On Artificial Intelligence

Near-term applications of AI will be militarily valuable, but not revolutionary.

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With this note, I am beginning an ongoing analysis of the role of artificial intelligence in modern military affairs, and what technologists, industrialists, and investors can do about it. To begin, I offer four points:

> In artificial intelligence, selective use at present points to broader applications emerging in at least five areas: target recognition, predictive intelligence and operational recommendations, resilience in command and control, increasing the autonomy of robotic systems, and labor-enhancing human-machine teaming.
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> Policy and professional angst are indeed restraining progress.
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> However, dire predictions that the US is behind may not be serious.
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> The big question for everything else in the military is simple: what can AI do for a platform do that it cannot do for a payload?

I will update this analysis as events warrant and time permits.

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On the margin, writing code can be far cheaper than bending steel. Thus have the importance of software and information increased greatly in warfare over the past few decades. However, as with most military-technical innovations, progress continues unevenly. If there is to be a revolution in military affairs from the introduction of artificial intelligence (AI), we will need more evidence before we call that looming. Even so, investors, industrialists, and technologists should care about what is practical over the next few years, because progress is unfolding. To learn more, I attended two conferences last week in Washington DC: SecondFront's Offset Symposium, and the Atlantic Council and Applied Intuition's Nexus 2023. I also continued reviewing recent research of artificial intelligence, for an initial assessment of its near-term military applications.

In artificial intelligence, selective use at present points to broader applications emerging.

Just two years ago, Marc Losito and John Anderson wrote of another “looming winter” in artificial intelligence research—the dénouement of that hype cycle seen at least twice previously in history, when huge promises of pending progress in AI disappointed despite years of effort. Late last year, the US Government Accountability Office (GAO) called out the difference between what the US Department of Defense says that it wants to do with artificial intelligence—seemingly everything—and what Defense is actually doing—a narrower but still useful set of activities (see GAO-22-104765). At Nexus, former Under Secretary of Defense Michèle Flournoy offered some further thoughts. Early selective use points to at least five sound, combat-use cases in the near future.

Target recognition

Air Force Secretary Frank Kendall noted in September 2021 (see the article by Amanda Miller) that the USAF was already then using an artificially intelligent algorithm “in a live operational kill chain.” Its success rate on its own (as reported by Patrick Tucker) was subsequently assessed as lackluster. However, the assistance of artificial intelligence may be facilitating the work of human intelligence analysts (on that, more below). Michael Horowitz, on loan from the University of Pennsylvania as the Pentagon’s chief of emerging capabilities policy, made the point that even when thus working faster, analysts can still employ their “appropriate levels of human judgment,” as the department prefers, and address many more potential targets.

Predictive intelligence and operational recommendations

As Margarita Konaev of Georgetown University noted at Nexus, battlefield data are very difficult to obtain, but very valuable if thoroughly analyzed. If enough data are properly cleaned, artificial intelligences can analyze patterns of past activity to predict (say) when the next adversarial satellite might launch, or (say as well) where the infantry should emplace their machine guns.

Resilience in command and control

Faster processing of intelligence and identification of targets do no favors to field headquarters. Russian command posts have backed up many miles on the Ukrainian front because their radio emissions have become comparatively easy targets for precision missiles cued by signals intelligence. Flounoy spoke specifically of the need for intelligent, automated rerouting of signal traffic when nodes disappear in combat.

Increasing the autonomy of robotic systems

As Marc Andreessen of Andreessen Horowitz noted at Nexus, a big technical breakthrough in image recognition with neural networks in 2012 led to rapid progress over the next decade in self-driving systems. We should note as well the progress with image recognition by cruise missiles. Already today some of the latest weapons, such as Kongsberg's Naval Strike Missile, are very difficult to decoy with electronic jamming or infrared decoying. An intelligent weapon that knows what it is attacking, and how to avoid its defenses, may prove very hard to kill, even with kinetic means. Moreover, as T. X. Hammes wrote in 2019, adding capacity for swarming to such systems requires a more limited, task-specific artificial intelligence than some of the advances currently contemplated.

Labor-enhancing human-machine teaming

In the Western Pacific, US forces should always expect to be outnumbered, at least at the start of any big war. However, in competing with the Chinese, the US may hold the advantage when both sides are using intelligent systems. AI empowers the individual holding the model, in what Bob Work, the former US deputy defense secretary, deemed the "centaur" concept (see Sydney Freedberg's article of 2015). Leveraging the possibilities of human capabilities extended by intelligent machines fits better with auftragstaktik than with political commissars and hierarchical control. At Nexus, Alex Brand, lieutenant colonel of the Luftwaffe and air attaché at the German Embassy, quite practically noted the great advantages that accrue in the air if aircrews can become more battle-managers than pilots and navigators. Perhaps because the colonel is a software developer and policy analyst, he may stand apart from the silk-scarf culture common in air arms in much of the world.

As Konaev and co-author Tate Nurkin wrote about a year ago, the US Defense Innovation Unit is pursuing artificial-intelligence innovations in several more fields, including predictive health, the long-evolving predictive maintenance, and a range of applications in supply chain analysis. As Seán Captain wrote in the Wall Street Journal a week ago, some initial research indicates that great increases in productivity in software development and office work are possible with generative AI. Such back-office applications will also be very valuable, and culturally easier to assimilate.

Policy and professional angst are restraining progress.

Greg Allen of the Center for Strategic and International Studies asserted at Nexus that the biggest barrier to greater integration of artificial intelligence in the US military is cyber-security requirements: simply granting "authority to operate". Schuyler Moore, chief technology officer for US Central Command, who spoke at both events, recently added lack of computing power, incompatibility of interfaces, and the classification of networks (see reporting by Edward Graham). The Ukrainians seem to have less difficulty with all this, given their practice of

assigning software developers to individual battalions for fast-reaction work. Allen recounted a lengthy Polish newspaper report from earlier this year which described a successful three-week effort in one Ukrainian battalion to develop a new pattern-matching algorithm for finding camouflaged Russian soldiers. At the other end of time, we have the remarkable comment at Nexus by Dan Burnett, of Kodiak Robotics, about his fifteen years of working on self-driving trucks. Recall how the Defense Advanced Projects Research Agency had seeded that technological field with its first Grand Challenge in 2004. None of the vehicles entered finished the course through the Mojave Desert, and the furthest drove less than eight miles. Today, Kodiak's website—like more than a few others—shows videos of tractor-trailer trucks driving themselves along highways in Texas. Law, regulation, and public perception may not yet be ready for what companies like Kodiak can do technologically for commercial logistics. Armies and navies seem no more ready for unmanned military logistics. Under fire, they could get enthused quickly, if the edge cases, those "rare but potentially disastrous scenarios that have already led to accidents," are easier to tolerate in wartime (see Christoper Mims' article in this past weekend's Wall Street Journal). Even so, smart marketing and policy work are needed to kick-start that effort in peacetime.

Dire predictions that the US is behind may not be serious.

In October 2021, Nicolas Chaillan, the USAF's first software chief, resigned his post in frustration, calling US efforts vis-à-vis China "kindergarten level," and asserting that the war was already lost. Some of these emerging applications, however, suggest that the situation could be worse. Despite our usual complaints about their byzantine procurement systems and obtuse procurement staffs, the Americans are not the Russians. As Margarita Konaev of Georgetown University's Center for Security and Emerging Technology admitted at Nexus 2023, most of "the community of Russian studies analysts" had hugely overestimated Russian capabilities prior to the present war. Sam Bendett of the Center for Naval Analysis noted on the same panel that Russia's current economic isolation has left the Russian government as the sole significant source of funding for innovation in the country. That military establishment has a bad track record for innovation over the past few decades. Bendett continued in observing that the Russian military essentially wants to copy-and-paste civilian artificial intelligence technologies into its existing systems and structures, but that rigid command-and-control is "allergic to new technologies," at least those that do not fit the accepted ways of fighting. Neither are the Americans the mainland Chinese. In 2019, Elsa Kania of Harvard University similarly wrote that for "Chinese military strategists, among the lessons learned from AlphaGo's victory was the fact that an AI could create tactics and strategies superior to those of a human player in a game that can be compared to a wargame." Of course, that had been true for a long time in chess and other highly bounded games. As Owen Daniels of Georgetown University wrote last November, "battlefield problems posed by competitors are challenging enough for warfighters without introducing the complexity of immature algorithmic tools that perform best in constrained environments." Back in the Cold War, lots of people tried to scare us about how good the Russians were at chess, as if that game bore more than a passing resemblance to modern warfare.

The big question for everything else in the military: what can AI do for a platform do it cannot do for a payload?

Over ten years ago, Jonathan Greenert, then US chief of naval operations, wrote in Proceedings of the "need to move from 'luxury-car' platforms—with their built-in capabilities—toward dependable 'trucks' that can handle a changing payload selection." Last week at Nexus, Greg Allen asked publicly whether artificially intelligent software could make inexpensive weapons much more capable. He noted that the Iranians Shaheds now vexing Ukraine were not really drones, but very slow cruise missiles. Worse than jet-powered cruise missiles in every respect, but so much less costly, they are a classic disruptive innovation in Clay Christensen's sense. This begs the question of what artificially intelligent systems can be emplaced on a drone or missile that will lack the space, weight, power, or cooling available on, say, a large warship. Schuyler Moore's near-term lament could collapse with further advances in computing power, or Gordon Moore's Law could finally slow up enough to confound easy progress. Either way, the survivability of large and expensive platforms, when beset by hosts of less expensive payloads and munitions, may have much to do with the answer. Much about how to best invest in technologies for the next war depends on the outcome of such development.

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