Australian Army
Research Centre

Spotlight Brief

No. 6, 2021

Edited by Lindsay O'Connor
and Kieran McInerney

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Serving our Nation

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Our Region

Toward a Trusted Autonomous Systems Offset Strategy: Examining the Options for Australia as Middle Power

Australian Army Research Centre – Apr 2021

Austin Wyatt and Jai Galliott's work presents an examination, grounded in theory, of the feasibility of the Army adopting a Trusted Autonomous System as part of an offset strategy. For Australia, the core purpose of an offset strategy is to generate an asymmetry of capability. By maintaining a comparative edge in Trusted Autonomous Systems Australia could invalidate the conventional superiority of rival militaries and compensate for its comparative weakness. This can create a strategic advantage that secures a niche over the long-term. Wyatt and Gaillott argue that this is achievable for the ADF over the medium term. However, the Australian Government must invest more deeply in developing the capacity of the domestic arms industry to innovate in identified priority areas for capability. They conclude that the broader Australian defence community needs to instigate a meaningful cultural shift to prioritise and support creative risk-taking in innovation.

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'Developed By Australia & Popularized By the UK, US, Marines Test Lethal Mini 'Grenade' Drones That Can Attack in Swarms', *The EurAsian Times*, 10 Jul 21

'The Future of War and Deterrence in an Age of Autonomous Weapons', *TRT World*, 17 Jun 2021

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'The Artificial Intelligence 'Backseater' in Future Air Combat', *The Strategist*, 05 Feb 21

Risks and Benefits of Autonomous Weapon Systems: Perceptions among Future Australian Defence Officers

Journal of Indo-Pacific Affairs – Nov 2020

Artificial intelligence, Autonomous Weapon Systems, and uncrewed platforms will play a crucial role in the ADF's capacity to maintain a capability edge over potential adversaries in the Indo-Pacific. Jai Galliott and Austin Wyatt survey over 800 officer cadets and midshipmen from the Australian Defence Force Academy to determine their attitudes towards being deployed alongside these technologies. The data illustrate that there is a significant relationship between the perceived level of independence of the 'robot' and a willingness to work with them. When the Autonomous Weapon Systems were either entirely under human control or were limited to preprogramed functions, the vast majority of respondents were 'willing' or 'somewhat willing' to deploy alongside them. However, there was a significant negative shift when the weapons could exercise preprogramed decision-making in the use of force. Of the three forces, Army had the highest level or opposition to deploying alongside Autonomous Weapon Systems. This is the first study to canvas military perspectives on these technologies, with Galliott and Wyatt distilling several critical recommendations for ADF training from the data.

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'Creating Reliable Robotic Weapons', *The Australian*, 28 Jul 21

'Militaries Are Planning for an Autonomous Revolution. What if the Tech Isn't Up to It?', *The Diplomat*, 13 Jan 21

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'Breaking: Boeing Carries Out First Flight of Australia-Made Robotic Jet', *National Defense*, 02 Mar 21

'Australia Invests in Advanced Maritime Weapons, Minehunters', *Defense News*, 26 Jan 21

A Southeast Asian Perspective on the Impact of Increasingly Autonomous Systems on Subnational Relations of Power

Defence Studies – Apr 2021

This article explores how the integration of uninhabited systems and Artificial Intelligence will influence rising powers in Southeast Asia. Austin Wyatt notes that militaries in these states maintain legitimate and long-standing roles in the domestic use of force. As such, if these militaries acquire Autonomous Weapon Systems it should be assumed that they will be deployed in subnational exercises of power. There are clear similarities between the perceived benefits of deploying these technologies for internal security/ law enforcement and in warfare. They offer substantial resource efficiencies, reduced risk for officers, and a greater capacity to conduct long-term surveillance and complex data analysis. Wyatt acknowledges that there is little evidence that law enforcement agencies have utilised autonomously operating systems to date, however they (Indonesia, Singapore, etc.) have deployed remote operated systems, passed legislation allowing for their use in broader contexts, and expressed interest in using Artificial Intelligence more generally. He believes that it is only a matter of time before Autonomous Weapon Systems are used for surveillance, border security, and internal repression.

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'Indian Army Employing Autonomous Weapon Systems', *South Asia Monitor*, 16 Jan 21

Evolving Geo-strategic Dynamics

Defence Innovation and the 4th Industrial Revolution in Russia

Journal of Strategic Studies – Dec 2020

Katarzyna Zysk's article grapples with two key questions. Firstly, what strategies has Russia adopted in order to pursue breakthrough technologies and stimulate defence innovation? Secondly, what ramifications will Russia's technological advancements have for strategic competition? Russia has systematically focussed on new potentially disruptive technology such as artificial intelligence, quantum computing, automated decision-making, uncrewed systems, and hypersonics. Zysk provides detail on Russia's artificial intelligence and hypersonics programs. She posits several reasons why Moscow has struggled to leverage Fourth Industrial Revolution technologies, noting that despite challenges, Russia has demonstrated a strong ability to experiment with these novel capabilities. Notably, Russia is creating an interconnected system that combines advanced features of artificial intelligence, autonomous systems, and quantum computing. Zysk concludes that this may provide "a sharpened edge on the battlefield, if not the critical advantage that the Russian top leadership is ultimately pursuing."

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'Tukey's Terminator', *The Mackenzie Institute*, 25 Jun 21

'Russia Has Developed 'Weapons of the Future': Defense Minister', *The Defence Post*, 25 May 21

'Weapons of the Future': Russia has Launched Mass Production of Autnomous High-Tech War Robots, Defense Minister Shoigu Announces', *RT*, 21 May 21

'Inside Russia's Robot Army: Rhetoric vs. Reality', *Breaking Defense*, 30 Apr 21

Small States and Autonomous Systems – The Scandinavian Case

Journal of Strategic Studies – Dec 2020

The Fourth Industrial Revolution is critical to the Army and ADF's force modernisation. Petersson explores the extent to which medium and small states are incorporating these technologies into their defence forces. His article focusses on Denmark, Norway, and Sweden. Autonomous Weapon Systems would seemingly be ideally suited to these states, as they have large geographical areas to monitor, numerically weak defence forces, and a reasonably clear threat picture. Given these characteristics, the picture Petersson paints is quite surprising. Denmark has been lukewarm to such systems, and there is very little evidence of a strategy to operationalise new technologies. Similarly, the Norwegian Armed Forces do not have a long-term strategy concerning Autonomous Weapons Systems. Petersson suggests this low-profile stance may be caused by solidarity with the NATO alliance and the United States. Sweden also lacks procurement plans, and there is no evidence of a strategy to incorporate these technologies into their defence structure. It would be prudential for Australian policy-makers to investigate the source of this hesitancy in Scandinavia before making any concrete decisions regarding the ADF's adoption of these technologies.

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'Weapons of Mass Debate – Sweden between Armed Neutrality and a Nuclear Umbrella', *Institut Montaigne*, 01 Jul 21

'Nato Allies Need to Speed Up AI Defence Co-operation', *Financial Times*, 08 Jun 21

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'How Norway is Folding Civilians into National Defense', *Defense One*, 12 Mar 21

'Denmark Ramps Up Artic Naval Defense Pending', *GCaptain*, 12 Feb 21

Strategy

Cyber Threats and Vulnerabilities to Conventional and Strategic Deterrence

Joint Force Quarterly – Jul 2021

Information technology has contributed to a transformation in military capabilities and power. An information technology counter-revolution is now underway, whereby digitally dependent militaries have become increasingly vulnerable to new types of threats. Mark Montgomery and Erica Borghard break down how adversaries of the United States are attempting to leverage such vulnerabilities to gain strategic advantage. The United States' military modernisation policy has led to highly technologically advanced capabilities and thus a large attack surface in cyberspace for exploitation. The computerised and networked nature of weapons systems has increased the number of access points for cyber intrusion and attacks that could hold key infrastructure at risk and compromise mission assurance. Montgomery and Borghard argue that there are four categories of vulnerabilities: technical vulnerabilities in fielded weapon systems, technical vulnerabilities across networked platforms, supply chain vulnerabilities, and nontechnical vulnerabilities stemming from information operations. They conclude by unpacking several specific measures to address the most pressing concerns that they raise.

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'Data Poisoning: When Attackers Turn AI and ML against You', *Security Intelligence*, 21 Apr 21

'Extending Human Performance through Technology: The Promost of JADC2', *Air Force*, 09 Dec 20

Autonomous Weapons Systems and the Contextual Nature of Hors de Combat Status

Information – May 2021

Who and who is not a combatant is becoming increasingly harder to define thanks to the longer range and greater types of weaponry in service. In this article, Umbrello and Wood seek to reconcile Autonomous Weapon Systems with hors de combat in international law. A substantial portion of their article is devoted to establishing precisely who should be considered hors de combat (out of combat). They argue for a broad (and somewhat counterintuitive) understanding of hors de combat, whereby any combatant who cannot harm their adversary falls into this category. Umbrello and Wood acknowledge that such an interpretation requires a nuanced and contextualised case-by-case evaluation. They contend that current Autonomous Weapon Systems do not possess a level of technical sophistication to make such fine-grained evaluations, so any attempt to remove humans from the decision-making process risks violating international law. Umbrello and Wood also highlight that as Autonomous Weapon Systems become more and more capable, it will increasingly be the case that they will be impervious to attempts to harm them. If Umbrello and Wood's relational understanding of hors de combat is accepted, this will mean that most combatants facing Autonomous Weapon Systems will actually be deemed hors de combat in the future, providing a complex ethical concern.

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'Down Is Not Always Out: An Infantry Leader's Guide to Persons Hors De Combat Under the Law of War', *Infantry*, 01 Mar 21

'Drone and War: The Impact of Advancement in Military Technology on Just War Theory and the International Law of Armed Conflict', *Ethics and International Affairs*, Sep 20

Clausewitzian Friction and Autonomous Weapon Systems

Comparative Strategy – Jan 2021

Gardner investigates the impact that Autonomous Weapon Systems will have on friction in war. Friction is one of Clausewitz's most intuitively accessible concepts. It encompasses all of the factors that distinguish war in practice from war in theory. The presence of humans in war necessarily generates a lot of friction. Humans suffer from diverse physical and cognitive limitations. The human brain has processing limitations and must often grapple with a shortage of accurate and relevant information. The magnitude and effects of these frailties increase under the intense stresses, pressures, emotions, fatigue, and combat responsibilities. Gardner notes that the advent of Autonomous Weapon Systems will decrease the role of humans in war, and considers whether this will lead to a reduction in friction. He ultimately concludes that Autonomous Weapon Systems will alleviate some aspects of friction but will amplify others. Friction will persist due to the limitations of artificial intelligence concerning recognising objects and understanding context. Focusing on context, Gardner cautions that Autonomous Weapon Systems have the potential to drastically magnify the risk of inadvertent escalation in conflict due to their inability to appreciate the (potentially disastrous) consequences of actions. This article concludes that friction is an enduring structural feature of war, which will persist due to the limitations of humans, the shortcomings of machines, and the interaction between the two.

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'Can We Make Our Robots Less Biased Than We Are?', *The New York Times*, 22 Nov 20

‘Catalytic Nuclear War’ in the Age of Artificial Intelligence and Autonomy: Emerging Military Technology and Escalation Risk between Nuclear-Armed States

Journal of Strategic Studies – Jan 2021

Johnson argues that the possibility of catalytic nuclear war has increased due to advancements in artificial intelligence and Autonomous Weapon Systems. Nuclear war is defined as catalytic when it is set in motion by the deliberate action of a third-party actor. The third-party deceptively induces nuclear war between States to gain some form of perceived advantage. Johnson posits several ways that a non-state actor could utilise or exploit artificial intelligence or Autonomous Weapon Systems to generate escalation pathways of reaction and retaliation that result in a nuclear exchange. Technology augmented with artificial intelligence could facilitate digital jamming, spoofing, malware attacks, data pollution, deepfake propaganda, false alarms, reverse engineering algorithms, and the spreading of malevolent disinformation. Johnson employs fictional cases to demonstrate how these technologies could be harnessed to manipulate governments into resorting to nuclear weapons. The final section of Johnson’s article considers specific measures he recommends implementing to reduce the risk of catalytic nuclear escalation. These include enhancing training, consulting independent sources to verify and collaborate threat assessments, collective monitoring of events, bilateral and multilateral data exchanges, and ensuring humans retain a fundamental role in the decision to deploy nuclear weapons.

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‘Talks for New US-Russia Arms Deal to Stir Up Old Bugaboo’, *The Middletown Press*, 27 Jul 21

‘The Future of War and Deterrence in an Age of Autonomous Weapons’, *TRT World*, 17 Jun 21

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‘Russia’s Impact on US National Interests: Preventing Nuclear War and Proliferation’, *Russia Matters*, 21 Jan 21

‘U.S. Nuclear Weapons Agency Hacked by Suspected Russians’, *Fortune*, 18 Dec 21

National Power After AI

Center for Security and Emerging Technology – Jul 21

There is currently an enormous amount of work in trying to determine what artificial intelligence can do for nations, and what the effect is across a variety of fields. Every aspect of national strategy will change: economy, defence, education and health among others. Nevertheless, little consideration has been to what is next, to what happens after AI has rolled out. Here, the Centre for Security and Emerging Technology attempts to answer that through the scope of international competition. Comparing the effect to the environmental change of an ice age, it stresses that we must do better to scope possible outcomes to best set-up the nation. Simply using AI to make extant processes better may not work; AI may fundamentally change what a nation wants, as much as what it can do. It also highlights that AI offers different nations different things, meaning that a deep understanding of the aims and interests of allies and partners is even more important.

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'The promise and perils of Artificial Intelligence partnerships', *Observer Research Foundation*, 23 Jun 21

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'Artificial Intelligence and National Security', *Institute on Global Conflict and Cooperation*, 16 Apr 21

Economy

Global Networks 2030: Developing Economies and Emerging Technologies

Centre for Strategic and International Studies – Mar 2021

Strategic competition in global communications is intensifying. the Centre for Strategic and International Studies has produced this report to help policymakers chart a strategic course regarding developing economies and emerging communications technologies. Hillman and Rivas core contention is that the United States and its allies must look ahead and formulate their own visions for global connectivity. This report emphasises that developing economies (particularly in Asia and Africa) are poised to play a much more significant role in global networks. Currently, more than half the world has limited or no access to the internet. As some of the world's fastest-growing economies come online, they will decide which communications systems to adopt. Hillman and Rivas assert that it is economically and strategically critical that the United States and its allies capture the market share of this opportunity, as this will position these States to set the standards and norms of use.

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'U.S. Weighs Deploying Balloons to Provide Internet Access to Cubans During Crackdown', *The Drive*, 22 Jul 21

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'Major Websites Begin to Come Back Online After Internet Outage', *Al Jazeera*, 08 Jun 21

People, Culture and Ethics

Accountability and Control of Autonomous Weapon Systems: A Framework for Comprehensive Human Oversight

Minds and Machines – Aug 2020

The emergence of Autonomous Weapon Systems has led to increased academic and societal interest in the concepts of accountability and responsibility. Considerable focus has been on accountability gap that will facilitate a lack of criminal liability and moral responsibility. The authors of this paper attempt to remedy this issue. They begin by proposing an understanding of 'accountability' that allows operationalisation as a verifiable requirement for practical use. They then identify three potential accountability gaps that Autonomous Weapon Systems may engender. The authors present the principle of 'Meaningful Human Control' to ensure human accountability for the decision to use force but propose that to broaden this principle to a framework for 'Comprehensive Human Oversight.' Drawing from engineering, socio-technical, and governance perspectives of 'control,' the authors' 'Comprehensive Human Oversight' framework provides a mechanism to ensure solid controllability and accountability for the behaviour of Autonomous Weapon Systems. While at first glance this article may appear highly technical and semantic, in practical terms, it outlines an instrument and process for ensuring oversight before, during, and after the deployment of Autonomous Weapon Systems.

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'Artificial Intelligence and War Without Humans', *Asia Times*, 23 Apr 21

'Regulating Military AI Will Be Difficult. Here's a Way Forward', *The Bulletin*, 03 Mar 21

'US has 'Moral Imperative' to Pursue AI Weapons, Panel Says', *Engineering and Technology*, 27 Jan 21

Challenges in Regulating Lethal Autonomous Weapons under International Law

Southwestern Journal of International Law – Mar 2021

Many states have called for binding international legal restrictions in the development, procurement, and use of lethal autonomous weapons. This paper outlines the challenges in creating such a regulatory scheme. A key limitation for this proposal is the lack of an agreed upon definition for 'autonomous weapons'. Another is the substantial gulf between individual nation's perspectives concerning the content of the laws. At least twenty-six States have called for a total ban on fully autonomous lethal weapons. Other States have asserted that the existing international laws of armed conflict are sufficient to govern the development and use of autonomous weapons. The United States, an obvious major player, advocates autonomous weapons could enhance conformity to the existing laws of war by increasing targeting precision and discrimination. This article considers historical trends concerning the traits of weapons that have been banned, finding that attempts to regulate the use of autonomous weapons will likely prove unsuccessful.

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'Changing the Conversation: The ICRC's New Stance on Autonomous Weapon Systems', *Lawfire*, 24 May 21

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'We Need to Restart Talks on Regulating Autonomous Weapons – Now', *The Ploughshares Monitor*, 25 Mar 21

'US Govt Panel: Don't Ban AI-Powered Autonomous Weapons', *The Defense Post*, 28 Jan 21

'Guidelines for Military and Non-Military Use of Artificial Intelligence', *European Parliament*, 20 Jan 21

In Search of the 'Human Element': International Debates on Regulating Autonomous Weapons Systems

The International Spectator – Feb 2021

The development of Autonomous Weapon Systems could create ethical and legal issues for the Army. Concerns about these weapons include accountability gaps, criminal liability, the potential to undermine violate human dignity by reducing targets to algorithmically processed 'data points.' In this work, Daniele Amoroso and Guglielmo Tamburrini propose a solution. They note that the international community has sought to avert these problems by preserving a human element when force is applied. These resolutions that fall under the umbrella of 'Meaningful Human Control' across three categories – boxed autonomy, denied autonomy, and supervised autonomy. Amoroso and Tamburrini highlight defects with these policies, and instead advance their own novel, differentiated approach to Meaningful Human Control. This differentiated approach stipulates that every individual type of Autonomous Weapon System requires its own individualised formula governing its ethical and legal deployment. This remedy seems appropriate for the Army given the wide variety of capabilities that could conceivably be labelled 'Autonomous Weapon Systems.'

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'Why We Should be Alert and Alarmed about Autonomous Weapons Systems', *The Canberra Times*, 11 Jun 21

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'Drone Swarms Are Getting Too Fast for Humans to Fight, U.S. General Warns', *Forbes*, 27 Jan 21

Coupling Level of Abstraction in Understanding Meaningful Human Control of Autonomous Weapons: A Two-Tiered Approach

Ethics and Information Technology – Apr 2021

Steven Umbrello argues that Autonomous Weapon Systems will not create an ethical accountability gap. He believes that those who claim that autonomy will generate this issue misunderstand the nature of military operations and engineering design. In the former's case, Autonomous Weapon Systems, and indeed any human agent in the military, are already constrained by various decisions and planning that occurs before and during the deployment. In the latter case, engineers already have a moral duty to ensure that Autonomous Weapon Systems are fully responsive to their orders. The practical implication of these 'two levels of abstraction' ensure that a human will always be accountable for any action taken. Suppose an Autonomous Weapon System kills a civilian. Either the killing is deliberately ordered as part of the military operation, in which case the decision-maker is accountable, or it was contrary to orders, in which case the engineers that designed the weapon are accountable. Umbrello concludes that arguments "against the development of Autonomous Weapon Systems, such as increased autonomy or the targeting of civilians, are only problematic if decoupled from responsible design, actually military planning, and actual operations practices. The challenge for Army in adopting this model of thinking lies in the second part. We obviously have significant control over military operations, but over the past three to four decades, we have actively steered away from being involved in design or manufacturing decisions.

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'Rise of the Robots: Weaponization of Artificial Intelligence', *National Maritime Foundation*, 01 Apr 21

'Are We Ready For Weapons to Have a Mind of Their Own?', *The Centre for Public Integrity*, 17 Feb 21

'Command Responsibility: A Model for Defining Meaningful Human Control', *Journal of National Security Law & Policy*, 02 Feb 21

On the Indignity of Killer Robots

Ethics and Information Technology – Mar 2021

All military personnel have an interest in maintaining their dignity in combat. Some theorists have claimed that death at the hands of Autonomous Weapon Systems would be undignified. Garry Young offers two rebuttals to this 'indignity argument.' His weaker rebuttal accepts that deploying Autonomous Weapon Systems to kill an enemy combatant involves an affront to their dignity and that violating someone's dignity is morally wrong. Despite this, Young contends that a moral good can override such a wrong. As such, it can be permissible to deploy these weapons if the affront to dignity outweighs the reduced suffering to achieve a military objective. Young's response that is more robust denies that Autonomous Weapon Systems violate the dignity of combatants targeted. Whilst the weapons themselves may be incapable of respecting the inherent dignity of combatants targeted, the military commanders who deploy these weapons can. Further, Young suggests that human beings may have an unconditional inalienable dignity and that combatants can maintain their dignity even in the face of indignity.

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'AI Ethics Have Consequences – Learning from the Problems of Autonomous Weapons Systems', *Diginomica*, 05 Jul 21

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'Autonomous Weapons and the Laws of War', *Valdai*, 09 Feb 21

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'Opposing Inherent Immorality in Autonomous Weapons Systems', *The Forge*, 01 Jan 21

Force Design

Lethal Autonomous Weapons Systems: Organisational and Political Consequences

The Philosophical Journal of Conflict and Violence – Jun 2021

Paul Dumouchel is interested in how Autonomous Weapon Systems will change Army's ability to project power, affect the composition of armed forces, and affect the power relationships within them. He makes several thought-provoking observations related to Army structure and force design more broadly. A standout one is militaries actively seek and resist technological innovations. Resistance is often due to cultural or social factors that reflect the composition of the different army corps. For instance, some pilots have been strongly opposed to the development of fully autonomous combat planes or drones. Resistance may also be broader – many officers are unsure to what level autonomous systems can be trusted and how they will fit into existing chains of command. Dumouchel asserts Autonomous Weapon Systems increase the distance between the weapon's operator and the theatre of war, consequently decreasing the importance of physically capturing territory and create a new class of 'absent warrior combatants.' These personnel are not physically present when violence takes place; however, are directly involved in the use of force. While some tentatively explore the psychological cost of this, no consideration of effectiveness exists. The article also stresses these weapons are only autonomous as part of a larger complex system. For this reason, the introduction of Autonomous Weapon Systems is likely to see an increase the number of people involved in any given operation, simply providing the enabling support to autonomous platforms. Dumouchel concludes that although more individuals will be involved in the deployment of these weapons, there will paradoxically be fewer people who are actually responsible for any decision to use lethal force.

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'Why NATO Needs Lethal Autonomous Weapon Standards', *Center For European Policy Analysis*, 23 Feb 21

AI-Enabled Remote Warfare: Sustaining the Western Warfare Paradigm?

International Politics – Jul 2021

Ash Rossiter explains that the two prominent features of recent Western force design have been precision and distance. These concepts favoured due to a preference to prosecute remote warfare – the deliverance of lethal force through precision strike and uncrewed platforms – while avoiding ground forces with higher chances of casualties. Rossiter's article questions the oft-uttered claim that advances in artificial intelligence will significantly enhance Army's capacity to conduct remote warfare. He argues that the impact of technological progress in this space is overstated and artificial intelligence may actually "lean toward methods of warfare antithetical to the Western warfare paradigm". Rossiter maintains that the advances in machine learning required to find and identify targets remotely are beyond near-term capabilities. The use of artificial intelligence in physical systems is also limited, partly due to a reluctance to take humans out of attack decisions for ethical, legal, and technical reasons. Rossiter concludes that rather than facilitating remote campaigns, emerging applications of artificial intelligence lend themselves more naturally to competition on quantity (mass over precision), such as swarms of drones overwhelming a defensive asset.

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'Military Drones Are Changing, As Are the Wars They're Fighting. Here's What's Happening Now', *ABC*, 26 Feb 21

Artificial Intelligence as Inventor: Exploring the Consequences for Patent Law

Intellectual Property Quarterly – Mar 21

Patent law, at is basis, is quite simple. A person comes up with a unique idea and they are recognised as the inventor. Furthermore, as it is a long-standing belief that computers cannot invent something, that creativity remains a uniquely human capability. Recently, artificial intelligence has challenged these fundamentals, which has caused the legal world to start considering what does have to change with patent law. In paralleling military ethical concerns, who is the owner of an AI generated patent and who is responsible for AI infringing a patent has no consensus. This article explores these issues, providing the major arguments within the field and finds, again similar to military ethics, that AI and patent law is likely to become a major international task for academics, lawyers and policy makers in the near future.

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'Only Humans, Not AI Machines, Get a U.S. Patent, Judge Says', *Bloomberg*, 04 Sep 21

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Science, Technology and Industry

ResQBot 2.0: An improved Design of a Mobile Rescue Robot with an Inflatable Neck Securing Device for Safe Casualty Extraction

Applied Sciences – Jun 2021

The authors of this study propose a novel design for a mobile rescue robot that can extract casualties from dangerous areas. They present ResQbot 2.0 – a stretcher-type robot capable of safely performing extraction through loco-manipulation that is synchronised with a conveyer belt and a mobile base to load casualties from the ground onto a stretcher bed gently. They believe that their design will ensure the safety of first responders and minimise the possibility of creating further damage or additional risk to casualties. The verification work done through successful experiments in the Gazebo physics engine simulator offer additional opportunities for Army interest across other land materiel. These initial findings indicate that ResQBot 2.0 could prove invaluable for loading and transporting casualties for future Army rescue missions, or other mission sets in complex terrain.

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Autonomous Technology and Dynamic Obligations: Uncrewed Maritime Vehicles and the Regulation of Maritime Military Surveillance in the Exclusive Economic Zone

Asian Journal of International Law – Mar 2021

The value in having a comprehensive picture of what is happening in the maritime domain has led nations to focus investment on a range of maritime surveillance assets. For instance, Australia's Attack-class submarine purchase is the largest acquisition project in Australian history. While ignored by other armies and maritime forces focusing on larger platforms; for a littoral force like the Australian Army, there must be smaller assets to provide similar capabilities in the inshore environments. The development of uncrewed marine vehicles (UMVs) will dramatically increase the possible scale in intelligence gathering operations. They can operate on or below the surface, be remotely controlled, pre-programmed, or have the capacity for some autonomous operations. In this article, Simon Mckenzie identifies some essential capabilities for UMVs to remain compatible with the United Nations Convention on the Law of the Sea. Legal obligations will require equipping UMVs with the capacity to communicate something about their identity and the purpose of their mission. For the future Amphibious Centre of Excellence, an understanding of these issues is vital.

Related

'Navy Large Unmanned Surface and Undersea Vehicles', *Congressional Research Service*, 02 Aug 21

'Drones of the sea: the rise of unmanned surface vehicles', *Naval Technology*, 23 Jul 21

'World-first Autonomous Marine Systems Course to Run in Townsville', *Australian Defence Magazine*, 29 Mar 21

'Autonomous Marine Robots Sent Out to Explore and Maintain Equipment', *Institutions of Mechanical Engineers*, 17 Mar 21

'Unmanned Surface and Underwater Vessels Receive New Position System Technology', *Vision Systems Design*, 06 Feb 21

Demonstrating Interoperability between Unmanned Ground Systems and Command and Control Systems

International Journal of Intelligent Defence Support Systems – May 21

This paper describes NATO efforts to integrate command and control systems with uncrewed ground vehicles. Primarily done at a basic standards approach (especially the Joint Architecture for Unmanned Systems) instead of at the higher levels that most nations have attempted, it found that not only was this feasible, but highly beneficial as it could be extended rapidly. While this success raised additional complications, it reinforces the recent lines of effort established by the Land Network Integration Centre to develop common architectural systems for all Army materiel – including uncrewed platforms.

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'Embracing open architectures', *New Electronics*, 02 Sep 21

'Generic Vehicle Architecture', *Think Defence*, 24 Jul 21

'Defining a Future-Proof Generic Soldier Architecture', *Luminact*, 2019

'Australian Generic Vehicle Architecture', *Land Network Integration Centre*, Mar 19

'Implementing a Generic Vehicle Architecture for the Australian Defence Force Land Environment', *Luminact*, 2017

Experimental Evaluation of Tasking and Teaming Design Patterns for Human Delegation of Unmanned Vehicles

Human-Intelligent Systems Integration – Jun 21

This article examines the workload challenge in the context of human-machine teaming. It posits ways to tackle the demands created by coordinating multiple systems at once, reducing tasks to manageable workloads while providing the desired effect. It also takes it a step further, in investigating how to increase the uncrewed component from one platform to a swarm. Overall, it did find a method that translated to real world trials with German Air Force pilots, but one that relied heavily on automation. It also highlighted cultural, workload, and accuracy issues with delegations coming from the uncrewed platform to the crewed platform that need further study, as well as the unexpected role that individual pilot preference played in delegations.

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'Air Force picks two companies to develop mission planning autonomy to facilitate manned-unmanned teaming', *Military and Aerospace Electronics*, 23 Aug 21

'Boeing-Led Team Demonstrates A Manned-Unmanned Teaming Concepts For Naval Aviation', *Naval News*, 05 Aug 21

'US Army's new network software paves way for manned, unmanned teaming', *Janes*, 09 Aug 21

'Artificial Intelligence in Avionics', *Indian Defence Review*, 16 Apr 21

'Meet the Apache V6- the Army's newest version of the iconic AH-64 gunship', *The Debrief*, 11 Feb 21

Workload-Adaptive and Task-Specific Support for Cockpit Crews: Design and Evaluation of an Adaptive Associate System

Human-Intelligent Systems Integration – Jun 21

While the above article deals with the complexity for crews when teamed with uncrewed platforms, this article looks at the increasing workload on a normal, crewed aircraft. Army Aviation has dealt with this once, as the cognitive workload between Kiowa and Tiger increased – with Boxer and LAND 400-3 coming online this issue is likely to be faced by others. Here, Yannick Brand and Axel Schulte tackle means by which to lower that cognitive load. Automation is the quick and easy answer, and has been the go to for engineers for the past decades, but as Brand and Schulte find, this can have its own disadvantages. Instead of a 'hidden' system, their automated agent acts as another crewmember, building on traditional crew relationships and simplify the integration. This model appears to work quite well, with the agent able to balance needs and knowledge better, reducing the normal disadvantages.

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'What Will Come Out Of NHTSA's Tesla Autopilot Investigation?', *Forbes*, 23 Aug 21

'Cockpit Automation - Advantages and Safety Challenges', *Sky Bray*, 13 Jul 21

'At the sharp end: Innovative cockpit tech points the way', *Clean Sky*, 30 Jun 21

'Research advances human/artificial intelligence synergy for combat vehicles', *Texas A&M Engineering Experiment Station*, 27 May 21

'Army researching enhanced lethality for future aircraft', *US Army*, 27 May 21

Small Data's Big AI Potential

Center for Security and Emerging Technology – Sep 21

Conventional wisdom is that AI demands large data sets. The more data, the more advanced and capable the AI. For many applications, this makes sense and is easy to achieve, especially for national governments. Critically though, and especially for the military, such large data sets are not always available. Furthermore, COVID-19 has demonstrated that big data sets can have flaws when something new or revolutionary comes into play. In this article, the authors demonstrate clearly that small data set AI is feasible, and offer alternative approaches for the development and use of AI. Furthermore, quality requirements associated with small data sets can improve traditional AI. Realising this, and leveraging transfer learning and research into small data sets, has the potential for rapid expansion of the scope and abilities of AI, including into aspects of the military that may not have yet considered using AI.

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'Don't buy the 'big data' hype, says cofounder of Google Brain', *Fortune*, 30 Jul 21

'AI Doesn't Have to Be Too Complicated or Expensive for Your Business', *Harvard Business Review*, 29 Jul 21

'Big Data vs Small Data for AI', *aiSnacks*, 25 Jul 21

'Gartner Says 70% of Organizations Will Shift Their Focus From Big to Small and Wide Data By 2025', *Gartner*, 19 May 21

'From artificial intelligence to small data and graph technology, data and analytics leaders should think about leveraging these trends', *Gartner*, 22 Feb 21

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