendly forces could try to suppress some of the enemy's ability to attack it. Entirely suppressing that ability may be impossible, however.[89]

Earlier campaigns conducted by Australia within a permanent weapons engagement zone have never previously been unduly restricted by factors relating to manoeuvre and sustainment. The challenge is new, real, and likely to endure. To be adequate, any concept for ADF deterrence by denial operations within Australia's northern approaches must meet and treat this reality.

Towards a Solution

Strategy

This article has established that a conceptual 'ways gap' exists between the ends and means of Australia's plan to conduct deterrence by denial within the littorals of Australia's northern approaches. It is clear from this review that the NDS does not adequately answer the 'ways' question posed, and some of the challenges to be addressed have been highlighted. Of note, these are examined in greater detail, including development of principles to inform Australian littoral manoeuvre, in a forthcoming Australian Army Research Centre Occasional Paper titled *In Denial: The ADF and Littoral Manoeuvre*. What is needed now is a way forward that articulates how to close the 'ways gap'. The two essential requirements identified are military strategy and concept development.

Strategy sets the direction and the frame for tactics. The actual conduct of littoral manoeuvre would be the tactical expression of the NDS-directed strategy of deterrence by denial. What is missing then is *military strategy* to provide the 'ways' for littoral operations in support of deterrence by denial within Australia's northern approaches.[90]

Until recently (within the last decade), Defence developed and published a (classified) Australian Military Strategy on an annual or biannual basis. Supporting the production of this important artefact was a branch in Strategic Policy Division called the Military Strategy Branch. The branch was led by an ADF officer with the title Director General Military Strategy (DG MS). This position and the branch have been retitled and repurposed

within the last five years. Paraphrasing the apocryphal statement attributed to Leon Trotsky, it appears that a case of 'you may not be interested in military strategy, but military strategy is interested in you' may be playing out in Defence. Defence need not have either a DG MS or a Military Strategy Branch, no matter how peculiar the absence of such a function or responsibility is. Nonetheless, there is an urgent need for a *military strategy* that logically and causally accounts for the *ways* and the means described in the DSR, NDS and IIP that will be utilised to achieve the *ends* of deterrence by denial through littoral manoeuvre in Australia's northern approaches.

It is irrelevant who takes ultimate responsibility for the task—bureaucratic jostling over responsibility and influence will inevitably arise. One model (and there are countless possible models) sees Strategic Policy Division given authorship responsibility, with deep consultation and engagement with the three services, Joint Operations Command and Military Strategic Plans Division. Hopefully, such a solution would see the emergence of greater clarity around how deterrence by denial would align with the ways and means selected. Another model might engage Chief of Army sponsorship, noting the primacy of the littoral manoeuvre task assigned to the Army in the NDS. No matter who takes responsibility for developing the necessary strategy, it must include causal logic to explain the strategy's theory of victory.

Developing a Littoral Manoeuvre Concept

Hoffman tells us 'strategy formulation should rigorously examine different conceptual approaches framed around a hypothesis about how each strategic option can obtain the specified desired aims'.[91] Clearly, concepts matter to inform the logic of strategy. We previously heard from Chris Field that an ADF concept 'Identifies and frames a joint military problem, its proposed solution, and the characteristics and attributes of capabilities required to implement the proposed solution'.[92] Development of a military strategy to address our 'ways gap' should be informed by the timely development of a suitable littoral manoeuvre concept.

The responsibility for developing the concept should fall upon the VCDF Group, noting the VCDF's accountability as Defence's Joint Force Authority (JFA). This is a suitable task within the remit of the JFA and their Force Design Division's (FDD) responsibilities. Given what has already been examined in this article, the littoral manoeuvre concept will have to be

'joint, integrated and multi-domain'. FDD is usefully positioned in Australian Defence Headquarters to coordinate and bring all the constituent services and group and domain capability managers together for the concept's development, while addressing the issues such as deterrence, logistics and sustainment, and threat A2AD raised here. Cognisant of key contextual differences, there is also an opportunity to review and 'cherrypick' from the recent US experience in multi-domain and littoral concept development. This will have an immediate benefit in the ongoing development of interoperability and combined integration between allies, something which is always a force design imperative. FDD also has the capacity and capability to conduct the wargaming, modelling and experimentation necessary to take a nascent littoral manoeuvre concept through to informing doctrine, preparedness direction and capability acquisition.

Conclusion

The Australian Army, and the ADF more broadly, is short of a suitable conceptual way to manoeuvre in the littoral regions of Australia's northern approaches. The thus far energetic embrace of an inchoate approach to the conduct of littoral operations stipulated in the NDS risks failure when confronted by the realities of the environment. The lack of clearly defined and understood 'ways' leaves Army conceptually adrift. The Deputy Chief of Army has stated: 'Transitioning to an Australian Defence Force that can generate decisive battlefield effects in all domains in Australia's immediate region is no trivial task.'[93] The focus will be necessarily broader than Army's concerns alone, but the imperative to situate Army within the integrated force to meet its task should motivate Army leadership on the issue.

In 2021, Ian Langford posed the question: does the ADF need a single, end-to-end, agreed concept or narrative describing 'how it fights'?[94] The answer is yes with respect to how the ADF will conduct littoral operations within Australia's northern approaches. Achieving this will address the current logic gap seen in policy between ends and means. John Nash highlights the benefit for the Australian Army (and the integrated force more broadly) from doing so:

> The Army has an excellent opportunity to move past ideas such as the, not unfairly maligned, 'air-sea gap' and finally embrace the sea as a manoeuvre space. As part of an integrated Australian Defence

> Force, Army can manoeuvre for advantage using the vast littorals of the Indo-Pacific, and position itself for area denial and long-range strike operations.[95]

The way ahead, then, is the development of a suitable military strategy to provide the 'ways' for littoral operations in support of deterrence by denial in Australia's northern approaches. This strategy should be the product of a collective Defence endeavour, led by Strategic Policy Division. The strategy should include a 'theory of victory' with a clear causal logic linking the use of 'means' and 'ways' to strategic policy's 'ends'. Development of a *joint littoral manoeuvre concept*, appropriately supported by wargaming, modelling and experimentation, should also be directed by the VCDF to inform the logic of the military strategy. In time this will also inform doctrine, preparedness direction and capability acquisition.

In the introduction to this article, I stated an aim of mobilising thought so that the ADF develops a position of advantage in littoral operations. The literature review conducted for this article underscores the ongoing utility and importance to the profession of arms of resources like the Australian Army Research Centre, the *Australian Army Journal* and the *Land Power Forum*. It is clear that when official policy falls short, there still exist places for the advancement, consideration and debate of ideas around Australia's defence and security. The maintenance of such professional institutions is vital to the future of ideas about littoral operations and about other challenges the nation faces.

Editor's Note

The Joint Warfare Note—Concept: Littoral Warfare—*The Future Integrated Force in the Archipelagic Region* (JWN-C: LW) was approved for publication earlier this year. JWN-C: LW describes how the future integrated force—that is, the force of 2031 and beyond—will conduct multi-domain littoral warfare in from competition to conflict in Australia's PAMI in order to contribute to a strategy of denial. JWN-C: LW informs joint and domain concepts, force design, plans, doctrine, training, preparedness and operations.

About the Author

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Endnotes

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2 There are several definitions of the term *Littoral Manoeuvre*. In this paper I use it in the sense defined by Australian maritime doctrine: 'The use of the littoral as an operational manoeuvre space from which a sea-based joint amphibious force can threaten, or apply and sustain, force ashore'. See Royal Australian Navy, *Australian Maritime Doctrine* (Commonwealth of Australia, 2010), p. 198. The NDS does not use the term 'littoral manoeuvre', favouring 'littoral operations' instead. The NDS is silent as to how it conceives of or defines the term 'littoral operations'. For an exploration of the lexicon and definitions relating to this subject, see Mark Mankowski, 'What Is Littoral Manoeuvre?—Part One', *Land Power Forum*, 23 August 2023, at: https://researchcentre.army.gov.au/library/land-power-forum/what-littoral-manoeuvre-part-1.

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Land Based Fires in a Littoral Environment: The Case of Ukraine's Black Sea Campaign

Charles Miller

Introduction

The Defence Strategic Review of 2023 (DSR) underlined the importance of the littoral environment in Australia's future defence needs.[1] As part of this, the DSR outlined an operating concept for army fires as a form of mobile coastal artillery (what Alfred Thayer Mahan would have called a 'fortress fleet') designed, in part, to deny use of the littoral environment to hostile forces.[2] This concept tracks closely with the rationale for the marine littoral regiments outlined in the US Marine Corps Force Design 2030 Initiative.[3] While this operating concept has many antecedents in military history, there are few in a modern technological environment. Consequently, whether this operating concept can perform as expected in combat is hard to prove definitively. In this article I examine the implementation of this operating concept by the Ukrainian Armed Forces in order to better understand the implications of this concept for the Australian Defence Force (ADF). This evidence is not perfect—as I outline, the strategic, political and geographic environment in Ukraine differs in important respects from the likely set of future Indo-Pacific scenarios. Yet Ukraine is also the best empirical evidence we have for the use of fires in such a manner under the conditions of the modern mature precision-strike regime.

The Littoral Environment and the Use of Fires

With the renewed rise of great power competition globally and in the Indo-Pacific especially, high-tech, high-end intense conventional warfare in a littoral environment is increasingly seen as being a key task for the ADF, including Army. As the DSR puts it, 'Army must be optimised for littoral operations in our northern land and maritime spaces and provide a long-range strike capability'.[4] These developments parallel trends in recent thinking in the US Navy and Marine Corps, as reflected in Force Design 2030 and the operating concepts of littoral operations in a contested environment (LOCEs) and expeditionary advance base operations (EABOs). These trends together spell out a role for the US Marine Corps to generate 'technically disruptive, tactical stand-in engagements that confront aggressor naval forces with an array of low signature, affordable, and risk-worthy platforms and payloads'.[5]

The idea behind these new concepts for both the Australian Army and the US Marine Corps is to use relatively small, dispersed and low-signature but lethal 'stand-in forces' based in littoral environments. A major role for these stand-in forces is sea denial through the projection of long-range precision strikes from land to sea. While sea denial is not the only purpose of these stand-in forces, it is a major one. Examining a similar role for the Ukrainian Armed Forces will form the focus for this article.

There are, of course, multiple historical precedents for the use of land-based fires to effect sea denial, from the Russo-Japanese War and World War Two to the Yom Kippur War.[6] None of these wars, however, took place under the mature precision-strike regime of the 2020s. The contemporary campaign by the Houthis in Yemen against international shipping is similar in many respects to the operational concept outlined in the DSR,[7] though the Houthis are faced with a more significant technological inferiority vis-à-vis their opponents than would likely be the case for the ADF. The war in Ukraine represents the most advanced case of the use of fires in a modern littoral environment but also offers a number of drawbacks in terms of application to the Indo-Pacific. This is not only because the war in Ukraine is primarily a land conflict but also because land and sea are not so closely and intricately intertwined on Ukraine's Black Sea coast as in the multiple small islands of the Indo-Pacific region. There are, moreover, important differences in the political and strategic context of the war in Ukraine when compared to some of the potential scenarios the ADF might face in the Indo-Pacific.

Littoral Combat in Ukraine

Russia's campaign in the Black Sea littoral was designed to help achieve its overall strategic goal of extinguishing Ukrainian independence and placing the country under the control of a Russian puppet regime.[8] However, the littoral part of the war has gone very poorly in this regard—Russia has achieved the ignominious sobriquet of the country which 'lost a naval war to a country with no navy'.[9] In no small measure this is due to Ukraine's use of long-range stand-off fires against the Russian Black Sea Fleet. Ukraine's striking success in this regard could be taken as a proof of concept for the idea of long-range fires in a littoral environment with the combat service support and kill-chain enablers characteristic of an advanced state military. As we shall see, however, there are a number of important caveats to this widely held view, which do serve to raise questions about whether the success of Ukraine's use of long-range fires in a littoral environment will necessarily travel into the very different geographic, strategic and political context of a possible future war in the Indo-Pacific environment.

At the beginning of the current war in 2022, Ukraine was certainly overmatched at sea. Ukraine lost 12 of its 17 major warships to Russia along with much of its naval aviation assets in Russia's illegal annexation of the Crimea in 2014.[10] By 2021 the Ukrainian Navy, relocated to Odessa, fielded one frigate, one corvette, four patrol boats, one mine hunter, one landing ship, one landing craft and a number of smaller vessels.[11] By contrast, the Russian Black Sea Fleet boasted six conventional attack submarines, a cruiser and five frigates with surface-to-surface missile capacity, and a number of other vessels including 13 corvettes, patrol ships, anti-mine warfare vessels and landing ships of various types.[12]

The initial purpose of the Black Sea Fleet appears to have been either to support a potential amphibious landing behind Ukrainian lines on the south coast of Ukraine, or to tie down Ukrainian ground forces to defend against the possibility of such an attack. However, Ukrainian mining of the south coast appears to have removed this as a significant concern from the minds of both Ukrainian and Russian policymakers. The primary purpose of the Black Sea Fleet thereafter was primarily to wage economic warfare on Ukraine by closing Ukraine's sea lines of communication through the Black Sea. Ukraine's primary objective in the naval war, conversely, was to keep these lines open.[13]

Russia's blockade posed a potentially existential threat to Ukraine. Approximately 40 per cent of Ukraine's export income is derived from agricultural exports,[14] primarily to developing countries.[15] Ninety per cent of these exports were transported by sea from Ukraine's southern Black Sea ports such as Odessa.[16] At the beginning of the war, Russia blockaded these ports and brought Ukraine's food exports to a virtual halt. The European Union on one hand, and the UN and Turkey on the other, took steps to unblock the ports via the 'solidarity lanes' and 'Black Sea Grain Initiative' respectively.[17] However, in July 2023, Russia withdrew from the Black Sea Grain Initiative and food exports from Ukraine declined again.[18]

Not only did this blockade reduce Ukraine's ability to finance its war effort; it played into Russia's strategic goals in other ways too. Namely, the blockade contributed both to global food insecurity and to inflation, which provided Russia with coercive leverage over third parties worldwide.[19] Russia may also have aimed to use these global-level economic developments to induce 'war weariness' on the part of Ukraine's supporters and neutral parties, who might be expected to put pressure on Ukraine to concede so as to enable food supplies to resume.[20]

Given its conventional inferiority at sea, Ukraine did not seek to use its small manned naval assets to challenge the Russian blockade. Instead, Ukraine followed a highly innovative and unconventional strategy based on a mixture of unmanned aerial and naval systems along with long-range land-based fires to attack the Black Sea Fleet. This approach has borne fruit with the sinking or destruction of 14 Russian naval vessels, including most famously the Black Sea Fleet's flagship cruiser *Moskva*, sunk on 13 April 2022 by a land-based Neptune missile fired from somewhere near Odessa. In addition, a number of other Russian naval vessels have been damaged or even destroyed in similar ways.

Below is a table of all the major known strikes on Russian naval vessels by Ukraine between the beginning of the war in 2022 and the time of writing in November 2024, along with the date, the strike location, the source location of the strike (if known), the method and outcome, and a number of other relevant details. This data is based on open sources and is necessarily incomplete—open-source intelligence is not always in a position to verify whether, for instance, a vessel such as the corvette *Askold* was indeed damaged beyond repair. Where there is uncertainty, this is noted below.

Although many of the successful strikes were carried out by unmanned naval and aerial drones, land-based fires account for many of the most important hits—including the *Moskva* and the *Saratov* landing ship.

Russian ships sunk or critically struck by Ukrainian long-range precision munitions (22 March 2022 – 12 September 2024)

Date	Ship	Location struck	Location fired	Method	Outcome
22/3/22	1 x Raptor-class patrol boat	Near Snake Island	Undisclosed	Anti-tank guiding missile	Hit and damaged
Details: A video appeared on this date of a Raptor-class patrol boat being hit and damaged by Ukrainian anti-tank guiding missiles. Russian sources state that the ship was towed and repaired.[21]					
24/3/22	*Saratov* Alligator-class landing ship	Berdyansk Port	Undisclosed	OTR-21 Tochka tactical ballistic missile	Sunk
Details: *Saratov* was sunk in retaliation for the Russian capture of Berdyansk 10 days earlier. Ukrainian missile strikes set fire to the ship, igniting the ammunitions aboard. The explosion damaged two nearby Ropucha-class landing ships, *Tsezar Kunikov* and Novocherkassk. The tactical strike disrupted port operations and damaged Russian confidence to operate on the Ukrainian coastline. Video footage showed the ship sinking, satellite imagery confirmed its demise, and Russia confirmed, exactly a year after the attack, the sinking and loss of crew members.[22]					

Date	Ship	Location struck	Location fired	Method	Outcome
17/6/22	*Veliky Ustyug* Buyan-M-class corvette	Off the Odessa coast		BM21 artillery system	'Slightly damaged'

Details:

Photos emerged on social media showing Russia's Buyan-M-class corvette, reportedly the *Velikiy Ustyug*, 'slightly' damaged in an attack by Ukrainian Forces off the Odesa coast.

The images show the *Velikiy Ustyug* corvette redeploying from the Azov Sea to Caspian for repairs. Apparently, the warship was seriously damaged due to artillery fire from the BM-21 Grad system in March.

The Buyan-M-class corvette (pr 21631) is armed with Kalibr missiles. The ships are primarily designed for operations within littoral zones to protect Russia's vast coastal areas. Due to the small tonnage, they can operate even within shallow parts of oceans and seas and Russia's river system.[23]

13/4/22	*Moskva* Slava-class guided missile cruiser	120 km south of Odessa	Land-based launcher near Odessa	R-360 Neptune anti-ship missiles	Sunk

Details:

The BSF's flagship, the *Moskva*, was hit by two Neptune missiles on 13/4 and sunk on 14/4. The ship was identified by a US Navy P-8A Poseidon prior to the attack. *Moskva* was equipped with a triple-tiered air defence that potentially could have mitigated the incoming attack with 3-4 minutes of radar detection warning. There was no evidence to show that the crew had activated these systems. Commentators suggest either that the ship's radars failed to detect the incoming missiles, or that the defences and crew were not prepared to engage the threat.

Reports and imagery suggest that a Bayraktar TB2 drone may have played a role in the event by distracting the crew.[24]

Date	Ship	Location struck	Location fired	Method	Outcome
17/6/22	*Spasatel Vasily Bekh* Project 22870 rescue tug	En route to resupply Snake Island	Undisclosed	Bayraktar TB2 drones in conjunction with two Harpoon anti-ship missiles	Sunk
Details: Ukrainian missiles struck the rescue vessel on its way to Snake Island. The ship sank shortly after the attack. It reportedly had a Tor-M2KM SAM system on board.[25]					
13/9/23 4/8/24	*Rostov-on-Don* Kilo-class submarine	Sevastopol	Aircraft above Black Sea	SU-24s armed with Storm Shadow missiles	13/9/23: 'Damaged beyond economic repair' 4/8/24: Sunk
Details: Storm Shadow missiles severely damaged the submarine during a nighttime raid on Sevastopol. Despite military analysts believing it decommissioned for good, Moscow states that it will return to service. On 4/08/24, Ukrainian officials claimed that they had sunk the *Rostov-on-Don* for good in a missile strike on Sevastopol. The submarine was believed to be repaired from the last attack and undergoing service trials in anticipation of a return to service.[26]					
13/9/23	*Minsk* Ropucha-class landing ship	Sevastopol	Aircraft above Black Sea	SU-24s armed with Storm Shadow missiles	Sunk
Details: Storm Shadow missiles destroyed the *Minsk* in an overnight raid on Sevastopol.[27]					
4/11/23	*Askold* Karakurt-class corvette	Zalyv shipbuilding yard (Kerch, Crimea)	Undisclosed	Cruise missiles	Very likely destroyed or beyond repair
Details: *Askold* was struck during a missile strike on shipbuilding yards in Kerch. The relatively new ship was carrying Kalibur cruise missiles.[28]					

Date	Ship	Location struck	Location fired	Method	Outcome
26/12/23	*Novocherkassk* Ropucha-class landing ship	Feodosia, southern Crimea	Aircraft above Black Sea	Air-launched cruise missiles	Destroyed

Details:

The Ukrainian Air Force struck the *Novocherkassk* at a naval base in Feodosia. The ship was believed to be carrying Iranian-made drones. The strike caused significant damage, secondary explosions, and heavy Russian casualties.[29]

23/3/24	*Ivan Khurs* Yury Ivanov-class intelligence ship	Sevastopol	Undisclosed	Cruise missile	'Slightly damaged'

Details:

The Ukrainian fleet have been hunting *Ivan Khurs* for the duration of the war. Drone boats pursued it in May 2023, but were unsuccessful. Satellite imagery has confirmed the damage of the March 2024 missile strike, but the ship is believed to still be in operation.[30]

Russian ships sunk or critically struck by other Ukrainian assets (22 March 2022 – 12 September 2024)

Date	Ship	Location struck	Method	Outcome
2/5/22	2 x Raptor-class patrol boats	Near Snake Island	Bayraktar TB2 drones	Sunk

Details:

Ukraine has destroyed three Russian Raptor-class patrol ships and damaged a further two since the war began, the Oryx open-source intelligence outlet has visually confirmed.

Two of these were destroyed with a Ukrainian Bayraktar drone in May 2022 near Zmiinyi (Snake) Island in the Black Sea, then Chief of General Staff Valeriy Zaluzhniy said at the time.

The high-speed patrol boats are capable of engaging in search-and-rescue, anti-sabotage, and anti-terrorism operations.[31]

Date	Ship	Location struck	Method	Outcome
7/5/22	1 x Serna-class landing craft	Snake Island	Bayraktar TB2 drones	Sunk

Details:

The Ukrainian military says it has sunk another Russian warship in the Black Sea near Snake Island, declaring that a missile launched from a Bayraktar drone struck a Russian landing craft.

'In the waters of the Black Sea, an enemy landing craft of the type Serna was destroyed', military spokesman Serhiy Bratschuk said on his Telegram channel on 7 May.

The Ukrainian Defense Ministry said an armed Bayraktar drone also destroyed a missile defence system on Snake Island, a small islet under Russian control.

The ministry posted what it says was a video of the ship sinking on its Twitter account.

'The traditional parade of the Russian Black Sea fleet on May 9 this year will be held near Snake Island—at the bottom of the sea', the Defense Ministry said.[32]

29/10/22	*Ivan Golubets* Natya-class minesweeper	Sevastopol	UAV strike	'Slightly damaged'

Details:

The Russian Defense Ministry said in October 2022 that the minesweeper *Ivan Golubets* was damaged during a 'massive attack' involving drones on the port city of Sevastopol in Crimea. The operation was conducted with nine Ukrainian unmanned aerial vehicles, and seven 'maritime drones', Moscow said.[33]

29/10/22	Admiral Makarov Admiral Grigorovich-class frigate	Sevastopol	UAV strike	'Slightly damaged'

Details:

'Russia's Black Sea flagship vessel, the Admiral Makarov, was damaged and possibly disabled during an audacious Ukrainian drone attack over the weekend on the Crimean port of Sevastopol, according to an examination of video footage.'

'Open-source investigators said the frigate was one of three Russian ships to have been hit on Saturday (29/10/22). A swarm of drones—some flying in the air, others skimming rapidly along the water—struck Russia's navy at 4.20 am. Video from one of the sea drones shows the unmanned vehicle weaving between enemy boats.'[34]

Date	Ship	Location struck	Method	Outcome
4/8/23	*Olenegorsky Gornyak* Ropucha-class landing ship	Near the port of Novorossiysk	Likely unmanned sea drone	Seriously damaged

Details:

A joint effort by the Ukrainian Navy and the Ukrainian SBU (Security Service of Ukraine) resulted in serious damage to the *Olenegorsky Gornyak*. It was the largest Russian ship to sustain damage since the sinking of the Moskva.[35]

14/9/23 5/3/24	*Sergey Kotov* Project 22160 patrol ship	Kerch Strait	Naval drone attack (9/23) Magura V5 unmanned surface vessels (3/24)	Damaged (9/23) Sunk (3/24)

Details:

The *Sergey Kotov* was damaged by a Ukrainian naval drone strike in September 2023. Six months later, it was struck again by Magura V5 unmanned vehicles off the coast of Crimea and sank after absorbing substantial damage.[36]

3/9/23 14/9/23	2 x KS-701 Tunets patrol boat	North-western Black Sea	Bayraktar drone	Destroyed

Details:

Ukraine's Armed Forces destroyed another Russian KS-701 Tunets (Tuna) patrol boat in the northwestern part of the Black Sea, Naval Forces of the Armed Forces of Ukraine reported.

The KS-701 Tunets is a patrol boat used mainly by Russian border guards and emergency services. The hull of this boat is 8.8 metres (29 feet) long and 2.5 metres (8 feet) wide. A KS-701 Tunets boat can take six to 10 people aboard, plus a captain.

The boat's maximum speed is 37.8 knots (700 km per hour or 435 miles per hour). The operational range is 200 nautical miles (370 km or 230 miles).

Ten days before, on 3 September, Ukraine's Armed Forces used a Turkish-made Bayraktar TB-2 armed drone to destroy another Russian KS-701 Tunets patrol boat with its crew, preventing a Russian landing in the north-western part of the Black Sea in southern Ukraine.[37]

Date	Ship	Location struck	Method	Outcome
2/2/2024	*Ivanovets* Tarantul-class corvette	Off Crimea	Naval drones	Destroyed

Details:

Ukrainian forces say they have destroyed a Russian missile boat from the Black Sea Fleet in a special operation off Russian-occupied Crimea.

The Ivanovets—a small warship—received 'direct hits to the hull' overnight, after which it sank, military intelligence said.

It has released video footage that purports to show the moment of impact, followed by a big explosion.

There has been no word about the incident from Russian authorities.

However, Russian military blogger 'Voenkor Kotenok' wrote on Telegram that the boat had sunk after being hit three times by naval drones.[38]

6/5/2024	Mangust-class patrol boat	Off Crimea	Magura V5 multipurpose sea drone	Destroyed

Details:

Ukrainian forces destroyed a Russian military fast attack craft on 6 May, Ukraine's military intelligence (HUR) reported.

The attack was reportedly carried out with a Magura V5 multi-purpose sea drone in occupied Crimea overnight.

The agency later identified the targeted Russian vessel as a Mangust-class patrol boat, also known under the designation Project 12150.

In recent months, Ukraine had intensified its attacks on occupied Crimea, targeting Russian military assets in and around the Black Sea.[39]

6/6/2024	Saturn-class supply tug	Off Crimea	'Kamikaze surface drone'	Destroyed

Details:

Ukrainian forces are claiming the destruction of a Russian supply tug that was being used to support the forces in Crimea. Reports are that this was the latest in a series of attacks designed to disrupt the supply lines into Crimea.

The official statement said that on 6 June a special unit launched an attack on the Crimean coast and that 'Saturn (the name of the tug) will no longer sail.' Other statements are saying that it was either the Saturn or Proteus.[40]

At the time of writing, these tactical successes have constituted a success for Ukraine's overall campaign at the strategic level: the Black Sea Fleet had withdrawn from Sevastapol further east to Novorossiysk, the Sea of Azov near Mariupol and occupied Abkazia in Georgia by mid-July 2024.[41] These withdrawals have allowed Ukraine to reopen its shipping lanes and return its agricultural exports to near prewar levels.[42]

Ukraine's success in exerting sea denial while operating with close to no conventional navy has been a shot in the arm for the idea of using long-range fires in a littoral environment. However, multiple caveats must be borne in mind.

The first is one which will be familiar to most Australian officers—namely that the Ukrainians were so successful in attacking the Black Sea Fleet primarily because they were able to present the Russians with a variety of threats from several different and unexpected vectors. For example, as the table notes, one of the reasons why the *Moskva* could be successfully targeted by a Neptune missile was that the crew's defences had been confused by a near simultaneous attack by a set of Bayraktar aerial drones. Long-range fires will work best in a littoral environment when paired with several other potential threats to present enemy defences with multiple dilemmas. In the Australian context, this implies close collaboration between Army and the other service branches, the Royal Australian Air Force (RAAF) and Royal Australian Navy (RAN).

Moreover, as will be familiar to students of the Ukraine War on land, the littoral war has seen significant adaptation and counteradaptation on both sides, which has in some cases served to blunt the initial advantage which land-based Ukrainian fires enjoyed in facing the Black Sea Fleet. As in the land battle, electronic warfare (EW) and increased fortification has been crucial in this regard. Systems such as Krasukha-4, Murmansk-BN and R-330Zh Zhitel have been instrumental in jamming GPS signals that are relied upon by Ukrainian long-range missiles.[43] More recently, Russian EW adaptation has prevented many of Ukraine's new ground-launched small-diameter bombs (GLSDBs) from hitting their intended targets.[44] Russian jamming has effectively disabled the GPS navigation systems in GLSDBs used in 2024.[45] Similar jamming methods have been used to deter Excalibur 155-millimetre artillery munitions.[46]

Moscow has also been deploying spoofing and decoy systems in its EW. The Pole-21 system is perhaps the most prominent of these and has been used in attempts to confuse GPS-guided missiles by transmitting false positional data.[47] Ukraine has been targeting such systems, with the most recent attack occurring in August 2024, damaging a former offshore gas platform used for GPS spoofing.[48]

American-supplied weapons, namely the Joint Direct Attack Munition (JDAM) and the High Mobility Artillery Rocket System (HiMARS) have proven to be susceptible to Russian jamming efforts.[49] Russian counter-satellite systems have also been powerful enough to degrade encrypted 'M-Code signals' from the US GPS constellation.[50] Russian media has targeted these vulnerabilities to undermine Ukrainian and American confidence. Outside of long-range precision munitions, Russian EW has been effective at adapting to counter the Bayraktar TB2 drones that wreaked havoc in the early stages of the war.[51] The aforementioned utility of combined attacks with drones and long-range precision munitions is reduced when competent jamming systems are in used to mitigate the drone side of the attack.

Russian EW capabilities are also often integrated with air defence systems, such as the S-400 and Pantsir-S1. This multi-layered protection has been part of the reinforcements in Sevastopol.[52]

When looking at applying the Ukrainian littoral tactical complex of long-range fires, mines, aircraft and air and sea drones to a potential scenario in the Indo-Pacific, moreover, multiple potential caveats emerge. These stem from the political, strategic and geographic differences with the war in Ukraine. Here I will outline them one by one.

The Littoral Campaign Was Never the Main Focus of Russia's Effort

The initial focus of Russia's war effort was Kyiv, to remove the Zelenskyy government and replace it with a friendly, pro-Russian puppet. Once it had become clear that this goal was unrealistic, the Russians switched the main locus of their efforts to the east. At no point was the campaign against Ukraine's sea lines of communication the main focus of Russia's effort.[53] If it had been, perhaps they would have been able to overcome the Ukrainian littoral tactical complex through sheer force of numbers and effort, as they slowly did in the ground campaign in the Donbas, for instance. The reason why this matters is that in a future Indo-Pacific contingency, the littoral environment is quite likely to be at the centre of

the enemy's main effort, which implies that they would mount a more determined attempt to overcome American, Australian or allied resistance than the Russians did to overcome Ukraine in the Black Sea.

The Ukrainian Littoral Tactical Complex Relies on C5ISR Support from Western Allies Which the Russians, for Obvious Reasons, Did Not Go All Out to Interdict

Some reports claim that the sinking of the *Moskva* was enabled in part by intelligence from a US P-8 Poseidon surveillance aircraft,[54] while other strikes on the Black Sea Fleet may have been enabled by US satellite intelligence.[55] While the Russians have attempted to jam or hack American and European command, control, communications, computers, cyber, intelligence, surveillance and reconnaissance (C5ISR) capabilities which were helping Ukraine (for instance, Starlink satellites), they have not attempted to shoot them down or physically attack them. There have, for instance, been no attempts made to use kinetic space-based assets to attack US satellite capabilities helping the Ukrainians. In a future Indo-Pacific contingency, this may not be the case, making it harder for Australia and its allies to use long-range land-based fires against enemy shipping. In most cases, the assumption is that the US and the People's Republic of China would be active combatants on opposing sides and would use kinetic measures to attack each other's C5ISR capabilities. Chinese fighters would attempt to shoot P8s down and use space-based weapons to attack US satellites,[56] in addition to any jamming measures undertaken by EW units.

Russia's Geography, Combined with the Montreux Convention, Prevented the Russians from Reinforcing the Black Sea Fleet with Similar Capabilities from Other Russian Naval Commands

Russia's geography, with multiple coastlines separated from one another by vast distances, has always complicated the task of the Russian Navy. The Russian Navy is divided into four fleets—the Baltic Fleet, the Northern Fleet and the Pacific Fleet in addition to the Black Sea Fleet.[57] Ships from one fleet cannot easily reinforce one another since they have to traverse possible hostile seas and choke points. This means that once a key vessel such as the *Moskva* is sunk, it can be very hard to replace even if similar capacities exist in another fleet. The *Moskva* played a crucial coordinating role for the anti-missile and anti-air defences of the Black Sea Fleet as a whole. After it was sunk, it could have been replaced by another Slava-class cruiser from a different Russian fleet, such as the *Marshall Ustinov*

of the Northern Fleet or the *Varyag* of the Pacific Fleet. However, this would have implied the necessity for one of these vessels to transit the Dardanelles. According to the Montreux Convention, the right to grant such transit rights is reserved to the Turkish Government, which refused them to Russia.[58] Why does this matter? In an Indo-Pacific contingency, Australia's adversaries may not require such transit rights and hence may be able more easily to replace any large vessels sunk by long-range fires. If the *Moskva* could have been replaced, Russia might have been able to maintain its chokehold over Ukraine's sea lanes.

The Geography of Ukraine Facilitates Resupply of Long-Range Fires Units and Also Facilitates Their Ability to Move to New Firing Points, as Compared with the Indo-Pacific

We do not know where exactly the Neptune missile which sank the *Moskva* was fired from. For illustrative purposes, however, I plot in Figure 1 a circle the radius of which is the maximum range of the Neptune missile reaching from the approximate site at which the *Moskva* was hit.

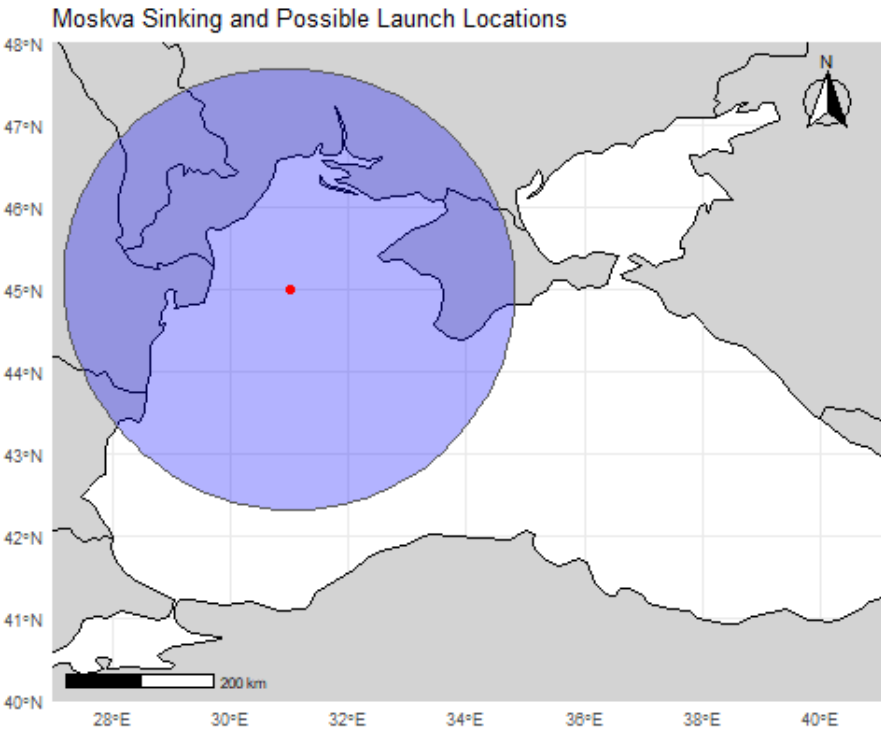

Figure 1. Possible launch locations for the missile which sank the *Moskva*

Anything to the west of the Dnipro River at approximately 47'N, 32'E can be taken at that time to be under fairly firm Ukrainian control. The area bounded by the Dnipro to the east, the Romanian border to the west, the coast to the south and the maximum range of the Neptune to the north can be taken to be the area from which the fatal shot might have been fired. This is a fairly large and extensive land mass far beyond the capability of Russian ground forces to interdict and hard, moreover, for Russian surveillance assets to sift through. By contrast, the geography of the Indo-Pacific, consisting to a large degree of small islands, offers a much smaller set of land masses in which mobile long-range artillery units can move, conceal and fire without being vulnerable to enemy detection and/or amphibious assault.[59] The ability for such units to manoeuvre in Ukraine, moreover, is greater given the flatter terrain and more extensive road system. Forces operating in the Indo-Pacific will find it harder to manoeuvre mobile artillery platforms to new positions after firing in order to escape enemy return fire, though on the other hand the terrain of the Indo-Pacific may also make it easier to conceal these platforms prior to first engaging the enemy. To illustrate this, I plot in Figure 2 and Figure 3 the road networks of Odessa Oblast in Ukraine and the Ilocos Norte Province in Northern Luzon in the Philippines, using data taken from OpenStreetMap.[60]

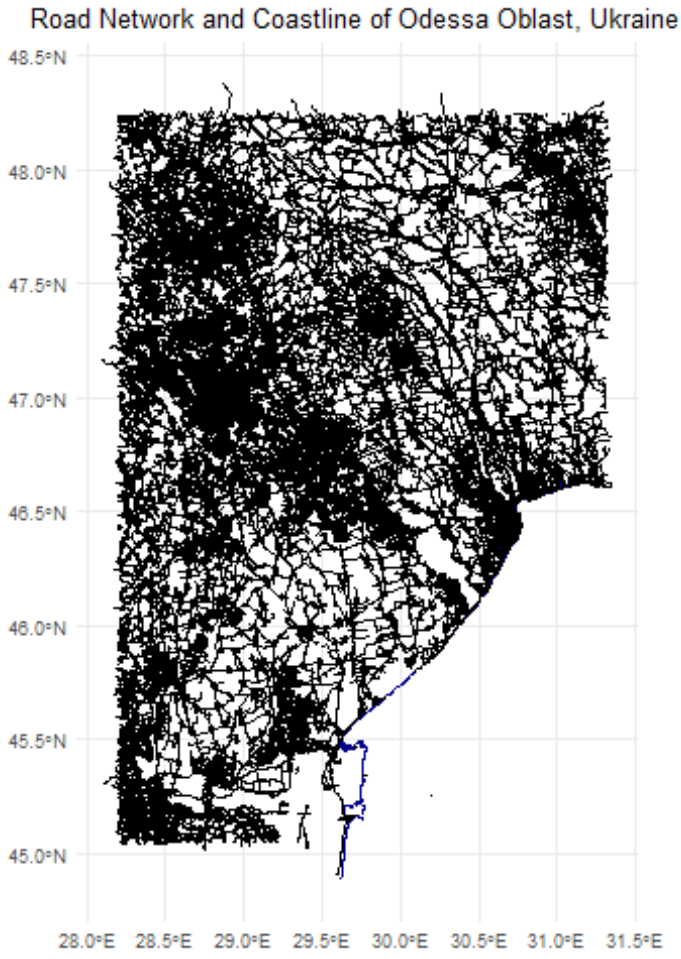

Figure 2. Road network in Odessa Oblast, Ukraine

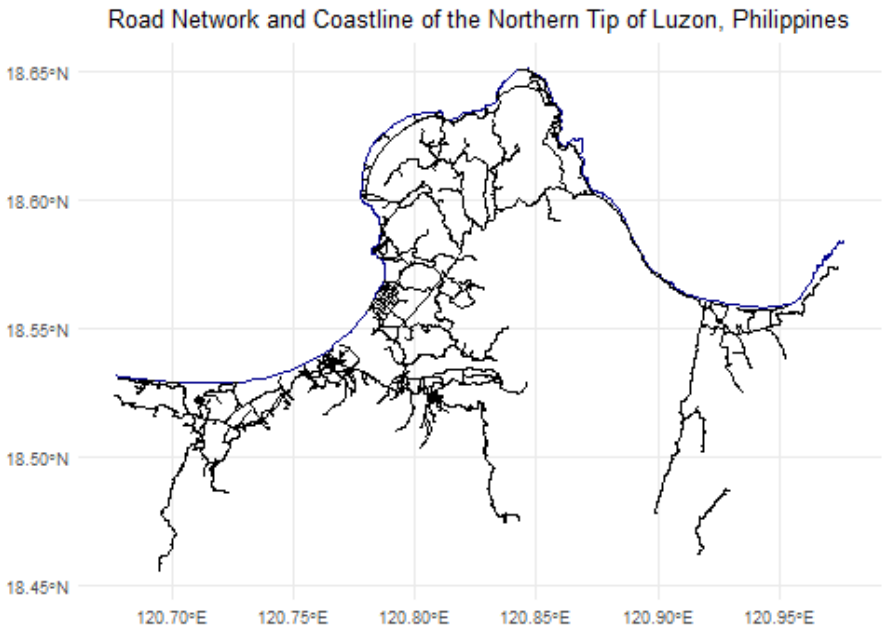

Figure 3. Road network in Ilocos Norte Province, Philippines

Even for off-road vehicles such as the carrier of the multiple launch rocket system, Ukraine is arguably better terrain to operate in given the relative flatness of the land and lack of dense forests. In Figure 4, I plot forest cover in the Black Sea region from Hansen et al. (2013).[61] Hansen et al. used the Landsat Thematic Mapper's imagery to provide measures of forest cover at high resolution across the world. The lighter shaded regions represent forested areas. The darker areas have no forests. The lightly coloured region at the bottom of the plot is northern Turkey and the lighter region towards the top is the southern tip of Crimea. As we can see, southern Ukraine is almost entirely denuded of forests. This may be bad for individual soldiers as the terrain provides minimal natural cover, but it also makes it easier for heavy vehicles, tracked or untracked, to manoeuvre.

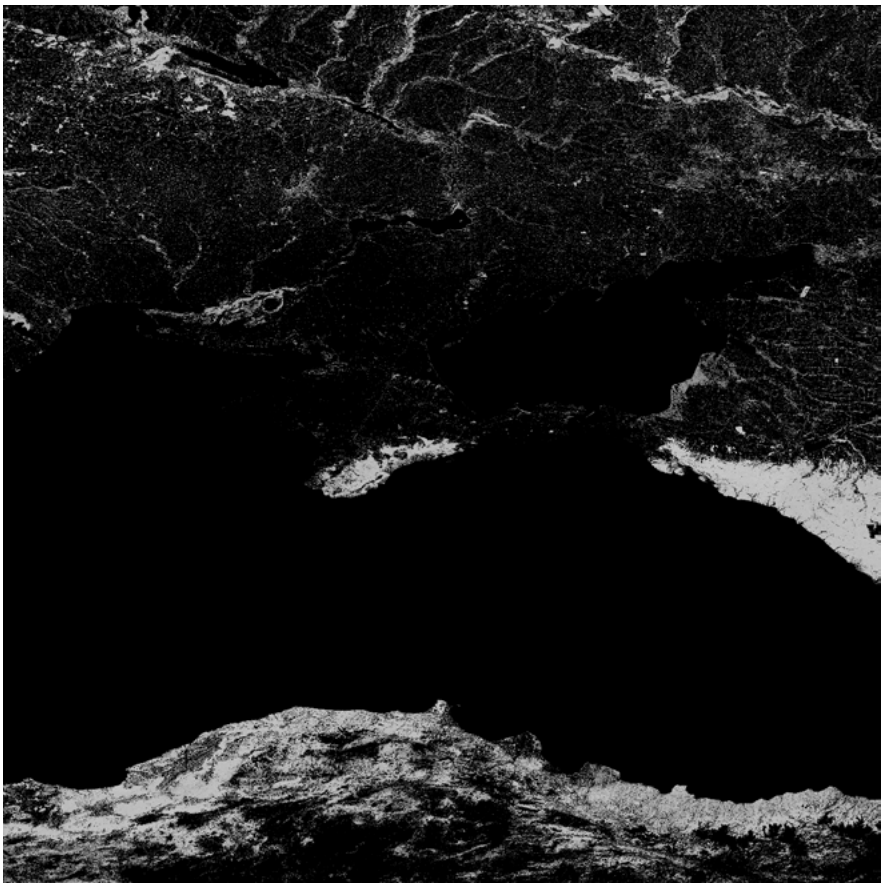

Figure 4. Forest cover in the Black Sea region

By contrast, many islands in the Indo-Pacific are extensively forested. This is well illustrated by a plot taken from the same data source of the Philippines in Figure 5 (the long, lighter coloured strip on the left represents the east coast of Luzon).

Figure 5. Philippines forest cover

Ukraine is also superior terrain for tracked or untracked vehicles because it is relatively flat. Nathan Nunn and Diego Puga developed a measure designed to capture this variable called 'terrain ruggedness'.[62] This can be thought of as the average distance in elevation between two points within the same square kilometres in a given country. In countries with large numbers of mountains and valleys, for instance, this distance will tend to be high—Switzerland's ruggedness score is 476.1 metres, while that of the Netherlands is 3.7 metres. According to this measure, Ukraine is significantly flatter than most of the Indo-Pacific nations in which a littoral battle might be fought. Ukraine has a ruggedness score of 41.6 metres (and this score is inflated by the Carpathian mountain range in western Ukraine, which is out of range of the Black Sea). By contrast, the Philippines comes

in at 202.8 metres, Indonesia at 96.7 metres and Papua New Guinea at a whopping 158.9 metres.[63] In short, the ability of long-range surveillance units in Ukraine to fire, then rapidly move to avoid Russian retaliation will almost certainly be much higher than the ability of similar units to pull off a similar feat in a littoral environment such as the Indo-Pacific.

Perhaps even more importantly, Ukrainian long-range artillery units and the units supporting their operations (including infantry and armour) can be relatively straightforwardly supplied over land from the neighbouring European countries in a manner which may prove much harder in a littoral Indo-Pacific environment.

At this point I should acknowledge that the goals of long-range fires in the littoral environment of the Indo-Pacific might be somewhat less ambitious than in Ukraine. In current US Marine doctrine, for instance, the goal of stand-in forces such as the Marine Littoral Regiments is partly to delay hostile forces in order to allow time to bring in reinforcements.[64] The littoral regiments need not necessarily halt the enemy's naval operations altogether, as the Ukrainians have effectively done. Nonetheless, caution should be taken in extrapolating from the undoubted strategic successes the Ukrainians have had with long-range land-based fires in a littoral environment to the very different context of the Indo-Pacific. The evidence from Ukraine is the best empirical evidence that we currently have of how effective long-range land-based fires can be in a littoral environment, but that does not mean we cannot use other types of evidence to explore how land-based fires might play out in a littoral environment in the Indo-Pacific.

Conclusion

The campaign of the Armed Forces of Ukraine (AFU) in the Black Sea is an impressive achievement and has had important operational consequences. With few remaining manned sea vessels of their own, the Ukrainians have sunk or damaged a large number of Russian warships, including large and important vessels such as the *Moskva*. These losses have forced Russia to effectively withdraw the Black Sea Fleet from the western portion of the Black Sea, where Ukraine's sea lines of communication lie. This achievement has provided important strategic benefits for Ukraine, allowing it to resume seaborne exports crucial to Kyiv's economic survival. Unquestionably, this constitutes a solid proof of concept for the idea of

using land-based fires to exercise sea denial. Importantly, however, it was not land-based fires alone which contributed to this outcome—air-fired missiles and air and sea drones also accounted for a substantial portion of Russian losses. Perhaps most importantly, the combination of multiple threat vectors is most potent—as the reported distraction of the *Moskva*'s crew by Bayraktar drones shows. This points to the fact that a reorientation of the Australian Army to the littoral environment must also involve extensive collaboration with the RAAF and RAN and the incorporation of autonomous air and sea systems into a joint kill chain. It must also involve extensive investment in electromagnetic spectrum capabilities to frustrate attempted jamming and spoofing countermeasures and to protect Australia's own kill web, especially satellites and a range of active and passive sensors to detect enemy assets.

That said, however, this article has raised some points of caution around over-extrapolating from the Ukrainian experience. For a number of reasons, the Black Sea is an environment more conducive to the success of land-based fires against shipping than the Indo-Pacific is likely to be. These reasons include the relatively low priority accorded the naval campaign by Russia, and the particular circumstances of the Montreux Convention and Turkey's refusal to allow Russian vessels to transit the Dardanelles. Similarly, the reluctance of the Russians, for obvious reasons, to directly target the Western C5ISR infrastructure aiding the Ukrainians is unlikely to be replicated in the Indo-Pacific. This would make the ADF's job in attempting to execute long-range precision-strike warfare from the land to the sea in the Indo-Pacific much harder than the AFU's effort in the Black Sea. This realisation points to the need to provide a robust set of enablers for these strikes—including satellites and active and passive sensors combined with possibly AI-powered data analysis—and for a set of capabilities to protect those enablers. If they can be neutralised, then long-range precision-strike capabilities will be rendered blind and ineffective.

Geography is also important. Ukraine's flat, bare geography and highly developed road system allows vehicle-borne missiles to operate relatively free from enemy interference. The flip side of this is that the dense jungle of much of the Indo-Pacific allows fire systems to be more easily concealed *prior to being used*. This in turn might imply the need for different types of fire systems—instead of expensive but mobile systems such as the HiMARS, perhaps a better option would be a larger number of cheaper

and hence more expendable systems which are assumed to only fire once while their crews conceal and or escape without the use of large road vehicles. Relative to Ukraine, logistics would also be a huge complicating factor in applying long-range precision fires in the littoral domain that characterises the Indo-Pacific. Whereas AFU long-range strike units can be resupplied overland from Europe, stand-in forces in the Indo-Pacific would be reliant on either host country supplies (which would in turn involve a set of political and economic complications), or on resupply by sea. Successful implementation of the long-range precision-strike concept in the Indo-Pacific littoral would require a secure supply chain back to Australia and/or other secure base countries. These chains could, however, be subject to interdiction by enemy resources, including their own reconnaissance strike complex. In terms of future research, testing the theory behind fires in a littoral environment will also require complementary approaches tailored more closely to the Indo-Pacific's strategic and natural geography, such as wargaming.

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Dynamic Support Relationships in Modern Combined Arms Operations

Jack Watling

The emphasis of studies intended to identify lessons from the Russo-Ukrainian War tends to fall into three categories: studies of procurement and capability innovation;[1] studies of threat with recommendations on adaptations to tactics, techniques and procedures;[2] and studies of platform effectiveness, especially of uncrewed aerial vehicles (UAVs).[3] Far less has been written on what can be learned from the Armed Forces of Ukraine (AFU) as regards force structure, or the employment of capabilities in combination as it might apply beyond the AFU, let alone the impact of new dependencies within the force on core doctrinal tenets of how Western land forces think they fight.[4] There are arguably three reasons for this. First, there is limited public information about Ukrainian structures and considerable variation within the AFU. As these structural changes have often been driven by necessity, the AFU's approach is not necessarily an optimal one. Second, the AFU comes from a Soviet military cultural tradition that makes its approach hard to transpose to militaries whose culture is rooted in the 'Western way of war'.[5] Third, there are many who argue that the Russo-Ukrainian War is one conflict, against a specific adversary, on particular terrain, that differs from the defence planning assumptions of many militaries observing the conflict.[6] This being the case, the argument goes that Ukrainian structures and methods have limited relevance beyond their theatre of operations. There are merits to these three considerations.

However, the same arguments are also often used to justify a reflexive conservatism within militaries against any significant change to structures or approach.

The Australian Army is very different from the Ukrainian Ground Forces. Australia has a small but highly professional force, postured to operate in littoral environments at considerable reach, with the People's Liberation Army (PLA) as their presumed adversary.[7] The Ukrainian Ground Forces have considerable experience but are poorly trained, are predominantly a conscripted force with mass, operating on their homeland, and fighting the Armed Forces of the Russian Federation. Nevertheless, there are a range of behaviours and structural changes that have emerged across the AFU that pose important questions for the Australian Army.

This article—based on direct periodic observation of the AFU over a three-year period—is intended to identify areas where changes in the combinations of tools employed by tactical units have driven adaptations in force structure and command relationships that would bear careful consideration by the Australian Army. The article is not intended to outline the Ukrainian approach and argue that Australia should adopt it. Rather it identifies where dynamics in Ukraine are likely to manifest in Australian operations and it outlines some conceptual problems that Australian force planners will need to address.

The article is structured in five parts. The first identifies the characteristics of ground combat in Ukraine that have relevance for the Australian Army. The second discusses the dependencies between new combinations of tools in Ukrainian ground operations and how these may shape Australian thinking. The third examines command and control (C2) structures. The fourth considers the impact of the identified dynamics on mission command, as a core pillar of the Western way of war. The article concludes by drawing out some specific conclusions relating to the Australian Army.

A note on language is necessary. Doctrinal language is very precise. But this very precision can leave the meaning of such language opaque when its use is detached from its application. For example, when writing about a single military, doctrinal language is often a useful tool for achieving precision in expression. By contrast, when comparing several militaries, doctrinal terms do not translate 'like for like' and so attempts to adhere to

one system can confuse more than illuminate. As a British author writing about Ukrainian concepts in an Australian publication, I have not aligned my language with one of these countries' doctrinal terminology.

The Characteristics of Ground Combat in Ukraine

Ground operations in Ukraine at the time of writing have several distinct characteristics.

Battlefield Transparency. Both Russian and Ukrainian forces use a high number of UAVs backed up with radar, space-based intelligence, surveillance and reconnaissance (ISR), electromagnetic, acoustic and other sensors to maintain constant observation of the battlefield. Observation is most pervasive within 15 kilometres of the front but is maintained with decreasing density out to 200 kilometres from the front.[8]

Contested and Congested Electromagnetic Spectrum (EMS). Both Russian and Ukrainian forces use electronic protection down to the platoon level and electronic attack in all combat brigades. As a result, navigational interference is pervasive and radio frequency jamming and fratricide are continuous, though there is always some available spectrum.[9]

Mass Precision Strike Throughout Operational Depth. Both Russia and Ukraine hold organic capabilities at all echelons that can strike into the deep of their opposing echelon. In this way, the company and battlegroup can strike out to 15 kilometres, the brigade out to 40 kilometres, and the division out to 90 to 120 kilometres, while higher echelons can strike beyond 500 kilometres at scale. Logistics and sustainment are therefore under persistent attack, with 50 per cent of casualties being taken behind the front lines.

Dispersion of Forces and Capabilities. Both Russian and Ukrainian troops operate in highly dispersed formations with brigade frontages of approximately 15 to 30 kilometres, and squads covering between 70 and 200 metres of ground, while a battalion is usually deployed over 7 to 10 kilometres of depth. When units—like North Korean troops—have fought with greater concentration, they have suffered unsustainable rates of casualties.[10]

Criticality of Complex Terrain. Fighting has pivoted around areas of complex terrain, whether they be rivers, urban areas or dense forests, where troops are protected from the dynamics outlined above. Rates of attrition for both sides, however, have tended to increase within these areas.

To fight within this context several approaches to force structure have been adopted by the AFU. First, the number of UAV operators in units has expanded, with approximately one UAV platoon or company per battalion, a UAV battalion per brigade, and a UAV brigade per operational-tactical group (an incomplete divisional echelon in the AFU) currently being restructured as army corps. Second, dispersion of forces has required more capability to be held organically by tactical units of action such that electronic warfare (EW) and air defence units are now fielded at the company and battalion level respectively and are critical to successful operations, even including platoon attacks. Third, resupply has become an increasingly automated function, carried out from greater distance to avoid persistent attrition. Fourth, command posts have been significantly reduced in size and in their direct engagement with subordinate units to limit their exposure. The relationship between command posts and subordinate units has also been altered. Finally, communications architectures are very different from traditional vertically integrated hub and spoke systems, having moved towards lateral integration enabled by satellite communications.

If we consider the defence planning assumptions for the Australian Army, it may superficially appear that some of these conditions—and therefore their associated implications for the force—do not apply. Australian forces assume that they will be fighting in a heavily vegetated littoral where battlefield transparency is harder to achieve. As both Australia and its opponent would be operating at reach in the Indo-Pacific, electronic attack may be more periodic. Significantly greater ranges in the Indo-Pacific make sensing and striking into operational depth a higher echelon function. Fewer observation assets and small force packets could reduce the need for dispersion within a unit while also increasing the dispersion of larger formations, thereby thinning out the lethal enablers that drive certain tactics in Ukraine. Dense and complex terrain is potentially the norm in the Indo-Pacific rather than the exception. Finally, Australia assumes that it will fight as part of a multinational coalition, led by the United States, obviating the need for some capabilities to be held organically.

There are, in fact, reasons to believe that many of the conditions prevailing in Ukraine are relevant to the Australian Army. First, Both Russia and Ukraine are critically dependent on Chinese equipment and components for those systems that contribute to battlefield transparency.[11] It is sensible to assume that PLA units will increasingly field this equipment at scale in their tactical formations.[12] As regards vegetation, when one examines vital ground—often relating to key terrain features, infrastructure, and main supply routes—then the density of overhead cover is far less than across the Indo-Pacific theatre in aggregate. Furthermore, in areas where forces come into contact, cover from overhead observation is liable to be degraded by fires.

As regards the congested and contested EMS, PLA forces invest heavily in EW equipment.[13] Furthermore, given the logistical constraints imposed across the Indo-Pacific by the need to resupply over the sea, it is disproportionately likely that forces will rely on precision fires to compensate for the difficulties in applying the necessary volumes of statistical fires to assure the requisite operational effect. This places disproportionate value in counterintelligence, surveillance, target acquisition and reconnaissance (ISTAR) capabilities and protection from precision. This situation is liable to encourage EW systems to be fielded with any deployed conventional force, irrespective of the size of the deployed unit.

With regard to the aforementioned advantages of precision in the Indo-Pacific, it is also relevant that the PLA fields large numbers of long-range multiple-launch rocket systems and ballistic and cruise missiles.[14] In addition, PLA doctrine emphasises the use of joint fires to achieve annihilation of enemy forces.[15] Moreover, the requirement to move supplies by sea, and the existence of limited ground infrastructure for heavy transport, are liable to exacerbate the vulnerability of sustainment in the Indo-Pacific as compared with Ukraine.

The size of many formations in the Indo-Pacific will inevitably be smaller than in Ukraine. This is because of the challenges of sustainment and the relatively small size of expeditionary units within the PLA, and even more so for Australia and other nations. Indeed, with Australia having a division assigned to expeditionary operations and a division responsible for homeland defence, while its brigades are small by the standards of

most militaries, force density across the area of operations will likely be even lower than in Ukraine. At the tactical level, meanwhile, there is little evidence to suggest that the same battlefield considerations will not keep forces dispersed.

Dense urban population centres around critical infrastructure are likely to be vital ground in the Indo-Pacific, such that operational challenges will revolve around these terrain pieces.[16] Ironically, however, agricultural and industrial activity around these same centres is liable to cause their environs to be less complex than remote areas, such that the approaches to that complex terrain are often more open. How forces operate in such terrain without either concentrating and becoming vulnerable to fires or having large numbers of symmetrical and therefore highly attritional small unit engagements is a serious tactical problem for a force like Australia's which lacks the depth to suffer significant casualties without a depreciation in force quality.

Australia will likely fight alongside allies and partners. At the sub-tactical level Australia should not assume extensive multinational considerations, given that the country will need to be able to own some problem sets and battlespace if it is to be a net contributor to the coalition. At the tactical and operational level, meanwhile, it is important to note that Ukraine relies on the same multinational partners for surveillance and reconnaissance support, and that the sustainment of the AFU is indeed a multinational effort drawing on many of the same platforms and munitions as would impact Australia. There is a difference in the level of integration. But the difference is insufficient to make the two contexts incomparable.

If we accept, therefore, that the environment and enemy capabilities may impose similar dilemmas in the Indo-Pacific to those experienced in Ukraine, then it follows that we should consider some of the conceptual problems for force structure that have arisen from the adaptations made by fighting forces to address these dilemmas.

Dynamic Dependency in Sub-Unit Operations

As already described, dispersion of units is one of the tactical responses to battlefield transparency and the increased range and precision of fires.[17] By dispersing, infantry units can prepare a greater number of secondary or decoy fighting positions within a relatively small footprint. This reduces the threat that the unit can be systematically targeted with precision fires. Having fewer personnel on each position also reduces the efficiency of an enemy's fires. A consequence of dispersion, however, is a greater dependency on indirect fire among infantry units. Without it, there is often insufficient combat power on any given position to hold under pressure.[18] Although indirect fire has been a critical support element for over a century, in Ukraine a company group wishing to hold their fighting positions must often deliberately attrit a company attack using organic or attached indirect fire elements over around 15 kilometres of depth. The ability of an opposing company to disperse an attacking force similarly creates problems of concentrating combat power. Small force packets become easily suppressed and, unless they can draw upon indirect fire, often struggle to regain mobility. Dispersion also imposes constraints on tempo, as it becomes dangerous to echelon units through one another, while small force packets lack the ammunition and stores necessary to accelerate through positions.[19]

The efficiency of enemy strikes can be further degraded through the distribution of electronic protection to interfere with enemy precision navigation and timing (PNT). PNT denial is generally erected over company positions in Ukraine while electronic countermeasures are fielded on most vehicles. It is often critical to deny radio frequencies for a period to ensure survivability, especially during activity that requires movement in open ground, whether that be a sub-unit in defence resupplying or a sub-unit conducting an attack. There is, of course, a tension here between dependence on indirect fire and electronic protection. Specifically, if the indirect fire is organic to the company, such support must primarily be achieved through precision fire. This is because the force will inevitably lack the magazine depth required to receive statistical fire with sufficient range to force an enemy attack to disperse. Instead, the force depends on the EMS for the delivery of precision fires and must therefore choose whether to posture itself to deliver effect or to harden itself against it.

Air defence is also a function critical to sub-unit operations in Ukraine. An important caveat to this observation is that air defence is generally not a function performed by dedicated air defence detachments, who sit at a higher echelon. Instead, it involves questions of where a unit's machine guns are placed, and whether to prioritise fire support or to act as an air defence picket. Similarly, the same UAV teams that enable and deliver indirect fire tend to be able—if supported by appropriate sensors—to intercept enemy reconnaissance UAVs. But it is not feasible for the team to do this and to attrit the enemy in depth. The missions are different, and capacity must be assigned to the one or the other. Given the ubiquity of reconnaissance UAVs, shooting them down tends to produce a window of opportunity for activity, as the enemy must regenerate the UAV orbits.[20]

The capabilities outlined above, necessary for the force to remain survivable while executing tactical actions, have trade-offs between them. Specifically, if a force must be able to deliver indirect fires using UAVs, then it becomes counterproductive to maintain robust electronic protection and air defence. The postures of the different elements must be carefully sequenced. A unit might, for example, prioritise freedom to deliver precision fires against the enemy in preparation for an attack, then pursue counter-reconnaissance with EW and air defence to create the freedom to manoeuvre, then manoeuvre, prioritising fires and direct fire support, then transition to prioritising air defence and fires at the expense of electronic protection to hold the new position, and then return to air defence and electronic defence to enable resupply on the position.[21] Whichever priority is being pursued exposes the force to vulnerability, as well as opportunity. Very often, it is the coherent transition between these postures that gives the force an advantage. In terms of how sequencing can fail, an advancing force can have a successful counter-reconnaissance fight, only to find that electronic protection efforts by its opponent prevent fires enabling manoeuvre. As a consequence, the advancing force can become suppressed, extending the timeline of an attack and therefore enabling the enemy to regenerate overhead observation such that the advancing force becomes exposed to fire.

There are several approaches to the synchronisation of arms and the coordination of the transitions outlined above. First, there is the centralised approach whereby all elements report to a headquarters and the staff direct the elements through the transitions. This method has the advantage of being responsive to context on the battlefield while retaining coherence

in relation to a unified plan. As the echelon at which this synchronisation of arms occurs becomes lower, however, such an approach may be unwise. This is because of the viability of a sufficiently large headquarters, its electromagnetic exposure, and its vulnerability as a single point of failure.[22] Second, units may use a distributed approach of battle drills and procedures to adjust their posture in response to pre-agreed situations. The challenge here is that it becomes harder to coordinate combat and support arms based on drills when sub-units that are not in line of sight require increased levels of synchronisation. The third approach is deliberate mission planning and rehearsal, allowing for the maintenance of coherence while avoiding centralised direction. In Ukraine, this approach has proven most successful, but it is also brittle, requiring operations to be delayed when conditions change and preventing exploitation of success beyond the planned objective.

In summation, therefore, the problem against which forces need to plan is a diversifying array of arms (necessary for successful sub-unit operations) combined with increasingly dynamic dependencies between them. It is not really accurate to consider some of the combat arms and other support arms in this context as threat manifests in depth. Therefore, who is supported and who is supporting has become highly contextualised. Although transitions between support and supported relationships are considered in doctrine as part of planning, the position is now often flipped by the enemy. The question therefore becomes how a force can rapidly identify and execute these transitions while dispersed.

Lateral Integration

Having described how current operations in Ukraine are creating dynamic and novel combined arms dependencies in sub-unit operations, it becomes possible to discuss the force structure implications. Both Russian forces and forces fighting according to the Western way of war have, for some time, pursued a high level of vertical integration in force structure. To use artillery as an example, the exact structure varies by military but the overall approach has consistent characteristics. Suppose, for example, that a battery from a brigade is assigned to support a battlegroup operation. A company commander, executing the battlegroup operation, may determine that fire support is needed and request this. The commander holding the guns must then assess this request against the risk to the

guns—whether the mission is worth the risk of unmasking—and against ammunition levels and the requirements for other fire missions. If a determination to accept the fire mission is made, then the forward fire controller within the artillery battery supporting the unit will be responsible for calling for battery fire. This individual will also warn comrades in the unit to which they are attached about the timing and proximity of the fire mission.[23] This process, therefore, requires the vertical integration of communications between the company, the battalion and potentially the brigade command post, and between the fire controller and battery.

Both Russia and Ukraine have diverged significantly from this approach over the course of the conflict. First, as forces have dispersed, the ability to have a fire controller in a position where they can effectively call for fire is rarely assured. Second, the patterns of communications exposed by this approach tend to enable the enemy to map the key nodes of a force with direction finding. Third, in a contested EMS—or in complex terrain—a vertically integrated approach introduces significant latency into fires. Most important, however, this approach is not necessary.

Most Ukrainian artillery batteries have generally replaced their forward fire controller with a UAV team. This team will push its orbits to areas of interest to the commander of the echelon at which they sit. However, the battery and the commander are not limited to this feed. Almost all uncrewed aerial systems (UAS) at echelon or below will upload their feeds to a common system, and anyone with appropriate credentials can log into any of these UAS and see through their eyes. Thus, while the artillery battery may have its organic UAS looking elsewhere, if the brigade command post observes a target that it wishes to prioritise (either through UAS attached to the battalion command post, through the brigade reconnaissance unit, or operated by the company in contact), then it can direct the battery to bring up the appropriate feed and then to deliver a fire mission and adjust fire from the feed. With each element having a satellite internet module, the signature of the whole force remains flat. Specifically, it appears as a series of dispersed uplink and downlink terminals with no distinguishing features of traffic. The uplinks and downlinks meanwhile are separated from the positions such that, while the enemy may know an area is occupied, they cannot determine where the target is within that area or what the target is. While the company in contact can submit a request via data (by dropping a pin for a fire mission) and can facilitate that mission (by ensuring that its organic UAS has eyes on the target), this is not required for the battery to engage.

To look at an even more pronounced example of the shift in communications structures, consider EW. Within most Western militaries, spectrum deconfliction and electronic attack are capabilities held at division level and above, with EW teams often attached at lower echelons. This is as much a reflection of there being a limited number of personnel with the relevant expertise as it is a consequence of capability. Although electronic countermeasures were distributed down to the platoon-multiple in Afghanistan (the additional weight requiring a functional squad/section expanding to 11 to 15 personnel), these jammers were usually assigned fixed frequencies, were deconflicted from communications prior to the operation, and were updated based on higher echelon exploitation and analysis of captured improvised explosive devices (IEDs).[24] In Ukrainian and Russian forces, EW is available at the company level. Jamming is adjusted regularly as the enemy moves its control frequencies, and this is done in the unit. In some cases, systems chase enemy frequency changes through the spectrum such that jamming within a particular piece of battlespace is not in one frequency band. Moreover, enemy systems that adjust frequency in response to jamming do not necessarily do so within a pre-assigned and deconflicted pattern.

There is widespread fratricide between units in the EMS in Ukraine. In an operation in Pokrovsk in January 2025, for example, a battalion UAV unit was assigned a series of targets to engage over a two-hour period which had been identified over the previous 12 hours. The UAS teams moved into their selected launch and control points and endeavoured to launch their UAS. Although their battalion had deconflicted its electronic protection to enable the launch, the neighbouring units had not. Nor was it straightforward to identify which element of the units on the flanks was still jamming. The result was that a two-hour operation became an eight-hour operation as the UAV teams sought to open a window in friendly jamming to execute their strikes.[25]

The approach to EMS deconfliction in Western armies should theoretically avoid this scenario because higher headquarters have the potential to coordinate the operations of units together. In practice, however, the character of the EW fight is localised and reactive to the enemy and is occurring with so many units that an attempt to centralise deconfliction efforts tends to saturate the higher headquarters and paralyse the lower headquarters, and leads to very high volumes of traffic up and down

echelons. In practice, therefore, such an approach to de-confliction has proven non-viable. However, lateral integration of the force (whereby a company deconflicts organic assets continuously and then engages with its neighbouring companies to deconflict for specific operations at the tactical level) actually produces far less fratricide and far less dependency and communications traffic. The reality is that higher echelons do not need to try so hard to deconflict with subordinate echelons. For example, because it is on the line of contact, a higher echelon can deal with the situation of a UAV overflying a company position by simply using electromagnetic survey data to plan its flight paths based on EW. This type of approach has a far better chance of achieving higher rates of mission success.

Three contrasting experiences with military units highlight the difference between the Ukrainian and Western approaches. In October 2021 I was in a company command post of a highly capable Western military unit. The command post had some access to battlespace management software on a couple of laptops, but the primary means by which it tracked the battle were scheduled radio reports from subordinate elements, used to update a physical map board. The command post was small and would have had no ability to deconflict the range of capabilities outlined above. Three years later, when I joined another Western company command post from the same nation in March 2024, there was a much greater degree of digitisation, reflecting the introduction into the unit of a range of the capabilities described above. The size of the command post, however, had expanded rapidly such that it had a much larger footprint and signature with an associated need for almost constant communication with subordinate elements. By contrast, when I visited a Ukrainian company command post in February of the same year, six people had comparable levels of information, while radio traffic was minimal. The units were able to monitor the battle in real time and apply effects organically from their echelon. The reason was that lateral integration created a smaller and more capable command layer. Most importantly, the ability to draw on the feeds of neighbouring units ensured that the company could make decisions that were coherent with activity on its flanks without the need to coordinate with a higher headquarters. The degree to which this has been achieved in Ukrainian units is variable. But where it has, it allows for synchronisation of effects beyond line of sight with much smaller staffs. It is worth noting that the Israel Defence Forces (IDF) have come to very similar conclusions as to how to restructure decision-making, having embarked on a much

more deliberate process of force design than Ukraine. Contrasting the IDF's performance in ground combat in Lebanon in 2006 with their performance in 2024 against a more capable Hezbollah, there is a significant amount of evidence to demonstrate that the lateral integration of the force produces a much more efficient kill chain.[26]

Convergence and Mission Command

Lateral integration of the force—as described above—offers units significant situational awareness concerning what is taking place on the battlefield. Training in Western militaries, however, is largely premised on decision-making under conditions of uncertainty. To move from the force structure implications of dynamic support relationships—lateral integration supplanting vertical integration—to the cultural challenges created by this change, it is important to reflect on mission command.

There are various definitions of mission command among those militaries that pursue it as a doctrine,[27] but it has consistent principles and is an attempt to solve a specific problem.[28] In war, operations almost always deviate from planning because of friction and enemy agency. Once committed, forces struggle to come back together and coordinate. Therefore, if they wait for instructions when the circumstances before them differ from expectations, then the force is generally paralysed. The Russian approach—of using rigid battle drills in response to events—makes the force predictable and gameable. By contrast, Western militaries generally delegate authorities to commanders to exercise judgement and to adjust the execution of a plan, so long as it moves the force towards the predefined commander's intent. In essence the reason for mission command is an assumption that units become isolated over time. Mission command is intended to enable such units to nevertheless act independently in a coherent manner.

The modern battlefield is no longer characterised by the conditions of isolation and information scarcity in which the principles of mission command originally emerged in the Prussian Army of the 19th century. Under the conditions of pervasive observation that characterise the modern battlefield, it is not just observation of the enemy that is possible, but also real-time observation of friendly forces. Of the six orbits of UAVs generated by a battalion command post in Ukraine, for example, four are usually

tasked with observing the line of contact from a position stood back from the front in order to track hostile and friendly forces. The other two orbits are dedicated to reconnaissance.[29] In theory, this configuration should allow for better decision-making by commanders because they have a high fidelity of information. In practice, however, and largely for cultural reasons, it often drives a series of negative behaviours.

When one examines the feeds from instrumented training areas, whether they be at Australia's Combat Training Centre,[30] the US National Targeting Centre,[31] or the Salisbury Plain Training Area in the UK,[32] it is evident that even highly capable military units behave suboptimally against any given tactical scenario. This reflects the impact of friction. The training audience must understand the situation they are confronting and respond appropriately. Invariably the courses of action taken across a formation are imperfect, given imperfect knowledge of the problem they are trying to solve. These imperfections are used by the directing staff during debriefs as points of discussion with the training audience. This is not done because anyone expects that a unit will, in the future, execute perfectly. Rather, the purpose is to build awareness within the unit of what an ideal situation looks like. This helps to ensure that military elements have a shared understanding of this ideal, while improving the unit's cohesion and overall performance. In short, the expectation is that the ideal is aspired to, rather than attained.

Under modern combat conditions, higher headquarters are often able to observe the battlefield with a level of fidelity that was historically available only to directing staff on instrumented ranges. Under these conditions, senior commanders, watching the growing incoherence of subordinate elements operating according to mission command, have a strong tendency to intervene in an effort to improve the coherence of the force or optimise its execution. In Ukraine, for example, it is not uncommon for General Oleksandr Syrskyi—the Chief of the Defence Staff—to directly contact, receive updates from, and direct tactical activity by battalion or company commanders on sectors he deems a high priority.[33] This is not a uniquely Ukrainian problem. It is understandable that senior commanders, exposed to high-fidelity tactical data, will often feel compelled to exercise control. First, they generally have more experience of tactical operations than of operational command. Therefore, when they are under pressure, reverting to tactical activity can be highly comforting. Second, senior

commanders often feel compelled to try to protect their people when they see problems arising that they fear will lead to casualties. This phenomenon, however, has serious tactical and operational consequences. Tactically, it often leads to paralysis among subordinate units and a loss of tempo as units begin to wait for higher echelon direction. Meanwhile, intermediate echelons lose understanding of the higher command' intent and become passive. They then struggle to reassert control once interest from the higher command shifts elsewhere. Operationally, the higher headquarters begins to reassign capacity to tactical activity and tracking at the expense of operational decision-making.

Educating commanders to avoid becoming fixated by the tactical activity they can observe is a necessary element of training but is not in itself sufficient. This is because in some contexts it is appropriate for the higher headquarters to intervene. For example, consider a company in the attack which succeeds in breaking through an enemy position and starts to exploit this success. At the same time, the assets that had been extending electronic protection become disrupted by the opponent's artillery. The battalion conducting the attack has a very limited ability to assess the footprint of its electronic protection. Higher headquarters, however, often can see this boundary because they have access to surveys of the electromagnetic spectrum. Under these conditions, it is consequential and beneficial for the higher headquarters to intervene to warn the company as to the geographic boundary beyond which they will begin taking disproportionately higher casualties if they continue to advance.

The concept of convergence—often difficult to visualise—can become tangible in this context and offers a useful framework to conceptualise how to overcome these problems. In essence, mission command envisages multiple groups acting in varying levels of isolation, but nevertheless able to advance their own position relative to the plan so that, collectively, that plan can be delivered. Convergence should see connected groups acting to advance other groups' positions relative to the plan.[34] A higher command, therefore, observing suboptimal but nonetheless collectively beneficial actions, should avoid trying to cohere all subordinate activity. Instead it should seek to employ effects under direct command to protect, enable, and compensate for the errors made by the force as it manoeuvres. Equally, it might operate to build on the opportunities subordinate units create and the vulnerabilities they impose on the adversary. Similarly, the luxury of

situational awareness within a higher echelon enables sub-units to move to support one another, and not simply to advance themselves in accordance with commander's intent. On a battlefield, where the combination and complexity of effects necessary to achieve success is increasing, this ability to converge becomes critical to maintaining lethality, survivability and therefore endurance. Perhaps the most intriguing consequence of convergence is that in Ukraine, for example, lateral integration allows for cross-boundary fires to actually be the predominant form of engagement against an enemy axis of advance.

And for the Australian Army?

Lessons from Ukraine will not translate directly to an Australian context and it is not the case that Australian forces should adopt wholesale Ukrainian methods. However, there are concepts that were hypothesised prior to the war in Ukraine that have been clarified by the conflict. Prior to Russia's full-scale invasion there was an active debate as to whether EW would functionally deny communications and thereby force units to operate 'unplugged'.[35] Operations in Ukraine, however, demonstrate that even against highly capable EW actors, networking remains possible and the risk of losing situational awareness cedes greater tactical advantage than the risk from enemy direction finding. Understanding that a high degree of connectivity can be made robust clarifies the extent to which advantage in this area should be fought for. But once the force has a significant uplift in situational awareness, maximising the utility of this capability goes beyond adding equipment and capability into existing structures. It enables the force to operate differently.

Perhaps the most relevant and important lesson from Ukraine for Australian forces is the value of both 'beyond line of sight' observation and strike capabilities that are organic to all fighting echelons, combined with the mutual support made possible through lateral integration. For the Australian Army, whose echelons in a future conflict may be separated by significant geographical features because of the characteristics of littoral warfare, time and distance will impose severe limitations on the ability of higher echelons to support subordinate elements. Mutual support among forward deployed units, therefore, will be critical. Given the small size of Australian forces—with a correspondingly greater impact from unfavourable outcomes of

tactical activity—there are likely to be strong incentives for higher echelons to try to control activity at reach. In practice, however, while it is feasible that higher echelons will see tactical activity in significant fidelity, it is likely more important that tactical units can collaborate at the edge.

Finally, the Australian Army has a strong conceptual foundation for dealing with the changing character of war because the Australian combat team is conceptualised as a mission-specific grouping of capabilities. The idea of leveraging new attachments, therefore, is not a major change for how Australian forces operate. Moreover, Australian units have proven innovative and willing to grasp emerging capabilities. However, whether it be 7 Signals Regiment or 20 Regiment, Royal Australian Artillery, it is less evident that the Army has geared its force generation to have a sufficient number of UAS and EW operators to make these core elements of combined arms combat teams, rather than novel and mission-specific attachments or higher echelon enablers. Similarly, Australia has been farsighted in some of its procurement decisions—such as acquiring a main armament for its Boxer reconnaissance vehicles that can engage aerial targets. But it is not yet clear whether units fielding Boxer are sized to allow or have battle drills that will allow air defence to be a continuous activity to protect the unit from a persistent threat. There are many more examples that could be drawn out. The point is that as the relevant components of combined arms manoeuvre evolve, it is vital that the Australian Army retains access to a sufficient density of the requisite capabilities to keep its forces survivable.

About the Author

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Originally a journalist he has contributed to Reuters, The Atlantic, Foreign Policy, the Guardian, Jane's Intelligence Review, Haaretz, and others. Jack was shortlisted for the European Press Prize Distinguished Writing Award in 2016 and won the Breakaway Award at the International Media Awards in 2017.

Dr Jack Watling was the 2024 Keogh Visiting Chair

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How Can the Army Assess and Prioritise Quantum Technology Based Capabilities?

Colin Cockroft and Jamie Vovrosh

Introduction

> Quantum technologies are a suite of emerging technologies that exploit the fundamental laws of nature to offer unprecedented capabilities in sensing, imaging, communications and computing. They are diverse, complex, generally early in technical readiness, and they demand new ways of thinking about the employment and exploitation of technology.[1]

Quantum technologies take advantage of the way matter and light behave at atomic and subatomic scales. 'Quantum mechanical properties (like entanglement, superposition and tunnelling) can be used to build advanced technologies that would otherwise be impossible.'[2]

Quantum technology promises to deliver many capability benefits to the Australian Army. These may include improvised explosive ordnance disposal, low probability of detection electronic support measures, navigation and timing systems that do not depend upon the global positioning system (GPS), faster mission rehearsal, and improved scenario analysis. The types of quantum technologies that promise to deliver the most significant improvements in these applications include quantum

computing, quantum clocks, optically pumped magnetometers, gravity sensors, Rydberg radio frequency (RF) sensors and atom interferometry based accelerometers and gyroscopes.

Each of these technologies is described in the following sections. They have been selected for analysis in order to provide a cross-section of use cases, costs and development timelines to demonstrate how technologies with different characteristics are represented differently in the analysis. This is by no means an exhaustive list of quantum technologies that could deliver capability benefits to Army, or even the only quantum technology option available for each use case. For example, this article assesses the utility of optically pumped magnetometers; there are various other competing quantum magnetometry technologies that could also have been considered. The technologies assessed nevertheless demonstrate how the multi-criteria analysis (MCA) tool is applied and how it could be used to inform investment decisions involving a much broader range of quantum technology options. A more comprehensive set of technologies is assessed in a forthcoming Australian Army Research Centre *Occasional Paper*.

Developing quantum technologies to the point where they can deliver meaningful capability to Army will require both private and public investment. Defence will need to prioritise which technologies offer the greatest capability gain in the shortest time for the least investment. This assessment will guide both public and private investment in the development of quantum technology.

This article contends that traditional methods of evaluating and prioritising investment options such as net present value and cost–benefit analysis have limitations when attempting to determine priorities in quantum capabilities. These limitations are due to the difficulty in assigning financial values to some aspects of military capability. This article contends that an MCA approach provides the most appropriate analytical tool because it can incorporate variables such as development timeline and performance benefits that are more subjective in nature than financial data. This article explores the benefits and challenges of applying different assessment options and illustrates the benefits of an MCA framework developed specifically to assess the suitability of quantum technology for military applications.

Quantum Computing

Quantum computers[3] have the potential to perform some calculations exponentially more quickly than conventional computers and even perform some tasks (such as breaking public key encryption protocols) that are beyond the practical limits of current computing technology.

In an Australian defence context, quantum computing has the potential to supplement or replace the existing 'super computers' that are permanently installed in static locations in Australian research or government facilities. Quantum computers could be used for enhanced operational simulation and geophysical modelling, enhanced signal and image processing, enhanced searching and extraction of intelligence from large unstructured databases, and enhanced optimisation of plans and logistics.

Before assessing the potential benefits of quantum computing, it is important to outline the characteristics of this type of technology. A quantum computer exploits quantum mechanical phenomena by leveraging the quantum behaviour of light and/or matter using specialised hardware. Quantum computers use 'qubits' as the basic unit of information rather than the conventional bit. Unlike conventional bits used in current computers, which can either be 0 or 1, qubits can be both 0 and 1 at the same time, and in different proportions. This results in a large number of possible qubit states, and means that it is possible for a quantum computer to address an exponentially larger state space (a representation of all possible configurations or states of a system) than a conventional computer with an equivalent number of bits. In the future, this technology is expected to allow quantum computers to efficiently analyse problems that are too large for conventional computers to handle.

Currently quantum computers are large and unwieldly and cannot yet solve computing challenges more quickly than existing supercomputers. The main impediment to higher performance is that current quantum computer hardware is limited to around 1,000 relatively noisy qubits per device. Qubits are inherently sensitive to electronic noise like electromagnetic interference from other electrical devices and electrical supplies. When noise thresholds are reached, they 'decohere', leading to corrupted results. This stage of quantum technology is referred to as the noisy intermediate scale quantum (NISQ) era.

The main development challenge is to move from NISQ to large-scale fault-tolerant computing. Achieving this will involve scaling up computer hardware so that the number of independent, individually addressable qubits in each computer is increased from hundreds to many thousands. Further, error-correction programs will be needed to make the computer fault-tolerant to the inevitable quantum decoherence. From a practical perspective the rest of the quantum computing system will need to be developed to the point where software engineers can program it.

An assessment of quantum computing is that it will be at least 10 years before it is readily available in a form able to meet the needs of this use case.

Quantum Clocks

Quantum clocks, also known as atomic clocks, are a type of quantum sensor used to measure the passage of time and are one of the more mature quantum technologies. Quantum clocks are based on vapour cells and are more precise than conventional clocks because they use atomic oscillations which have a much higher frequency and are much more stable than other phenomena.

A small range of quantum clocks are already commercially available. They are typically designed to be mounted in 19 inch (482 centimetre) rack units and are around 30 to 40 litres in size. One example is the commercially available Infleqtion unit pictured in Image 1. A potential military use for quantum clocks is in tactical vehicles to provide timing signals for navigation in a GPS-denied environment, or to provide highly coherent and low-drift timing to synchronise spread spectrum communications systems.

**Image 1. Infleqtion Tiqker. Quantum Clock Pilot Unit.
Source: Author supplied image.**

In order for quantum clocks to be used more broadly in the military, they need to be made more rugged and reduced in size, weight and power demand. These are largely engineering challenges rather than being related to the underlying quantum technology and could be achieved within a couple of years.

Optically Pumped Magnetometers

Optically pumped magnetometers (OPMs) are one type of the quantum magnetometers currently under development worldwide that are used to measure magnetic fields. OPMs have similar sensitivity but are smaller and lighter compared to conventional magnetometers.

OPMs are one of the more advanced quantum technologies and are available commercially from a number of suppliers. They come in a variety of types designed to operate in different ranges of magnetic field strength. They can be found in packages with a volume of less than one litre, weigh less than 50 grams and draw less than 5 watts[4] of electrical power.

Exploiting their small size and weight, OPMs have potential to be mounted on unmanned aerial vehicles or unmanned ground vehicles to detect unexploded ordnance. The key to maturing OPMs as a military capability is to make them more robust and to integrate them with conventional military technologies. Systems are already in use in very similar applications but there may be some additional integration required for military applications.

Atom Interferometry Based Gravity and Gravity Gradient Sensors

Gravity gradiometers (or gravimeters), allow for the accurate mapping of local variations in gravity. Atom interferometry based gravity sensors are among the more complicated quantum systems currently under development. They use the fundamental properties of atoms such as polarisabilities, van der Waals forces and tune-out wavelengths. Unlike springs or other macroscopic components used in non-quantum sensors, atoms do not change over time, resulting in devices with inherently low drift. Using two atom interferometers spaced a distance apart makes it possible to construct a sensor which is largely immune to vibrations.[5]

Most of the portable sensors in operation are university prototypes. Some are also used in the domains of geophysics and civil engineering. In these sectors, they support tunnel detection in urban environments,[6] and mapping and navigation on moving platforms such as ships[7] and aircraft.[8]

To date, gravimeters tend to be too large for most military platforms, with the possible exception of ships. For example, one available gravimeter has a sensor head with a height of 70 centimetres, a diameter of 38 centimetres and a control unit of 100 x 50 x 70 centimetres. The sensor head is 25 kilograms and the control unit is 75 kilograms. The power consumption for both of these units is 250 watts.[9] These demands are at the top end of what could be supported by an Australian Army military vehicle. Also, quantum gravity sensors typically require long measurement times and are relatively fragile. If these limitations are overcome, quantum gravity sensors could be used effectively in tactical scenarios, mounted in specialist reconnaissance vehicles for bunker and tunnel detection. While the technology is mature enough to be integrated into a vehicle, particularly as a technology demonstrator, it would need to be reduced in size, weight and power draw for an operational capability. The development time is estimated to be more than 10 years.

Rydberg Based Radio Frequency Sensors

Electromagnetic radiation is incredibly important to modern societies for telecommunications, GPS navigation and radar. To detect the various EM waves requires a range of antennae and electronic receivers. A new type of receiver is presently under development which uses atoms in 'highly excited' states, termed Rydberg atoms.

While the use of Rydberg atoms as quantum electric field sensors is still a relatively new concept, it has demonstrated some impressive benefits over existing technologies. For example, Rydberg atom sensors have been observed to detect electromagnetic radiation over a very large range of frequencies (from DC to THz). In laboratory experiments, Rydberg receivers have been able to determine the direction of incoming electromagnetic waves.[10]

There are several potential military applications for these RF sensors. For example, vehicle-mounted staring RF detectors that can sense a broad band of frequencies simultaneously could be used in an electronic warfare support role to increase the sensitivity and bandwidth of the detector. This would significantly reduce the visual signature of the vehicle by reducing the number and size of antennae. Before widespread military use is possible, however, more portable systems need to be developed. Further, more experimentation and development is required before a stable military-use capability will be small enough, be light enough and have a small enough power draw to make it suitable for deployment. It is anticipated that while the development of systems such as the Infleqtion SqyWire is maturing quickly, it may still take more than five years before they offer an operational capability.

Atom Interferometry Based Accelerometers and Gyroscopes

Cold atom interferometers (CAI) are the atomic version of traditional optical interferometers. CAI inertial sensors promise sensitivity and stability orders of magnitude greater than their non-quantum counterparts by harnessing quantum effects. CAI replace three axis gyroscopes in a conventional inertial navigation unit and have the advantage of being resistant to GPS jamming. Further, they do not drift like conventional systems, meaning the performance benefit improves over time. CAI use ultra-cold atoms to detect changes in quantum phase (phases of matter at zero temperature) due

to accelerations and rotations. Optical methods are used to observe the atoms, and these measurements can be used to infer the accelerations and rotations experienced by the sensor body (relative to the inertial frame of the atoms). These outputs can then be fed into an inertial navigation system to calculate position via dead-reckoning, providing the most accurate location marker possible. Recent demonstrations of continuous CAI by the US Army Research Laboratory[11] promise to revolutionise the technology by enabling unbounded data rates.

CAI accelerometers and gyroscopes have demonstrated phenomenal performance in laboratory environments but this performance has not yet been achieved in real world conditions. There have been only a handful of CAI inertial sensing trials, including flight trials by the Observatoire de Paris,[12] and Colorado-based private research firm Infleqtion[13] and Imperial University (London) have trialled their CAI accelerometer in maritime[14] and rail[15] environments. Current CAI sensors are large and require significant amounts of power. The lasers and control electronics typically span multiple rack units, resulting in a total system size comparable to a large fridge. Significant work will be required to achieve a full six-degree-of-freedom sensor (iXAtom has recently demonstrated a 3D accelerometer but this has a data rate of only 0.1 Hz).[16]

In a military context, CAI have considerable potential for use in tactical vehicles for navigation in the absence of GPS. There are, however, many challenges to tackle before this technology can be fully exploited by military users. These include significantly reducing systems size, weight and power draw, extending the dynamic range and developing six-degree-of-freedom systems. At current development rates, the industry is at least 10 years from having operational units available for battlefield use. While this is some time away, Army should nevertheless remain abreast of major developments to gauge their emerging application in the military domain.

Prioritising Quantum Development

To deliver useful capability to Army, a new technology must be safe to operate and must fill a capability gap. The capability gain needs to be sufficient to justify the investment required to develop the new capability for military application. The challenge for Army in applying quantum

technology is to balance the trade-offs between technical maturity, cost and benefit, and the practicality of deploying different technologies into military environments.

The AUKUS Quantum Arrangement under AUKUS Pillar II[17] aims to accelerate military investments that integrate emerging quantum technologies into trials and experimentation over the next three years. Australia's involvement in this arrangement is underscored by the Defence Strategic Review, which states: 'The development of selected critical technology areas as part of AUKUS Pillar II Advanced Capabilities should be prioritised in the shortest possible time.'[18] To be effective, any such prioritisation will need to be underpinned by a transparent and repeatable decision-making process.

There are a number of accounting methods that are typically used to assess options for investment in new technologies. These include net present value and cost–benefit analysis. These are well-established methodologies with numerous sources of reference material to explain their application. One reference that is particularly useful in providing an easy to understand explanation in an Australian context is *The Valuation of Businesses, Shares and Other Equity*.[19]

Net present value is based on the principal that people place greater value in money they receive today than money they will receive at some point in the future. So a discount rate is applied to values in the future in order to calculate their present value. Net present value discounts all future cash flows whether they are positive (income) or negative (costs). The discount rate is applied each year, meaning that income that occurs further in the future is discounted more than shorter term income. The sum of these present values is known as the net present value and is used to evaluate the value of an investment. The inevitable outcome of the discount rate is that investments that have significant upfront costs but do not accrue benefits for a long time need to accrue significantly more benefits than investments with shorter term returns. Applying a net present value approach works well for projects in which all costs and benefits are financial.

In the case of investment in quantum technology, the capability benefits are predominantly non-financial. In this case, a cost–benefit analysis method is more appropriate. This approach is similar to net present value but it considers intangible costs such as customer churn or loss of user

confidence, and indirect benefits like social benefits and environmental benefits. Values can be assigned to these benefits using a range of established accounting methods. Where it is not practical to derive a financial value, other approaches like key performance indicators can be used. For example, in a commercial context, customer satisfaction can be measured by tracking the rate at which customers stop using a particular service.[20] Using the same key performance indicators for both costs and benefits enables different investment options to be compared.

In the case of military capability, it is particularly challenging to assign financial values to the intended military benefits. What needs to be assessed is how the investment improves capability compared to a potential adversary's. Comparing capabilities requires an understanding of complex and often conflicting information, which may change over time. There are many factors involved that will impact the valuation of both the adversary's and Army's capabilities. These may include questions regarding the credibility of knowledge held about an adversary's actual capability. The operational context also affects the comparison—i.e., where will the equipment be employed? These factors raise the potential for a very broad range of values that could be attributed to the capability improvement. In this context, there is a risk that the range becomes so large that any confidence in the result is lost.

An alternative approach is to use an MCA method that ranks or scores the performance of options against multiple objectives or criteria. Each option is rated against each criterion using performance measures. The criteria are weighted to reflect their relative importance. The weights are combined with the performance measures to calculate an overall rank or score for each option.[21]

MCA approaches are used by numerous governments in Australia and internationally to guide investment and policy decisions. A web search will highlight numerous case studies; examples are:

- the UK Government[22]
- the Victorian Government by the Department of Treasury and Finance[23]
- the Australian Government by Infrastructure Australia[24]
- the ACT Government.[25]

There is no single definitive method for MCA; instead, MCA is an umbrella term for a number of different techniques and tools that use multiple objectives and decision criteria (or attributes) to analyse a problem.[26] References that will be useful to readers who want to investigate MCA further include:

- 'Methods of Multi-Criteria Analysis in Technology Selection and Technology Assessment: A Systematic Literature Review'[27]
- *Guide to Multi-Criteria Analysis: Technical Guide of the Assessment Framework*[28]
- *Multi-Criteria Analysis: A Manual*.[29]

The approach described in this article scores how well each option meets the needs and objectives of the stakeholders. The needs and objectives are financial, operational performance, risk, suitability, urgency etc. Financial performance includes how much it will cost to develop the technology into a mature product and what it will cost per unit to purchase and operate the new product. Operational performance includes how much smaller and lighter the equipment will be, how much more sensitive a detector will be or what increase in processing power can be expected from a new type of computer. Suitability is measured based on how appropriate the technology will be for the environment it is expected to operate in and how soon it is needed. These factors in combination become the evaluation criteria for the MCA.

MCA develops scores against measurable criteria to represent how well the objectives have been met. Those scores are then normalised (scaled to fit between 0 and 1) to remove any unintended bias. For example, if the scores for development cost are $1 million for one technology and $1 billion for a second technology, it makes no sense to try to combine these with a score related to the equipment's power (e.g. the capacity for the technology to reduce the power requirements of a device from 100 watts to 10 watts). The reason is that the power reduction score would be so swamped by the cost score as to make it meaningless. To avoid this situation, both scores are scaled (normalised) to a range of between 0 and 1.

While normalising the scores allows variables to be compared, it may tend to imply that all are equally important, which is very unlikely to be the case. MCA addresses this by allocating a weight to each criterion that reflects how important it is to the stakeholders. For example, a user may prioritise reductions in size as more important than development cost; so it is given a higher weighting. To avoid every criterion becoming a high priority, the sum of all weights is set to 100 per cent. The normalised scores are then multiplied by their weights. The sum of the weighted scores indicates which option best meets the needs of the stakeholders.

An important feature of MCA is that different stakeholders will bring different perspectives to the assessment of each option. As a decision-making tool, MCA therefore relies on the judgement and decisions of the evaluation team to determine the objectives of the assessment, the assessment criteria, and their relative weighting. While this can lead to concerns about subjectivity, MCA has the advantage of making decision-makers' subjectivity transparent, and the means by which different criteria are taken into account is explicitly communicated. In addition, considerable 'objective' data (such as expected costs and capability benefits) can be included.

Different stakeholder groups can come up with their own set of weights to reflect the preferences of different organisations. In the above example, Capability Acquisition and Sustainment Group may give the development cost a weight of 80 per cent and the power reduction score a weight of 20 per cent. By contrast, military operators represented by Army Headquarters may consider that the additional performance gained by the reduction in power consumption is more important. Accordingly, headquarters representatives may give this factor a weight of 60 per cent while giving the cost criterion a weight of 40 per cent.

MCA models can be used for complex one-off decisions, or they can be used to inform investment decisions about a portfolio of technologies to be tracked over time.

While MCA is well adapted to the task of evaluating quantum technology development opportunities, it remains an aid to inform decisions rather than the absolute determiner of the best decision. In addition to providing decision-making guidance, MCA can help officials improve their understanding of the issues involved, including why their preferred options are not the highest scored. Alternative scores and weights can be adjusted in real time in a workshop setting to tease out subtleties in the trade-offs.

Applying MCA to Prioritise Quantum Technology Development

Having described the benefits and approach of conventional MCA, the remainder of this article shows how the MCA assessment tool could be used to help prioritise investment decisions in the development of quantum technology for application within Army. To demonstrate its utility, MCA will be applied to the technologies of quantum computing and OPMs.

The approach described here differs from a conventional MCA in two ways. Firstly, it groups the evaluation criteria into capability benefit, financial benefit, and suitability. Secondly, the evaluation criteria in the suitability group are based on the specific operational setting in which the technology will be used. This could include, for example, an Australian research facility, a deployed strategic headquarters or a tactical environment in the hands of soldiers.

The purpose is to describe an assessment tool that could be used to inform iterative investment decisions. Because MCA can be conducted regularly as technology develops and capability priorities change, it is far more useful to inform investment decisions in quantum technology than other methods that involve long time periods between assessments.

The process used to develop and apply this MCA framework is shown in Figure 1.

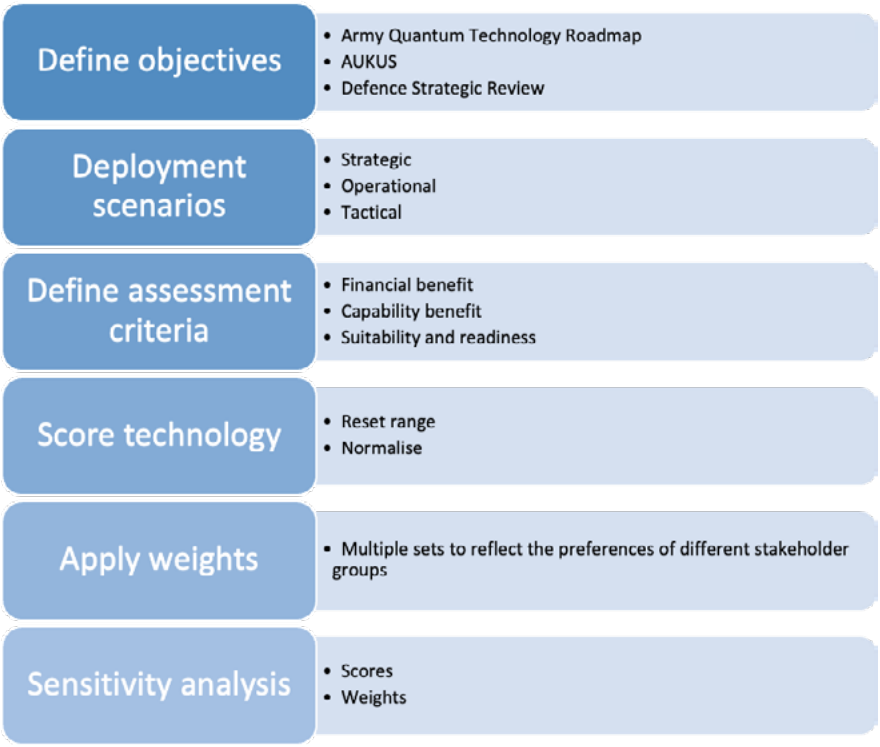

Figure 1. MCA Method

It is evident from the Defence Strategic Review[30] and the Army Quantum Technology Roadmap[31] that Army is expected to deliver the greatest increase in capability for the least cost and in the shortest possible time. In view of these strategic priorities, this article generates a set of evaluation criteria grouped into the categories 'suitability and readiness', 'financial benefit' and 'capability benefit'. These evaluation criteria represent the characteristics of the technology that are deemed most important to Army stakeholders. Grouping the criteria in this way enables a nuanced presentation of the results as the three perspectives can be presented separately.

Scoring methods are suggested to demonstrate how MCA can be applied. In reality these scoring methods would be developed and validated in collaboration with stakeholders.

Suitability and Readiness

These evaluation criteria are used to assess how suitable and ready a technology is for use in a particular deployment scenario. Scoring is based on several factors. These include its power demand and whether it can withstand the expected environmental conditions (such as temperature and humidity, shock and vibration, dust and water). In this regard, technology is scored at 1 if it meets the limits for the relevant scenario and 0 if it doesn't.

The evaluation criteria also consider how long it is expected to take to mature the technology to Technology Readiness Level (TRL) 8, where it can be deployed operationally. The development timeline is scored by estimating which of the following three time periods apply:

- 1—short term: less than five years
- 0.5—medium term: five to 10 years
- 0.1—long term: more than 10 years.

The technology is also assessed for usability—i.e., whether the personnel deployed in the scenario are likely to have the necessary skills and expertise to operate and maintain the equipment. Finally, suitability is also assessed as to whether it will be able to achieve electromagnetic compliance (EMC) while withstanding electromagnetic interference (EMI).

The suitability and readiness criteria are driven by the operational context in which the technology is expected to be used. For example, a quantum computer is best suited to a static environment with stable infrastructure and resident expertise to use it. Creating the conditions in which a quantum computer could be made ready to deploy and used in a tactical setting would require significantly greater investment and a longer development time. By comparison, OPM-based devices designed for explosive ordnance disposal need to be both suitable and ready to be used in a fluid tactical environment. Based on this realisation, the authors identified three distinct deployment scenarios: 'strategic', 'operational' and 'tactical'—with the latter divided into three sub-categories (a set of deployment scenarios) that enable each technology to be evaluated against the demands of the environment in which it might be used. The nature of each sub-category can be described as follows.

Strategic. This could include a government building or a research organisation where there are no size, weight or power restrictions, people with specialist skills are readily available to operate and maintain the equipment, and there are no shock or vibration risks once the equipment is installed. This would be an environment well suited to quantum computers.

Operational. This could be an environment in which equipment is deployed from Australia to the highest echelon and/or the least mobile force elements within an area of operations. Such an environment might include a joint task force headquarters or a point of entry such as an airfield or port. In this scenario, the equipment would be transported on civilian or military low loaders and potentially installed in 20-foot shipping containers. During transit, the equipment would be subjected to the shock and vibration. Assuming that the equipment would be installed in a shipping container or some other similar enclosure, it would require ingress protection (IP) 65,[32] which is dust tight and protected against water jets. In this scenario, the electrical, technical and information technology skills available to operate and maintain the equipment would be restricted to that which would normally be available among the deployed military, defence civilian or contracted personnel. Three-phase power would also need to be made available from a deployable power system. The power output of such systems would likely be limited to a maximum of several hundred kilowatts.

Tactical. This scenario includes the increasingly demanding conditions imposed by a **forward operating base**, when troops are **mounted** in vehicles, or when carried by a **dismounted** soldier.

- A **forward operating base** is unlikely to be accessible by heavy-lift capabilities which would impose size and weight restrictions on the technology. For example, Army's HX77 tactical trucks have a 13.1 tonne limit which puts an upper limit on the size and weight of equipment that can be deployed. Assuming that the equipment is deployed on formed but unsealed class B roads establishes the shock and vibration limits for equipment. The IP limit would be 66,[33] which is dust tight and protected against powerful water jets. This assessment is based on the assumption that, while the equipment would be installed in a protective enclosure, it may nevertheless be exposed to environmental elements, either during transport or while in operation. In this scenario, the technical skills available to operate and maintain the equipment would be limited to those which were available among

the deployed Army personnel at the forward operating base, most likely signals staff or electrical and mechanical engineers. It is assumed that single-phase power would be available from a deployable power system. This would limit the power available to a maximum of several tens of kilowatts.

- For **mounted** troops, the technology would be carried in (or operated from) a military vehicle such as a Bushmaster protected mobility vehicle (PMV), shown in Image 2,[34] or a Hawkei PMV-Light (PMV-L), in a tactical situation.

Image 2. Australian Army soldiers from the 6th Battalion, the Royal Australian Regiment arrive at Exercise Diamond Run by Bushmaster Protected Mobility Vehicle, at Shoalwater Bay Training Area. Source: Defence Image Gallery

In this scenario, the technology would need to be deployed on an HM40 truck or fixed to a Hawkei or Bushmaster (shown in Image 2) because of size and weight requirements. In either case, the weight could not exceed 100 kilograms. Further, the equipment would need to be able to withstand the shock and vibration associated with being deployed in an off-road vehicle. In this situation, the IP limit is 66[35] (which is dust tight and protected against powerful water jets) based on the assumption that, while the equipment would be installed in a protective enclosure, it would nevertheless be exposed to environmental elements both during its initial transportation into theatre and then regularly on operations.

It is assumed that no specialist tradespeople such as electricians, technicians and IT specialists would be available to maintain the equipment. The power source would be the vehicle's direct current (DC) supply, which would be limited to several hundred watts depending on what other equipment is installed in the vehicle.

- The most demanding tactical environment is for **dismounted troops** when equipment is carried by a **soldier** in the field either in their pack or on their person (see Image 3).[36] The size and weight restrictions of the technology would be based on what a soldier could reasonably carry in addition to their other equipment. The limit in this scenario is assumed to be up to 10 kilograms. This limit could be increased if the technology were allocated to a section and some of the equipment of the soldier carrying it were distributed among the other soldiers.

Image 3. An Australian Army special forces soldier from 2nd Commando Regiment ashore on Norfolk Island shortly after conducting a static-line parachute insertion as part of Exercise Talisman Sabre 2023. Source: Defence Image Gallery

But this is assumed to be a reasonable limit for this assessment. In this case it is assumed that the soldier and their equipment is deployed in a vehicle off-road before they start dismounted operations. The more demanding shock and vibration conditions will be used to assess the equipment's suitability, which in this case will be while the equipment is being deployed to the area of operations. In this situation, the IP limit would be 67 (which is dust tight and protected against the effect of temporary immersion in water).[37] It is assumed that while the soldier is on patrol, no specialist tradespeople such as electricians, technicians and IT specialists will be available. The equipment will be powered from an internal battery supply, which will limit the power available to several tens of watts.

Financial Benefit

This evaluation criterion scores the financial costs to develop, procure and operate the technology. The cost to develop the technology is an estimate of the investment required to take the technology from its current TRL to TRL 8, where it can deliver operational capability. The costs are scored by estimating expenditure within three broad groupings. The best score, 1, is allocated when the costs are less than $10 million; a score of 0.5 is used for costs of between $10 million and $100 million; and the lowest score, 0.1, is used when the costs exceed $100 million. Within the financial benefit criterion, there are two sub-categories:

- The **procurement cost** criterion compares the expected procurement of a mature quantum product to the cost of a non-quantum technology that offers a similar operational capability. This is scored as a percentage of the purchase cost of non-quantum technology, where 100 per cent is the same price, less than 100 per cent is cheaper, and greater than 100 per cent is more expensive.
- The **operating cost** criterion is scored in a similar way to procurement costs and takes into consideration the factors power, consumables and labour. The financial benefit criterion scores the increase or decrease in the technology's operating costs compared to non-quantum technology that offers a similar operational capability. The method used applies 100 per cent for the same cost, less than 100 per cent for a lower cost and more than 100 per cent for a higher cost.

Capability Benefits

The capability benefits of technology are quantified by comparing it to the performance, size and weight of a non-quantum technology in a similar use case and deployment scenario. These three criteria can be described as follows.

- The **performance benefit** criterion compares the performance of the mature quantum technology to non-quantum technology in the same use case. There may be some technologies that have the same or even worse performance compared to non-quantum technology but may be considerably smaller or lighter.
- The **size benefit** criterion compares the size of the technology, when it is part of a mature capability, compared to a non-quantum solution for the same use case.
- The **weight benefit** criterion compares the weight of the technology, when it is part of a mature capability, compared to a non-quantum solution for the same use case.

For each criterion, a 100 per cent score is allocated if the new technology achieves the same outcome as the non-quantum technology, greater than 100 per cent is assigned if there is a comparative increase, and less than 100 per cent is allocated if there is a comparative reduction. For example, a quantum technology that has twice the sensitivity but is half the weight of the comparable non-quantum technology would score 50 per cent for the weight benefit and 200 per cent for the performance benefit. It may be apparent from this assessment that a higher score represents a better result for the performance score, while a lower score represents a better result for the size and weight benefits. This means that the size and weight scores need to be reversed before they are normalised so that higher scores represent a better result.

A **weighting** is then applied to each normalised score, adjusting them to reflect the preferences of the stakeholders.

The weights are applied to each set of criteria individually. An example set of weights is provided in Table 1; this represents what could reasonably be expected from Army stakeholders. The sum of each set of weights is 100 per cent. This method forces stakeholders to decide the relative importance of each criterion and to avoid allocating a high priority to all. Different sets of

weights can be used to represent the preferences of different stakeholder groups. These weights can be adjusted regularly as priorities and other circumstances change. In practice, they are often developed in a workshop environment where the impact of different decisions can be seen in real time. This can lead to an iterative process of adjustment before the final weights are decided.

Table 1. Example weights

Category	Criterion	Weight
Suitability	Transportable	10.0%
Suitability	Power	4.5%
Suitability	Temperature and humidity	4.5%
Suitability	Shock and vibration	10.0%
Suitability	Ingress protection	10.0%
Suitability	EMI/EMC	1.0%
Suitability	Technical expertise	10.0%
Suitability	TRL and development timeline	50.0%
	Total	**100.0%**
Cost	Development	50.0%
Cost	Procurement	40.0%
Cost	Operating	10.0%
	Total	**100.0%**
Benefits	Performance benefits	75.0%
Benefits	Size benefit	15.0%
Benefits	Weight benefit	10.0%
	Total	**100.0%**

Results and Interpretation

Based on the MCA method of evaluating and prioritising investment options in quantum computers and OPMs, Table 2 presents the respective weighted scores for each technology. These scores are based on an assessment by a group of subject matter experts in QinetiQ in Australia and the UK with relevant quantum expertise and military experience. The assessment includes what level of capability could be delivered by a mature system given the development timelines and available Defence budgets. If this MCA approach were adopted by the Army the QinetiQ expert panel would be expanded to include capability experts from the Army.

What is immediately noticeable from the raw scores is that the first seven 'suitability and readiness' criteria have the same score for both technologies. Therefore, in this assessment these scores do not contribute materially to the relative prioritisation of technology. There are two reasons for this. Firstly, the candidate technologies were selected with a use case in mind, so these criteria were already considered in the choice of the technology. The same result would not necessarily arise in a more comprehensive technology assessment. Secondly, in most cases systems can be designed to address these criteria, with the underlying technology integrated into a case or enclosure for use. Occasionally, however, there will be technical challenges that cannot be overcome by a protective case, shock mounting or other engineering solution. In these instances, application of the deployment scenarios can help identify the existing deployment limits of the technology and provide guidance to technology developers to help mitigate the issues.

Table 2 shows how the scores are distributed between 0 and 1, where 1 is the greatest benefit and 0 is the least. The remaining scores are distributed linearly between the maximum and minimum. This removes any unintended bias that can result from the scale of the raw scores. For example, if the results of an analysis resulted in a development cost of several million dollars and a weight saving of several kilograms, then in a direct comparison the development cost would swamp the weight saving. Adjusting scaling all score to a range of between 0 and 1 removes this bias and means that criteria can be deliberately prioritised by applying weights that represent the relative importance of each criterion. In some cases (such as the 'size benefit' and 'weight benefit'), a higher raw score represents poorer performance. In these cases, it was necessary to reverse the score so that the lowest score represented the greatest benefit.

Table 2. Scores

Category	Criterion	Raw scores		Normalised scores		Weighted scores	
		Quantum computing	OPM	Quantum computing	OPM	Quantum computing	OPM
Suitability and readiness	Transportable	1	1	1	1	0.1	0.1
	Power	1	1	1	1	0.045	0.045
	Temperature and humidity	1	1	1	1	0.045	0.045
	Shock and vibration	1	1	1	1	0.1	0.1
	Ingress protection	1	1	1	1	0.1	0.1
	EMI/EMC	1	1	1	1	0.01	0.01
	Technical expertise	1	1	1	1	0.1	0.1
	TRL and development timeline	0.1	1	0.00	1.00	0.00	0.50
Financial benefit	Development	0.1	1	0.00	1.00	0.00	0.50
	Procurement	500%	100%	1.00	0.00	0.00	0.40
	Operating	110%	100%	1.00	0.00	0.00	0.10
Capability benefit	Performance benefits	1,000%	100%	1.00	0.00	0.75	0.00
	Size benefit	100%	40%	1.00	0.00	0.00	0.15
	Weight benefit	100%	40%	1.00	0.00	0.00	0.10

Bubble graphs were chosen to display the three results for this study. Spider graphs or three-axis graphs could also be used but bubble graphs were chosen because they are an easier format for most casual readers to interpret. The 'performance benefit' criterion is represented on the x axis and the 'financial benefit' is on the y axis. The 'suitability and readiness' of the technology is represented by the size of each bubble.

The graph in Figure 2 is particularly informative. It illustrates the relative scores for each group of criteria and also shows the trade-off between the 'financial benefits', the 'performance benefits' and the 'suitability and readiness' of each technology.

OPMs score higher in terms of readiness but have a lower score for performance benefit. By contrast, quantum computing has the highest score for performance benefit because it enables a significant increase in processing speed, but it scores poorly in terms of financial benefits and readiness because of the relatively long development timeframe and higher cost of development. The results from the MCA analysis therefore highlight the comparative advantages and disadvantages between different technologies in a way that would not be possible using other methods of financial evaluation.

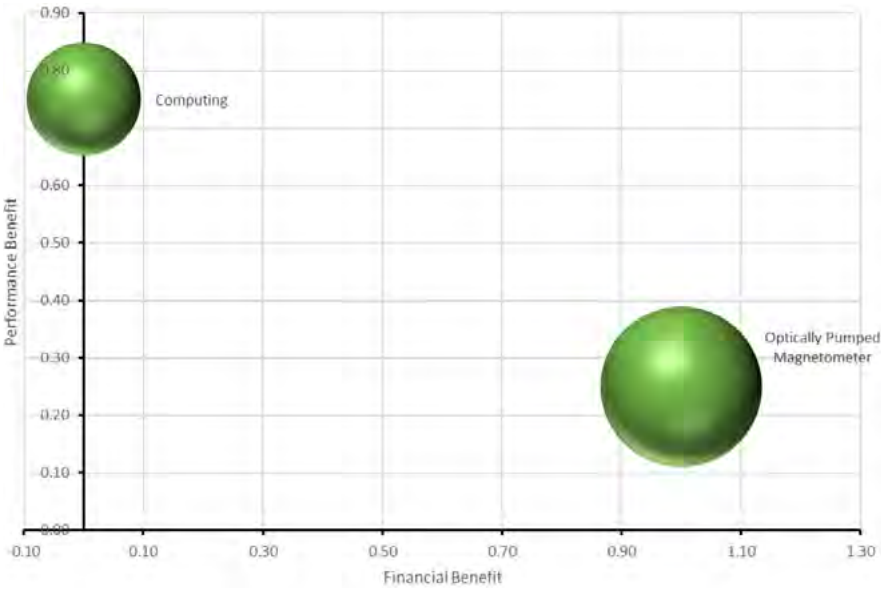

Figure 2. Results using example weights

Conclusions and Recommendations

Prioritising the development of military capability requires complex trade-offs between often conflicting requirements. These include balancing considerations such as how long and how much it will cost to mature the technology, how critical is the capability gap that it will fill, and what performance gains the new technology offers. Traditional financial evaluation tools like net present value and cost–benefit analysis are not well suited to evaluating these intangible costs and benefits. By comparison, an MCA is more appropriate because it uses scoring methods for a set of evaluation criteria that represent the objectives of the stakeholders. Weights are applied to each score to increase the significance of criteria that are considered more important by stakeholders.

This article has presented a modified MCA tool by splitting the financial, capability and suitability criteria into different groups and analysing them separately. This new variation on MCA reveals valuable trade-offs that would be hidden in a traditional MCA. The three-dimensional aspect of the framework shows separate results for 'suitability and readiness', 'financial benefit' and 'capability benefit'. This is well suited to the Defence context, which inevitably involves investment decisions that trade off cost versus capability. The MCA developed for this article represents an impartial and pragmatic way to assess the value of quantum technologies for Army.

Due to the editorial limitations of the *Australian Army Journal*, the example assessments provided in this article only assessed two technologies. While these two candidate technologies demonstrate how the modified MCA can be applied to the prioritisation of Defence investment decisions, this article is not intended to provide a comprehensive review of quantum technology or even to provide recommendations concerning the technologies assessed here. The benefits of the MCA approach become increasingly apparent as a portfolio of development priorities is assembled from a greater selection of technologies and use cases. To illustrate this point, an upcoming Australian Army Research Centre *Occasional Paper* will extend the analysis to include all of the quantum technologies identified in this article. Based on further consultation with stakeholders, this paper will:

1. further refine and validate the deployment scenarios
2. increase the fidelity of the scoring methods through additional criteria or higher resolution in the chosen criteria
3. refine the weight sets through stakeholder workshops
4. reduce the uncertainty in scoring different technologies through additional research, testing and experimentation.

In the meantime, this article has shown that the MCA assessment framework has the potential to deliver ongoing benefits to Army. It does this by providing an assessment tool that can inform the iterative update and maintenance of technology road maps and the generation of ongoing development priorities in response to changes in technology and capability demands. It can also inform development thresholds that emerging technologies need to pass before they can be considered operationally viable.

While the benefits of the MCA tool are clear, there are limitations on how this assessment framework can be applied. Specifically, the tool evaluates the capability benefit of quantum technology over current technology in a similar use case, but it does not compare the higher level benefits of different use cases. For example, it does not measure whether a quantum computing capability will deliver a greater contribution to military capability when compared to an unmanned aerial vehicle based magnetometer. It does, however, provide context and information to guide that analysis. For the results to be of most value, the inputs need to remain simple so that analysis can be conducted relatively quickly by experts able to describe the use case for each technology and to tailor appropriate sets of weights that reflect the needs of the relevant stakeholders. In view of the Defence Strategic Review's directive to develop selected critical technology in the shortest time possible, the MCA tool described in this article and the forthcoming *Occasional Paper* will assist Army decision-makers to move quickly and competently in their efforts to explore, capitalise on and bring into service quantum capabilities that can enhance the land domain's contribution to the integrated force.

About the Authors

Dr Colin Cockroft is a Senior Principal Engineer and Engineering Fellow at QinetiQ and Engineers Australia. He holds a PhD in hydrogen-based transport, and master's and honours degrees in electronics and communications engineering. Colin has 20 years' experience in Defence in special forces and conventional units. He has held senior engineering positions in several defence companies and co-founded an energy consultancy that provided project development services to defence and non-defence clients. In his current role Colin is responsible for QinetiQ Australia's power and energy program, including the development of products for defence applications.

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A Framework for Safely Scaling Multi-Agent Teams

Zena Assaad

Introduction

Studies have demonstrated human-machine teaming (HMT) to be an effective and strategic mechanism for combining the strengths of human skills and knowledge with the benefits of robotic, autonomous and artificial intelligence (RAS-AI) enabled capabilities.[1] In a military context, HMT provides a way for 'humans to operate in tomorrow's faster, more data-heavy and more autonomous battlefield.'[2] The advent of HMT has also paved the way for other forms of collaborative military operations, including human-swarm teaming (HST), also referred to as swarming. Swarming is a structured and coordinated collaboration of multiple capabilities, of the same type, to achieve a strategic outcome.[3]

While HST and HMT have proven benefits, particularly in combat scenarios with dynamic operating environments, integrating these teaming capabilities together is not a straightforward process. Both HST and HMT come with their own sets of unique challenges which are exacerbated when implemented at scale and in operations which combine these two forms of teaming. Collectively, HST and HMT are referred to as multi-agent teaming.

The Australian Army's hyper-teaming project is an example of Army preparing for combined scaled operations using a multi-agent teaming approach. This project brings together RAS-AI systems, across both air

and land platforms, to achieve adaptive, efficient and resilient teaming and swarming outcomes. Multi-agent teaming is expected to support complex, multi-phase intelligence, surveillance and reconnaissance (ISR) related tasks and aims to increase the efficiency and scale of ISR on operations.

In these hyper-teaming operations, the robotic agents collaboratively identify targets within an area of interest and report back to their human teammates. In some cases, the robotic agents move towards objectives in combination with their human teammates. The order of movements means of communication, overwatch and surveillance priorities are determined by humans. Subject to the robotic agents' level of autonomy, there may be degrees of variation to the order of movements if the robotic agents are responding to a dynamic operating environment in real time. The extent of possible variations is bounded by the machine's functions and capabilities.[4]

These hyper-teaming operations present an opportunity to strategically navigate dynamic and high-risk environments. The challenge, however, is to mitigate the additional complexities and risks that come when humans operate alongside RAS-AI capabilities. In teaming contexts, these capabilities are implemented as teammates rather than tools,[5] adding a social layer to these considerations.

This article will explore three key research questions:

1. What is the impact of agentive composition of swarms on the planning and facilitation of multi-agent teaming operations?
2. How do the different communication structures in multi-agent teams shape the interdependence between actors and impact the safety of the operation?
3. How do the goals of independent agents impact the safety of multi-agent teams and what methods of goal definition can be implemented to ensure system safety?

This article will explore each of these research questions from a technical perspective, focusing on the safety implications that come with multi-agent teaming. The purpose of the analysis is to further develop the body of knowledge around multi-agent teams, highlighting the significance of teaming compositions and the importance of systematically defining and actualising goals. Based on the findings and the context in which they are made, the article presents a method for safely scaling multi-agent teams.

While this article focuses on the technical considerations of HST and HMT, teaming itself is a social construct and therefore considerations around teaming are not just technical. Social considerations, particularly trust, contribute to the overall safety and effectiveness of a teaming operation. The importance of these considerations would furnish a paper in its own right, so further analysis is omitted from this short work.

HST and HMT have many similarities but also a number of differences that distinguish them. As hyper-teaming involves the combination of HST and HMT, it is important to understand these distinctions. One of these distinctions is around how agency is conceptualised within a swarm. In this regard, it is important to understand whether the swarm is one agent made up of multiple systems working towards the same goal, or whether instead it is made of multiple independent agents with local goals that ultimately contribute to a broader goal. Planning and facilitating operations with swarms, particularly in the case of hyper-teaming in which swarms are integrated into broader HMT, requires an understanding of agentive composition. This understanding dictates how goals are defined and actualised within an operation. This topic is explored in detail in Section 2.

Section 3 delves further into the distinction between HST and HMT, focusing on the differences in communication structures from three different perspectives: roles, responsibilities and interdependencies between agents within the team; coordination of communication between team members; and situational awareness through shared cognition. Section 4 presents a method for defining goals for multi-agent teams. Section 5 then offers a framework for safely scaling teaming operations, which is applied to Army's hyper-teaming operations as a case study analysis.

Conceptualising Agency

The notion of agency for cognitive systems is defined by three attributes that an agent should possess. The agent should be capable of acting independently, it should be capable of reacting to its environment, and its actions should be in pursuit of an identified goal.[6]

Swarms represent a collective conception of agency, with swarm intelligence (SI) emerging from decentralised and self-organised systems that follow simple patterns of behaviour. SI, a subset of AI, refers to the 'emergent collective intelligence of groups of autonomous agents'.[7] The concept of SI for artificial systems developed from the field of cellular

robotic systems, which involves cooperation between machines to achieve a predefined goal or task. In cellular robotic systems, the concept of SI was used to describe self-organisation of machines through nearest neighbour interaction.[8] There are two factors that distinguish SI from cellular robotic systems. Firstly, cellular robotic systems involve a finite number of robots operating in a finite space. Secondly, they function against limited communication between adjacent robots.[9]

With SI, there are no boundaries confining the number of machines and the space within which they must operate. Further, communication is not limited to neighbour interaction.[10] In swarms, complex dynamics emerge from the patchwork of interactions between the individual agents that comprise the larger system. The individual agents that make up multi-agent systems are self-organised entities that respond to local information within their domain of possible interactions. Decentralised and self-organised systems exhibit complex behaviours that shape collective notions of individuality and agency. Individuality is one of the core attributes of agency. If a swarm is composed of agentive systems that are distinguishable as individual entities, it is more difficult for the collective to coordinate interactions as one entity.

SI emerged from cellular robotic systems, which involves cooperation between machines to achieve a predefined goal or task. Given its genesis, it might be expected that the foundational ideology of the swarm agency concept aligns with that of cellular robotic systems. However, more recent language and research around SI suggests that swarms could be perceived as one collective agent.[11]

Minar et al. describe swarms as a 'group of agents and their schedule of activity.'[12] This description leans into the idea of swarms being a cohesion of individual agents; however, 'schedule of activity' suggests collective emergent behaviour. The authors' assertions regarding the strategic advantages of individual agents within a swarm supports the ideology that swarms pursue localised goals and support individual goal-fulfilling behaviour. In order to direct swarms towards more collective, global outcomes, Walker et al. propose a mechanism in which individual agents are selected as leaders among the group.[13] In making this suggestion, Walker et al. acknowledge that agents within swarms act individually and that having humans guide the swarm 'leaders' is a necessary mechanism

to ensure that one global goal is actualised. By contrast, Giles and Giammarco[14] do not appear to subscribe to the notion of individuality within swarms. Instead, they view swarms as constituting one collective agent that pursues one global goal.

The varied descriptions of swarms and their behaviour invite multiple interpretations of agency for swarms. When considering how swarm technology might be used, it seems each of the suggested interpretations of agency holds true under different contexts. Take for example, a swarm of drones used for mapping large areas.[15] In this example, the swarm consists of individual agents cooperating to achieve a collective and easily segmentable goal—mapping a large area. Each drone captures a particular segment of a broader area and the collation of data from the drone swarm provides enough information to map one large area. Each drone has its own task that contributes to the broader goal. So the absence of one agent within the swarm would impact the overall goal because a portion of the area being mapped would be missing. In the context of this example, the idea of swarms being a cohesion of individual agents would be most appropriate, as each agent is working towards their own individual goal. However, if the swarm were to have self-healing mechanisms[16] (also referred to as resilience[17]), the remaining agents should theoretically have the capacity to act as self-organised systems, redistributing responsibilities to ensure the broader goal is fulfilled. In such a situation, one or more agents would map the missing area in addition to their own allocated areas. In this approach, the notion of a swarm being defined as one collective agent would be more fitting, as the entities that comprise the swarm are altering their behaviour as a means of fulfilling the collective goal.

When considering these examples, it can be seen that an entity's capacity to act plays a role in how collective tasks are handled, and this has significance for how one considers swarms. The multiple perspectives of swarms and SI presented in the literature may in fact be reflective of the significance of context in swarm operations. It might not be possible to confine swarms and SI within one definition as the context and capacity to act impact how swarms are organised and therefore defined. The notion of agency for swarms may be viewed as a cohesion of individual agents when goals are defined and actualised on more localised levels. In cases of global goals and goal actualising behaviour, the idea of one collective agent is more appropriate.

In the case of hyper-teaming, which can involve swarms operating within an HMT, understanding the agentive composition of the swarm, and how goals are defined, will be critical to effectively integrating swarms with an HMT operation. The differences between HST and HMT dictate how communication is managed, how roles and responsibilities are distributed, and the level of situational awareness among human and non-human agents within the operation. This topic is explored further in the following section.

One-to-Many, Many-to-One

The notion of HMT (also commonly referred to as human-autonomy teaming[18]) encompasses the concept of teams. The term 'team' can be understood to mean a group of individuals working together to accomplish a goal, where there is an element of interdependence and combined efforts.[19] The term also implies a discrete lifespan, distributed expertise and clearly defined roles.[20] Some studies suggest that a capability can be considered a member of a team if it has the capacity to take on roles and responsibilities and to function interdependently.[21] Teaming extends beyond one-to-one interactions, often including multiple heterogeneous agents—human and non-human—in the broader HMT system, with each agent assigned their own roles and responsibilities. Here, a system is described as a composition of multiple parts and is often defined by the interactions between those parts.[22] When conceptualising a system, it should be considered as a whole, as Whitchurch and Constantine[23] describe:

> Wholeness is characteristic of systems because there are properties or behaviours of the system that do not derive from the component parts themselves when considered in isolation. Rather, these emerge from their specific arrangement in a particular system and from the transactions among parts made possible only by that arrangement. These are called emergents or emergent properties because they emerge only at the systemic level.

In HMT operations, machines do not replace humans; rather, the collaboration between human and machine achieves 'outputs that neither machines nor people could deliver independently'.[24]

Before moving forward, it is instructive to note the difference between HMT and human-machine interaction (HMI) for the purpose of clarity in terminology. The concept of HMI was popularised in the 1980s and, at the time, it characterised a dialogue between humans and computers.[25] HMI involves actions by a human that elicit immediate responses by a machine through physical communication prompts, such as pushing buttons, reading dials or responding to warning signals or messages. In this dynamic, there is little uncertainty on the part of either the human or the machine. The human is limited in their interaction capacity and the machine is limited in its ability to respond. These limited interactions incur little uncertainty and invite little or no opportunity for negotiation between the two parties. In comparison, the concept of HMT extends beyond the one-to-one interactions that are seen in HMI.

There exist numerous proposed definitions of HMT—no consensus has yet been reached on a single definition. Many of these definitions articulate a narrative in which HMT involves pursuit of 'shared', 'common' or 'aligned' goals.[26] In fact, it would be more precise to say there is an overarching system goal and, in order to achieve that goal, the goals of the human teammate and the goals of the machine teammate are 'aligned'. The overall system goal is set by human decision-makers, such as operators and developers. This overall system goal is the function or purpose of the HMT system. Given the overall system goals, these are then translated for the machine into objective functions and reward functions—collectively, 'functions'. The machine is designed to optimise these functions to achieve required outputs.[27] The machine's goals are aligned to the human teammate's goals in order to achieve the overall system goal. The goals are 'aligned' rather than 'common' or 'shared' because there are two categorically distinct kinds of goals here: the human's operational goals and the optimisation of the machine's functions.[28] The human's goals are largely qualitative and the machine's goals are necessarily quantitative.

Working from the literature underpinning the concept of teams and that of HMT, and considering the conceptual understanding of aligned goals, the following definition for HMT is proposed:

> A combination of human and machine agents working together towards a system goal that is achieved through a set of aligned goals.

Theoretically, HST should align with this proposed definition of HMT; however, there are some distinctions between the two. Firstly, the composition of a team differs between HST and HMT. Literature on biological swarms pertains to insects or animals of the same species.[29] Equally, artificial swarms have followed a similar pattern, with HST comprising elements with the same technology capability—for example, drone swarms. This does not mean swarms cannot be implemented across an integrated platform; rather, the swarm itself only comprises one type of capability. In comparison, HMT can consist of multiple different capabilities and has been described in the literature as a multi-capability system.[30] Teaming in this scenario often involves collaboration across integrated platforms.

The second distinction between HST and HMT relates to coordination. As Kolling et al. describe, artificial swarms:

> involve coordination between robots that relies on distributed algorithms and information processing. Because of this, global behaviors are not explicitly stated and, instead, emerge from local interactions. In such cases, the individual robots themselves likely could not act independently in any successful manner.[31]

By comparison, HMT demonstrates what can be characterised as greater levels of independence. While the agents within an HMT do coordinate to achieve a shared goal, their behaviours are self-interested and centred around fulfilling their designated outputs.[32]

The third distinction between HST and HMT pertains to communication structures within the team. The rest of this section of the article details communication structures in teaming operations, for both HST and HMT, from three different perspectives. The first is understanding roles, responsibilities and interdependencies between agents within the team. The second is determining coordination of communication between team members. The third perspective explores situational awareness through shared cognition.

Understanding Roles, Responsibilities and Interdependencies

In HMT, roles and responsibilities are independent for each agent and interdependent within the broader team.[33] That is, each agent is capable of operating independently to achieve individual goals. The interdependency manifests in the cooperation to achieve a broader system goal, where the system represents the HMT. Each agent is capable of fulfilling their roles and responsibilities independently; however, the broader system goal cannot be effectively fulfilled in the absence of one of the agents within the team—be they human or non-human.

By comparison, in self-healing or resilient swarms, roles and responsibilities are all interdependent, so individual agents could not successfully operate independently. Therefore artificial swarms are generally more robust, flexible and scalable than HMT.[34] Equally, swarms which are conceptualised as individual agents working towards a collective goal will operate similarly to an HMT structure.

One of the distinguishing factors of teaming is that it involves more than one human and one machine.[35] Each agent—both human and non-human—possesses roles and responsibilities which contribute to a particular goal, be it a localised goal or a global system goal.[36] As the numbers and types of agents in a system increase, so too does the complexity of the interdependencies between these agents. As Rusbult and Van Lange state, 'interaction is shaped by broader considerations'.[37] The challenges of managing these interdependencies (which include information sharing and coordinating communication) increase as the number of agents, human and non-human, increases.

In the case of hyper-teaming, which includes a combination of swarming and HMT, the interdependencies will be even more complex. The significance of interdependence reveals itself in situations where errors, malfunctions or disruptive deviations to an operation occur. These instances can lead to a snowball effect on other agents within the teaming operation.

Coordination and Assurance of Communication

As teaming involves multiple interdependent agents, coordinating communication between these heterogeneous entities is essential for effective and successful teaming operations. In fact, team cognition is often characterised by communication and coordination processes.[38] The challenge for human agents within an HMT will be to effectively navigate reciprocal and dynamic communication.[39] Coordinating which agents need to communicate with one another, at what time and in what format—verbal, signalling, text etc.—is critical to effective teamwork. For HST with resilient swarm structures, communication is coordinated within the swarm structure, and is not managed or directed by human agents.[40] Additionally, as swarms are made up of one type of agent—for example, drones—the format of communication will be consistent across agents.

In addition to coordinating communication, humans need assurance of the information being communicated (notably, this requirement will be essential for safety-critical information). Particularly in dynamic operating environments, effective communication requires accurate and consistent information.[41] Team process will inevitably be affected by the tolerances on the accuracy and integrity of information, as well as the robustness of that information, which is demonstrated in the availability and continuity of information between interdependent agents. Depending on the nature of the operation, these assurances may need to be provided in real time.

Assurance mechanisms for information may differ depending on the format, content and purpose of that information. In general terms, quantifiable metrics are more accepted in safety-critical environments because they are repeatable and justifiable.[42] For example, the aviation industry has regulatory requirements for the real-time assurance of positioning data, which are standardised quantifiable measures.[43] Quantifiable assurance mechanisms take time. While this time may appear short when considering advanced computational capabilities (perhaps a matter of minutes or seconds) even this latency may be a hindrance in a dynamic operational environment.

For hyper-teaming operations, it is important to determine how information is being coordinated between agents and between teaming compositions—swarming and HMT. Information deemed safety critical should be identified alongside mechanisms for assuring that information, be it quantifiable or otherwise.

Situational Awareness through Shared Cognition

Situational awareness can be facilitated through shared cognition, in real time, of team members' roles and responsibilities, goals, limitations etc.[44] When considering the heterogeneity of HMT systems, dynamic operating environments can generate emergent behaviours at the system level.[45] These behaviours result in diversity in the body of knowledge held by individual agents within a system.[46] Sharing such knowledge among other team members contributes to effective team processes.[47] When considering the interdependencies of HMT systems, situational awareness through shared cognition is essential for actualising goals at both the local and system levels.[48]

There is an abundance of information that can be made available from the digitally enabled agents which make up an HMT. The challenge is finding the balance between quality and quantity of information. Data is a collation of unprocessed facts, while information is data that has been given meaning through context and interpretation. The transition from data to information takes time, and more data does not always equate to more information.[49]

It is unsustainable and impossible to effectively utilise every single data point collected in an operation. Nevertheless, choosing to omit certain information may lead to misrepresentation of the operation, as well as of the respective operating environment. Understanding what information is important and relevant, and prioritising that information, will be key to effective and safe operations. This will be a core function of human commanders and operators within HST and HMT.

It is important to note the connection between goals and situational awareness. Goals can be used to define how much situational awareness (and therefore information) is required for each agent.[50] What is and is not relevant information to each agent—human and non-human—will be heavily dependent on the goals of that agent.

For resilient HST, situational awareness is facilitated in the swarm structure and is not reliant on human agent intervention.[51] In the case of hyper-teaming, there must be shared cognition between the swarm and the broader HMT to ensure collective situational awareness for the broader hyper-team.

A summary of the difference of communication structures between HST and HMT is provided in Table 1.

Table 1. Summary of the difference between HST and HMT communication structures

	HMT	HST
Understanding roles, responsibilities and interdependencies	Roles and responsibilities are independent for each agent and interdependent within the broader team.	In self-healing or resilient swarms, roles and responsibilities are all interdependent and, as such, individual agents could not successfully operate independently.
Coordination and assurance of communication	Requires coordination of communication and information sharing between interdependent agents. Assurance of safety-critical information is required.	For resilient swarm structures, communication is coordinated within the swarm structure, and is not managed or directed by human agents. Assurance of safety-critical information is required.
Situational awareness through shared cognition	Situational awareness is achieved through shared cognition between agents.	For resilient HST, situational awareness is facilitated within the swarm structure and is not reliant on human agent intervention.

While there are differences in the communication structures across HST and HMT, what is consistent across these multi-agent teams is the requirement for goal definition. This is true for both individual and collective goals.

A Method for Defining Goals for Multi-Agent Teams

In the context of this article, goals are defined simply as 'objectives of the system'. Morasky describes the two major functions of goals as facilitating system control and system evaluation.[52] The effectiveness of a system is dependent on the system's ability to achieve a desired state or goal, and that desired state or goal is the driving force behind system behaviour. In the context of systems theory, systems are 'understood as a whole and cannot be comprehended by examining its individual parts in isolation from each other'.[53]

Alignment of goals in multi-agent systems is a form of coordination.[54] In addition to system effectiveness, goal definition is a factor in system safety.[55] Incorrectly defining goals can lead to unexpected system outputs and behaviours. Literature on this topic often distinguishes between soft goals (high-level objectives for the non-functional capabilities of the system) and hard goals (high-level objectives for the functional capabilities of the system).[56] These are also referred to as functional and non-functional goals.[57] The granularity of this distinction is not within the scope of this article.

Beyond delineating soft and hard goals, literature around goal definition for multi-agent teams is sparse.[58] There are, nevertheless, some studies on optimisation in different contexts that are relevant.[59] Based on analysis of this material, this article proposes the following guidelines for defining goals for multi-agent teams. These guidelines are intended to aid users in effectively defining goals for multi-agent teams, to facilitate system evaluation and to ensure system safety:

Be clear and specific so that goals can be objectively interpreted

Goal specificity encourages a *means–end analysis* approach, thus supporting the pursuit of behaviours that transform the current state into the specific goal state.[60] There is also literature related to 'goal setting theory' which argues that specific goals lead to higher levels of task performance in comparison to vague and/or unclear goal definitions.[61] This being the case, goals must be defined clearly and with specificity to ensure cohesion among the multiple agents that comprise an HMT or HST.

Distinguish between individual local goal(s) or collective global goal(s)

As discussed in Section 2, the concept of agency for swarms is dynamic and highly dependent on context. There may be situations in which swarms consist of agents working towards individual goals, while other contexts may involve multiple agents working towards one collective goal. When defining goals, it is important to distinguish between the two. Defining one goal for the collective will differ from defining multiple individual goals. For HMT, there will be both individual goals and a broader system goal.

Specify time requirements

Generating effective systems depends on the achievement of effective coordination among multiple agents.[62] In turn, cohesive coordination is dependent on time parameters. If time parameters are not specified, each agent may fulfil their goals across varying timeframes. In a static environment, this may not cause concern. However, in the dynamic environments that commonly characterise military operations, time variations in task completion will impact the accuracy and validity of the information generated. If one agent returns data in 10 minutes and another returns data in 30 minutes, the difference of 20 minutes in safety-critical settings is significant enough to deem information no longer usable.[63]

Make goals measurable or quantifiable

If goals are not measurable or quantifiable, it is difficult to know when a goal has been achieved. For multi-agent teams (which operate with multiple parallel and complementary goals), it must be possible to clearly determine whether a goal is complete, and the assessment must be binary in nature: the goal either has or has not been achieved. If the assessment is left open to multiple interpretations, there is no clear measure of effectiveness, and this means that military operations cannot be fulfilled effectively.

Challenges of Scale

There are a number of challenges that come with scaling multi-agent teams. Of these, the following three are of focus for this article: judgements of risk, latency in decision-making, and maintaining communication structures. These challenges and their implications are discussed in turn.

Judgements of Risk

A state of zero risk will never exist, because risks can only be mitigated; they cannot be eliminated.[64] For multi-agent teaming operations, there must therefore be an understanding of what constitutes an acceptable level of risk. The principle of *as low as reasonably practicable (ALARP)* is commonly implemented in the civil sector for managing risks.[65] However, the military domain operates under more nuanced risk thresholds where the concept of what is *reasonably practicable* will differ from the concept in the civil domain.

In the case of scaled teaming operations (which comprise an amalgam of goals between the many agents within the team), judgements of acceptable risk will need to be considered individually and in relation to the potential impacts of identified risks on the broader teaming operation. Additionally, for non-human agents with roles, goals or functions deemed safety critical, there may need to be a human point of assurance or redundancy. In a scaled operation, such as hyper-teaming (which includes many non-human agents), it will be particularly challenging to maintain the human element across these systems in real time.

Latency in Decision-Making

When teaming operations are conducted in dynamic operating environments, decisions will need to be made for the whole duration of the operation. The benefit of digital systems is their capacity to analyse vast amounts of data in much shorter timeframes than a human could manage. In multi-agent teaming operations, where humans and RAS-AI systems operate in tandem, there may be a latency in decision-making between humans and machines. This latency will be heightened in scaled operations, such as hyper-teaming operations, which involve greater numbers of digitally enabled systems.

Additionally, subject to the goal definition framework presented earlier in this article, cohesive coordination is dependent on the designation of time parameters. While goals should be defined with reference to specific time requirements, the interdependent nature of multi-agent teams may result in latency of human decision-making. Such delays will impact the capacity of RAS-AI systems to meet designated time requirements.

Maintaining Communication Structures

This article has highlighted the difference in communication structures between HST and HMT. For scaled operations, managing these communication structures will be critical to safety. The complexity of managing these communication structures increases with the number of agents—both human and non-human—within the team.

For hyper-teaming operations (which include both sets of communication structures), this complexity is exponentially increased. For safety-critical operations, communication will play a fundamental role in maintaining safety. Accordingly, managing communication structures is critical to safely scaling multi-agent teaming operations.

Framework for Safely Scaling Multi-Agent Teaming Operations

For the purposes of this analysis, five guiding principles have been adapted to support the safe scaling of multi-agent teaming operations. These principles draw upon a previous research study which presented a method for categorising physical and psychosocial safety risk for HMT operations.[66] As this article is more technically focused, the guiding principles have been amended. The original guiding principles, and how they have been amended, are presented in Table 2.

Table 2. Amended guiding principles

Original guiding principle	Amended guiding principle	Reasoning for amendment
Adaptability—understanding the capacity to which the human and the machine can adapt to their environment.	**Agency**—technical understanding of the agentive composition of swarms in HST.	The original principle is more focused on a capacity to act, whereas the amended principle is focused on a technical understanding of the composition of a swarm. The concepts are closely related but amended slightly due to the technical focus of this article.
Goal setting and goal actualisation—understanding how goals are determined and actualised for both humans and machines.	**Goals**—defining goals and monitoring goal completion.	Minor simplification of the label and additional focus on goal completion to capture the more technical considerations of goal setting and goal actualisation.
Communication—understanding how, what, why and when information is communicated between human and machine.	Unchanged	Unchanged
Ethics—understanding the ethical implications of humans operating in close proximity to a machine within specific environments.	**Information**—identifying safety-critical information and determining methods of assurance for that information.	Ethics is considered out of scope of this article. It is therefore omitted and replaced with information.

Original guiding principle	Amended guiding principle	Reasoning for amendment
Trust—understanding how trust between the two entities influences decision-making.	**Interdependence**—understanding interdependencies between actors and the critical points of these interactions.	As mentioned in the introduction, trust is considered out of scope of this article. It is a concept which requires a study of its own. The terminology of trust has therefore been replaced by the closely related concept of interdependence.

These guiding principles are detailed below and applied to the concept of hyper-teaming in an Army context to demonstrate how they would be actioned in practice.

Agency

Understanding the agentive composition of swarms, and how goals are defined, is essential to safely integrating these systems into a broader teaming operation, such as Army's hyper-teaming operation. The difference in how agency is conceptualised dictates how goals are defined, how communication is managed, how roles and responsibilities are distributed and the level of situational awareness within the operation.

When scaling multi-agent teaming operations, the following steps should be taken in consideration of agency:

- Determine the agentive composition of the swarm.
- If the swarm consists of multiple independent agents, define local goals using the goal definition method outlined in Section 4.
- If the swarm consists of collective agency, define a global goal using the goal definition method outlined in Section 4.

Taking Army's hyper-teaming operations as an example, if the swarm component of such an operation consisted of individual agents, there would be multiple goals which need to be monitored and achieved throughout the operation. However, if the swarm were to operate as a resilient collective agent, there would be only one global goal to monitor and achieve. Establishing this distinction from the beginning will support more streamlined and effective operations.

Goals

The effectiveness of a teaming operation is dependent on the system's ability to achieve a desired state or goal, and that desired state or goal is the driving force for behaviour. Alignment of goals in multi-agent teaming operations is a form of coordination and is also a factor in system safety. Incorrectly defining goals can lead to unexpected system outputs and behaviours.

When scaling multi-agent teaming operations, the following steps should be taken in consideration of goals:

- Define local and global goals using the goal definition method outlined earlier.
- Determine a mechanism for monitoring goal completion.

The amalgam of many human and non-human agents can make the logistical organisation of an operation challenging. Goals, while essential to an operation, are also a strategic means of organising roles and responsibilities and monitoring the effectiveness of the operation over time.

Applying this principle to the Army's hyper-teaming operation, clear goals for each platform are a prerequisite to the successful integration of multiple platforms at scale. Equally, commanders must understand how those goals contribute to the overarching goal of the whole operation. The goals will need to be defined prior to the operation, with methods for monitoring and measuring goal completion during and after the operation. Some of these measures may be technical and others may be fulfilled by a human actor. For hyper-teaming, the number of goals will scale in parallel with the scale of the operation. The interdependence of these goals may also dictate how the operation can be carried out. This may include, for example, the order in which actors fulfil their goals.

Information

Teaming operations involve a plethora of information analysed and shared among the many agents within the team. Determining what information is important to the teaming operation (particularly in the context of safety-critical operations) will be essential to the achievement of effective information management. Some information may require different levels of assurance or oversight depending on the context of the operation.

Judgements of risk come into effect when determining what information is safety critical and what is not. Additionally, latency in decision-making is a relevant factor to consider for any information which needs human oversight or human assurance.

When scaling multi-agent teaming operations, the following steps should be taken in consideration of information:

- Identify what information is safety critical or is related to safety-critical components of the operation.
- Determine what assurances are required for that information and how they can be achieved within timeframes and processes which align with the operation.

In Army's hyper-teaming operation, many of the autonomous agent's functions may be deemed safety critical, requiring different levels of assurance, some human and others digital. Any form of assurance will require time to achieve. Even a few minutes can disturb an operation. When scaling operations, it is therefore important to consider how to achieve adequate assurance. For hyper-teaming operations, the existence of many different platforms will add an additional layer of complexity to this task due to differing expectations of assurance. For example, air and land platforms are designed and operated against different standards relevant to their industries. Balancing such standards against the information requirements of these platforms is essential if operations are to be safely scaled.

Communication

The structure, management and coordination of communication between agents in a teaming operation is fundamental to safe and effective operations. Teaming operations involve reciprocal and dynamic communication, as well as the requirement to operate within the changing and unpredictable environments common in military contexts. The complexity of managing and coordinating multiple types of communication across different platforms (whether verbal, signalling, text etc.) increases with the number of agents in the team. To safely scale multi-agent teams, there must be safe and effective communication methods supported by appropriate management structures.

When scaling multi-agent teaming operations, the following steps should be taken in consideration of communication:

- Determine what communication structures are required within the operation.
- Identify how communication is to be coordinated and managed throughout the operation.

For hyper-teaming operations which consist of both HST and HMT, determining communication structures is the first step in understanding how communication needs to be coordinated and managed throughout the operation. Given the interdependent nature of these operations, effective communication is essential to remedying unexpected or incorrect outputs or behaviours before they create a flow-on effect through the operation. This is particularly important for hyper-teaming operations which involve multiple platforms that may require multiple different communication mechanisms.

Interdependencies

Multi-agent teaming operations are achieved through interdependent agents cooperating to achieve a system goal. These interdependencies create flow-on effects between agents, some constructive and others disruptive. In order to safely scale teaming operations, these interdependencies must be understood by commanders. They must also appreciate the potential flow-on consequences of unexpected or incorrect outputs or behaviours from agents (both human and non-human) within the teaming operation. The team's interdependencies will ultimately be shaped by judgements around risk, and the impacts of latency in decision-making.

When scaling multi-agent teaming operations, the following steps should be taken in consideration of interdependencies:

- Map interdependencies across the teaming operation.
- Identify critical points across this map, and measures to ensure these points are monitored and managed effectively.

There will be critical points of interdependence across any teaming operation in which one agent cannot fulfil their roles and responsibilities without the work of another agent. Equally, the ineffective operation of one agent contributes to significant repercussions for other agents. These points are accompanied by high risk and should be identified and appropriately managed. For hyper-teaming operations, these points will likely emerge across the different platforms, creating a greater emphasis on the importance of the guidelines discussed here.

Table 3 summarises the guidelines.

Table 3. Summary of the framework for safely scaling multi-agent teams

Guideline	Steps
Agency	• Determine the agentive composition of the swarm. • If the swarm consists of multiple independent agents, define local goals using the goal definition method outlined in Section 4. • If the swarm consists of collective agency, define a global goal using the goal definition method outlined in Section 4.
Goals	• Define local and global goals using the goal definition method outlined in Section 4. • Determine a mechanism for monitoring goal completion.
Information	• Identify what information is safety critical or is related to safety-critical components of the operation. • Determine what assurances are required for that information and how they can be achieved within timeframes and processes which align with the operation.
Communication	• Determine what communication structures are required within the operation. • Identify how communication is to be coordinated and managed throughout the operation.
Interdependencies	• Map interdependencies across the teaming operation. • Identify critical points across this map and measures to ensure these points are monitored and managed effectively.

Conclusion

Understanding the concepts relevant to teaming is pivotal in effectively determining how these operations need to be organised and managed, and specifically in determining their goals. This article has presented a method for defining goals for multi-agent teams, with the intention that it informs the actions of both human and non-human agents within a team. Multi-agent teaming has proven benefits for military operations; however, these operations are not without their challenges, particularly when implemented at scale. These challenges include judgements about the acceptability of risk, the impact of latency in decision-making, and the need to establish and maintain appropriate communication structures. With these key challenges in mind, this article has presented a framework for scaling multi-agent teams. The framework presented five guiding principles to support the safe scaling of multi-agent teaming operations: agency, goals, information, communication and interdependencies. The challenges of scaling multi-agent teams are nuanced and interwoven with one another, making mitigation of related risks less straightforward. While these potential risks are more complex to navigate, they are not insurmountable.

About the Author

Dr Zena Assaad is a senior lecturer in the School of Engineering at the Australian National University. She has held fellowships with the Australian Army Research Centre and Trusted Autonomous Systems. Her research explores the safety of human-machine teaming and the regulation and assurance of autonomous and AI systems. Dr Assaad is a member of the expert advisory group for the global commission on responsible AI in the military domain.

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From the Nackeroos to the New: Crafting a Vision for the Future Australian Army

Ian Langford

> *The fall of Singapore opens the Battle for Australia … what the Battle of Britain required, the Battle for Australia demands.*
>
> Prime Minister John Curtin, 1942[1]

Introduction

By late 1941, Australia had deployed more than 22,000 soldiers across its northern approaches in preparation for a possible Japanese advance on the mainland. By February 1942, Singapore, Malaya and The Dutch East Indies were all under Emperor Hirohito's control. New Guinea and the Solomon Islands would soon follow. Only one outfit, the 2/2nd Independent Company stationed in Portuguese East Timor, remained behind enemy lines.[2]

Back in Australia, military planners agonised over the nation's defence. With the failure of the American-British-Dutch-Australian (ABDA) Command and the 'Singapore Strategy' (which essentially placed the defence of the country into the hands of the Royal Navy), Prime Minister John Curtin, who had only been in the role since the previous October, now found himself in confrontation with British Prime Minister Winston Churchill over the issue of the 7th Australian Division.[3] Churchill wanted them deployed to Burma to bolster the Commonwealth forces in and around the eastern flank of

India. Curtin was adamant that the troops were to be brought home for the defence of Australia itself. The bombings of Darwin in February 1942 followed the Japanese invasion of Rabaul earlier in January, which now provided it with a significant air and naval base upon which to launch operations south towards continental Australia. Curtin ultimately prevailed—Churchill was furious.

1942 would prove a seminal year for Australia in World War II. Two days after Darwin was bombed and 70 days after Singapore fell, civilian and military leadership alike had realised that the nation's capacity to defend itself was primarily restricted to the populated industrial centres of the south-east corner of the continent.[4] A Japanese amphibious assault on Darwin, Broome, Wyndham or Derby (all subjected to bombing raids throughout February) was assessed as 'probable', and it seemed that there was not much of a military force capable or ready to oppose it.[5]

Fast-forward to 2025 and, just like in February 1942, the continental defence of Australia remains critical to Australia's military strategy. Defence policy updates in 2023 and 2024 compare Australia's current strategic circumstances to those of the late 1930s.[6] Whether Australia finds itself in 2025 in a 'pre-war' moment or not, the return of great power competition between current and emerging hegemonic nations worldwide, but perhaps most acutely in east and north Asia, has again exposed Australia's security and defence vulnerabilities. Commentators agree that this coming decade is a crucial moment for Australia regarding how best to prepare for a future that sees a heightened risk of strategic miscalculation and conflict.[7]

The issue of northern continental defence across an area so vast is as much a challenge today as it was to Australia's war planners in 1942. What was essentially defined in the early 1940s as 'ABDA's elbow room' (which included northern Australia and the South-East Asian archipelago) is now acknowledged in the 2023 Defence Strategic Review as 'an area facing its most significant strategic circumstances since the Second World War'.[8] The question of how best to provide for the nation's security requires a review of Australian military history, especially in the South-West Pacific Theatre of the Second World War. This paper will examine one aspect of how Australia planned to defend itself in the early 1940s. The 2/1st 'Northern Australia Observer Unit' mission represents parallels in geography, force design, innovation and technology to the geographic, conceptual and

operational problems the Australian Army now faces in 2025. Drawing upon these lessons and insights, a proposed future scenario circa 2029 describes how the Army might respond to its strategic circumstances.

1942 and the 'Real' Threat of Invasion

The seizure of Rabaul by the advancing Japanese on 23 January 1942 was primarily designed to fortress and defend their large air and naval base on the island of Truk, as well as to begin advance force operations to capture Lae and Salamaua (seized in May), with Port Moresby a subsequent future objective.[9]

In making his operational assessment in the aftermath of the loss of Rabaul, the commander of the ABDA forces, General Sir Archibald Wavell, concluded that he needed most of continental north-western Australia to act as a buffer and provide more strategic depth, particularly after the loss of Singapore on 15 February.[10] Australian Army Chief of the General Staff General Vernon Sturdee's *Future Employment of the A.I.F.: General Sturdee's Paper of 15th February 1942* (written around the same time) prioritised the 'holding of the (Australian) continental area from which we (sic) can eventually launch an offensive in the Pacific when American aid can be fully developed'.[11] The area in question spread from Normanton in the Gulf of Carpentaria west to Onslow in Western Australia.[12] Everything south of the newly defined 'ABDA elbow room', according to both plans, was to be undefended.

In early 1942, a classified report to the Australian Chiefs of Staff was damning in its assessment of Australia's military force readiness. The country's armed services had undergone years of neglect; no meaningful civil defence concept or coastal or air defence plan of any national consequence existed.[13] Three Australian divisions were serving in the Middle East, the bulk of 8th Division had been lost in Singapore, and the seven divisions of the Citizen Military Forces were undertrained and underequipped.[14] The one saving grace was that in November 1941 the US had requested, and Australia had agreed, to begin staging American forces in and around Australia to rebalance their force posture as a result of increasing concern over Japanese military intention, later confirmed with Japan's surprise attack on Pearl Harbor and rapid advances into South-East Asia after 7 December 1941.[15]

In realising that Australian forces had little to contribute to northern defence in the immediate aftermath of the collapse of ABDA and the defeat in Singapore, the Deputy Chief of General Staff, Major General Sir Sydney Rowell, turned his mind to the issue of intelligence gathering, surveillance operations, security operations and counter-espionage across the remote, accessible and vulnerable northern approaches to continental Australia.[16] Rowell's thinking also led him to conclude that, should the mainland be attacked, Australian forces should essentially not oppose but rather collapse south and focus efforts on securing the populated centres between Melbourne and Brisbane. However, accepting an enemy occupation required a presence of stay-behind elements capable of reporting on enemy movements and conducting harassing and sabotage operations inside the Japanese rear area.[17]

Enter EH Stanner

The task of devising a plan for stay-behind forces in northern Australia fell to a relatively unknown adviser to Francis Forde, the Minister for the Army. Dr Edward 'Bill' H Stanner, an anthropologist by training, had served Forde as a politico-military adviser after being rejected from service in the Army at the outbreak of the war in 1939.[18] Stanner's research into Aboriginal communities around the Daly River and across northern Australia made him well qualified to lead the strategy discussion.[19] It was in Stanner that Forde put his faith to develop the stay-behind mission. Stanner had also recently led a strategic task force to remediate acute supply shortages across the Army and had also been warned to lead an operation to recover sensitive military equipment from Singapore (the activity was abandoned after the Allied surrender). On Forde's recommendation, General Rowell tasked Stanner to widen his reporting and conduct a military appreciation on how best to defend the north with the limited resources available.[20] A planning activity was soon organised and attended by representatives of the three armed services, the US defence attaché and the Royal Flying Doctor Service.

The military appreciation subsequently undertaken by Stanner in 1942 described the need for a new unit, a Northern Australia Observer Unit (NAOU). Stanner proposed a force that would coordinate all surveillance across northern Australia and provide critical information and advice necessary for the War Cabinet to plan for the defence of the continent in

the event of a Japanese invasion. The likely tasks of the NAOU were agreed as: (1) surveillance of the coastal and inland zones of the named area of operations; (2) seagoing surveillance of rivers, coast, and any waterway that gave access to the inland; (3) aerial observation of seaward, coastal and certain inland areas; (4) establishment of a unit headquarters capable of coordinating inter-agency activities; (5) transmission of intelligence to support war planning; (6) counter-espionage and counter-propaganda among Aboriginal tribes and security control of all non-military European, Aboriginal and Asian populations in the area; and (7) establishment and maintenance of 'security zones' around operational centres, to include airfields and port facilities.[21]

Stanner emphasised the need for organic 'mobility' in the NAOU. He chose horses rather than wheeled vehicles based on his own experiences in the area during the 1930s; long-range communications, light weapons and light logistics were also judged as critical elements of capability. Personnel would be required to patrol for months, with little to no support, relying on their bushcraft and local Aboriginal guides to assist them in navigation and local area knowledge.[22]

Stanner drew inspiration for the NAOU from an unlikely source: the South African Boer Commando from almost 50 years earlier.[23] During anthropological research in Kenya during the 1930s, Stanner had heard first-hand the stories of the Boers and their ability to survive in bush conditions in South Africa that were not unlike those of northern Australia. He had also studied closely the German Army's operations in East Africa in the First World War, where more than 160,000 British troops had been effectively contained by fewer than 14,000 Germans who, with their knowledge of local weather and terrain, had proven the ability of small, highly mobile troops and what they could do against larger, fixed forces. 'Time, space, physical movement, and supply' were the philosophical foundations of the NAOU's mission, roles and tasks.[24]

Stanner's appointment as the commanding officer was seen as radical by many other military officers—he had never held a military command before. His previous experience was a brief stint in a military signals unit in the 1930s.[25] In 1942, however, he was universally acknowledged as a genuine military intellectual in addition to being an already established anthropologist, a sought-after newspaper editor and a trusted political

adviser. His written military appreciations were admired by many and are even today acknowledged as 'classics' in terms of quality and prose.[26] Any perceived lack of experience militarily was no apparent concern for Land Headquarters (LHQ) (previously Army Headquarters until April 1942); Stanner was therefore appointed to his first unit command.[27] Operational command and control of the NAOU was soon an ongoing tension across the LHQ staff—should it be responsible to the local military district commander or, given the strategic nature of its role and task, should it be directly accountable to the LHQ itself? Command arrangements based on territorial boundaries were how the rest of the home defence force was structured. Given, however, the unique nature of its mission and the role it was expected to play in the event of a Japanese land invasion, it was decided that the NAOU would be directly commanded by the LHQ. Stanner would notably also be force assigned as 'responsible' to the local field commander, the General Officer Commanding 'NT Force', who commanded the area of operations where the NAOU would deploy and operate.[28]

Throughout May to October 1942, LHQ and local commanders debated the likely role of the NAOU (who had by this time given themselves the nickname 'the Nackeroos' owing to the clunkiness of 'the NAOU' as a collective noun).[29] Using the tasks derived from Stanner's earlier appreciation, LHQ settled on the primary role of surveillance, reconnaissance and reporting. In the event of a Japanese land invasion, the Nackeroos would transition to a guerrilla force with a focus on 'independent warfare', to include sabotage, harassment and offensive action.[30] This mirrored the independent companies operating throughout Portuguese Timor. Notwithstanding their guerilla role in the event of invasion, their mission was primarily intelligence collection and surveillance rather than a fighting role, especially given their force structure, logistics and weapons (unlike most infantry units, which were purpose-designed for close combat). The Nackeroos were to be headquartered in the central Australian township of Katherine, with an Administration Company and a Training and Reinforcement Company, with their three 'Field' companies located in Roper Bar (Northern Territory, east of Katherine, on the coastline opposite Groote Eylandt), Ivanhoe (Western Australia, west of Katherine, beyond Wyndham and out to Bonaparte Gulf) and Gregory Downs (Queensland, south-east of Katherine, stretching along the width of the Gulf of Carpentaria as far east as Normanton).[31]

Raising the 2/1st NAOU

From May to July 1942, the NAOU was a top priority for the Australian Army.[32] The call for volunteers was answered overwhelmingly: hundreds of men signed up, many from recently disbanded light horse regiments and many looking to escape the monotony of Army camp life. The NAOU equipment tables were unlike any other in the Army, consisting of more than 1,500 horses, 41 vehicles, 15 bicycles and six motorcycles. In addition to standard Army-issue rifles and machine guns, the Nackeroos would also carry smaller calibre.22 rifles and 12-gauge shotguns, essential for hunting and foraging.[33] The unit's personnel establishment was also unique—it totalled approximately 550 men, including farrier sergeants, saddlers and a bootmaker.[34] It resembled a light horse regiment of the First World War rather than a reconnaissance unit of the Second. Force concentration, training and operational preparation before deployment would occur in Katherine.

The NAOU was also authorised to integrate 15 guides from the Northern Territory Police and local Aboriginal trackers, who would prove vital to the unit's survival across the coming months; rather than merely living 'off' the land, with their Indigenous guides the NAOU sought to live 'with' the land instead. The integration of military and civilian agencies into an 'inter-agency force' was both new and novel for the Army in 1942.

Operations of the 2/1st NAOU

The commencement of surveillance and reconnaissance patrols of the Nackeroos from their arrival into Katherine on 10 August 1942 finally gave shape to Stanner's strategy; it put the 'eyes and ears' of the Australian Army firmly in those areas where the LHQ had assessed a Japanese land invasion as most likely to occur.[35] It also could not have come soon enough: four weeks earlier, the Army's Western Command (later re-badged as III Corps) had entirely withdrawn from the Wyndham area, leaving it undefended.[36] Reporting of enemy survey vessels inside the lower Gulf region and the recovery of several radio communication sets reinforced the assessment that enemy forces were active in the area.[37]

Between August 1942 and late 1943, the NAOU likely conducted somewhere between 100 and 250 patrols (based on partial war diary tallies and unit reports).[38] These patrols typically lasted anywhere from a few days to several weeks, with small patrol detachments (often four to 10 men) covering large tracts of territory on foot, on horseback, or using light vehicles. NAOU patrols were strafed by Japanese aircraft conducting counter-air and reconnaissance missions.[39] War diary entries show multiple instances of the NAOU reporting unidentified aircraft, possible submarine periscopes off the coast, and suspicious boat landings.[40] While many turned out to be false alarms or friendly vessels, these reports kept Australia's northern command on constant alert and contributed to overall threat awareness. The patrols provided critical early-warning coverage and on-the-ground reconnaissance, helping shape Allied decision-making in northern Australia. They also served as an experimental force, refining techniques for sustained operations in harsh, remote environments. NAOU patrols also trialled various means of long-range patrolling, as well as advanced communication technologies (using wireless telegraphy in harsh conditions across vast distances) and logistics (employing packhorses and scavenged vehicles). These future tactics laid the groundwork for the Army's doctrine and concepts, particularly in northern Australia and South-East Asia.[41] Over the course of its operations, LHQ highly valued NAOU reporting. Surveillance and reconnaissance forces remained in high demand throughout 1942 and 1943, even as the threat of land invasion decreased.

By late 1943, LHQ began to see other priorities, namely operations in New Guinea, and consequently began to reduce the scale and capability of the NAOU. By 1944, the Nackeroos had been re-roled into a coastwatcher unit, no longer conducting the type of long-range surveillance patrols that the unit had been originally designed for. Eventually Stanner himself was posted out of the Nackeroos and back to a research role in Army Headquarters.[42] As the war turned increasingly in the Allies' favour, the NAOU would become less and less prominent; it would be disbanded and removed from the Army order of battle in 1945.[43] No unit capable of the same type of regional surveillance operations would appear again in the Army's establishment until the raising of the North West Mobile Force in 1981.[44]

Learning from the Past to Shape the Future: 2025–2030

The NAOU demonstrated the Army's ability to force project its capabilities across Australia's approaches (including into its vast northern interior) as well as to contribute to strategic intelligence collection through the conduct of long-range surveillance and reconnaissance patrols. Today the Australian Army's presence in northern Australia continues this practice through its Regional Force Surveillance Units (RFSUs): NORFORCE (North-West Mobile Force); the 51st Battalion, Far North Queensland Regiment; and the Pilbara Regiment.

The NAOU's significance stretches beyond the remit of present-day RFSUs, however. Its history highlights key lessons on structuring adaptable forces for various operational needs, the methods of raising, training and sustaining them, and the importance of both innovation and risk management in concept development and force design. Crucially, it also reinforces the value of inter-agency coordination, intelligence and surveillance in protecting Australia's northern approaches. Today these insights are essential for the Army, especially given the multi-agency approach and complex challenges faced by military forces in providing for Australia's security against myriad known threats and adversaries.

By 2025, security concerns reminiscent of those that arose on the eve of the Second World War have again prompted the Australian Government to address how best to safeguard the nation amid growing uncertainty. In April 2024 the government released its inaugural National Defence Strategy, which included this strategic assessment:

> Entrenched and increasing strategic competition between the United States (US) and China is a primary feature of our security environment. It is accompanied by an unprecedented conventional and non-conventional military build-up in our region, taking place without strategic reassurance or transparency. Various other security risks, including climate change, grey-zone activities, and technological advancements, compound the challenges to regional stability and prosperity arising from this competition.[45]

The National Defence Strategy sets as its objective a need to build a future Australian Defence Force (ADF) more focused on deploying military forces inside its strategic 'inner arc', including the immediate region to the nation's north, and providing enduring access to the maritime commons. This objective also comes with the ongoing need to be prepared to contribute to a major conventional war in East and North Asia among great powers.[46]

This capability assessment coincides with what many experts see as a forthcoming military revolution. Rapid advances in applied military and 'dual use' technology, including robotic and autonomous systems, artificial intelligence, and human and machine technology teaming, is featuring significantly in national military arsenals that commentators such as TX Hammes, a former United States Marine and military commentator, describe as 'game changers'.[47] Significant also are the advent of long-range missiles and the use of space and cyber as military warfighting domains, all of which change the equation regarding the deployment and use of military forces. For instance, armies would until recently calculate the 'close, deep and rear' battlespace in the tens to hundreds of kilometres; battles were fought over distances where land forces were able to manoeuvre troops, observe the enemy, and fire artillery and rockets at targets they could see. With the advent of hypersonic and other long-range missile systems, armies now essentially co-equal navies and air forces in their ability to fire missiles, deploy intelligence and reconnaissance assets, and command and control disparate forces over thousands of kilometres.[48] Recent conflicts in Ukraine, regional crises in the Middle East, and the military arms build-up throughout the Asia-Pacific all attest to the importance of these technologies and their critical role in a nation's concept of military power.

The combination of a changing security environment and a revolution in military affairs will require the Australian Army and the broader ADF to reappraise their strategy and concepts, often best described as 'how to fight'. While the National Defence Strategy outlines significant changes to the strategic environment as well as the planned technology uplift of the future ADF, it is important also to acknowledge what does not change in Australia's defence posture: the vastness of the continental interior; the epic scale and distance between the Indian and the Pacific oceans, which define Australia's geography; the South-East Asian archipelago stretching from the Torres Strait north to the South China Sea; and the challenge for a middle power, with a modest population and resource base, to provide for its self-reliant self-defence.

While military history tends to look only to the past, future force design and the development of modern military strategies and concepts must, by necessity, focus on the future. When combined, history and force design can provide a very effective foundation for understanding how to best prepare for security challenges that lie ahead. In the case of the NAOU, the urgency and innovation deployed by the Army to raise a new and specialised unit (noting that it still took six months, despite being in a state of war) offer distinct insights and lessons which strategists and operational planners today can learn from, be inspired by, and apply in their thinking. To that end, what follows is a proposed future operational concept for the Australian Army, enabled by the decisions and investments of the 2024 National Defence Strategy and informed by the wartime experiences of EH Stanner and the NAOU. This scenario is forecasted for the year 2029, when many, but not all, of the planned future ADF capability investments have begun to arrive in service. It also assumes that the international operating environment continues to deteriorate, and that Australia is increasingly concerned about how it will safeguard its future and protect itself from any future threat adversary or declared enemy.

A Scenario-Based Concept of Employment, 2029–30: A Strategy in Advance

The year is 2029. The ADF is force-structured following the policies and directions of the Australian Government's 2023 Defence Strategic Review and 2024 National Defence Strategy, focusing on 'deterrence by denial' as a military objective.[49] This approach largely follows Australia's tradition of strategic thought, defined by its Asian geography, its Western identity, its status as an island continent and the importance it places on allies for security beyond the limit of what it can provide.[50] With investments in long-range space-based intelligence, surveillance and reconnaissance systems, cyber effects, and littoral force projection now coming online, military commanders see options to deploy operational concepts throughout Australia's inner arc should the strategic environment warrant the employment of military power to prevent coercion from a hostile power or rogue state.

However, 2029 is a challenging year. Much of the planned investment in maritime and strike capability for the future ADF is still some years away. At this time, Australia does not have access to any Virginia-class submarines, which are not due for delivery until the early 2030s under the 2021 AUKUS Pillar I program.[51] Sustainment, maintenance and fleet rotation of its aging Collins-class submarines places significant pressure on the ADF's deterrence capabilities. Much like the military crisis of 1942, the rapidly changing security environment suddenly exposed the lack of immediately available high-readiness military forces to defend Australia against any hostile state with hostile intent. In 2029, political and military leaders are once again at risk of being unable to deter any potential aggressor if confronted at a time when the ADF has not yet fully completed its re-capitalisation as a result of the policy-driven reforms of the early and mid-2020s. In short, 2029 is the year when Australia is reminded again that it does not always get to choose when conflict and war come; in this case, it arrives before much of the force is ready. There is no AUKUS submarine fleet, only partially upgraded destroyers, no anti-submarine frigates, no additional general-purpose frigates, too few amphibious ships and only a few littoral vessels as well as a small number of minor warships, all committed to constabulary duties across Australia's northern approaches.[52]

It is not all doom and gloom, however. The 2024 National Defence Strategy did make some provision for accelerated delivery of a few advanced weapons and platforms, specifically in the land-based surface and maritime strike capabilities of the Australian Army, as well as continuing to deliver the 'objective force' structures derived from its 2019 Force Structure Plan. By 2029, the Army has upgraded and re-capitalised its close combat capabilities with new investments in combat reconnaissance vehicles, infantry fighting vehicles, main battle tanks, armoured bridging and breaching capabilities, self-propelled artillery, combat aviation and deployable logistics. Perhaps most significantly, however, has been the uplift of the Army's contribution to joint strike—the essence of any military deterrence strategy. The delivery of the High Mobility Artillery Rocket System (HiMARS), complete with its sophisticated 'missile mix' and surface, maritime and air defence guided weapons now enables it to threaten maritime choke points, target ships on the high seas, provide close and general air defence, and essentially threaten enemy forces at the *operational* level of war. When combined with the newly arrived littoral combat fleet, as well as an upgraded and enhanced security relationship

with allies and partners throughout the region, the Army both conceptually and mechanically can now project forces across Australia's northern approaches, operating alongside the Navy and Air Force, as well as deterring potential enemy force elements at ranges and distances now in the hundreds, if not thousands, of kilometres.

The Army also paid close attention to the lessons and insights of the 2022 Russo-Ukraine War and other regional conflicts. Throughout the 2020s, it invested heavily in emerging technology, including its robotics and autonomous systems programs, distributed digital command and control systems, and theatre logistics capabilities. Crucially, the Army also refined and developed its operating concepts by identifying more as a 'marine force', capable of being an amphibious-enabled expeditionary force closely aligned to the United States Marine Forces—Pacific.[53] Army also concentrated heavily on developing its long-range strike, force projection, and theatre logistical capabilities, ultimately meaning that it was capable of deploying into South-East Asia and the South-West Pacific either as an element of a joint force or, if necessary, as a standalone land force, using its watercraft and intra-theatre aviation assets to do so.

Deterrence by Denial, 2029: Anti-Access through Persistent Presence[54]

The story of the NAOU demonstrates how quickly the Australian Army can raise and train specialised units under the pressure of imminent threat despite limited resources and time. This aligns with the demands of the modern ADF, whereby geography and strategic necessity drive an emphasis on northern and archipelagic operations, especially in a resource-constrained environment, as the Army was in 1942. Technology, in the form of robotics, artificial intelligence and long-range missiles, also now enables the Army to contribute significantly to the maritime and air domains, just as radios and aerial surveillance did for the NAOU and other Army units in the Second World War. Much like the NAOU's innovative response in 1942, the Army in the late 2020s once again finds itself in a race against time to field and integrate cutting-edge technologies while refining new operational concepts. Unlike the NAOU, however, this time its operational concept for northern defence is no longer confined to 'ABDA's elbow room'—thanks to modern military technology, the Army is now as capable as air and maritime forces to project itself well into Australia's northern approaches, thousands of kilometres beyond its continental shores.

By 2029 the Australian Army has reconfigured itself into small, lethal, low-signature, mobile and survivable force elements designed to operate throughout South-East Asia and the South-West Pacific as the leading edge of an ADF deterrence strategy focused on establishing and maintaining an anti-access, area denial capability as a foundational operational concept. Critical is the need for the Army to contribute to this deterrence through *persistent presence* throughout the area of operations, with the primary aim to be able to deploy into South-East Asia and the South-West Pacific, prepare and defend key areas (including maritime choke points), build deterrence capacity by partnering with local forces and, where necessary, conduct offensive operations against any hostile power seeking to interdict Australia's key maritime trade routes or attack the Australian continent directly.

The Australian Army's enduring function throughout the pre-conflict phase is to support the joint force to 'win' the intelligence, reconnaissance, counter-reconnaissance and surveillance battle at every point (much like the NAOU before). Land forces, both in 1942 and in 2029, do this by gaining and maintaining contact with regional partners and allies, establishing a joint fires and command and control network with the ability to develop and 'lay on' targets discreetly, and conduct preparation in anticipation of any sudden or rapid escalation triggering conflict. The central purpose of the *persistent presence* phase is to assist the joint force commander in identifying and countering any enemy preliminary actions that threaten to undermine Australia's security in the region and commence any preparation necessary in anticipation of likely future conflict.

As it was for the NAOU in 1942, establishing targeting and surveillance networks in the early phases of *persistent presence* is crucial for the Army on behalf of the joint force. Completing 'kill webs' that can rapidly identify and select potential future targets within and across intelligence and joint fire networks is essential to building the common operating picture necessary to enable future joint strikes. Army, as a networked, integrated component of the future ADF joint fires network, will be critical in this regard, especially in the early phases of a deterrence strategy when other joint assets, including clearly identifiable and overt maritime and air platforms, may not be able to penetrate adversary systems without significant risk or compromise.

Through these early *persistent presence* deployments and actions, the Australian Army becomes an operational problem for any potential adversary even before the commencement of hostilities—an army capable of threatening maritime forces before any conflict across the Indo-Pacific region is a problem for any enemy naval task group and *must* be dealt with if operations are to occur without being threatened from coastal and littoral access points. Army, in its *persistent presence*, is now capable of overwatching critical maritime choke points and effectively *deters* any potential adversary by denying them freedom of manoeuvre. For deterrence to succeed, however, it must be legitimate—it must shape the thinking of a potential adversary to a point where 'the costs outweigh the benefit'. Land-based maritime strike capabilities are critical in this instance. *Persistent presence* also draws on the history of the NAOU, honouring the operational concept of EH Stanner as it focuses on military operations in the enemy's rear area before hostilities and pre-positions advance force elements in key terrain areas in anticipation of conflict.

Deterrence by Denial, 2029: Area Denial through Offensive Strike

Suppose the *persistent presence* phase of a 2029 military strategy fails to deter an adversary. In that case, vertical escalation by the ADF into an 'area denial' phase becomes the sequel to the operational concept. In this scenario, the Australian Army's *persistent presence* force pivots into military operations, where locatable and tracked adversary platforms and assets are instantly declared as actionable targets on strike lists. Supporting ADF forces would deploy rapidly by sea, air and land from across the region, set the operational theatre, and leverage the existing land-supported joint force's sensors, strike, and manoeuvre assets to commence decisive military operations. 'Kill webs' activate, and targets are serviced by a joint fires network capable of employing air, maritime, space, cyber and surface fires to neutralise enemy combatants within declared operational areas. This phase is designed to be sudden, violent and decisive. It also anticipates the likelihood of hostile action from an enemy at any point, meaning that the Army must also be capable of rapidly scaling from its current force structure into a mobilised one.

When deployed forward with land-based maritime strike capabilities, Army force elements, protected by their close combat system, can perform sea denial through organic sensors and weapon systems as part of an ADF joint fires network, integrated with naval, air and other joint all-domain

capabilities. In 2029 the Army also possesses sufficient organic littoral manoeuvre and offensive capability to hold tactical positions of advantage and manoeuvre force elements independent of the Navy and Air Force. Army, including special forces, can also seize and secure contested ports and airfields and control critical maritime sea lines of communication. Army also enables concurrent joint operations, including amphibious lodgements to support other theatre objectives.[55]

This phase is the culminating point of this 2029 operational concept.

Of note in this phase is the emergence of two new distinct tasks for Army force elements. *Maritime reconnaissance* by land forces throughout Australia's strategic arc is now a mission-critical task for the Australian Army. Army's 'leading edge' forces responsible for this maritime reconnaissance mission will likely consist of robotic and autonomous air, land, maritime and space systems. These systems will have the range and endurance to perform an ADF first-echelon 'advance guard' on behalf of the joint force (much like the NAOU in 1942). When integrated into existing joint command and control (including the Joint All-Domain Command and Control system as part of the ADF's future Advanced Battle Management System), Army maritime reconnaissance forces will be capable of effectively operating across vast tracts of land, air and sea, consistent with the range and distances typical of the Indo-Pacific region.

The second emergent task for the Army in 2029 is to provide the forward edge to the ADF's *defence in depth*. Whereas the 1987 White Paper pointed to an air- and maritime-centric force necessary to control the 'sea-air' gap, by 2029 this is no longer appropriate given the evolving threats against naval and air platforms across the Indo-Pacific region.[56] Due to rapid advances in space-based surveillance, the maritime commons no longer provide a sanctuary for ships or aircraft to avoid detection—therefore, the 'large, expensive and few' are, by necessity, replaced by the 'small, cheap and many', including not only hardened, mobile and protected Army force elements but also significant numbers of drones and remotely operated surveillance systems. When combined, the land force's ability to hold a hostile power's critical assets at risk and deny them sanctuary across both phases of the ADF's future operating concept further highlights the utility of this force. From 2029, the Army's ability to generate sea denial through long-range detection and maritime strike capabilities throughout South-East

Asia and the South-West Pacific becomes fundamental to Australia's future deterrence strategy, relying upon combinations of geography, technology and tactics. In this regard, its two new tasks, 'maritime reconnaissance' and 'defence in depth', become critical across both the persistent presence and offensive strike phases of the ADF's future deterrence strategy.

Lessons from History

The NAOU legacy is not simply a footnote in history; it is a study of how Australia can secure its remote northern expanses under resource constraints and in rapidly shifting threat environments. By examining how the NAOU integrated with other agencies and local communities, empowered non-traditional leaders and specialists, innovated using both low-tech and high-tech solutions and improvisation, enhanced surveillance and early-warning capability, and laid the groundwork for modern RFSUs' enduring mission, the Australian Army of 2029 can harness these insights to strengthen its capacity for flexible, agile defence solutions for northern Australia. In doing so, the NAOU experience becomes a timeless example of how to blend people, technology and local knowledge into a force capable of detecting, deterring and responding to evolving security challenges—just as it did eight decades ago.

Both history and future force design converge in shaping Australia's defence posture. The NAOU's legacy—urgency, innovation, adaptability and the importance of intelligence-driven operations—remains relevant. By learning from the NAOU's experiences, today's Army can better adapt to an uncertain strategic environment in a rapidly changing Indo-Pacific theatre.

Conclusion

The Army of 2029 vastly differs from the Army at any time in its previous history. Much as the Australian Army experienced between 1942 and 1945, the Army has reassessed its core operating concepts and capabilities and adjusted itself to meet an urgent operational need. In that same vein, the Army will continue to draw upon the lessons of the NAOU, with its focus on preparing for military operations inside a contested (or even possibly occupied) area, as well as its emphasis on intelligence gathering, surveillance, disparate command and control, distributed logistics, joint

operations, and offensive action. The history of the Nackeroos provides a novel insight into how the Army manages crisis and change in war.

The decisions and investments of the 2024 National Defence Strategy aim to give the ADF a 'home field' advantage; just like EH Stanner's operational appreciation of 1942, the National Defence Strategy seeks to describe the need for new force elements and capabilities. What would significantly improve the quality of professional discourse regarding military capability and high-level strategy would be a greater, more intense appreciation of Australia's military history, the nature and character of the region in which it operates, and an intelligent, open discussion on some of the operational concepts that describe how the Army will best operate to defend Australia over the coming decades. A straightforward, compelling narrative describing how future military forces *might* be used could significantly benefit future strategies and improve the quality of the 'future of war' debate in Australia. It would also give greater logic and purpose to the substantial uplift in investment expected over the coming decades as Australia grapples with protecting itself in an uncertain and changing world.

About the Author

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54 This proposed concept *does not* represent the breadth of contingencies, roles or likely missions of the future ADF; it instead seeks to demonstrate the aggregation of national power circa 2029 based on current government policy. Australia must also manage its other core security interests, which include access to the maritime commons, undersea infrastructure, defence alliances etc. It will most likely also maintain force elements capable of sub-Antarctic operations, humanitarian assistance and disaster relief operations, domestic counterterrorism and other related civil assistance tasks as future strategic circumstances dictate.

55 This phase of the Army's 2029 strategy represents the total capacity of its planned capabilities. It goes to the heart of many of the investments announced over various policies and strategies from 2019 to 2024. In addition to its newly formed maritime surveillance and maritime strike role, Army, as the land force element of the 2029 joint force, must also enable other warfighting domain operations, including long-range strike and air and ballistic missile defence; air combat and strategic lift operations; commanding and controlling air and maritime space via a joint, all-domain command and control system; and offensive strike (including tactical to strategic kill chains, full-spectrum targeting, alliance integration, and theatre missile defence); as well as integrated and resilient reconnaissance and surveillance systems, long-range maritime strike, naval task group operations, limited undersea surveillance and long-range 'deep' strike (specific to special forces and Tomahawk land attack missiles).

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Proxy Warfare in Yemen: An Enduring Strategic Challenge

Andrew Maher

On 24 May 2024, the Australian Government quietly designated Ansar Allah (also known as the Houthis) as a terrorist organisation.[1] The Australian terrorist designation was made long after the Houthis initiated attacks on Red Sea shipping in solidarity with Hamas following the 7 October 2023 attacks, and long after the Houthis became the de facto government for northern Yemen (circa 2014), emulating the governance models of Hamas in Gaza and Hezbollah in southern Lebanon. When the Houthis threatened maritime shipping in October 2023 in solidarity with Hamas and the 'Axis of Resistance', they became a hostile actor to the global system that could no longer be ignored.

Understanding the Houthis is important for several reasons. First, the Australian Defence Force (ADF) is now engaged under Operation Hydranth in supporting the US's and the UK's defensive actions, targeting the capabilities used in Houthi rebel attacks in the Red Sea.[2] Second, an insurgency wins by not losing; to date this principle is playing out for the Houthis. US and UK efforts have failed to prevent continuing attacks against Red Sea shipping. Understanding how the Houthis have resiliently withstood the Saudis, British and Americans is imperative, given the ADF's similar methodologies for waging war. Third, the Houthis have demonstrated asymmetric capabilities with strategic effect in their campaign

of littoral strike. Analysing how this has occurred is particularly relevant to understanding how a much weaker power can persevere in imposing costs on sea lines of communication despite the seemingly overwhelming ubiquitous technical surveillance capabilities of its stronger opponents. Fourth, support for insurgency creates a proliferating proxy warfare dynamic as regional and global powers seek to impose costs upon their competitors. In this context, the Houthis are just as much a nationalist insurgency as they are a manifestation of the 'Axis of Resistance' or the Iranian Threat Network (ITN). This proxy dynamic threatens retaliation against Israeli or American interests in the Middle East. It also represents a form of strategic asymmetry relevant to ADF preparedness in a period of strategic competition against a broad range of threats.

This Houthi campaign of strikes and attempted strikes against maritime shipping in the Bab el-Mandeb Strait is highly asymmetric. In 2024, the targeting of just 5 per cent of maritime traffic transiting the Red Sea (some 134 vessels from October 2023 to December 2024) had resulted in the re-routing (or other forms of disruption) of 20 per cent of global maritime traffic.[3] Many of these attacks were conducted with Iranian-supplied military equipment.

The way that the West is currently embroiled in the Houthi insurgency has parallels in the engagement of Western interests in the conflict in Yemen in the mid-Cold War period of the 1960s. This proxy conflict grew in scope over time, metastasising with broader regional tensions, eventually contributing to the causes of major conventional conflict during the Six-Day War. Proxy competition also spread laterally to undermine British interests in Oman during the Dhofar War. There are lessons that might be drawn from this period of history that could help mitigate the risk of vertical escalation into regional war today.

This article explores the implications and dimensions of proxy wars involving Yemen in recent history. In doing so, it seeks to familiarise Australian policymakers with the roots of the Houthi insurgency and to inform ADF decision-makers tasked with prosecuting operations against Ansar Allah's maritime strike capabilities under Operation Hydranth.

This article builds upon themes concerning the nature of strategic competition which will be further explained in my forthcoming book *Riding Tigers: The Strategic Logic of Proxy War*. The case studies examined

in this article, complement and reinforce the book's key findings—most importantly, that proxy wars emerge during periods of strategic competition. The implications of this understanding are profound for their relevance to ADF efforts to 'shape' and ultimately 'deter' confrontations that occur between state and non-state powers from escalating into open conflict—thus avoiding the need for the ADF to 'respond' to such conflict. In this regard, it is critical to acknowledge that Australia is not, and will never be, the only party wishing to 'shape' the outcomes of strategic competition. Thus we need to understand how other competitors will shape the strategic environment toward their desired ends.

Cold War Competition: The Egyptian–Saudi Cold War

> *Be sure to tell [Saudi King] Faisal that we will not be dragged into his little war in the Yemen.*
>
> Secretary of State Dean Rusk's guidance to Ellsworth Bunker[4]

During the 1950s, President Nasser of Egypt sought to challenge British influence in the Middle East and exploited the unstable environment of Yemen to do so. At this time, Nasser used confrontation with the British as a foil to justify his legitimacy as the leader of the Arab world. Britain was vulnerable to subversion due to having recently faced simultaneous crises in Malaya, Kenya, Cyprus and Borneo, begetting a perception of the end of the British colonial period. Conversely, these overlapping crises sharpened London's perception that its strategic interests were under threat and that it needed to generate cost-effective response options.[5] The Soviet Union was the other key player. Having built upon the Comintern of the 1920s and 1930s, by the 1950s it had codified a pattern of 'economic penetration, propaganda, subversion and, if necessary, revolution'.[6] In the post-World War II environment, particularly in the post-1956 Suez crisis period, Moscow began to weaponise Arab nationalism as a component of strategic competition.

In light of the rising threat of Arab nationalism, by June of 1955 British strategic thinking had extended to the use of proxy methods to clear up 'the present troubles in the Aden Protectorate'.[7] Limited provision of arms to Yemeni tribesmen had begun by May 1958, with the stated purpose being to enable cross-border raids into Yemen against military posts and lines

of communication.[8] The British also sought to unify the tribes in the Aden hinterland under a 'Federation of Arab Emirates of the South'.[9]

Yemen's leader, Imam Ahmed, believed that the concept of the Federation was a challenge to his power base, the Zaydhi Shi'a. This was because the predominantly Sunni tribes of the Federation shared a fraternal tie with the two-thirds of Yemenis who followed the Sunni branch of Islam. Imam Ahmed thus believed that the 'Free Yemeni' movement was supported by the British administration in Aden.[10] Consequently, he replied in kind by seeking to foster dissent between the tribes that constituted the Federation, exacerbated by the provision of arms.[11] Ahmed also courted Eastern Europe, Russia and China, while accepting Nasser's proposal for a United Arab Republic (UAR) between Egypt, Syria and the Yemeni Imamate.

In 1956, Soviet Ambassador Evgenii Kiselev consulted with Nasser about the provision of Soviet support to Yemen.[12] This outreach was partly driven by Egypt's resistance to the British, French and Israelis during the Suez crisis.[13] Moscow was thus presented with a wedge against NATO solidarity, with President Eisenhower siding publicly against British and French policy. Soviet arms shipments began to flow to Egypt and Yemen, closely followed by Soviet and Egyptian military missions to Sana'a. The Soviet advisers were 'responsible for weapons maintenance and training and the Egyptians providing instruction on strategy and tactics at the new military college in Sana'a'.[14] Soviet 'volunteers' were also deployed to Egypt, with as many as 1,000 technicians and instructors deployed by November 1956.[15]

A Soviet interest-free loan to Yemen facilitated the construction of a port at al-Hudaydah, inaugurated in January 1962, followed by a TU-16-capable airport near Sana'a.[16] This 'dual-use infrastructure' overshadowed the Bab el-Mandeb straits at the eastern exit of the Red Sea to the Indian Ocean and exacerbated Western fears of Soviet intention to dominate the northern Indian Ocean region and thus hold Middle Eastern petroleum exports at risk.

In 1961, Nasser's UAR project started to collapse. Imam Ahmed, fearing the level of Egyptian influence that had been created during the UAR era, sought to balance it by accepting American aid.[17] From a Soviet point of view, they risked 'losing Yemen' in a manner akin to the later Politburo concerns about losing Afghanistan in 1979. Nasser, furious at Ahmed's affront to his socialist project, called for the Imam's overthrow.[18]

On 26 September 1962, 'free officers' led a coup that overthrew the centuries-old Yemeni Imamate and established the Yemen Arab Republic (YAR).[19] Egyptian support for the Republican government in Sana'a followed so closely thereafter that observers saw Egyptian influence driving the Yemeni revolutionaries.[20] The Egyptian plan was to 'use "nationalism" and republicanism to undermine' and 'thus to overthrow the present regime' that, in turn, might 'make the British position and the military base in Aden untenable'.[21] A Soviet-supported air-bridge began almost immediately after the coup—indeed, suspiciously soon after the coup—between Cairo and Sana'a, alongside the Egyptian merchant marine beginning 1 October.[22]

These logistic support efforts occurred concurrently with the Cuban Missile Crisis, a context that highlights the need for a global view of strategic competition. Rapid Soviet decision-making following the coup manifested in Khrushchev's support for the dispatch of Soviet pilots and planes. It is notable that China's limited incursion into India—the Sino-Indian War—also occurred at the same time, and the combination of these events undoubtedly left US policymakers with limited capacity to also consider strategic developments in Yemen. It is unclear, but these concurrent crises may have been the basis of a deliberate strategic calculus by the Soviets to exploit the West's distraction in order to achieve a fait accompli in Yemen.

The Aden Emergency

Less than a year after the coup d'état in Sana'a, in October 1963 a tribal uprising began in the Radfan—the mountainous region north of Aden.[23] By December, the British were forced to declare a state of emergency in Aden due to escalating political violence. This declaration was significant as Aden was, at this time, the home of Britain's Middle East Command—the headquarters for the region which could also base a rapid-reaction force.[24] In other words, it fulfilled a position of strategic importance commensurate with that held by Royal Air Force Base Akrotiri in Cyprus today.

The British counterinsurgency efforts that began in October 1963 were soon losing ground against the Egyptian-supported National Liberation Front in the Radfan area of the Federation of South Arabia territory (i.e. present-day southern Yemen) and in Aden itself.[25] Egypt supported multiple 'horses', its influence extending to the Organisation (later Front) for the

Liberation of Occupied South Yemen, which mounted mass demonstrations to discredit colonial authority.[26] The British Joint Intelligence Committee (JIC) summarised:

> The Yemeni Republicans will continue to try to undermine the authority of the Federal regime, especially that of the Sherif of Beihan, by encouraging disorders and revolts, by actively supporting tribal dissidents in the Protectorate and … by using Sana'a Radio for inflammatory broadcasts.[27]

In response to this threat, commencing in the summer of 1964, the British responded in kind by supplying arms and money to Royalist Yemeni tribesmen (i.e., supporters of the Zaydi Shi'a Imamate) under Operation Rancour.[28] The impetus for this operation was a British view of Egyptian complicity in sponsoring an 'organised campaign of terrorism' in Aden.[29] By 1964, the British had concluded that the Egyptians had assumed 'complete direction' over the insurgency.[30]

Over time, British support escalated to include the covert supply of weapons and active organisation of small-scale retaliatory operations carried out by royalist Yemeni tribesmen.[31] British and French mercenaries (66 British and 24 French, who were financed by Saudi Arabia and logistically supported by Israeli military aircraft) were reportedly used to aid these rebel groups—seemingly demonstrating a discreet policy position of containment without confrontation.[32] The British mindset of retaliating by sponsoring proxy warfare as a 'punishment' was evident through Joint Action Committee deliberations that carefully and discreetly calibrated such operations through British-sponsored tribes against Egyptian-sponsored attacks in the Federation of South Arabia and in Aden.[33]

British efforts at proxy warfare were amplified by the use of 'unattributable propaganda' to highlight 'Egyptian brutality, imperialism, and subversion'.[34] British policymakers saw Egyptian influence as destabilising their plans for an orderly transition to local governance when they withdrew from Aden in November 1967.[35] This sense of threat led to the establishment of the South Arabian Action Group (SAAG), whose stated purpose was to 'weaken the Egyptian position in Yemen'.[36]

Proxy Warfare as a Form of Strategic Competition

Egyptian interests in the YAR (North Yemen) were ultimately thwarted by the Royalist Yemeni insurgency against the Republican government. The support required from Egypt grew from several hundred commandos in October 1962 to roughly 70,000 men by the summer of 1965 as the insurgency matured.[37] Former Egyptian General Muhammad Fawzi, Minister of Defence during the 1960s, subsequently confirmed that such heightened Egyptian expenditure of resources was never intended—it was always meant to be a limited action.[38] Yemeni Royalists were creating a quagmire for the Egyptian military, much as Afghan mujahedeen would do for the Soviets two decades later. In the summer of 1965, the Yemeni Republican effort seemingly culminated, suggesting that the British efforts at proxy warfare had been effective.[39]

The Egyptians withdrew from Yemen by 15 December 1967, with the country divided. Generally speaking, most of the countryside was in the hands of the Royalists while the cities were held by the Republican government. The Egyptian withdrawal was likely influenced by the attainment of their (and their Soviet sponsor's) strategic objective of removing British influence from Aden and, therefore, the region.[40] It is also notable that, at the time of the commencement of the Six-Day War in June 1967, Egypt had approximately half its ground forces still bogged down in Yemen, dislocated from where they were needed in the Sinai.[41] Egypt's attention and resolve were also diminished by its concurrent support to Somalia, southern Sudanese forces, and the Eritrean Liberation Front during the 1960s.[42] While the Egyptians were undoubtedly influenced in their decision to withdraw from Yemen by the significant losses they had incurred during these conflicts, it was not the sole determinative factor.

Absent the context of competition, the Saudi government sought to end the Yemeni civil war by recognising the YAR and abandoning its Royalist proxy. The Soviets filled the gap that the Egyptian withdrawal created, using their pilots to directly intervene in supporting the YAR, an approach that emulated their strategic behaviour in the Korean War (Soviet aviators likewise supported the North Korean war effort a decade earlier).[43] Ultimately, however, Soviet focus shifted alongside Egyptian priorities to the War of Attrition over the Sinai (1967–1973). The Yemeni civil war thus came to an end in December 1970 absent support from the patron states: Egypt, Saudi Arabia, the Soviet Union and Britain.

Lessons

An Arab 'Cold War' emerged for the leadership of the Arab Middle East. This regional competition existed within the context of the global Cold War, in this case, placing the Soviets and British in competition over the strategic terrain of the Bab al-Mandab Straits and the Red Sea.

The US understood the significance of this emergent competition. This is evidenced by President Kennedy's National Security Memorandum 227 of 27 February 1963, which offered to base a US Air Defence squadron in Saudi Arabia with the purpose to 'deter UAR air operations' and thus contain the competition in Yemen.[44] The Soviet Union backed Egypt as its regional proxy in order to further its strategic interests in the Middle East, including Yemen.[45] Perhaps sensing success in Yemen, Russia commenced support to Somalia in 1964, thus underscoring the strategic interests that had inspired its Yemen adventure—controlling the Bab el-Mandeb straits.[46] Soviet policy was borne by a sense of a new 'correlation of forces' in the Middle East at the commencement of the 1960s.[47] Rather than achieving its objectives, however, the Soviet Union was dragged into the Yemen conflict by Egypt, a situation that paralleled the experience of the US in South Vietnam over the same period.

Underlying such dynamics is another facet of this Arab 'Cold War': the financial and ideological support provided by Saudi Arabia to the Muslim Brotherhood from the mid-1950s through to 1990.[48] This subtle support most sharply manifested itself in the failed uprising of the Arab Nationalist Movement in Egypt in June 1969. In other words, it is important to recognise that a sub-competition also existed, beyond that between the major powers—the Soviet Union, the UK and the US.

The Yemeni civil war left the YAR (North Yemen) in a state of disrepair with limited resources to rebuild. As a consequence, it remained closely tied to Saudi Arabia. Meanwhile, Saudi Arabia faced a new competition with the nascent Marxist People's Democratic Republic of Yemen (PDRY, or 'South Yemen'), which had won the Aden insurgency on 29–30 November 1967.[49] Riyadh cultivated an army of ex-Royalist Yemeni from the north and ex-sultans from the former southern protectorates of the Federation as its proxies in the PDRY. Thus, Riyadh imposed costs upon the PDRY and kept its options open.[50] In its efforts to maintain influence over the Bab el-Mandeb straits, the Soviet Union directly supported the PDRY. In doing so it

proved how fickle it could be as a patron by its switching support from the YAR to the PDRY and thereby demonstrating how its actions were guided by its evolving national interests rather than its former allegiances. It is to the proxy warfare dynamics employed by South Yemen that we shall now turn.

Late-Cold War Competition over Oman

An outcome of the Aden Emergency was the emergence of the Communist government in PDRY (South Yemen). Almost immediately, in 1965 the Communist government in Aden established a front organisation—the Dhofar Liberation Front (DLF, later the Popular Front for the Liberation of the Occupied Arabian Gulf, PFLOAG)—to wage an insurgency that pursued the secession of Dhofar from Oman.[51] The DLF was also quickly supported by other revolutionary regimes in the region: Iraq, for example, trained some 140 fighters in guerrilla warfare in the winter of 1965.[52]

Israel's victory in the Six-Day War served to radicalise Arab opinion across the Middle East. The ignominious British withdrawal from Aden in November 1967 further amplified Arab nationalist sentiment and the perceived benefit of using irregular warfare methods. This was the first example of the British having been militarily defeated in the region by 'Communist Revolutionary Warfare' doctrine, which was exploited to its full by Communist propagandists. Smarting from the humiliating experience of withdrawal from Aden, Britain refused to allow itself a second defeat in Oman, coming so soon after its Aden fiasco.[53]

Capitalising on the burgeoning nationalist sentiment, the DLF insurgency soon came to dominate large swathes of the Dhofar countryside. This included the Jebel highlands region, which accounted for some 80 per cent of the Dhofar region.[54] From 1968–70, the DLF campaign was supported by South Yemen, the Soviet Union and the People's Republic of China (PRC). Importantly, this backing was hardly fraternal; the Soviet Union and PRC were then in competition for influence globally. It was this dynamic that saw Dhofari leadership training in both China and the Soviet Union, the PRC establishing guerrilla training camps in South Yemen, Cuban guerrilla warfare instructors schooling Dhofari rebels in South Yemen, and even the provision of Chinese combat advisers in Oman (until January 1968 when an adviser was killed in an ambush).[55] In other words, a local competition for influence in Arabia drew major powers already locked in strategic competition.

The writ of the Sultan of Oman was, by 1970, contained to the immediate surrounds of Salalah on the coast and South Yemen, such was the success of the Dhofari insurgency. The PDRY unsuccessfully sought to spread the rebellion to other regions of Oman. The DLF, now known as the PFLOAG, was capable of fielding 2,000 fighters in the field for offensive operations and was supported by another 3,000 militia members in the Jebel, capable of defensive operations.[56] A competing insurgent organisation, the National Democratic Front for the Liberation of Oman and the Arab Gulf (NDFLOAG), attempted a '*focoist*' insurrection in northern Oman on 12 June 1970, which proved a spectacular failure.[57]

In 1970 a palace coup—with UK Chiefs of Staff backing—led to Sandhurst graduate Prince Qaboos bin Said becoming Sultan.[58] British counterinsurgency support to the Sultan's Armed Forces (SAF) followed, as did eventual support from Iran in 1973.

British support proved particularly consequential in rolling back PFLOAG influence in Dhofar. The trust placed in the British advisers by Sultan Qaboos enabled a collaborative and ultimately war-winning 'hearts and minds' approach to counterinsurgency efforts against FPLOAG. This had been impossible under his stubborn father, who preferred more repressive (and counterproductive) methods. This counterinsurgency effort was reinforced by the establishment of a minor British footprint operating from Salalah alongside the SAF and would soon involve the use of irregular tribal militia—the *firqa*, *firaq* or *firqat*. Britain once again found itself fighting fire with fire, waging cross-border raids and fomenting proxy warfare into South Yemen in a covert action that was strongly supported by the Chief of General Staff, Sir Michael Carver (April 1971 through October 1973).[59]

At Sultan Qaboos's request, the British began to train a *firqa* for 'unattributable small-scale guerrilla operations', known as Operation Dhib.[60] The British rationale for supporting this request was that the agreement was intended to aid the British to resist requests for direct intervention in support of the SAF, a situation that would have risked escalating the conflict. This risk was acutely felt in May 1972, when cross-border artillery and air-strikes were exchanged.[61] The proxy effort proliferated; the Jaysh al-'Asifa ('army of the storm') *firqa* was recruited by MI6 with Saudi Arabian funding to conduct raids into South Yemen, and Sultan Qaboos also directly mobilised a 250-man *firqa* independently of the British.[62]

Ultimately, the British-backed campaign was able to roll back the PFLOAG towards the Omani border with South Yemen. This followed the flawed decision by the PFLOAG's leadership to fight conventionally from December 1974 until March 1975 to defend its logistics bases just inside the Omani border.[63] Becoming fixed to its logistics bases removed the advantages of guerrilla warfare, making British-provided firepower decisive. The insurgency thus concluded in January 1976, albeit with the final PFLOAG operation attempted on 9 May 1979.[64]

Concurrently to the Dhofar insurgency, a minor war broke out between North and South Yemen in September–October 1972. Hostilities were initiated by the North, preceded by incursions of Saudi-supported rebels in February, involving the mounting of attacks in South Yemen, in addition to an assassination attempt against Prime Minister Ali Nasir Muhammad in May.

In both the YAR (North Yemen) and PDRY (South Yemen), Soviet and Chinese competition for influence continued apace throughout the 1970s. Beijing's efforts were ultimately frustrated by an atmosphere of instability and a gradually radicalising regime in Aden.[65] Of course, both the YAR and PDRY regimes played the foreign powers off against each other, with Soviet largesse ultimately winning out. It must be noted that this competition for influence in Yemen occurred during the period of Soviet reversal in Somalia, in which Moscow lost access to the port of Berbera (which had been cultivated through the 1960s, with port visits beginning from 1972).[66] The Soviet Union scrambled to pivot support to the revolutionary Ethiopian state (led by the Derg) following the 1974 revolution and thus to retain its influence over the Bab-el Mandeb straits. It is therefore unsurprising that it had a low risk appetite for the potential loss of port facilities at Aden (PDRY) and Hudaydah (YAR).

Lessons

Following the PDRY's success in Aden and South Yemen, Marxist-Leninist theory, accentuated by the interests of its major power sponsors, urged expansion of the conflict into Oman. This strategy was initially successful and, had British will not been so resolute, it very well may have succeeded. It is important to recognise that multiple subversive organisations may themselves be competing for influence, and that the manner in which such influence is created is important. The PFLOAG employed a slow and deliberate expansion that was proving successful; the NDFLOAG attempted a rapid insurrection which proved unsuccessful.

While there are abundant lessons for counterinsurgency practice demonstrated by the British in the Dhofar campaign, of particular relevance to this paper is the British proclivity to engage in proxy warfare. It did so with the support of Saudi Arabia, which unsurprisingly had negative second-order effects. Saudi Arabia's interests in its near abroad lay behind its support to North Yemen, much as British interests in Oman lent MI6 support for the raising of these tribal militias in South Yemen. The cautionary lesson is the potential for any proxy warfare action to be reciprocated and, in turn, to expand the conflict horizontally, even though its ascribed purpose is to constrain escalation vertically. In the case of this Cold War example of competition over Eastern Arabia, the conduct of proxy warfare also had the effect of fomenting divisions within South Yemen's own borders—divisions that manifested in a brief civil war in January 1986.[67]

A New Competition—the Shi'a-Sunni Cold War

In 1990, North and South Yemen merged into today's state of Yemen. The loss of external patronage from the major powers likely contributed to this reconciliation, albeit with ongoing distinctions between the north and south that continued to re-emerge in Yemeni politics. Saudi support pivoted to the Yemeni forces, despite its history of suspicion, driven by the markedly changed context in the post-9/11 era. Salafi-jihadism, in the form of the al-Qaeda presence in Yemen (al-Qaeda in the Arabian Peninsula (AQAP)), manifested in the USS *Cole* and French super-tanker *Limburg* attacks in 2000.

Home-grown discontent against Riyadh initially flared during the siege of Mecca (1979) and was channelled by AQAP into a regional insurgency against Riyadh in the spring of 2003.[68] Containing the AQAP threat was the foremost consideration behind Saudi policy to support Sana'a. The second driving factor was the growing importance of the Shi'a al-Houthi tribe, which challenged Sana'a's dominance over Yemeni politics.[69]

The Houthi movement has its origins in the fall of the Zaydi Imamate following the Egyptian-supported coup d'état of 1962. The roots of today's conflict thus lie with the long-term repercussions from Nasser's ill-considered interference in Yemeni politics. As radical Sunnism proliferated (including the teachings of Wahhabi doctrine with Saudi backing), the Zaydis perceived their culture to be at risk. What emerged was 'resistance' to the 'Sunnisation' of Zaydism, exacerbated by the marginalisation of the

Zaydi community from its former role in leading the Imamate.[70] Thus, the term 'resistance' resonates at the core of Houthi grievances, a grievance routinely refreshed by external interference in Yemeni affairs.

Houthi rebels scrawled graffiti on government buildings in Sada'a in 2003 in opposition to President Ali Abdullah Saleh's support for the US-led invasion of Iraq.[71] Wide-scale repression, involving hundreds of arrests, attempted to disrupt and crush the movement. In response, Husayn al-Huthi 'exhorted his followers to stop paying taxes' and to 'take up positions in the mountains in preparation for a guerrilla war'.[72] From these origins, the First Sada'a War began. Husayn was martyred in 2004, with his martyrdom serving as a 'noble bandit' or 'Robin Hood' mobilising narrative for the Zaydis, as historian Eric Hobsbawm would have described it.[73]

By 2006, thousands of men were fighting for the Houthis, drawn toward 'coasting the wave' of rebellion against their rival tribes or the government.[74] With the sixth surge in fighting in 2009, it was clear that with each confrontation the intensity of fighting increased as new grievances were provoked.[75] In the words of anthropologist Marieke Brandt, these wars were 'neither a power struggle of local tribes, nor a social revolution of the economically and politically marginalised, nor a sectarian war. Rather they were all three at once'.[76]

In short, President Saleh's repressive response to the Houthi insurgency only inflamed broader social grievances, and thus provoked a cycle of self-defeating behaviour. The Houthi insurgency became more capable year by year. Worse, government spending—even with American military support—exacerbated economic fragilities in one of the poorest countries in the Middle East. Between 1999 and 2008, youth unemployment doubled, and overall unemployment grew to approximately 35 per cent.[77] In such an environment, some corrupt government officials had an interest in perpetuating the war as a means of generating personal wealth.[78]

Concurrently, the Global War on Terror (GWOT) fuelled a growing American interest in the fragile state of Yemen. Efforts to partner with the Saleh government to fight AQAP while minimising 'boots on the ground' gave rise to the phenomenon of 'by, with and through', 'remote warfare' or 'light footprint' models of counterterrorism.[79] This approach quickly became fraught with divergent interests: the US focused on AQAP, while President Saleh increasingly focused on countering competition to government

rule. At times these interests aligned, but they often did not, giving rise to American frustrations in implementing the proxy strategy.

While it might be argued that the US proxy strategy was ultimately successful (AQAP was markedly degraded and contained during the GWOT era), it clearly contributed to the ongoing political fragility of the Yemeni state. This fragility was markedly demonstrated with the arrival of the Arab Spring. As protests swept across the Middle East and North Africa, Sana'a saw widespread protests against Saleh's authoritarian governance style. With these protests—termed the 'Change Revolution' in Yemen—Saleh lost control of the north-western periphery, leading to an enormous expansion and empowerment of the Houthis.[80] On 18 March 2011, government snipers were employed to kill some 52 protestors (with hundreds more injured) in 'Taghair' or 'Change' square, which resulted in Saleh losing the support of his military and his ousting from government on 23 April 2011.[81]

The Saudi-Led Intervention

In 2009 the Saudis erected a 1,600 kilometre fence line to contain the threat posed by the growing capacity of the Houthi rebels.[82] The apprehension that led to this preventive action grew to alarm as the Houthis secured power in September 2014 and expanded their area of control from some 30,000 square kilometres in 2014 fourfold to some 120,000 square kilometres in 2015.[83] The view from Riyadh was that the Houthis were the 'new Hezbollah', a view reinforced by Iranian member of parliament Ali Reza Zakani. Zakani claimed that Sana'a was the fourth Arab capital to fall under a growing Iranian influence, behind Beirut, Baghdad, and Damascus, reinforcing the notion of a 'Shi'a crescent' forming across the Middle East.[84] Thus, Iranian commentary intimated Iranian sponsorship and some level of influence over the Houthis as a proxy. This assertion resonated throughout the Middle East, given the context of broader regional Saudi–Iranian confrontation and competition.

A multifaceted competition for influence thus evolved. Within the Sunni world, this competition was between Saudi Arabia and the UAE on one hand and Qatar, supporting Muslim Brotherhood affiliates, on the other. This competition manifested through proxy conflicts in Syria, Libya and Sudan, alongside a direct Saudi–Qatari confrontation in 2017.[85] At a wider level, there was competition between the Sunni world and the Shi'a, a competition viewed from Tehran as leaning toward its interests during

the GWOT era. This dynamic lay behind increasingly assertive Saudi foreign policy from 2011 onward, markedly demonstrated by the Saudi intervention to quell the Arab Spring protests in Bahrain. At the global level, this competition was viewed by the US as manifesting the divide between the nascent stages of the democracy that it sought to support, and the autocratic influence of Russia, Iran and China.

These factors precipitated the Saudi-led and US-backed intervention into Yemen to oust the Houthis from power beginning on 26 March 2015. Ironically, this intervention was initially termed Operation Decisive Storm but was renamed Operation Restoring Hope after the military effort proved to be indecisive. As part of the Saudi-led coalition, Emirati forces partnered with southern militias from Aden; up to 14,000 mercenaries were drawn from the Janjaweed militia of southern Sudan.[86] This Saudi-led military intervention employed some 23,000 airstrikes between March 2015 and July 2021. Of note, few counterinsurgency measures were taken to better the governance, economic outlook or welfare of Yemen's population.[87] As a consequence, the Saudi-led interventions unsurprisingly failed to contain growing Houthi influence in Yemen.

In 2018, Emirati proxy warfare efforts with the southern militias (now termed the National Resistance Forces) successfully rolled back Houthi control of Yemen's Red Sea coastline, culminating in a division of control that endures today.[88] As the conflict stabilised in 2018–19, much of the violence began to abate, but it did not entirely subside. By mid-2022, the war against the Houthis had resulted in some 150,000 Yemenis being killed.[89]

Tempering of the Houthis through Conflict

Iranian proxy support to the Houthis was absent until 2011 and minimal prior to 2014. Given the organic growth of the Houthi movement, Tehran arguably had no reason for providing greater support, and there were no guarantees that the Houthis would show deference to Tehran even if they did.[90] In other words, the Houthis' success in capturing territory within Yemen owes much to their own resilience and their methods of mobilising tribes into a broad coalition. This recognition is key to dispelling the simplistic narrative of a Saudi–Iranian proxy war in Yemen that ignores Houthi agency. Deep-seated grievances with Saudi Arabia are present within Yemeni politics, undoubtedly exacerbated by Riyadh's support to Saleh throughout the 2000s.

Iran purportedly advised against the Houthis seizing power. Its position was likely based on its understanding that reciprocal Saudi pressure would follow, and an underestimation of its client's capacity to endure.[91] Nevertheless, Iranian support markedly escalated following the 21 September 2014 Houthi capture of Sana'a, reinforcing the Houthis' success, albeit discretely.[92] This support slowly but surely grew Houthi resilience in the face of Saudi military efforts. The Houthis' capacity for asymmetric strike also increased gradually as drone capability emerged in 2016, before undertaking a step-change in 2018 and another in 2021.[93] This new technology, combined with growing missile capabilities, enabled the Houthis to achieve some 100 claimed attacks against Saudi Arabia, the UAE, Israel, and its Yemeni adversaries, ranging missiles to 2,000 kilometres and drones to a claimed 2,500 kilometres. The range of these capabilities was seemingly proven on 19 July 2024 with a Houthi strike against Tel Aviv that involved a transit of 2,600 kilometres.[94]

The Houthis seem to have effectively leveraged Iranian and Hezbollah advice to grow a centralised proto-state capability that now dominates much of Yemen. The current leader of the Houthi movement, Abdalmalik al-Huthi, engages in a style of public speaking that closely resembles that of former Lebanese Hezbollah leader Hassan Nasrallah.[95] Abdalmalik surrounds himself with a cadre of commanders who learned the art of war through the six Yemeni wars of the 2000s and may well have been radicalised by the experience and grateful for any tactical advice provided by Iran or Hezbollah during this period. It seems no coincidence that the Houthi Jihad Council is structured in a way that closely resembles Hezbollah's centralisation of functions.[96] It also employs a similar model of media propaganda to that of Hezbollah and is correspondingly effective in painting its case as that of an oppressed group resisting an illegitimate government.[97] Furthermore, the Houthis have developed a Basij Logistics and Support Brigade akin to that of Iran, which is similarly backed by a mass indoctrination program that militarises society.[98]

With longevity of support to the Houthis, Iran's Islamic Revolutionary Guards Quds Force (IRGC-QF) and Hezbollah are able to employ a small advisory staff—'measured in the tens, not the hundreds'.[99] This 'light footprint' approach emphasises the agency of the Houthis, ensuring local solutions fit local governance problems. Further, Tehran has deployed to Yemen elements of IRGC-QF Unit 340, which is the technical department 'whose

remit is to enable the transfer of military capabilities to partner forces'.[100] This provision of specialist technical support has connected branches of the ITN—Hezbollah, Hamas and the Houthis—and underlies the proliferation risk posed today of transfers of advanced military capabilities to non-state actors.

Yemen Today

On 10 October 2023, Abdalmalik al-Huthi announced that the Houthis would join the conflict initiated by Hamas on 7 October 'to shield Hezbollah and Iran from direct U.S. pressure'.[101] This language is significant as it intimates two broad strategic possibilities. The first is that Iran sought this support from its client as an unorthodox form of 'deterrence by punishment', the threatened shifting of costs from the area under contention (Gaza). The second possibility is that the Houthis decided (of their own accord) to support their patron, presumably with the motive of attaining military resources. This option is backed by long-term terrorism analyst Michael Knights, who argues that the Houthis sought to become the:

> *leading* player in the axis of resistance, which may help explain Houthi over-performance and above-average risk-taking (by the standards of non-Palestinian axis members) since October 2023.[102]

In joining Hamas against the US, it is possible that Abdalmalik was motivated by a combination of these two strategic aims. Further, it is important to note that the militarisation of society needs an adversarial 'other' against whom society must be militarised. This dynamic was likely to have also been an influencing factor.

The Houthis commenced their military attacks on Israel following the explosion at the Al-Ahli Hospital on 17 October 2023. The Houthis were the first of the ITN proxies to employ a medium-range ballistic missile against Israel, on 31 October 2023.[103] Within six months (by 24 April 2024), the Houthis had launched some 135 anti-ship ballistic missiles, 87 anti-ship cruise missiles, 263 one-way attack or larger surveillance drones, and some 38 unmanned surface vessels.[104] These statistics are important as they can be understood to be 'enemy-initiated attacks' against which the Houthis controlled their 'loss rate'. This means that this tempo of asymmetric strike (notably a tempo that is beyond the current capacity of the ADF) was *believed* to be sustainable by Houthi leadership. While many

of these attacks were not militarily successful, the fact that they forced the deployment of Western naval platforms and the diversion of shipping suggests that they were *politically* successful. In this way, it can be said that the Houthis conducted a form of littoral guerrilla warfare.

The Houthi conduct of asymmetric strike operations against Israel risked escalating the contained conflict in Gaza to a regional war with significant ramifications for the global economy. Indeed, Israel's sequencing of action against Hamas and then Hezbollah, alongside occasional strikes against Houthi infrastructure (20 July 2024 and 29 September 2024), demonstrates Israel's astute management of this escalation risk, albeit strongly supported by Western-led aerial interdiction efforts against Iranian-launched missiles and one-way systems.

Today, the Houthis have proved resilient to the Western targeting efforts that began after following the Houthi-initiated strikes against commercial shipping. This success is likely due, in part, to resilient support networks that transcend Sunni extremist (AQAP and al-Shabaab) and Shi'a ideological divides.[105] These networks have been enabled by Horn of Africa based smugglers, Iranian state sponsorship, and the creation of symbiotic benefits.[106]

Lessons

Houthi networks of support demonstrate the risk that drone and missile technologies can proliferate from state to non-state actors.[107] Arguably, the genie is already out of the bottle on these capabilities. If such transfers can occur in a tightly controlled part of the globe, where existing pressure against Iran and al-Shabaab already exists, just how effective will other forms of blockade and preventive interdiction be? If the Houthis can develop such asymmetric strike capabilities, what happens if these capabilities proliferate to al-Shabaab?

The Houthis' attainment of potent military capabilities, with the pragmatic sponsorship of Iran, shows that economic and capability-development interests can transcend ideological divides. These factors warrant concern that Iran could rebuild its network of proxies beyond its traditional Shi'a affiliation (as it broached with Hamas) to a much more capable network of Shi'a and Sunni extremists. The rationale for Iran to provide such support might be simply to impose costs on its opponents, reconciling what presently seems an unrealistic policy option of retaining the Shi'a crescent of influence from Beirut to Baluchistan.

The potential for aggrieved non-state actors to emerge is acute in the Horn of Africa. In 2011, Yemen was one of the most food-insecure populations in the world while being awash with some 6 million tribally-held small arms.[108] Sudan was facing the world's largest displacement crisis in 2024, and between 2020 and 2023 the Horn of Africa suffered five failed rainy seasons.[109] Due to climate-induced displacement, rebellion, and the proxy effects of strategic competition given the strategic importance of the Red Sea, the trajectory of Yemen becomes a cautionary lesson as to the potential emergence of insurgencies that might transpire elsewhere in the region.

The case of the Houthis further represents the proxy dynamics that have generated novel asymmetric strike and littoral guerrilla warfare concepts. From November 2023 to February 2024 (in the three months following the Houthis' commencement of hostilities against Red Sea shipping), the volume of transiting shipping dropped by 46 per cent.[110] The second-order economic effects of diverted shipping, or increased maritime insurance rates, are almost impossible to calculate. But they evidently cannot be described as inconsequential to a global economy already detrimentally affected by cost-of-living crises. The ability for a patron to empower a non-state actor to impose costs against maritime choke points as a component of conflict should now be readily apparent.

These lessons are of significant concern given the expansion of Houthi presence into Iraq (a senior Houthi missileer was killed by a US strike on 30 June 2024), which suggests a possible conceptual and technological proliferation risk across the ITN.[111] Furthermore, the emergence of a Russian–Houthi relationship expands this risk through either Russian-supplied military equipment to the Houthis (such as a reported transfer of Yakhont/P-800 Onik anti-ship cruise missiles) or the application of Houthi concepts in the Russo-Ukraine War (or as a possible escalation risk against Baltic shipping).[112]

Conclusions

The war in Yemen is the region's main engine of unpredictability.[113]

An echo of history borne by the case study of proxy warfare in Yemen is that of state-supported terrorism. In the 1960s it was Egypt's support to the National Liberation Front in Aden, which used grenade attacks to terrorise the British population. In the 1970s it was the DLF that used terrorism as a tactic augmenting the broader campaign in Dhofar, based on the PDRY and its Soviet and Chinese backers. From the 2010s to today it is Iranian sponsorship of the Houthis and the Houthi use of advanced conventional weapons to terrorise maritime shipping. Strategic competition begets sponsorship of unsavoury methods, and the emergence of such dynamics needs to be expected. Our models for understanding 'terrorism' and for orchestrating counterterrorism responses therefore need to adapt.

The Houthis emerged from this 1960s era competition through long-simmering grievances exacerbated by ineffective governance and the region-wide Arab Spring protest movements. American and Saudi support to the Saleh government throughout the GWOT era arguably exacerbated the Houthi problem by protecting the Saleh government from a need to reform. Today, the web of competing interests has created a mess of proxy support relationships. These interests have broader ripple effects, as a piece in *Foreign Affairs* ably recognised in July 2024:

> The political violence and state fragmentation that fuelled the Houthis' rise in Yemen is now wreaking havoc across the broader Horn of Africa. A metastasising web of intrastate and interstate conflicts stretching from Sudan to Somalia could bring unprecedented chaos across the Horn, creating space for extremist militant networks and countries hostile to Western interests and a free and open Red Sea …
>
> Multiple wars are causing deep instability in the Horn of Africa and contributing to the crisis in the Red Sea. From 2018 to 2019, popular revolts toppled long-standing authoritarian regimes in Ethiopia and Sudan, but both states have since descended into astonishing levels of violence. A two-year war between Ethiopia's federal authorities and forces from the Tigray region killed over 500,000 people and displaced millions more.[114]

These ripple effects are not yet registering on the agenda in Australian foreign policy debates, despite the designation of the Houthis and the commencement of Operation Hydranth. Yet, as this paper has outlined, there is much to learn from the manifestation of proxy conflicts as a component of strategic competition. First, we should expect proxy conflicts to break out. This realisation increases the importance of identifying the emergence of support relationships and the broader influence that such proxy wars seek to achieve. Second, strategic competition will continue to require land forces to engage in counterinsurgency and capacity-building operations that we erroneously associate only with the GWOT era. Third, our models of understanding 'terrorism' (shorthand for Salafi-jihadist terrorism of the GWOT-era) must evolve. Terrorism as a tactic is employed by a range of non-state actors, and in times of strategic competition short of war, and it is often state-supported. Fourth, the Houthis have shown that even a 'cheap' form of littoral asymmetric strike can exert strategic influence. The Houthis offer an instructional model for the development of such capability.

The lessons outlined in this paper demonstrate that localised competition may prove to be the incubator for highly effective operational concepts, such as the Marxist Dhofar insurgency in the late 1960s, through to the Houthis' demonstration of asymmetric strike or littoral guerrilla warfare today. The case of Yemen helps to demonstrate how even obscure geographic locations need to inform our understanding of what strategic competition means in practice, helping to inform the ADF's ability to 'shape' and 'deter'.

About the Author

Dr Andrew Maher is a postgraduate lecturer on irregular warfare with the University of New South Wales Canberra, and a professor with Arizona State University. His forthcoming book *Riding Tigers: The Strategic Logic of Proxy Warfare* (Hurst, 2025) examines the use of proxy warfare as a component of strategic competition.

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To What Extent Has the Theory and Practice of Military Command Changed in the 21st Century?

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> *From Plato to NATO, the history of command in war consists essentially of an endless quest for certainty.*[1]

Warfare has both changed and remained surprisingly similar over the last century. The interventions in Iraq and Afghanistan led the Western world to believe that conflicts in the 21st century would be characterised by stabilisation, intervention and avoiding the human costs suffered during the two world wars and the Vietnam War. The Russo-Ukrainian War has shown this not to be the case, with thousands of casualties per day and trench warfare resembling the wars of the 20th century. However, it has also exhibited how modern technology can be utilised for military means—for example, the proliferation of commercial drones and the prevalence of electronic warfare. Technological developments in weaponry, communications and other fields in the 21st century have changed the character of war. Given that command is one of the eight tactical functions of war, it would be prudent to examine how command in particular has evolved since the turn of the century. This essay will do so by first defining the concept of command and then using that definition to analyse how the theory and practice of command may have changed. While there are

multiple areas that could be explored, this essay will look specifically at the requirement for decentralisation, leadership, multinational interoperability, the location of command posts (CPs) and the potentials of artificial intelligence (AI). This essay asserts that, while the practice of command may have changed, the underlying theory of command remains unchanged.

Defining Command

British Army doctrine defines command as 'the authority vested in a member of the armed forces for the direction, coordination and control of military forces'.[2] This definition is insufficient for the purpose at hand; it fails to encompass the root requirement for command in militaries and the components through which command is effected. Also, 'authority vested' implies that the existence of command is contingent on its formal recognition as a concept. However, command systems have been present in some form since the first violent conflicts between two or more groups of humans in the Stone Age.[3] Therefore, an accurate definition of command should identify the underlying mechanisms that are at play. Although military historians and academics have frequently studied leadership, tactics and strategies, little study has explored command and its associated systems and decision-making processes.[4] In order to circumvent this obstacle, this essay will define military command through the process of conceptualisation, identifying the underlying constants of military command throughout history; in essence, it will seek to determine the nature of command.

It is uncertainty in war that naturally draws out the practice of command from those in charge of armies. One should imagine two hypothetical, evenly matched armies facing each other in battle. On the basis of identical size, materiel and technology, neither army should win or lose but, in reality, one will. The reason for this is the presence of uncertainty. Grauer explains that any organisation, military or civilian, faces uncertainty due to three factors: the size of the organisation, the sophistication of its technology or cognitive processes employed and the rate of change in the external environment.[5] In the military context, this final factor can be broken down into four further uncertainties. The first is the presence of a thinking enemy, who will deliberately disrupt a military's activity in unexpected ways. The second is that the naturally degrading effect of combat on the human soldier means that a plan may not necessarily be completed as directed.

The third is Clausewitz's concept of the 'friction' of the battlefield, which can naturally inhibit or obstruct activity. The final uncertainty is chance. To distinguish this from friction, Grauer gives the example of the US Navy's aircraft carriers coincidentally being out at sea rather than in Pearl Harbor on 7 December 1941.[6] It is this myriad of uncertainties (size, technology, the enemy, human soldiers, friction and chance) that can mean the difference between victory and defeat.

To be successful, a military must do what it can to either inhibit, mitigate or cope with uncertainty. It achieves this through designing and employing a command system appropriate to the uncertainties present.[7] There are two methods to adapting command systems: 'differentiation' and 'decentralisation'. Differentiation increases the levels of hierarchy in an organisation, which reduces the cognitive load of a commander at the expense of a longer passage of information. Decentralisation increases the responsibility of junior commanders, which allows them to reduce uncertainty at the lowest levels but means less control for higher commanders.[8] Larger organisations will benefit from increased differentiation regardless of centralisation. Conversely, in a more uncertain operating environment, organisations should increase decentralisation but disregard differentiation. Finally, as technological sophistication increases, organisations should increase both differentiation and decentralisation.[9] If a military applies differentiation and decentralisation correctly to meet the types of uncertainty present, then its command system will be more effective. This is known as 'contingency theory'. It provides a logical explanation for the genesis of command systems in armed forces: they are efforts to minimise uncertainty.

Next, this essay will analyse the actions that a command system will take to mitigate, inhibit or cope with uncertainty. Van Creveld defines command as 'a function that has to be exercised, more or less continuously, if the army is to exist and to operate'.[10] This function comprises gathering intelligence, processing it to understand the situation, selecting objectives, designing courses of action, disseminating orders, and coordinating the execution of the plan.[11] Each stage in this process demands the effective management of information.[12] Pimlott's definition of command echoes this informational nature: 'the assessment and dissemination of information needed to direct military force'.[13] To that end, the ability of a command system to manage information effectively will impact its fighting power accordingly.

The final element that must be examined to conceptualise command is leadership. Theories differ on the relationship between command and leadership; leadership is either a subordinate component of command or an entirely separate concept. British doctrine identifies leadership as one of three functions of command, the other two being control and decision-making.[14] Anthony King's *Command in the 21st Century* reinforced this view.[15] By contrast, Gary Sheffield argues that leadership is only concerned with inspiration and motivation, while command is a separate managerial function.[16] However, leadership must be a subordinate function of command. Given that leadership has the capacity to motivate soldiers in the face of danger, it can be the difference between a commander's plan going as intended or failing. Michael Howard describes his experience of respected commanders arriving on the battlefield and dispelling fear and fatigue among soldiers.[17] In this way, leadership inhibits the uncertainty that the human factor poses in war. As this is the purpose of command, strong leadership can be seen as integral to effective command rather than separate.

A general theory of command can now be formed. Its purpose is to reduce the uncertainty of battle. A command system will be structured and decentralised appropriately to manage that uncertainty. It must be effective at managing information that it receives, processes and disseminates. Leadership should be considered as a subordinate function of command. These concepts will guide the analysis of any changes to the practice of command during the 21st century.

Decentralisation of Command and Control

A cornerstone of both the British and Australian armies' command philosophy is the idea of 'mission command', which aims to decentralise decision-making to the lowest possible level.[18] This decentralised approach allows junior commanders to seize the initiative wherever possible during battle.[19] The philosophy was necessary in the 20th century, when communication systems were too limited for the scale and pace of operations. As a result, a central commander could not retain as high a degree of decision-making authority.[20] This environment was evident during the Falklands campaign. Radios were insecure and so the 3 Commando Brigade commander issued orders prior to battle in person. He would

specify what he wanted his subordinates to do but not how they should do it.[21] Had he not done so, the battalion commanders would have had to await a face-to-face meeting with him on the battlefield or risk using their radios to request updated orders. Both options would have increased the uncertainty posed by the thinking enemy and risked failure.

Since then, communication systems have improved significantly. With this improvement, the requirement for decentralisation should in theory decrease. However, the complexity of warfare has also increased. In Iraq during the 2000s, US generals McChrystal and Mattis exercised mission command to counter the complicated operating environment. McChrystal used technology to form a network of subordinate commanders to ensure shared understanding, united efforts and coordinated activities. Mattis religiously adhered to mission command's tenet of a clear intent and developed shared understanding through rehearsal of concept (ROC) drills. Mattis knew this would achieve speed, which was critical to deposing Saddam Hussein.[22] Both commanders exhibited the principle of mission command known as 'unity of command'.[23] Mission command continues to be vital now. This is evident in Ukraine, where both sides have struggled to communicate due to the overcrowding of the electromagnetic spectrum (EMS).[24] This means that militaries will need to be prepared for limited communication, however sophisticated their technology may be. Mission command can provide a mitigation for loss of communications and allow EMS usage to be rationed. In the sense of decentralisation, therefore, little has changed in both the theory and practice of command. If warfare continues to increase in complexity and the EMS remains as crowded, command systems will need to remain decentralised to manage the increased uncertainty.

Figure 1. France. 16 November 1918. French Army Marshal F. Foch and British Army Field Marshal Sir Douglas Haig entering the advanced General Headquarters train. Source: Australian War Memorial, Acc no. H12252

Requirement for Leadership

Leadership acts as a function of command in its ability to reduce the uncertainty that the human soldier poses to a military; if a commander can motivate their soldiers to carry out their orders, then the plan is more likely to succeed. In Vietnam, both the ANZAC and the American leadership faced challenges in sustaining morale and the willingness to fight amongst the ranks. The ANZACs mitigated this problem by providing leave centres and amenities in base camps and fostering relations with the local South Vietnamese population. The American leadership were less successful in mitigating low morale, which likely contributed to the deterioration of operational progress. However, by the Gulf War, the US military authorities had learnt the importance of maintaining morale and achieved this through communicating a clear political purpose and ensuring massive combat superiority before risking soldiers' lives.[25]

The importance of fostering a political purpose and a will to win among soldiers is evident in the Russo-Ukrainian War. On the Russian side, high casualty rates and inconsistency in the rationale behind the invasion have led to extremely low morale. Russian soldiers have shown an unwillingness to follow orders. Meanwhile, on the Ukrainian side, the purpose was initially clear and persuasive: they were defending their sovereignty.[26] However, as Ukraine has failed to prevent Russian advances, reports of low morale and desertion have increased.[27] This decrease in morale coincides with a shift in public opinion towards the war: in February 2022, 73 per cent of Ukrainians believed that their country should fight until victory; but in October 2024, this had shifted to just 38 per cent.[28] It is possible that a declining political purpose has contributed to Ukrainian soldiers' lack of a will to win. On both sides, however, it is evident that a will to win can impact the outcome of military operations. An effective command system should seek to raise morale to prevent it undermining the execution of plans. This is possible through strong leadership.

With the increased complexity of the 21st century operating environment, leadership is shifting from a leader-centric model to a follower-centric model, in which subordinates are educated and collaboration with other subordinates is encouraged.[29] British doctrine highlights the value of followership, which has proven to be a force multiplier when employed properly. In this system, followers maintain high energy to perform and a will to win, primarily because they have a sense of purpose. However, followership is only achieved through effective leadership.[30] It requires leaders to be humble and accept loyal dissent.[31] By maintaining a will to win, a culture of followership is more likely to ensure that a command system operates effectively.

Multinational Interoperability

Multinational alliances have occurred frequently throughout recent history. In the Vietnam war, the ANZAC battalion group responsible for the Phuoc Tuy province was subordinate to a US brigade.[32] During Operation Desert Storm, the British 1st Armoured Division was fully integrated into the US VII Corps and approximately 100 UK officers worked in the US CENTCOM.[33] In Iraq between 2006 and 2009, the UK-led Multi-National Division South East (MND SE) was subordinate to the US-led Multi-National Corps—

Iraq (MNC-I).[34] More recently, in 2024, NATO's Very High Readiness Joint Task Force consisted of the UK's 7th Brigade with force contributions from eight NATO allies.[35] Western allies, in particular European nations, have increasingly depended upon multinational task forces to mitigate their national militaries' deficiencies. The UK acknowledged this in its Defence Command Paper 2023, in which it called NATO the 'cornerstone' of UK defence.[36] If multinational alliances are going to become more commonplace and more integrated on operations, then any lack of interoperability will add uncertainty to operations.

Several issues arise with multinational interoperability, particularly a lack of experience operating together, language differences and differing political objectives.[37] From a command perspective, these factors could impede the effectiveness of multinational forces. A lack of experience operating together is likely to increase the uncertainties posed by friction. For example, a forward passage of lines between two formations of different nationalities would be problematic without substantial rehearsal and a thorough understanding of the control measures. Language differences could impact the ability of a commander to achieve mutual understanding with a subordinate from another nation. Finally, differing political objectives can cause issues by presenting commanders with more than one authority to contend with. In 2007, British Major General Jonathan Shaw was ordered by Permanent Joint Headquarters to carry out Operation Zenith, the withdrawal of British forces to Basra Airport, against the wishes of the MNC-I.[38] This shows how an unclear and non-linear command structure can impede the effectiveness of the system. For multinational alliances to be successful, militaries must ensure that the added complexities are mitigated through suitable and agreed command systems.

Location of Command Posts

The location of a commander in battle can impact the outcome significantly. On the one hand, too close a proximity to the battle can put the commander and their staff at risk of leaving their subordinates without a controlling headquarters. On 28 May 1982, Lieutenant Colonel Herbert Jones, commanding officer of the 2nd Battalion, Parachute Regiment, was killed when he assaulted an enemy trench to regain his battalion's momentum.[39] Although this was a display of commendable gallantry, it left

the battalion without its commander for the remainder of the operation. On the other hand, if a commander is too far back, they run the risk of their line of communication failing through chance or malign actors. Furthermore, they are less able to exert leadership and 'bring their personal presence to bear'.[40] With the advent of the telegraph and telephone age, commanders could coordinate the battle from far away, but wires laid to achieve this communication were liable to be cut by traffic, shrapnel and enemy saboteurs.[41] In decisions about positioning a CP, commanders have sought to strike a balance between the CP's own survivability and the commander's ability to carry out their role effectively and reliably.

Advances in communication technology have allowed commanders to oversee operations from still greater distances. During the Vietnam War, the commander-in-chief commanded from Hawaii using submarine cables and satellites.[42] During the Falklands War, the task force commander operated from England via satellite phone.[43] This trend continued into the 21st century. In 2014, the commander of US Army Africa supervised a drone strike to kill Al-Shabaab's chief of intelligence in Somalia from a CP in Italy.[44] Furthermore, with a relative lack of threat and in pursuit of maximum capability, US CPs in Iraq and Afghanistan grew in size significantly, which increased their signature.[45] The Russo-Ukrainian war has highlighted the dangers of locating large CPs too close to the front line in a peer-level conflict. By June 2023, the Ukrainians had destroyed several Russian army, corps and divisional headquarters, killing more than 1,500 Russian officers.[46] This example should prompt commanders to think carefully about how far forward they situate their CPs. With ATACMS having an effective range of 300 km, this would mean a considerable distance to achieve security and survivability.[47] However, while satellite and 4G communication networks would allow sufficient situational awareness from that distance, the risk of those networks failing through cyber warfare, jamming or overcrowding of the EMS could have a substantial impact on command and control. In the 21st century, commanders still need to balance their own survivability with (over-)reliance on communication systems.

Figure 2. Republic of Korea Armed Forces firing a K239 Chunmoo during Talisman Sabre 2023 at Shoalwater Bay Training Area. Source: Defence Image Gallery

Decision Support Systems

In recent years, AI has evolved such that it can add value in military command systems; the use of AI in this manner is termed 'decision support systems'.[48] The Israeli military has already begun to incorporate AI meaningfully. 'Habsora' aggregates data from a variety of sources, such as surveillance data and drone footage, to generate targets of militants' locations for brigade- or division-level targeting.[49] 'Lavender' sifts through enormous amounts of intelligence from both past and present surveillance sources to identify Palestinians linked to Hamas and pass them on as potential targets.[50] In the Russo-Ukrainian war, even relatively rudimentary AI in Ukraine's drones can distinguish between T-72 and T-90 tanks.[51] Although these systems are far from perfect (Lavender suffers from a 90 per cent misidentification rate[52]), they prove that AI can be incorporated into command systems. Previously, in order to handle the exponential increase in information from modern operating environments, commanders would have to do one of two things: either increase the size of their staffs or

decentralise the authority to act.[53] Decentralising allows more flexibility and speed at the lower levels but decreases control for the higher commander. Should AI capabilities continue to improve, the capacity to process large amounts of information for decision at higher levels will improve significantly without requiring larger command staffs. This will free humans for higher level tasks.[54] Furthermore, it is likely that the quality of an AI's capability will be proportional to the edge that a military holds over its adversary.

Conclusion

Command systems seek to reduce the uncertainty of warfare, in order to maximise fighting power and attain victory wherever possible. The increased pace of warfare, new threats from sophisticated weaponry, and the requirement to operate in multinational alliances across multiple domains have added to this uncertainty. With new technologies, commanders are able to alter the design and employment of their command systems to mitigate that uncertainty. This is evident in the practice of decentralised command, remote CPs and the use of AI since the turn of the century. For these reasons, the practice of command has changed in some ways and will always be subject to change so that it fits the evolving operating environment. Commanders should remain flexible in this sense to maximise their fighting power at all times.

What remains unchanged is the underlying theory of command. Decentralisation is balanced between mitigating uncertainty at the lowest levels and retaining control and clarity for the commander. Strong leadership will always be required to protect the will to fight and minimise the uncertainty of fatigue and fear in soldiers. Multinational alliances may become more commonplace but the theory of command must be applied to mitigate the added friction on interoperability; this means robust command structures, unity of command and clear communication. CPs will always be positioned as far forward as possible to maintain communication and control without undue risk to survivability. Finally, novel decision-support systems may begin to dominate the management of dense information flow, but this is a change to the practice of command rather than its theory. The character of war will continue to evolve and the practice of command must change with it. It can only do so by adhering to the theory of command—'the endless quest for certainty'—which has not changed; nor will it.

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How Will Emerging Technological Revolutions Including Artificial Intelligence and Robotic Autonomous Systems Impact the Command and Control of Land Operations?

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Introduction

Throughout history, military commanders have sought to exploit technologically superior capabilities to achieve tactical advantage on the battlefield. Technology informs strategy and provides tools to deliver tactical advantage, and is widely recognised as a force multiplier on the battlefield.[1] However, technologically superior capabilities alone do not assure military success; rather it is 'the integration of innovation into effective methods and means that gives a strategic or tactical edge'.[2]

The rate of military innovation and technological change is most pronounced in times of war, with remarkable advancements in military technology made during World War I and World War II. Even outside of major conflicts, and consistent with the theory of accelerating change, the rate of technological development has continued to exponentially increase over the last century.[3] Since the turn of the 21st century, significant research

and development has been undertaken by governments across the globe looking to create military advantage.[4] This has led to the emergence of a wide range of advanced technologies with the potential to revolutionise how future military operations are conducted.

This article examines how the emerging technologies will impact the command and control (C2) of land operations. First, it explores the scope of the technologies that are commonly referred to as 'the emerging technologies' and assesses whether any of these technologies alone should be considered revolutionary. Second, it evaluates whether the collective technologies have resulted in a revolution in military affairs (RMA) or merely represent the natural evolution of existing military capabilities. Third, the article describes additional criteria that must be considered to realise an RMA. Finally, it highlights the aspects of military operations that will be affected by the emerging technologies, and the resulting impact on the C2 of land operations. The article concludes by stating that, with the exception of artificial intelligence (AI) and robotic autonomous systems (RAS), emerging technologies are evolutionary rather than revolutionary; that an RMA has not yet taken place; and that as a result of this, the impact on C2 of land operations will remain marginal until the technologies mature to their full potential and are fully integrated into the military.

Emerging Technologies

Sun Tzu stated: 'In warfare, there are no constant conditions. He who can modify his tactics in relation to his opponent will succeed and win.'[5] Tactical evolution is often driven by technological change, the rate of which is rapidly increasing. It is estimated that the rate of change 20 years from now will be four times greater than it is today, and 16 times greater in 40 years.[6] New battlefield technologies will thus become increasingly common, which may in turn lead to the evolution of tactical operations. However, the impact of new technologies will vary greatly. Some technologies will produce short-term tactical advantage that will only persist until effective countermeasures or counter-tactics are developed, whereas others will have a more enduring impact. To quantify the impact, it is first necessary to clarify what the term 'emerging technological revolutions' means, and identify if the individual technologies could bring about revolutionary change.

There is no authoritative list of emerging technologies, which are often categorised into groups based on shared characteristics. Common groups include cyber; space-based technologies; directed energy weapons; biotechnology, quantum sensing and computing; hypersonic missiles; and extended reality, which incorporates virtual and augmented reality.[7] In 2000, a study of 29 different types of military-related technologies identified only two that were likely to experience revolutionary change (notionally defined as 'a type and pace of progress that renders obsolete old weapons, tactics, and operational approaches while making new ones possible') over the following 20 years: computer hardware and computer software.[8] In 2018, the author subsequently concluded that although his prediction about computers was correct, he should have included robotics such as unmanned aerial vehicles, for which he had predicted a high rate of change rather than revolutionary change.[9] What, then, distinguishes computer technologies and robotics from other emerging technologies, and what has driven their revolutionary development?

AI is defined as 'the capacity of computers or other machines to exhibit or simulate intelligent behaviour'.[10] One such behaviour that has remained constant is military decision-making, which has always been a responsibility entrusted to humans. However, the development of AI has presented a potential cultural shift in which 'for the first time since the cognitive revolution began tens of millennia ago, human strategy may be shaped by non-biological intelligence that is neither embodied nor encultured'.[11] The integration of AI decision-making into military operations would represent a fundamental change to warfare. Nonetheless, militaries across the world are investing significantly to integrate AI technology, recognising that not only is it highly likely to change future warfare but it could 'tip the strategic balance'.[12] It is important to additionally differentiate AI from other emerging technologies in the effect it delivers. Unlike many other emerging technologies, AI in isolation has no kinetic effect on the battlefield. Instead, AI is integrated into existing military capabilities to enhance aspects such as distinction, manoeuvrability, survivability and lethality. In doing so, AI does not contribute a single capability to a military force but has the potential to deliver significant military advantage through enhancements across the force.

History has taught us that even the most impressive of new weapons rarely determine the outcome of a battle on their own. Integration and adaptation of existing technologies, enhanced with new innovations, are key to increasing military effectiveness and recognising military objectives.[13] RAS technologies rely on integrated AI. Like AI, they have the potential to profoundly influence future military operations by delivering tactical actions determined through non-human decision-making. RAS is a collective term for military capabilities that include unmanned aerial vehicles, autonomous ground vehicles, autonomous weapons systems and loitering munitions. RAS are composed of a number of sub-components that allow the platform to collect and process information, then determine and execute an appropriate response. RAS exemplify the importance of integrating technologies to enable functionality and maximise a capability's potential. Without integrated AI, autonomous technologies would only be capable of completing rudimentary tactical actions that rely on human input, but with integrated AI their potential is vast: 'Bringing AI into the realm of warfare through the use of AI-enabled autonomous weapon systems (AWS) could revolutionise defence technology.'[14] AI-integrated systems could facilitate an era of warfare in which autonomous decision-making will enable military forces to plan and execute operations far more quickly than those which rely exclusively on human decision-making, while delivering increased precision and lethality on the battlefield.[15]

Revolution in Military Affairs or Weapons Systems Evolution

To assess the impact emerging technologies will have on the C2 of land operations, a determination must be made as to whether the collective technologies could lead to an RMA, or whether they are merely an evolution of extant capabilities. An RMA is defined as a military transformation delivered through organisational, doctrinal and technical change, resulting in military operations characterised by revolutionary tactics.[16] Historical examples of RMAs include the Gunpowder Revolution in the late medieval ages (firearms and artillery), the Industrial Revolution of the 18th and 19th centuries (mechanisation and mass production), World War I and World War II (tanks and aircraft), the Cold War (satellites and nuclear missiles) and most recently the Information Revolution of the 21st century (computing, network-centric warfare and precision targeting). Each of the historically recognised

RMAs was characterised by a significant technological advancement providing a substantial military advantage. However, there is a divergence of opinion as to whether the current emerging technologies have triggered a new RMA.

Western nations have publicly acknowledged the benefits the emerging technologies can offer to military operations, and have actively engaged to integrate them to enhance existing capabilities. US Congress was informed in 2018 that 'the nexus of robotics and autonomous systems (RAS) and artificial intelligence (AI) has the potential to change the nature of warfare',[17] with estimated defence spending on these technologies rising from USD$1.8 billion in 2018 to over USD$3 billion in 2023.[18] Similarly, other Western nations' militaries and NATO partners are investing heavily in research and experimentation activities utilising AI and RAS technologies, including the UK.[19] However, these nations have acknowledged that advanced technologies alone do not have the capacity to decisively win battles and that 'military history over the last eighty years offers many cases in which forces with inferior technology have won conflicts'.[20] For example, for a limited period during World War II, the US Air Force employed a tactic of daylight bombing using unescorted heavy bombers, with disastrous consequences for itself.[21] Technologically the aircraft were far superior to those of the German Luftwaffe, but the doctrinal failure to integrate them with other technology—namely long-range escort fighters—initially denied the sought-after operational advantage. The potential of the current emerging technologies is widely acknowledged by Western nations, but it is rarely articulated that a new RMA has taken place.

Conversely, Russia and China hold the belief that the emerging technologies have already led to a form of RMA. In 2019, Chinese leaders concerned about a technological gap with the US urged the People's Liberation Army to leverage AI and related technologies 'to enable and enhance a range of military capabilities' through the development of AI-enabled C2 and weapons systems.[22] In recent years, China and Russia have partnered to develop these emerging technologies and incorporate them into modernised and increasingly interoperable militaries.[23] Russia has used these in the ongoing conflict in Ukraine, and claims that the use of AI-enhanced drones and missiles has led to a radical change in military strategies, indicative of an RMA.[24] However, the claim appears to be an overstatement based on a misunderstanding of the definition of an RMA.

It is also perhaps more reflective of Russian rhetoric, which is intended to enhance the credibility of its military equipment, thereby seeking to attract future trading partners and allies to assist with its ongoing war against Ukraine.

Recent military operations in Ukraine and Israel have demonstrated the application of advanced technologies and weapons on the battlefield, achieving high levels of success, but their application has been evolutionary rather than revolutionary. In the Ukraine war, AI has been integrated into C2 systems to enhance logistical and operational planning, and further integrated into autonomous drones to improve battlefield situational analysis. Meanwhile, in Israel, AI technology has been incorporated into missile defence systems, such as the Iron Dome.[25] Although they have undoubtedly changed how military operations are conducted, the basic technologies that enable them have existed for some time; AI is a technological progression of advanced computing, and aerial intelligence, surveillance and reconnaissance capabilities have existed since the 19th century, when in the US Civil War 'the Army used aerial technology, such as balloons, kites and pigeons, to gather intelligence and to survey the battlefield giving ground commanders the ability to make informed decisions'.[26] Scholars argue that as the wider transformations necessary to fully integrate these technologies have not yet occurred, and existing military capabilities have not been rendered obsolete, an RMA has not yet taken place.[27]

Fundamental Requirements for Realising an RMA

Although technological advancement is widely accepted as the key driver of military innovation, it is acknowledged that a series of complex transformative changes are required for an RMA to occur. There is a difference of opinion as to what these may entail, with some arguing 'a military's ability to assimilate and adopt new operational concepts and doctrine'[28] is vital, whereas others emphasise the need for 'the assembly of a complex mix of tactical, organisational, doctrinal and technological innovations in order to implement a new conceptual approach to warfare or to a specialized sub-branch of warfare'.[29] Furthermore, the integration of AI and RAS technologies has emphasised legal and ethical considerations that must also be addressed.

'Organizational adaptation connotes changes to the structure of the fighting force to exploit new systems and patterns of operations'.[30] The changes required to fully exploit the range of emerging AI-enabled technologies are diverse and incorporate both physical and cultural measures. Physical measures include structural changes to units, and order of battle changes to formations. Cultural change would necessitate a revised mindset where innovation and experimentation with the latest technologies becomes routine business.[31] Due to the rapid rate of technological change, the adaptation of agile principles and processes would be key in enabling transformation at the pace of relevance. This should be underpinned by flexible and responsive training and education, and agile procurement. To fully capitalise on the advantages the emerging technologies can bring, military operating concepts and doctrine would also need to be amended accordingly.

Legal and ethical changes are challenging because they extend beyond state boundaries, requiring international cooperation. When considering this issue from a military perspective it can become even more challenging and contentious. For example, when contemplating the use of lethal autonomous weapons systems (LAWS), legal and ethical concerns are raised regarding 'accountability, decision-making, and whether granting machines the power to automatically engage and eliminate a target demeans human life'.[32] Many critics of AI-based weapons state that policy should prohibit the killing of any human without the direct authorisation of another human (referred commonly as the 'human-in-the-loop').[33] Conversely, there are some who argue that AI reasoning would be able to consider clearly defined legal, societal, moral and ethical considerations to reach unbiased conclusions, and that AI technologies only operate within their permitted programming.[34] Some go further still to claim that as AI-based technologies do not suffer from fatigue and stress, unlike their human counterparts, they could make more ethical decisions.[35] Although International Humanitarian Law (IHL) provides the legal framework for military use of AI, there are concerns that it does not adequately cover the complexities of AI use in warfare, particularly regarding the use of LAWS. Further work must be conducted by the international community to address this challenge.

Potential Impact on C2 for Land Operations

Current NATO operational philosophy for the conduct of land operations is the manoeuvrist approach, used in conjunction with the NATO command philosophy of mission command.[36] Military operations are planned collaboratively and conducted as multi-domain operations based on combined arms manoeuvre, integration with allied forces, and network-centric capabilities. The decision-making framework employed by NATO is the OODA loop (observe, orient, decide and act), developed by US Air Force Colonel John Boyd during the mid-20th century, which until recently has relied exclusively on human-centric decision-making.[37] However, with the evolution of data-centric warfare made possible through the rapid expansion of data collection platforms, AI technologies are required to rapidly process vast amounts of data, beyond the processing ability of humans alone, to achieve timely data-driven decision-making. For now, the observe/orient/act elements of the OODA loop will be enhanced through human-machine teaming, leaving the decision-making to humans. However, with the inevitable further development and integration of semi-autonomous and fully autonomous capabilities into militaries, a fundamental change will occur from the current model, in which decision-making is almost exclusively done by humans, to one where human involvement transcends from being in the loop to on the loop, and ultimately out of the loop.[38]

The integration of these emerging technologies offers significant military advantage that could transform C2 in the future. Enhanced situational awareness developed through advanced sensing capabilities and all-source data processing and fusion will produce a richer, more accurate and timely intelligence picture.[39] AI-supported planning cycles will be quicker, allowing operational decision-making and tactical actions to take place more quickly than those of an adversary.[40] Improved target acquisition and automated effector matching will lead to faster and more efficient kill chains.[41] Resilient C2 networks secured by leveraging AI technology will support improved multi-domain integration through the production and sharing of a joint common operating picture.[42] And improved logistical resupply will be enabled through 'robotic and autonomous systems [that] will conduct precision supply operations that extend operational reach and prolong endurance'.[43] While the integration of the emerging technologies could provide a significant military advantage, it will also present significant threats that must be carefully mitigated.

In addition to the ethical and legal issues previously discussed, the integration of such emerging technologies presents a number of additional challenges and threats. AI-enabled systems are constrained by the data used to create the AI algorithm, and are therefore initially subject to inbuilt AI bias introduced by humans in the selection of the training data.[44] Once operational, the systems are susceptible to data poisoning, particularly when open-source reporting and intelligence gathering has been used to complement military datasets. AI-enabled C2 systems themselves are susceptible to offensive cyber activities, and British analysts predict that 'the manipulation of artificial intelligence for malicious or unethical purposes will become increasingly widespread, resulting in an urgent need to address and counter artificial intelligence biases'.[45] Although RAS capabilities do not suffer from battlefield fatigue and have the ability to operate in extreme environments hazardous for humans, they are vulnerable to direct cyber attacks. This can render the platforms useless or manipulate them into potential threats to friendly forces, and investment must be made to ensure they remain resistant to hostile interference.[46] Finally, the integration of emerging technologies and the resulting reduced planning timelines may 'overcentralise C2 functions at the political or strategic level',[47] which may 'be detrimental to the conduct of military operations at the operational and tactical levels'.[48]

Conclusion

The emerging technological revolutions, particularly AI and RAS, have the potential to significantly impact the C2 of land operations. These technologies offer substantial enhancements in situational awareness and decision-making at the strategic level, as well as target engagement, logistical resupply and support to multi-domain integration at the operational and tactical levels. Increased operational tempo derived through the integration of the technologies would additionally provide military advantage over adversaries who do not possess similar capabilities. However, the technologies have so far primarily enhanced existing capabilities rather than fundamentally changing warfare and rendering existing capabilities and tactics obsolete. The application of these technologies in the recent conflicts in Ukraine and Israel has been evolutionary rather than revolutionary, and an RMA has not yet been realised.

An RMA is dependent on more than just technological innovation. To realise the full impact of the emerging technologies in land operations, a series of transformational changes must take place including technological advancement, organisation adaptation, and amendments to military operating concepts and doctrine. Additionally, changes to military culture are required in which truly agile processes are adopted to create an environment in which innovation, experimentation and agile procurement can thrive. The integration of AI and RAS also raises important legal and ethical challenges, particularly in the development and use of LAWS. International collaboration will be required to define an agreed framework for the use of these technologies on the battlefield, and amendments may be required to IHL to cover the complexities of using AI-integrated weapon systems in warfare.

While these emerging technologies have the potential to have a significant impact on the C2 of land operations, their influence will remain marginal until the technologies mature and are fully integrated into the wider military. In the near term, these technologies will not replace human decision-making but instead augment C2 through human-machine teaming allowing commanders to make more informed decisions, with greater speed. In the long term, emerging technologies may trigger an RMA, fundamentally transforming the future of warfare.

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Major Iain Robinson enlisted in the British Army in 1996 as a Terrain Analyst with the Corps of Royal Engineers. He has served at various headquarters including 3rd (United Kingdom) Division, Permanent Joint Headquarters, and 7th Armoured Brigade. Additionally, he has held specialist geospatial roles at the National Centre for Geospatial Intelligence and the Royal School of Military Survey, and completed operational tours in Bosnia, Kosovo, Iraq and Afghanistan. He commissioned in 2018 and obtained a Masters in Geospatial Intelligence from the Royal School of Military Survey in 2020. Major Robinson was selected for the Intermediate Command and Staff Course (Land) as a Late Entry Officer candidate while serving at Army Headquarters in 2023.

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Book Review

Russia and the Changing Character of Conflict

Author: Tracey German

Cambria Press, 2023, ISBN 9781621966739, 280 pp,
RRP USD$109.99 (hardcover)

Reviewed by: Alexey D Muraviev

It is not an overstatement to observe that anyone in the profession of arms, and in the broader community of professionals and scholars in defence and strategic studies, would value opportunities to raise their awareness of adversaries and their capabilities. Such efforts often prioritise the careful studies of their military technology and tactics. However, a broader inquiry into the adversary's intent, including their way of thinking and analysing an armed struggle, and their approach towards contemporary and future warfighting, is an equally valuable endeavour.

Over the past 30 years, Western analysis of Russia's military power, including its school of military thought, has evolved. During the 1990s and early 2000s, Western literature provided dramatic descriptions of the collapse of the former Soviet military machine. In more recent years, specialist works have emerged that analyse new forms of Russia's

warfighting such as hybrid warfare and grey zone operations. Balanced works concerning Russian military power and potential are more difficult to find; indeed, the war in Ukraine has made any serious efforts at even-handed analysis even more challenging to achieve. As Alexander Hill accurately observes:

> In the West, Russian military power is often portrayed as considerable when NATO defence spending is being discussed, but is downplayed when an escalation in military assistance to Ukraine is being promoted.[1]

There are remarkably few examples of well-considered Western analysis of Russia's military school of thought. And this is regrettable given that, since the late 19th century, Russia has been one of a few nations which have transformed their understanding of 'conflict' and 'war' into a science. In her book *Russia and the Changing Character of Warfare*, Tracey German underscores the breadth with which Soviet/Russian strategists and defence thinkers have approached this topic:

> The Soviets distinguished between military science, the system of knowledge about the character and laws of war, and military art (*voennoe isskustvo*), which covers the theory and practice of military operations (Russians today also make this distinction).[2]

Moscow's national school of strategic and military thought is considered to be one of the oldest and most reputable in the world. Russian military theoreticians and practitioners were among the first to engage in systematic analysis of trends in the application of armed force under various battlefield conditions. To some extent, Russia also pioneered the conversion of such research findings into publications. For example, the *Morskoi Sbornik* (*Naval Digest*), which was first published in 1848, remains the world's oldest specialised professional journal on naval affairs.

German's book is among only a few that offer a thorough, balanced and methodical analysis of Russia's strategic and defence thinking in the 21st century. One of the book's key strengths is the extensive and competent use of Russia's specialised defence publications, which offers a Western readership an accurate insight into the country's current school of military thought. The book provides a detailed overview of the evolution and particulars of Soviet and Russian strategic and defence thinking since the

end of the country's civil war in the early 1920s until early 2022, touching on some aspects of the Russia–Ukraine war but mostly focusing on the period ending with the Syrian expeditionary campaign and proxy operations in eastern Ukraine between 2014 and 2021.

From the viewpoint of efforts to understand a potential adversary's strategic intent and battlefield methodology, the book is particularly relevant to an Australian readership. The relevance of Russian military doctrine to Western military practitioners and strategists can be highlighted by observations made by General Valery Zaluzhny, who commanded the Ukrainian forces during the first two years of the Russia–Ukraine war. He praised the Soviet and Russian military schools of thought, including theoretical works by the current Chief of Russian General Staff, Valery Gerasimov. In his 2022 interview Zaluzhny conceded:

> I was raised on Russian military doctrine, and I still think that the science of war is all located in Russia … I learned from [General] Gerasimov. I read everything he ever wrote … He is the smartest of men, and my expectations of him were enormous.[3]

A year later, Zaluzhny admitted that—during an unsuccessful Ukrainian counteroffensive of 2023—he urged his staff to find him a monograph by Soviet Major General PS Smirnov, *Breaching Fortified Defence Lines*, because it provided a thorough battlefield analysis of offensive and counter-offensive operations of World War I:

> And before I got even halfway through it, I realised that is exactly where we are just like then [WWI], the level of our technological development today has put both of us and our enemies in a stupor.[4]

In a similar vein, German's book makes several important observations concerning the way that Russian military thinkers assess, strategise, action plan and implement. To showcase the breadth of the flow of ideas and debates, German reinstates key points made by Tor Bukkvoll, who identified 'three camps of Russian military theorists: traditionalists, modernists and revolutionaries'.[5]

Russia and the Changing Character of Warfare highlights the value of learning lessons from the experiences of adversaries. In one chapter, German showcases how the Russians reviewed a select number of campaigns of the 1990s and 2000s. These included offensives against Iraq

in 1991 and 2003, NATO's operation against former Yugoslavia in 1999, and Operation Enduring Freedom in Afghanistan in 2001. The lessons learned from these previous campaigns demonstrated to Russia that unmanned aerial vehicles (UAVs) had become one of the 'critical components of success in new-generation wars'.[6] This assessment informed Moscow's planning for and conduct of the Azerbaijani campaign against Armenia in 2020, which saw the extensive combat use of UAVs by Azerbaijani forces.

Overall, German's book provides useful insights into how Russia conceptualises future wars and emerging military technologies. These concepts are shaping Russia's military offensive in Ukraine now, and will continue to influence its military decision-making into the foreseeable future. A specific chapter is dedicated to understanding Russia's way of influencing the hearts and minds of targeted audiences or nations, including its take on information and physiological operations, 'controlled chaos' and reflective control. Readers will undoubtedly also value the opportunity presented by German's book to learn more about how the Russian military strategises its interactions with friendly non-state paramilitary elements and proxies.

Reviewing Russian operational experience in limited-scale conflicts—ranging from the First Chechen War of 1994–96 and ending with Syria, Crimea and conflict in eastern Ukraine—offers valuable information about how Russia has evolved its way of fighting in response to different types of conflicts with different operational tempo and requirements. This includes observations concerning what lessons Russian planners and commanders took from their previous combat experience into their planning and military action in Ukraine, as well as German's views concerning what lessons they appear not to have adequately reflected upon. For example, reading German's critical analysis of Russia's combat performance in Chechnya in 1994–95 makes one wonder how the Russian defence planners and commanders made similar errors of judgement in the first year of the war in Ukraine. These omissions included underestimating the adversarial will to resist, the challenges of organising offensive operations in urban areas, problems with effective coordination of different formations assigned to different ministries, issues around control of information flows, and the implications of Ukraine's successful conduct of information operations in the initial phase of the war.[7]

From reflecting on how Russian military thinkers and senior military leaders conceptualise warfare, informed by German's book and the outcomes of Moscow's firsthand combat experience in Ukraine, it is evident that Russian military thought is anything but stagnated or out of date. It is thriving and likely to influence national and (non-Western) international military thinking and force planning for decades to come. Hence, *Russia and the Changing Character of Conflict* provides a great foundation for future inquiries in this field.

About the Reviewer

Alexey D Muraviev is Associate Professor of National Security and Strategic Studies at Curtin University, Perth, Western Australia. He is the founder and director of the Strategic Flashlight forum on national security and strategy at Curtin. Alexey has published widely in the field of national security, strategic and defence studies. He is Australia's leading authority on Russian military power. His broader research interests include problems of modern maritime power; contemporary defence and strategic policy; Russia as a Pacific power; Russia's strategic engagement in the Indo-Pacific; and Australian national security and defence. Among his latest publications are Alexey D Muraviev, *Battle Reading the Russian Pacific Fleet 2023–2030*, Sea Power Paper (Canberra: Sea Power Centre Australia, 2023); and Alexey D Muraviev, 'Russia and the South China Sea', in Howard M Hensel (ed.), *Security Dynamics in the South China Sea* (London and New York: Routledge, 2024). He was one of the key contributors to *The Routledge Handbook of Soviet and Russian Military Studies* (London and New York: Routledge, 2025).

Endnotes

1 Alexander Hill (ed.), *The Routledge Handbook of Soviet and Russian Military Studies* (London and New York: Routledge, 2025), p. 1.

2 Tracey German, *Russia and the Changing Character of Conflict* (Amherst, NY: Cambria Press, 2023), p. 22.

3 Simon Shuster and Vera Bergengruen, 'Inside the Ukrainian Counteroffensive That Turned the Tide of the War', *Time* (webpage), 26 September 2022, at: https://time.com/6216213/ukraine-military-valeriy-zaluzhny/.

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5 German, *Russia and the Changing Character of Conflict*, p. 29.

6 Ibid., p. 71.

7 Ibid., pp. 82–90.

Book Review

Our Enemies Will Vanish: The Russian Invasion and Ukraine's War of Independence

Author: Yaroslav Trofimov

Penguin Random House, 2025, ISBN 9781405957946, 400 pp,
RRP AU$24.95 (softcover)

Reviewed by: Oleksandra Molloy

In his book *Our Enemies Will Vanish: The Russian Invasion and Ukraine's War of Independence*,[1] Yaroslav Trofimov reports firsthand perspectives on Russia's war against Ukraine. In the ever-evolving field of contemporary warfare, Trofimov's book stands as a critical document, offering both granular battlefield details and a sweeping geopolitical overview of Russia's full-scale invasion of Ukraine. Unlike conventional military histories that analyse war from a purely doctrinal perspective, this book immerses the reader in the lived experiences of soldiers, commanders, and civilians caught in the crossfire. Trofimov's conversations with political and military leaders and firsthand observations add depth to the book, making it both a historical record and a gripping war chronicle.

As a Ukrainian-born chief foreign affairs correspondent for the *Wall Street Journal* with extensive experience covering conflict zones, Trofimov presents a detailed, firsthand perspective on the war, capturing both the harrowing realities of combat and the enduring spirit of the Ukrainian people. Trofimov, accompanied by his photographer Manu Brabo and security adviser Stevo Stephen, embeds himself in the frontline experience. Trofimov paints a vivid picture of how the war has unfolded, not just in military terms but also in its impact on civilians, soldiers, and the nation's identity. The author captures the evolution of combat strategies, the shifting nature of modern warfighting, and the role of both technology and human ingenuity in resisting a numerically superior force.

Since Russia's full-scale invasion of Ukraine in February 2022, Trofimov has spent several months at the heart of the conflict, very often on its front lines. In this authoritative account, he traces the war's decisive moments—from the battle for Kyiv regions, like Bucha and Irpin, to southern Mariupol and north-eastern Bakhmut—to show how Ukraine and its allies have turned the tide against Russia. Putin had intended to conquer and annex Ukraine with a vicious *blitzkrieg*, redrawing the map of Europe in a few short weeks with seismic geopolitical consequences. But in the face of this existential threat, the Ukrainian people have fought back, even as the territorial battle continues to seesaw to this day.

With deep empathy and local understanding, Trofimov describes how everyday Ukrainian citizens—doctors, computer programmers, businesspeople and schoolteachers—risked their lives and lost loved ones. He blends their brave and tragic stories with expert military analysis, providing unique insight into the thinking of Ukrainian leadership and mapping out the decisive stages of what has become a perilous war for Ukraine, the Putin regime and, indeed, the world. It is the story of ordinary people fighting not just for their homes and their families but also for justice and democracy.

One of the book's central themes is Ukraine's strategic and psychological resilience. Trofimov illustrates how Ukrainian forces adapted, innovated and resisted, turning what many expected to be a swift defeat into a protracted and determined defence. The book delves into tactical shifts, battlefield conditions and the role of international support, providing a well-rounded view of how the conflict evolved. Beyond the battlefield,

Our Enemies Will Vanish explores the human cost of war. Trofimov highlights the sacrifices made by ordinary Ukrainians, from volunteers and medics to families separated by the conflict. He does not shy away from depicting the suffering caused by war crimes, displacement, and the constant threat of missile strikes.

One of the book's highlights is Ukraine's asymmetric warfare strategies. Trofimov expertly dissects how Ukrainian forces transformed from a conventional military into a highly adaptive force capable of leveraging drones, Western weaponry, and deep local intelligence networks:

> What the world witnessed was not just a battle between armies but a contest of innovation. Each week brought a new tactical adaptation, a fresh countermeasure, as Ukraine rewrote the rules of modern conflict in real time.[2]

By emphasising Ukraine's agility in integrating real-time intelligence with battlefield manoeuvres, the book offers a nuanced understanding of how wars are won no longer solely by firepower but by superior decision cycles and information dominance—key tenets of manoeuvre warfare theory. Military professionals studying the evolution of asymmetric warfare will find *Our Enemies Will Vanish* invaluable. Ukraine's ability to counter a numerically superior adversary through mobility, precision strikes, and decentralised command structures provides a contemporary case study that echoes conflicts such as the Soviet–Afghan War and insurgencies in Iraq and Afghanistan.

One of the book's most striking insights concerns the role of drone warfare, with Trofimov noting:

> The defining image of this war may not be tanks rolling into battle, but the silent hum of a drone above a Russian convoy, a single operator altering the course of an entire engagement.[3]

This observation reinforces the book's overarching theme: technological agility, rather than sheer numbers, will define the wars of the 21st century.

Great military books are as much about the people waging war as they are about the tactics deployed. Trofimov ensures that *Our Enemies Will Vanish* does not devolve into a purely operational analysis; instead, it brings to life the individuals shaping the war's outcome. The book introduces us

to Ukrainian commanders who faced overwhelming odds yet managed to hold critical positions, often with dwindling resources. 'In this war, waiting for orders gets you killed. We adapt, we improvise, and we win'.[4] This sentiment underlines a crucial theme of the book—while Russia's military doctrine remains entrenched in Soviet-era rigidity, Ukraine's decentralised model, fuelled by empowered junior leaders, has proven vastly superior in key battles such as the defence of Kyiv and the counteroffensives in Kharkiv and Kherson. Military strategists often emphasise numbers and tactics, but *Our Enemies Will Vanish* reminds us that wars are fought by individuals who must adapt, endure and overcome. The book serves as a critical text on leadership in combat and resilience under extreme conditions.

Beyond strategy and tactics, *Our Enemies Will Vanish* does not shy away from the grim realities of war. Trofimov documents the atrocities committed in Ukrainian cities, presenting harrowing testimonies that echo the investigative rigor of Timothy Snyder's *Bloodlands*.[5] His descriptions of Russian occupation tactics—targeting civilians, weaponising winter, and mass deportations—serve as a sobering reminder that modern warfare is not solely confined to the battlefield. The book makes a powerful case for accountability in warfare:

> War is not just fought with bullets and artillery. It is waged against history, identity, and memory. For Ukraine, survival is not just a matter of holding territory but preserving a national consciousness that its enemies seek to erase.[6]

This perspective elevates the book from a mere war chronicle to a larger reflection on war crimes, historical erasure, and Russia's brutal aggression against a sovereign and democratic state.

No modern war operates in isolation, and Trofimov dedicates significant attention to the global implications of Ukraine's resistance. He examines how Western military aid—ranging from the High Mobility Artillery Rocket System to Leopard 2 tanks—has transformed the battlefield, drawing comparisons to Cold War era proxy conflicts. The book's discussion on the geopolitical chessboard recalls Lawrence Freedman's *Strategy: A History*, particularly in how nations calibrate military assistance to balance deterrence with escalation risks. The book offers insight into how Ukraine effectively combined Western-supplied weaponry with home-grown tactics, making it a must-read for those studying modern military logistics, force

projection, and the role of allied support in active conflict zones. Trofimov does not just recount battles; he situates them within the larger context of European security and global deterrence theory. Historians will appreciate the depth of his analysis regarding the war's long-term implications for NATO and global power dynamics.

The book is written in a gripping, fast-paced style that reflects the urgency of the events it describes. Trofimov's journalistic clarity ensures that even readers without a deep background in Ukrainian history or military affairs can follow the unfolding narrative. His storytelling is vivid, making the reader feel the weight of each battle, the uncertainty of each moment, and the hope that fuels Ukraine's resistance. *Our Enemies Will Vanish* is an essential read for anyone seeking to understand the realities of modern warfare and the geopolitical stakes of Russia's invasion of Ukraine. Trofimov's analysis goes beyond battlefield movements, offering insights into the war's broader implications for Europe and the world. This book serves as both a historical document and a testament to the resilience of those fighting for Ukraine's sovereignty.

With *Our Enemies Will Vanish*, Yaroslav Trofimov delivers a powerful and necessary account of a war that continues to shape global politics. For those seeking to understand how wars are fought in the modern age—where information, technology and leadership outweigh brute force—this book is essential reading. Trofimov's *Our Enemies Will Vanish* will likely be referenced for years to come as a definitive account of Ukraine's most existential battle.

About the Reviewer

Dr Oleksandra Molloy is a senior lecturer in human factors and aviation safety, in the School of Science of the University of New South Wales at the Australian Defence Force Academy. Oleksandra is a multiple award-winning leader and research trailblazer dedicated to advocating, educating, collaborating, and empowering and inspiring the next generation of professionals. Dr Molloy is an expert on drones in modern warfare and their role in the Russia–Ukraine war.

Endnotes

1 Yaroslav Trofimov, *Our Enemies Will Vanish: The Russian Invasion and Ukraine's War of Independence* (Penguin, 2024).

2 Ibid., p.134.

3 Ibid., p.198.

4 Ibid., p.187.

5 Timothy D Snyder, *Bloodlands: Europe between Hitler and Stalin* (Penguin, 2011).

6 Trofimov, *Our Enemies Will Vanish*, p. 224.

Book Review

China's Law of the Sea: The New Rules of Maritime Order

Author: Isaac B Kardon

New Haven, Connecticut: Yale University Press, 2023, ISBN 9780300256475, 416 pp, RRP US$40.00

Reviewed by: Samuel White

Isaac B Kardon's *China's Law of the Sea: The New Rules of Maritime Order* offers an insightful examination of China's maritime ambitions and their implications for international maritime law. My own background is in the Australian Defence Force (ADF) (13 years across the permanent and reserve forces), and in my civilian employment I am an international lawyer and academic. This is not a particularly new area for me. However, Kardon's analysis notably shifted my perspective on the complexity of the field and the flexibility of international relations, especially as it pertains to maritime governance, a subject of considerable importance as the ADF, Australia and many within the Indo-Pacific nervously eye events in the South China Sea.

Simply put, the book is structured into six substantive chapters. In Chapter 1 Kardon highlights how China is challenging traditional understandings of international law, and in Chapter 2 he outlines the relevant legal

framework. The following four chapters are core reading for anyone trying to understand the key issues in the South China Sea. Kardon examines international legal principles as they apply in the following contexts: geographic (Chapter 3), resource (Chapter 4), navigation (Chapter 5) and dispute resolution (Chapter 6). These chapters are followed by a conclusion.

In framing the principles of international law, Kardon does not engage as heavily as one might expect with its Eurocentric nature, the history of its development as a corollary tool of colonisation and imperialism, or modern critiques of its structure.[1] These are important areas to cover in order to understand why Australia's approach to a 'global rules based order' is not so readily received by other states within our region, let alone globally. To understand China's motivations for critically engaging with the rules of international law, and questioning its application, requires consideration of its history, particularly its 'century of humiliation' (1839–1945). Kardon emphasises that China's experience with foreign intervention and territorial losses during this period continues to shape its approach to international law. The emphasis on sovereignty and control over maritime space is not simply expansionist; it is deeply rooted in a historical narrative of vulnerability. Acknowledging this can provide a more nuanced understanding of Chinese actions in the South China Sea.

Instead of considering international law from the perspective of its European roots, Kardon posits that international law is binary in nature—developed and implemented either 'top down' or, alternatively, through 'grassroots' by states.[2] These two approaches to international law are simply put yet eye-opening. With this perspective, Kardon argues that China uses both methods concurrently not so much to break or change the rules as to reorder their importance. This unique standpoint provides a solid framework to engage with the contemporary debate of 'Is China breaking the law of the sea?'.

One of the book's strongest sections explores customary international law, with Kardon delving into its complex dual foundations in Chapter 2. Establishing that something (a rule, a principle, a crime etc.) is a matter of customary law depends on the satisfaction of two tests: *state practice* and *opinio juris*. Kardon illuminates the challenges these tests pose. *State practice* requires that countries act in a way that reflects a particular norm, consistently and over a significant period. As Kardon notes, the difficulty

lies in identifying a genuine, consistent pattern of state behaviour. Countries may act with diverse motivations, and their actions are not always a straightforward reflection of legal obligation, making it tough to determine when a genuine customary norm has emerged. Opinio juris is the second requirement. It requires that a state act in a certain way in the belief that its actions are legally required, not simply as a matter of convenience. This element is especially difficult to prove. States may outwardly align with a practice but internally lack any belief that they are obligated to do so. In practice, opinio juris is challenging to measure, as states often keep their strategic reasoning private or justify deviations based on immediate needs rather than as an outright rejection of a norm. For those in the military legal field, Kardon's analysis is a crucial reminder of just how intricate the process of establishing customary law is—and why it is so often contested.[3] Indeed, Kardon notes that customary international law is made through breaches of it.[4] This is not unique to international law and is reflected in the concept of critical legal theory that asserts that social friction drives law. Importantly, custom is the malleable part of international legal frameworks, making it the focus of strategic attention among states in grey-zone operations. A key strength of this monograph is its articulation of this concept.

Fundamentally, international law is implemented by states through their domestic law. In this regard, Kardon effectively highlights the Leninist approach to law as a tool.[5] In this model, law is explicitly and inescapably linked to party politics—law (international and domestic) should be used to promote party politics where it legitimises conduct, and distanced when it does not. China's insistence on sovereign control over key ports and oceanic routes is, in many ways, comparable to Australia's strategic imperatives to sovereign control over its maritime zones, as an island nation heavily reliant on secure maritime access. Reading Kardon's account clarifies that China is hardly unique in strategically using treaties and international legal principles to secure national interests—a practice common to many nations.

In Chapter 5 Kardon dissects the ongoing debate over the nature of the United Nations Convention on the Law of the Sea (UNCLOS)—whether it serves as a 'constitution for the oceans' as some international lawyers believe, or merely a framework that states can interpret as they see fit. On the one hand, UNCLOS is black-letter law and is regarded by some lawyers as a constitution for the regulation of international maritime matters.

On the other, the reviewer's personal experience indicates that UNCLOS was intended to create a general framework only, with its architects hoping that subsequent treaties would develop in accordance with it.[6] Western nations, including Australia, largely subscribe to the notion of UNCLOS as a binding set of rules for maritime order.[7] By contrast, China views UNCLOS as a framework, interpreting its provisions to align with national strategies. Kardon highlights that this divergence in perspectives is not simply academic but has very real consequences for maritime stability in contested regions. For someone who has regularly worked within the framework of these laws (and continues to do so in the Indo-Pacific region), Kardon's arguments compel reflection on the limits of standard assumptions about the stability of international legal systems. International law is often depicted as a stable framework, with clear rules defining states' actions.[8] Yet Kardon exposes a much more dynamic, malleable reality, particularly when China not only violates and bypasses existing rules but also seeks to reshape them to serve its national interests. For those seeking to understand the critical area of controversy, Chapter 5 is significant. For those wanting to understand the full ambit of the complexity of the law of the sea, I recommend the book in its entirety.

Given the detailed nature of Kardon's work, *China's Law of the Sea* is a rigorous and eye-opening study but one that requires some commitment. This book offers dense reading for general practitioners in the profession of arms, with significant portions devoted to black-letter law. However, for those who can persevere through its technical aspects, it is a rare opportunity to see the world through the lens of the Chinese Communist Party and its approach to wielding law as a strategic tool. For staff officers in particular, Kardon's analysis is invaluable. Understanding the roots of tension in maritime theatres and the legal frameworks surrounding these disputes is crucial. Equipped with the insights this book offers, staff officers can enhance their ability to seek nuanced assessments on aspects of international law from military and defence legal officers. In modern operations, where legal thresholds shape almost every decision, it is vital to understand our own legal frameworks and those of our military partners, as well as the legal perspectives of those nations with which Australia may find itself in competition. Kardon's book equips military and strategic analysts alike with the context needed to interpret these frameworks and to anticipate how China may leverage them in future scenarios.

China's Law of the Sea is more than an academic treatise; it is a critical resource that encourages practitioners to rethink the assumptions underpinning a Western understanding of maritime law. By challenging traditional perspectives, Kardon not only enriches the discourse but also equips military professionals with a deeper understanding of the evolving legal landscape. His work reminds us of the fluidity of international law and the role state practice plays in remoulding it, a reality that requires constant vigilance and adaptability.

About the Author

Dr Samuel White is an Associate Professor at the National University of Singapore, where he is the Senior Research Fellow in Peace and Security at the Centre for International Law. He is the Army Fellow at the Australian War Memorial and a Visiting Fellow at the Australian Defence Force Academy, and in 2025 was appointed a Fellow of the National Library of Australia for his work on Australian legal history. Samuel has served as both a Royal Australian Infantry Corps and an Australian Army Legal Corps officer in a variety of tactical, operational and strategic level postings. He currently holds the rank of Major at Army Headquarters.

Endnotes

1 See Samuel White and Ikhwan Fazli, *Pax Britannica: Tracing Customary War Crimes in the Age of Empire* (Brill Nijhoff, 2025).

2 Isaac B Kardon, *China's Law of the Sea: The New Rules of Maritime Order* (New Haven CT: Yale University Press, 2023), p. 14.

3 Ibid., p. 16.

4 Ibid., p. 24.

5 Ibid., p. 59.

6 See for example the Underwater Cultural Heritage Convention, which expands upon UNCLOS Article 303.

7 Natalie Klein, 'Resolving Disputes under UNCLOS when the Coastal and User States are Disputed', in Nong Hong and Gordon Houlden (eds.), *Maritime Order and the Law in East Asia* (Routledge 2019), pp. 19 – 32.

8 Kardon, *China's Law of the Sea* (n 2), p. 120.

Book Review

The Military Revolution and Revolutions in Military Affairs

Edited by: Mark Charles Fissel

De Gruyter Oldenbourg, 2023, ISBN 9783110657258, 471 pp,
RRP EUR€84.95 (hardcover)

Reviewed by: Nick Bosio

Many commentators view the concepts of military revolutions and revolutions in military affairs (RMA) as synonymous with technological advantage. A cursory view of these concepts assumes that advanced technology drives military development. Under this simple view, the military that harnesses technology more quickly than its opponent will achieve superiority. Commentators who take this view then assert that technology equates to decisive victory. Fortunately, Mark Fissel's edited book *The Military Revolution and Revolutions in Military Affairs* does not fall into this trap.

Fissel's book takes a fresh approach to exploring military revolutions and RMA. Most of the text focuses on military revolutions and their interplay with politics, society, culture and the harnessing of national power. The book takes a broader view compared to other works by exploring different regions and periods, emphasising Eastern European, Ottoman/Türkiye and

North Asian military revolutions. Much of the text reinforces three themes relevant to any military practitioner wishing to understand the interplay between technology and military power.

The first central theme is that military culture influences technological use. The work compares the gunpowder military revolutions in Western Europe, North-East Asia, Eastern Europe and the Ottoman Empire. It explains that nations of the time understood the relevant technologies, their benefits and how others used such advances. Nevertheless, each case showed a very different interpretation and implementation of capability.

Hyeok Kang's chapter is highly illustrative of this first theme. Kang's chapter, 'Difference in an Age of Parity', discusses musketry development, use and training. Kang highlights how the West was capable of crafting precision muskets for hunting, yet the West's military culture emphasised military mass in combat. In the gunpowder era, this culture manifested as weight of firepower through mass-produced weaponry. Such weapons were individually less accurate but faster to reload and easier to train. East Asia, with a culture of individual martial excellence, focused instead on precision fire using exquisitely crafted weapons. Kang's case studies, and others throughout the book, show how different military cultures often use the same technology in different ways. Therefore, understanding military culture helps one interpret how one's own nation—and others—may apply technology. Already contemporary military cultural differences see different nations emphasising and using emergent technology, such as drones and artificial intelligence, in divergent ways. Understanding military culture may also give insights into future adaptations by allies, partners and possible malign states. The importance of military culture is not the only theme within this text.

The Military Revolution and Revolutions in Military Affairs outlines the importance of political and social culture and context. While military culture may influence the *use* of technology, several authors explain how political and social culture influences technology's *acceptance*. Of the book's chapters, Wayne Lee's chapter, 'To Stop a Cannonball: Ottoman Fortress Design and Comparing Military Revolutions', best demonstrates this theme. Lee explains several factors that influenced Ottoman strategic and military thinking. First was the need to manage a large empire. Next, the Ottoman Empire was reliant on centralised control from Istanbul. Such a centralised

system created economic inefficiencies but was necessary to manage different political groups within the empire. Finally, the Ottomans had a military culture of swift offensive action.

Lee outlines how the Ottomans understood all the technological developments occurring in Western and Asian nations. Further, the Ottomans recognised the need to fortify their frontier. However, such fortifications rarely leveraged the technological advances seen in Western, and later Asian, nations. The decision not to integrate or upgrade military infrastructure was partly based on the main threat faced by the Ottomans: insurgencies within provinces. Another reason was the difficulty of disseminating design and technological knowledge across the empire. For cultural reasons, there was limited use of the printing press and perspective drawing. These limitations hindered the widespread promotion of knowledge of new technological methods. Instead, Ottomans often held centrally controlled scale models, or replicated designs by hand. Such replication was time and cost intensive. Lee's analysis clarifies how a nation's decisions on technology are grounded as much in political, economic and societal culture as in military culture. Therefore, studying a nation's socio-political culture and economic context helps military officers understand what technology is likely to be accepted, how that acceptance may be enhanced, and how the technology could be used beyond the military sector. As Kang states in his chapter:

> The difference … stemmed not from an incommensurable gap (or 'divergence') in drill and training … but from a certain 'interpretation' of technology that shaped (and was being shaped by) its surrounding context, social and cultural as well as political, economic, and aesthetic.[1]

The final theme that reading *The Military Revolution and Revolutions in Military Affairs* makes clear is how technology can also be a weakness. Technology may give a military, and by extension a nation, an edge in war. However, technology can also become a crutch. Nations and militaries must be careful not to become over-reliant on specific capabilities. Such over-reliance leads to second- and third-order adverse effects on logistics, industry, the economy, and potentially society. Although discussed by several authors within the book, this theme is best seen in James O'Neill's analysis of the military revolution in Ireland during the early and mid-17th century.

O'Neill's chapter, 'Firearms and Fieldworks: Military Transformation and the End of the Gaelic Ireland', discusses two points. The first is that middle and small powers can leverage military revolutions to defeat larger powers tactically. This lesson has relevance to Australia. However, the second point is just as pertinent and is a recurring theme in this book and history: technology can lead to military weakness. O'Neill explains how the Irish readily adapted the pike and shotte technology (capability) and tactics more quickly than early English forces. Irish political leaders and society embraced such capabilities, including limited manufacture. This enabled technology acceptance. However, without considering the second- or third-order effects, the Irish became fixated on gunpowder and its tactics without developing robust logistics and national systems to support its use. When the English finally targeted this weakness, English victory became inevitable, even though the English were not as superior in capability or the military arts. As O'Neill states:

> The dramatic and enthusiastic adoption of firearms and firepower dominated [Irish] warfare … However, their rapid change also planted the seeds for Irish defeat … Irish had come to depend almost completely on gunpowder, without which the thousands of Irish guns become just so many expensive clubs.[2]

Over-reliance on select capabilities has been seen throughout history. For example, Israeli over-reliance on tanks and strike craft post the Six-Day War, at the expense of other arms and military arts, contributed to the surprise and early losses in the Yom Kippur War.

This book also includes some unique discussions on military revolutions. The abovementioned chapter on Irish military revolutions is a valuable case study for a small to middle power. Noting the capability risks identified above, the case study explores how small powers can adapt technology, adjust culture and enhance national power to achieve disproportionate outcomes. Vladimir Shirogorov writes about the development of amphibious warfare and technology. His chapter provides a useful foundation for anyone interested in exploring the different ways to think about littoral and amphibious operations. Finally, Fissel provides a chapter that helps scholars and practitioners understand the links between historical case studies and contemporary thinking concerning technology, military revolutions and RMA.

Advocates for RMA often over-emphasise the benefits of technology and minimise the importance of culture and national power. *The Military Revolution and Revolutions in Military Affairs* takes a broader view. It captures the themes of how military culture influences the use of technology, how political and societal culture influences the acceptance of technology, and how technology over-reliance can lead to national weakness.

The lessons one can draw from *The Military Revolution and Revolutions in Military Affairs* are critical for the profession of arms. Whether it is within military education, capability development, training and doctrine, or in the development of future warfighting concepts, military professionals should remember the importance of culture and context. Often culture and context drive technology acceptance and use. Technology will either be ignored or become a tactical fascination without cultural support. Tactical fascinations often lead to technological weakness and, as seen with the Irish, can result in strategic risk and failure.

About the Reviewer

Colonel Nick Bosio has held various command and staff appointments across tactical, campaign and strategic posts within Australia and on operations. His experience includes Chief of Campaign Plans for a 3-Star Coalition Headquarters, Commanding Officer of the 6th Engineer Support Regiment, and Deputy Head/Director of Military Strategic Plans. Colonel Bosio holds a Bachelor of Engineering, three master's degrees and a research doctorate (PhD) focusing on military theory, strategic studies, and systems thinking. He is the author of the Australian War College's *On Strategic Art* handbook. He is currently Director Strategic Preparedness in Force Design Division.

Endnotes

1 Mark Charles Fissel, *The Military Revolution and Revolutions in Military Affairs* (Berlin and Boston: De Gruyter Oldenbourg, 2023), p. 58.

2 Ibid., p. 200.

Book Review

The Arms of the Future: Technology and Close Combat in the Twenty-First Century

Author: Jack Watling

Bloomsbury Academic, London, 2023, ISBN 9781350352957, 258 pp (paperback), RRP AU$44.99

Reviewed by: Robin Smith

The Arms of the Future: Technology and Close Combat in the Twenty-First Century by Jack Watling is a seminal work that delves deeply into the transformative impact of emerging technologies on modern warfare with a particular focus on the land domain. As a military strategist, Watling brings a wealth of knowledge and expertise to the table, offering a comprehensive analysis of the future of close combat, drawing significantly on his insights from Ukraine, Iraq, Mali and other conflicts.

At its core, the book explores the intersection of technology and warfare, examining how advancements in technology fields such as autonomous systems, artificial intelligence and cyberwarfare are revolutionising the nature of combat. Watling's central argument is that these technologies

will fundamentally change the way militaries operate and integrate—not only enabling more precise and efficient operations but also introducing new vulnerabilities and ethical considerations. Furthermore, he offers great insights into the impact not just on tactics, techniques and procedures but also on force design, organisational structures and command and control of the joint force.

One of the book's greatest strengths is its accessibility. Watling's writing is clear and concise, making the book an invaluable resource for both military professionals and non-experts. He expertly breaks down complex technological concepts, making them understandable to a broad audience. This is no small feat, given the technical nature of the subject matter and the deductions on the impact for the non-military professional.

Watling's expertise shines through in his highly nuanced discussion of the tactical application of such emerging technologies. He provides a detailed analysis of the potential benefits and drawbacks of autonomous systems, artificial intelligence, space and cyberwarfare. For instance, he explores how autonomous systems could enhance precision and reduce the risk of civilian casualties but also raise ethical concerns about accountability and decision-making. While these are both well-trodden arguments, he brings great insight to what impact this might have in terms of both defence and offence.

The book's structure is well organised and logical, with each chapter building on the previous one to create a cohesive narrative—leading the reader to the very clear deductions that the author draws. From examining the historical context of technological innovation in warfare to delving into the specifics of emerging technologies and their applications, he takes the reader on a comprehensive journey. He then explores the ethical and strategic implications of these technologies, before concluding with a thought-provoking discussion of the future of close combat and of structural impacts, including on the other domains: maritime, air, space and cyber. He goes so far as to signpost potential ramifications for future acquisition and force postures.

Throughout the book, Watling draws on a range of case studies and expert interviews to illustrate his points. These examples serve to ground the discussion in reality, making the book feel more like a practical guide than a theoretical thought experiment. The inclusion of firsthand insights from

military professionals, policymakers and technologists adds depth and nuance to the analysis, providing a detailed view of the complex issues at play.

One of the book's most compelling aspects is its balanced approach to the benefits and risks of technological advancements in warfare. Watling is neither a technophile nor a Luddite, instead offering a measured assessment of the potential advantages and disadvantages of emerging technologies, with practical examples. He raises important questions regarding the potential for technological over-reliance and the need for careful consideration of the human costs of war. He grapples with the complex moral questions surrounding the development and deployment of machines that can select and engage targets without human intervention. His analysis is thoughtful and nuanced, while also highlighting the risks of unaccountable decision-making and the potential for machines to make life-or-death decisions without human oversight.

The book's final chapter, which explores the future of close combat, is both thought-provoking and sobering. Watling paints a vivid picture of a future in which autonomous systems, artificial intelligence and cyberwarfare play an increasingly prominent role in modern conflict. He argues that militaries must adapt to these changes, embracing innovation while also addressing the ethical and strategic implications of emerging technologies.

In conclusion, *The Arms of the Future* is a timely and important contribution to the discourse on modern warfare and technological innovation. Watling's expertise and balanced approach make the book an invaluable resource for military strategists, policymakers, and anyone interested in understanding the future of conflict and the role of technology in shaping it. Its contemporary nature will assist in making sense of the current conflict in eastern Europe.

About the Reviewer

Colonel Robin Smith OBE, CSC is a military officer with significant recent experience in the application of emerging and disruptive technology, including the foundation of the Army's Robotic & Autonomous Systems Implementation & Coordination Office. He is currently working in Headquarters Space Command.

Book Review

Heavy and Continuous Sacrifice: New Zealand, Her Allies and the Second World War

Editors: Peter Cooke and John Crawford

New Zealand Military History Committee, 2024, ISBN 9780473704230, 486 pp., RRP NZD$45 (softcover)

Reviewed by: Brian Farrell

The most difficult obstacle facing any effort to publish a history book that emerges from an academic conference is to persuade a publisher to take it on in the first place. Many shy away, citing the difficulty of compiling a volume that maintains coherence in coverage of its connecting theme, and quality in standards of analysis and writing. This volume would have cleared both those bars with ease but, in any case, the New Zealand Military History Committee, assisted by the New Zealand Defence Force and the Ministry for Culture and Heritage, was always going to publish this product of the sixth in its internationally successful series of conferences on New Zealand and its military history. It not only maintains the high standard set by its predecessors; it also meets the challenge to add new things to our critical knowledge of its subject. Achieving this required some redesigning of the

topic, as the inaugural conference in 1995 also focused on New Zealand in World War II. This volume found a way to do that redesign, using three approaches. It asked some fresh questions. It returned to familiar themes from a different perspective. And it put the stories of the war experiences of New Zealand and New Zealanders in a broader context: examining those experiences within the network of alliances inside which the country waged war. As such, this volume takes its place alongside the commanding studies—McGibbon, Henley, Wood, Gardiner, Pugsley, Harper, to name a few—that have shaped the historiography of New Zealand.

Indeed, this volume strongly reminds us, by its quality and breadth, of the continuing validity of using the nation and national experience as a vantage point from which to understand histories that are by no means restricted to that nation. World War II was a global total war. Australian readers will certainly encounter problems discussed herein that featured in their own country's war history: difficult relations with the British and the Americans, concerns about the Japanese, the strains of mobilising for a long global war—one could go on. But each problem had either a feature unique to New Zealand or a singular impact on New Zealand, or often both. Jewish refugees fled to many countries before and during the war, but those who wound up in New Zealand certainly had experiences unlike any other and they affected their new home in unique ways. New Zealand service personnel were not the only contingent to experience 'culture shock' in overseas encounters, in their case in the Mediterranean and Middle East. One thinks of the American 'invasion' of wartime Britain. But again, the New Zealand experience not only was singular but also left footprints, overseas and at home. These and a number of other themes are not unique to New Zealand experience but, in important ways, are singular within it. They include medical protection of troops in the field, sexual violence and garrison troops, perceptions of the enemy and their impact on the war effort, and New Zealand's awkward effort to cope with a former ally turned possible enemy. These topics all receive strong critical analysis.

For readers of this journal, however, the chapters most likely to be of greatest interest are those that deal with the running and fighting of New Zealand's war, on land, at sea and in the air. The development of wartime intelligence is analysed, as are questions of command and strategy, the New Zealand Division in battle in North Africa, casualties and what they can tell us about unit performance, and New Zealanders participating in

the war against Japan. Most chapters provide critical analysis drawn from archival research; all reward reading and five deserve extra comment. David Littlewood's careful evaluation of conscription drives home how fundamental this policy became to every aspect of New Zealand's war. John Crawford works through the official records to explain how New Zealand chose who to appoint to command positions in its second major expeditionary force within a generation. He underlines the price that must be paid for allowing capabilities to decline below critical mass but he also notes quality and success when he encounters it. Peter Wood uses court-martial records to subject an incident involving one platoon to analysis, and his observations can be expanded to shed light on wider questions of morale and the 'will to fight' among larger formations, in long and tiring campaigns. His conclusions are sober but fair and surely timeless. Jonathan Fennell exploits a large mass of different kinds of records to do something no-one had previously tried: to use cultural history to explain the relationships between New Zealand society and the national army it produced, and how the composition of that army affected the nation as well as the war. And Simon Moody rescues the Royal New Zealand Air Force from undeserved obscurity for its role in the unsuccessful British Empire campaign to defend Malaya and Singapore, teaching us more, in the process, about the wartime evolution of that air force and its coalition experiences.

Books such as *Heavy and Continuous Sacrifice: New Zealand, Her Allies and the Second World War* cannot, by their nature, be single-volume general histories of their subject. The range of themes presented herein is intended instead to illustrate the breadth and complexity of the New Zealand wartime experience, rather than narrate it comprehensively. It does this very well. Two final points can be made for Australian readers of this journal. Dan Lear's poignant study of how New Zealand struggled to get Australian attention in the run-up to war in Europe might make interesting reading for those more used to reading about Australian struggles to catch British or American attention. And the editors chose wisely in concluding with Roger Steele's very personal account of his parents, their war, and the long shadow it cast on their lives. As Steele said, this war has never really ended—not in New Zealand or anywhere else.

About the Reviewer

Professor Brian P Farrell is a Professor of Military History at the National University of Singapore, where he has been teaching and writing since 1993. His main research interests are the military history of the defence of the British Empire, the Western military experience in Asia, and coalition warfare. He has published extensively in these fields. His most recognised work is *The Defence and Fall of Singapore 1940–1942* (2005), his most recent publication is *From Far East to Asia Pacific: Great Powers and Grand Strategy 1900–1954* (2022, co-edited), and his forthcoming book is *Misfire: British Empire Special Forces and Defeat in Malaya in World War II*.

Book Review

Forging the Anglo-American Alliance: The British and American Armies, 1917–1941

Author: Tyler R Bamford

University Press of Kansas, 2022, ISBN 9780700633180, 304 pp,
RRP USD$59.99 (hardcover)

Reviewed by: Megan Hamilton

The alliance between Great Britain and the United States of America in World War II was deemed to be 'the most complete unification of military effort ever achieved' by General George Marshall, US Army Chief of Staff during the war.[1] However, as other scholars of alliance warfare in the 20th-century Anglosphere have shown, such tight collaborations rarely materialised out of nowhere. These relationships required nurturing over many years, especially in peacetime when limited military budgets forced creative problem-solving.[2] Tyler Bamford illustrates this theme clearly for the Anglo-American alliance in his book *Forging the Anglo-American Alliance: The British and American Armies, 1917–1941*.

In a departure from previous literature, particularly Niall Barr's *Yanks and Limeys*, Bamford 'asserts that an informal Anglo-American defense relationship existed before the outbreak of World War II and uses the armies as the platform to demonstrate this relationship's existence'.[3] By focusing on the interactions between the British and American armies in the late World War I and interwar years, Bamford demonstrates how the two nations were able to harmonise their efforts so quickly when the US officially joined the war in 1941. While top generals feature in this narrative, Bamford places most emphasis on the influence of the military attachés stationed in London and Washington. His evidence conveys that personal relationships and precedence were more important than formal structures. Shared class, culture and religion also helped to cement the bonds between officers of the two armies. The close levels of cooperation that became so apparent during World War II were the product of a long military-diplomatic process that began in 1917.

Bamford structures his content chronologically, beginning in 1917 with the dispatch of the American Expeditionary Force to the Western Front. Chapter 1 explores the encounters between the UK and US armies through training and frontline service in 1917 and 1918. By using postwar memoirs, Bamford finds that relations between officers were warmer than those between the rank and file due to the officer classes sharing more comparative social backgrounds than other ranks. On the whole Anglo-American relations in this period were warmer than those with the French Army, a point of comparison that Bamford employs throughout this study. Chapter 2 deals with the years 1918 to 1923, during which both armies fought in Russia as well as in the occupied sectors of south-west Germany. It was during this time that the wartime bonds were crystalised and Anglo-American 'military diplomacy' began in earnest with the establishment of formal military attachés.[4] While politicians from the two countries did not always agree on the postwar international order, Bamford explains how informal relations between the British and American occupation forces set a positive tone for the interwar years.

Chapters 3 through 5 illustrate how the Anglo-American armies maintained close peacetime ties after the American occupation force left Europe. The two countries viewed each other as their most important international partner, but also as a rival. This balancing act played out through various degrees of formal and informal information sharing, with military attachés being the key informants. Bamford explains how the British War Office was

often the more secretive partner, forcing the American attaché to create strong personal relationships that enabled him to bypass formal channels. However, shared language, class and culture allowed for officers from both armies to enjoy warm personal relationships. All of this was essential to maintaining peacetime bonds between two armies that were suffering from Depression-era budget cuts. As Germany, Japan and Italy began to show signs of aggression in the mid-1930s, the Anglo-American alliance focused on the topic of rearmament. Even while unpaid British war debt and differing international outlooks caused tension, Britain and the US watched each other's rearmament efforts and technological developments closely.

When Britain went to war with Germany in 1939, there was no guarantee that the US would officially get involved. However, as Bamford demonstrates in chapters 6 and 7, American politicians and military officials did much to prepare for the possibility that they would go to war alongside the British. Military attachés continued to play essential roles in the transatlantic dialogue, but after the fall of France in June 1940, the connections became much more formalised. Secret staff talks commenced to discuss formal structures in the event that the alliance was to become official, while large military and scientific missions were established in London and Washington. Bamford focuses largely on the higher strategic perspective in these final chapters, such as the 'Destroyers-for-Bases' deal, Lend-Lease and the Atlantic Charter, but makes it clear that it was the strong personal bonds of the interwar years that allowed for the alliance to be bolstered so quickly. His conclusion discusses how the Anglo-American alliance of the Second World War was based on lessons from the countries' experience of World War I. Bamford ends the main narrative in January 1942 before briefly discussing the postwar legacies of the alliance.

Forging the Anglo-American Alliance is a thoroughly researched study that deserves to enjoy a prominent place in the busy historiography of alliance warfare in the 20th century. By conducting an in-depth exploration of the mechanics of the transatlantic alliance, Bamford reveals the influence of individuals and long-term relationship development. He goes beyond the strategic links of the two nations to consider the impact that shared culture, language and values had on the strength of the alliance. While Bamford sets out to tell the narrative from both sides of the Atlantic, and bases his book on the conduct of multi-national archival research to support this aim, the book nevertheless tends to use the American perspective as the default lens, likely stemming from the author's greater familiarity

with American sources.[5] More could have been made of the importance of Britain's dominion armies in the relationship. The armies of the British Commonwealth were closely integrated into the British Army's strategic plans, as London knew that its imperial forces were a critical asset, allowing for British strategic aims to be projected in all theatres of war.[6] With the Commonwealth armies serving as an extension of the British Army, and considering America's own involvement with the Commonwealth armies in various theatres of war, this study would have been enhanced by a few pages dedicated to acknowledging these wider ties. Bamford's preference to consider ties as purely bilateral does not reflect alliance warfare in a networked and imperial war, the globality of which is increasingly being unearthed by modern scholars. In addition to Douglas Delaney's *The Imperial Army Project*, Jonathan Fennell's *Fighting the People's War* would have been a useful addition to the bibliography in this regard.[7] Use of Sam Edwards's *Allies in Memory* would have given the conclusion further support.[8]

Despite having some areas for improvement, this book remains highly readable and will be of utility to academics and military professionals alike. It will engage not only those studying the Anglo-American alliance but also those interested in the mechanics of alliance development through history. Bamford's study highlights the impact of both formal and informal relationship building on wider strategic synchronisation. In regard to the Australian Defence Force, military personnel and public servants working in the areas of international engagement and in military strategic plans would benefit from an understanding of this history, as would senior leaders who influence the tone of relationships with their international counterparts. In the age of collective security, the takeaway for modern readers should be that alliances must be nurtured in peacetime if they are to be relied upon in times of war.

About the Reviewer

Megan Hamilton is a PhD candidate in the Defence Studies Department at King's College London. She holds history degrees from Wilfrid Laurier University and the University of Waterloo, those being largely focused on the Canadian experience of the world wars. Her current research is an Arts and Humanities Research Council Collaborative Doctoral Partnership project at King's College London and the Imperial War Museum that studies World War II army training across the British Empire.

Endnotes

1 Quoted in Niall Barr, *Yanks and Limeys: Alliance Warfare in the Second World War* (London: Jonathan Cape, 2015), pp. 1–2.

2 One prominent example is Douglas E Delaney, *The Imperial Army Project: Britain and the Land Forces of the Dominions and India, 1902–1945* (Oxford: Oxford University Press, 2017).

3 Tyler R Bamford, *Forging the Anglo-American Alliance: The British and American Armies, 1917–1941* (Lawrence: University Press of Kansas, 2022), p. 3.

4 Ibid., p. 48.

5 Ibid., pp. ix–x.

6 Delaney, *The Imperial Army Project*, pp. 2–6.

7 Delaney, *The Imperial Army Project*; Jonathan Fennell, *Fighting the People's War: The British and Commonwealth Armies and the Second World War* (Cambridge: Cambridge University Press, 2019).

8 Sam Edwards, *Allies in Memory: World War II and the Politics of Transatlantic Commemoration, c.1941–2001* (Cambridge: Cambridge University Press, 2015).

Book Review

War of Supply: World War II Allied Logistics in the Mediterranean

Author: David D Dworak

University Press of Kentucky, 2022, ISBN 9780813183770, 282 pp,
RRP USD$40 (hardcover)

Reviewed by: John Nash

As the well-worn aphorism goes, 'amateurs talk tactics, professionals talk logistics'. Undoubtedly, logistics is at the core of every military operation throughout history, making or breaking battles, campaigns and wars. *War of Supply* by David Dworak is an excellent examination of Allied logistics in the Mediterranean during World War II, reinforcing just how critical it was to Allied success not only in the Mediterranean campaign but also as a prelude to the northern European campaign that followed. As Dworak reminds the reader from the outset, 'Logistics alone may not win the war, but absent or ineffective logistics *can* lose it'.[1]

The book itself is arranged chronologically, divided into three sections that represent different campaigns. Part One examines North Africa, Part Two covers Sicily and Italy (including Anzio), and Part Three deals with Operation Dragoon, the often overlooked landing in southern France in August

1944. Aside from being chronological, these three parts accord with the maturation of the Allied logistics organisation over the course of the war. As Dworak argues, it was its hard-won experience in North Africa and Italy that convincingly set up the Allies for success during Operation Overlord in June 1944.

Dworak begins his analysis with Operation Torch. He provides a quick sketch of the strategic supply situation in 1942, from Allied losses in shipping to the German U-Boats through to the requirements for vast amounts of aid sent to the Russians to keep them in the war.[2] All of this complicated the United States's ability to build up forces in the UK and impeded its efforts to launch an invasion of North Africa to establish a foothold in the Mediterranean.

Dworak's analysis spans the strategic, operational and tactical levels. At the strategic level, there are noteworthy issues that often do not receive much attention. For instance, it is often forgotten that the French troops that went over to fight for the Allied side had to be equipped and armed: 300,000 of them by November 1942.[3] This put an enormous strain on the already stretched Allied supply chain and, as Dworak reminds us, every tank or plane that went to the French could not go to the Russians or the Pacific theatre. Therefore, every allocation of supplies had to be weighed. While the French would develop their own logistics organisation over time, they would remain dependent on the US system throughout the landings in southern France and the Allies' push into Germany.[4] This realisation is an important reminder not only of the French contribution to the theatre but also of the sheer number of demands placed on Allied logistics from all manner of directions.

There are many salutary lessons in *War of Supply* for the modern reader, especially when considering a future that will involve the Australian Defence Force conducting expeditionary operations. The first is the criticality of ports and port facilities in supporting a force ashore. When the Allied Western Task Force landed in North Africa in 1942, it took weeks for the supply situation ashore to reach a reasonably ordered state. Some of the delay was due to poor planning concerning what supplies needed to be loaded, and in what order they needed to be landed to maintain combat operations. But one of the main problems was the lack of transportation and the absence of a port unit with trained stevedores who could order and clear the port facilities and sustain the combat units ashore.[5] During the Sicilian campaign, the capture of Palermo and its port was vital to

Lieutenant General George Patton's ability to advance on Messina and drive German troops off the island. Until the capture of Palermo, Patton's army was reliant on logistics coming over the beach at Gela.[6] In France too it was the capture of ports that was prioritised by the Allied high command. While many historians have focused on the role of the Channel ports, the French Mediterranean ports were of utmost importance and were eventually able to support 35 divisions. Indeed, the port at Marseilles handled more supplies than any other port during the war.[7] This southern front was thus critical to supporting and expanding the Allied foothold in Western Europe in 1944 and into 1945.

In the absence of a port, beaches were the alternative. Logistics over the shore is much more difficult, but almost always unavoidable in some form. Effective beach teams were vital to any amphibious operation during World War II. An issue that arose during many of the Mediterranean operations, however, was a lack of strong leadership on the beaches, especially during the Sicily landings at Gela.[8] At one point, Patton was forced to wade in, deducing that the poor beach party situation was 'due to a lack of force of character in the men of the Army and Navy commanding them [the beach teams]'.[9] Another problem arose with lines of authority and the misuse of vital assets. The introduction of the DUKW amphibious vehicle was a significant addition to amphibious assault forces; it considerably aided the assault and resupply over the beach. The problem was that during the Salerno landing, in the absence of trucks and other logistics vehicles, DUKWs were also used to haul supplies inland, exposing them to damage and loss and slowing down the unloading of supples from ships. This led the naval commander, Vice Admiral Henry Hewitt, to recommend for future operations that the DUKWs (and their drivers) be under direct naval control until the completion of the unloading phase, so as to keep this considerable specialist capability where it was most needed.[10] This is the kind of command and control / lines of authority issue that will no doubt arise in any future littoral operations.

While the focus of *War of Supply* is on Allied logistics, Dworak helpfully provides comparisons to some German logistics issues in the theatre. Such comparison helps reinforce his argument that poor logistics can lose a war. He details many of the problems encountered, including a lack of theatre-level control which left room for service rivalry and reprioritisation. Even rank levels could demonstrate the priority given to logistics—where a

certain position in the US logistical organisation might be filled by a General, the German equivalent might be a Major.[11] Allied interdiction of the Axis supply route into North Africa, especially from Malta, played a key role in worsening the Axis position there.[12] The Allied landings on mainland Italy near Salerno were hotly contested by the Germans, but a poor German logistics organisation meant they could not muster a sufficiently powerful counterattack to throw back the American and British beachheads.[13] These and other examples demonstrate what can happen when logistics is not prioritised or given due consideration.

War of Supply is essential reading for anyone with an interest in littoral operations. It is an illuminating study of how the Allies were able to sustain their operations in the Mediterranean theatre, building their expertise to a level that helped ensure the logistics success of Operation Overlord. There are many good photos throughout, including several of the personalities involved, and some useful maps to aid the reader. The book covers the topic in detail without becoming bogged down in the weeds. It is an excellent read and highly recommended.

About the Reviewer

Dr John Nash is an Academic Research Officer at the Australian Army Research Centre. Previously he was a researcher at the Australian War Memorial for The Official History of Australian Operations in Iraq and Afghanistan, and Australian Peacekeeping Operations in East Timor. He was awarded a PhD from the Australian National University in July 2019. He is also a Lieutenant in the Royal Australian Naval Reserve, having completed nine years' full time and 10 years' reserve service as a Maritime Warfare Officer. He was the inaugural winner of the McKenzie Prize for the Australian Naval Institute and Chief of Navy Essay Competition, Open Division, 2019. His most recent publication is *Rulers of the Sea: Maritime Strategy and Sea Power in Ancient Greece, 550–321 BCE*, Volume 8 in the series 'De Gruyter Studies in Military History'. Other publications include articles in the *Australian Army Journal*, the *Journal of Advanced Military Studies* (Spring 2024), the *Journal of Indo-Pacific Affairs* (March-April 2022) and the *US Naval War College Review* (Winter 2018, vol. 71). His areas of research focus include sea power and maritime strategy, littoral warfare, land power, and strategic studies.

Endnotes

1 Italics in original. David Dworak, *War of Supply: World War II Allied Logistics in the Mediterranean* (University Press of Kentucky, 2022), p. 2.

2 Ibid., 2022, p. 8.

3 Ibid., pp. 51–54.

4 Ibid., p. 182.

5 Ibid., p. 23.

6 Ibid., p. 92.

7 Ibid., p. 151.

8 Ibid., p. 87. In the Australian context, beach teams were essential to Australian operations in the Pacific in 1943–45. See Dayton McCarthy, 'No Other System Could Have Achieved the Result', *Australian Army Journal* 20, no. 2 (2024), at: https://researchcentre.army.gov.au/library/australian-army-journal-aaj/volume-20-number-2/no-other-system-could-have-achieved-result.

9 Dworak, *War of Supply*, p. 99.

10 Ibid., p. 108.

11 Ibid., p. 56.

12 Ibid., p. 67.

13 Ibid., p. 109. Such lack of logistical aptitude by the German forces was not unique to the Mediterranean. For example, see David Stahel, *Operation Barbarossa and Germany's Defeat in the East* (Cambridge: Cambridge University Press, 2009).

Book Review

Nimitz at War: Command Leadership from Pearl Harbor to Tokyo Bay

Author: Craig L Symonds

Oxford University Press, 2022, ISBN 9780190062361, 496 pp,
RRP GBP£27.49 (hardcover)

Reviewed by: Thomas J Rogers

Nimitz at War is a biographical study of Admiral Chester W Nimitz during his time as Commander in Chief of the Pacific Fleet (CINCPAC) in World War II. Author Craig L Symonds presents a chronological narrative beginning with Nimitz taking control in Hawaii in late December 1941. A prolific naval historian at the United States Naval Academy, Symonds approaches this history with an engaging tone, adding anecdotes and asides that demonstrate a broad knowledge both of the war and of the character of Nimitz himself. The book draws on an extensive bibliography of the expected official sources and secondary literature, and also includes collections of oral histories and family papers relating to Nimitz's time in Hawaii during the war. The result is a surprisingly intimate portrait of Nimitz, despite its overall focus on his particular brand of command leadership during the Pacific War. Indeed, the analysis of Nimitz's command style is bolstered by the insights into his personal life and habits interspersed throughout the narrative.

Nimitz at War opens with an overview of the contemporary political and practical questions about command of US forces in the Pacific theatre. The decision of President Franklin D Roosevelt—a self-described 'navy man'—to make Nimitz CINCPAC had puzzled some in the US Navy, who considered the appointee to be a desk admiral. However, Nimitz had the full confidence of Admiral Ernest J King, who served as Commander in Chief, United States Fleet during the war. As Symonds relates, the two admirals had very different leadership styles. King was cold and logical, quite happy to play up to his abrasive reputation, and had a tendency to micromanage his subordinates. By contrast, Nimitz was warm and genial, could put a roomful of nervous junior officers at ease, and trusted his subordinates to achieve the best results, a theme to which the narrative returns. One thing the two admirals had in common was a disdain for, or caution about, speaking to the media. In this they differed from the Commander of the Southwest Pacific Area, US Army General Douglas MacArthur, whose frequent grandiose public statements Nimitz privately disparaged.[1]

In a war that was defined by new applications of air power, tensions arose between the 'black shoe' admirals—surface fleet officers who had not undergone aviation training—and the younger generation of 'brown shoe' naval aviators. There was a growing lobby of 'brown shoe' officers who felt strongly that aircraft carriers should only be commanded by 'brown shoe' admirals. Nimitz heard out these arguments but resisted being bound by them, a good example of his overall approach to leadership—ready to negotiate with his subordinates but iron-willed once he had made up his mind.

Leadership is a key theme of Symonds's narrative. As noted above, Nimitz expected the best from the officers who reported to him, and trusted them to perform their duties under general direction. In part, Nimitz's style of leadership reflected his character, but it was also shaped by the theatre in which he and his men served. Symonds reminds readers of the sheer size of the Pacific at various points in the text, as well as conveying it very effectively in several charts. Nimitz was out of touch with his task forces for days at a time, often at the most critical points of the war.[2] Symonds captures the tension this produced at headquarters, particularly during the early actions of the Battle of Leyte Gulf.[3]

Trust was central to Nimitz's style of leadership. After the Battle of Midway, Rear Admiral Marc Mitscher submitted a report to Nimitz that clearly did not represent what units under Mitscher's command had done during the battle. Not wishing to cause a public controversy that would bring disrepute to the navy, Nimitz accepted the report but 'shelved' Mitscher, removing him from seagoing command for several years. The episode adeptly illustrates the ongoing pressures of Nimitz's command, in which relationships with and between senior officers had to be carefully managed to produce the best possible military capability.

The inclusion of lengthy details about Nimitz's private life in Hawaii, and particularly his relationship with Sandy and Una Walker, at first appeared somewhat incongruous in a study of war and leadership. However, as the narrative progresses, it becomes apparent that Nimitz's downtime was as much a part of his approach to war leadership as his time in headquarters. The Walkers' home was a place of respite for the admiral but it also played an important diplomatic role as the war progressed and the danger to Hawaii lessened, when ever-greater numbers of civilian VIPs came to visit. Nimitz's vigorous walking and swimming routines, often with less-than-enthusiastic subordinates, similarly allowed him to thrash out issues away from the formal setting of headquarters. His ability to nurture informal relationships meant that in times of crisis, everyone knew what each was expected to achieve. The book really does show the admiral at war in all respects.

Despite being the biography of an admiral, the book's study of war leadership transcends service boundaries. Anyone considering warfare across the vast distances of the Pacific would do well to consider Nimitz's example. The style of leadership based on trust, which came naturally to him, remains a necessity in the region. Lengthy periods without communications with subordinates are likely in any future conflict as opposing sides seek to impose communications denial on each other. As case studies, the widely dispersed maritime and littoral operations Nimitz oversaw are worth revisiting.

Eminently readable and engaging, *Nimitz at War* is both a chronology of the US Navy's war in the Pacific and a study of Nimitz's leadership. Illustrated with black-and-white photos and charts, it will appeal to all who have an interest in the naval aspects of the US forces in the Pacific War. In presenting a well-rounded portrait of Nimitz, the book is a particularly worthwhile exercise in the study of war leadership as it happened.

About the Reviewer

Dr Thomas J Rogers is a historian at the Royal Australian Navy's Sea Power Centre. He has previously worked as a historian at the Australian National University, the Australian War Memorial and the University of Melbourne.

Endnotes

1 Craig L Symonds, *Nimitz at War: Command Leadership from Pearl Harbor to Tokyo Bay* (New York: Oxford University Press, 2022), p. 166.

2 For example, ibid., pp. 21, 326–328, 367.

3 Ibid., pp. 330–334.

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