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Evolving towards military innovation: AI and the Australian Army

Alex Neads [a], Theo Farrell [b] and David J. Galbreath [c]

[a]School of Government and International Affairs, Durham University, Durham, UK; [b]Vice-Chancellor's Unit, University of Wollongong, Wollongong, Australia; [c]PoLIS, University of Bath, Bath, UK

ABSTRACT

Established theory views military innovation as extraordinarily difficult, resulting in painful if infrequent revolutionary transformations. This article presents a divergent view, in which military innovation occurs progressively in an evolutionary fashion. Drawing on New Institutionalism and the Sociology of Science and Technology, we explore processes of professional debate and consensus-building among military officers, which can lead to evolutionary innovation. Examining the future application of artificial intelligence to command-and-control in the Australian Army, we find that officer attitudes to automation are rooted in shared experience of existing digitisation programmes, creating an emergent consensus over the evolutionary trajectory of future military innovation.

KEYWORDS Military innovation; human-machine teaming; future war; artificial intelligence; command and control; Australian Defence Forces

Established theory views military innovation as an extraordinarily difficult undertaking. Armed forces are seen as conservative and risk averse organisations whose institutional cultures naturally resist change. According to this logic, armed forces can only be cajoled into innovating with great difficulty, typically requiring a high level of external pressure to overcome internal inertia. As a result, military innovation is often characterised as an abrupt and destructive process that occurs via sudden and painful ruptures – described by Sapolsky et al as moments of 'creative destruction' – that emerge when the momentum for change finally overwhelms resistance.[1]

CONTACT Alex Neads alexander.neads@durham.ac.uk School of Government and International Affairs, Durham University, Durham, UK

[1]Harvey M. Sapolsky, Brendan Rittenhouse Green and Benjamin H. Friedman, 'The Missing Transformation', in Sapolsky, Friedman and Green (eds.) *US Military Innovation since the Cold War* (Abingdon: Routledge 2009), 6. See also Barry Posen, *The Sources of Military Doctrine: France, Britain, and Germany between the World Wars* (Ithaca, NY: Cornell UP 1984); Stephen Peter Rosen, *Winning the Next War: Innovation and the Modern Military* (Ithaca, NY: Cornell UP 1991); Kimberley Marten Zisk, *Engaging the Enemy: Organization Theory and Soviet Military Innovation, 1955–1991* (Princeton, NJ: Princeton UP 1993); Deborah D. Avant, *Political Institutions and Military Change: Lessons from Peripheral Wars* (Ithaca, NY: Cornell UP 1994); Elizabeth Kier, *Imagining War: French and British Military Doctrine between the Wars* (Princeton, NJ: Princeton UP 1997).

This article presents a divergent understanding of military innovation as a constant evolutionary process, rather than one characterised by episodic revolutionary upheavals conditioned by otherwise implacable opposition to change. Drawing on insights from New Institutionalism and the Sociology of Science and Technology, our account focuses on the role of officer perspectives in determining the degree of resistance or acceptance to innovation. By situating internal professional military discourses on innovation in the context of wider patterns of socio-technological development and prior organisational change, we highlight the ways in which armed forces gradually generate a degree of internal consensus over the uses, applications and limitations of new military ideas and equipment. In so doing, they can avoid eliciting the ferocity of resistance that is traditionally held to result in organisational stagnation, external intervention, and dramatic ruptures in policy and practice. This does not mean that evolutionary innovation is somehow less transformative that other forms of change, or that change never occurs via revolutionary schism. Rather, we conclude that through a process of collective assessment, debate, and consensus-building, armed forces do sometimes evolve towards military innovation.

We explore this approach through a case study of artificial intelligence (AI) and the Australian Army. AI and advanced robotics are widely expected to transform warfare in multiple ways.[2] We focus on one area: the application of AI to command and control (C2). We use original interviews with serving Australian Army officers to examine professional debates over the application of AI in Australian military C2. We show how officer attitudes to future innovation have been collectively shaped by shared experience of a decades-long programme of existing military digitisation, creating a degree of consensus over the future trajectory of change.

The evolution of military innovation

In the scholarly literature, military innovation is presented as something of a paradox. On the one hand, militaries have strong incentives to innovate in order to succeed in war. Indeed, the historical record is replete with examples of militaries innovating, albeit with variable frequency, vigour, and success. On the other hand, organisation theory suggests that militaries should be slow to innovate. This is because organisations invest in developing ways of working that are optimised for their missions and environments, and these routines become institutionalised in special-interest communities and sub-cultures within

[2]Kenneth Payne, *I Warbot: The Dawn of Artificially Intelligent Conflict* (London: Hurst 2021); Paul Scharre, *Army of None: Autonomous Weapons and the Future of War* (New York: W. W. Norton 2018).

organisations (sometimes described as 'tribes within a tribe') each with their own somewhat divergent preferences and interests. Given sunk investments, any major change to organisational routines has high opportunity costs and is likely to be challenged by impacted communities. Hence, for Stephen Rosen, military innovation involves nothing less than 'an ideological struggle … around a new theory of victory'.[3]

For this reason, military innovation has typically been described as a process of radical upheaval, in which fundamentally novel ways of operating can only be implemented via organisationally painful step-changes in policy and practice. In many theories of military innovation, change is described as the product of top-down processes fundamentally driven by external factors, such as strategic threats or civilian intervention. Barry Posen's classic account of military innovation, for instance, argued that military change often hinges on the herculean efforts of radical 'maverick' officers protected and enabled by external political (rather than internal professional) support.[4] In like fashion, explanations for the absence of successful innovation typically centre on the obstacles to change, particularly on the role of organisational culture and vested interests in generating high levels of internal resistance and institutional inertia.[5] Even where theories emphasise the internal capacities of armed forces to identify and implement change themselves, the picture presented is one of extraordinary effort driven by the influence of key senior leaders. Stephen Rosen and others have highlighted the role of internal bureaucratic politics, and particularly the importance of coalition-building and control over promotions and appointments, to the enactment of military reforms in the face of opposition within the officer corps.[6]

To borrow a metaphor from evolutionary biology, the established picture of military innovation can therefore be described as one of 'punctuated equilibrium', in which organisational stasis is only occasionally ruptured by sudden leaps in capability.[7] This view of innovation as a disruptive break is particularly apparent in the literature on military technology. The invention of new military technology is considered central to various historical leaps in military practice, from the 'military revolution' of the late 16th century to the

[3]Rosen, *Winning the Next War*, 20.
[4]Posen, *Sources of Military Doctrine*. See also Zisk, *Engaging the Enemy*; Avant, *Political Institutions*.
[5]Kier, *Imagining War*; Avant, *Political Institutions*; Adam M. Jungdahl and Julia M. Macdonald, 'Innovation Inhibitors in War: Overcoming Obstacles in the Pursuit of Military Effectiveness', *Journal of Strategic Studies* 38/4 (2015), 467–99.
[6]Rosen, *Winning the Next War*; Theo Farrell, Sten Rynning and Terry Terriff, *Transforming Military Power since the Cold War: Britain, France and the United States, 1991–2012* (Cambridge: Cambridge UP 2013); Benjamin M. Jensen, *Forging the Sword: Doctrinal Change in the U.S. Army* (Stanford, CA: Stanford UP 2016).
[7]Niles Eldridge and Stephen Jay Gould, 'Punctuated Equilibria: An Alternative to Phyletic Gradualism', in Thomas Schopf (ed.), *Models in Paleobiology* (San Francisco: Freeman, Cooper 1972), 82–115.

digital 'Revolution in Military Affairs' of the 1990s.[8] Consequently, the early adoption of new technologies is widely held to confer distinct military advantages, and much recent literature has focused on the potentially disruptive military implications of emerging technologies such as automation and AI both for the 'first movers' who successfully innovate and the laggards who do not.[9]

However, not all military change conforms to this stereotype of institutional transformation via a dramatic but difficult leap forward. Prolonged Western military interventions in Iraq and Afghanistan have highlighted the importance of bottom-up adaptation in driving reform.[10] These campaigns produced a myriad of grassroots adjustments to military practices, often extending well beyond low-level tactics and techniques to encompass technology and equipment as well as concepts of operation.[11] Repeated minor adaptive changes can also accumulate into more significant shifts, as witnessed by various historical military transformations.[12] Yet, for this to occur, a subsequent process of organisational formalisation is typically required to promulgate local adaptations throughout the military institution – with all the same challenges as other top-down reforms.[13] Hence, while adaptation and innovation can be seen as different points on the same spectrum of military change, incremental adaptation is typically viewed as something less than true innovation.[14] Horowitz and Pindyck's recent model of military innovation typifies this view. According to this model, innovation follows

[8]See Geoffrey Parker, *The Military Revolution: Military Innovation and the Rise of the West, 1500–1800* (Cambridge: Cambridge UP 1996); Andrew F. Krepinevich, 'Cavalry to Computer: The Pattern of Military Revolutions', *The National Interest* 37 (1994), 30–42.

[9]P. W. Singer, *Wired for War: The Robotics Revolution and Conflict in the 21st Century* (New York: Penguin 2009); Moritz Weiss, 'How to become a first mover? Mechanisms of military innovation and the development of drones', *European Journal of International Security* 3/2 (2018), 187–210; Michael Raska, 'The sixth RMA wave: Disruption in Military Affairs?' *Journal of Strategic Studies* 44/4 (2021), 456–47.

[10]Theo Farrell, 'Improving in War: Military Adaptation and the British in Helmand Province, Afghanistan, 2006–2009', *Journal of Strategic Studies* 33/4 (2010), 567–594; Robert T. Foley, Stuart Griffin and Helen McCartney, '"Transformation in contact": learning the lessons of modern war', *International Affairs* 87/2 (2011), 253–270; Theo Farrell, Frans Osinga and James A. Russell (eds.), *Military Adaptation in Afghanistan* (Stanford: Stanford UP 2013).

[11]Nina Kollars, 'Military Innovation's Dialectic: Gun Trucks and Rapid Acquisition', *Security Studies*, 23/4 (2014), 787–813; Anthony King, 'Understanding the Helmand campaign: British military operations in Afghanistan', *International Affairs*, 86/2 (2010), 311–332.

[12]Adam Grissom, 'The future of military innovation studies', *Journal of Strategic Studies* 29/5 (2006), 920–4; Robert T. Foley, 'Dumb donkeys or cunning foxes? Learning in the British and German armies during the Great War', *International Affairs* 90/2 (2014), 279–298; Marc Milner, 'Convoy Escorts: Tactics, Technology, and Innovation in the Royal Canadian Navy, 1939–1943', *Military Affairs* 48/1 (1984), 19–25.

[13]Frank G. Hoffman, *Mars Adapting: Military Change During War* (Annapolis, MG: US Naval Institute Press 2021); Sergio Catignani, 'Coping with Knowledge: Organizational Learning in the British Army?', *Journal of Strategic Studies* 37/1 (2014), 30–64; Nina Kollars, 'War's Horizon: Soldier-Led Adaptation in Iraq and Vietnam', *Journal of Strategic Studies* 38/4 (2015), 529–553; Raphael D. Marcus, 'Military Innovation and Tactical Adaptation in the Israel – Hizballah Conflict: The Institutionalization of Lesson-Learning in the IDF', *Journal of Strategic Studies* 38/4 (2015), 500–528.

[14]Farrell et al, *Military Adaptation in Afghanistan*.

a broadly linear pathway beginning with the *invention* of new tactics or technologies, followed by an *incubation* phase in which novel practices gain institutional traction, resulting in period of top-down *implementation*.[15] Thus, while adaptation may occur early in the process, successful change is ultimately still defined by the conduct of the final stage of 'classic' top-down reform.

Nonetheless, Horowitz and Pindyck's model reflects an important shift in scholarly understandings of military innovation as a process rather than an outcome.[16] When defined as an activity rather than an end-state, it becomes possible to separate the mechanisms of military innovation from their actual observed impact on later battlefield performance. This is significant because, unlike in scholarly studies, military officers must make decisions about innovation without post-hoc knowledge of its subsequent impact on battlefield performance. Without this benefit of hindsight, disagreements over the shape and desirability of innovation appear less the reactionary defence of parochial interests, and more the product of principled professional debate in the face of profound uncertainty.

Consequently, our account centres on officer perceptions of the strengths and weaknesses of potential military innovations, and how these collectively shape professional understandings of the desirability of change.[17] While the degree of opposition to change has long been viewed as a factor in the success of military innovation programmes, it is not inevitable that professional debate will always result in polarisation, factional resistance to change, and eventual enforced upheaval. Certainly, officers' attitudes do not appear to be solely conditioned by the parochial interests of their own service subcommunities.[18] Instead, professional debate can result in a degree of organisational consensus that enables less dramatic and forced forms of reform. Indeed, argument and debate has been identified as a central mechanism of change in international affairs, owing to its ability to shape both stakeholders' normative values and their perceptions.[19] We argue that professional debate can sometimes result in organisational consensus about the trajectory of innovation, facilitating an evolutionary pattern of 'sustaining innovation'

[15]Michael C. Horowitz and Shira Pindyck, 'What is a military innovation and why it matters', *Journal of Strategic Studies* 46/1 (2023), 96–108.

[16]See also Michael A. Hunzeker and Kristen A. Harkness, 'Detecting the need for change: How the British Army adapted to warfare on the Western Front and in the Southern Cameroons', *European Journal of International Security* 6/1 (2021), 66–85.

[17]On the importance of officer attitudes to military innovation see Thomas G. Mahnken and James R. FitzSimonds, 'Revolutionary Ambivalence: Understanding Officer Attitudes towards Transformation', *International Security* 28/2 (2003), 112–148.

[18]Edward Rhodes, 'Do Bureaucratic Politics Matter? Some Disconfirming Findings from the Case of the U.S. Navy', *World Politics* 47/1 (1994), 1–41.

[19]Thomas Risse, '"Let's Argue!" Communicative Action in World Politics', *International Organization* 54/1 (2000), 1–39.

rather than acrimonious infighting and discontinuous 'disruptive innovation'.[20]

We draw on two insights from New Institutionalism to provide a theoretical explanation for how and why internal consensus over the trajectory of innovation might develop. Whereas studies of military innovation have generally viewed institutional factors like organisational culture as pathological for change, New Institutionalism suggests that the influence institutions exert over member attitudes and behaviour can instead *facilitate* some avenues of change, over and above others. Here, institutions can be understood as collections of formal rules and informal norms, derived from past experience and embedded in socio-economic and political structures.[21] Because the norms embedded in these structures have the power to shape members' individual and corporate behaviour, the trajectory of past institutional development inevitably 'renders some interpretations of problems more persuasive and makes some prospective policies more politically viable than others', encouraging path-dependent changes that appear to form part a 'policy sequence' of successive incremental steps.[22] This same process of social selection can be seen in technological development, where new innovations rarely follow a hypothetical natural trajectory in which objectively better designs replace older ones. Rather, social networks develop around particular technological designs and ways of using technology, creating eventual consensus on the 'right' way to understand and apply innovations. It is these social processes that determine innovation outcomes, rather than any supposedly innate qualities of the invention per se.[23]

Importantly, the decision-making processes of institutions and their individual members are influenced not just by past organisational experiences, but also by the behaviour and views of similar actors in the wider field in which they operate. These are known as organisational sectors, defined as 'a collection of organizations operating within the same domain, as identified by the similarity of their services, products or functions'.[24] The sociological school of New Institutionalism finds that organisations are profoundly shaped by sector-wide models and standards for operating, and this produces a strong tendency towards isomorphism in organisational sectors. This

[20]On these terms see Gautam Mukunda, 'We Cannot Go On: Disruptive Innovation and the First World War Royal Navy', *Security Studies* 19/1 (2010), 124–159.

[21]Sven Steinmo, Kathleen Thelen and Frank Longstreth (eds.), *Structuring Politics: Historical Institutionalism in Comparative Analysis* (Cambridge: Cambridge UP 1992); Walter W. Powell and Paul J. DiMaggio, eds., *The New Institutionalism in Organisational Analysis* (Chicago, IL: Chicago UP 1991).

[22]Margaret Weir, 'Ideas and Politics of Bounded Innovation', in Steinmo et al., *Structuring Politics*, 192.

[23]Wiebe E. Bijker, Thomas P. Hughes, and Trevor J. Pinch (eds.), *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology* (Cambridge, MA: The MIT Press 1987); Donald MacKenzie & Judy Wajcman (eds.), *The Social Shaping of Technology* (Maidenhead: Open UP 1999).

[24]W. Richard Scott and John W. Meyer, 'The Organization of Societal Sectors: Propositions and Early Evidence', in Powell and DiMaggio, *The New Institutionalism*, 117.

isomorphic pressure is not simply the result of competitive dynamics, but also the product of explicit normative exchange between institutions within the same professional community.[25]

When applied to military innovation, these insights require us to examine the organisational and doctrinal antecedents of innovation, to understand the extent to which institutional precedents condition the prospects and possibilities for future change. Viewed through this longer historical lens, many apparently revolutionary transformations actually appear to be grounded in long periods of incremental development, while others rely on equally long periods of subsequent adaptation to practically implement.[26] They also suggest that many instances of military change will reflect sector-wide trends visible at work in other armed forces at the same time. Traditionally, the study of military diffusion has often been seen as distinct from innovation proper, on the basis that diffusion implies the importation of already established innovations from one setting to another.[27] Nonetheless, many military organisations invest significant time and effort in understanding the developmental trajectories of allies and rivals, through mechanisms as varied as formal exchanges to covert espionage.[28] Thus, while national armed forces may each draw different conclusions about the 'right' way to pursue the same innovation, the approaches and attitudes of the wider global military sector towards a given innovation will still shape national debates. Over time, we hypothesise that these two processes will interact to produce path-dependent forms of military innovation, displaying a recognisable degree of international convergence as consensus within each institution settles around parallel 'policy sequences' of change.

Artificial intelligence and Australian Army innovation

In the remainder of this article, we explore the evolutionary process of sustaining innovation in the Australian Army's response to the military potential offered by AI. AI and advanced robotics are widely expected to transform warfare in the coming decades through multiple military innovations. We

[25]Theo Farrell, 'Transnational Norms and Military Development: Constructing Ireland's Professional Army', *European Journal of international Relations* 7/1 (2001) 63–102.

[26]Jeremy Black, *A military revolution? Military change and European society 1550–1800* (Basingstoke: Palgrave Macmillan 1991); Eliot A. Cohen, 'Change and Transformation in Military Affairs', *Journal of strategic Studies* 27/3 (2004), 395–407.

[27]Emily O. Goldman and Leslie C. Eliason (eds.), *The Diffusion of Military Technologies and Ideas* (Stanford, CA: Stanford UP 2003); Emily O. Goldman, 'Cultural Foundations of Military Diffusion', *Review of International Studies* 32/1 (2006), 69–91; Burak Kadercan, 'Strong Armies, Slow Adaptation: Civil-Military Relations and the Diffusion of Military Power', *International Security* 38/3 (2014)2, 117–52; Michael C. Horowitz, *The Diffusion of Military Power: Causes and Consequences for International Politics* (Princeton, NJ: Princeton UP 2010).

[28]Thomas G. Mahnken, *Uncovering Ways of War: U.S. Intelligence and Foreign Military Innovation, 1918–1941* (Ithaca, NY: Cornell UP 2002).

focus on one area, namely, how AI could enable innovations in C2. We explore how these emerging innovations build on a decades-long programme of army digitisation, as well as a broader socio-technological trend that will see AI and advanced robotics transform societies and industries across the developed world. The application of AI to C2 in the Australian Army provides a useful exploratory case for the concept of evolutionary innovation for three reasons.

Firstly, the development of AI and its application to military operations via autonomy has been widely described as heralding a potentially revolutionary shift in the character of warfare. The concept of autonomy can be defined as 'the ability of a machine to perform a task without human input'.[29] Automation implicitly involves the replacement of human judgement with synthetic decision-making processes, as anticipated future advances in software, programming, and machine learning technologies allow machines to undertake tasks which currently necessitate human involvement. Accordingly, automation has the potential to radically reshape large swathes of the economy and civil society, in what some commentators have described as the coming 'fourth industrial revolution'.[30] In the military sphere, these technologies are similarly predicted to change the future conduct of warfare by enabling new ways of organising and employing armed force. In so doing, autonomous systems are expected to become increasingly central to all aspects of military capability, in a process referred to by contemporary armed forces as 'human-machine teaming' or HUM-T.[31]

Perhaps the most obvious military application of AI is in the field of robotics. Here, diverse autonomous systems are expected to gradually augment and then supplant conventional weapons and vehicle platforms, altering the landscape of tactical risk by undertaking the most 'dirty, dangerous, and dull' tasks in place of human soldiers. Yet, the potential to automate military processes extends far beyond smart missiles and driverless vehicles (sometimes described as 'autonomy-in-motion') to include the panoply of planning, co-ordination, and administrative functions that underpin all military operations (so-called 'autonomy-at-rest').[32] Together, these changes are likely to have a profound impact on the character of military C2, affecting

[29]NATO Supreme Allied Commander Transformation definition of automation, as adopted by the Australian Army RAS Strategy. See Australian Army, *Robotic and Autonomous Systems Strategy* (Canberra: Future Land Warfare Branch 2018), 5.

[30]T. X. Hammes, 'Technological Change and the Fourth Industrial Revolution', in George P. Shultz, Jim Hoagland and James Timble (eds.), *Beyond Disruption: Technology's Challenge to Governance* (Stanford: Hoover Institution 2008), 37–74.

[31]Army, *Robotic and Autonomous Systems Strategy*, 20–22, 27; Major General Mick Ryan, *Human-Machine Teaming for Future Ground Forces* (Washington, DC: Center for Strategic and Budgetary Assessments 2018), 18–22.

[32]Forrest E. Morgan, Benjamin Boudreaux, Andrew J. Lohn, Mark Ashby, Christian Curriden, Kelly Klima and Derek Grossman, *Military Applications of Artificial Intelligence: Ethical Concerns in an Uncertain World* (Santa Monica: RAND 2020), 9–11.

both the construction and tactical application of military force and the mechanisms through which military commanders plan, direct and supervise that activity.

To a certain extent, the implications of military automation can already be seen. The combination of unmanned aerial vehicles (UAVs), electromagnetic sensors, and precision munitions achieved decisive results against conventional armoured forces in Nagorno-Karabakh in 2020, for example.[33] Importantly, the relative accessibility of some of these capabilities even for minor powers and non-state actors has begun to challenge the qualitative foundations of Western conventional military superiority. According to one analyst, the proliferation of small tactical drones may prove to be as significant as the development and diffusion of machine guns for its impact on military operations, such that, in the words of another, a 'future force that does not have fully autonomous systems may not be able to effectively compete with an enemy that does'.[34] The application of AI and autonomy to military C2 therefore constitutes a significant innovation, which is predicted to be both revolutionary and disruptive in nature.

Secondly, and by extension, senior Australian officers and policy makers have demonstrated a commitment to implementing just such a change in the Australian Army. For Australia, the appeal of military automation is underlined by strategic concerns about the changing regional balance of power. According to Australia's *2020 Defence Strategic Update*, China's revisionist foreign policies are creating the Indo-Pacific's 'most consequential strategic realignment since the Second World War', while Chinese military modernisation is 'placing Australian military forces at greater risk over longer distances'.[35] In response, the Australian Army has initiated a significant programme of technological modernisation in a bid to become both 'Ready Now' and 'Future Ready'.[36] At its heart lies a new *Robotic and Autonomous Systems Strategy*, launched in 2018, supported by projected investments of AU$55Bn in new land systems, including the promise to acquire enough new UAVs and robotic ground vehicles to equip a brigade.[37] However, the desirability of military automation, and its acceptability in C2 processes in particular,

[33] Jack Watling and Sidharth Kaushal, 'The Democratisation of Precision Strike in the Nagorno-Karabakh Conflict', *RUSI Commentary*, 22 October 2020, https://rusi.org/commentary/democratisation-precision-strike-nagorno-karabakh-conflict.

[34] Major General Kathryn Toohey, 'Challenge and Opportunity: Robotics and Autonomy as Part of Future Land Warfare', *United Service* 69/4 (2018), 9; Elinor Sloan, 'Robotics at War', *Survival* 57/5 (2015), 110–111.

[35] Department of Defence, *2020 Defence Strategic Update* (Canberra: Commonwealth of Australia 2020), 3, 13.

[36] Brigadier Ian Langford, 'Tactical and Strategic "Readiness" for the Australian Army', *Land Power Forum*, 15 May 2020, https://researchcentre.army.gov.au/library/land-power-forum/tactical-and-strategic-readiness-australian-army; Lieutenant General Rick Burr, 'Army in Motion: Accelerated Warfare Statement', Australian Army, 22 October 2020, https://www.army.gov.au/sites/default/files/2020–11/2020%20-%20Accelerated%20Warfare_0.pdf.

[37] Army, *Robotic and Autonomous Systems Strategy*; Australian Defence Force, *Concept for Robotic and Autonomous Systems* (Canberra: Commonwealth of Australia 2020); DoD, *2020 Defence Strategic*

remains the subject of significant internal debate within the Australian officer corps. Recent surveys, for example, suggest that Australian military attitudes to AI are somewhat divided, raising the prospect of exactly the sort of internal resistance that leads to either stagnation and failed reform or herculean top-down creative destruction.[38]

Thirdly, the introduction of autonomy to Australian military C2 can also be seen as a logical extension of previous reform efforts, and thus part of a 'policy sequence', despite its purportedly revolutionary aspects. Since the turn of the millennium, Australian defence policy has come to view expeditionary land power is as necessary for the maintenance of strategic alliances and regional stability. This has resulted in a series of reform initiatives to modernise the Australian Army in continuity with its most significant strategic partner, the US Army.[39] Under the Hardened and Networked Army (HNA) programme, launched in 2006, the Australian Army reorganised around more deployable combined-arms battlegroups, mirroring the US Army's move towards medium-weight, expeditionary, and networked force structures. From 2011, Plan Beersheba saw the army further restructure into multi-role combined arms brigades, in anticipation of Australian withdrawal from Afghanistan. Both programmes were accompanied by significant equipment investments, including in digital C2 capabilities, alongside explicit importation of US concepts like 'Network Centric Warfare'.[40]

While current interest in automation and HUM-T can thus be seen as part of a policy continuum spanning two decades, this trajectory of change should not be seen as a foregone conclusion. The HNA initiative and Plan Beersheba both elicited a mixed response from Australian officers, with support for modernisation tempered by concerns over affordability and the wisdom of specific reforms, and both subsequently struggled to realise all their intended benefits.[41] Consistent with the Sociology of Science and Technology, our approach focuses on contention and consensus-building within the core community operating this new

Update, 39, 53–54; Department of Defence, *2020 Force Structure Plan* (Canberra: Commonwealth of Australia 2020), 72–73.

[38] Jai Galliott and Austin Wyatt, 'A consideration of how emerging military leaders perceive themes in the autonomous weapon system discourse', *Defence Studies* 22/2 (2022), 253–76.

[39] Albert Palazzo, 'Forging Australian Land Power: A Primer', Australian Army Research Paper, December 2015, 17–26, https://researchcentre.army.gov.au/sites/default/files/2015_12_flw_palazzo_web_0.pdf.

[40] Lt Col Sean Ryan, 'Hardened and Networked Army – an Army for now and the future', *Defence Magazine*, February 2006, https://web.archive.org/web/20070920190839/http://www.defence.gov.au/defencemagazine/editions/200602/features/feature01.htm; Col Craig Bickell, 'Plan Beersheba: The Combined Arms Imperative behind the Reorganisation of the Army', *Australian Army Journal* 10/4 (2013), 36–52, https://researchcentre.army.gov.au/sites/default/files/aaj_2013_4.pdf.

[41] Peter Leahy, 'The Future for Land Forces', *Security Challenges* 9/2 (2013), 59–66, https://www.jstor.org/stable/26462915; Mick Ryan, 'After Afghanistan: A Small Army and the Strategic Employment of Land Power', *Security Challenges* 10/3 (2014), 51–72, https://www.jstor.org/stable/26465445.

technology, namely, the officer corps of the Australian Army. We examine army officer perspectives on the potential applications, risk, and opportunities of this military innovation, and thus the extent to which acceptance or resistance to change will facilitate evolution or eventual rupture. Our article draws on original interviews with 17 serving Australian Army officers and one Defence civil servant involved in different aspects of innovation, deliberately selected from diverse roles to encompass a breadth of professional opinion, to uncover the landscape of Australian military discourse on AI-enabled innovation in C2.[42]

The rest of this article proceeds in three parts. The first section explores the diversity of Australian officer attitudes to future automation, highlighting the contested nature of contemporary innovation. The second section places these narratives in the context of previous Australian Army innovation initiatives, identifying areas of commonality derived from shared experiences of past reform that span narratives of progress and resistance. The article then charts the emergent path of resultant reforms, drawing attention to Army efforts to tread a middle ground that builds on past reform (mirroring parallel initiatives in the US and UK) before offering conclusions for the management of Australian military change and theories of military innovation more generally.

The contested promise of future automation

In its emergent doctrine and policy, the Australian Army has identified three key benefits of future HUM-T. Firstly, autonomous systems are expected to improve force protection by reducing Australian soldiers' exposure to the most dangerous battlefield tasks (such as urban breaching, obstacle clearance, and CBRN detection), and by enabling the reliable interdiction of some enemy munitions. AI is expected to build on current semi-autonomous or remote-controlled systems in fields such as bomb disposal, air defence and counter-mortar artillery.[43] Secondly, and relatedly, Australian concept documents also highlight the potential to use autonomous systems to generate scale and mass in a cost-effective (and potentially expendable) way. The Australian Army's Semi-Autonomous Combat Team concept, for instance, envisages a future infantry company capable of undertaking tasks currently

[42]This research was funded in part by the Australian Army Research Centre under the Australian Army Research Scheme 2019. Interviews were conducted in accordance with ethical approval from the Defence Research People Low Risk Ethics Panel, and some participants have been anonymised accordingly.

[43]Samuel Cox and Lieutenant Colonel Robin Smith, 'An Interview with Robin Smith: Robotic and Autonomous Systems in the Australian Army', Grounded Curiosity, 2 March 2020, https://groundedcuriosity.com/wp-content/uploads/2020/02/LTCOL-Robin-Smith-Interview-APPROVED.pdf;
P. W. Singer, 'Tactical Generals: Leaders, Technology, and the Perils of Battlefield Micromanagement', *Australian Army Journal* 6/3 (2009), 157.

assigned to a battlegroup three or four times its size with the help of a fleet of automated vehicles, drones, and software systems.[44] Here, automation is viewed as an 'opportunity to fundamentally alter the structure of Defence from a force of a few large and expensive platforms to one of many small and cheap platforms'.[45]

Finally, the application of AI to the collection, analysis and dissemination of tactical information is expected to facilitate better and faster decision-making and greater flexibility in the control of activity, thereby driving up the tempo of operations. The panoply of existing electronic sensors and digital communications employed by modern armies produces a prodigious quantity of information, threatening to overwhelm commanders and their staffs. AI could help HQs to sift, sort, and fuse multiple different types of information without suffering from human frailties like fear and fatigue, cognitive overload or bias. Moreover, HUM-T might also enable the efficient passage of such information between units, even in the face of physical dispersion or enemy countermeasures, improving both the quality and rapidity of analysis that underpins decision-making in planning, targeting, logistical resupply, and co-ordination. In so doing, HUM-T in C2 is intended to provide the Australian Army with 'decision superiority' over an adversary, enabling troops to seize the initiative in combat and thus generate a decisive advantage over less capable opponents.[46]

However, the Australian Army's official vision of automated innovation is not universally shared by Australian officers. Interestingly, the underlying geostrategic drivers of technological modernisation do appear to enjoy a broad degree of consensus among Australian officers. Participants generally viewed the rise of China as a destabilising development, with one officer describing heightened military and political competition as akin to the 'Roaring 20s' in its potential future implications.[47] In particular, the increasing range and profusion of precision strike systems throughout the region was seen as particularly concerning – especially in comparison to existing ADF

[44]Samuel Cox and Lieutenant Colonel Scott Holmes, 'An Interview with Scott Holmes: Human-Machine Teaming', *Grounded Curiosity*, 1 March 2020, https://groundedcuriosity.com/wp-content/uploads/2020/02/LTCOL-Scott-Holmes-Interview-APPROVED.pdf, Matthew Sawers and Kim Tang, *Semi-Autonomous Combat Team: Dismounted Infantry 2030 Concept* (Canberra: Defence Science and Technology Group 2020), iv.

[45]ADF, *Concept for Robotic and Autonomous Systems*, 9.

[46]Army, *Robotic and Autonomous Systems Strategy*, passim; Australian Defence Force, *ADF Concept for Command and Control of the Future Force* (Canberra: Department of Defence 2018); Toohey, 'Challenge and Opportunity', 9–12; Interview with Major General Mick Ryan, Commander Australian Defence College, Australian Army, conducted on 29 September 2020; Ryan, *Human-Machine Teaming*, 7–30; Australian Army Headquarters, 'Human-Machine Teams: Discussion Paper', Soldier Combat System Program, 29 March 2019, 1–28.

[47]Interview with Participant 6, Australian Army Lieutenant Colonel, Cavalry, conducted on 18 August 2020; Correspondence with Participant 10, Australian Army Lieutenant Colonel, Cavalry, received on 22 September 2020; Interview with Participant 11, Australian Army Lieutenant Colonel, Intelligence, conducted on 5 November 2020.

capabilities.[48] Perceptions of the immediacy of this threat varied, however. One officer characteristically remarked that 'I don't see us preparing for threats to Australia in the physical domain', while several participants argued that the benefits of AI-related innovation would primarily be seen in hybrid or asymmetric conflicts rather than conventional warfare.[49]

This diversity of opinion can be seen in officers' perceptions of each aspect of proposed innovation. The most widespread appeal of AI lies in its dual potential for force protection and as a force multiplier, specifically to 'mitigate Western military weakness in terms of casualty aversion'.[50] For example, one officer noted how 'HUM-T can expand mass effect' to give a battlegroup 'the combat power of what we associated with a brigade' – something which would also help the relatively small Australian Army to sustain significant deployments for longer periods of time.[51] In the words of Major General Kathryn Toohey, 'for a modestly-sized force such as the Australian Army, the opportunity to generate greater mass is very appealing' – especially when, according to the Army's autonomous systems strategy, this might be done 'without the need to grow the human workforce'.[52]

At the same time, however, this prospect also provoked unease among some officers. Both regimental and staff officers highlighted the potential to use HUM-T to generate cost efficiencies through personnel savings – a concern given some credence by senior officers' remarks about the use of HUM-T for 'balancing operational and enterprise effectiveness, affordability, and institutional values'.[53] Moreover, while participants understood HUM-T as about pairing soldiers and autonomous systems 'to their respective strengths' in principle, many still worried that in reality this would simply mean relegating officers to the tasks machines still could not do.[54]

If anything, these divisions are more pronounced in relation to the innovative potential of AI in Australian military C2. Even so, most officers accepted the underlying premises upon which AI might serve to improve command

[48]Interview with Participant 2, Australian Army Lieutenant Colonel, Army HQ, conducted on 7 August 2020; Interview with Participant 5, Australian Army Lieutenant Colonel, Army HQ, conducted on 14 August 2020; Interview with Participant 7, Australian Army Lieutenant Colonel, Engineering, conducted on 19 August 2020; Interview with Participant 9, Australian Army Lieutenant Colonel, Army HQ, conducted on 10 September 2020; Interview with Participant 13, Australian Army Lieutenant Colonel, Aviation, conducted on 13 November 2020.

[49]Interview with Participant 2; Interview with Participant 8, Australian Army Lieutenant Colonel, Artillery, conducted on 20 August 2020; Interview with Participant 12, Australian Army Lieutenant Colonel, Signals, conducted on 3 November 2020; Interview with Participant 3, Australian Army Major, Army HQ, conducted on 10 August 2020.

[50]Interview with Participant 3; Interview with Participant 6.

[51]Interview with Participant 3.

[52]Toohey, 'Challenge and Opportunity', 10. See also Sawers and Tang, *Semi-Autonomous Combat Team*, iv; Army, *Robotic and Autonomous Systems Strategy*, 9.

[53]Interview with Participant 4, Australian Army Lieutenant Colonel, Cavalry, conducted on 12 August 2020; Interview with Participant 7; Interview with Participant 12; Interview with Participant 11; Ryan, *Human-Machine Teaming*, 11–14.

[54]Interview with Participant 3; Interview with Participant 8; Interview with Participant 5.

practices. In the words of one officer, 'military decision-making relies on data processing, which is the dull end of planning'.[55] Hence, there was widespread recognition that automation could in theory improve current processes, for example through AI-generated terrain analysis or by improving the impartiality of red teaming – currently described by one officer as the Army's 'biggest weakness in planning'.[56] Moreover, the ability to use automated processes to improve tactical co-ordination and speed-up decision making has broad appeal in principle. The generation of higher tempo was recognised as a 'super effective' way to 'disrupt the enemy's decision process', with some officers voicing concern at the Army's perceived propensity to retard the generation of tempo by 'over-planning'.[57] Consequently, one participant identified AI's potential to 'link multiple sensors to multiple shooters' as 'a game changer', while others felt that 'the big win' for Australian HUM-T is in 'helping individuals with their OODA loops'.[58]

Yet, notwithstanding these purported benefits, many officers still raised significant concerns about the prospect of greater automation in command processes. For some officers, the Army's vision of HUM-T appeared to place too much weight on untested and little-understood computer software. Participants questioned how officers were supposed to place their trust in AI decision-support tools 'when we don't understand the AI algorithms?'[59] Indeed, one officer expressed scepticism at the very prospect, concluding that 'Commanders are not comfortable if the decision-making process is not theirs – even less comfortable if decisions are vested in machines'.[60] For some, the practical obstacles to enacting HUM-T rendered the concept inherently faddish. In the words of one officer, 'AI is the latest thing people jump on because it will solve all their problems. They don't understand the limitations'.[61]

The roots of consensus: Placing automation in the context of digital change

As the previous section demonstrates, Australian military attitudes to HUM-T in C2 display precisely the sort of professional contestation expected by both evolutionary and revolutionary understandings of military innovation. However, both the landscape of this debate and the current trajectory of

[55]Interview with Participant 4.
[56]Interview with Participant 13; Interview with Participant 9; Interview with Participant 1, Australian Army Lieutenant Colonel, Artillery, conducted on 5 August 2020; Interview with Participant 2; Interview with Participant 6.
[57]Interview with Participant 4; Interview with Participant 3; Interview with Participant 13.
[58]Interview with Participant 12; Interview with Participant 2; Interview with Participant 7.
[59]Interview with Participant 3; Interview with Participant 2.
[60]Interview with Participant 1.
[61]Interview with Participant 11; Interview with Participant 13.

ongoing change display a high level of path dependency and a degree of emergent consensus. While officer attitudes to automation vary significantly, especially in respect of the benefits of AI in future C2, the views of both proponents and sceptics are heavily rooted in Australian officer experiences of prior army digitisation programmes on which visions of automation explicitly build.

Military digitisation refers to the adoption of digital communication and computer processing technologies and has its roots in the US Revolution in Military Affairs (RMA) of the 1990s. Hence, it is neither particularly new, nor uniquely Australian, having been underway for the past three decades and has come to encompass most Western armed forces to a greater or lesser extent.[62] In the Australian Army, the application of digital processing to C2 can be traced back to the Battlefield Command Support System, developed from 1999 out of an earlier attempt known as AUSTACCS. From 2005, successive tranches of the LAND 200 programme subsequently rolled out new digital radios, satellite communications and BMS suites across the force.[63] The LAND 17 programme also selected Raytheon's Advanced Field Artillery Tactical Data System (AFATDS) for the artillery in 2007; a digital application initially developed for the US Army in the 1990s connecting gun lines with HQs and forward observers capable of calculating firing solutions.[64] Importantly, BMS and associated hardware not only represent the centrepiece of digitisation, they provide the underlying armature around which future AI applications might develop.

The LAND 200 programme represents the third generation of Australian Army digitisation efforts, and by 2017 was seen as the 'highest-priority project in the Army' according to Australia's Chief of Army.[65] Nonetheless, LAND 200 has been beset by multiple problems, attracting significant criticism from commentators and serving officers alike. In part, these have stemmed from the difficulties inherent in rolling out a large project across a force constantly engaged in training and operations. The Army's force generation cycle, for instance, means that units are only periodically available for new equipment refits, such that the digitisation of an entire brigade could take up to three years.[66] When combined with delays in procurement, this has resulted in patchy implementation and the operation of new digital equipment

[62]Terry Terriff, Frans Osinga and Theo Farrell, *A Transformation Gap? American Innovations and European Military Change* (Stanford: Stanford UP 2010).
[63]Australian National Audit Office, *Auditor-General Report No. 40 2018–19: Modernising Army Command and Control – the Land 200 Program* (Barton: Commonwealth of Australia 2019), 14.
[64]Interview with Participant 9; Steven W. Boutelle and Ronald Filak, 'AFATDS: The Fire Support Window to the 21st Century', *Joint Force Quarterly* 10 (1996), 16–21.
[65]NAO, *Modernising Army Command and Control*, 14.
[66]Interview with Professor M. J. Ryan, Director of the Capability Systems Centre, University of New South Wales Canberra at the Australian Defence Force Academy, conducted on 6 November 2020; Michael Clifford, Michael Ryan and Zoe Hawkins, *Mission command and C3 modernisation in the Australian Army: Digitisation a critical enabler* (Canberra: Australian Strategic Policy Institute 2015), 12.

alongside legacy systems they were never intended to interact with, creating pernicious systems integration issues.

These issues were also exacerbated early on by the Australian Army's disparate approach to procurement, which saw related acquisitions managed as independent projects. In the view of one participant, this resulted in a propensity to 'buy a whole lot of stuff and then try to figure out how it can be integrated' as an afterthought.[67] For example, under LAND 200 the army purchased an Israeli-made BMS suite which it hoped to integrate with digital communications equipment procured from a US company.[68] Since the benefits of digitisation largely rely on its systemic application, the ensuing integration challenges often limit envisaged capability. Officers widely criticised the initial roll out of BMS to lower tactical levels because of the lag in digital tracks of friendly forces units, essentially caused by the limited bandwidth of most units' digital communications equipment, which sometimes rendered BMS not just ineffective but actively misleading.[69]

Consequently, many officers expressed significant frustration with their experience of existing digitisation activities, which in turn shapes attitudes to future innovation. Participants described the army's effort to date as 'haphazard', with digitisation still heavily reliant on 'manual input' software such as Excel and email. In the view of one infantry officer, the army has not digitally innovated so much as been 'weighed down by digital infrastructure', while others argued that the sporadic nature of implementation meant that officers continually felt like systems were only interim and therefore not worth investing in.[70] In the case of BMS, for example, one participant noted that most senior and field officers were not willing to use the system for lack of training, while others noted a tendency among colleagues to ignore or switch off the system rather than persevere when the promised benefits were not immediately manifest.[71] One participant, for instance, recalled personal experience of a major exercise in 2017 when the commander directed that BMS would be employed despite HQ staff's inability to make the system function usefully, resulting in a kind of theatre in which the system was used to brief the commander but not actually used behind the scenes.[72]

Critically, because of the close association between automation of current digital C2 and the experience of recent digitisation, concerns about

[67]Interview with Participant 11.
[68]Interview with Participant 8.
[69]Interview with Professor Ryan; Interview with Participant 8; Interview with Participant 4; Interview with Major General Adam Findlay, Special Operations Commander Australia, Australian Army, conducted on 23 October 2020. Successive tranches of LAND 200 are expected to address this issue. See NAO, *Modernising Army Command and Control*, 14.
[70]Interview with Participant 7; Interview with Participant 11; Interview with Participant 2; Interview with Participant 8; Interview with Participant 12.
[71]Interview with Participant 1; Interview with Participant 6; Interview with Participant 12; Interview with Participant 13.
[72]Interview with Participant 12.

digitisation directly affect officer perceptions of future autonomous innovation. At face value, digitisation lacked legitimacy among many participants, with one describing the idea of a digital RMA as 'fool's gold'.[73] When discussing the prospect of future tranches of reform to deepen networking across the army and with sister services, another officer quipped that 'Army has enough problems communicating with itself digitally, let alone with joint force comms'.[74] Yet, much of this scepticism appears to be rooted in the challenges of delivering change, rather than in the potential benefits of the technologies themselves. A number of interviewees felt that the real issue was the pace at which change was being driven from above, arguing that 'senior officers see capability that works at higher levels and want it to work at lower levels' without making the necessary enabling changes.[75] One interviewee bluntly stated that LAND 200 was 'our third go at digital C2. A couple of senior leaders have forced this on the organisation. . .Even advocates acknowledged shortcomings but said it was necessary to get on'.[76] Others described senior officers as imprudently pursuing 'silver bullets' prematurely 'sold as panacea' against a backdrop in which over-promising about technical possibilities was 'rife'.[77]

For advocates of automation, meanwhile, the real issue highlighted by the challenges of digitisation was not the limited benefits of future technologies but rather the army's inability to think and act innovatively enough. According to the Australian National Audit Office's report into the LAND 200 programme, digitisation has been hindered in part by the speculative nature of all innovative change, which has tended to result in a lack of clarity over acquisition requirements in industry tenders.[78] Moreover, as the Australian Army itself recognises, 'HUM-T is an immature capability, defined more by imagination and concept than a firm grounding of the technical opportunities and constraints of key technologies' making it 'difficult to pull user requirements for systems without precedent'.[79] To quote one civilian technical expert working for Australian defence, 'radical development of wholly new tech is not going to come from the war-fighter – what they want is better Gortex. . .not a bunch of batteries that they are going to have to cart around'.[80] Thus, despite significant enthusiasm for innovation, one officer described much actual activity as achieving little more than designing 'a better tent peg', metaphorically speaking.[81]

[73]Interview with Major General Adam Findlay.
[74]Interview with Participant 7.
[75]Interview with Participant 8; Interview with Professor Ryan.
[76]Interview with Participant 4.
[77]Interview with Participant 11; Interview with Professor Ryan; Interview with Participant 5.
[78]Clifford, Ryan and Hawkins, *Mission Command and C3 Modernisation*, 8.
[79]Army, 'Human-Machine Teams: Discussion Paper', 13.
[80]Interview with Professor Ryan.
[81]Interview with Participant 2.

This connection between the experience of digitisation and officers' divergent views on future automation is most apparent in discussions about the doctrine and culture of Australian military command. In common with various other anglophone armed forces, the Australian Army formally espouses a doctrine of mission command, in which commanders stipulate the objectives to be achieved while permitting subordinates discretion over the best way to achieve them depending on local circumstances. However, the experience of digitisation in the Australian Army as elsewhere has tended to erode this concept, as new communication technologies have led to greater centralisation of information at higher levels of command. At the same time, the management of these greater volumes of information has seen the size of HQ staffs expand considerably in many Western armed forces, necessitating concomitant shifts in the practice of senior command. Perhaps perversely, Anthony King has observed an increasing degree of collegiate and delegated decision-making *within* headquarters, as senior officers distribute traditional leadership functions in response to the new problems of staff management, even as higher HQs have become increasingly better placed to dictate the detail of tactical activity to their subordinate units and also more practically able to micromanage it.[82]

Consequently, this centralising imperative has resulted in a growing tension between espoused doctrine and the actual practice of mission command in the eyes of many Australian officers. For example, one interviewee observed a general 'reluctance to decentralise and reticence to employ mission command' among many commanders, bluntly stating that the army has 'good doctrine but it is the rare officer who practices it'.[83] Another stated that in his experience, 'Doctrine is a good read but it does not reflect mission command in practice. . .mission command and micromanagement tend to go hand-in-hand'.[84] Moreover, the increased size of HQs necessary to handle all this centralised digital information has created persistent concerns that digitisation has actually made Australian military command practices less flexible and more fragile. Major General Ryan, for example, recalled seeing one exercising 'brigade HQ that couldn't move. . .because it had become too bloated', while another officer rhetorically asked 'What did digitisation do to us? It has led to bloating of HQs'.[85]

In contrast, other officers argued that much of the concern about the impact of digitisation on mission command actually reflected a common

[82]Interview with Participant 5; Anthony King, *Command: The Twenty-First-Century General* (Cambridge: Cambridge UP 2019).
[83]Interview with Participant 3.
[84]Interview with Participant 1.
[85]Interview with Major General Ryan; Interview with Participant 14, Australian Army Lieutenant Colonel, Army HQ, conducted on 26 November 2020; Interview with Participant 13; Lieutenant Colonel Richard King, 'How the Army Learned to Plan but Forgot How to Think', *Australian Army Journal* 5/3 (2008), 141–152; Interview with Participant 7; Interview with Major General Findlay; Interview with Participant 3.

misunderstanding about extant doctrine, rather than the pitfalls of new technology. According to this view, mission command has never precluded directive leadership or so-called micro-management; instead, the degree of delegation commanders choose to employ reflects their degree of trust and confidence in the abilities of their subordinates. Hence, to these officers, mission command was in evidence daily in the army – at least, for those deemed sufficiently competent.[86] Accordingly, automation is seen as an opportunity to redress some of the perceived issues with digitised command practices, insofar as HUM-T might help to bolster the capabilities of subordinate units, improving commanders' confidence in the effectiveness of delegation. As one internal discussion paper suggested, HUM-T provided an opportunity to democratise rather than centralise tactical networking, meaning that automation is 'not a story of "digitisation"'.[87]

The evolutionary trajectory of Australian military innovation

Hence, not only do officers' experiences of past digitisation programmes significantly account for divergent professional perspectives on future innovation, this disagreement actually belies significant consensus over how the Australian Army *ought* to function and fight rooted in existing doctrine and practice. Moreover, this underlying consensus sits at the heart of ongoing efforts to develop autonomous systems and concepts, which tend to build on established models and practices. For example, the Australian military explicitly views the rejuvenation of mission command as the best vehicle for integrating future autonomous systems.

The ADF concept for future C2 envisages a future in which greater networking and artificially intelligent software enables fluid task organisation of tactical forces by decentralising co-ordination, known as 'agile control'. Certainly, the document makes clear that the future force 'will continue to embrace Mission Command because it utilises Australian culture to generate an advantage', highlighting how future C2 is expected to evolve from established models rather than supplant them entirely.[88] In principle, this concept might produce a further extension of the distribution of control King observed in HQs to much lower tactical levels, thereby reviving a somewhat older vision of battlefield leadership. It is possible to envisage a future under such a doctrine in which command and control functions become separated, such that senior commanders continue to provide guiding intent, set

[86]Interview with Participant 4; Interview with Participant 1; Interview with Participant 5; Interview with Participant 8; Interview with Participant 14; Interview with Major General Ryan; Interview with Brigadier Mark Ascough, Commander 6 Brigade, Australian Army, conducted on 21 October 2020; Interview with Major General Findlay.
[87]Army, 'Human-Machine Teams: Discussion Paper', 2, 16.
[88]ADF, *Command and Control of the Future Force*, 32.

intermediate objectives, and facilitate operations, but control of tactical activity is fluidly and exclusively managed by those subordinates closest to the fight once battle is joined.

Efforts to procure new autonomous capabilities similarly build on established digitisation programmes by addressing existing areas of weakness. Notably, a digital divide has emerged under LAND 200 at the brigade level, below which digitisation has been significantly more limited because the transmission of voice over VHF radio remains the most practical way of exercising leadership in close combat.[89] Here, the Australian Army recently signed a contract with Microsoft to develop a tool to automatically transcribe verbal radio messages into digital text using speech-recognition software, extending digital integration through the application of AI to C2 practices.[90]

In a similar fashion, efforts to address some of the organisational limitations highlighted by digitisation also tend to undercut some concerns levelled at future innovation, creating a degree of continuity between the two. Indeed, much of the scepticism about automation's potential actually pivots not on ideational differences about the purported benefits of technology but on the ability to institutionally realise them. As one interviewee remarked, '[t]he technology problem of systems not speaking to each other is actually a human problem of acquisition'.[91] Here, the Australian Army has already begun to revise its procurement processes, merging siloed programmes into unified teams. It has also established the Robotic and Autonomous Systems Implementation Coordination Office as the central authority to manage the army's future systems integration standards.[92]

In fact, the Australian Army appears to be actively trying to curate consensus around innovation through a series of initiatives intended to involve wider communities of military stakeholders in the development process. These include the Army Innovation Day and MakerSpaces as well as the Defence Entrepreneurs' Forum, alongside new mediums for professional education such as *The Forge*.[93] These initiatives likely reflect senior officers' conviction that most soldiers are not actively hostile to change; indeed, one participant felt that that the most 'innovative part of Army is [its] soldiers' while Major General Findlay described ordinary 'Diggers' as 'innovation carnivores'.[94]

[89]Interview with Major General Findlay; Interview with Professor Ryan; Interview with Participant 4; Interview with Participant 6; Interview with Participant 7; Interview with Participant 8; Interview with Participant 2.

[90]'Australian Army and Microsoft collaborate on AI-infused platform to transcribe combat net radio', Microsoft website, 16 December 2021, https://news.microsoft.com/en-au/features/australian-army-and-microsoft-collaborate-on-ai-infused-platform-to-transcribe-combat-net-radio/.

[91]Interview with Participant 3.

[92]NAO, *Modernising Army Command and Control*, 34; Australian Army, *Army in Motion: Army's Contribution to Defence Strategy* (Canberra: Australian Army 2020), 40.

[93]Army, *Army in Motion*, 40–47.

[94]Interview with Major General Findlay; Interview with Participant 13.

Equally, parallel interest in technological and conceptual change among allied armed forces has tended to reinforce emerging Australian consensus about the shape and value of AI for military organisations. Unsurprisingly, the British Army – another medium sized army which privileges inter-operability with the US – has drawn similar conclusions to the Australian Army when it comes to the potential benefits of HUM-T. The UK MoD concept document on HUM-T, for example, argues that automation could provide 'battlefield points of presence increasingly independent of the numbers and locations of human combatants'.[95] Emerging British concepts of future C2 bear a strong family resemblance to the ADF's vision of 'agile' control, highlighting the importance of 'information advantage for understanding, decision-making, tempo of activity and assessment'.[96] Moreover, both British and Australian concepts are in continuity with the direction of travel the US military is embarking upon. The US Army, for example, is explicitly pursuing robotic and autonomous systems to enable 'high-tempo, decentralized operations' though 'mission command on-the-move'. Australian agile C2 likewise reflects US doctrinal interest in creating 'mosaic' operations leveraging networks of sensors and shooters across conventional domains.[97] In fact, partner nations' concepts and policy documents are explicitly cited in Australian doctrine, highlighting their shared intellectual parentage.[98]

Much of this similarity between US, British and Australian concepts of innovation likely reflects the high degree of overlap between their experiences of digitisation during operations in Afghanistan. Just as Australian officers have voiced frustration at the practice of mission command in the digitised Australian Army, so their US counterparts have described digital C2 technologies as 'like crack for generals'.[99] The British Army likewise hopes that HUM-T will reverse the prevailing 'tendency for senior decision-makers to monitor and intercede in low-level tactical action in real time', just as Australian officers do.[100] As a result, many of the practical efforts to address these shared concerns through the use of new technologies also mirror each other. The US 82nd Airborne Division, for example, has built a permanent operations centre at Fort Bragg to act as a rear headquarters in an effort to reduce

[95]UK Ministry of Defence, Joint Concept Note 1/18: Human-Machine Teaming (Shrivenham: Development, Concepts and Doctrine Centre 2018), 1; Ryan, *Human-Machine Teaming*, 11–14.
[96]MoD, *Joint Concept Note 1/18*, 2; UK Ministry of Defence, *Joint Concept Note 2/17: Future of Command and Control* (Shrivenham: Development, Concepts and Doctrine Centre 2017), iii.
[97]US Army, *Robotic and Autonomous Systems Strategy* (Fort Eustis, VA: U.S. Army Training and Doctrine Command 2017), i, 10; Lieutenant General David Deptula, Heather Penney, Major General Lawrence Stutzriem and Mark Gunzinger, *Restoring America's Military Competitiveness: Mosaic Warfare* (Arlington, VA: Mitchell Institute 2019).
[98]Army, *Robotic and Autonomous Systems Strategy*; ADF, *Concept for Robotic and Autonomous Systems*; ADF, *Command and Control of the Future Force*.
[99]Singer, 'Tactical Generals', 150.
[100]MoD, *Joint Concept Note 1/18*, 33.

the size and scale of deployed command posts through increased use of satellite enabled reach-back, while on a smaller scale, the Australian Army has managed to reduce the headcount of exercising brigade HQs from 250 to 75 through similar reach-back techniques.[101]

Importantly, this isomorphism is not simply a one-way street in which the Australian Army imports US or British concepts and technology once its partners' preferences have become clear. Both Australian and British troops have deployed on joint exercises with the US military to test and evaluate new technology and warfighting concepts, reciprocally influencing development in single-national contexts.[102] Australia is also involved in bilateral technology development with the US DoD, such as Australian participation in projects such as TORVICE (Trusted Operation of Robotic Vehicles in a Contested Environment).[103] Inevitably, Australian interest in US innovation reflects the strategic importance Australia places on its relationship with the US, concomitantly placing a high premium on military inter-operability. Nonetheless, the broadly similar patterns of civil-military relations in each country, together with the high degree of inter-connectedness of their civil societies, mean that notions of societal acceptability in military innovation tend to cluster around the same set of issues regardless. Surveys of US military officers, for example, display precisely the same professional and ethical concerns about HUM-T (such as the potential for erosion of command responsibility) that animate Australian professional debate – reinforcing the tendency towards path dependent, evolutionary and symbiotic innovation.[104]

Conclusions

This article has found that professional debate in the Australian Army displays a notable degree of emergent consensus over the utility and acceptability of

[101]King, *Command*, 315–321; Interview with Participant 1; Interview with Major General Findlay.

[102]Defence News, 'Exercise Autonomous Warrior testing new technologies to meet emerging maritime security challenges', Australian Department of Defence, 16 May 2022, https://news.defence.gov.au/media/media-releases/exercise-autonomous-warrior-testing-new-technologies-meet-emerging-maritime.

[103]Jerome Aliotta, 'Using Long-Distance Control, Army Tests Robotic Vehicle Along Challenging Australian Terrain', U.S. Army Tank Automotive Research, Development and Engineering Center Public Affairs, 7 October 2016, https://www.army.mil/article/176368/using_long_distance_control_army_tests_robotic_vehicle_along_challenging_australian_terrain; Department of Defence, *Giving Army the Capability Edge: Science and Technology Highlights from the Land Domain* (Canberra: Defence Science and Technology Group 2017).

[104]Morgan et al., *Military Applications of Artificial Intelligence*, 101; Julia Macdonald and Jacquelyn Schneider, 'Battlefield Responses to New Technologies: Views from the Ground on Unmanned Aircraft', *Security Studies* 28/2 (2019), 216–249; Interview with Participant 2; Interview with Participant 8; Interview with Participant 9; Interview with Participant 11; Interview with Brigadier Ascough.

future AI innovations. Although officers' views on the specific utilities of autonomous systems vary considerably, they nonetheless display a remarkable amount of commonality in the underlying values against which future innovation should be judged, reflecting shared ideals about how the Australian Army ought to fight. For example, while the *feasibility* of using AI to increase the rapidity and fidelity of Australian military decision-making remains contested, the *desirability* of increasing the tempo of operations enjoys broad support. Consequently, the professional attitudes of AI enthusiasts and sceptics share a degree of common ground, indicating the likely direction of future change. Moreover, early efforts at Australian military automation appear to be treading this path of least resistance, projecting a vision of HUM-T developed from and extending along the existing trajectory of Australian digitisation, creating a high degree of path dependence in ongoing military change.

In line with the expectations of New Institutionalism and the Sociology of Science and Technology, this article finds that this emergent professional consensus results from the influence of two factors. Firstly, Australian military attitudes to future HUM-T are heavily conditioned by prior experiences of digitisation, which significantly shape officers' receptivity to automation. Because both adherents and opponents of HUM-T root their arguments in broadly the same experience of past reform, debate centres on the extent to which HUM-T can practically be enacted, and the degree to which it might redress perceived inadequacies in existing practice. As a result, proposed initiatives, concepts and doctrine eschew the most extreme visions of change in favour of developing established practices, albeit in novel and potentially radically important ways.

Secondly, Australian military exposure to parallel innovation activities underway in key partner armed forces (such as the US Army) serves to reinforce this path dependent trajectory. The longstanding importance of inter-operability with allies means that Australian officers face similar challenges to their international partners, while the high level of professional exchange and cultural similarity means they confront these challenges with a similar set of professional values. Consequently, isomorphic pressures generated by engagement with allied innovations only serve to reinforce the existing trajectory of Australian military change.

This conclusion has a number of important implications. Firstly, it demonstrates that innovation is not always inherently destructive or episodic for military organisations. Instead, principled professional debate can result in a degree of consensus among military officers, facilitating an evolutionary rather than revolutionary pathway to innovation. Although this process may be fragile and faltering, it nonetheless challenges established perceptions of military institutions as inherently conservative and resistant to change, and of military innovation as achievable only through risky and sporadic upheavals.

Military innovation is not always defined by revolutionary shifts in which the conduct of warfare changes swiftly. Instead, some military organisations are in a constant state of slight flux, incrementally remaking themselves in important ways. This insight focuses attention on understanding the ways in which armed forces make collective sense of their changing environments for theorising military institutional behaviour, and on the international interconnections that can underpin innovation as well as diffusion. It also lends support to the growing recognition that studies of military innovation all too often rely on arbitrary delineations about the 'start' and 'end' of change, reinforcing the importance of viewing innovation as a *longue durée* process.[105]

Secondly, the importance of internal debate and principled discussion within the officer corps for evolutionary innovation – and by extension, support for change – underscores the fundamental paradox of military institutional reform. On the one hand, vigorous professional debate over the value and viability of prospective innovations can be seen to support the generation of professional consensus, while creating the space to interrogate alternate possible organisational futures in a robust fashion. On the other hand, the potential acrimony such debates can generate may also threaten the corporate integrity of the officer corps and undermine the authority of the chain of command – especially where entrenched views mean a consensus position cannot be reached, and contestation continues beyond the point of official decision-making. While the armed forces of democratic states such as Australia appear to have found ways to manage this tightrope-walk between debate and direction (although perhaps less well than some officers might like), we might reasonably expect this balance to be more challenging in the armed forces of more authoritarian states, where internal dissent in the officer corps is more likely to be viewed through a political lens.[106] Further work is required to understand the nature and scope of internal professional debate within authoritarian armed forces, and the associated implications for innovation processes.

Finally, the evolutionary nature of military innovation in Australian C2 serves to temper the some of the more strident predictions about military technological change. Much of the trajectory of Australian innovation in the field of intelligent automation is decidedly evolutionary in nature, building on existing and long-standing patterns of reform. This should not imply that the impact of Australian military change will be insignificant or entirely

[105]Horowitz and Pindyck, 'What is a military innovation'; Kendrick Kuo, 'Military Innovation and Technological Determinism: British and US Ways of Carrier Warfare, 1919–1945', *Journal of Global Security Studies* 6/3 (2021), 1–19.

[106]We are indebted to an anonymous peer reviewer for this observation. On the ways in which authoritarian armed forces limit internal communications among the officer corps and the effects this can have on battlefield adaptation, see Caitlin Talmadge, *The Dictator's Army: Battlefield Effectiveness in Authoritarian Regimes* (Ithaca, NY: Cornell UP 2015).

predictable. It does, however, suggest that some of that possible future can at least be understood through reference to the present, and will continue to share a degree of commonality with the past.

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Notes on contributors

Alex Neads is Assistant Professor of International Security at the Durham Global Security Institute, a specialist research centre in the School of Government and International Affairs at Durham University. His research explores the changing construction and diffusion of martial power in the modern world, and its implications for international security.

Theo Farrell is Deputy Vice-Chancellor and Vice President (Academic and Student Life) at the University of Wollongong, Visiting Professor in War Studies at King's College London, and Senior Associate Fellow at the Royal United Services Institute.

David J. Galbreath is Professor of International Security in the Department of Politics, Languages & International Studies at the University of Bath. His research interests are in comparative national security and defence policy, as well as how science and technology affect war, conflict and violence.

ORCID

Alex Neads http://orcid.org/0000-0001-9173-6360
Theo Farrell http://orcid.org/0000-0002-2952-3783
David J. Galbreath http://orcid.org/0000-0002-0515-0871

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