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To what extent will the development of Artificial Intelligence change the nature of war and what are the strategic security implications for the United Kingdom?

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Abstract

Artificial Intelligence is a rapidly growing area of technology which will impact societies, economies and national security. AI presents new strategic security challenges for the UK, as such, this paper seeks to explore how AI will impact the nature of war and analyse what implications there are for UK security strategy.

This paper will first use Clausewitz's trinity concept as a theoretical analytical framework. It will explore previous RMAs to consider the extent to which the nature of war will be changed by AI. The analysis of this inquiry will then be used to examine the threats AI poses to UK security and finally, how the UK can achieve strategic advantage.

The paper argues that war's essence will continue to be a politically-directed human endeavour. Violence, chance and friction will endure in the seventh RMA. Whilst AI will amend the character of war; Clausewitz's two-century old theory remains robustly extant. The paper will then assert that although technological advantage is a necessary condition, it is not sufficient to claim strategic success. Therefore, to protect UK interests, the UK must develop a defence-specific AI strategy in order to gain and maintain strategic advantage.

Whilst there is a growing amount of scholarly research on AI, this is largely focused on US capability and American rivalry with China. To date, there is a significant research gap in the UK application of AI for national security; this paper hopes to go someway to address that.

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Abbreviations

AI: Artificial Intelligence

ACT: Allied Command Transformation

AWS: Autonomous Weapons Systems

BEIS: Business Energy Industrial Strategy

CIO: Chief Information Officer (United Kingdom Ministry of Defence)

CPC: Communist Party of China

DARPA: Defense Advanced Research Projects Agency (United States of America)

DCDC: Doctrine and Concepts Development Centre

DCMS: Department for Culture Media and Sport

DE&S: Defence Equipment and Support

DSTL: Defence Science and Technology Laboratory

DOD: Department of Defense (United States of America)

DODD: Department of Defense Directive (United States of America)

GAIDP: Generation Artificial Intelligence Development Plan (China)

ICRC: International Committee of the Red Cross

JAIC: Joint Artificial Intelligence Center (United States of America)

LAWS: Lethal Autonomous Weapons Systems

MDP: Modernising Defence Programme

MOD: Ministry of Defence (United Kingdom)

NATO: North Atlantic Treaty Organisation

NSCR: National Security Capability Review

PLA: People's Liberation Army (China)

R&D: Research and Development

RMA: Revolution in Military Affairs

T&E: Test and Evaluation

UOR: Urgent Operational Requirement

UN: United Nations

Definitions and Concepts

Artificial Intelligence. The literature review for this paper found there is no common acceptance for a definition of AI. This is in part due to the vast array of fields, (ranging from medicine to manufacturing) that are investigating AI's potential. Therefore, and given this study is focussed on national security, the UK Government's definition of AI will be used throughout - "Technologies with the ability to perform tasks that would otherwise require human intelligence."[1]

Autonomous Weapons Systems. Akin to AI, there is no accepted definition for AWS. Indeed, defining AWS has become highly contentious in recent years, largely because an agreed definition would impose standards and limits on those who sought to employ AWS. Therefore, for the purposes of this study the ICRC's definition will be used - "Weapons that can independently select and attack targets."[2]

Nature and Character of War. Clausewitz declared that "wars are things of the same nature."[3] He describes all war as having three elements - violence, chance and reason. The trinity is the unchanging essence and provides the enduring nature of war. The character of war details "the changing way that war as a phenomenon manifests in the real world."[4] In sum, the character of war is how war is fought; the nature of war describes what war is.

Revolution in Military Affairs. There is a varied and wide selection of definitions of RMA throughout the literature, though a common element is technological advancement. Throughout this paper, RMA will be defined as: "The application of new technologies into a significant number of military systems combined with innovative operational concepts and organizational adaptation that fundamentally

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[1] Department for Business, Energy and Industrial Strategy, "Industrial Strategy Building a Britain Fit for the Future," 37.
[2] Righetti et al, "Autonomous Weapon Systems: Technical, Military, Legal and Humanitarian Aspects." 11.
[3] Clausewitz, *On War*, 606.
[4] Mewett, Christopher. "Understanding war's enduring nature alongside its changing character."

alters the character and conduct of conflict. It does so by producing a dramatic increase - often an order of magnitude or greater - in the combat potential and military effectiveness of armed forces."[5]

Strategy. Numerous fields, such as business, have attempted to define strategy. At its purist however, strategy is about fighting and winning wars. Therefore Liddell-Hart's broad and encompassing definition will be employed throughout this study - "the distribution and application of military means to fulfil the ends of politics."

Introduction

In September 2017, Vladimir Putin stated that whoever "becomes the leader in this sphere [AI], will become the ruler of the world".[6] Whilst few have posited AI's potential quite as strongly as Putin, AI will impact societies, economies and national security in the coming years. Therefore, whilst Putin's hyperbolic language could be subjected to strong critique, AI and the subsequent implications on UK security strategy is a relevant and important area of study.

Scope, Aim and Research Questions. The debate surrounding AI's impact in national security has several stakeholders and aspects to it. This paper does not seek to address all challenges that AI will pose to the UK's national security, nor will it focus on the technical intricacies of AI, such as machine decision-making or cybersecurity which are covered extensively in existing multi-disciplinary literature. Furthermore, the widely contested legal, ethical and moral arguments surrounding the use of AI in warfare will not be explored, though certain ethical implications will be expanded in Part Two. Whilst the author notes the definition of 'security' is

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[5] Krepinevich, "Cavalry to computer: The pattern of military revolutions," 30.
[6] Vincent, "Putin says the nation that leads in AI 'will be the ruler of the world."

contested and broad; this paper will largely focus on the implications for UK 'defence' elites – namely MOD.

Rather, this paper will focus on the macro-question of the nature of war, which will then inform Parts Two and Three. Specifically, AI's emergence has highlighted several questions which this paper aims to answer. First: To what extent will AI change the nature and character of war? Second: What strategic security variables is the UK exposed to by the development of AI? Third: How can UK security elites improve upon current positioning to gain a strategic advantage?

Hypothesis. This paper will contend that whilst AI is a rapidly growing disruptive technology, Clausewitz's theory on the nature of war will endure. As with previous technological advances, the character of war is likely to change with the seventh RMA – the autonomous revolution. This hypothesis asserts that technological advantage is a necessary, but not a sufficient condition for the UK to gain strategic success.

Methodology. This hypothesis will be tested by both primary and secondary source material. Qualitative analysis will be the preferred method of research, largely due to the lack of relevant quantitative data on technology that has not been widely implemented yet and security caveats. The paper will predominantly be evidenced and supported by scholarly material, but will also refer to theorists, as well as archive source. Part One will use Clausewitz as a theoretical framework to consider AI's impact on the nature of war, and a comparative method will be used to analyse previous military revolutions. The author of this paper has no deep technological knowledge of AI, therefore highly-technical literature will be seldom referenced which will allow for an increased use of AI strategic specific research, as well as elements of cross-disciplinary research. The historical case study of Blitzkrieg will be studied to highlight the limits of technological advantage; and Project Maven will be used to focus on the strategic challenges that AI implementation may cause in future years. Part Three will predominantly rely on primary source material and official government publications as the paper seeks to analyse current policy and highlight strategic strengths and weaknesses.

Structure.   This study is grouped into three thematic parts, and will first use Clausewitz's trinity model as an analytical theoretical framework to study the impact of AI on the nature of war. Following this, previous RMAs will be analysed for any lessons that may be applicable to the autonomous revolution. Part Two will then consider the strategic variables and challenges that AI poses to the national security of the UK. This section will consider, AI's impact on the international order, as well as the effect regime type has on AI development. Finally, Part 3 will aim to provide the reader with an examination of the UK's current AI strategic positioning and what is required to gain and maintain strategic advantage. The study concludes with a summary of the main conclusions of Parts 1-3. Key terms and concepts within this paper have been defined separately and warrant their own section given many terms are academically contested or politically ill-defined.

Part One

Part one of this paper will examine the extent to which AI will change the nature of war. To do this, the seminal work of Clausewitz will be used as a theoretical framework and past RMAs analysed. This section, will argue that although AI will lead to a seventh RMA; the age of autonomy will be evolutionary rather than revolutionary. Whilst AI will change the character of war, warfare will remain an undertaking of violence, chance and reason. It will continue to be a human endeavour and the nature of warfare will not change.

Is Clausewitz really still relevant?   Since the publication of Clausewitz's 'On War,' few would dispute that the ways and means of the battlefield have not adapted and changed over time. Indeed, the Prussian's central thesis stated this - the character of war will change, but its nature will endure.

Followers of Clausewitz, understand that the nature of war is absolute, war is without limits and violence will escalate until there is an eventual victor. We can (thankfully) reflect on history and realise such destruction is relatively rare, more theoretical than

real. Clausewitz explains this is due to fog, friction and politics; armies are unsure what lies in the next valley, engines run out of oil and politicians will be indecisive.[7] It is for these reasons that we have been, more often than not, spared annihilation. It is the human being that provides war her nature, therefore, according to Clausewitzian theory, if machines were to replace humans on the battlefield, it is a rational assumption that the nature of war would fundamentally change – this is why it is important to examine the future of war through the prism of history.

Character versus Nature. Villacres and Bassford convincingly suggest AI is an attempt to improve warfare, reduce human suffering, eliminate the fog of war and friction, leading to ultimately "de-politicizing war, turning it from a phenomenon marked by an amalgam of rationality, irrationality, and non-rationality.[8] Moreover, Ankerson suggests warfare will evolve towards hyper-rationality.[9] In this scenario, AI would perform strictly to reason and logic. Human flaws such as fear, biases and exhaustion would be eliminated – a compelling argument that the nature of war will itself change. However, central to Clausewitz's theory is that war is not logical and strategy has too many variables. If humans are removed from warfare, so too will the social and political context that it operates in. Ultimately, the nature of war is forged on human disposition, it is bounded by our failings. Humans flaws provide a safety net and therefore should not be viewed as weakness - the brutality and sacrifice of war are necessary protections.

Clausewitz differentiates between the objective nature of war and the subjective character of war, highlighting such components such as; technology, ethics, law and culture that will change across space and time.[10] In his book Modern Strategy, Colin Grey captures this well, "There is a unity to all strategic experience: nothing essential changes in the nature and function [or purpose] in sharp contrast to the character— of strategy and war."[11] Indeed, Clausewitz himself observed that every period has its, "own kind of war, its own limiting conditions and its own peculiar preconceptions."[12] Whilst Clausewitz was basing his theory of war over 200 years

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[7] Ankerson, "Melancholic and Fascinated: Artificial Intelligence, Authentic Humanity, and the Future of War."
[8] Villacres and Bassford, "Reclaiming the Clausewitzian Trinity."
[9] Ankerson, "Melancholic and Fascinated: Artificial Intelligence, Authentic Humanity, and the Future of War."
[10] Hoffman, "Will War's Nature Change in the Seventh Military Revolution?," 23.
[11] Gray, *Modern strategy*, 362.
[12] Clausewitz, *On War*, 593.

ago, in which the character of warfare was changed largely by social and political conditions, he was aware that technological advancement would change the character of war.[13] And like Grey, many contemporary theorists agree with Clausewitz. Murray believes that technology cannot dissipate war's nature and contends war's nature includes the fog and the friction of war, and any argument contending war's nature can be altered are false.[14] Further arguing, "No amount of computing power can anticipate the varied moves and the implications of an enemy's capacity to adapt in unexpected ways."[15] In security strategy - the enemy always has a vote.

Whilst Murray is rooted in his views, there is reason nevertheless to question Clausewitz's theory. Writing over 200 years ago, could the Prussian really be certain that 21st Century revolutionary technology would not alter or even eliminate the objective and subjective elements of warfare?[16] There is nuance to Clausewitz's theory though, as Echevarria has stated; elements of warfare do interact and influence each other, "Under Clausewitz's concept, the objective and subjective natures of war are closely connected to one another and interact continuously. New weapons or methods can increase or diminish the degree of violence or uncertainty, though probably never eliminate them entirely."[17]

Additionally, Clausewitz did believe the nature of war did not exist in isolation, and, was in itself a product of interactions. Clausewitz did not limit wars reciprocal nature to a clash of opposing trinities, but asserted interaction with the trinity, "these three tendencies are like three different codes of law, deep-rooted in their subject and yet variable in their relationship to one another."[18] Accordingly, all elements of the trinity must be appropriately considered rather than view them as arbitrary to one another. It is this exchange between the three elements which shapes violence and causes war's uniqueness, this in turn provides context to each case.[19] Accordingly, a change in character, such as AI, could influence an essential element and therefore could

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[13] Hoffman, "Will War's Nature Change in the Seventh Military Revolution?," 23.
[14] Owens and Offley, *Lifting the fog of war*, 9.
[15] Williamson, *America and the Future of War: The Past as Prologue*, 34-35.
[16] Hoffman, "Will War's Nature Change in the Seventh Military Revolution?," 24.
[17] Echevarria, "Globalization and the Clausewitzian Nature of War," 318.
[18] Clausewitz, *On War*, 89.
[19] Hoffman, "Will War's Nature Change in the Seventh Military Revolution?," 25.

affect the nature of war. Furthermore, Beyerchen argues that the conduct of war affects its character and this amended character feeds back into the political ends that ultimately drive its conduct.[20] Given the separate elements of Clausewitz's trinity do not operate in isolation, but rather attract and repel each other,[21] it is therefore worth analysing the trinity in further depth in relation to AI.

Violence (The People). As will be expanded in Part 2, China is one nation that has been forthright in adopting AI for not just military purpose, but to also control the wider population, "The CPC hopes AI will have utility in enhancing the 'intelligentization' of 'social management' and protecting social stability."[22] Whilst the CPC does not have the constraints of parliamentary democracy (like the UK) to limit policy options, the widespread use of AI may see the relationship between government and the population it serves blunted, simultaneously reducing public interest in the armed forces and as a consequence damaging the relationship between the military and the people.[23] Hoffman expands on the consequences of this and suggests 'cabinet wars' will become more frequent as they will be perceived as politically low-risk. However, such conflicts will likely be prolonged as the nation's sons and daughters would be protected. Consequently, this increase in conflict may ultimately result in machines being seen as a policy failure and a demand for humans to return to the battlefield. The rise of AI, and the increased anonymity of warfare, may erode professional military identity and in turn the "unique social responsibility that involves risk and danger."[24]

Chance (The Armed Forces). The tactical predictability of AI is unlikely to reduce strategic friction; though, the effects on 'tactical chance' may be decreased despite unpredictable interactions.[25] Clausewitz highlighted the importance of adaptation and organisational learning in warfare. A key capability of AI is the ability to rapidly process data and update programs – this will be of benefit. Nevertheless, Clausewitz observed "this type of knowledge cannot be forcibly produced by an apparatus of scientific formulas and mechanics; it can only be gained through a talent for

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[20] Beyerchen, "Clausewitz, nonlinearity, and the unpredictability of war," 87.
[21] Hoffman, "Will War's Nature Change in the Seventh Military Revolution?," 25.
[22] Kania, "China's artificial intelligence revolution."
[23] Hoffman, "Will War's Nature Change in the Seventh Military Revolution?," 27.
[24] Walsh, "The effectiveness of drone strikes in counterinsurgency and counterterrorism campaigns," 53.
[25] Hoffman, "Will War's Nature Change in the Seventh Military Revolution?," 27.

judgment, and by the application of accurate judgment to the observation of man and matter."[26] Clausewitz, theorised that it was only the blend of the practical experience of war and study that would result in 'applied military judgement.' Future commanders who have AI to rely on, will likely be at an advantage as their tactical understanding of the battlespace will increase; nevertheless, there will always be a need for a 'general's instinct' – often crafted over decades of combat experience. Clausewitz did acknowledge commanders could gain talent "through the medium of reflection, study and thought,"[27] however, the quality he valued most in a commander was combat experience, so whilst AI will be able to learn and adapt quicker than humans, this will be an unlikely substitute for seasoned training, professional military education and combat experience.

Reason (Political Direction).   Whilst inevitably humans need time to process information in order to inform decision-making, AI decisions will likely be instantaneous which has led to warnings about 'hyperwar.'[28] The speed at which decisions are taken by machines will render human reaction time pedestrian and policy lagging behind; thus potentially removing political direction from warfare – a fundamental of the nature of war.[29] Nevertheless, as long as humans remain responsible for directing war, programming machines and fielding AWS, which they will likely do so as politicians are unlikely to cede control to a machine; war's elements namely violence, chance and reason will remain, as will fog and friction.[30] As Lawrence posits, "both friction and 'the flash of the kingfisher' will remain fundamental to war."[31]

Revolution in Military Affairs. As evidenced, the Clausewitzian trinity offers a relevant analytic framework as we enter the age of autonomy and the seventh military revolution [see Table 1]. This era will blend the advances of the industrial revolution and the information age, creating developments in machine learning, deep-learning AI and fully autonomous systems.[32] Such a revolution would unquestionably change

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[26] Clausewitz, *On War*, 97.
[27] Clausewitz, *On War*, 146.
[28] Allen and Husain. "On hyperwar," 31.
[29] Hoffman, "Will War's Nature Change in the Seventh Military Revolution?," 29.
[30] Watts, "Clausewitzian friction and future war," 64.
[31] Lawrence, *Seven pillars of wisdom*, 193.
[32] Hoffman, "Will War's Nature Change in the Seventh Military Revolution?," 20.

the ordering of forces who employ such technology. Potential changes could include a reduction in military numbers, old organisations made redundant/new ones formed, force structures recast and savings reinvested into R&D.[33]

Previous military revolutions have produced changes in the way wars are deterred, fought and resolved, and as a result have reduced the value of existing military power including weapons, platforms and doctrine.[34] Krepinevich, posits that RMA's consist of four elements; technological change, systems development, operational innovation, and organisational adaptation. With each element in itself being necessary, but not a sufficient condition to military effectiveness.[35] Whilst it should be noted, Krepinevich wrote in 1994 (in the context of overwhelming US success in the Gulf War and the significant contribution of precision weapons), this is noteworthy in the present day especially as the debate surrounding technological advancement and the changing nature of war is not new. As Hickman notes, history is littered with predications; the machine gun, tanks, aircraft were all supposed to change warfare radically.[36]

However, history teaches us that this is not the case. Often, and within a short-time, less technologically capable forces were able to mitigate such advances through tactical innovation and frequently seize victory against their more technologically adept adversaries.[37] This is reinforced by research that demonstrates technological advantage does not significantly increase the likelihood of a military victory – it is as predictive as a "toss of a coin."[38] Multimode analysis by Biddle, has shown that of 16 wars between 1956 and 1992, the technologically superior side was victorious just eight times.[39] Biddle argues this was because despite the lethality that tanks, air power and machine guns introduced to the battlefield, 20th-century technological advances did not fundamentally alter the way modern armed forces fight. Rather, it

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[33] Cohen, "A revolution in warfare," 37.
[34] Krepinevich, "Cavalry to computer: The pattern of military revolutions," 30.
[35] *Ibid.*
[36] Clifford, "AI Will Change War, But Not in the Way You Think."
[37] Hickman, "The Future of Warfare Will Continue to Be Human."
[38] Biddle, *Military power: Explaining victory and defeat in modern battle*, 21.
[39] *Ibid.*

was human innovation that rapidly matched technological disadvantage through exploitation of the battlefield.[40]

A cursory qualitative glance at the UK's recent campaigns (Iraq, Afghanistan, Libya) proves that overwhelming technological advantage does not translate into success. Accordingly, whilst AI will be a powerful weapon in the armoury of a state, it is unlikely that said state will then go on to enjoy absolute military dominance. Hickman suggests there are two reasons for this. First is the "glacially paced change of recent memory", suggesting the battlefield of 2035 may not look too dissimilar to now; and second, is the history of specious forecasting over the past 40 years suggesting revolutionary change is "just around the corner."[41]

Evolutionary versus Revolutionary. Given recent technological transition periods have been between ten to twenty years,[42] it is a convincing argument to suggest that periods between technological advances are evolutionary, rather than revolutionary. Nevertheless, it is not just the speed at which technological shifts, occur but rather the appreciation that the character of conflict has changed - requiring change in military organisations and doctrine.[43] Strategic military analysts such as Grey, concluded that their contemporary period was on the brink of a revolution in military affairs.[44] Nevertheless, a researcher of the exponential growth in battlefield lethality in 1950 would be just as likely to predict a RMA in 2020, as the scale of the curve is identical.[45] Consequently, despite being seemingly always on the cusp of a RMA, this advises that advances in lethality are not revolutionary, but rather evolutionary. Furthermore, in peacetime especially, it is unlikely existing technologies will be fully exploited by militaries; this is due to military institutions normally evolving rather than committing to revolutionary change.[46]

Organisational Structure and Culture. As detailed, there are numerous factors preventing military institutions from committing to rapid radical change.

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[40] Biddle, *Military power: Explaining victory and defeat in modern battle*, 22.
[41] Hickman, "The Future of Warfare Will Continue to Be Human."
[42] Krepinevich, "Cavalry to computer: The pattern of military revolutions," 30.
[43] *Ibid.*
[44] Gray, "*Strategy for chaos: Revolutions in military affairs and the evidence of history*," 17.
[45] Hickman, "The Future of Warfare Will Continue to Be Human."
[46] Cohen, "A revolution in warfare," 52.

Organisational culture and structures however, play a central role. Cohen highlights this point well by comparing the evolution of the US Army with General Motors. Comparing the organisational charts between the two institutions in 1950, they would look broadly similar; namely, a classic pyramid with small units reporting up to larger units. Fast-forward seventy years and an army corps looks similar, whereas General Motors have stripped out middle management and vastly reduced the social and functional distinction between the 'labour force' and management.[47] Compare this to the UK Armed Forces today, and those hierarchical structures still very much exist, as does the social and functional distinction between commissioned and non-commissioned. It is the "radical revision" of these structures that will be the last indication of an RMA and the most difficult to implement.[48]

Nevertheless, humans are able to adapt. When air power first targeted massed forces, opponents did not simply stay paralysed and succumb to mass vaporisation. Instead commanders dispersed forces and minimised exposure to aerial attack weapons. Whilst the learning curve is often steep and costly, tactical innovators will often succeed.[49] Yet, if militaries focus too much on developing AI, there is a danger that battle-winning essentials could be overlooked.[50] All elements of strategy are competitive meaning the employment of forces, doctrine and tactical decision-making will be as important as ever to gain the decisive edge. Regardless of who has the technological superiority, the likely victor will be those that develop strategic, operational and tactical innovators who then leverage the battlespace to their advantage – "Human intelligence and creativity will win the next war, not technology."[51] Blitzkrieg provides a compelling example of the consequences of failing to/successfully implementing the necessary organisational structures and culture.

Blitzkrieg – A Case Study. Whilst the concept of blitzkrieg is widely known as a German doctrinal approach, the raw conceptual elements can be traced back to 1918 and J.F.C. Fuller's plan for a final assault by the British Army into Germany.

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47 Cohen, "A revolution in warfare," 48.
48 *Ibid.*
49 Hickman, "The Future of Warfare Will Continue to Be Human."
50 Biddle, *Military power: Explaining victory and defeat in modern battle*, 207.
51 Hickman, "The Future of Warfare Will Continue to Be Human."

Nevertheless, it took a further two decades to put the British military strategist's theory into practice – by the Germans. Despite the Germans having a comparable number of tanks to the British and French in 1940, they succeeded not because of technological superiority, but due to organisation, operational concepts and command and control structures.[52] As Cohen highlights, "military organizations that did not adapt in a rapidly changing, highly competitive environment have declined, often quite quickly."[53] The British and French failed to adapt and suffered grievously.[54]

The creation of a panzer division reflected the requirements of the modern battlefield, building combined arms around the tank. In contrast, the Allies had armoured divisions consisting almost entirely of tanks. Not only did the Germans field engineers, infantry and air power with their tanks, they also bred a "climate of command." [55] As a US liaison officer in Germany highlighted in a 1930's report, "the Germans point out, that often a Commander must make an important decision after only a few minutes [a fair decision on this basis] is much better than one wholly right but too late. They visualize rapidly changing situations in modern warfare and are gearing their command and staff operations accordingly."[56] The examination of Blitzkrieg as a case study, demonstrates that intellectual innovation combined with organisational flexibility, provides a competitive advantage and a decisive strategic edge.

Is the Seventh Revolution Different? Historically, superiority on the battlefield has been determined by two conditions; quality and quantity. In traditional warfare, quantitative advantage was prized, but with technological breakthrough, numbers became less important and qualitative aspects became more relevant.[57] Nevertheless, one element that has endured throughout history is that all superpowers gained and retained hegemony through unmatched technological advancement.[58] Yet, with AI technology likely to be ubiquitous, the 'offset strategy'

[52] Cohen, "A revolution in warfare," 46.
[53] Krepinevich, "Cavalry to computer: The pattern of military revolutions," 30.
[54] *Ibid,* 36.
[55] Martinage, "Toward a new offset strategy," 15.
[56] Wedemeyer, "Memorandum: German General Staff School Report," 12.
[57] Khaqan. "Artificial Intelligence and the Changing Nature of Warfare," 66.
[58] *Ibid,* 71.

faced by many defence ministries may no longer be relevant as AI will be widely available to lone-terrorists and adversary states alike.

Unlike exquisite technology such as the F35, the ubiquitous nature of AI will not necessarily be able to offset adversarial strength. There are also other elements that distinguish AI from previous periods of weaponry development. Caton suggests that due to AI generating perception, cognition and action in weaponry, weapons will no longer be a means of warfare, but rather the driving force of warfare.[59] This may certainly be the case if humans cede control as "predictable tasks are being performed, where reaction time is critical."[60] Therefore, it is likely that some of the greatest benefits to come from AI are not AWS, but rather mundane everyday tasks where AI does not replace, but rather augments human-decision making. Former US Deputy Secretary of Defense Robert Work made this exact point, "Rapid advances in AI...are pointing towards new and more novel warfighting applications involving human-machine collaboration and combat teaming."[61]

Leveraging Technological Development. Whilst the vast majority of military technological change derives from external source; occasionally it occurs internally. It was military R&D that facilitated the nuclear revolution, the early stages of space exploration and submarines.[62] Nevertheless, the majority of military technological change lies in the political and economic sphere.[63] The civil development of the railroad during the American Civil War, enabled the Union to transfer 25,000 troops, with artillery and logistics, over 1,100 miles from Virginia to Tennessee, in under 12 days.[64] The Interwar and Second World War years were dominated by states rapidly adapting civilian technology into military capability. There was then an interval during the Cold War which saw the rise of the defence industry. However, as Cohen wrote in 1996, just 7 years after the fall of the Berlin Wall and the end of bi-polarity, he predicted the pendulum was beginning to shift back in favour of civil industry and indeed that economic strength will prove a great enabler to military power.[65] Whilst

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[59] Caton, "Autonomous weapon systems: A brief survey of developmental, operational, legal, and ethical issues," 17.
[60] Work and Brimley, "Preparing for war in the robotic age," 24.
[61] Hoffman, "Will War's Nature Change in the Seventh Military Revolution?," 22.
[62] *Ibid.*
[63] Cohen, "A revolution in warfare," 39.
[64] Cohen, "A revolution in warfare," 42.
[65] *Ibid,* 51.

this is a compelling argument, the dawn of the autonomous era will not necessary need a strong state economy, but rather the ability to leverage the civilian AI technology sector and translate that into military power – after all, no one is going to have a monopoly on AI. It is up to humans to recognise and decide what the future characteristics of the battlefield will be, by employing the ever-expanding array of technological, operational, and organisational options.[66] To ignore this would risk strategic impotence.[67] Ultimately, it will be up to political leaders to link AI with strategy – and leverage the people, organisation, technology and process to gain a decisive edge – this will be expanded in Part Three.

The contemporary debate surrounding the extent to which RMA and AI will change warfare, is likely to endure, as this quote from the US's National Intelligence Council demonstrates, "The nature of conflict is changing...with robotic systems."[68] The US Army has also forecasted that technological revolutionary shifts "may even challenge the very nature of warfare itself."[69] Whilst a UK assessment noted "the increased capability of robots is likely to change the face of warfare."[70] What these UK and US national reports highlight, is the need for precise understanding of this debate and the need for precise terminology. Technological advances will change the character of warfare and do have the potential to impact the nature of war. Nevertheless, as long as humans remain responsible for directing war, programming machines and fielding forces, fog and friction will remain and so too will Clausewitz's enduring essence of war.

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[66] Fitzsimonds, "The Coming Military Revolution: Opportunities and Risks," 32.
[67] Matsumoto, "Defeating A Super Power: Challenges That Can Emerge Against American Conventional Warfare in an Age of Fog of Technology," 19.
[68] National Intelligence Council, "Global Trends: Paradox of Progress."
[69] US Army Training and Doctrine Command, "The Operational Environment and the Changing Character of Future Warfare," 6.
[70] MOD, "Strategic Trends Programme: Global Strategic Trends—Out to 2045," 67.

Part Two

Part Two of this paper will explore the challenges AI will pose to the national security of the UK. To do this, the paper will examine how AI may destabilise the balance of power in the international order and look into adversary and allies' capabilities and strategy. Consideration will then be given to whether democracies are disadvantaged in relation to R&D of AI compared to authoritarian regimes – Project Maven will be used as a case study. This section will argue that the UK's adversaries are rapidly developing AI to gain advantage, and authoritarian regimes are in a favourable position, in comparison to democracies. Given strategy is competitive, the UK will need to overcome such strategic variables to create and maintain the decisive edge.

The Balance of Power. The study of Clausewitzian theory and past RMAs, have demonstrated that technological advantage is transient. There is no guarantee that technological leadership will be maintained in the battlespace. Furthermore, not all nations will follow the same developmental AI path; geostrategic disposition, strategic and economic position will lead to competitors taking different routes.[71] The case of Blitzkrieg also demonstrates that current technological advantage, does not translate into dictating the direction and pace of future progress. In sum, western strategic technological-military dominance is far from guaranteed and there is convincing argument that AI will upset the balance of power in the international order.

The availability of AI will not provide a barrier to individual and state actors, as the 'cost of competition' is not likely to mirror that seen in previous RMAs, additionally the advantage of monopoly is likely to be shorter lived than ever. The use of AI could also undermine both conventional and strategic deterrence between states, by lowering the threshold of war.[72] Furthermore, the 'technological fog of war' could lead to a mismatch in planning and conduct given the speed and complexity of future operations; this could lead to a situation in which, "militaries fail to take their political

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[71] Krepinevich, "Cavalry to computer: The pattern of military revolutions," 41.
[72] Zhu and Long, "How will artificial intelligence impact Sino–US relations?" 142.

goals."[73] Cowan amplified this argument and concluded that for three reasons, "robots will significantly increase the potential for future conflicts."[74] His theory devised from Clausewitz's trinity, claimed this was due to fewer people being involved (violence); less friction as robots do not suffer from human frailties (chance), and decision makers may act with less constraint given the possibility that human casualties will be reduced (reason).[75] Therefore as Singer wrote, it is a decision to "embrace, technologies that make war safer, and...counter the trend that such technologies have to disengage us, to make war more acceptable or potentially more ubiquitous."[76] So whilst AI has the potential to make the world a more dangerous place, it is the responsibility of people, military and politicians to ensure the "most troubling features of the current revolution"[77] are controlled.

Furthermore, a recent US Army War College study found, "Human perceptions and the relative value of truth have increasingly become ripe territory for low risk/high impact manipulation of strategic outcomes."[78] This convincingly suggests that actors with limited resource could effectively combat technology, such as AI, to achieve an asymmetric strategic effect. Correspondingly, as demonstrated in the recent publication of the UK's Intelligence and Security Committee's Russia report, state-on-state interference in electoral systems through disinformation[79] suggests the threshold of traditional forms of strategic control is lowering.

With the AI arms race firmly underway and a finite amount of resource, the UK spending more of the defence budget on AI would likely to lead to budgetary cuts from conventional forces - it is a zero-sum gain. As Matsumoto posits, this could result in the ill-preparedness of existing forces.[80] And, as Part One has demonstrated, technological advantage does not translate into guaranteed success. The winner of the AI race will need to; understand adversary capability, be fast enough to counter the adversary and have the economic resource to fund the

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[73] Matsumoto, "Defeating A Super Power: Challenges That Can Emerge Against American Conventional Warfare in an Age of Fog of Technology," 19.
[74] Cowan, "Theoretical, Legal and Ethical Impact of Robots on Warfare," 14.
[75] *Ibid,* 7.
[76] Singer, *Wired* for War, 337-338.
[77] Cohen, "A revolution in warfare," 53.
[78] Freier, "Strategic Insights: Speed Kills, Enter an Age of Unbridled Hyperconnectivity."
[79] Intelligence and Security Committee of Parliament, Russia Report, 13.
[80] Matsumoto, "Defeating A Super Power: Challenges That Can Emerge Against American Conventional Warfare in an Age of Fog of Technology," 14.

capability.[81] If the UK fails to achieve these three necessary conditions, there is a danger of strategic impotence which will damage conventional power.[82] In an emerging multi-polar world, the UK needs well defined political goals that the military can follow. In a void of political direction, it is the nature of war that will result in defeat, rather than any adversary.[83]

Great Power Competition. The US, China and Russia are all modernising existing systems and weaponry by incorporating AI.[84] Additionally, the economic centre of gravity moving eastward,[85] will likely disrupt the balance of power, threaten the liberal rules base order and challenge US political, economic and military dominance.[86] China has specifically developed capability in the Pacific, unsurprising given 60% of US Naval forces are positioned in Pacific Ocean vicinity and outmatch China quantitatively and qualitatively.[87]

Russia. In September 2017, Vladimir Putin professed (his now infamous) views on AI stating it was, 'the future, not only for Russia, but for all humankind' and the nation which, 'becomes the leader in this sphere, will become the ruler of the world'.[88] Russia is investing heavily in robotics and AI, especially in the military arena, where investment is significant when compared to commercial efforts.[89] This, in comparison to the UK, US and China where AI development is largely emanating from commercial enterprise, will likely put Russia at a disadvantage given the dynamism of the US and Chinese innovative ecosystems.[90] Nevertheless, in 2012 Russia founded the Foundation for Advanced studies, (largely in response to DARPA) which has taken the lead on AI including image recognition and human thought process.[91] As Putin made his 2017 speech, levels of state investment in AI technology stood at 700 million rubles (US$12.5 million). When compared to the US or China this is

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[81] Fitzsimonds, "The Coming Military Revolution: Opportunities and Risks," 35.
[82] Hoadley and Lucas, Artificial Intelligence and National Security, 36.
[83] Matsumoto, "Defeating A Super Power: Challenges That Can Emerge Against American Conventional Warfare in an Age of Fog of Technology," 19.
[84] Khaqan. "Artificial Intelligence and the Changing Nature of Warfare," 67.
[85] MOD, "Strategic Trends Programme: Global Strategic Trends—Out to 2045," 103.
[86] Horowitz, "Artificial Intelligence, International Competition, and the Balance of Power, 37.
[87] Khaqan. "Artificial Intelligence and the Changing Nature of Warfare," 67.
[88] Vincent, "Putin says the nation that leads in AI 'will be the ruler of the world."
[89] *Ibid.*
[90] Horowitz et al, "*Strategic competition in an era of artificial intelligence,*" 15.
[91] *Ibid.*

relatively low; however, Russia has been increasingly successful at leveraging private sector investment in recent years. AI investment was forecasted to be at 28 billion rubles (US$500 million) by 2020.[92] Given Russia's levels of investment in AI, it is not likely to single-handedly challenge US hegemon. However, Russia's increased use of hybrid warfare combined with AI technological advance, demonstrates how US conventional power will be increasingly challengeable[93] and UK interests will be threatened.

China. Two years ago, the UK's NSCR stated "The United States continues to be our single most important international partner,"[94] - it is therefore in the UK's national interest for the US to retain a military and economic advantage over China. Furthermore, given NATO also remains the cornerstone of UK security posture,[95] NATO's Secretary-General Jens Stoltenberg, recent comments calling on the alliance to stand up to Beijing's "bullying and coercion"[96] were pertinent. Given strategy is competitive and China is now challenging the US for primacy, it is important to examine China's surge in creating a 'Fog of Technology' that could rival US power.[97]

It was in 2017 that China launched the GAIDP (新一代人工智能发 展规划) which headlined, "AI has become a new focus of international competition. AI is a strategic technology that will lead in the future; the world's major developed countries are taking the development of AI as a major strategy to enhance national competitiveness and protect national security."[98] Zhu and Long suggest the greatest risk to US power is the continuous development and application of AI weapons which could erode the foundation of strategic deterrence between China and the US – subsequently lowering the threshold for war.[99] Nevertheless, as with previous RMA's it should be noted that the US and China have varying strategic goals, access to different

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[92] Bendett, "Red Robots Rising: Behind the Rapid Development of Russian Unmanned Military Systems."
[93] Matsumoto, "Defeating A Super Power: Challenges That Can Emerge Against American Conventional Warfare in an Age of Fog of Technology," 19.
[94] HM Government, "National Security Capability Review."
[95] *Ibid.*
[96] Speranza, "China Is NATO's New Problem."
[97] Matsumoto, "Defeating A Super Power: Challenges That Can Emerge Against American Conventional Warfare in an Age of Fog of Technology," 11.
[98] Allen, "Understanding China's AI Strategy: Clues to Chinese Strategic Thinking on Artificial Intelligence and National Security," 4.
[99] Zhu and Long, "How will artificial intelligence impact Sino–US relations?" 150.

resources and different strategic cultures; therefore, any evolution in military AI is likely to take different routes.[100]

Additionally, it is unclear whether China will be able to develop its capacity and strategy fast enough to challenge US conventional power.[101] Factors such as economic disruption as a result of Covid-19 and downturn in corporations linked to the Chinese state such as Huawei losing the UK 5G contract may all impact implementation; the most difficult element of strategy. Nevertheless, and in accordance with the GAIDP, China is emerging as a 'powerhouse in AI' and is seeking to become "the world's premier AI innovation center."[102] To achieve this China is currently investing in an AI industry of 1 trillion RMB (US$150 billion) by 2030.[103] Whilst this is an ambitious spending target, China is leveraging the dynamism of commercial enterprise wisely, whilst simultaneously synergising with national defence applications – resulting in a national strategy of military-civil fusion.[104] As an example, the Chinese technology company Baidu, has been pursuing an 'AI First' strategy and has launched Deep Learning and AI Labs in Beijing and Silicon Valley. It is this 'national team' ethos that will be so vital to China's progress. Companies such as Baidu, Alibaba and iFlytek[105] are developing dual-use technologies; suggesting a deep accord with the party-state, advancing the military-civil fusion strategy.[106] The PLA is capitalizing on these rapid advances.

Nevertheless, despite being one of the few nations to have an AI strategy that integrates political, economic and military elements, China still believes it is losing the AI battle to the US. It was AlphaGo's victory over Lee Sedol that was a catalyst for Chinese AI development, providing a 'Sputnik moment' for the Chinese military especially with regards to AI's capability to influence command and decision making.[107] The Chinese are right to be scrutinising US progress in AI. The US is well positioned and benefits from one of the world's best university systems and the most

[100] Krepinevich, "Cavalry to computer: The pattern of military revolutions," 40.
[101] Matsumoto, "Defeating A Super Power: Challenges That Can Emerge Against American Conventional Warfare in an Age of Fog of Technology," 17.
[102] Horowitz et al, "*Strategic competition in an era of artificial intelligence,*" 12.
[103] *Ibid.*
[104] *Ibid.*
[105] Yi-Zheng, "China, the Party-Corporate Complex."
[106] Hoffman, "The Communist Party's autonomic approach to managing state security," 12.
[107] China Military Science, "A Summary of the Workshop on AlphaGo."

advanced AI researchers in academia.[108] This relationship between academia and commerce, forges the baseline of global US technological leadership.

Meanwhile, the US military have declared that in the 2021 budget, US$841 million will be spent on AI (0.1% of the US$705 billion fiscal proposal).[109] However, this does fail to capture the AI integration costs throughout different weapons systems.[110] Similarly, the Chinese military have been even less than transparent about AI strategic intentions, though it is clear they understand the importance of this RMA, which the PLA refer to as "intelligentized warfare."[111] However, an examination of this form of warfare suggests it is largely an extension of existing operational concepts; namely an information-centric approach. Whilst the US military are focussing effort on AWS, the Chinese are concentrating effort on the use of AI to dominate information systems and networks in an attempt to "paralyse" an opponent's joint force – a systems confrontation approach.[112] The English-language translation[113] of China's 2019 Defense White Paper observes a change in modern warfare: "War is evolving in form towards informationized warfare, and intelligent warfare is on the horizon," noting the changing character of warfare. However, a Chinese-language version is more revealing describing "that the change is not about moving toward informationized warfare, it is about an evolution in informationized warfare."[114] Regardless of the differences, what Western analysts should note is the Chinese are studying AI seriously, including how it will shape the character of war and from this analysis, doctrinal changes are likely.

Democracy versus Authoritarianism. With a population nearing 1.4 billon, China enjoys the advantages of scale and can use entire cities as experimental grounds. In April 2020, Xi Jinping visited the 'smart city' of Hangzhou calling for more cities to become "smarter," to enhance city-wide management and security. However, as mentioned in Part One, this use of AI (as a control measure) could weaken public

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[108] Kania, "Battlefield Singularity: AI, Military Revolution and China's Future Military Power," 21.
[109] Dahm, "Chinese Debates on the Military Utility of Artificial Intelligence."
[110] *Ibid.*
[111] *Ibid.*
[112] Engstrom, "*Systems Confrontation and System Destruction Warfare: How the Chinese People's Liberation Army Seeks to Wage Modern Warfare,*" 16.
[113] Li, "China's National Defense in the New Era," Ministry of National Defense.
[114] Dahm, "Chinese Debates on the Military Utility of Artificial Intelligence."

support and allow less democratic regimes to 'manipulate populations.'[115] Whilst the US can rely, to a certain extent, on companies such as Google and Amazon who have copious amounts of data, Chinese state control enables free and ready access to huge quantities of data, enabling them to generate machine learning algorithms. This is reinforced by state control of the internet, which enables a more efficient method to harvest data for algorithms when compared to the US.[116] Furthermore, as Spiegeleire et al note, autonomous weaponry is also confronting two major obstacles, first the vast economic costs needed for R&D, and second, ethical concerns.[117] Project Maven provides an example of how ethical concerns within democratic states can thwart military progress.

Project Maven – A Case Study. In June 2018, Google cancelled a contract with the DOD as a result of thousands of Google employees signing a petition strongly opposing the partnership. If progressed, Project Maven would have supported algorithms that helped analysts to select military targets from video imagery.[118] The aim of the AI application was to increase the fidelity of battlefield information and in turn, increase military effectiveness and ultimately save lives.[119]

Google pulling out of the contract is not an isolated incident. Amazon also recently refused to sell facial recognition software to the US police; this is a worrying trend for the US Government. US corporations such as Google, Facebook, Apple, Microsoft, and Amazon have driven technological innovation in the US, but they have also been the beneficiaries of a highly skilled and educated workforce comprised of thousands of US citizens. Indeed, many of the US's economic policies also favoured and accelerated the exponential growth of these tech-corporations.[120] Nevertheless, corporations are more than aware of the ethical concerns and public scepticism that associates with AI. As evidenced in leaked emails, by Dr. Fei-Fei Li, chief scientist for AI at Google Cloud, she advised her staff against mentioning "AI" in relation to the Project Maven contract, referring to it as "red meat to the media."[121] When

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[115] Hoffman, "Will War's Nature Change in the Seventh Military Revolution?," 30.
[116] Horowitz et al, "*Strategic competition in an era of artificial intelligence,*" 13.
[117] Spiegeleire et al, "Artificial Intelligence and The Future of Defense," 75.
[118] Wakabayashi and Shane, "Google will not renew Pentagon contract that upset employees."
[119] Clifford, "AI Will Change War, But Not in the Way You Think."
[120] Shane et al, "How a Pentagon contract became an identity crisis for Google."
[121] *Ibid.*

Google employees protested asked their CEO to "cancel [the] project immediately," stating it would "irreparably damage Google's brand,"[122] the DOD lost the strategic narrative. Commercial innovation will be vital to winning the AI war. Nevertheless, it seems democracies have some way to go to convince their citizens and corporations that AI will be vital for national security. Whilst the battle for the strategic narrative will be important in places with authoritarian regimes; the case study of Project Maven proves it is essential for democracies.

Control and Regulation. Whilst there is concern about the rate at which adversaries are developing AI, the UK and allies should also be concerned with how they might use it. No international legal restrictions currently exist regarding the military application of AI, and it is unlikely China and Russia will be constrained by domestic concerns over ethics or morality. Accordingly, both states are developing military AI systems. This is unsurprising, given they view themselves as "weaker militarily than the combined forces of NATO and its partner countries, and as such, have doctrinally declared that they will be seeking out any asymmetric advantage they can."[123]

Conversely, the UK's position on developing AWS is somewhat confused. At the Geneva UN LAWS Conference 2019, the UK was amongst a group of states including Australia, Israel, Russia and the US, to speak against legal regulation for LAWS.[124] Nevertheless, the MOD has also stated, "The United Kingdom does not possess fully autonomous weapon systems and has no intention of developing them."[125] This leaves the UK exposed as AI developments would likely mean an adversary could defeat the human-loop relationship by switching to fully autonomous systems, making them even faster - thereby defeating the more human system.[126] The UK is strategically communicating mixed messages in trying to prevent an international ban on one hand, whilst stating it has no intention to develop AWS on the other. The UK have effectively ignited their own strategic constraints and made strategy more difficult than it needed to be; allowing adversaries to develop AWS whilst not doing so ourselves.

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[122] Shane and Wakabayashi, "'The Business of War': Google employees protest work for the Pentagon."
[123] Defence-In-Depth, "One to Ponder: The UK's Ethical Stance on the Use of AI in Weapons Systems."
[124] Gayle, "UK, US and Russia among those opposing killer robot ban."
[125] *Ibid.*
[126] Ankerson, "Melancholic and Fascinated: Artificial Intelligence, Authentic Humanity, and the Future of War."

Furthermore, unlike many conventional weapons that professional militaries use, AWS are likely to be widely available to states, corporations and individuals alike. Whilst states will have greater leverage over other entities, the extent to which this technologically will be available for use is a cause for concern. A case in point being Ayoub Kara an Israeli politician who stated Israel is currently developing military robots as small as flies with nuclear capability.[127] As Horowitz posits, "the sharper the competition, the greater the need...for a race to the bottom in AI safety."[128] As competition increases between corporations and militaries alike, there is a risk that reliability and safety will be overlooked, heightening the potential for unreliable systems and accidents; this is especially the case if commercial and military sectors value 'first mover advantage.'[129] The promises of increased combat effectiveness, combined with reduced costs could prove to be seductive; nevertheless, some of the key benefits of AI are reliability, speed and accuracy, if corners were to be cut in T&E this could impact on both effectiveness, safety and value for money.

The balance between speed of development, procurement and ensuring value for money for taxpayers will be pivotal with AI. The UK Armed Forces have not always achieved the right balance. Throughout the Iraq and Afghanistan campaign, the British Army needed to procure equipment at short notice. They did this through UOR - defined as equipment bought due to the "the identification of previously un-provisioned and emerging capability gaps because of current or imminent operations."[130] Nevertheless, in subsequent evidence given to the Defence Select Committee, UOR was represented as, "poor value for money...historically, within the defence sector, value only comes from well-planned work programmes."[131] Additionally noting "until the main equipment programme can be as agile, there will still remain coherency issues with running a UOR portfolio alongside the main, equipment programme.[132] The speed at which AI is constantly developing is unlikely to tessellate with the current procurement practices of DES. An enhancement on capability delivery is needed – this will be explored in Part Three.

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127 Khaqan. "Artificial Intelligence and the Changing Nature of Warfare," 70.
128 Horowitz et al, "*Strategic competition in an era of artificial intelligence,*" 9.
129 *Ibid.*
130 HM Government, "The EU Defence and Security Public Contracts Regulations (DSPCR) 2011."
131 UK Parliament, "House of Commons - Defence Acquisition - Defence Committee."
132 UK Parliament, "House of Commons - Defence Acquisition - Defence Committee."

Part Three

Part Three of this study will examine how the UK is currently positioned and what is required to gain and maintain strategic advantage. Part Three will first examine what AI strategy is for the UK, the paper will then look at three elements; People and Organisation, Technology and Process and Policy. It will argue that the UK is relatively well positioned nationally in the development of AI; however, an AI Strategy is needed for Defence.

How is the UK Positioned – Current UK Strategy. As discussed in Part Two, the US and China are leading the global race in AI by some margin. The UK's investment in AI is relatively low when compared to the US and China, with American spending outstripping the UK's by 50 times.[133] Conversely though, the UK ranks as one of Europe's leaders in AI development,[134] currently ahead of the EU-28 pack on AI Readiness.[135] A McKinsey report convincingly suggests this is because of relative strengths in science and its policy leadership.[136] As the MOD MDP report recently stated **"**AI is a necessity, without which we risk losing our edge."[137] It is therefore unsurprising that the UK has stated intentions to compete in AI given the impulse to prevail is "entirely human and consists of twin desires: to avoid misery and to not be left behind."[138] Subsequently, the UK has seen significant investment in AI technology. In 2019 over £1 billion was committed to AI R&D,[139] a prudent investment, given gains in the AI global economy are predicted to be £12 trillion by 2030.[140]

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[133] McKinsey & Company UK and Ireland, "Artificial Intelligence in the United Kingdom: Prospects and Challenges."
[134] Bughin et al, "Notes from the AI frontier: Modeling the impact of AI on the world economy."
[135] McKinsey & Company UK and Ireland, "Artificial Intelligence in the United Kingdom: Prospects and Challenges."
[136] *Ibid.*
[137] Ministry of Defence, Mobilising, Modernising & Transforming Defence.
[138] Ankerson, "Melancholic and Fascinated: Artificial Intelligence, Authentic Humanity, and the Future of War."
[139] Ankerson, "Melancholic and Fascinated: Artificial Intelligence, Authentic Humanity, and the Future of War."
[140] PricewaterhouseCoopers, "PwC's Global Artificial Intelligence Study: Sizing the Prize."

Nevertheless, developing an AI industry is not easy or quick. To grow a successful industry multiple policy areas need to be aligned to create successful conditions. These include: AI investments, building an AI talent pool, economic policies to mitigate displaced workers, establishing industry leadership and evaluating ethical and moral issues.[141] Therefore a successful approach is comprehensive and must encompass a variety of government departments, ranging from Education, BEIS, DCMS and MOD. As Horowitz sensibly posits, the gap between the development of technology and the implementation of technology, is the strongest argument for a national approach to AI.[142] Accordingly, the UK has made significant progress in AI development. The Office for AI, a joint BEIS-DCMS organisation, was founded in 2018 and is responsible for overseeing implementation of the AI and Data Grand Challenge.[143] In the same year the UK government published its national AI strategy – the AI Sector Deal. The aim of the AI Sector Deal is to prepare the economy and society for AI development and provide the foundations to advance the UK's global position in AI technologies.[144]

The strategic narrative from the UK is consistent and is fervent in its support of AI, as the then Prime Minister laid out her ambition at the 2018 World Economic Forum, stating she wanted the UK to be, "a world leader in AI, building on the success of British companies like Deepmind."[145] Nevertheless, whilst the UK's strategy covers a wide range of societal impacts such as AI's impact on medicine, manufacturing and transport; at no point does the document mention Defence or military.[146]

This exclusion of Defence from the national strategy is contrary to the MOD's own thinking on AI. The MOD's most recent Global Strategic Trends publication mentions AI no less than 72 times and states "those who most effectively integrate the capabilities of machines and people, may derive decisive advantage."[147] Subsequently, to make no mention of national security in a national strategy seems incongruous at best. Furthermore, the UK Government published 'A guide to using

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[141] Horowitz et al, "*Strategic competition in an era of artificial intelligence,*" 10.
[142] *Ibid.*
[143] HM Government, "Office for Artificial Intelligence, About Us."
[144] HM Government, "AI Sector Deal."
[145] World Economic Forum, "Theresa May's Davos Address in Full."
[146] HM Government, "AI Sector Deal."
[147] UK MOD, "Strategic Trends Programme: Global Strategic Trends—Out to 2045," 145.

artificial intelligence in the public sector'[148] in 2019 and once again omitted any direction on how AI could be implemented by Defence or security agencies. Whilst the guide does provide generic advice on data and machine learning, there are no specifics on how the MOD could develop or implement AI in everyday tasks. This would have been useful, especially as the MOD does not have an 'AI literate' workforce.

The MOD's DCDC have produced a comprehensive and impressive Joint Concept Note – Human-Machine Teaming,[149] nevertheless, this is not a strategy. As stated in the Purpose and Aim of the document, it "considers potential changes to the ways, as well as the means, with which we will fight," but, "is to guide coherent future force development and help frame Defence strategy and policy on automation and autonomy."[150] This is an issue given there is currently no Defence strategy on AI. The MOD's own Digital and Information Technology Strategy admits there are "unconnected systems" across defence, yet AI is only mentioned once, "The CIO will provide the link for defence with…DCMS, interpreting central direction for defence regarding data governance and AI exploitation, where appropriate."[151] However, this does not mitigate that in 2020, there is no one consolidated strategy that brings together AI direction, ambition and resource for the security of the UK. The single services are developing their own projects,[152] however, there is not a coherent approach which would provide vital lessons as well as likely savings and efficiencies. Encouragingly, DSTL have established an AI Lab which works across DSTL's whole portfolio "in the application of AI related technologies to Defence and Security challenges,"[153] nevertheless, this does not link into higher direction from MOD Head Office.

In an anarchic international system, the UK is the sixth biggest economy in the world. Whilst strategy exists within the sphere of politics, economics and society, the UK still has relative power and has the ability to shape the future of war. But to do so

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[148] Government Digital Service, "A Guide to Using Artificial Intelligence in the Public Sector."
[149] HM Government, "JCN(1/18) Human-Machine Teaming."
[150] *Ibid,* v.
[151] HM Government, "Digital and Information Technologies Strategy."
[152] HM Government, "Revolutionary Artificial Intelligence Warship Contracts Announced."
[153] HM Government, "The Dstl Biscuit Book Artificial Intelligence."

requires strategic thought. The UK needs to ensure it has the right people, has the correct organisational structures, technology and processes in place to advance development and place the UK as a leading AI state.

People and Organisation. The investment battle in the forthcoming Integrated Review will be opportunity cost, there will have to be a loser. If AI sees significant investment, this will likely be at the expense of conventional capability or human resource. The MOD would need to redirect resource into AI R&D and train and sustain an AI capable talent pool.

The human resource skills required to develop AI systems are rare. Newly qualified PhD's, in the relevant field, can often command starting salaries of $300,000 to $500,000 a year – or more,[154] this remuneration package suggests the MOD will be unable to compete with industry to attract talent. Nevertheless, countries that have strong education and training domestically, and immigration policies that can attract talent, have an advantage over others. The UK is relatively well positioned and has a large pool of AI talent, including attracting skills from overseas,[155] though Brexit may have an adverse impact on this. Lithuania is one country whose dynamic national AI strategy created 'start-up visas' which have facilitated innovators from abroad to settle and work in the country.[156] Despite the threat of Brexit, the UK has the second-largest number of software developers in Europe, comprising 15% of the total.[157] Nevertheless, for the UK military, it is not just about software developers. As concluded in Part One, often force employment, doctrine and tactics can overcome technological advantage. Indeed, too much focus on software could lead to blind spots elsewhere, including neglecting conventional capability that once abandoned, can be all but impossible to recapitalise. It is worth noting that just as the nuclear revolution did not render conventional weapons obsolete; the AI revolution will not render, "guerrilla tactics, terrorism, or weapons of mass destruction obsolete."[158] Therefore the MOD needs to ensure investment in its people.

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[154] Metz, "Tech Giants Are Paying Huge Salaries for Scarce A.I. Talent."
[155] McKinsey & Company UK and Ireland, "Artificial Intelligence in the United Kingdom: Prospects and Challenges."
[156] Castro et al, "Who is winning the AI race: China, the EU or the United States," 55.
[157] McKinsey & Company UK and Ireland, "Artificial Intelligence in the United Kingdom: Prospects and Challenges."
[158] Cohen, "A revolution in warfare," 50.

As pointed out over a decade previously, "we must get smart people more engaged; not as corrosive critics, but as constructive contributors. This will develop the habit of thinking strategically…and tap into a deeper pool of strategic ideas."[159] Furthermore, and as history has taught us, "the best bet for future victory is developing the tactical, operational, and strategic innovators who will leverage battlespace conditions to achieve victory, regardless of the tech balance. Human intelligence and creativity will win the next war, not technology."[160] This will also require a transformation in organisational structures across MOD; strong strategic leadership and accountability will be vital.[161] As Porter convincingly argues, classical realism – especially Clausewitz and Morgenthau is "valuable resource" today for "handling uncertainty more reflexively...[whilst] governments...should insure against the likelihood of predictive failure by developing the intellectual capability to react to the unknown."[162]

At the national level, education to develop AI talent will also be vital and is a central tenet of the AI Sector Deal.[163] The Office of AI is establishing up to 20 AI Centres of Doctoral Training in UK universities.[164] However, China is also rapidly sustaining and growing home-grown capability, with 35 universities now teaching AI-related degrees – and over 100 degrees that combine AI and other subjects.[165] The UK simply cannot compete with the scale and rate of change that is taking place in the Chinese university system. The UK will likely have to rely on international collaboration if it is to gain a strategic edge; and at present the MOD will have to rely on the AI Sector Deal to build domestic AI capability.

Doctrine. In his influential book 'Wired for War,' Singer surveyed US military officers and found that they "identified developing a strategy and doctrine [for using robots in combat] as the third least important aspect to figure out."[166] Whilst this was not a

[159] Newton et al, "Reclaiming the art of British strategic thinking."
[160] Hickman, "The Future of Warfare Will Continue to Be Human."
[161] Robertson and Robertson, "Three Steps the UK's Ministry of Defence Can Take to Ensure It Makes the Most of Artificial Intelligence and Automation."
[162] Porter, "Taking uncertainty seriously: Classical realism and national security," 239.
[163] HM Government, "AI Sector Deal."
[164] Shead, "UK Government to Fund AI University Courses with £115m."
[165] Bughin et al, "Notes from the AI frontier: Modeling the impact of AI on the world economy."
[166] Singer, *Wired for War*, 210.

study on the UK armed forces, Singer's findings suggest a more informed approach is needed. As demonstrated by the Blitzkrieg case study, doctrine is an essential element for a fighting force if it is to achieve its full potential. Whilst the Joint Concept Note on Human-Machine Teaming provides limited ways and means – it is not doctrine; nor does it expand on the use of AWS in-depth. Without renewed conceptual effort, AI may become the new Blitzkrieg, as Ader convincingly states, "while R&D continue apace, rhetoric and doctrine has calcified. Major powers are conceptualising automation to augment and support existing force structures – not exploring how it might change the character of war. This is a mistake."[167]

Whilst UK and NATO doctrine are widely published, AI is likely to change set assumptions. Wargaming is one tool that allows a diverse set of people to test novel capabilities in a safe environment. This forum would provide cooperation with military, civilian and commercial partners to test AI platforms whilst maintaining control over technical parameters.[168] Furthermore Hickman convincingly posits that greater investment in multi-domain virtual training is needed.[169] Therefore, whilst the UK must develop AI specific doctrine, it must also review how AI will impact current doctrinal assumptions. To ignore this would risk exposure to adversaries. As the 2018 US National Defense Strategy stated, "competitive military advantage has been eroding" and, if unaddressed, will allow adversaries to exploit these weaknesses to their own advantages.[170] This is important to note given the quantitative element (number of ships, tanks, aircraft) measurement of military effectiveness is more in question than ever. Cohen assuredly predicts platforms will become less important as munitions and information will result in increased difficulty for analysts to assess the military balance of adversaries.[171]

Technology. On the cover of the Economist in May 2017, was story that argued that data had replaced oil as "The World's Most Valuable Resource."[172] Whilst this is a controversial claim that has yet to be proven, states that are able to identify, acquire and apply data that is militarily important will be well positioned to develop high-

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[167] Ader, "Are Automated Weapons the next Tank?."
[168] *Ibid.*
[169] Hickman, "The Future of Warfare Will Continue to Be Human."
[170] Cohen et al, "Peering into the Crystal Ball: Holistically Assessing the Future of Warfare."
[171] Cohen, "A revolution in warfare," 53.
[172] The Economist, "The world's most valuable resource is no longer oil, but data."

performance AI systems.[173] However, there are worrying indicators that the UK is not maintaining a firm onshore tech-industry which will be vital to both national prosperity and security. Non-EU companies are acquiring AI technological firms, as demonstrated when a Chinese government-backed private equity firm, purchased Imagination Technologies, a UK semiconductor firm for £550 million in 2017.[174] As demonstrated at [Table 2], the EU also trails behind the US in AI company numbers despite higher investment. Additionally, the UK trails Germany, France, Japan and South Korea on AI patents.[175]

The UK's involvement in conflicts since the turn of the century have proved unpopular with the appetite to risk decreasing amongst generals, politicians and the population; this is why AI technology is so attractive.[176] Moreover, with exquisite conventional technologies such as the F-22 costing $68,346 an hour to produce,[177] AI will be an attractive option for both treasuries and militaries alike, especially as the global economy takes a downturn due to Covid-19. Strategy is inherently competitive and with a recent UK economic recession, resource is evermore precious. As a consequence, the MOD needs a strategy that maximises the benefits of AI whilst minimising threat as the UK enters the Integrated Review.

Process and Policy. States must make regulatory choices regarding the use of AI, and balance trade-offs such as privacy versus efficiency. The AI Sector Deal is a solid foundation covering economic and societal development, however, as argued, the UK government has yet to state ambition or constraints on the use of AI by the UK armed forces. Until this happens the implications for national power will not be answered.[178] Nevertheless, even if policymakers were to remove all constraints, this would not guarantee effective and efficient implementation or regulate use.[179] As detailed in Part Two, it is likely democracies will face more constraints when compared to more autocratic regimes, therefore if UK policy was to be fixed as always having 'a man in the loop,' having an AI system that could do the Observe,

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[173] Horowitz et al, "*Strategic competition in an era of artificial intelligence,*" 4.
[174] CrunchBase, "ARM."
[175] McKinsey & Company UK and Ireland, "Artificial Intelligence in the United Kingdom: Prospects and Challenges."
[176] Ankerson, "Melancholic and Fascinated: Artificial Intelligence, Authentic Humanity, and the Future of War."
[177] Spiegeleire et al, "Artificial Intelligence and The Future of Defense," 46.
[178] Metz, "Google, Facebook, and Microsoft Are Remaking Themselves Around AI."
[179] Horowitz et al, "*Strategic competition in an era of artificial intelligence,*" 11.

Orient, Decide but then have to wait for a human to Act would give capable adversaries an advantage. This is why policy direction is vital; likewise, that policy needs to be accountable.

Acquisition and Procurement. For the UK government to harness the most out of AI for national security purposes, leveraging private sector innovation is needed. Though narrowing the AI gap inside and outside government will be a challenge,[180] China's military-civilian fusion strategy, is an example of how this can be achieved. This RMA also provides strong potential economic gains through leveraging small and medium enterprise and in turn supporting Defence's prosperity agenda.[181] As former Undersecretary of Defense for Acquisition, Technology, and Logistics Frank Kendall states, "Automation and AI are one of the areas where the commercial developments dwarf the military investments in R&D."[182] Singapore is one state that is leading the South East Asia region in AI investments, having created a technology hub to attract significant investment.[183]

The pace of change in commercial development requires agile capability delivery, or a 'fail fast' approach. Whilst there are elements of the MOD currently practicing this conceptual and cultural shift in acquisition,[184] such innovation is isolated rather than the norm. Cook suggests that "MOD...risks mission failure if agility is not injected into procurement and operating models rapidly."[185] This is a compelling argument, especially as highlighted in Part 2, MOD procurement practices are often criticised. A conceptual and cultural shift will be needed across domains and headquarters. Procurement practices will have to work with onshore small tech start-ups, up to the likes of Boeing. This will require trained and capable staff that do not settle for "nostalgia and comfort...to lull the [UK] into greater disadvantages against adversaries."[186] Huntington correctly suggests that everyone involved in the human-machine interface, from politicians, commanders to watchkeepers will need to become more AI literate "if they are to remain effective managers of violence."[187] As

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[180] *Ibid,* 17.
[181] Dunne, "Growing the Contribution of Defence to UK Prosperity."
[182] Scharre, *Army of none: Autonomous weapons and the future of war*, 91.
[183] Chitturu et al., "Artificial Intelligence and Southeast Asia's Future," 12.
[184] Royal Air Force, Rapid Capability Office.
[185] Cook, "The Humble Task of Implementation is the Key to AI Dominance."
[186] *Ibid.*
[187] Huntington, *The soldier and the state: The theory and politics of civil–military relations*, 112.

Custons strongly posits, "most importantly...successful commanders all [have] the ability to navigate government bureaucracy and understand acquisition processes".[188]

Whilst the lessons are Project Maven should be firmly in policymakers' minds, the UK does have levers to incentivise AI commercial partnership. These could include trade policies, infrastructure investment, and other economic stimuli.[189] Building trust and shedding bureaucratic constraints between the MOD and private enterprise is a necessary condition to facilitate AI into UK national security capability.[190] The status quo needs to be upset and the strategic narrative needs to stress that UK industry's success, relies on the national security of the UK.[191]

Assurance. Whilst the speed and agility of AI acquisition is important, so too, as highlighted in Part 2, is the assurance and safety of such systems. The MOD will likely have to manage more stakeholders and ensure the product it receives is both operationally effective as well as safe. The DOD have established strict test parameters for AWS and all systems must be certified by the Director of Operational T&E.[192] If the MOD is to move to an agile acquisition process, it will have to develop the capacity to "test safe and controllable autonomous systems, especially those that fire weapons."[193] Implementation is the most difficult element of strategy. Implementing an assurance organisation whilst understanding acquisition and bureaucracy[194] will be an enormous, but necessary challenge for UK Defence.

Operating within Alliances and Interoperability. The 1999 NATO-led war over Kosovo, provides a good example of issues that arise when alliance states have differing levels of capability. Many NATO states lacked precision-guided munitions and therefore many operational targets fell to a small number of states;[195] AI has the potential to increase such "burden-sharing"[196] tensions. Whilst AI will likely increase

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[188] Custons, "Commanders Need to Know Innovative Acquisition."
[189] Clifford, "AI Will Change War, But Not in the Way You Think."
[190] Custons, "Commanders Need to Know Innovative Acquisition."
[191] *Ibid.*
[192] US Department of Defense, "Unmanned systems integrated roadmap FY2011-2036, 2015," 87.
[193] Cummings, "Artificial intelligence and the future of warfare," 2.
[194] Cook, "The Humble Task of Implementation is the Key to AI Dominance."
[195] Larson et al, "*Interoperability of us and nato allied air forces: Supporting data and case studies."*
[196] Lin-Greenberg, "Allies and Artificial Intelligence: Obstacles to Operations and Decision-Making."

military efficiency, there are significant issues that may arise whilst working in a multinational environment such as interoperability, information sharing and the speed of decision-making[197] which may heighten mistrust within a coalition.[198] Nevertheless, NATO has overcome interoperability challenges in the past and is taking action to address the challenges ahead. Several NATO allies have called for increased collaboration and Germany's 2019 National AI Strategy advocates "work[ing] with the nations leading in this field … to conduct joint bilateral and/or multilateral R&D activities on the development and use of AI."[199] Additionally NATO's ACT have implemented workshops recently "to improve awareness and understanding of autonomous systems, promote interoperability and provide guidance for the development of, use of, and defence against, autonomous systems."[200]

Whilst AI alliance scenarios have yet to be explored in any great depth by militaries and scholars alike, there are existing alliance studies from the likes of Walt and McCalla that could inform potential challenges in the next RMA. This paper has not explored AI and alliances in depth, nevertheless, it is noteworthy given the likelihood of the UK participating in multilateral operations in the future is significantly higher than operating unilaterally. The UK should encourage NATO to develop policies and doctrine that streamline decision-making and data sharing, whilst mitigating procedural and technical gaps to bolster defences against adversaries.[201]

Conclusion

While AI's potential in military application remains to be seen, recognition of the impact to the UK's society, economy and national security should be noted. Deciding and managing AI's rise and development is essential to prevent strategic impotence.

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[197] Hartley, "NATO, Standardisation and Nationalism: An Economist's View," 57.
[198] Lin-Greenberg, "Allies and Artificial Intelligence: Obstacles to Operations and Decision-Making."
[199] German Federal Government, "Nationale Strategie Für Künstliche Intelligenz [AI Strategy]."
[200] Kuptel and Williams. "Policy Guidance: Autonomy in Defence Systems," 5.
[201] Firth, N, "DeepMind's AI Has Used Teamwork to Beat Humans at a First-Person Shooter."

This dissertation began by using Clausewitz as a theoretical framework and studied previous RMAs to establish the extent to which the nature of war would be changed by AI. It then went on to critically analyse some of the challenges and strategic variables that face the UK in the seventh RMA such as, the balance of power and international actors, regime type and control and regulation. Part Three summarised the UK's current strategy and approach to AI and progressed to prioritise 3 elements, namely, People and Organisation, Technology and Process and Policy. These headings were selected as a lens through which to examine what UK security elites need to consider, and act upon, to gain strategic advantage.

The hypothesis in this paper was tested through a combination of analytical framework comparison, primary and secondary source material and the use of case studies. The study concluded that as long as humans remain responsible for directing war and programming and fielding machines; war's nature will continue to be defined by violence, chance and reason. Fog and friction may dissipate at the various levels of warfare but will not be eliminated entirely. Clausewitz is as relevant today as ever. Analysis of previous RMAs, demonstrated that although technological advantage is a necessary condition, it is not sufficient to claim strategic success. Rather an adaptation of process, organisational structure and culture is needed to gain success. To ensure the UK maximises AI's contribution to national security and can compete in the international strategic environment, a comprehensive approach is needed. This strategic approach should be underpinned by strong leadership and strategic communication. The importance of exploiting the civilian technology sector for military application was highlighted, as well as agile acquisition and regulation.

In sum, the MOD needs an AI strategy. A strategy would enhance the spectrum of Defence operations and would allow single services and allies to collaborate; enabling efficiencies and progress. Perhaps most significantly, an AI strategy would go some way to gaining a strategic decisive edge, by balancing risk of overestimating AI's potential to the cost and detriment of conventional force.

The limited scope of this study, necessarily excluded in-depth examination of both alliance AI interoperability issues and the effect regime type has on AI policy and

implementation. Nevertheless, and in spite of such research gaps, these subjects have both raised further questions that have implications for UK security. Therefore, it is judged both subjects warrant further research.

Annexes

Military Revolution	Implications
First Revolution	
Westphalian System	Revenue generation, banking and taxes for financing wars, and professional militaries
Second Revolution	
French Revolution	National mobilization, levy en masse, and large-scale armies with conscription
Third Revolution	
Industrial Revolution	Mass production, standardization, and large-scale economic exploitation
Fourth Revolution	
World Wars I & II	Combined arms, armored blitzkrieg, carriers, bombers, and jets
Fifth Revolution	
Nuclear Revolution and missiles	Nuclear weapons and intercontinental ballistic missiles
Sixth Revolution	
Information Revolution	Command and control, connectivity and instant global reach, imagery, and cyber levy en masse by violent extremists
Seventh Revolution	
Autonomous Revolution	Autonomous weapons, swarms of robotic vehicles in multiple domains, self-organizing defensive systems, automated weapons, big data analytics, and machine and deep-learning programs

Table 1. Military Revolutions.[202]

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[202] Hoffman, "Will War's Nature Change in the Seventh Military Revolution?," 20.

Metric	China	European Union	United States
Number of AI Companies	224	762	1,727
Number of AI Companies per 1 Million Workers	0.3	3.1	10.5

Table 2. Number of AI companies, 2019.[203]

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[203] World Bank, World Bank Open Data labor force."

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