Junior Leaders in the Age of Experimentation

by MAJ Adam Nodin

Why should anyone outside of Army Futures Command bother thinking about the future of innovation and technology? Battalions and companies hardly have enough time to squeeze in a good training event, they can barely keep up with new equipment being fielded, and they can't get rid of the old stuff fast enough. The property books are a mess, and junior leaders struggle to find time to train their troops.

Anyone who has ever been fielded the new Enhanced Night Vision Goggle-Binocular (ENVG-B) or a PUMA unmanned aircraft system can attest to their utility on the battlefield, but those technologies did not arrive by accident. Their concepts were meticulously researched, designed by teams of scientists and soldiers, and went through rigorous testing before landing on any company commander's property books. As the character of war evolves at the pace of technological advancement, and without a raging war to spur technological advancement, the Army is investing in the Army Futures Command's Project Convergence. Experimentation will be key to the Army's ability to evolve with new concepts and technologies, to adapt to those changes, and to integrate devices and systems to win on the next battlefield.

The fundamentals of fire and maneuver and the force's ability to adapt to a changing landscape will always be important**,** still everyone must remember that technological advancements are not unique to the United States – its adversaries are adopting their own experimentation programs to aggressively compete on a global scale. Therefore, the United States' lead as the world superpower is being contested. All said, the fundamentals of soldiering will likely stay un-touched. Very few envision a terminator-like landscape with clashing drones, while the humans remain hidden from sight. Wars will be fought, and won, with people, and those people need to be trained to close with and destroy their enemy. Training this force will be increasingly complex, and leaders need to not only understand their role in training lethality to fight tonight, but also embrace the requirements to be relevant tomorrow.

Imagine the maneuver company commanders of 2040. For the most part, they look like the company commanders of today: physically fit, Ranger qualified and trained to jump out of an airplane. They wear body armor adorned with fighting tools, are bogged down by an array of wires, batteries, and antennas, and carry a rifle that is likely still the 6.8mm Next Generation Squad Weapon that is presently being fielded. The main difference is their access to information. They'll probably carry an advanced version of Integrated Tactical Network (ITN) that gives them portable data and voice communications transport to both over-the-horizon nodes and shorter-range networks. A device that resembles a cell phone on their chest will give them access to sensors, shooters, and command and control centers in their network. With the support of artificial intelligence (AI) software, they'll be able to communicate their company's situation more efficiently and contribute to the generation of offensive and defensive actions. The company's structure will look much the same as today except for a larger headquarters platoon to manage a small fleet of drones and offensive cyber and communications specialists.

Consider the stature of the Army in which those company commanders serve, possibly as much as 20 years removed from counterinsurgency and full-scale combat operations. Years of successful competition and deterrence could keep threats to the United States and its allies in check. Thanks to the degradation of Russia in Ukraine, the shrinking of a Chinese work force, and economic and domestic pressure on North Korea and Iran, the typical big four adversaries might not cross the threshold of armed conflict. Heavy investment in strengthening partnerships and alliances, and a nimble counter-terrorism force might keep threats on the homeland manageable. Despite occasional Immediate Response Force deployments for noncombatant evacuation operations in unstable states across the Baltics and Africa, the low demand on the U.S. Army's divisions would allow its experimentation culture to accelerate. Since technology tends to advance most rapidly during combat operations, the absence of armed conflict will necessitate the focus on rigorous, deliberate military development. The challenges of managing an effective training plan would be complicated by the consistent introduction of new equipment or experiments to refine the understanding of the battlefield of 2060.

If war breaks out in 2040, those company commanders' roles will look much like todays, though the character of war will look different. Their primary mission will still be to close with and destroy the enemy in close combat. A

multi-dimension battlefield will be second nature to those companies. They'll be well-versed in signals collection and disruption, likely have the means to launch limited cyber-attacks on local objectives, and they will be able to deploy ground and air unmanned systems. Their enemy will have the same capabilities. Should these company commanders find themselves being the objective of an enemy attack, their advanced communications, drones, and cyber weapons could be disabled or disrupted, meaning their ability to fight in an analog environment will be important for survival. The training and attention they put into the fundamental fighting skills that are cherished today will still be the root of their success on a future battlefield. Ultimately, the force that can survive in a contested environment, protect its advanced capabilities, and mass all its power in a narrow window of opportunity will win the day.

What is experimentation?

Experimentation is ubiquitous in most Army formations, and it allows leaders to learn what they don't already know. What exactly is experimentation? This might sound like an easy answer. Many took high school chemistry and remembered the reaction when baking soda was mixed with vinegar. But many might not remember what made that event an experiment. After all, the reaction of the mixture is well-known and unsurprising. Most likely, the teacher had the students write a hypothesis – *I believe that adding vinegar to baking soda will create a fizz in the solution*. A controlled environment was likely prepared for the experiment that included a clean classroom, a graduated cylinder, or a scale for measuring the variables, and a sterile glass cylinder to mix everything together. The students repeat the experiment using different amounts of the variables or by adding additional variables like water or food coloring. Students probably recorded the size of the initial reaction as the control, then measured the size of the reaction when different amounts of the variables were added. Finally, over time, the experimenters not only answered their hypothesis, but also learned the exact ratios of vinegar and baking soda required to make the biggest reaction, the speed that they must be added, and how non-reactive ingredients like water affect the reaction.

The Department of Defense (DoD) defines experimentation as "*testing a hypothesis, under measured conditions, to explore unknown effects of manipulating proposed warfighting concepts, technologies or conditions."* It is not an end, but a tool to explore unknown relationships and outcomes that result from new disruptive technologies and concepts, new applications of existing capabilities or emerging threats.[1] Experimentation is more about learning what isn't known or understood rather than proving what already exists.

In recent years, an evolution in individual soldier technology landed in the hands of some of the most junior combat arms troops. Some examples include ITN, a brick-style radio that utilizes both FM and cellular networks to transport voice and data through a relay-style mesh network; ENVG-B, the dual-tube, thermal-enabled night vision devices that incorporate picture in picture views of the user's geo-position and weapon optic and can be linked to the ITN; and the Infantry Squad Vehicle, a vehicle that can rapidly transport a nine-person squad without the cumbersome weight of armor and large-caliber weapons. These enhancements are a result of experimentation, prototyping, and assessment. They went through years of development, withstood the durability tests of the Defense Advanced Research Projects Agency, and were tested by Soldiers at numerous stages called Soldier touch points before fielding. Through the research and development cycle, these products tangentially informed the capabilities of the future force. Innovation breeds more innovation, and that is the power of experimentation.

Army Futures Command

Conceptualizing the future battlefield through the lens of today's technology. Army Futures Command is already researching the challenges, capability gaps, and requirements that must be overcome to achieve the future operating concept. It is a multi-domain effort, and artificial intelligence and machine learning are at the forefront to accelerate problem-solving. A key objective is to build networks from powerful processors that can digest data from sensors of any service, provide actionable information to a designated command node, distribute an effects solution to available systems, and inform a logistical action for resupply or maintenance. Multinational partners and the joint services make up a portion of the solution since the United States will rely heavily on others for things like penetration, mobilization and basing in any conflict.

It might sound like the problem is not necessarily revolutionary, and many might be surprised the U.S. military doesn't already have such a system. Unfortunately, the U.S. military's focus for the last 20 years has been based on

defeating a shape-shifting adversary – the ideological foot soldiers of various terrorist networks in the Middle East who used their ability to vanish within the local population as their primary means of survival. From the 1980s through the wars in Iraq and Afghanistan, the U.S. military focused on platforms to give it the competitive and lethal edge on the battlefield.[2] Some of the platforms that gave U.S. troops a tactical advantage in the Middle East included the Mine-Resistant, Ambush-Protectant vehicles, the 155mm M777 Howitzer, the Javelin anti-armor missile, the M142 High Mobility Artillery Rocket System (HIMARS), and the AH-64 Apache Helicopter. Key defensive platforms include the C-RAM (Counter Rocket, Artillery, and Mortar) and the Patriot missile system. All these platforms brought much-needed technological leaps to the battlefield, but none revolutionized the character of war.

These platforms often showcased a major enhancement of an old problem, but lacked an improvement to the Decide, Detect, Deliver, Assess (D3A)[3] targeting process, sometimes referred to as the kill chain or kill web.[4] The M777 or HIMARS brought longer-range precision fires and the Apache brought advanced targeting, but a human was still required for much of the targeting process. Humans are required to determine if a target observed through an Apache's Forward-Looking Infrared is friend or foe, to decide the best munition to attack the target, and consider whether that target could be passed to a different platform (such as a howitzer), so the Apache could preserve its ammunition for deeper targets. Should this tactical scenario play out on a current battlefield, a cumbersome process of verbal communications would fill the radio net to precisely describe the problem. Then, the information would get translated into an Advanced Field Artillery Data System to determine if the target is in range before sending a message to the gun line to prosecute. A well-trained team might take minutes before a commander would be able to approve the plan. Iterated dozens of times per day, the consequence translates to fuel burn and exposure for the Apache, mental fatigue for the staff, and potential temporary reduction in situational awareness for the commander.

The Army Futures Command's Project Convergence is focused on conceptualizing the design of the future force through an experimentation plan to pursue and integrate the technology and capabilities needed to dominate a future conflict. Every two years, the Army Futures Command holds its Capstone event (formerly called Project Convergence). Industry partners such as Raytheon, Lockheed Martin, and Palantir join Army research and development teams and active Army units to test the force's ability to fight on a conceptualized future battlefield. Special operations troops, naval fleets, fighter aircraft, Marines, Space and Missile Defense, and Army troops along with international partners such as the United Kingdom and Australia attempt to link their sensors, shooters, and command and control nodes to reduce the time of the D3A process in complex scenarios. Drone swarms, ballistic missile barrages, unmanned vehicles, and cyber-attacks are typical problems that complicate the network during this experiment. A difficult balance of imagination, probability, and technology takes place in a six-week conceptualization of the future company commander's battlefield to identify shortcomings and gaps that must be addressed.

At a very high level, the Army Futures Command, the Army service component commands (ASCC), and even the Army corps are hosting experiments with consequential results. Aside from Capstone, the Futures and Concepts Center, a three-star directorate within Army Futures Command, designs experiments within annual training events held by U.S. Army Pacific and U.S. Army Europe and Africa. Not only are these experiments tailored to a particular region, but they also harness the thoughts and knowledge of Soldiers who live outside the continental United States, actively participate in partner force operations, and are focused on deterring and defeating a specific adversary. The data taken from these experiments inevitably feeds future experiments, including Capstone, as well as smaller-scale experiments hosted by the Army's warfighting functions.

A solution to link the existing and new platforms to cut down on the D3A process to speed target prosecution in narrow opportunity windows will be the means to dominate the next battlefield. Advances in processing power, software, and algorithms are leading to computation solutions to improve a leader's ability to make decisions based on impossible volumes of data. In turn, computer-assisted command and control means decisions can be made faster, orders can be distributed and synchronized more rapidly, and precision effects can be delivered to multiple targets at a much higher rate. Those future company commanders will be in the throes of this high-intensity and fast-moving kill chain. Their companies will collect data through their sensors, refine unclear data, or act on data collected by other sensors. The information they transmit or act on will lead to decisions that will be computed in milliseconds, and the pace of their battlefield will move far faster than today. Unlike many other

military innovations, these advances are occurring off the battlefield in digital labs and in experiments like Capstone.

How innovations intersect with junior Soldiers

The junior leaders of today will have to embrace technological developments to be relevant on the battlefield of tomorrow. Without question, the higher-level focus on experimentation is important to the Army as a force, but it does not overhaul what tactical-level leaders need to think about day-to-day. Army Futures Command is experimenting with solving problems at the three-star, joint task force level. Ballistic missiles, deep sensing, drone swarms, and multi-domain operations are common themes at that level. At the tactical edge, Soldiers still need to be competent at their core skills of fire and maneuver. Leaders should embrace opportunities to participate in experiments, be mindful of ways to innovate within their own formations, and to become experts with, and provide feedback for, newly fielded equipment.

Company leaders today have an important responsibility in bridging the counterinsurgency force with the multi-domain force. The future battlefield will have drones, hypersonic missiles, a mind-blowing network architecture, and Soldiers. With a 10 to 20-year time horizon for implementation, the transition will take root slowly. In that time, Soldiers and leaders will be subjected to testing and training with new equipment. Technology will continue to advance in and out of the DoD sphere, and there will be several force design updates. Soldiers from across the force are often requested to take part in these experiments where they are mixed with industry leaders, scientists, and innovators to test prototypes and inform concepts. Their participation and feedback provide steering guidance for those shaping the force's understanding of the character of warfare.

Soldiers are natural innovators and experimenters, and formations should, when practical, take opportunities to learn from each other. There isn't an Infantry or Armor Soldier who isn't the beneficiary of a good tactic, technique, or procedure (TTP) that will never be found in any Army publication. Often these TTPs are honed by an individual or group striving to make their lives a little better. Finding the best position for a magazine pouch for shooting from the prone position or the best antenna setup to use for a dismounted radio or a smart way to quickly establish voice communications after a combat equipment static line jump are all examples of these experiments that resulted in a useful TTP. Often the proprietor of these TTPs isn't sure if they're going to like a particular configuration, but they experiment in a training environment and decide if it works for them. Often a squad leader or team leader will make his or her team follow the same TTPs, beginning a micro-propagation of an experiment that will inevitably be refined by those who use it. The more our leaders can nurture this culture, the better our formations will be at applying critical reasoning when testing and evaluating new equipment.

In pursuit of furthering its understanding of the next battlefield, training exercises would add another flavor of conceptualized warfare that underscore the value of adaptive leaders. For echelons above brigade at the combat training centers, in warfighter exercises, and in regionally aligned ASCC exercises, experiments will be integrated into training events. They will incorporate concepts and prototypes of yet-to-be-fielded technologies and capabilities, and Soldiers across the force will be subject to far-fetched ideas that, seemingly, have no chance of becoming reality. Those company commanders will likely find themselves navigating the complexities of technology dependency, adapting their formations to new technology, and training their companies to fight austere – without battery power and radio waves. Collectively, the force's ability to rapidly assimilate new capabilities into its arsenal and scale their usage at the exact right moments might become a critical competency.

Leaders in brigades do not need to make a hard pivot toward innovation, especially given the challenges already on their plate, but they do need to be prepared to adopt and assimilate new innovations within their ranks. For starters, individual skill competency should be the highest priority at the lowest level. Amateurs train to get the task right; professionals train until they can't get the task wrong.[5] New technology and equipment will not replace the requirement for Soldiers to be experts at their craft. With technology comes new burdens, such as a heavy dependency on batteries and more devices that transmit and receive communication signals. Adversaries will have capabilities to detect signal communications, and batteries will almost always be a commodity. China, for instance, is the world's largest manufacturer of battery-grade Lithium,[6] meaning digital technology cannot replace fighting with analog systems. Soldiers will always need to live, and be expected to succeed, in analog environments. Innovation does not reduce the importance of field craft and core competencies, and formations will have to learn to be effective in all conditions.

Putting it all together

The Army is deliberately planning for a fast-paced, integrated, a technologically assisted future battlefield. Therefore, today's junior leaders will be the catalysts of that highly sophisticated Army. Predicting the future is almost impossible, especially when it comes to uncertainty in geopolitical tensions, economics, and the strength of a nation's fighting force. Trends and patterns provide indications and clues to what the future might look like, but nothing is for certain. Despite these challenges, Army Futures Command is making a well-educated estimate of the threats the Army will face in the next two to three decades. As such, Project Convergence is the professional, scientific, and war-focused process to continuously refine understanding of the future, while simultaneously learning through experimentation. Soldiers from across the Army will be in increased demand to support such experiments, and their participation should be embraced as on opportunity to inform development rather than as a hinderance to training.

More importantly, today's leaders are in the best position to train the generation of leaders ahead of them since tech-enabled decision making will already be part of the Army they join. With a new reliance on digital warfare, tactical leaders' greatest challenge will be keeping their troops focused on individual warfighting skills to fight, and survive, until they reach a window of opportunity to strike.

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Notes

[1] Department of Defense. 2021. ***Experimentation Guidebook,*** Version 2.0. Washington, D.C.: Office of the Under Secretary of Defense for Research and Engineering.
[2] Brose, Christian. 2020. ***The Kill Chain***. Hachette Books.
[3] Department of the Army. ATP 3-60, ***Targeting,*** *2015*, Washington, D.C.
[4] Joint Chiefs of Staff, JP 3-09, ***Joint Fire Support,*** Suffolk, VA, 2019, Joint Force Development, J7.
[5] No citation, but it is known to circulate many of the combat arms communities within the Joint Special Operations Command.
[6] Chang, Agnes, and Keith Bradsher. "Can the World Make an Electric Car Battery Without China?" ***New York Times***, May 16, 2023.

Acronym Quick-Scan

AI – artificial intelligence
ASCC – Army service component commands
D3A – Decide, Detect, Deliver, Assess
DoD – Department of Defense
ENVG-B – Enhanced Night Vision Goggle-Binocular
HIMARS – High Mobility Artillery Rocket System
ITN – Integrated Tactical Network
TTP – tactics, techniques, and procedures