A portrait of a futuristic soldier showcases a blend of human strength and technological prowess. (AI image from Adobe Stock)

Achieved Overmatch

A Potential Future for AI in the Army

Maj. Thomas Haydock, U.S. Army

It's very clear that AI is going to impact every industry. I think that every nation needs to make sure that AI is a part of their national strategy. Every country will be impacted.

—Jensen Huang, Nvidia CEO

Eastern Europe, 2045

Observing an artificial intelligence (AI)-enhanced wet-gap crossing (WGX) was like watching a colony of bees at work. The V Corps' masterAI system effortlessly controlled everything from the initial reconnaissance, the planning, 3D printing the bridging segments and driving them to the water, and even linking the segments into a complete bridge. The AI even controlled the vehicle movement across the modular bridge. Because of the sensors that continuously measured the current, torsion between bridge sections, weight of each vehicle, and other factors, crossing was amazingly rapid. The abundance of sensor data meant the AI could comfortably cross many vehicles at once, all at higher speeds. But the masterAI did far *more, from planning to preparation, through execution and assessment.*

In planning, it created the nucleus of the plan for the staff, generated and then answered information requirements and synchronized the plans vertically and horizontally across echelons. In seconds, it performed the work of a hundred human minds by analyzing the terrain and weather, including accessing information from historical records and live imagery. It rapidly created courses of action (COA) that accounted for the enemy's doctrine and recent observations, capabilities, composition, and disposition. As instructed, it integrated deception into each COA, arranging large and small actions to build an image of a very different reality.

With COAs built, the AI segregated the friendly plan into one persona and war-gamed the COAs against a separate persona that played the enemy. Through hundreds of war-game iterations, which combined took only seconds, the masterAI improved the three requested COAs and lowered risk. Further, it seamlessly integrated the often-neglected aspects of traffic control, nonlethal fires, command post jumps, and more, all while building the right signals and noise for the deception plan. The generation of all these staff planning products, which combined military decision-making process steps 2 to 5, took the commander and operations officer about seven minutes and a few prompts to the AI.[1]

The masterAI's output included the collection plan for tasking human and autonomous systems to answer information requirements. With a few minutes of human review, that collection plan was approved, and the crossing plan was ready for continued refinement as new information was fed into the COAs and their war games.

Within five hours, the minimum information required for decision-making was available. The commander and staff donned their virtual reality goggles as the masterAI presented each COA in an immersive movie-like format. Interacting with each other and the AI in the simulated world, the plan was adjusted and approved. V Corps' masterAI seamlessly coordinated with similar AI enterprises from sister services, subordinate divisions, and allies/partners. Within twenty-four hours, the orders process was complete across all echelons, and plans were synchronized and rehearsed vertically and horizontally across echelons. Rehearsals mimicked the COA briefs, with formations rehearsing on the virtual version of the actual terrain.

AI had a similarly transformative impact on execution. For the actual crossing, the masterAI synchronized efforts, reduced inefficiency, and directed autonomous systems. Following the plan it helped develop and disseminate, it positioned maneuver, protection, sustainment, and more. For example, with human help, the industrial 3D printers in the rear printed the autonomous bridging sections that drove themselves onto trailers for trucking to the crossing site. Once delivered, the sections drove off the trucks, swam into the water, and linked themselves, with humans verifying connections.

All around, a cornucopia of manned and unmanned, autonomous and remote controlled, and expendable and treasured systems combined as individual tiles into a mosaic. In the mosaic, 3D-printed modular systems scanned the electromagnetic spectrum (EMS) for enemy usage and dynamically adjusted jamming, overwatched the crossing or looked further out, or retransmitted friendly communications. In the river, modular swimming drones, scaled-down versions of the bridging type, monitored current, looked for mines, and waited for enemy boats or swimmers. On the ground, soldiers marked positions for autonomous excavators to converge on and swiftly produce vehicle fighting positions. A few kilometers down and a few hours before, a brigade, augmented by all-terrain vehicles with 3D-printed slip-on covers to mimic supply trucks and mortar carriers, performed a demonstration that mimicked a division. The demonstration was complete with human-impersonating AI chatbots running a dynamic conversation on the EMS to add realism. The masterAI harmonized efforts and delegated as much as it could to lower-level platform AI when it could, still embracing the philosophy of mission command. From overhead to below surface, each warfighting function (WfF) was enhanced for the better, producing overmatch for the U.S. Army.

The masterAI's effect on protection was particularly remarkable. By integrating a plethora of cameras and other sensors around the crossing and empowering them with machine vision, defensive weapons truly became a layered protection

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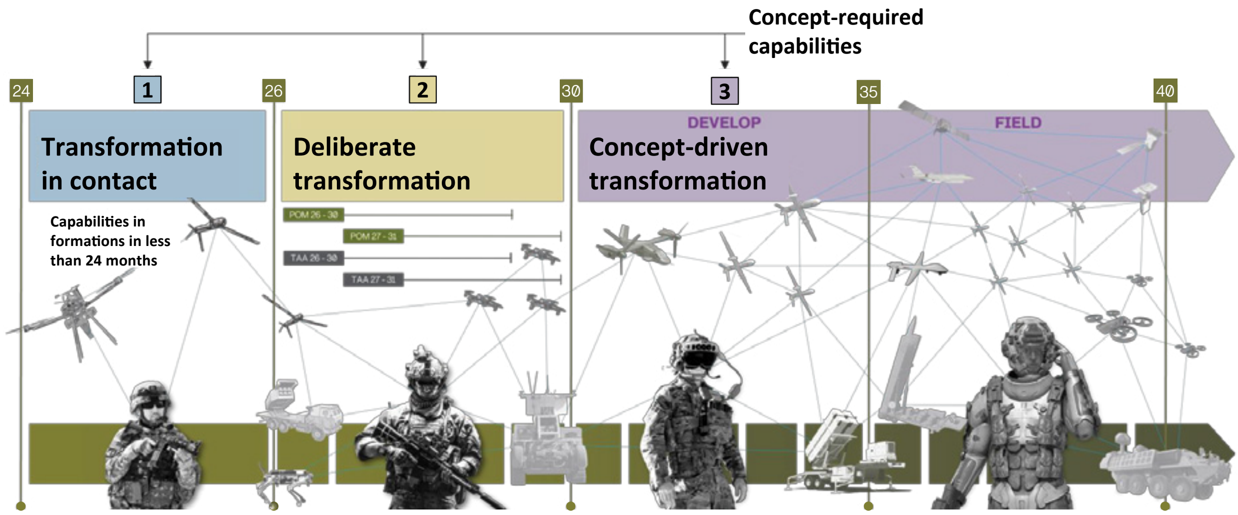


(Figure by Army Futures Command)

Figure 1. Continuous Transformation, the Army's Forthcoming Warfighting Concept

system. Machine guns, microwave emitters, defensive drones, acoustic weapons, lasers, missile launchers, and decoys were seamlessly integrated. Simultaneously, various sensors recorded every engagement, allowing the masterAI to furiously determine enemy locations and strength. Using that information, the masterAI recommended options and supporting taskings to decision-makers to deal with problems.

AI similarly transformed the final step in the operations process, assessment. Assessment was transformed by the combination of machine analysis, near instantaneous conversion of observations into lessons, and easing of human friction. For instance, recording engagements allowed the masterAI to better analyze each success and failure of protection. When bridging sections had issues properly connecting due to bad 3D printing, the problem was noted and a remedy instantly implemented. Human friction, including not sharing lessons with adjacent units, became a relic of previous generations, as each echelon's AI ceaselessly interacted vertically and horizontally. The entire operations process, from planning to preparation, execution, and assessment, was still conceptually the same but now heightened by machine speed.

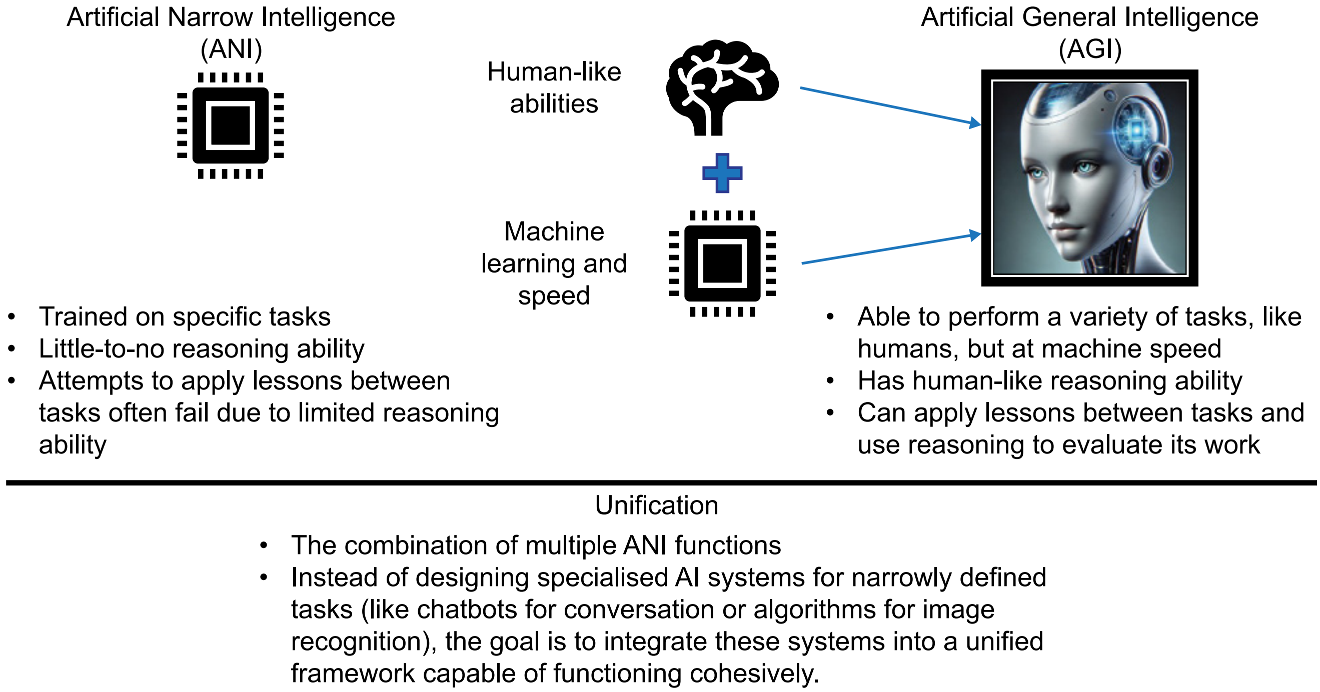
AI systems like masterAI were revolutionary, but each step of the revolution was itself a small evolution rather than a giant break with the past. It was the aggregate of years of development, the proliferation of sensors, and the integration of AI with other systems like 3D printing that was revolutionary compared to the generation prior.

How to Think About AI

The U.S. Army Futures Command is currently producing the forthcoming Army warfighting concept, *continuous transformation* (CT). As so far laid out by Gen. James Rainey in a *Military Review* article, CT looks across three time horizons (see figure 1).[2] This article explores how we in the U.S. Army can use AI to gain battlefield advantages across all three horizons. Specifically, we will examine how harnessing current trends in the first two horizons can build evolutionary advantages, generating overmatch against all adversaries in the third horizon. An overmatch representing a revolution compared to militaries that have not harnessed AI. In that light, the vignette above is a preview of our concept-driven future: an AI-boosted U.S. Army that acts faster, makes superior decisions, is more lethal, and better protects the force than every adversary. This article also discusses expected challenges, potential mitigations, and why the Army needs to integrate this approach as part of a national strategy for AI superiority in national defense.

Transformation in Contact

Transformation in contact (TiC) looks forward two years to enable "solving problems and seizing opportunities today."[3] With that short horizon, TiC revolves around using capabilities that are already



(Figure by author; AI image generated with Google Gemini)

Figure 2. The Spectrum of AI

or imminently available. The tension for TiC is how AI can create advantages in the existing force while incorporating evolutionary change to build up revolutionary overmatch in the later *concept-driven transformation* (CDT) horizon. Resolving that tension requires understanding the current and impending state of AI.

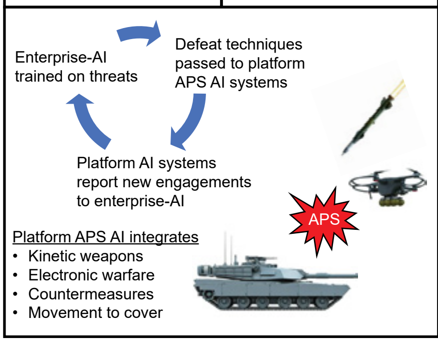
Currently, AI is highly narrow (known as artificial narrow intelligence, or ANI), with available products offering very-limited-use cases. Anyone that has used large language model (LLM) chatbots like ChatGPT knows they excel at understanding text. Indeed, they provide great responses to prompts like, "Tell me about the use of operational art in the American Revolution," or "Summarize this attached article." Experiences vary between products and how the prompt is worded, but the responses can typically illustrate a very good understanding of nuance (which operational art has much of), facts, and more. Other well-known forms of AI include self-driving vehicles like Alphabet's Waymo and facial recognition systems. But those applications are very narrow, performing a particular task quite well, at machine speed: text-based interaction, driving, or identifying criminals in our examples.

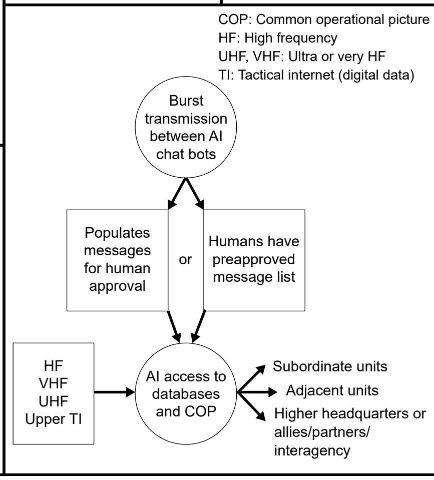
Humans, then, are a form of *general intelligence* because we can do all these tasks, apply lessons between different types of tasks, and at least make reasonable attempts at things we have not been trained to do (see figure 2).[4] In short, while we are slower, we know how to adapt for things we have not specifically trained for, like unusual traffic situations. Given this state of narrow AIs, what then does evolutionary advantage in the TiC horizon look like?

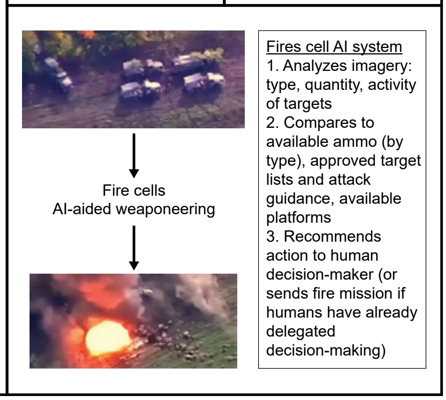
It looks like a variety of artificial narrow intelligence systems performing limited functions that humans are capable of but at machine speed to generate advantages. Figure 3 illustrates examples of evolutionary change that AI can bring to the Army. Two areas particularly ripe for AI advantages are active protection systems (APS) for vehicles (included in figure 3), and orders production (not included in figure 3), which primarily align with the protection and command-and-control WfFs.[5]

APS can build on concepts already in place in hundreds of thousands of self-driving vehicles. Those vehicles take inputs from sensors like cameras, radar, sonar, and Global Position System signals and feed it into a dedicated AI inside the platform (see figure 4). That platform AI makes decisions about how to react

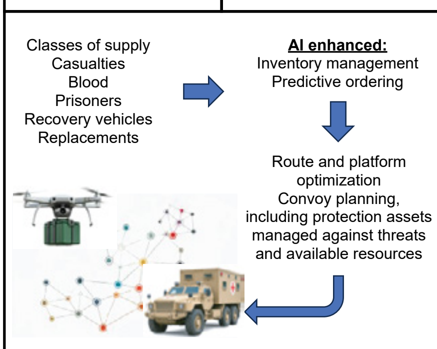
Protection		Command and Control		Fires	
Example: Active protection systems (APS) that learn		Example: Automated reporting		Example: AI-aided weaponeering	
How Active protection systems are designed to defeat threats like antitank guided missiles. Enterprise level-AI can be trained on the growing myriad of drone and other threats and learn how to defeat them, then pass lessons to less-robust platform AI that manage individual APS. Each engagement recorded by platforms and sent to the enterprise in turn enhances the APS in a learning cycle.	**Implication** Continually learning APS that can help restore freedom of movement and maneuver to infantry, armor, reconnaissance, engineer, and other close combat forces; this problem is clearly acute in the Russia-Ukraine War. APS can also be trained to recognize and not engage friendly systems, enabling things like friendly defensive drone swarms.	**How** AI handles routine reports like personnel status, communication checks, etc. Transmissions do not suffer from human issues of poor radio etiquette, mispronunciation, etc.	**Implication** Fewer and shorter emissions through AI chat bots communicating with each other with 100% accuracy in burst transmissions.	**How** Observers send images of targets to fires cells, and the fires AI system analyzes the pictures to count the enemy platforms (by type), dismounts, bunkers, etc., and determine fires platform, type and quantity of round or effect, etc., while accounting for ammo stockages and target priorities.	**Implication** Superior weaponeering and effects. Errors in observer reporting eliminated, and fires cell understanding enhanced. Accuracy increased and munitions usage decreased.

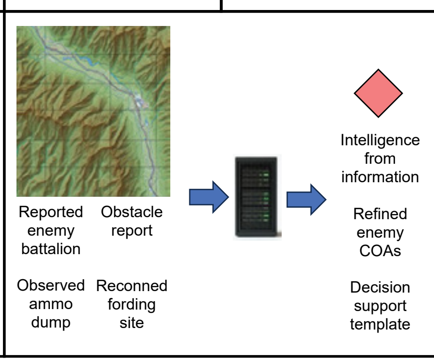


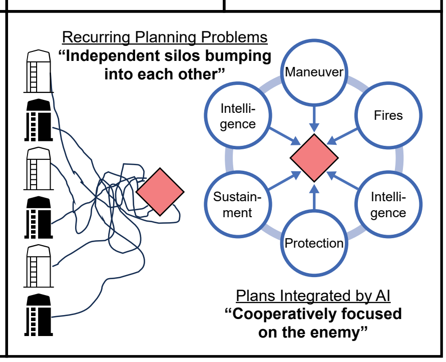




Sustainment		Intelligence		Movement and Maneuver	
Example: (1) Predictive commodity management and (2) distribution optimization		Example: Information rapidly converted into intelligence		Example: Rapidly produced, integrated schemes of maneuver, fires, intelligence, etc.	
How (1) AI maintains real-time inventory across echelons, and predicts and proactively orders based on historical data, analysis of potential future operations, etc. (2) Routes and platform type/quantity optimized against priorities, conditions of routes, distance, competing usages of routes (e.g., civilian refugees, maneuver forces), etc.	**Implication** (1) Lethality enhanced through maintaining momentum and reducing chance of supply culmination (2) Faster delivery to units, with less fuel consumption and less platform usage via optimized routes Note: examples (1) and (2) are both included due to their interrelationship.	**How** Near instantaneous determination of implications from each report. Combing observations, enemy doctrine, and recent trends, with known and suspected composition, disposition, strength, and terrain/weather, will turn information into intelligence. Further, AI can continuously update enemy courses of action, decision templates, etc.	**Implication** Faster and more comprehensive ability to turn information into intelligence. AI can avoid human pitfalls of forgetfulness, quality disparity between analysts, lost information in shift changes, and other drawbacks.	**How** AI can digest and synchronize a scheme of maneuver with supporting functions (e.g., fires) to identify and remove friction. Further, if directed, it can do the same for decision points, injects like loss of key breaching assets, and branch and sequel plans. AI can perform this automatically for AI generated courses of action, or as an aid for human generated plans.	**Implication** More robust plans, that integrate WfFs together, rather than stitching together plans produced in isolation. Plans that can account for factors and contingencies that humans rarely have time for.

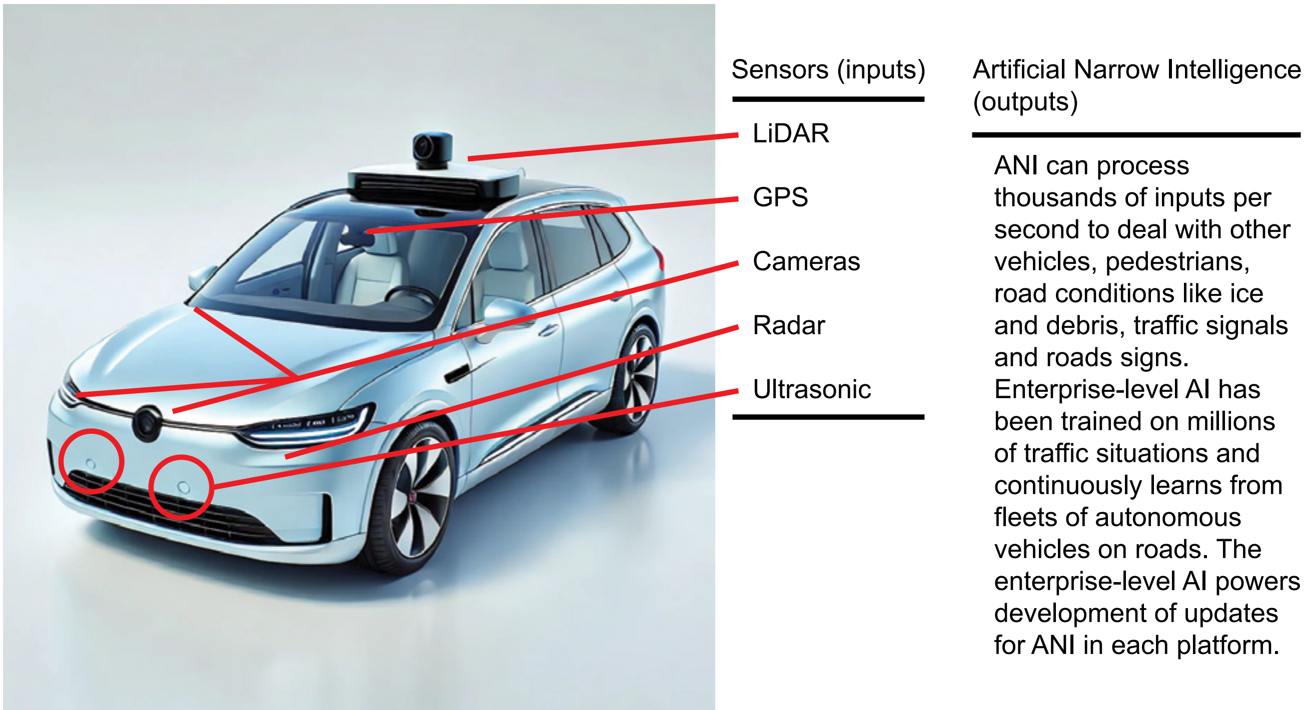






(Figure by author)

Figure 3. AI's Potential Across Warfighting Functions During Transformation in Contact



(Figure by author; AI image generated with Google Gemini)

Figure 4. Model of Current Self-Driving Car Systems

to road hazards, other vehicles, icy roads, and more, all while keeping the vehicle on route. These platform systems are updated as higher-level enterprise AI is trained in new scenarios. APS on armored vehicles can follow a similar model.

Like self-driving vehicles, APS can integrate a variety of sensors, be taught new threats, and make decisions about threats (or at least enable human decision-makers). APS sensors can include passive sensors like cameras and acoustic sensors, and emitters like LiDAR (Light Detection and Ranging) or radar. AI-powered APS can learn about new situations, like how to recognize and then defeat new types of enemy missiles or drones. Importantly, they can also be taught to ignore friendly systems to prevent fratricide. If allowed, they can also be empowered to defeat those threats with defensive weapons, countermeasures, maneuvering, etc.

Further, recorded engagements, with supporting sensor data and possible hypothetical situations, can enable AI systems to create and disseminate lessons learned throughout the force, as in our vignette. Imagine the Maneuver Center of Excellence with an enterprise-level AI system that continuously analyzes successful and failed APS engagements and learns how to defeat a spectrum of threats. Perhaps the defeat for a particular situation is a tank using organic defenses (probably TiC horizon) and another involves the tank platoon collaboratively defeating the threat (deliberate transformation horizon). A powerful AI system running countless iterations and learning to win and then disseminating new techniques to less robust vehicle-mounted AI systems would be an incredible protection advantage. Looking at warfare now in Ukraine, where drones, mines, and missiles have severely reduced the freedom of movement and maneuver by both sides, and a transformation of APS is called for.

Orders production as a command-and-control function is similarly fertile ground for AI empowerment. Analyzing orders and annexes, imagery, friendly and enemy situations and capabilities, etc., are human tasks that machines can perform now. Simplistic tasks like reading an order and pulling out specified and implied tasks can be done by AI in seconds. More complex tasks like digesting enemy doctrine, equipment capabilities, and analyzing terrain and weather to create possible enemy courses of action, devour hundreds of staff labor hours. AI can produce the same output in almost no time. This capability can be built now with our thousands of real-world and training operations orders as training data. Admittedly, using AI in orders production has an opportunity cost (as all decisions do): putting human staffs through the orders process creates a deep understanding to guide decision-making. But imagine a staff that can complete mission analysis, generate an information collection plan, initiate it, and find and then target its opponent's command post that is still highlighting their order and formatting slides! Which side would you choose?

In all these examples, the technology is either currently available or can be adapted from existing systems. However, the challenge for the TiC horizon is harnessing or creating *unified AI systems*, or combining narrow AI systems that can handle an entire process without having to involve other AI for subtasks. For instance, we do not want to use an LLM to analyze written orders and produce some outputs for orders production while using a different AI to analyze military graphics, maps, and imagery. AI in the TiC window will perform tasks that humans are capable of, but it will perform them much more efficiently and effectively. But central to harnessing that advantage is employing unified AI system. The *deliberate transformation* (DT) horizon will expand the unification of systems and the progression from narrow to general AI, generating cumulative advantage.

Deliberate Transformation

Where TiC is about "solving problems and seizing opportunities today," DT is "efforts managed through Army-level processes to deliver the Army we need within the time horizon for defense programming."[6] Building on advancements during TiC, AI in the DT period will become increasingly unified while approaching, but possibly short of, general AI (see figure 5). Crucially for our Army, this will include the transition from tasks humans can do (but faster) into the initial emergence of tasks that humans cannot. Importantly, AI's evolution will intersect with other burgeoning technologies like 3D printing and autonomous vehicles (which need AI). Deliberately managing the integration of these related technologies will enable the later emergence of revolutionary advantages.

The example of printing bridging sections in the opening vignette previewed how narrow AI systems will become more unified and provide potential advantages from integrating emerging trends. Printing material as large and complicated as bridging sections may realistically belong in the CDT horizon, but its earlier version will emerge during DT. In this horizon, AI's ability to provide route and platform optimization will merge with the ability to manage 3D printers and robotic warehousing duties (figure 5). This will look like sustainment AI receiving an inventory alert for network cables or lug nuts and executing a decision-making process. That process will be another optimization problem to determine whether the AI prints the items itself or resources from elsewhere. Included in the distribution assets may well be autonomous vehicles. In short, AI in sustainment will grow increasingly unified, expanding from narrow uses like inventory management and route/platform optimization into management and optimization of entire supply chains.

Figure 5 highlights additional changes to expect during the DT horizon. Among those, the fires WfF offers a superb illustration of the evolution that will incorporate more systems and processes into unified AI. For example, fires will build on the TiC advantages to grow more robust counterfire (sensing and strike) capabilities and integrate more strike assets and effects.

AI enabled by sensors will change counterfire sensing by spreading the capability across the battlefield while introducing passive sensors that do not have to reveal themselves. Counterfire sensing is the ability to detect munitions and predict the launcher's point of origin using ballistic calculations; it currently relies on specialty radar emitters. However, APS, which will already be using cameras and other sensors to scan for drones and antitank weapons, can serve as counterfire sensing nodes for mortars, rockets, and ballistic missiles. These platforms can either predict the launcher's location or send raw data for fires cell action. Additionally, passive sensing (not emitting signals) like cameras avoids the dilemma of current counterfire radars announcing themselves as high payoff targets when turned on. In short, AI-enabled APS will proliferate counterfire sensing across the battlefield with the potential for passive sensing.

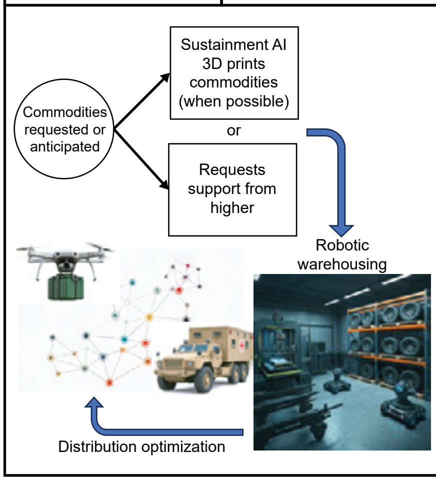
Concurrently, AI fires decision-making will evolve from TiC to unify lethal and nonlethal effects, from

Sustainment	Movement and Maneuver	Intelligence
Example: Supply chain management and optimization	Example: Autonomous, robotic support by fire (SBF)	Example: AI manages information collection

Sustainment

How
AI builds on prior predictive commodity management and distribution optimization capabilities and adds control of 3D printers and robotic warehousing functions into a more unified sustainment AI.

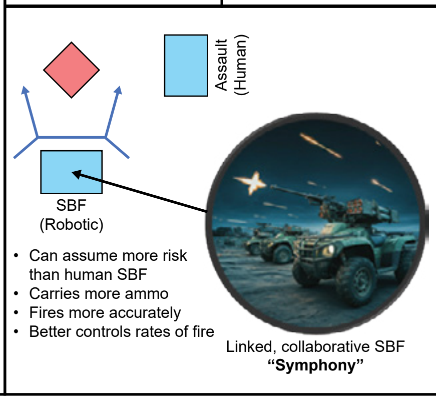
Implication
Unification of these capabilities allows sustainment AI to manage and optimize an entire supply chain.



Movement and Maneuver

How
AI empowered autonomous vehicles with weapons, a capability demonstrated in Ukraine. However, this evolves to safely work in support of human assault elements. Robotic SBF platforms also linked to be a mutually supportive symphony, rather than separate systems obliviously providing the same service.

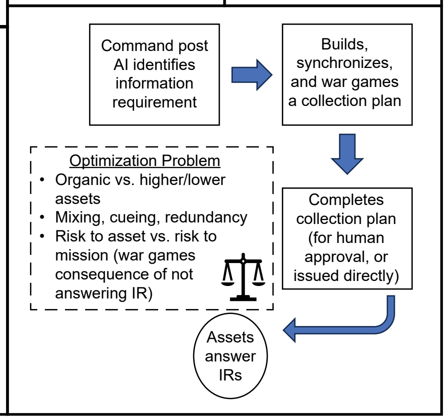
Implication
Lethality enhanced as robotic SBF assumes risk we do not with humans. Robot SBF can also carry more ammo, more precisely account for ballistics (wind, range, etc.), and better control rates of fire.



Intelligence

How
During TiC, AI developed the abilities to rapidly turn information into intelligence and also to produce orders. In DT, these evolve and unify into AI producing information requirements (IRs), synchronized plans to collect that information, and management of autonomous assets.

Implication
AI will be able to ask questions about the enemy and operational environment and act to answer those questions. Humans and AI will complement each other by asking different questions. More efficient use of assets as AI synchronizes information requirements in an organization.



Fires	Command and Control	Protection
Example: (1) Robust counterfires and (2) Integration of more strike assets and effects	Example: Plans synchronized across echelons	Example: Active protection systems synchronized across formations, and with passive protection

Fires

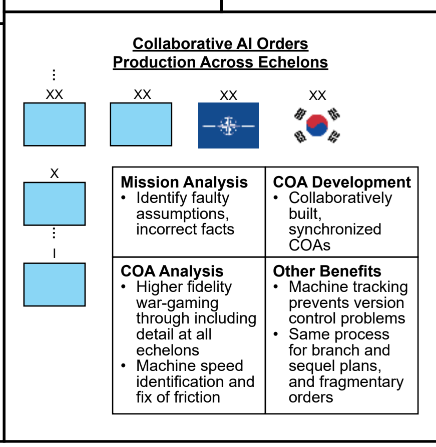
How
(1) APS systems serve as counterfire sensing nodes.
(2) Unification of more lethal & nonlethal effects, across echelons into fires AI.

Implication
(1) Marked advantage in counterfire sensing. Profusion of passive sensors, like cameras, solves dilemma of exposing radar systems.
(2) Superior matching of systems and effects to need while balancing inventory, risk to launcher, need of supported unit, etc.

Command and Control

How
Builds on AI enhanced orders production from TiC that supported separate echelons. Evolves into more holistic orders production where AI from different echelons collaborate to synchronizes plans between higher and lower echelons, adjacent units, allies and partners.

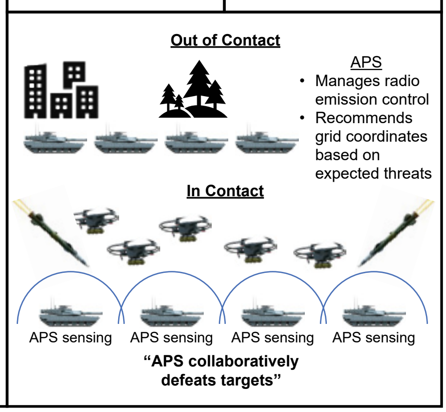
Implication
Enables the much sought after collaborative and concurrent planning between echelons. Can include AI systems war-gaming COAs across echelons, simultaneously. Identifies and solves friction points at machine speed.



Protection

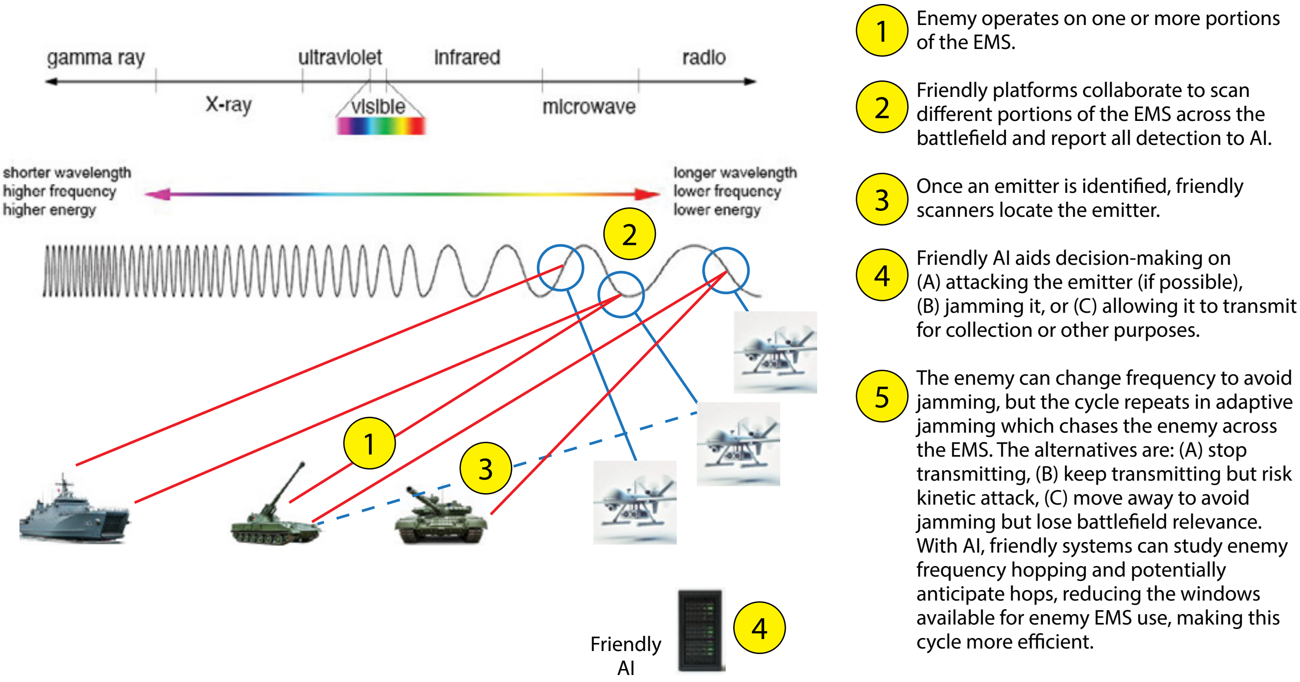
How
APS AI grows to include synchronized protection for entire formations. Platforms collaborate to defeat threats, allocate targets, and minimize signature. APS expands to include passive measures like radio emission control management, evaluating terrain for protection against expected threats.

Implication
APS AI in formations able to defeat increasingly complex threats due to collaboration. Overall protection also enhanced by APS actively managing passive protection.



(Figure by author; AI images generated with Google Gemini)

Figure 5. AI's Potential Across Warfighting Functions During Deliberate Transformation



(Figure by author; AI images generated from Google Gemini and electromagnetic spectrum image from NASA)

Figure 6. Dynamic Jamming

mortars and drones to electronic warfare and obscuration, and across echelons. In TiC, images will enable fires AI at a given echelon, say division, to weaponeer for its rockets, artillery, and mortars. In DT, data like target images (including thermal and infrared), detection of jamming sources, and APS counterfire sensing will grow the optimization provided by fires AI. Optimization will include near-instantaneous decisions on potentially sending targets for lower echelon prosecution or if a strike by loitering drones or cannon artillery (or multiple effects together) is better. Nonlethal optimization can include AI overseeing frequency scanning and the dynamic adjustment to jammers to match the speed of enemy transition (see figure 6). These enhancements will be part of the evolution of fires AI as additional systems and capabilities are unified into the enterprise.

In the DT horizon, the combination of increasingly unified AI systems in each WfF and their intersection with other emerging trends will generate advantages by beginning to do what humans cannot. In our sustainment example, AI expanded into managing and optimizing an entire supply chain and did so in a dynamic operational environment. That type of task, precisely managing inventory and determining optimal delivery to customers, is something that massive companies like Amazon can do now but only in a static environment. For Amazon, the consequences of failure are low compared to large-scale combat operations, and its optimization is the product of years in a world where no enemy is attempting to destroy delivery assets, warehouses, headquarters, or bridges. Presently, in military sustainment, we willingly sacrifice utility (providing as much sustainment as possible to every customer possible), for simplicity. We designate priority of support because it makes planning and execution simple but not optimized. This unification of AI, that increasingly does what humans cannot, will build the revolutionary advantages to come from CDT.

Concept-Driven Transformation

CDT "is the longer-term vision described in the Army's emerging warfighting concept."[7] Returning to figure 1, CDT focuses on seven-to-fifteen years out; our goal for the CDT horizon is achieving overmatch against all adversaries, an overmatch that represents a revolutionary advantage in decision-making speed and quality, protection, and lethality over ground forces that have not unlocked AI's potential (like our Army was around 2020). Figure 7 illustrates a version of that overmatch, following examples in the opening vignette.

I believe AI's greatest value for our Army will be realizing the potential of *mosaic warfare* (MW). MW focuses on creating "adaptability and flexibility for U.S. forces and complexity or uncertainty for an enemy through the rapid composition and recomposition of more disaggregated U.S. forces using human command and machine control."[8] MW is form of combined arms that envisions fitting different pieces (tiles) together to create a coherent friendly system (the mosaic); figure 7 provides additional insight. The contrast is a puzzle, in which there is only one arrangement of the pieces, and alternatives produce failure.

The central advantage MW seeks is presenting a greater variety of dilemmas to adversaries through tailored force packages that couple robust and exquisite platforms with many small, highly specific partners that may be autonomous and/or expendable. Essentially, it means supplementing a few large, powerful mosaic pieces with a variety of small tiles. Mosaics and puzzles can produce the same system, but one is robust and the other is fragile. Consider the following examples:

> A frigate and several unmanned surface vessels could replace a surface action group of three destroyers, or a section of strike-fighters could be replaced by a strike-fighter acting as a C4ISR [command, control, communications, computers, intelligence, surveillance, reconnaissance] platform for a group of standoff missiles and sensor- and EW-equipped [electronic warfare] UAVs [unmanned aerial systems]. In a ground force, rather than relying on large formations, smaller units and subunits could be augmented with small and medium-sized UGVs [unmanned ground vehicles] and/or UAVs to improve their self-defense, ISR, and logistics capability.[9]

The opening vignette's WGX is a model for MW synergistically combined with AI and 3D printing. The bridge was printed in segments that moved to the river and assembled autonomously. In the air, drones retransmitted friendly communication, provided observation and attack, and located and chased the enemy across the EMS with jamming. In the water, drones measured current and scanned for mines. On the ground, autonomous excavators massed to rapidly prepare survivability positions for far-side security. Decoys made the demonstration force of a brigade look like a real division, mimicking tanks, ambulances, and more, including details like chatbot-run EMS activity to impersonate friendly patterns. This is the potential of MW with AI harmonizing the tiles, assisting human staffs and commanders envision new arrangements of the tiles that enhance our capabilities while creating dilemmas for adversaries.

In the CDT horizon, we can also harmonize deception, intelligence, and operations, a feat that today is a herculean mental effort and cannot be done quickly. The point of deception is to cause enemy action or inaction that provides advantages for friendly forces. As history has proved repeatedly, deception can be decisive, as in a handful of Greek troops hidden inside a wooden horse infiltrating inside Troy to enable the victory that years of siege could not. But deception requires meticulously synchronizing real and false activities with observations of the enemy. Deception is not thought of as a mosaic, but it could be; the right arrangement of tiles into a lenticular image to create one mosaic from a friendly perspective and a different mosaic from the enemy's, but while watching the enemy to see if they interpret the image as friendly forces want them to. However, deception is about providing the right breadcrumbs (or tiles) to create a believable story.

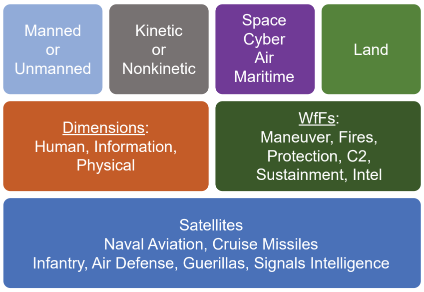
In the WGX scenario, synchronizing deception, intelligence, and operations might look like painting the picture (or arranging the tiles) that the decoy is the real crossing while the real crossing is in fact a demonstration. In other words, arranging events and monitoring enemy activity to see if they believe the fake is real and the real is fake. With the thousands of friendly actions, how can we orchestrate this lie? The U.S. Army has done this masterfully in instances such as the 1944 Normandy landings and the 1991 Gulf War, but it takes months of practice to properly arrange the tiles without giving away the truth.[10] With AI, this can become drastically easier as synchronizing efforts and resources among deception, intelligence, and operations can be addressed as an optimization problem, and then war-gamed at machine speed as described in figure 7.

Movement and Maneuver

Example: Mosaic warfare

How
Force package mixes of manned and unmanned systems, and their capabilities are tailored for the threat and operational environment. The tailoring is designed to arrange discrete friendly strengths across domains and dimensions, to create and exploit opportunities.

Implication
Creation of perpetually new dilemmas for enemies. Knowing the existence of the capabilities (tiles) does not give the enemy insight into their arrangement. The loss of some capabilities (tiles) either does not prevent the formation of the overall effect (image) or prompts the formation of a new image.



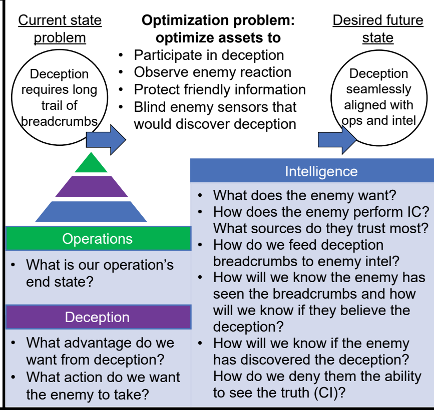
Tiles on a mosaic create a specific outcome or can be rearranged for different outcomes; subsets of tiles can create multiple smaller outcomes. There is no single way the tiles must be arranged to produce the same bigger picture.

Intelligence

Example: Synchronization of intelligence, operations, and deception

How
Deception plans rely on the enemy observing false friendly actions and not observing actions that would reveal the deception (part of the real operation). AI grows to unify capabilities to synchronize information collection (IC) and counterintelligence (CI) with deception.

Implication
Deception can become dramatically easier and more feasible over short time horizons. With machine power building and synchronizing efforts, individual events in the wider deception plan can be effortlessly incorporated into operations, all with the alignment of IC and CI.

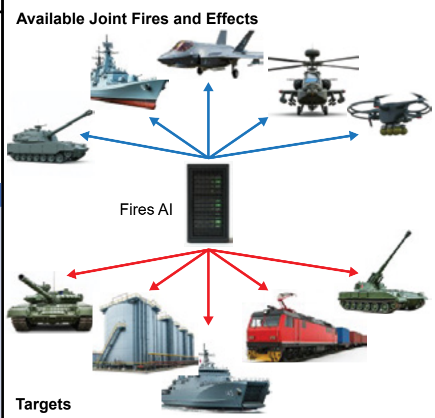


Fires

Example: Unification across services

How
The evolving unification of fires AI during DT grows to include joint fires and effects. Fires AI systems between services are either built to be natively compatible or are taught to build their own compatibility and bridge gaps.

Implication
Synchronization of more fires platforms and effects adds tremendous flexibility to friendly forces and presents more dilemmas for adversaries. This unification compliments mosaic warfare approaches in movement and maneuver.

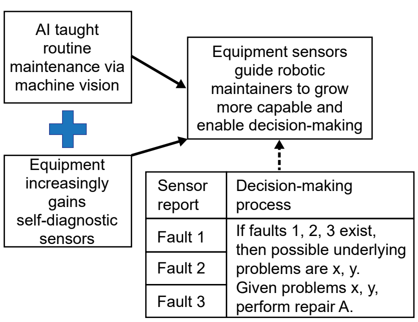


Sustainment

Example: Robotic maintenance and repair

How
AI taught standardized routine maintenance/repair. Machine vision teaches maintenance AI via repeated observation of humans performing sequential tasks, like oil changes, weapons gauging, and optics calibration. Additional sensors in equipment guides robotic maintainers to correctly identify faults and apply learned maintenance algorithms.

Implication
Maintenance AI supplements human maintainers, allowing them to focus on complicated repairs. Tremendously increases maintainer capacity. As maintenance AI learns more tasks, this advantage grows and can increasingly be applied to more austere conditions, such as brigade maintenance points in the field.



Command and Control

Example: Rehearsals in virtual reality

How
AI combines planning products, information on enemy forces and the operational environment, and friendly force status and operational plans for immersive virtual reality (VR) rehearsals.

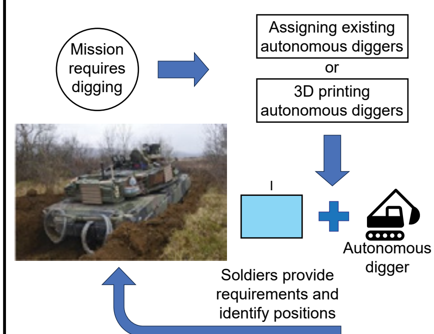
Implication
Superior ability to synchronize friendly efforts in time, space, and purpose and model factors that cannot be replicated by maps and terrain models.

Protection

Example: Autonomous robotic digging

How
Robotic digging equipment like excavators already exists, and when paired with trained AI, it can autonomously dig survivability positions for vehicles and command posts. Using learned algorithms, AI can learn the requirements for different position types and modify them based on different possible threats and friendly needs.

Implication
Potential to massively increase survivability through fielding assets that do not need sleep or breaks. When combined with 3D printing, assets can be made in the field. More assets can also aid deception since with enough diggers, commanders will not face the dilemma of building real or decoy positions but can dig both.



(Figure by author; Abrams tank image by Staff Sgt. Steven Colvin)

Figure 7. AI's Potential Across Warfighting Functions Concept-Driven Transformation Horizon

Table. Recent Significant Federal Policies on AI

Title	Date	Purpose
Exec. Order No. 14179, "Removing Barriers to American Leadership in Artificial Intelligence"	23 January 2025	"Develop AI systems that are free from ideological bias or engineered social agendas" and also revoke "certain existing AI policies and directives that act as barriers to American AI innovation."
OMB Memorandum M-25-21, "Accelerating Federal Use of AI through Innovation, Governance, and Public Trust"	3 April 2025	"Agencies must remove barriers to innovation and provide the best value for the taxpayer … empower AI leaders to accelerate responsible AI adoption … [and] ensure their use of AI works for the American people."
OMB Memorandum M-25-22, "Driving Efficient Acquisition of Artificial Intelligence in Government"	3 April 2025	"Ensuring the government and the public benefit from a competitive American AI marketplace," "safeguarding taxpayer dollars by tracking AI performance and managing risk," and "promoting effective AI acquisition with cross-functional engagement."
U.S. Department of Energy release, "DOE Identifies 16 Federal Sites Across the Country for Data Center and AI Infrastructure Development"	3 April 2025	"Inform development, encourage private-public partnerships and enable the construction of AI infrastructure at select DOE sites with a target of commencing operation by the end of 2027."

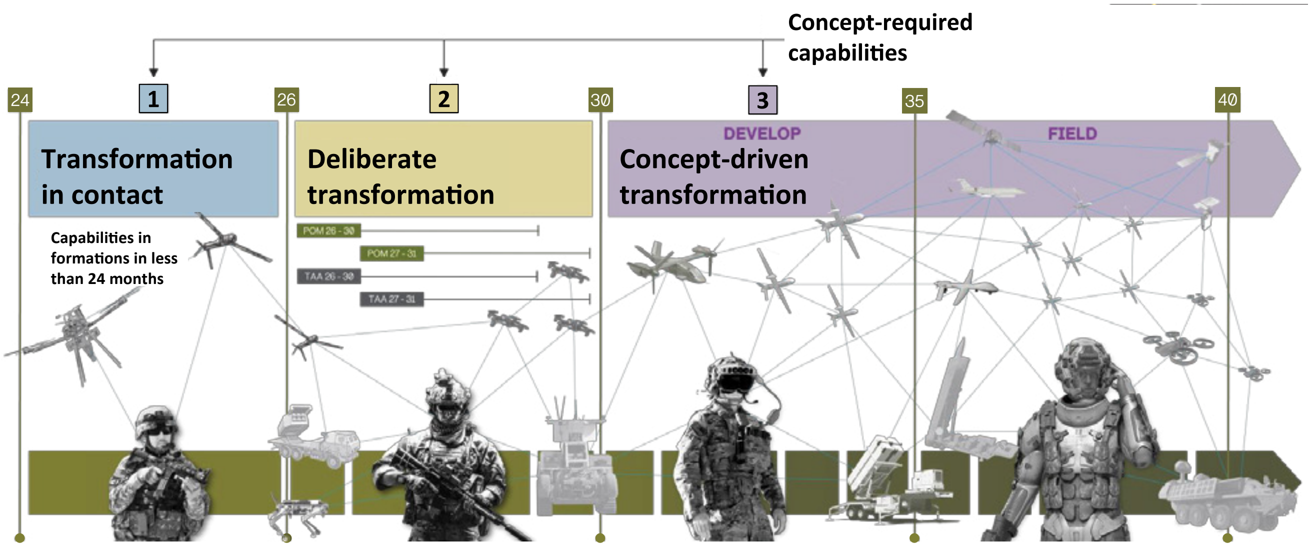
(Table by author)

Conclusion and Future Steps

AI can produce overmatch for our Army, but the road to overmatch requires continual evolution and an accompanying national strategy for AI superiority. Overmatch will be the product of the continual evolution in AI that unifies more capabilities. During the TiC horizon, AI will be able to do many human tasks but at machine speed. However, the lack of artificial general intelligence (AGI) may mean a variety of specialized AI products, such as an LLM AI for digesting orders from higher with a machine-vision AI for understanding maps, imagery, and military graphics. The DT window will see increasingly unified AI, and perhaps even the emergence of true AGI. This includes a potential command post AI like our vignette's masterAI, performing a complete orders process, identifying information requirements, building and war-gaming a collection plan, and then supervising the collection via manned and unmanned systems. These evolutionary advances can build up to an overmatch in the CDT horizon.

Our potential CDT future is the vignette's WGX that harmonized human and autonomous efforts, producing overmatch in decision-making speed and quality, protection, and lethality over ground forces that have not unlocked AI's potential. The increasingly unified AI, if not full AGI, will enhance the speed of planning and synchronization, as in the example of the synchronization of deception, intelligence, and operations. Particularly important will be the leaps for protection as the APS of individual platforms unifies into collaboration between APS to protect entire formations. As seen in the Russia-Ukraine War, protection has not kept pace with threats, hence the abundant videos showing drones preying on platforms and forcing tanks to add homemade cages. Protection's advancement will not stop there. APS can grow into collaborating systems across sister services while also adding in passive measures like autonomous excavators and AI-managed emission control. Lethality will similarly advance as MW becomes a possibility and collaborative AI between sister services eases the burden of joint operations and fires. However, achieving this CDT future is far from certain.

We need a deliberate strategy to not only codify our ends, ways, and means but also to align the Army's efforts with the rest of government and industry while also creating dilemmas for adversaries through lawfare, export controls, and other measures. AI is clearly an extraordinary federal priority, as seen in the table, which samples just a few recent federal actions.[11] AI is also vividly important to industry, as seen in the stock price of chipmaker Nvidia, the world's third most valuable public company as of 28 April 2025.[12] How to create an Army strategy for AI that reaps synergistic effects from alignment with wider federal strategy and trends in industry will require its own research effort.



- Lay the foundation for revolutionary overmatch
- Start with ANI
- Variety of specialized ANIs likely, integrated by human reasoning
- What humans can do but at machine speed

- Build on the foundation, evolve AI, generate cumulative advantage
- Grow ANI through unification
- Convergence of AI and 3D printing, autonomous vehicles
- AI begins to do what humans cannot

- Goal: overmatch against all adversaries
- Increasingly unified, if not full AGI
- Revolutionary advantage in decision-making speed and quality, protection, and lethality over ground forces that have not unlocked AI's potential

Common to all horizons

- Align Army AI strategy with wider national strategy for AI superiority
- Alignment for synergistic advantage from federal and industry efforts
- Deliberately create dilemmas for adversaries (lawfare, export controls, etc.)
- National strategy to speed

(Figure by Army Futures Command, adapted by author)

Figure 8. The Army's Road to Achieving Overmatch

Part of this strategy must deliberately focus on creating dilemmas for adversaries: What capabilities do we want to delay or deny adversaries, and how can we align that disruption with federal strategy and industry desires? Creating dilemmas is essential since overmatch is a state of advantage, and advantage comes from both speeding ourselves up and slowing down adversaries.

Alignment of Army and federal AI strategies and industry efforts is also essential to solve the myriad technical, legal, and procedural issues. For instance, AI voraciously consumes power, produces tremendous heat and EMS emissions, and tends to be centralized in data centers (as opposed to edge computing at the end devices).[13] The Army cannot solve these problems, but industry can and already is, and federal strategy is essential to guiding industry to solve military problems. Similarly, there is a natural tendency for model creators to develop proprietary systems that do not seamlessly work with those of rivals. Lack of alignment with federal strategy and interaction with industry could see the Army, Navy, and Air Force hitch themselves to incompatible providers, erasing our advantage over time to the cost of billions of dollars and years of wasted effort. Lastly, the examples and overall vision here for AI in the Army is quite optimistic for each time horizon. If we fight trends, we will certainly not afford future overmatch or achieve it in time; if we harness trends, it may speed up use cases, especially those with dual military and civilian application.

AI has recently reached an inflection point where it can provide real, if still limited, functional value; this value will rapidly change as AI unifies more capabilities and AGI becomes a reality. Across all the horizons of continuous transformation, AI can enhance our Army to provide evolutionary advantages. But the Army clearly cannot achieve this on its own, hence the need to build concepts now while creating and aligning an Army strategy for AI with federal strategy and industry efforts, simultaneously determining how to create dilemmas for adversary development so we grow our advantage. An AI revolution is happening in society at large, and now is the time to plant the seeds of military revolution. A revolution that provides the Army overmatch in the ability to act faster, make superior decisions, be more lethal, and better protect the force, than every adversary (see figure 8). ■

Notes

Epigraph. Jensen Huang, "Nvidia's Jensen Huang on the White House's AI Initiative," interview posted by Dean Takahashi, Venture Beat, 13 May 2018, https://venturebeat.com/ai/nvidias-jensen-huang-on-the-white-houses-ai-initiative/.

1. Field Manual 5-0, *Planning and Orders Production* (U.S. Government Publishing Office [GPO], 2024), 77. The steps to the military decision-making process are (1) receipt of mission; (2) mission analysis; (3) course of action (COA) development; (4) COA analysis; (5) COA comparison; (6) COA approval; and (7) orders production, dissemination, and transition.
2. James E. Rainey, "Continuous Transformation," *Military Review* 104, no. 5 (September-October 2024): 10–26, https://www.armyupress.army.mil/Journals/Military-Review/English-Edition-Archives/SO-24/SO-24-Continuous-Transformation/.
3. Rainey, "Continuous Transformation,"12.
4. Unification definition in figure 2 from "Unification in AI," accessed 15 January 2025, https://www.geeksforgeeks.org/unification-in-ai/.
5. Screenshots in fires pane from "HIMARS Accurately Hits a Convoy of Russian Military Vehicles," YouTube video, posted 29 September 2024 by My Global Issues, https://www.youtube.com/watch?v=dfReyUUESb0.
6. Rainey, "Continuous Transformation,"12.
7. Rainey, "Continuous Transformation,"12.
8. Bryan Clark, Dan Patt, and Harrison Schramm, *Mosaic Warfare: Exploiting Artificial Intelligence and Autonomous Systems to Implement Decision-Centric Operations* (Center for Strategic and Budgetary Assessments, 2020), 27, https://csbaonline.org/research/publications/mosaic-warfare-exploiting-artificial-intelligence-and-autonomous-systems-to-implement-decision-centric-operations.
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10. Scott C. Farquhar, "Deceive, Divert, and Delay: Operation FORTITUDE in Support of D-Day," in *Weaving the Tangled Web: Military Deception in Large-Scale Combat Operations*, ed. Christopher M. Rein (Army University Press, 2018), 137–53; Donald P. Wright, "Deception in the Desert: Deceiving Iraq in Operation DESERT STORM," in Rein, *Weaving the Tangled Web*, 215–30.
11. Donald J. Trump, "Removing Barriers to American Leadership in Artificial Leadership," White House, 23 January 2025, https://www.whitehouse.gov/presidential-actions/2025/01/removing-barriers-to-american-leadership-in-artificial-intelligence/; Russell T. Vought, memorandum, "Accelerating Federal Use of AI through Innovation, Governance, and Public Trust," Office of Management and Budget, 3 April 2025, https://webdevelopmentgroup.us20.list-manage.com/track/click?u=6821469cd180710d53bfc94d1&id=70ff037017&e=f395826b19; Russell T. Vought, memorandum, "Driving Efficient Acquisition of Artificial Intelligence in Government," Office of Management and Budget, 3 April 2025, https://www.whitehouse.gov/wp-content/uploads/2025/02/M-25-22-Driving-Efficient-Acquisition-of-Artificial-Intelligence-in-Government.pdf; "DOE Identifies 16 Federal Sites Across the Country for Data Center and AI Infrastructure Development," U.S. Department of Energy, 3 April 2025, https://www.energy.gov/articles/doe-identifies-16-federal-sites-across-country-data-center-and-ai-infrastructure.
12. Measured by total market capitalization as of market closing 28 April 2025 from "Largest Companies by MarketCap," CompaniesMarketCap, accessed 28 April 2025, https://companiesmarketcap.com/.
13. Promising potential solutions to reduce AI's voracious appetite for power include photonic chips. See Jim Cramer, host, *Mad Money with Jim Cramer*, podcast, interview with Simona Jankowski, 18 November 2024. Information on impacts to the national power grid can vary widely. For an introduction, see Andrew Schwartz, host, *The Truth of the Matter with Andrew Schwartz*, podcast, interview with Joseph Majkut, 21 November 2024.