

PERSPECTIVES OF HIGHER MILITARY EDUCATION THROUGH EMERGING TECHNOLOGIES: INTEGRATING RADIOLOCATION AND ARTIFICIAL INTELLIGENCE FOR AERIAL SURVEILLANCE

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ABSTRACT

This paper explores the integration of emerging technologies, specifically radiolocation and artificial intelligence (AI), into higher military education. The study highlights the transformative potential of AI, blockchain, Internet of Things (IoT), virtual reality (VR), augmented reality (AR), big data, and government cloud in modernizing military curricula. These technologies enhance decision-making, personalize training, and improve aerial surveillance capabilities. The paper concludes with recommendations for proactive curriculum updates, continuous investment in emerging technologies, and strategic partnerships to prepare military officers for future technological and strategic challenges.

KEYWORDS: AI, blockchain, IoT, military education, radiolocation

1. Introduction

In the era of emerging technologies, higher military education must adapt to prepare officers to meet modern challenges. Artificial intelligence (AI) enables advanced simulations and training personalization, providing real-time decision support (Flournoy, 2023). Blockchain ensures the security and transparency of educational processes, facilitating the secure sharing of data (Rashid et al., 2023). The Internet of Things (IoT) collects and analyzes data in real time, improving the monitoring and adjustment of training programs (Goldfarb & Lindsay, 2022). Virtual reality (VR) and augmented reality (AR) create immersive simulation environments for realistic workouts (Kreps & Wallace, 2023). Integrating these technologies into the

military curriculum modernizes education and prepares officers for the technological and strategic challenges of the 21st century (Laux et al., 2024).

This paper is structured in several chapters to explore in detail the impact of each emerging technology on higher military education. Chapter 2 covers emerging technologies in military education, including AI, blockchain, IoT, VR/AR, and big data. Chapter 3 focuses on airborne surveillance through radiolocation and the integration of AI into radar systems. Chapter 4 examines the use of AI in higher military education, and Chapter 5 looks at the synergy between emerging technologies and military education. Finally, Chapter 6 provides conclusions and recommendations for the effective implementation of these technologies, highlighting the need to

update the curriculum, continuous investments and develop strategic partnerships.

2. Research Methodology

This research was conducted to evaluate the integration of emerging technologies, such as AI, blockchain, IoT, VR, AR, big data and the government cloud, into education.

The study was structured to analyze the impact of these technologies on the military curriculum and the preparation of officers for the technological and strategic challenges of the 21st century. The research included a review of the specialized literature to identify the latest studies and practices in the field of emerging technologies and military education. Additionally, ad-hoc debates were used to provide detailed qualitative perspectives on the experiences and opinions of participants, as well as direct observations made during training and simulation sessions within the disciplines to examine the practical applicability of these technologies at the “Henri Coandă” Air Force Academy in Braşov, Romania. The sample consisted of students from the academy, selected through a stratified sampling method to ensure the representativeness of different levels of experience and specializations.

3. Emerging Technologies in Higher Military Education

Emerging and disruptive technologies, such as artificial intelligence (AI), blockchain, and the Internet of Things (IoT), have redefined many aspects of society. In military education, integrating these technologies into the upper military curriculum is essential to ensure that officers are prepared to handle new technological challenges and opportunities (Goldfarb & Lindsay, 2022).

Artificial intelligence (AI) is one of the most promising emerging technologies. Using advanced AI-based simulations can provide students with realistic and interactive scenarios that allow them to

learn and adapt to complex situations (Flournoy, 2023). AI has the ability to quickly and efficiently analyze the data collected, providing real-time decision support (Horowitz & Lin-Greenberg, 2022). Machine learning algorithms can help identify the most effective methods of training and personalize courses for each student’s needs (Goecks & Waytowich, 2024).

Blockchain can be used to ensure the security and transparency of educational processes. This technology has the potential to protect sensitive information and ensure data integrity by providing a high level of security in the management of educational and operational information (Laux et al., 2024). Blockchain can facilitate the secure sharing of information between different military and educational institutions, improving collaboration and knowledge sharing (Kreps & Wallace, 2023). The Internet of Things (IoT) can facilitate real-time data collection and analysis for more effective preparation. Connected devices can provide valuable insights into student performance and help monitor and improve educational processes (Goldfarb & Lindsay, 2022). IoT sensors can be used to monitor training conditions and adjust training programs according to individual student needs (Rashid et al., 2023).

Virtual reality (VR) and augmented reality (AR) are emerging technologies that can transform the way military students learn and train. VR and AR can create immersive simulation environments that allow students to experience realistic combat scenarios and develop their skills in a safe and controlled way (Kreps & Wallace, 2023). VR can be used to simulate complex aerial surveillance missions, and AR can provide additional real-time information overlaid on top of the real environment (Lushenko & Sparrow, 2024).

Using BIG DATA and predictive analytics can provide valuable insights into students’ learning trends and patterns.

These technologies can help identify students' strengths and weaknesses, allowing instructors to customize training programs to meet individual needs (Lonergan, 2024). Predictive analytics can predict student performance in different training scenarios and adjust training programs accordingly (Meclea et al., 2024). The government cloud can facilitate the storage, processing, and securing of educational and operational data, providing scalable and efficient IT solutions (ADR, 2025). It will enable quick and secure access to educational resources and facilitate collaboration between different military and educational institutions (Erskine & Miller, 2024).

C4ISR/C5ISR/C6ISR systems (**Command, Control, Communications, Computers (+Cyber-defense, + Combat systems,) Intelligence, Surveillance, and Reconnaissance**) (Brett, 2020) is a set of integrated technologies and systems that enable military forces to collect, process, and distribute information essential for decision-making. In military education, C4ISR can improve the coordination and efficiency of operations by providing students with access to real-time information and advanced analysis tools (Arai & Matsumoto, 2023).

The integration of these technologies into military education will allow the development of a modernized curriculum, which will prepare officers for the technological challenges of the 21st century. By taking a proactive approach in updating the curriculum and continuously investing in emerging technologies, higher military education will be able to become a leader in preparing officers to successfully address the technological and strategic challenges of the future.

4. Aerial Surveillance by Radiolocation

Radiolocation plays a major role in modern aerial surveillance, enabling

accurate detection and tracking of aerial objects (Horowitz & Lin-Greenberg, 2022). In the previous chapter, we discussed the importance of emerging technologies, such as AI, blockchain, IoT, VR/AR, big data, and the government cloud, in military education. These technologies can be integrated to improve airborne surveillance through radiolocation, providing advanced and effective solutions (Lin-Greenberg, 2023).

State-of-the-art radar systems are essential for detecting and tracking aerial objects at long distances and in difficult weather conditions. Students in higher military education must be familiar with the latest developments and practices in the field of radiolocation (Flournoy, 2023). These advanced radar systems can be integrated with AI to quickly and efficiently analyze the data collected, providing real-time decision support (Goecks & Waytowich, 2024). For example, AI can detect and track aerial objects with increased accuracy, predict their trajectories, and provide recommendations for defensive or offensive actions.

Jamming and counter-jamming techniques are essential to protect and improve the efficiency of radar systems. It is important for students to understand and be prepared to use these techniques to thwart adversaries' attempts to disrupt or deceive aerial surveillance systems (Lonergan, 2024). Integrating AI into these techniques can improve the ability to detect and respond to jamming threats, providing more effective and accurate solutions. For example, AI can analyze jamming signals and automatically adjust radar frequencies to avoid interference (Erskine & Miller, 2024).

Integrating radiolocation with other surveillance systems, such as IoT and big data, can create a complete and accurate picture of the airspace. This integration allows for better coordination and real-time response to air threats, thus improving the security and efficiency of military

operations (C4ISRNET, 2025). For example, IoT sensors can collect real-time data about flight conditions and aerial activities, and big data can analyze this information to identify trends and behavior patterns of aerial objects. This will allow officers to make informed decisions and respond quickly to emerging threats (Lin-Greenberg, 2023).

Simulators and virtual reality (VR) can be used to train students in the use of radar systems and in the application of jamming and counter-jamming techniques. These technologies allow students to experiment with realistic scenarios and develop their practical skills in a controlled environment. For example, aerial surveillance simulators can recreate complex and unpredictable flight conditions, allowing students to practice their aerial object detection and tracking skills (Horowitz & Lin-Greenberg, 2022). VR can provide an immersive experience, allowing students to train in field-like conditions.

Remote support and the government cloud can facilitate access to educational resources and technical support for students and instructors. For example, instructors can provide remote support and training using advanced communication technologies, and the government cloud can store and secure educational and operational data (Goldfarb & Lindsay, 2022). It will enable more effective collaboration between different military and educational institutions and facilitate rapid access to essential information and resources. Remote support can include online training sessions, consulting and technical support, allowing students to benefit from the expertise of specialists regardless of their location.

Artificial intelligence (AI) can play an important role in improving aerial surveillance through radiolocation. Machine learning and deep learning algorithms can quickly and efficiently analyze the data collected by radar systems, identifying aerial objects and providing real-time

decision support (Ersine & Miller, 2024). For example, AI can detect and track aerial objects with increased accuracy, predict their trajectories, and provide recommendations for defensive or offensive actions. The integration of AI into radiolocation will enable more efficient and accurate aerial surveillance, improving the ability to respond to aerial threats.

By integrating these emerging technologies into military education and radiolocation aerial surveillance, future military personnel will be prepared to face the technological and strategic challenges of the 21st century. In the following chapters, we will explore in detail how AI can improve radiolocation and how these technologies can be integrated into military education to prepare future military personnel for future challenges.

5. Artificial Intelligence in Higher Military Education

Artificial intelligence (AI) has huge potential in transforming higher military education. From data analysis to realistic simulations, AI can significantly improve learning and training (Flournoy, 2023). In this chapter, we will explore how AI can be integrated into higher military education to prepare future military personnel for the technological challenges of the 21st century.

AI can be used to develop advanced simulations that provide students with realistic and interactive scenarios. These simulations allow students to learn and adapt to complex situations in a controlled environment (Goecks & Waytowich, 2024). For example, AI-powered simulations can recreate combat scenarios, aerial surveillance missions, and other military operations, allowing students to develop practical skills and improve their ability to make quick and informed decisions. These simulations can be customized to meet the individual needs of students, giving them the opportunity to learn in a way that is

tailored to their learning style (Horowitz & Lin-Greenberg, 2022).

Machine learning algorithms can help identify the most effective methods of training and personalize courses for each student's needs. AI can analyze student performance and provide recommendations for improving the learning process (Goldfarb & Lindsay, 2022). For example, AI can identify students' strengths and weaknesses and suggest additional educational resources or practical exercises to improve their performance. This allows instructors to customize training programs and provide individualized support to each student.

AI can also be used to develop decision support systems that help officers quickly and accurately analyze available information and make informed decisions in critical situations. These systems can analyze data collected from various sources, such as radar systems, IoT sensors, and other surveillance systems, and provide recommendations for defensive or offensive actions (Erskine & Miller, 2024). For example, an AI-based decision support system can analyze air surveillance data and identify potential threats, providing officers with accurate and real-time information to make quick and effective decisions.

Integrating AI into higher military education can also improve the process of evaluating student performance. AI can analyze performance data and provide detailed and objective feedback, helping students understand their strengths and weaknesses and improve their skills. For example, AI can evaluate students' performance in simulations and practical exercises and provide recommendations for improving them. This allows for a more accurate and objective assessment of student performance and helps to identify needs for further training.

AI can also be used to develop adaptive learning systems that provide students with personalized educational resources and practical exercises tailored to their individual

needs. These systems can analyze student performance and adjust educational content based on their progress (Rashid et al., 2023). For example, an AI-based adaptive learning system can provide students with additional exercises in areas where they need improvement and adjust the difficulty level of the exercises according to their performance. This allows for more effective and personalized learning, tailored to the needs of each student (Goecks & Waytowich, 2024).

AI can also play an important role in developing officers' command and control skills. For example, AI can be used to develop command and control simulations that allow officers to practice their decision-making skills and coordinate military operations. These simulations can recreate complex combat scenarios and provide officers with the opportunity to develop their command and control skills in a controlled and secure environment (Horowitz & Lin-Greenberg, 2022). AI can analyze officers' performance in these simulations and provide detailed feedback and recommendations for improving their skills.

The integration of AI in higher military education is not only a technical necessity, but also a strategic one. AI offers significant opportunities for improving military training and readiness, enabling the development of more effective and personalized training programs. By taking a proactive approach in integrating AI into the higher military education curriculum, military institutions can ensure that future military personnel will be prepared to meet the technological and strategic challenges of the 21st century.

Thus, it can be concluded that AI has the potential to transform higher military education, offering advanced solutions for simulations, decision support, evaluation and adaptive learning. Integrating AI into higher military education can enable the development of a modernized and personalized curriculum that prepares officers for future challenges. In the next

chapter, we will explore in detail how AI can be used to improve aerial surveillance and how these technologies can be integrated into higher military education to prepare future military personnel for future challenges.

6. Synergy between Emerging Technologies and Higher Military Education

The integration of emerging and disruptive technologies in higher military education is not only a technical necessity, but also a strategic one. These technologies offer significant opportunities for improving military training and readiness. Emerging technologies such as artificial intelligence (AI), blockchain, the Internet of Things (IoT), virtual reality (VR) and augmented reality (AR), big data and the government cloud can transform the way officers are prepared for the technological challenges of the 21st century (Rashid et al., 2023). Integrating these technologies into the curriculum of higher military education can provide students with the tools to develop advanced aerial surveillance strategies and respond effectively to emerging threats.

An example of good practice is the use of AI-based simulations in military exercises. These simulations can recreate complex combat scenarios and military operations, allowing students to develop practical skills and improve their ability to make quick and informed decisions (Goecks & Waytowich, 2024). For example, aerial surveillance simulations can allow students to practice their aerial object detection and tracking skills, providing them with the opportunity to learn in a controlled and safe environment.

Blockchain can be used to ensure the security and transparency of educational and operational processes. For example, blockchain can be used to create secure and immutable records of students' academic performance, thus ensuring that data cannot

be altered or falsified (Laux et al., 2024). Additionally, blockchain can facilitate the secure sharing of information between different military and educational institutions, improving collaboration and knowledge sharing (Kreps & Wallace, 2023).

The Internet of Things (IoT) can facilitate real-time data collection and analysis for more effective preparation. Connected devices can provide valuable insights into student performance and help monitor and improve educational processes (Goldfarb & Lindsay, 2022). For example, IoT sensors can be used to monitor training conditions and adjust training programs according to individual student needs. This allows for a more personalized and efficient training, adapted to the needs of each student.

Virtual reality (VR) and augmented reality (AR) can create immersive simulation environments that allow students to experience realistic combat scenarios and develop their skills in a safe and controlled way. For example, VR can be used to simulate complex aerial surveillance missions, allowing students to practice their aerial object detection and tracking skills (Kreps & Wallace, 2023). AR can provide additional real-time information overlaid on top of the real environment, helping students make more informed decisions and improve their performance.

The use of big data and predictive analytics can provide valuable insights into student learning trends and patterns. These technologies can help identify students' strengths and weaknesses, allowing instructors to customize training programs to meet individual needs. For example, predictive analytics can predict student performance in different training scenarios and adjust training programs accordingly (Meclea et al., 2024). In addition, big data can be used to monitor and evaluate the effectiveness of different training methods, helping to continuously improve the curriculum of higher military education.

The government cloud can facilitate the storage, processing, and securing of educational and operational data, providing scalable and efficient IT solutions (ADR, 2025). It will enable quick and secure access to educational resources and facilitate collaboration between different military and educational institutions. For example, the government cloud can store student performance data and provide secure access to this information for instructors and administrators, thereby improving the management and evaluation of academic performance.

C4ISR (Brett, 2020) is a set of integrated technologies and systems that allow military forces to collect, process, and distribute information essential for decision-making. In higher military education, C4ISR can improve the coordination and efficiency of operations by providing students with access to real-time information and advanced analysis tools. The integration of C4ISR into the curriculum of higher military education will allow the development of command and control skills, as well as surveillance and reconnaissance capabilities, essential for the success of modern military missions (Lockheed, 2025).

By taking a proactive approach in updating the curriculum and continuously investing in emerging technologies, higher military education can become a leader in preparing officers to successfully address the technological and strategic challenges of the future. The integration of these technologies into military education will allow the development of a modernized curriculum, which will prepare officers for the technological challenges of the 21st century.

In essence, the synergy between emerging technologies and higher military education offers significant opportunities for improving military training and training. By taking a proactive approach and continuously investing in these technologies, military institutions can

ensure that future military personnel will be prepared to meet the technological and strategic challenges of the 21st century. In the following chapters, we will explore in detail how AI can be used to improve aerial surveillance and how these technologies can be integrated into higher military education to prepare future military personnel for future challenges.

7. Conclusions and Recommendations

The technological revolution offers immense opportunities for higher military education. Integrating advanced radiolocation and artificial intelligence (AI) into the curriculum not only improves the quality of education but also prepares officers to face future challenges. In previous chapters, we explored various emerging technologies and their impact on military education. In this chapter, we will summarize the main conclusions and provide recommendations for the effective implementation of these technologies.

The integration of emerging technologies, such as AI, blockchain, IoT, VR/AR and big data, contributes to the creation of a modern and efficient educational environment. AI provides real-time decision support and training personalization through advanced simulations and machine learning algorithms. These technologies allow students to quickly adapt to complex situations and develop their practical skills in a controlled environment (Lushenko & Sparrow, 2024).

Blockchain ensures the security and transparency of educational and operational processes, protecting sensitive information and facilitating the secure sharing of data between institutions. The Internet of Things (IoT) facilitates real-time data collection and analysis, improving the monitoring and adjustment of training programs according to the individual needs of students (Goldfarb & Lindsay, 2022). Virtual reality (VR) and augmented reality (AR) create immersive simulation environments for

realistic training, allowing students to experience combat scenarios and develop their skills in a safe and controlled way. Big data and predictive analytics provide valuable insights into student learning trends and patterns, allowing for personalization of instruction and continuous improvement of the curriculum (Lonergan, 2024). The government cloud provides scalable and efficient IT solutions for storing, processing, and securing educational and operational data (ADR, 2025).

Airborne radiolocation surveillance benefits significantly from these emerging technologies. The integration of AI into radar systems allows for the rapid and efficient analysis of collected data, providing real-time decision-making support and improving the ability to respond to aerial threats (C4ISRNET, 2025). Jamming and counter-jamming techniques, using AI, improve the efficiency and accuracy of radar systems (Lockheed, 2025). The integration of radiolocation with IoT and big data creates a complete and accurate picture of the airspace by integrating data collected from various sources, improving coordination and real-time response to air threats.

Student training and assessment are also improved through the use of these technologies. Advanced simulations develop realistic and interactive scenarios for students, allowing them to learn and adapt to complex situations in a controlled environment. Student performance evaluation is optimized by using AI to analyze performance data and provide detailed and objective feedback, helping

students improve their skills. Adaptive learning systems provide tailored educational resources and practical exercises tailored to students' individual needs.

Recommendations for the effective implementation of these technologies include taking a proactive approach in updating the curriculum to include the latest technologies and practices in the military field. Continued investment in emerging technologies is essential to maintain a high level of readiness and efficiency in military education (Erskine & Miller, 2024). Also, developing partnerships with leading institutions and organizations in the technological and military field is very important to facilitate the exchange of knowledge and resources. Providing continuous training for officers, so that they are up to date with the latest technological developments and can apply this knowledge in practice, is also vital. In addition, the implementation of a system of constant evaluation and improvement of educational programs will respond to the changing needs of students and the military field.

By adopting these recommendations, higher military education can strengthen its leadership position in preparing officers to successfully address the technological and strategic challenges of the future. The integration of advanced radiolocation and artificial intelligence into military education will ensure that officers are prepared to handle new technological challenges and opportunities, thus contributing to the security and effectiveness of military operations.

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