Autonomy and Ethics: AI, Autonomous Weapons, and the Defense Sector

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Introduction

Autonomy and Ethics: AI, Autonomous Weapons, and the Defense Sector examines one of the most consequential junctions of our time: the meeting point of rapid advances in artificial intelligence and the enduring demands of security, law, and human dignity. Around the world, militaries are integrating AI across sensing, decision

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support, logistics, and force protection, while debates over autonomous weapons raise profound questions about control, accountability, and the moral bounds of warfare. This book maps that landscape with an eye to both the promise and the perils, combining technical overview with ethical analysis to illuminate where opportunities for risk reduction and responsible governance are strongest. It is written for policy makers seeking actionable frameworks, technologists navigating hard constraints, and ethicists working to safeguard humane principles in an era of accelerating change.

Clarity of terms is essential. “Autonomy” is not a synonym for “no human control,” nor does “AI-enabled” imply agency or intent. We distinguish automation from autonomy, examine levels of autonomy and their operational implications, and situate “meaningful human control” within practical command-and-control realities. The book also treats human–machine teaming as the default paradigm rather than an exception, focusing on how people and systems can complement each other’s strengths while guarding against automation bias, overtrust, and cognitive overload. These distinctions matter because policy, doctrine, and technical design are shaped by how we define the systems in question.

Technical constraints are as important as capabilities. AI systems that perform impressively in the lab can struggle in contested environments characterized by cluttered sensor inputs, electromagnetic interference, deception, and adversarial tactics. Distributional shift, data scarcity, and degraded communications challenge reliability, while adversarial machine learning, spoofing, and cyber intrusion test resilience. Verification and validation remain difficult when models are complex, adaptive, or opaque, and edge cases are common in high-stakes, fast-moving scenarios. A sober assessment of these limits grounds more realistic policies and safer system designs.

Ethical and legal analysis provides the compass. International Humanitarian Law—especially the principles of distinction, proportionality, and precaution—remains the bedrock for assessing AI-enabled military systems. Just war theory offers complementary moral lenses for judging resort to force and conduct in war. Yet autonomy raises new questions: How should accountability be allocated among developers, commanders, and operators? How can bias and dataset limitations translate into disparate harm, and what safeguards are necessary to reduce civilian risk? Throughout, we center human dignity and the prevention of unnecessary suffering.

Governance is a multilayered endeavor. Within states, procurement and acquisition processes can embed safety-by-design through testing, evaluation, verification, and validation; standards and certification; incident reporting; and continuous auditing. Internationally, norms emerge through diplomacy, transparency measures, and confidence-building, including work at the United Nations Convention on Certain Conventional Weapons, regional alliances, and bilateral arrangements. Arms control,

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export controls, and dual-use governance each play roles in shaping technology diffusion and responsible use. Effective governance requires not only rules but also institutions capable of implementing them under pressure.

This book is organized to move from concepts and capabilities to risks and responsibilities, and finally to governance and practical roadmaps. Early chapters survey the state of autonomous military systems and the nuances of human–machine teaming. Midway, we examine safety engineering, cybersecurity, TEVV, accountability, and escalation dynamics to illuminate where failures are most likely and most consequential. Later chapters assess international norms, standards, and multistakeholder coordination, culminating in scenario-based explorations and concrete policy frameworks. Each chapter is designed to be read on its own yet contributes to a cohesive whole.

Above all, the approach here is pragmatic and balanced. We neither dismiss the potential benefits of AI for reducing risk to noncombatants and service members nor minimize the dangers of premature deployment, overconfidence, or opaque decision-making. Responsible stewardship requires humility about what AI can and cannot do, sustained investment in assurance and governance, and attention to the organizational and cultural factors that shape real-world outcomes. By bringing policy makers, technologists, and ethicists into a shared conversation, this book aims to support decisions that enhance security while upholding the law and the values that make security meaningful.

Chapter 1: The State of Autonomous Military Systems

The integration of artificial intelligence into military operations is no longer a futuristic concept but a burgeoning reality, fundamentally altering the landscape of defense. Across the globe, armed forces are actively incorporating AI across various domains, from refining logistical operations to enhancing decision-making in the heat of battle. This transformation is driven by the perceived potential of AI to accelerate processes, improve efficiency, and ultimately gain a decisive operational advantage.

One of the most immediate and impactful areas where AI is making its mark is in intelligence, surveillance, and reconnaissance (ISR). Military intelligence has long relied on sensing technologies like satellites and drones to gather information and enhance situational awareness. However, the sheer volume of data collected by these systems today necessitates AI-driven processing and analysis to extract "actionable" intelligence. AI algorithms are now adept at sifting through vast quantities of data

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from diverse sources, including satellite imagery, drone footage, and even social media posts, to identify objects of interest, analyze patterns, and provide commanders with a comprehensive overview of the operational environment. This capability significantly reduces the workload on human analysts and dramatically speeds up the intelligence cycle, moving from days to mere hours in some cases. For example, Project Maven, a Pentagon initiative, initially focused on using AI to process surveillance imagery and video, and has since expanded into a broader military intelligence and targeting platform. Similarly, the Indian Army in 2025 patented an AI-powered Automatic Target Classifying System that uses sensors and algorithms to identify and classify targets on radar by comparing real-time data with a stored database.

Beyond merely processing data, AI is proving invaluable in decision support systems (DSS) for command and control (C2). These AI-enabled tools are designed to assist military personnel at various levels, from combat to tactical and operational, in making complex decisions, especially when time is limited or the number of choices is overwhelming. AI can analyze information, predict enemy actions through threat analysis, and even evaluate alternative actions for friendly forces before execution. This enhances situational awareness and can accelerate critical operational decisions in dynamic environments. The U.S. Army, for instance, is actively prototyping Next Generation Command and Control (NGC2) systems that leverage AI to rapidly process data, inform commanders' decisions, and reduce the cognitive burden on soldiers. This includes training AI models to review sensor data, recognize and process targets, and then nominate them for human review and decision. The aim is to enable human decisions at machine speed, ultimately providing commanders with options to achieve "decision overmatch." While AI can offer analytical insights and predict outcomes, particularly in areas governed by physical laws, predictions involving human interactions still inherently carry uncertainty and require human judgment.

Logistics and sustainment, often considered the lifeblood of any military operation, are also undergoing a significant transformation with the integration of AI and machine learning (ML). AI applications in this sector range from predictive analytics that forecast supply needs and identify potential disruptions in the supply chain, to autonomous vehicles and drones used for transporting goods. ML algorithms continuously improve by learning from past data, optimizing operations from warehouse management to dynamic routing of supplies. Militaries worldwide, including the U.S. Department of Defense and NATO, are actively exploring these technologies. The Defense Logistics Agency (DLA), for instance, is applying AI to supply chain risk management to predict bottlenecks, identify unreliable suppliers, and recommend alternatives before disruptions occur, shifting from a reactive to a proactive approach. This extends to detecting counterfeit components and non-conforming materials, which can have life-or-death consequences in military contexts. AI-driven demand forecasting, which considers geopolitical indicators, mission tempo, and deployment schedules, helps balance readiness against budget constraints.

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Robotics and automation are further redefining military logistics by performing dangerous, difficult, or mundane tasks, thereby enhancing efficiency and safety.

The concept of human-machine teaming (HMT) is not just an aspiration but a fundamental paradigm shaping the development and deployment of autonomous military systems. It acknowledges that while AI can offer unprecedented capabilities, human oversight, intuition, and contextual understanding remain crucial. This collaboration leverages the strengths of both humans and machines, with AI handling data processing, pattern recognition, and scenario modeling at speeds impossible for humans, while humans retain the capacity for ethical judgment and complex strategic thinking. Militaries are actively experimenting with HMT to enhance situational awareness, improve decision-making, and extend the range and lethality of human operators. For example, the U.S. Air Force, in collaboration with allies, has conducted "Decision Advantage Sprints for Human-Machine Teaming" (DASH) experiments to test and refine AI's potential in battle management operations. These exercises have demonstrated significant reductions in decision-making time and improved solution generation when AI-driven software assists human operators. The focus is on amplifying human capabilities rather than replacing them, ensuring that humans remain firmly "in command, not just in the loop."

However, the increasing sophistication of autonomous military systems inevitably raises profound ethical and legal questions, particularly concerning lethal autonomous weapon systems (LAWS). While a universally agreed definition of LAWS remains elusive, they are generally understood as weapons that can identify and engage targets without human intervention. Some defensive systems with rudimentary autonomous functions have existed for decades, such as anti-vehicle mines and missile defense systems. More recently, systems like loitering munitions, which can autonomously locate and attack targets, have become increasingly sophisticated, incorporating AI technologies. The ethical debate surrounding LAWS centers on the removal of human judgment from lethal decision-making, raising concerns about accountability, the potential for arbitrary or indiscriminate harm, and compliance with international humanitarian law (IHL). Proponents argue that LAWS could enhance military efficiency, reduce casualties by eliminating human error, and potentially improve compliance with IHL through algorithmic precision. However, critics emphasize that algorithms lack the ability to deliberate on ethical principles like proportionality and distinction, which are crucial for morally justified military actions. The debate is ongoing within international forums like the United Nations Convention on Certain Conventional Weapons (CCW), where discussions focus on the need for meaningful human control and the ethical legitimacy of deploying such systems.

The cyber domain is another critical area where AI is rapidly being integrated, fundamentally reshaping both offensive and defensive capabilities. AI is enhancing cyber warfare by automating intelligence gathering, optimizing attack vectors, and improving electronic warfare. AI-driven tools can sift through massive amounts of data

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to pinpoint high-value targets with incredible speed and accuracy, accelerating attacks and making them harder to detect. This includes AI-generated phishing campaigns, deepfake impersonations, and adaptive ransomware. Conversely, AI is also being deployed for defense, with applications in threat detection, phishing prevention, behavioral analytics, network security, and identity management. AI-powered systems can identify new forms of malware, detect unusual behaviors, and monitor communications to stop threats before they cause widespread damage. Agentic AI cyberweapons, capable of autonomously conducting reconnaissance, modifying system settings, and adapting to new environments, are becoming the tool of choice for state-sponsored attackers, underscoring the escalating pace of cyber combat. The strategic importance of AI in digital warfare is leading to heavy investment in its development.

The overall trend indicates that AI is increasingly viewed as a central pillar of national power, capable of bolstering military effectiveness, driving industrial vitality, and leveraging diplomacy. Governments are emphasizing accelerated integration of AI across federal agencies, adaptive procurement pathways, and sustained incorporation of commercial innovation into national security initiatives. The strategic implication is that leadership in AI acts as both an internal force multiplier and an external signaling mechanism. However, this rapid integration also introduces systemic dependencies related to data validity and integrity, model robustness and reliability, and the resilience of information infrastructures, expanding the defense ecosystem's exposure to novel vulnerabilities. As AI systems become more complex and embedded across various military functions, maintaining human judgment at the core of decision-making while effectively harnessing AI's potential will remain a critical challenge. The ongoing evolution of autonomous military systems demands a balanced approach that embraces technological advancements while rigorously addressing the associated ethical, legal, and operational complexities.

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