

AI - Driving Change Toward a Data-Centric Chemical Corps

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Artificial intelligence (AI) has been rapidly developing over the past few years, radically changing how we interact, plan, and leverage technology in our everyday lives. The latest National Defense Strategy¹ outlines the role of AI in building enduring advantages by leveraging commercial market capabilities and implementing trusted AI platforms in the force. With the increased deployment of AI throughout the Department of Defense (DOD), the U.S. Army Chemical Corps stands to gain a vital resource across formations and components at the tactical, operational, and strategic theater levels.

AI

AI is a field of computer science that enhances the simulation of intelligent behavior by computer systems.² Breakthroughs and rapid iteration have brought AI-enabled services and products with incredible capabilities to market. Although the parameters of AI are extensive, its components are applied in everyday life. And AI is here today. Examples include the use of Global Positioning System navigation for determining best routes, the use of a chat box with an AI avatar for interaction on a website, and the use of historical data to create solutions to crucial problems. These military-adjacent capabilities are beginning to be used across DOD.

AI is a field with subsets that are working tangentially or individually. The two most common subsets are data analytics and machine learning. To fully utilize and integrate emerging AI technology, we must expand and iterate on implementing AI in critical domains of the Chemical Corps. The Soldier and, ultimately, the commander are still the key lynchpins in the decision-making process.

Humans serve as the decision point in the four-step cycle known as the observe-orient-decide-act (OODA) loop,³ a concept developed by U.S. Air Force Colonel John R. Boyd; in a sense, AI is an enabler. The OODA concept has driven a great deal of strategic thought and planning regarding how combat operations evolve to win the fight. As DOD continues iterations of emerging AI technology, more of our systems and processes will become automated, underscoring how rapidly AI has been and will continue to be developed. Endeavors of complete autonomy using AI are still being researched and show promising results.

AI Today

DOD has begun implementation of AI in aircraft, and the upcoming Chemical Corps Tactical Contamination

Mitigation System is currently in development. The integration of AI in aircraft has improved detection and aided in the targeting process via the Air Force “kill chain”⁴ by linking data and processing it through the Air Force-distributed Standard Ground System, which is spread across the globe. The Tactical Contamination Mitigation System will use unmanned ground vehicles to conduct assessments and apply decontaminants. These AI-enabled features will classify potential contamination and decontaminate the area without the need for Soldiers. These combined features will reduce the requirements for manpower and resources, which can then be applied elsewhere in the fight. However, Service-specific applications are only one use of AI.

An AI-enabled joint force would offer an incredible suite of tools to aid in warfighting functions across multidomain operations. This article discusses how chemical, biological, radiological, and nuclear (CBRN) planning and operations can be aided by AI integration in the land and air domains and the physical, information, and human dimensions. With the focus on large-scale combat operations (LSCO), contested and challenged environments are to be expected. AI enablement can reduce the overhead of planning and resource requirements while increasing the speed with which warfighting functions take place across the operational environment.

Future Vision of AI in CBRN

As the Army pivots its efforts in modernization and doctrine for LSCO, so too must adaptations be made to the tools that enable warfighters to correctly execute their tasks faster and with as much context as possible. The ability to pivot as the battle ensues will rapidly and exponentially propagate from the Soldiers on the ground to the corps headquarters. At these critical levels, we envision an integration with AI and we highlight the positive impact on our Dragon Soldiers.

In terms of CBRN staffs at the battalion and brigade levels, AI could be utilized to promote faster reporting systems, both on the sending and receiving ends. For example, AI-enabled software could be used to quickly generate CBRN reports based on data collected at the edge of the fight, highlighting the concept of Soldiers as sensors and integrating it to produce a common operating picture at the tactical level. A CBRN warning order could also be generated based on information received from a

higher echelon. Such a two-way, integrated communication scenario would be beneficial at the edge of the fight, where the speed of information transmission is critical to success in CBRN-contaminated environments.

Additionally, AI-enabled software could be used for early detection, allowing for faster responses to CBRN threats. For CBRN staff planning at battalion and brigade levels, a quicker detection rate for CBRN threats would result in faster countermeasures and more timely protection against imminent threats. The “every Soldier as a sensor concept” could be combined and implemented with unmanned aerial systems/unmanned ground vehicles, alongside traditional standoff detection equipment. Thanks to the machine learning capabilities of AI, CBRN threats could be accurately identified and assessed. The resources and logistics necessary for commanders to make precise decisions about overcoming any CBRN threat could be generated.

From warning and reporting to sensing at the edge of the fight, AI could—through speed, accuracy, and context—enhance the data throughput of our Soldiers at the tactical level. Together, these ideas and concepts could improve the relevancy of data to commanders, rendering them better informed and better able to efficiently fight and win in CBRN-contaminated environments.

But the Regular Army makes up just one-third of our branch. The U.S. Army Reserve and the Army National Guard also stand to gain an immense opportunity with this emerging technology. One of the major struggles for the U.S. Army Reserve is the maintenance of vehicles because they are not operated or serviced as often as their Regular Army counterparts. The use of AI to help identify upcoming maintenance requirements and issues would save time and money by placing the focus on vehicles and equipment, thus improving response time for deploying units. This data-focused approach would also enable better integration beyond the Chemical Corps. AI—specifically, data analytics—could be integrated to keep track of equipment capabilities and status and to monitor future maintenance impacts based on current service plans. Tying this data-centric approach to the radiological/nuclear side of CBRN, the software could further be used to record the radiological exposure of Soldiers on the line to ensure accurate adherence to operational exposure guidance limits. This is crucial when conducting operations through the U.S. Army National Guard and partner agencies in support of homeland defense.

The deployed area of operations can have a negative effect on the sending and receiving of reports and updates. Critical reporting requirements are sometimes delayed due to network issues. AI could be integrated to send real-time status reports to higher headquarters by automatically switching to the best network for use and updating the latest data stream. This concept has begun to make its way to software-defined radios being tested today.⁵ A conceptual implementation might consist of a CBRN sensor, such as an Internet of Things (IoT)TM device, attached to the tactical network and dispersed over the area of operations to sense for CBRN agents. When a possible threat is detected, a check of surrounding sensors combined with live data from a Soldier could indicate a CBRN threat. A warning could then

be sent via the best pathway, as dictated by the algorithm, to reach the proper echelon as quickly as possible. Through this implementation of continuous integrated delivery, live data streams could be horizontally injected so that all stakeholders would be aware of the situations across their formations.

As the Army transitions to the LSCO fight, the Chemical Branch also stands to gain sustainment efficiencies. Effectively managing dispersed personnel and resources is vital in maintaining sustained land operations. AI can be used to continuously assess information to improve mission analysis, providing commanders with the capability to anticipate personnel requirements related to the Soldier-as-a-sensor concept and informing higher echelons of accurate operational capabilities. Implementing AI to continuously monitor all Soldiers would improve interoperability throughout all echelons, enhancing CBRN warfighting functions. These AI capabilities would transform the ability of commanders to access critical information, allowing them to strengthen the management of resources and dispersed CBRN units.

The link between the hazard assessment platoons, the chemical company, and the battalion is key to framing the use of this new technology. Adopting AI at the hazard assessment platoon level while a team is downrange would potentially reduce time on target for dismounted operations and would help the overall mission go smoother. Employing capabilities that make our jobs less stressful while also reducing the risk to Soldiers is a winning combination.

The envisioned software could help identify precursors and agents studied in secure research laboratories and assist in narrowing possible chemical threats. This would increase the lethality of our Soldiers and decrease the time spent wearing the self-contained breathing apparatus (SCBA). A stream of data obtained from Soldiers and unmanned vehicles, coupled with incident command post software, could enable faster real-time threat assessments at the tactical and theater levels. The data stream could also be integrated with CBRN vehicles, providing wider reconnaissance of possible contamination. This would decrease the burden on higher-echelon CBRN experts by providing real-time data and analytics of potential threats.

Another way that AI technology could help the Chemical Corps evolve and modernize is through the use of the software to establish a data-focused incident command post. Integrating AI with sensors could help establish faster team and equipment monitoring and measurement of hot and cold zones. In conjunction with the possible integration of AI into incident command post software, AI could also be integrated into existing hardware, automating the monitoring of variables that Soldiers typically observe, such as wind directions, humidity, and other environmental factors. Automating the monitoring of these variables would lead to faster time on target to confirm or deny the presence of CBRN threats.

Conclusion

With the ever-increasing evolution of AI, we must, as a Corps, seize the opportunity by integrating AI capabilities
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qualities. The ability to convince others that CBRN support is essential maintains and increases CBRN relevancy. Sometimes, the title of warrant officer is not enough and 740As must be able to articulate the precise value of CBRN units and explain what CBRN technicians bring to the fight. Extending influence is dependent upon listening, building connections, developing oneself, and integrating into the needs of the unit.

While stationed in Korea, 740As have established relationships with a multitude of units across the Korean Peninsula. CBRN technicians in Korea often participate in monthly warrant officer professional development briefings to network and engage their counterparts in other MOSs; this assists with posturing unit readiness if it becomes necessary to “fight tonight.” Understanding the organization allows for the building of trust among each for the betterment of all.

Teamwork

Lastly, teamwork is the foundation that has been set for the CBRN warrant officer cohort. The more CBRN technicians can collaborate toward a common goal, the more efficient and effective they are. As new warrant officers still testing the waters and finding our way, we have become integrated into a Family, with members who have each other’s best interest in mind. This cohort is diverse, constantly facing new hurdles and working to grow. Success hinges on group collaboration and team effectiveness—and on never needing to recreate the wheel but, rather, building on the foundation that has been set.

Join us; you will not regret it! What a difference a year makes!

We All We Got! (#WAWG)



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and becoming leaders in AI-enabled operations. The visions presented in this article include a variety of concepts that can be used to work toward a solution to problems as we pivot to the LSCO fight and continue to modernize the Army of 2030.

In addition to the benefits of AI for our warfighting functions, our U.S. Army Reserve and Army National Guard Soldiers and formations stand to gain capabilities in the field of homeland defense. The cases discussed in this article offer a glimpse into the likely future of the Chemical Corps at various levels of multidomain operations. AI is here, and it is continually iterating. We must innovate now in order to overmatch, fight, and win in any operational environment.

Endnotes:

¹2022 *National Defense Strategy*, U.S. Department of Defense, 27 October 2022, <<https://www.defense.gov/News/Releases/Release/Article/3201683/department-of-defense-releases-its-2022-strategic-reviews-national-defense-stra/>>, accessed on 10 April 2023.

²Darrell M. West, “What Is Artificial Intelligence?” *Brookings*, 4 October 2018, <<https://www.brookings.edu/research/what-is-artificial-intelligence/>> accessed on 10 April 2023.

³Gary Olson, “Keeping the Human in the OODA Loop,” *Federal Times*, 31 October 2022, <<https://www.federaltimes.com/management/2022/10/31/keeping-the-human-in-the-ooda-loop/>>, accessed on 5 April 2023.

⁴David Hambling, “Artificial Intelligence is Now Part of U.S. Air Force’s ‘Kill Chain,’” *Forbes*, 28 October 2021, <<https://www.forbes.com/sites/davidhambling/2021/10/28/ai-now-part-of-us-air-force-kill-chain/>>, accessed on 10 April 2023.

⁵Jon Harper, “Military, Industry Gung-Ho on Software Defined Radios,” *National Defense*, 15 February 2019, <<https://www.nationaldefensemagazine.org/articles/2019/2/15/military-industry-gung-ho-on-software-defined-radios>>, accessed on 10 April 2023.

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