An image on the live stream screen of a night vision drone operating circa 2025 near Pokrovsk, Ukraine, shows individual heat signatures of Russian soldiers and equipment congregated at a single location that were targeted for attack. (Photo by Anton Shtuka for NPR)

Distributed Combined Arms Rehearsals

Say Goodbye to Giant Terrain Models

Maj. Gen. Thomas M. Feltey, U.S. Army

Lt. Col. Jay A. Ireland, U.S. Army

Maj. Micah C. Barley, U.S. Army

Maj. Scott W. Russell, British Army

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The era of in-person combined arms rehearsals (CAR) with hundreds of people stacked up around a terrain model straining to hear the commander is over—there, we said it.

Among the vital lessons learned from the Russo-Ukrainian conflict is that the dominant prevalence of unmanned aircraft systems (UAS) and modern long-range precision fires in the changed operational environment of modern battlefields makes unnecessary mass gatherings unacceptably risky. Moreover, each movement from a covered and concealed position is now a high-risk proposition that demands much greater risk-versus-reward calculation. Given these risks, how can we provide commanders an opportunity to communicate the necessary intent together with facilitating the synchronization of combat operations through rehearsals while also ensuring survivability? The answer is *distributed CARs*.

To accomplish this, our doctrine and policy must change to stipulate that CARs in the future must be distributed to protect the force because of the vulnerability of mass gatherings during large-scale combat operations (LSCO), and combat training centers must mandate the use of distributed CARs during training rotations. We expect resistance to this assertion from many experienced operators because their past experiences with distributed CARs may have been adversely colored by suboptimal software, clunky and unreliable communications equipment, or a preference for human interaction. However, if we consider the large scale of a brigade CAR during a National Training Center (NTC) rotation in the context of the Ukraine war influenced by a pervasive UAS threat, there is clearly a problem with the way we currently do business.

While there is real value in face-to-face conversations with the commander, the modern LSCO fight will only get more dangerous and the weapons more lethal. Imagine a battlefield with thousands of unmanned aircraft buzzing around in the skies. Would we really send our commanders and staffs to a centralized location in that scenario? We think not. The war in Ukraine shows us that we must consider distributed communications first before we expose our people to autonomous loitering munitions to preserve the force and minimize the impact of a key enemy capability.

What Is to Be Done?

The Army already has tools that can facilitate such virtual rehearsals, and initiatives stemming from the Army's transformation-in-contact concept are further modernizing the communications architecture to facilitate improved upper tactical internet (TI) across the force.[1] While this article focuses on CARs, it also obliquely highlights the pressing need to conduct a thorough DOTMLPF-P (doctrine, organization, training, materiel, leadership and education, personnel, and facilities) review where we are unafraid to evaluate with a critical eye even what are regarded by many as our most tried-and-true practices. Transformation in contact is delivering critical materiel to the force, and it is now time for our training, doctrine, and practices to catch up with the modernization taking place in the Army.

Vulnerability of Command-and-Control Nodes in LSCO

The Russo-Ukrainian conflict provides a stark reminder that our command-and-control (C2) structures must be light and agile to survive on the modern battlefield. Targeting adversary C2 nodes is not a new concept, but the war in Ukraine has highlighted the increased vulnerability of large tent-based headquarters due to modern precision long-range fires and drones. Lt. Gen. Milford H. Beagle Jr. and then–Brig. Gen. Jason C. Slider draw comparisons between Russian corps and division command posts (CP) and U.S. Army CPs in the article "The Graveyard of Command Posts."[2] The article highlights how the Russian defense of Kherson collapsed in early 2022 after a "relentless assault on command and control characterized by a systematic attack on Russian command posts at scale."[3] During the eight months leading up to the collapse of the Russian front at Kherson, the Armed Forces of Ukraine successfully struck Russian division, corps, and army-group headquarters on twenty-two separate occasions, severely degrading C2 capability and killing the commander of the 49th Combined Arms Army.[4]

UASs have become a pervasive threat on the battlefield in Ukraine and in those parts of Russia's Kursk Oblast where conflict is also raging. Not only do they provide the surveillance and target acquisition

Top: A screen capture of Ukraine drone imagery identifying the heat signature of a Russian command post on 16 May 2022. *Bottom:* A second screen capture shows the first in a series of explosions created by bombs dropped from a Ukrainian drone that destroyed the command post. (Screenshots from YouTube)

capability for long-range precision fires, but rapid "while in contact" innovation has also led to a wide array of different kinds of UAS that now provide a range of previously unknown capabilities to both sides.[5] One important development has been the use of commercially available first-person-view UASs modified into kamikaze drones by the addition of small payloads that have become so commonplace that they are now described as the "Ukrainian Army's principle anti-tank weapon."[6] They are everywhere on the battlefields of Ukraine. Countless examples of battlefield reports and widely advertised visual imagery on the internet provided by Ukrainian and Russian outlets depict the effectiveness of first-person-view drones chasing and destroying moving tanks, being navigated into confined spaces such as trenches or inside buildings to strike targets, and being used in a large-scale effort to hunt down and kill individual soldiers attempting to find shelter against such UAS attacks.[7]

The UAS revolution has had such an impact on the tactics employed by both sides of the Russo-Ukrainian war that some argue that it may have "fundamentally altered the nature of tactics and warfare" itself.[8] Yet despite the pervasive threat of UAS observed in Ukraine and elsewhere, both in terms of constant surveillance and direct strikes, U.S. doctrine remains largely unchanged.[9] UAS expansion into multiple ubiquitous roles in support of both Ukrainian and Russian forces should compel an immediate clear-eyed reassessment of our doctrine and practices to ensure the success of our operations.

Relevance of Real-Time, Real-World Lessons from Ukraine

The U.S. Army's effort to reduce CP size is not solely a result of the Russo-Ukrainian war; CP survivability has been a consideration since the Army began to refocus on the fundamentals of LSCO.[10] Yet, while efforts are being made to reduce the size of CPs and make them more mobile and survivable, our doctrine and training persists in driving us to conduct full-up CARs although it should be obvious that such large gatherings are simply not compatible with LSCO.

Additionally, the problem is not just the mass gathering of commanders and staff for the CAR itself but also the movement of those commanders across the battlefield to a reach a CAR. Movement draws the eye, and with the proliferation of UAS on the battlefield, such movements place the commanders at greatly increased risk as compared to previous operational environments free of UAS. Worse yet, they provide opportunities for the enemy to track movement back to a CAR site or higher headquarters location and queue up a devastating strike against our C2.
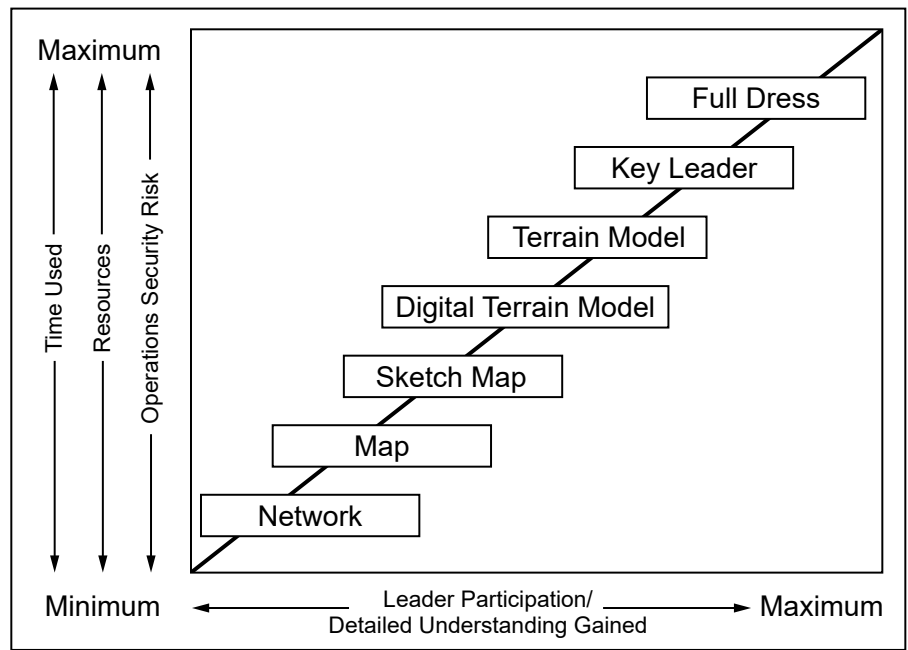
Combined Arms Rehearsals

CARs are not immune to the threat posed to CPs or large gatherings in LSCO. However, while in-person CARs are becoming more dangerous, commanders still need a venue to be able to synchronize their plans in time and space with their staffs and their subordinate commanders.

"A rehearsal is a session in which the commander and staff or unit practices expected actions to improve performance during execution."[11] At present, training publications lead us to assume our rehearsals should be conducted in person around large terrain models.[12] Current doctrine further reinforces this assumption by listing techniques on a sliding scale of effectiveness with digital, map, and network rehearsals listed among the least effective (see the figure).[13] So ingrained is the assumption that during course of action analysis, we instinctively break out the terrain model kit and go into arts-and-crafts mode on an unsuspecting piece of ground to build a terrain model.[14] However,

(Figure from Field Manual 6-0, *Commander and Staff Organization and Operations*)

Figure. Rehearsal Techniques

the observable current operational environment has now rendered this doctrinal diagram obsolete. It was formulated during a time when network rehearsals were conducted over FM voice radio with analogue maps in hand. In contrast, modern networks using new technologies like Starshield (proliferated low earth orbit, or pLEO, satellites) empower commanders and staff to take part in rehearsals digitally that include moving unit icons across a map in real time for all participants to see. Consequently, commanders are now able to participate in dispersed rehearsals without leaving their CP, or even while mobile in a vehicle. The upshot is that we have the required technology. We only need the foresight and commitment to use and to develop it further by exploiting and expanding on its potential, and to do so quickly.

Furthermore, practical experience among many has debunked the notion that the network CAR is less effective than the in-person CAR. We assert that this view is outdated. Feedback from commanders within the 1st Cavalry Division (1CD) has been overwhelmingly positive as they were better able to understand the plan and better able to engage in dialogue and synchronization efforts no less than during an in-person CAR. Additionally, staff members reported having clearer situational awareness and being better able to follow

the commander's dialogue than is usually possible at an in-person CAR, where they are often relegated to the periphery and struggle to see the map and hear the dialogue. Unlike in-person CARs, virtual CARs grant all participants front-row seats.

It is understandable that there will be a natural preference for in-person CARs based on habits and tradition; some resistance to change is to be expected. But the situation has changed, both on the battlefield and in technological development, and we must be willing to change with it. Our challenge to doctrine on the conduct of CARs is therefore based on two factors. First, as we have established, dispersion is essential on the modern battlefield, and large gatherings must be avoided. Second, with the software that now exists, virtual CARs can now be more effective than in-person CARs in generating a detailed understanding of the plan.

Virtual CAR

1CD experimented in conducting virtual CARs during Avenger Triad 24, a multicorps NATO exercise involving ten partner nations and the first NATO exercise of its kind since the early 1990s.[15] The division's forces were spread over a large front in eastern Europe during the exercise, which meant an in-person

rehearsal was not possible, yet the complexity of the operation demanded careful synchronization—meaning a CAR was vital.

Division planners considered different virtual CAR methods before selecting Virtual Joint Operating Center (VJOC) in late August 2024, which proved effective at allowing the staff to establish a common understanding of the plan and facilitating commander dialogue. VJOC is a collaborative tool often used for briefings. A series of map boards were constructed on VJOC for the CAR along with moveable unit icons that, when combined with the drawing tool, allowed commanders to articulate their part in the plan. With these straightforward, easy-to-use tools at his disposal, the commander was allowed to inject contingencies, highlight his own concerns, and rapidly propose his own changes to things like the scheme of maneuver in a way that allowed the entire staff to follow along.

1CD is not the first formation to run rehearsals over VJOC. III Armored Corps used it to conduct distributed CARs while executing the 1st Armor Division's NTC rotation in January 2024. It conducted virtual CARs as a matter of necessity due to the dispersal of forces, with not all participants being physically located at the NTC. III Armored Corps realized the potential of executing distributed CARs in this manner and quickly discerned that this was the way of the future. During the rotation, no face-to-face corps or division rehearsals were conducted.

However, while VJOC can facilitate effective rehearsals, it was not purpose-built for virtual CARs. We found it to be a laborious process to snip Command Post Computing Environment (CPCE) map images, create and import unit icons, and test that outstations could move the icons across the maps image. There were bandwidth issues that precluded using the VJOC voice capability. However, concurrently using CMS AudioVisual or Ventrillo audio during the rehearsal solved this problem. In short, VJOC is the best system we currently have for virtual CARs, but there is scope for improvement.

Not every division and corps headquarters in the Army has VJOC. Using CPCE by itself is an alternative, and the 3rd Infantry Division were able to use it to good effect during their deployment to the European Command area of operations.[16] Its method was to create a "dirty" CPCE layer with moveable icons, similar to the map boards we created on VJOC.[17] However, from our experience, VJOC is

(Photo by Staff Sgt. Noshoba Davis, U.S. Army National Guard)

The Risk of Large Gatherings

This photograph of a brigade combined arms rehearsal during a major NATO exercise in central Europe demonstrates the significant risk of gathering unit leadership during large-scale combat operations. Based on what we are seeing in Ukraine, such a gathering would certainly come quickly to the attention of an adversary due to ubiquitous loitering UAS intelligence collection over operational areas. Subsequently, it would be targeted by fires either coordinated or actually executed by UAS. Consider the impact that would have on the brigade's command and control if its collection of senior leaders and key staff were attacked in such a manner. Is that a risk we should be taking? Is it a standard procedure we should continue encouraging in doctrine and practice?

Maj. Ryan Hamilton (*center*), a field artillery officer with 1st Cavalry Division Artillery, works closely with Polish officers during Avenger Triad 24 on 11 September 2024 in Bolesławiec, Poland. Avenger Triad 24 was a U.S. Army Europe and Africa command post exercise with U.S. Army, NATO, and multinational organizations held 9–19 September 2024 in multiple locations in Europe. Incorporating lessons learned from Austere Challenge 24, this exercise implemented operational concepts, doctrine and procedures to increase readiness, enhance interoperability, employ new concepts, and inform regional planning. (Photo by Staff Sgt. Jasmine McCarthy, U.S. Army)

more user-friendly, allowing multiple map boards to be constructed and, through its "bring users to me" function, one user is able to steer the CAR by controlling what the other users can see.

Conversely, CPCE requires users to pull up the right layers and to manipulate their own map to the correct location for the discussion. Regardless of whether VJOC or CPCE is used, moveable icons are essential; the virtual CAR cannot just become a rolling presentation moving from slide to slide, or layer to layer on the CPCE. Such an approach turns the CAR into a back-brief rather than a dynamic rehearsal.

We assert that to embrace the virtual CAR, the Army cannot rely solely on CPCE and must field VJOC or a similar system across the force, supported by training and doctrine. Until that occurs, there will be no uniform way to conduct virtual CARs. Identifying the right software solution is an issue that could be addressed during a DOTMLPF-P review.

Electronic Signature

One counterargument to distributed CARs is that it would create an electronic signature that could give away the location of participants, exposing them to the risk of being targeted by enemy fires. This concern is rational, as we use electronic warfare to identify and target enemy command nodes, and surely the enemy would do the same. However, while this may be true of such communication types as HF and VHF radios, the emissions given off by pLEO satellite systems like Starshield are harder to detect. Such pLEO systems transmit in a common commercial bandwidth, which makes them hard to detect amidst the ambiance of most modern countries. This is one of the reasons that Starlink is being used so effectively in Ukraine.[18] Also worth noting, the electronic signature of such
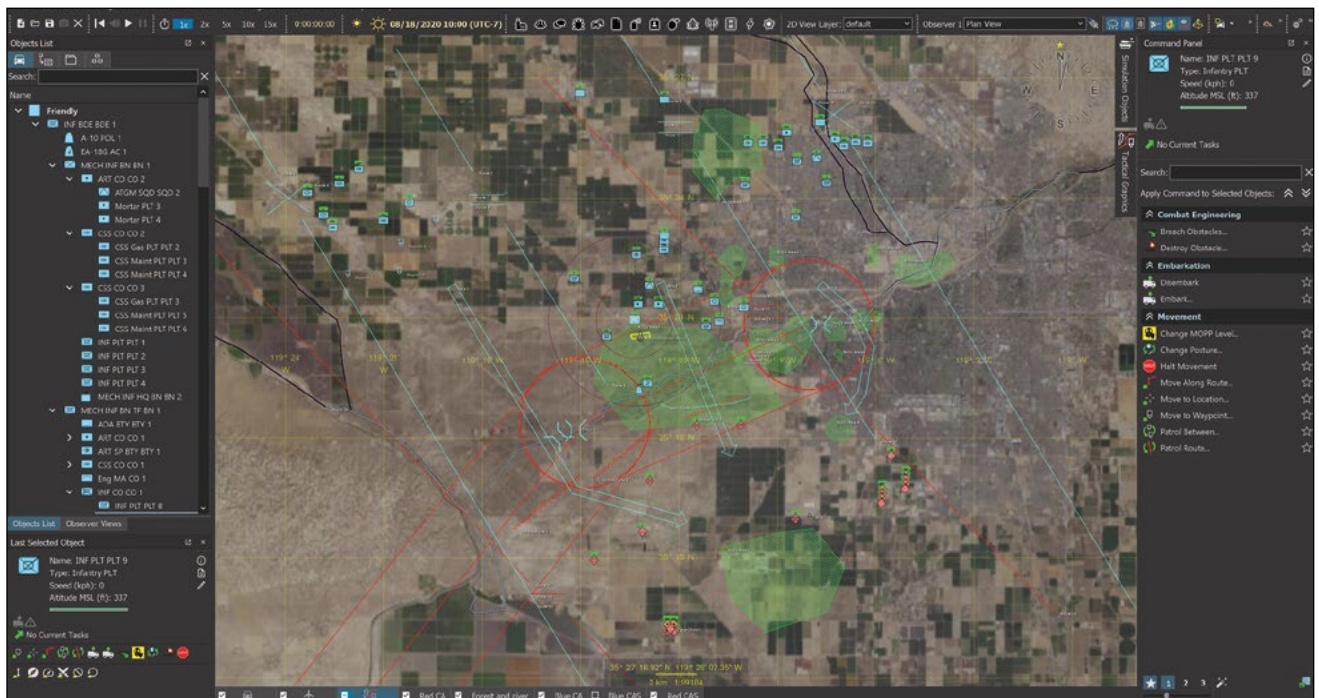
This screen capture from a VR-Forces simulation is similar to the interactive screen images that were employed 9–19 September 2024 during Avenger Triad 24, a combined, multinational exercise in Poland that included combined arms rehearsals by the 1st Cavalry Division and international partners via computer networks. The VR-Forces synthetic environment supports multidomain, multiechelon, and multiresolution simulation, including both entity- and aggregate-level modeling within a common tool suite. (Graphic courtesy of MAK Technologies' VR-Forces)

systems does not grow in strength as the number of users increases, therefore running a distributed CAR over upper TI using Starshield will not create emission spikes for enemy targeting.

Yet, while the risk of detection is reduced using pLEO systems, we cannot discount it entirely; the enemy will always look at innovative ways to detect our communications. So, what is the solution? Should we simply go radio silent and give up trying to communicate across our force? Of course not. That is not how the Army synchronizes its efforts and exercises C2. Instead, we should seek to minimize the risk of detection through all means available to us, including masking our signals and using decoys. Ultimately, the choice of whether to conduct a full-dress CAR or a virtual CAR is made through a risk assessment, but we argue that the risk of bringing leaders and staff together for an in-person CAR significantly outweighs the risk of doing it

over distributed means using discrete pLEO satellite communications like Starshield.

Another counterargument to distributed rehearsals is the belief that the Army's C2 Fix initiative is removing upper TI communications at brigade and below, which would make it impossible for them to conduct virtual rehearsals.[19] This is a misconception. C2 Fix aims to increase mobility and survivability for echelons at brigade and below by elevating network and server complexity to the division level. Upper TI is still required at brigade and below to access information critical to the commander's decision-making process. For this reason, the proliferation of pLEO is key to removing the network complexity at brigade and below, which is why Starshield is a critical part of modernization efforts. 3rd Brigade, 10th Mountain Division's recent combat training center rotation, where they were the first transformation-in-contact unit to participate in Combined Resolve 25-01 in Germany, showcased the brigade's innovative use of Starshield down to the battalion level, enabling excellent upper TI communications throughout the brigade and ultimately to the division headquarters.[20]

Recommendations and a Way Ahead

The Russo-Ukrainian conflict must be a cognitive wakeup call across the U.S. Army and specifically

for the armored force. We cannot fight and win the way we wanted to five years ago. The proliferation of UAS (armed and unarmed) and electronic warfare throughout the battlefield has rendered some of our most important capabilities extremely vulnerable. The chief of staff of the Army's transformation-in-contact initiative is critical to our success on the future battlefields. But we cannot think that materiel solutions alone will bring in the change that we need to dominate future wars.

The fact that in-person CARs still exist in our training events and doctrine in the face of numerous examples of Russian catastrophic failures is an indicator that we have an opportunity to look not only at our materiel shortfalls (which transformation in contact looks to address) but also across the spectrum of DOTMLPF-P. What sacred cows exist that might need a facelift? Or better yet, a complete and total rewrite? The CAR should be our canary in the coal mine. Also, what other things are we doing that might have been relevant twenty years ago but now just don't make as much sense given the fundamental shift in warfare? A future study could consider those questions and examine such issues as the following:

- Integrated weapons training strategy
- Gunnery table progression and training
- Electronic warfare/counter-UAS policies on home-station training (spectrum management)
- Home-station training area capabilities (dragon's teeth, antitank minefields)

Conclusion

We continue to observe a rapidly evolving tactical situation during LSCO in the Russo-Ukrainian war characterized by the proliferation of UAS. Concurrent to this, the U.S. Army is being transformed through modernization, and this includes the rolling out of state-of-the-art communications equipment that will deliver high-speed upper TI to the field army. Yet despite the lessons from the battlefields of Ukraine and our own technological advances, our training and doctrine remains largely stagnant. *This needs to change.*

We are not the first to make the case for a shift to distributed CARs. U.S. European Command and 3rd Infantry Division have experimented with and now advocate fully digitized rehearsals. In a 2024 article, Maj. Gen. Christopher Norrie et al. state that "fully distributed mission command replicate[s] how subordinate commanders will fight in large-scale combat operations where they will likely be separated by geography to increase dispersion for protection."[21] Consonant

Maj. Gen. Thomas Feltey, U.S. Army, is the commanding general of the 1st Cavalry Division. He holds a BS from Rutgers University, an MA in national security and strategic studies from the Naval War College, and an MS in campaign planning and strategic studies from the Joint Forces Staff College of the National Defense University. His last assignment was as the deputy commanding general of maneuver in III Armored Corps, and he has served in a diverse selection of command and staff positions including as the fifty-third chief of armor; director, G-3/5/7, Futures and Concepts Center; and chief of staff, 4th Infantry Division. He has multiple tours in Iraq, Afghanistan, and Europe.

Lt. Col. Jay A. Ireland, U.S. Army, is an armor officer and the 1st Cavalry Division assistant chief of staff for operations, G-3. He holds a BS from the U.S. Military Academy and an MA in geography from the University of Hawaii, Manoa. He previously served as the commander of the 1st Battalion, 8th Cavalry Regiment, with earlier assignments in the 1st Armored Division, the 4th Infantry Division, and the 1st Cavalry Division.

Maj. Micah C. Barley, U.S. Army, is a future operations planner with the 1st Cavalry Division. He holds a BA in organizational leadership and supervision from Purdue University, Indiana, and an MA in operational studies from the Command and General Staff College at Fort Leavenworth, Kansas.

Maj. Scott W. Russell, British Army, is the chief of operations of the 1st Cavalry Division. He is an infantry officer from the Royal Regiment of Scotland and has served in Afghanistan and Eastern Europe. He holds an LLB (with honors) in law from Aberdeen University, UK, and an MSc in battlespace technology and MSc in defense acquisition management from Cranfield University, UK.

with his and other observations by senior leaders on the future of CARs—if we accept that we will not conduct large-scale, in-person CARs during times of war, then why are we doing it in training?

The CAR is a glaring example of how our practices are not compatible with the modern battlefield and are failing to embrace our technological capabilities. Virtual CARs should be implemented in doctrine and practice to mitigate risk; the tools exist in our formations. However, while this article has focused on the CAR, that is just one example of how our processes need to catch up with the transformation taking place in the Army. A full DOTMLPF-P review needs to be conducted to ensure that our doctrine and training evolve to keep pace with the materiel changes being delivered to the force by transformation in contact.

To emphasize the importance of the issue to the Army at large, as a practical matter, the next time a brigade at the NTC forms up for a full-dress CAR in range of enemy long-range fires, the observer-coach/trainers should inform them they have just been struck by indirect fire and start handing out casualty cards. This would fairly make the vital point in a direct but appropriate way. ■

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