Taking off from an undisclosed location 25 April 2021, the 332nd Air Expeditionary Wing blazed new trails when they configured six F-15E Strike Eagles to carry extra bombs to bare base locations. This new configuration allows the U.S. Air Force to increase combat capabilities by carrying more munitions than the F-15E can use on one mission for storage on small, dispersed operating bases. (Photo by Tech. Sgt. Paul Duquette, U.S. Air Force)

Artificial Intelligence and Agile Combat Employment

Lt. Col. Benjamin "Buzz" Hagardt, U.S. Air Force

In 2018, the U.S. Secretary of Defense published the *National Defense Strategy* (*NDS*), signifying a strategic reawakening for the United States in which the primary concern to national security is "the *reemergence of long-term, strategic competition* by … revisionist powers."[1] Russian and Chinese military modernization efforts have shifted the global security environment, displacing the United States as the uncontested or dominant superpower of the world.

Among many lines of effort, the *NDS* calls for developing a more lethal, resilient, and rapidly innovating force capable of dynamic employment and unpredictable operations that will challenge adversary decision-makers.[2] The threats presented by enemy weaponry, pervasive surveillance technology, and cross-domain long-range fires have motivated the U.S. Air Force (USAF) to apply its operational resiliency framework to the new scheme of maneuver called *agile combat employment* (ACE).[3] This posture of resiliency enables the ability to deploy our forces using small, dispersed, and adaptive basing techniques to survive and operate in all domains.[4]

The *NDS* also calls for rapid innovation in advanced autonomous systems, including artificial intelligence (AI) and machine learning (ML).[5] China declared its intent to be the world leader in AI by 2030, investing hundreds of billions of dollars to apply AI across the range of military decision-making, deductions (e.g., wargaming), and defense equipment.[6] Opposing this Chinese threat, the 2018 *Department of Defense* [DOD] *Artificial Intelligence Strategy* outlines the intention of the United States to use AI-enabled information systems to create agile and resilient logistical systems that empower our military leaders.[7] These initiatives, while in their early stages, present opportunities to prepare for strategic employment as the technology matures. Commercial businesses have already proven to be the leading edge of AI innovation and strategic integration. Leveraging their success could serve as the military's pathway to dominating the "intelligentized" battlefield of the future.

ACE and AI Integration Vignette

Imagine the United States is involved in a contingency operation during which escalations in force are imminent. Over several months, senior leaders have utilized AI and ML systems to assess enemy movements and design a countering force structure to respond. Main operating bases (MOB) and contingency locations (CL) are designated, and military big data sources report the availability of resources and optimal delivery methods in that theater of operations. Air operations directives and commander's intent are published, allowing the AI to make suggestions on how to apply airpower to achieve objectives. Commanders select and approve a course of action that orders the posturing of assets and support equipment to those locations to prepare for ACE operations.

Enemy targets are identified to be struck by friendly forces with precision weapons in the next twenty-four hours. The ACE logistics engine processes the desired effect, knowing what aircraft and munitions are available, pairing specific aircraft based on weapons load, proximity to the target, and follow-on missions. Meanwhile, additional algorithms are calculating the impacts of weather around the target area and the availability of other assets that could be retasked to that assignment if the paired asset was destroyed. This information is being "pushed" proactively to decision-makers rather than waiting for assessments to be requested.

The threat engine calculates potential enemy responses that could either preemptively destroy the friendly paired aircraft before takeoff or while flying to the mission area. The threat database contains extensive information on the known enemy aircraft (e.g., types, numbers, weapons, locations, combat radius, historical flight patterns, pilot proficiency, day/night

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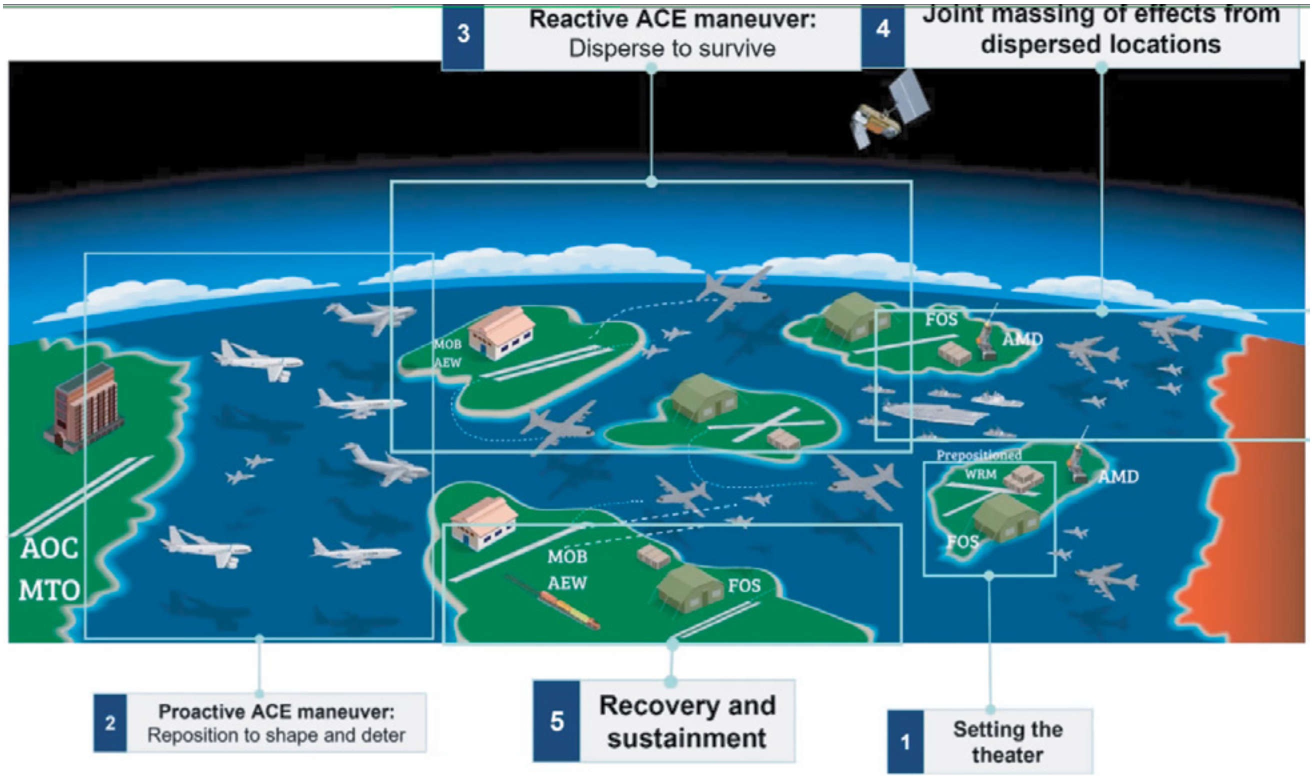


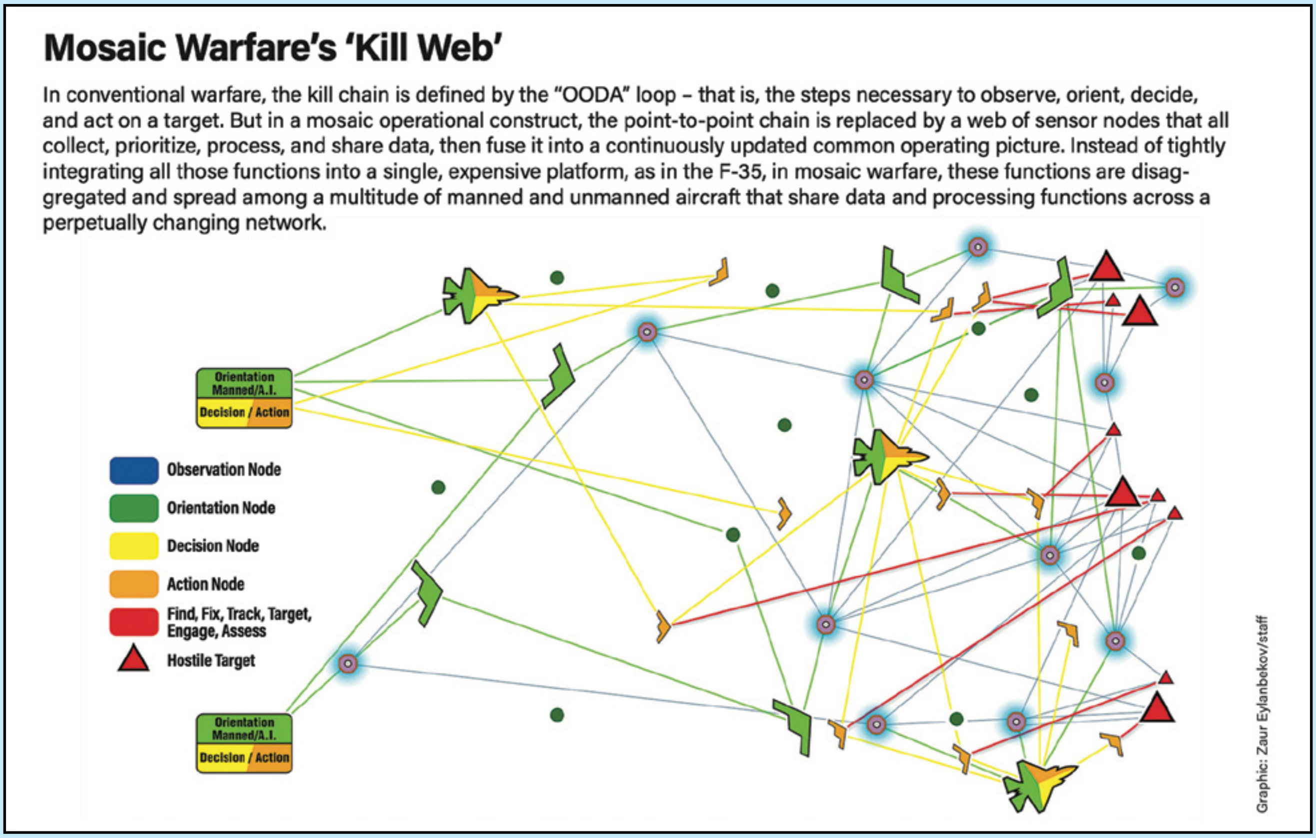
A screen capture from a 15 December 2022 U.S. Air Force online briefing outlines the Agile Combat Employment concept using a simulated scenario with illustrative phases demonstrating decentralized control by dispersing pared-down forward-deployed command-and-control elements over a broad geographical region. Decentralized control mitigates the threat of entire networks of operational control being dramatically degraded or eliminated entirely. The ability to operate, sustain, defend, and project power will be reshaped as new connectors and different ways of using aviation assets, including expanded reach from leveraging seabasing, drive both force redesign and operations innovation for force distribution and integration. (Public affairs video by James Self, U.S. Air Force)

limitations) and surface-to-air weapons that could intercept the strike package. When it merges this information together, the AI system recommends various options based on acceptable levels of risk (e.g., low, moderate, significant, high, extreme) to the available assets. If senior leaders choose to adjust risk levels, the system will automatically adjust to include updated solution profiles and suggest new courses of action. When it anticipates the enemy response from previous attacks, the AI suggests movements of supporting assets (including supplies and delivery system) to new CLs to increase survivability.

ACE Elements with AI

ACE relies on four essential themes: agility, posture, protection, and joint all-domain command and control (JADC2). These themes are further applied to our forces through five core elements: posture, command and control, movement and maneuver, protection, and sustainment.[8] ACE distributes assets and support resources among forward operating bases with decentralized control to ensure survivability and limit adversary disruption. This prevents the elimination of central hubs that would cripple entire networks of operations.

The comparison of e-commerce AI to ACE is relevant because business marketing involves performance relative to another competitor with complex networks of relationships composed of allies and adversaries. ACE and e-commerce logistics share similar challenges and benefit from the same technological advantages. Although this framework can be applied to how support equipment might reach friendly forces facing a peer global power adversary (similar to packages reaching customers), it can also be thought of in terms of delivering kinetic or nonkinetic effects (e.g., bombs or electronic attack jamming) to specific targets like enemy troops or weaponry.



(Graphic by Zaur Eylanbekov, courtesy of *Air & Space Magazine*)

Agile combat employment distributes assets and support resources among forward operating bases with decentralized control to help create a "Kill Web" in operations against adversaries that also limits adversary disruption of command and control and fosters base survivability.

ACE Posture with AI

The posture element of ACE establishes the starting positions from where operations will take place, creating strategic predictability and operational fluidity. Initial actions redistribute theater-assigned assets and follow-on forces from MOBs to optimal forward CLs for mission execution. These CLs can either be preplanned or ad hoc based on the threat environment and tasking requirements. This large network of flexible and multiplatform-enabled bases must also be able to support entire mission sets (e.g., refueling operations), not just specific aircraft types (e.g., KC-10 or KC-135 tankers). This complex planning and decision-making process can benefit from the application of ML techniques. The same algorithms that analyze e-commerce suppliers within smart production and supply chain management can assist in selecting ideal locations to operate military activities from. These criteria could include dozens of factors such as runway conditions, geography (e.g., distance to friendly/enemy forces or relation to priority objectives), vulnerability to attack, existing supply inventories and resupply options, means of communication, and life support capabilities (e.g., medical treatment, food, shelter).

To maximize the effectiveness of these algorithms, vast data sources similar to the big data framework that e-commerce uses are required. The combination of existing military information systems (e.g., Defense Readiness Reporting System, Deliberate Crisis Action Planning and Execution Segments, Logistics Module), civilian networks, internet-of-things technology, and sharing agreements with allies or partner nations would satisfy the critical component allowing the ML process to filter, sort, and group decision-making criterion for ACE. ML algorithms could also assist with CL selection by grouping them into categories of primary, alternate, contingency, emergency options for increased planning flexibility. Armed with this information, senior

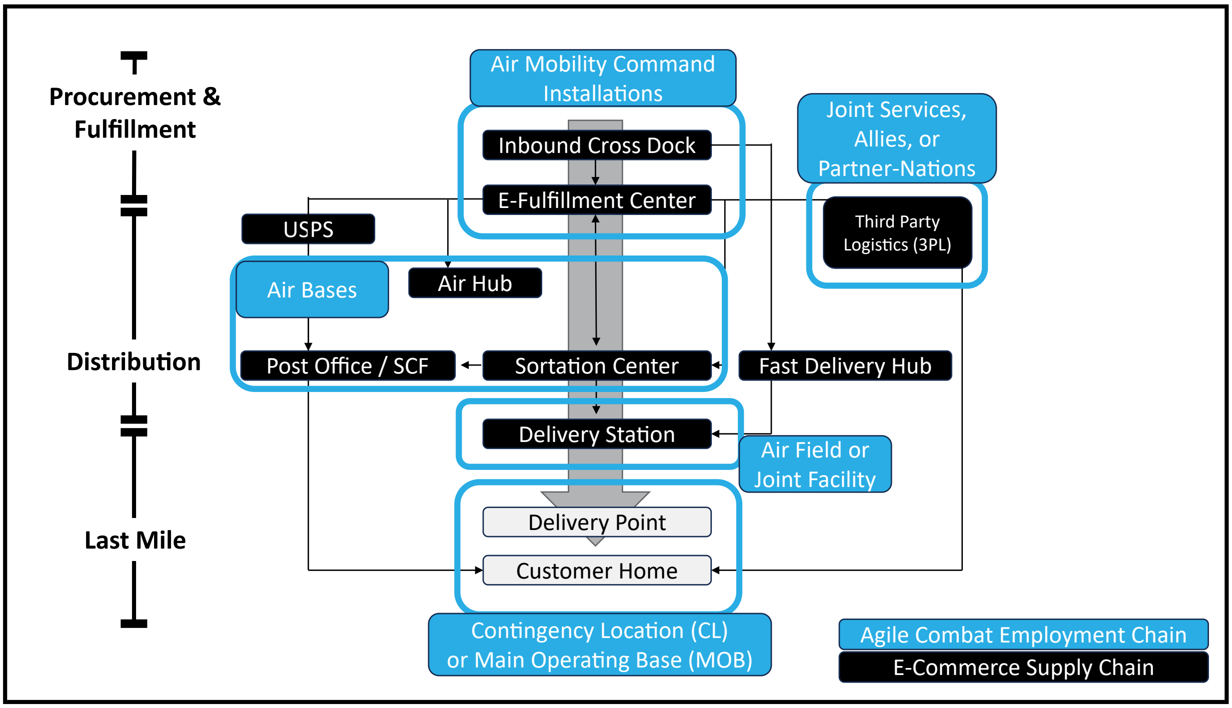
An aircrew from the 489th Attack Squadron performs preflight safety checks before initiating the automated takeoff and loading capability for an MQ-9 Reaper at Creech Air Force Base, Nevada, 3 August 2021. Advanced technological developments in the use of drones and employment of artificial intelligence facilitate decentralized command and control of operational platforms. (Photo by Staff Sgt. Omari Bernard, U.S. Air Force)

Air Force leaders can help shape the needs of their forces by determining the demand signal for resources and awareness of what is readily available.

ACE Posture with AI Supply/Demand Forecasting

The enabling support forces required to meet the demands of ACE operations are referred to as agile combat support (ACS). The ACS community is undergoing a similar transformation to this new adaptive mindset, exploring ways to shift from MOBs to CLs and platform-agnostic support methods. Since the mid-1990s, the Expeditionary Aerospace Force concept has leveraged forward-based equipment to organize combat power into leaner deployment packages called *unit type codes* (UTCs).[9] These predefined package UTCs of personnel and equipment offered commanders the ability to ask for specific capabilities and quantities of aircraft or supporting assets. Although this created easier human-based planning, it also increased the likelihood of perceptual oversights, personal biases, and human error resulting in force shortages or wasted oversupply.

AI ML systems, similar to Google's DeepMind, offer creative solutions by generating predictive figures to discern future resource needs and automatically assemble equipment packages tailored to meet those force requirements.[10] This could replace legacy UTCs and extensive inventory stockpiles, saving money on hidden storage expenses while optimizing supply inventories. In the event certain supplies are not available via organic military sources, the algorithms can expand search criteria to include compatible civilian equivalents or that of our partner nations and allies. Furthermore, any resource gaps or emerging requirements identified during this process would be reported to decision-makers to immediately invest into production contracts. The urgency of the requirement would determine whether the request for proposal would follow standard contracting channels or emergency selection by military council based on AI



(Figure by author; modified from Jean-Paul Rodrigue, "The Distribution Network of Amazon and the Footprint of Freight Digitalization")

Figure. E-Commerce Supply Chain of Amazon (*in black*) with Agile Combat Employment (*in blue*) Comparison

trend analysis of performance histories, relatability to existing contracts, and total cost. New design prototypes would be run through ML simulations and predictive analytic tools to solve design flaws long before they enter mass production for warfighter implementation.

These advantages also enable the command-and-control and protection ACE elements by ensuring self-protection and communication equipment are sourced and available. The longer these ML techniques are utilized, the more accurate their data becomes. This enables solution recommendations for anticipated issues from historical analysis and give leaders more time to make decisions. Once these UTC packages are configured, their positioning relative to other MOBs and CLs becomes just as critical as their content.

ACE Maneuver and Movement with AI

The maneuver and movement element of ACE seeks to outpace an adversary by consistently moving to fight from positions of advantage. This requires forces to flow between dispersal bases (e.g., MOBs to CLs, between CLs, and back to MOBs) to increase survivability or mass forces for strategic objectives. AI-based systems have proven invaluable for optimizing this sort of movement between e-commerce warehouses to sorting centers and the end-stage consumers. Amazon organizes this hierarchical supply chain process first into *procurement and fulfillment*, then *distribution*, and finally the *last mile*.[11] Procurement and fulfillment use massive cross-dock facilities (average size 855,000 sq. ft.) that transfer to hundreds of e-fulfillment centers. Distribution focuses on taking products from those e-fulfillment centers and allocating them among air hubs and sorting centers (average size 350,000 sq. ft.). The last mile involves the delivery stations (average size 91,200 sq. ft.) that take products from sorting centers to the final delivery location.[12]

The figure depicts the flow between each facility and illustrates their approach to solving an incredibly complex logistical problem set.[13] It also shows how the military could adopt a similar construct for movement and maneuver logistics through the same ML and AI systems. Large U.S. Air Mobility Command installations (e.g., Travis Air Force Base in California or McGuire

Airmen with the 35th and 55th Combat Communications Squadrons replace a feed boom on a Ranger 2400 Flyaway Multi-Band Terminal during Exercise Agile Blizzard-Unified Vision 2023 near Comox, British Columbia, Canada, 19 June 2023. The satellite dish allows for quick setup satellite communications that are necessary when operating in a semi-austere location where communications are limited. (Photo by Tech. Sgt. Betty R. Chevalier, U.S. Air Force)

Air Force Base in New Jersey) could act as ACE cross docks or e-fulfillment center equivalents. Smaller air bases outside of the United States could serve as air hubs or sorting centers with smaller airfields or joint facilities as the final delivery stations taking resources to CLs. This would involve both intertheater and intratheater transportation coordination to ensure the global deployment capabilities of U.S. forces.

ACE Maneuver and Movement with AI Distribution

Although the USAF has reduced its overseas bases from ninety-three to thirty-three since the end of the Cold War, it retains the ability to project forces through agreements with allies or partner nations to provide access, basing, and overflight.[14] The “logistics sprawl” that Amazon achieved in their distribution market can be applied to ACE basing networks. Training AI systems to identify where resources can be sent to directly support CLs will enable them to reduce distribution costs and optimize shipping systems (i.e., the closer the supplies can get to CLs, the faster and easier it will be to receive them when requested). This also enables USAF senior leaders and logisticians to design optimal CLs in relation to these known supporting networks. Any threats that would displace U.S. forces from that CL can relocate to the alternative location within the hub-and-spoke design, creating the desired operational resiliency ACE advocates seek.

ACE Maneuver and Movement with AI Delivery

The method of delivering force support materials is just as critical as its sourcing. What cannot be transported by USAF assets is either assisted by joint services or contracted out to nonmilitary companies. Considering that ACE involves global operations, both intratheater and intertheater transportation methods must be carefully planned as time-phased force deployment data. This time-phased force deployment data outlines how equipment, aircraft, and personnel will flow into an operational area (e.g., airlift, sealift, land convoy). As ACE shifts away from traditional air bases to temporary CLs, the level of complexity in successfully planning and executing operations is exponential. AI-driven third-party logistics can identify the most efficient means of accomplishing this feat (e.g., contractors, joint services, allies, partner-nations), while predicting the needs of future movements based on predetermined threat or mission profiles. In 2021, the commander of U.S. Transportation Command—responsible for providing air, land, and sea transportation to meet national security needs—supported the exploration of AI systems for the intertheater transport problem set.[15]

A machine capable of understanding the logistical requirements to move personnel, cargo, and aircraft to a forward location within a specific amount of time for an intended duration can easily determine the most efficient means of getting there. Then once these hub-and-spoke locations are established, military planners can coordinate the movement between locations to achieve mission objectives or react to enemy activities. Incorporating AI feedback systems that report degradation to the transportation scheme (e.g., enemy destruction of major bridges or obstructed waterways) would return recommendations to USAF leaders to adjust the method of transportation (e.g., planned sealift updated to airlift). Generally, a short-notice change to these transportation plans would incur a significant amount of strain on logisticians to reproduce load plans while addressing cascading delays for follow-on shipments. However, training ML models to recognize the loading dimensions, weight, and characteristics of that cargo can enable machines to automatically reflow the transportation plans to available aircraft down to the exact airworthiness inspection requirements needed to load the equipment.

For intratheater travel, training ML systems to recognize the best access methods of CLs is critical. With limited airfields available in dynamic areas, vertical takeoff and landing vehicles such as the CV-22 Osprey or HH-60 Pave Hawk are ideal but can only transport small amounts of cargo and personnel. However, if these same AI systems process the duration for how long each CL requires support, the algorithms can account for this and tailor the supply delivery plan accordingly.

Loss of friendly forces from mishaps and enemy attack is a reality to be expected from warfare with China or Russia. AI tracking of fluctuating aircraft inventories will provide senior leaders with data to adjust strategic movements or know when to request additional support from allied forces. Conversely, ML and AI systems applied to allied or partner-nations would also assist in predicting when those forces would need U.S. intervention or assistance.

ACE Sustainment with AI

The foundation of the entire ACE framework rests upon the ability to continue operations through sustainment. In the face of overwhelming adversity, contested domains, and extreme distributed mission operations, innovative solutions are required to ensure resources are proactively maintained to fight tomorrow's battles. AI and ML integration enables the level of information superiority required to meet the complex logistical demands of ACE while bolstering joint force capabilities. Current UTC packages are staffed and supplied with enough resources to operate for thirty days until further support is required and sustainment begins.[16] However, that model was designed for continuous operations from established air bases, where long-standing support infrastructure and protection is assumed to be available. ACE breaks that mold and further challenges the logistical planning process. ACE from a CL could be as short as twenty-four hours or longer than thirty days depending on the effectiveness of the supply chain and the influence of enemy threats.

ACE Sustainment with AI Supply Chain Management

Although supply chain management spans the entire logistics process, the effectiveness is largely determined by two critical factors: flow of information and flow of products. Therefore, without a means of communicating the need for a product or a method of delivery, supply chain management is irrelevant. AI and ML systems enable these processes by either forecasting outcomes or identifying patterns of information that saves human decision-making time.[17] The analysis of big data and algorithms that make proactive future indicators is where machine augmented decision-making best serves ACE. This is especially true when considering the risk-management aspect capabilities of AI applied to ACE.

ACE Sustainment with AI Supply Chain Risk Management

The comparison of risk management between civilian and military domains is challenging because peacetime and wartime operations involve completely different mentalities. Although both experience routine safety hazards and equipment malfunctions, ACE "logistics-under-fire" transitions from competition to armed-conflict hostilities with another nation. In this sense, risk management has more potential applications to ACE than general commercial logistics. The ability to identify, monitor, and mitigate these vulnerabilities is paramount, lest the United States lose much more than profit margins and stock market shares. Acceptable levels of risk are decisions that senior USAF leaders are familiar with and expect from any system.

Artificial neural networks are special algorithms designed to measure complex degrees of a criteria rather than simple binary pathways. Instead of equipment being broken or functional (e.g., 0 or 1), it can be expanded to levels of "brokenness" (e.g., 0.2, least functional; 0.5, partly functional; 0.9, mostly functional). In this way, ACE can use these algorithms for detecting routine aircraft maintenance issues, analyze defects in high-failure-rate items, expedite work orders, and save the need for expensive service contracts or pricey damage repairs resulting from those breakdowns. In 2018, the U.S. Army predicted these AI systems could save up to $100 million per year by determining the most time- and cost-efficient means of transporting repair parts alone.[18]

Quality assurance machines have endless applications from assembly line equipment manufacturing to chemical warfare gear packaging, life support equipment testing, and aircraft munitions loading. Although these systems are very capable, they may not be transferable to every CL, likely reserving their pertinence for peacetime operations and training military personnel. During wartime operations, the biggest risk to U.S. forces becomes the enemy itself.

The biggest risk to U.S. forces during ACE is the adversary that operations are designed against. The ability to predict outcomes is the strength of AI and ML, enabling the resiliency to survive disruptions and attack. Applying the same artificial neural networks to a threat, but expanding parameters to variables such as size (e.g., number of units), location (e.g., airbase, ship, forward location) maneuverability (e.g., dismounted, armored vehicle, ship, aircraft), munitions (e.g., conventional munitions or electronic attack), capabilities (e.g., speed, combat radius, radar cross-section), and vulnerabilities (e.g., armor piercing rounds, small diameter bombs, precision guided munitions) allows these AI systems to learn how to pair weapons against enemy forces and calculate risk probabilities of attack or engagement results. Instead of spending hundreds of hours with dozens of intelligence analysts sifting through a myriad of metrics and designing enemy courses of action, ML techniques generate actionable information in near real-time without human biases or perceptual errors.

Conclusions

Conclusion 1. AI can be integrated into ACE operations. The results of this exploratory research demonstrated that AI can be integrated into ACE operations, particularly the elements of posture, movement and maneuver, and sustainment. This was illustrated through an evaluation framework comparison of e-commerce logistical elements supply/demand, distribution/delivery, and sustainment. These AI systems successfully integrated a mixture of supervised/unsupervised ML techniques and linear/nonlinear algorithms to augment human decision-making. As a result, companies benefited from its massive data processing, error detecting, adaptive problem solving, and predictive pattern analysis. These capabilities align precisely with the ACE Air Force doctrine note calling to transform USAF logistics systems. Air Force Doctrine Note 1-21, *Agile Combat Employment*, emphasizes the need to "push" proactive information, "anticipate limitations to standard means of distribution and transportation, and leverage an adaptive logistic system to support operations."[19]

Although this report focuses on the Air Force, successful integration would undoubtedly expand to all services. The Joint Artificial Intelligence Center (JAIC) is the primary organization responsible for refining and training these algorithms to meet component-level initiatives.

Conclusion 2. AI and ACE integration elicits numerous advantages. Integration of AI into ACE has widespread advantages beyond those discovered in this report and is likely to create compounding effects on all military operations. As the catalyst for these transformations, the advantages can be grouped into three themes: logistical resiliency, decision superiority, and financial efficiency.

Logistical resiliency is the most critical aspect of ACE's ability to prepare an area of operations, deploy forces, and maneuver forces while withstanding enemy disruptions. AI systems can collect, filter, and fuse seemingly limitless amounts of digital information gathered from every source imaginable. These data sets can forecast demand; balance supply; improve quality assurance; streamline maintenance; predict and solve problems; recycle resources; expedite resupply; and identify, manage, and mitigate risk to ensure continuity of operations.

Decision superiority is what machine augmentation offers senior Air Force leaders executing ACE through AI. Military strategist John Boyd's "observe-orient-decide-act loop" revolutionized how humans approached the battlefield decision cycle, and AI would further usher this concept into a new age. AI and ML algorithms armed with the proper data sets give leaders access to a higher number of quality information sources in near real time. These systems can identify patterns, predict outcomes, and assess risks based on historical analysis that far exceed what human cognition could perform unaided. This would enable machines to complete the cumbersome observing and orienting while freeing human military strategists to decide and act in a constantly changing environment.

The financial efficiencies gained from automation and process optimization are perhaps the most appealing advantages to budgetary defense planners. AI and ML techniques used by Google, Amazon, and others have proven to reduce waste and optimize resource recycling that eliminates hidden business costs and the manpower associated with it. As more functions of the logistical equation become increasingly automated, stakeholders can expect hundreds of millions of dollars in savings that will continue to compound exponentially. These funds can then either be apportioned to other priority projects or reserved for reinvestment back into improving equipment packages associated with ACE or AI technology.

Conclusion 3. AI integration better prepares the United States for great power competition. Integrating AI into ACE is not only possible but necessary to maintain the competitive edge over our adversaries in great power competition. China and Russia are eager to apply AI technology to improve their military weapons and infrastructure. Failing to invest time and resources toward integrating AI into USAF doctrine may leave our legacy equipment irrelevant on the battlefield, jeopardizing our national security and defense.

War cannot be won with machines alone, but it cannot be won without them.

Recommendations

Recommendation 1. Invest in DOD-owned systems, cybersecurity, and ACE case studies. Artificial narrow intelligence (designed to accomplish limited tasks) is constantly evolving but is mature enough for reliable integration into current military information systems. With thousands of ongoing private-sector research and DOD AI projects, there may already be significant advancements in these lines of effort. To successfully integrate AI into ACE, the USAF must consider investing in these technological initiatives: USAF- or DOD-owned AI algorithms, common language operating systems, and cybersecurity defense.

To develop and maintain control over military AI expansion, the USAF or DOD must use an open architecture system to allow flexibility for change without proprietary constraints. Relying on companies with strict technological patents would cripple the U.S. military's AI growth and likely be delayed by years of acquisition contract legal battles. DOD-owned open architecture ensures they are not legally tied to one company or contract and can evolve with technological breakthroughs.

With potentially hundreds or thousands of different data stream types, the AI machine will require a common language to process, interpret, and share the information for use. With dozens of current logistics programs (e.g., Defense Readiness Reporting System, Logistics Module), the central AI processor must be trained on how to understand their outputs. Not all systems need to speak the same machine language, but the central AI machine must be able to understand all the others. This paves the way for a military big data ecosystem that algorithms can use to provide effects.

The only task more important than creating this technology is defending it. Although no research was conducted to determine civilian cyber protective measures, any military integration will involve advanced classification and encryption systems. Cybersecurity is paramount considering how proficient our adversaries are in stealing intellectual properties and military patents for their benefit. The only situation worse than the AI systems being stolen is if the United States never had them in the first place, with our enemies having developed them first. A cross-domain solution to enable unclassified and classified data flow is vital; as well as having a strong defense architecture (e.g., blockchain technology) and high-capacity (e.g., high-speed 5G) networks.

Future research is required in each of these areas to determine the best way to integrate them into ACE. An important case study to consider is the 2022 invasion of Ukraine by Russian forces and their military's logistical errors. Exploring the missteps and failures of their military is critical to understanding the potential vulnerabilities of ACE and how AI can be designed to remedy them. Successful integration of AI systems into ACE will also enable its expansion to counterintelligence and threat awareness as a heightened form of risk management against strategic competitors.

Recommendation 2. Integrate AI using three distinct phases. Designing complex and sophisticated AI algorithms while integrating them into an emerging military concept is no simple task. However, the innovations pioneered by commercial companies combined with ACE doctrine in its early stages allow time to develop them in parallel. Using a phased approach, the USAF should consider dividing AI integration efforts into three phases focused on technology, processes, and assessments.

The technology associated with AI systems, algorithms, machines, and equipment must come first. It is the most challenging and lengthy task that will continue to evolve based on feedback from the other phases. The speed at which technology advances will also determine the pace of how quickly the entire program progresses. Continued partnerships with the Defense Advanced Research Projects Agency and the RAND Corporation will be vital to translating theoretical concepts into formal sciences. Human-in-the-loop automation should be the primary focus until enough trust in the AI models allow for higher levels of automation.

The processes are supported by the technology, but they also define the requirements in which the devices are built to complete. Imagine ACE as a game of chess, where the pieces are USAF assets, the board is the area of operations, and movement decisions are the AI construct. The first process to examine is the ACE element of posture, where chess pieces of ACE are placed on the board with AI determining the initial placement. Then the element of movement and maneuver will determine where each piece moves after the initial placement based on inputs from AI. Finally, sustainment will address how new pieces will be placed on the board and how AI can optimize the survivability of those pieces while defeating an opponent.

Assessments are critical to determining the effectiveness of AI and ACE integration. Continuing the chess analogy, if the game is never played against an opponent, there is no way to know where the vulnerabilities and deficiencies are. Wargaming is an excellent means of AI testing and can be done in simulations or with real-world exercises. Plans of action and milestones will be set and measured by the JAIC to determine success and share best practices.

Continuity during these phases is paramount and cannot be understated. The JAIC was designed to manage these processes but the team that drives innovation should be comprised of (but not limited to) expert logisticians, command-and-control professionals, maintenance technicians, and cybersecurity specialists. If ACE continues to be the USAF's primary strategy against our global power competitors, then investments into AI integration and training will help establish the foundation for its application and accelerate the delivery of this capability to the joint force. ■

The recommendations expressed are those of the author and do not reflect the official policy or position of the U.S. Air Force, the Department of Defense, or the U.S. government.

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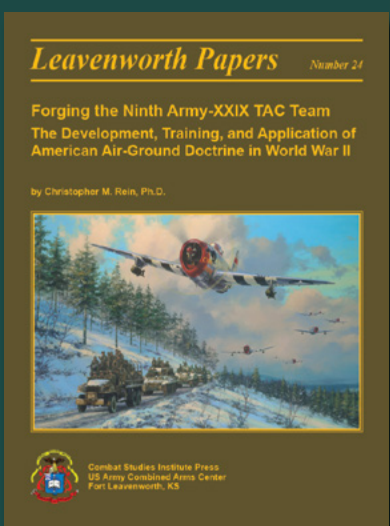

Leavenworth Paper No. 24

Forging the Ninth Army-XXIX TAC Team: The Development, Training, and Application of American Air-Ground Doctrine in World War II

Christopher M. Rein, PhD

This 2019 study tells the story of how before D-Day, the U.S. Army developed new doctrine and training for its air-ground teams. As Dr. Christopher Rein shows, the close air support provided by these teams often proved decisive as the Allies fought their way across the Rhine and defeated Germany.

To read *Forging the Ninth Army-XXIX TAC Team* online, visit https://www.armyupress.army.mil/Portals/7/combat-studies-institute/csi-books/leavenworth-papers-24-forging-the-ninth-army-xxix-tac-team.pdf.