Junior Leaders in the Age of Experimentation

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Why should Soldiers outside of the U.S. Army Futures Command (AFC) bother thinking about the future of innovation and technology? After all, battalions and companies are often busy enough conducting training events while keeping up with new equipment fieldings and getting rid of the old equipment.

Any Soldier who has ever fielded the new Enhanced Night Vision Goggle-Binocular (ENVG-B) or a Puma unmanned aircraft system (UAS) 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 AFC's Project Convergence. Experimentation will be key to the Army's ability to evolve with new concepts and technologies, adapt to those changes, and 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, we must remember that technological advancements are not unique to the United States — our adversaries are adopting their own experimentation programs to aggressively compete on a global scale, and the U.S.'s lead as the world superpower is being contested. All said, the fundamentals of soldiering will likely stay untouched. 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 and prepared 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.

A 10th Mountain Division Soldier adjusts his Enhanced Night Vision Goggle- Binocular in preparation for a land navigation exercise as part of the device's reliability growth test in June 2020. (Photo by Bridgett Siter)

Imagine the maneuver company commanders of 2040. For the most part, they will look similar to company commanders of today: physically fit and both Ranger and Airborne qualified. They'll wear body armor adorned with fighting tools; be 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. The main difference is their access to information. They'll probably be carrying an advanced version of the 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 may 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 U.S. 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 counterterrorism force, might keep threats on the homeland manageable. Despite occasional immediate response force (IRF) deployments for noncombatant evacuation operations (NEO) 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 2040.

If war breaks out in 2040, the roles of company commanders may look much like today's, 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 cyberattacks on local objectives, and be able to deploy ground and air unmanned systems. Their enemy will have the same capabilities. Should these company commanders find themselves as 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 later battlefield. Ultimately, the force that can survive in a contested environment, protect its advanced capabilities, and mass all of 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 may have taken high school chemistry and remember the reaction when baking soda was mixed with vinegar. But some 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 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

Soldiers from the 3rd Brigade Combat Team, 82nd Airborne Division train with the Integrated Visual Augmentation System on 11 October 2022 as a part of Project Convergence 22 at Camp Talega, CA. (Photo by SGT Thiem Huynh)

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 the 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 (ISV), a GMC-designed 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 (DARPA), and were tested by Soldiers at numerous 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.

The Army Futures Command

Conceptualize the future battlefield through the lens of today's technology.

AFC is already researching the challenges, capability gaps, and requirements that must be overcome to achieve the future operating concept. It is a multidomain effort, and artificial AI 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 U.S. 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, its 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 a 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 Protected (MRAP) vehicles, the 155mm M777 howitzer, the Javelin weapon system, the M142

High Mobility Artillery Rocket System (HIMARS), and the AH-64 Apache helicopter. Key defensive platforms include the Counter Rocket, Artillery, and Mortar (C-RAM) and the Patriot missile system. All of 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) targeting process, sometimes referred to as the kill chain or kill web.[3-4] 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 (FLIR) 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 communication would fill the radio net to precisely describe the problem. Then, the information would get translated into an Advanced Field Artillery Data System (AFATDS) 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 in a position to approve the plan. Iterated dozens of times per day, the consequence translates to fuel burned and exposure for the Apache, mental fatigue for the staff, and a potential temporary reduction in situational awareness for the commander.

AFC'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, AFC 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 Soldiers, along with international partners such as the UK 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 cyberattacks 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, AFC, the Army Service Component Commands, 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 the U.S. Army Pacific Command 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 that 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 be collecting data through their sensors, refining unclear data, or acting 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.

Innovations in Practice: How Innovations Intersect with Junior Soldiers in the Field

The junior leaders of today will have to embrace technological developments to be relevant on the battlefield of tomorrow.

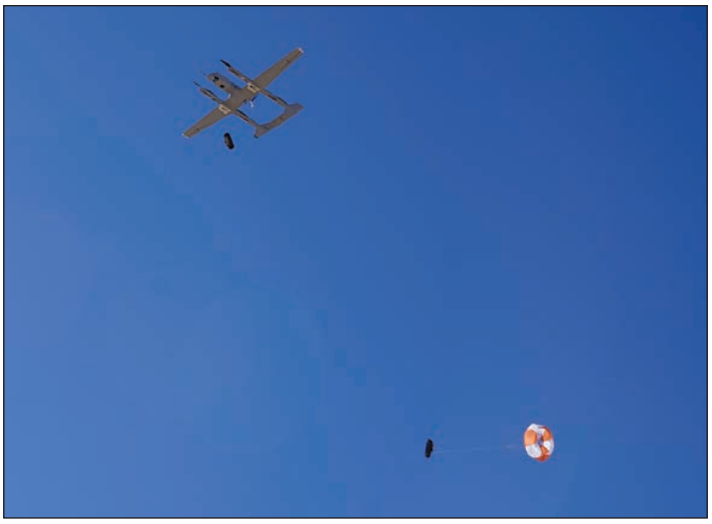
British soldiers from C Company, 2nd Battalion of the Yorkshire Regiment take part in an experiment as part of Project Convergence 22 on 4 November 2022. (Photo by Army Futures Command)

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 be thinking about day-to-day. AFC is experimenting with solving problems at the three-star, joint task force level. Ballistic missiles, deep sensing, drone swarms, and multidomain 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 10-20-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 Department of Defense 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, 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 proprietors of these TTPs aren'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 are able to 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 (EAB) at combat training centers, in warfighter exercises, and in regionally aligned ASCC exercises, experiments will be integrated



A U.S. Army Group 3 Medical Drone delivers a payload during Project Convergence 22 on 28 October 2022. (Photo by SGT Thiem Huynh)

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 skills 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 — meaning digital technology cannot replace fighting with analog systems.[6] Soldiers will always need to live, and be expected to succeed, in analog environments. Innovation does not reduce the importance of fieldcraft 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, and technologically assisted future battlefield. Today's junior leaders will be the catalysts of a 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 certain. Despite these challenges, AFC is making a well-educated estimate of the threats the Army will face in the next two to three decades. Project Convergence is the professional, scientific, and war-focused process to continuously refine its understanding of the future while simultaneously learning through experimentation. Soldiers from across the Army will be in increasing demand to support such experiments, and their participation should be embraced as an opportunity to inform development rather than as a hindrance 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.

Notes

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

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