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Future-Proofing PME: How AI is Redefining Adaptive Wargaming and Strategic Readiness

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Wargaming has long been central to military education, evolving from Prussian *Kriegsspiel* exercises to sophisticated digital simulations. Today, Artificial Intelligence (AI) in wargaming and scenario planning marks the next leap in Professional Military Education (PME), shifting from static, scripted scenarios to adaptive, real-time simulations.^[1] Modern warfare spans cyber, space, and multi-domain operations, demanding AI-driven wargaming that introduces intelligent adversaries and evolving operational dilemmas.^[2] Unlike traditional wargames, which rely on pre-set conditions, AI-powered models employ machine learning-based red-teaming, dynamically adjusting to human decision-making and forcing Air Force personnel to adapt in real time.^[3]

Beyond adversary simulation, AI enhances Course of Action (COA) development, integrates real-world intelligence data into training, and ensures that PME remains relevant in a rapidly evolving security environment.^[4] AI-enabled platforms are already reshaping PME by reinforcing data-driven decision-making and multi-domain readiness.^[5] This paper explores four critical questions: (1) How AI transforms wargaming, scenario building, and crisis simulations; (2) The new training exercises AI enables; (3) AI's role in PME over the next 10–15 years; and (4) The competitive implications of AI-driven PME for the U.S. Air Force versus near-peer adversaries. Through an analysis of military policy, AI applications, and PME innovation, this study examines how AI serves as a force multiplier, enhancing strategic readiness while maintaining ethical safeguards.^[6]

AI-Driven Adaptive Wargaming and Scenario Planning

The integration of AI into wargaming and crisis simulations is transforming PME by introducing real-time adaptability, autonomous adversaries, and predictive analytics. Traditional wargaming relies on pre-scripted scenarios with fixed outcomes, limiting its ability to replicate the complexity of modern warfare. AI, however, dynamically adjusts scenarios based on participant decisions and adversary responses, creating an evolving and data-driven training environment.^[7] AI-driven autonomous red-teaming surpasses traditional, instructor-led adversary models by employing reinforcement learning and neural networks to mimic real-world enemy decision-making. These AI-enabled systems analyze real-time intelligence, adjust force postures, and generate adaptive dilemmas, requiring Air Force personnel to develop strategic agility.^[8] Programs such as Project Maven demonstrate AI's ability to create more complex, responsive simulations, ensuring PME remains aligned with contemporary multi-domain warfare.^[9]

Traditionally, scenario planning requires extensive manual research and recalibration. AI automates this by analyzing historical battle data, intelligence reports, and operational trends, generating highly detailed, evolving training modules in minutes.^[10] AI-powered strategic foresight tools allow PME to anticipate geopolitical shifts, technological advancements, and adversary strategies, enabling a forward-looking training model that adapts to cyber, space, and asymmetric conflicts.^[11] Crisis simulations train officers to make rapid decisions under pressure. AI enhances these by incorporating real-time geopolitical data, logistical constraints, and adversary actions, ensuring that each simulation is unique and unpredictable.^[12] Unlike static crisis models, AI adapts in real time, increasing the realism of combat stress training. AI-driven systems can also analyze

cognitive load and stress responses, adjusting difficulty levels dynamically to build resilience and improve crisis leadership.^[13] By leveraging autonomous adversaries, scenario automation, and real-time crisis response modeling, AI ensures PME is more dynamic, strategic, and adaptable. As AI technology advances, its role in PME will only expand, equipping the U.S. Air Force with a decisive training advantage over near-peer competitors.^[14]

AI-Enabled Training Innovations

AI is transforming PME by introducing adaptive, high-fidelity training environments that were previously infeasible due to technological and logistical constraints. By leveraging AI-driven simulations, personalized learning, and stress resilience modeling, PME can enhance realism, adaptability, and decision-making agility, ensuring that Air Force personnel are prepared for modern warfare.^[15]

AI-powered virtual reality (VR) and augmented reality (AR) create immersive, interactive battle simulations that dynamically adapt to user actions. Unlike traditional scripted exercises, AI-enhanced VR modifies enemy tactics, mission objectives, and terrain in real time, providing fluid, data-driven training.^[16] For example, AI-generated dogfighting scenarios challenge pilots with unpredictable adversary behavior, while urban combat simulations use AI-controlled non-playable characters (NPCs) that react dynamically to trainees' decisions.^[17] This level of adaptive engagement builds combat readiness and tactical flexibility.^[18]

AI introduces individualized learning models that assess user performance and generate customized training paths, optimizing skill acquisition. Unlike conventional PME curricula, AI-driven instruction adapts in real time, allowing trainees to progress at their own pace while receiving targeted feedback.^[19] For instance, AI-powered intelligent tutors analyze decision-making patterns and provide automated performance assessments, helping officers refine their strategic thinking based on real-world case studies.^[20] These systems ensure continuous improvement and retention of mission-critical knowledge.

Blended learning models combining live-action drills and AI-driven simulation offer the most comprehensive training solutions. AI enhances multi-domain exercises, integrating air, land, sea, cyber, and space warfare in a seamless, interactive environment.^[21] For example, AI dynamically adjusts mission parameters during joint military exercises, simulating logistical disruptions, cyber threats, and adversarial deception tactics, thereby exposing trainees to realistic operational uncertainty.^[22] AI's ability to generate ever-evolving battlefield conditions ensures that PME prepares leaders for the complexities of future conflicts.

AI extends beyond technical training, playing a crucial role in mental resilience development. AI-driven stress inoculation training exposes personnel to high-pressure decision-making scenarios, tracking biometric responses like heart rate, pupil dilation, and reaction times to adjust scenario intensity dynamically.^[23] This capability is particularly vital for combat pilots, intelligence officers, and special operations personnel, where decision-making under extreme stress is critical. AI-driven simulations provide progressive exposure to high-stakes conditions, allowing Airmen to adapt and build psychological endurance over time.^[24] By integrating AI-powered simulations, personalized instruction, and cognitive resilience training, PME can provide more efficient, adaptive, and impactful education. AI ensures that training environments evolve dynamically, preparing Air Force personnel for the unpredictability and complexity of modern warfare.^[25]

Long-Term Vision: The Future of AI in PME Over the Next 10–15 Years

As AI evolves, its role in PME will expand to shape training, leadership development, operational planning, and strategic decision-making. Over the next 10–15 years, PME must integrate AI-driven methodologies to ensure that Air Force personnel remain adaptable, technologically proficient, and strategically prepared.^[26] AI-powered learning assistants will replace one-size-fits-all training with tailored professional development. By analyzing individual performance, cognitive traits, and career trajectories, AI will deliver real-time feedback and adaptive learning paths.^[27] PME institutions will leverage AI-driven mentorship platforms that suggest customized training programs based on an officer's assignment history, leadership style, and operational strengths. This ensures continuous, data-informed career progression, bridging educational gaps in real-time rather than relying on static, pre-planned PME courses.^[28]

AI will redefine strategic foresight by integrating real-time geopolitical intelligence, predictive analytics, and operational modeling into PME curricula. AI-powered decision-support systems will immerse trainees in dynamic, data-driven scenarios, challenging them to develop strategies amid evolving threats.^[29] Future PME may incorporate AI-generated war games that simulate global security trends, adversary behaviors, and emerging technologies. These systems will allow officers to test strategic options in high-fidelity environments, honing critical thinking and crisis management skills.^[30]

AI will reshape leadership training by tracking decision-making styles, communication patterns, and stress responses, providing instant feedback on command effectiveness.^[31] AI-driven simulations will expose officers to high-pressure, multi-domain leadership scenarios, reinforcing agility in unpredictable environments. Leadership programs will increasingly focus on cross-domain strategy, where AI helps commanders integrate air, space, cyber, and information warfare into unified campaigns. This will cultivate leaders capable of adapting to complex, rapidly changing battlespaces.^[32]

For PME to fully leverage AI's potential, institutions must develop scalable, AI-powered training ecosystems. This requires:

- o Investing in AI-enhanced educational platforms that facilitate real-time knowledge updates and interactive learning environments.^[33]
- o Implementing ethical AI safeguards, preventing bias, misinformation, and over-reliance on machine-generated insights.^[34]
- o Training PME instructors in AI literacy, ensuring human oversight in AI-driven decision-making.^[35]

As PME transitions to a continuous learning model, training programs will evolve in response to technological advancements and global security shifts. This shift will ensure that Air Force personnel remain strategically competitive and operationally agile.^[36] By integrating AI-driven mentorship, strategic foresight, leadership training, and infrastructure modernization, PME can prepare Air Force personnel for the next generation of warfare. Institutions must act now to ensure that PME remains a dynamic, responsive, and AI-enhanced learning ecosystem, positioning the U.S. Air Force at the forefront of military strategy and innovation.^[37]

Competitive Advantages and Disadvantages of AI in PME

The integration of AI into PME presents a critical opportunity for the U.S. Air Force to maintain strategic superiority over near-peer adversaries. AI-driven PME enhances training efficiency, decision-making speed, and multi-domain readiness, but improper implementation could lead to security risks, over-reliance on AI, and loss of leadership intuition.^[38] AI enhances PME through adaptive learning, strategic agility, and operational efficiency, providing a decisive advantage over traditional training models.

- o Accelerated Training and Decision-Making: AI enables automated performance assessments, personalized learning models, and real-time scenario adaptation, ensuring faster skill acquisition and strategic responsiveness.^[39]
- o Multi-Domain Readiness: AI-driven PME integrates air, space, cyber, and information warfare, preparing personnel for complex, multi-theater conflicts.^[40]
- o Enhanced Wargaming and Scenario Planning: AI-generated simulations create intelligent, evolving adversaries, producing more realistic and high-stakes decision-making exercises.^[41]
- o Future-Proofing AI-Integrated Warfare: AI-driven PME ensures that Air Force personnel become proficient in AI-enhanced decision-making, maintaining technological leadership over slower-adopting adversaries.^[42]

By leveraging these capabilities, the U.S. Air Force can outpace competitors who rely on conventional PME models, ensuring faster adaptation to emerging threats and enhanced cross-domain coordination.

Despite its advantages, AI-driven PME carries risks if not carefully implemented.

- o Over-Reliance on AI Systems: Excessive dependence on AI could weaken human critical thinking and introduce vulnerabilities to cyber threats and AI biases.^[43]

- o Ethical and Security Challenges: AI in PME must be secure, transparent, and resilient against adversarial manipulation, ensuring reliable decision-making.^[44]___
- o Erosion of Traditional Leadership Skills: If misused, AI could undermine intuitive, experience-based decision-making, diminishing the human element of command.^[45]___
- o Adversarial AI Development: China and Russia are rapidly advancing AI-driven PME models. If the U.S. fails to innovate, it risks falling behind in AI-enhanced warfighting methodologies.^[46]___

To mitigate these risks, PME must ensure balanced AI-human integration while safeguarding ethical standards and cybersecurity.

To maximize AI's benefits while mitigating potential downsides, PME should focus on:

- o Balanced AI-Human Collaboration: AI should enhance, not replace human expertise, preserving leadership intuition and ethical decision-making.^[47]___
- o Robust Ethical and Cybersecurity Measures: AI frameworks must prevent bias, misinformation, and over-automation, ensuring trustworthy AI integration.^[48]___
- o Continuous Innovation and AI Adaptability: PME must adopt AI ecosystems that evolve with technology and global threats, preventing stagnation and ensuring cutting-edge military education.^[49]___

By embracing AI's advantages while addressing its risks through responsible implementation, PME can secure long-term strategic superiority. AI-driven PME, if executed effectively, will serve as a force multiplier, ensuring that the U.S. Air Force remains dominant in future warfare scenarios.^[50]___

The integration of AI into PME represents a transformative shift in how the U.S. Air Force prepares its personnel for future challenges. AI-driven training methodologies offer unparalleled advantages in adaptive wargaming, scenario-based learning, strategic foresight, and leadership development. By leveraging AI to enhance decision-making, accelerate learning, and improve operational preparedness, PME can ensure that Air Force personnel remain at the forefront of military innovation and strategy.^[51]___

Over the next 10–15 years, AI will play an increasingly critical role in shaping PME, from personalized career mentorship and AI-driven leadership assessments to strategic planning simulations and multi-domain operational training. While these advancements offer immense potential, they also introduce challenges, including over-reliance on AI systems, ethical concerns, cybersecurity risks, and adversarial AI development by near-peer competitors.^[52]___ The U.S. Air Force must strike a balance, ensuring that AI serves as a force multiplier rather than a substitute for human expertise, leadership, and ethical judgment.^[53]___

By proactively investing in AI-driven PME infrastructure, ethical AI frameworks, and AI-literate leadership, the U.S. Air Force can secure a decisive advantage over adversaries, maintaining strategic dominance in the era of AI-driven warfare. As AI continues to evolve, PME institutions must remain adaptive, forward-thinking, and committed to innovation, ensuring that Airmen are equipped with the cognitive, strategic, and technological skills necessary to navigate the complexities of modern military engagements.^[54]___ With a thoughtful and deliberate approach, AI-powered PME will not only enhance individual and unit readiness but will also reinforce the U.S. Air Force's position as a global leader in military strategy and operational excellence.

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he completed the AI for Managers course through the UConn School of Business, further deepening his expertise in ethical AI implementation and strategic decision-making.

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