

# **Beyond Destruction:**

## Bridging the Gap in Artillery Effects Expertise

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contemporary Large-Scale Combat Operations (LSCO), a significant gap in the tactical application of artillery exists due to a widespread lack of understanding among military professionals of surface-to-surface munitions effects. This deficiency hinders the effective use of artillery capabilities crucial for achieving tactical objectives. To bridge this knowledge gap, it is imperative to enhance the training, understanding and expertise of designated subject matter experts, specifically the 131A Field Artillery Targeting Technicians. The addition of an advanced weaponeering course, focused on the effects of artillery, offers a pathway to align operational execution with doctrinal expectations and improve tactical level targeting. A deep understanding of munitions effects is essential for leveraging artillery's full potential in LSCO, ensuring that military operations are precise and efficient.

#### Why this is a gap

Major General Snow wrote about the importance of understanding artillery effects as a pivotal component to military success in 1911 (Snow, 1911). Additionally, FM 3-60 Army Targeting lists "effects-based" as one of the key principles of targeting. Effects represent the intended outcome of artillery engagements and are used by the Joint Weaponeering Software (JWS) and the Advanced Field Artillery Tactical Data System (AFATDS) to calculate munitions necessary for achieving that end state based on several factors. These systems use complex statistical calculations based on probabilities and advanced computer modeling to arrive at the necessary rounds needed to achieve those effects (Driels, 2020). However, at the tactical level these systems are only intended to provide planners with a confidence measure for a single engagement (JTCG/ME, 2016). The effectiveness of these calculations depends on the computational power of the system, data available and the operators understanding of the tactical situation when engagements will occur including location error, area versus point targets and meteorological data. This variability in outputs across systems and operators stems from the uncertainties in tactical needs and the inefficiency of AFATDS weapon pairings compared to JWS (Thompson, 2018). To expedite and further simplify this process, the use of pre-computed weaponeering databases and adjudication tables are used for tactical products and decision-making, misrepresenting the rounds required, wasting resources and potentially eroding commanders' confidence in artilleries effectiveness. This issue is exacerbated when training relies on these adjudication tables, creating unrealistic expectations to "win with fires" at training centers, not based on accurate weaponeering calculations (Holm, 2022).

Modern artillery, utilized in Ukraine, has been proven to be more effective than the artillery of historical LSCO conflicts, particularly due to its accuracy and precision munitions (Hinton, 2023). While destroy, neutralize and suppress remain the standard effects for JWS calculations and cannon doctrine TC 3-09.81, this categorization is reductive compared to the 23 tactical/targeting tasks and 44 intended effect outcomes described in FM 3-60 Appendix C. Understanding how artillery can be used to achieve most of the 44 targeting outcomes at the tactical level requires a deeper understanding of the technical mechanisms of artillery effects. This includes blast and fragmentation effects, aimpoint manipulation or sheaf selection and the wide variety of shellfuse combinations available. LSCO will require staff to interpret desired effects to better utilize weaponeering software when appropriate, ensuring the artful application is grounded in this well researched science whenever feasible. However, due to the dynamic nature of tactical level operations, that weaponeering process can be prohibitive. A depth of knowledge of the inherent effects will provide staffs at these echelons more flexibility, resources and effectiveness with artillery.

#### Proposal to address this gap

Introducing an advanced munitions effects course to supplement the current 40-hour weaponeering course, addresses the critical need for an expanded understanding of artillery's operational capabilities, focusing on the detailed mechanics of artillery effectiveness, the vulnerabilities of specific enemy materials and the intricate use of shell-fuse combinations. By drawing on extensive research and practical insights into artillery, the course can be designed to enhance the operational effectiveness of military leaders, making this a valuable addition to the professional development of artillery personnel. The adoption of such courses by other nations and sister services, like the Air Force and Navy courses for their munitions, underscores

the global recognition of the importance of advanced weapons effects training (Personal communication).

The aforementioned course should be added to the current precision fires courses at the Army Multi-Domain Targeting Center and be developed in collaboration with the Joint Technical **Coordinating Group for Munitions Effectiveness** (JTCG/ME) and other key government and nongovernmental entities, as well as industry partners. This can have the same prerequisites and instructors as the current weaponeering course minimizing time to implement. The JTCG/ME already offers a similar course focused on air-to-surface munitions called the Joint Munitions Effectiveness Manual methodology course and adapting this course for surface-tosurface munitions would be seamless as artillery effects are well researched and documented. Key to the curriculum is a deep dive into the principles underlying target vulnerabilities, blast fragmentation pattern and how artillery can be applied to efficiently compromise targets. Integrating the theoretical knowledge with practical demonstrations, videos and even simulations, the course will guide participants through the complex dynamics of blast waves and shrapnel dispersal, emphasizing the selection of munitions based on the specific targets that will be engaged. Finally, this course can cover nonlethal artillery effects such as cratering to delay, obscuration to degrade, fires to deceive or divert and its psychological effects.

While all artillery professionals would benefit from such a course, the 131A Field Artillery Targeting Technicians should be the focus of such advanced study. These professionals are charged with being subject matter experts in artillery and the targeting process. Their role, highlighted throughout the War on Terrorism, has proven their abilities in targeting and target development (Rios, 2023). The proposed expansion of their effects knowledge equips them to better assess threat vulnerabilities and select and prioritize targets in alignment with the entire targeting process and resources available. This evolution of the 131As' role, mirrors the development of the current weaponeering course in 2010, which anticipated the growing necessity for specialized expertise in effects and coincided with their shift from radar technician (Fensler, 2016). Enhancing 131As' understanding will enable tactical commands to fulfill all of the targeting principles and provide options to achieve all targeting effects with artillery.

This advanced knowledge better equips staffs to leverage computational tools effectively when time and circumstances allow, while also providing the expertise to make informed, rapid decisions when reliance on technology is restrictive. Such an approach ensures that tactical level targeting is not only grounded in science, but also remains versatile in the face of fluctuating battlefield dynamics and resource constraints. By marrying the depth of subject matter expertise with a strategic use of computational resources, commanders can optimize targeting decisions to exploit opportunities, converge effects and mitigate challenges in real-time, whether through calculation with JWS and AFATDS or the application of experience by educated subject matter experts.

#### Conclusion

Addressing the critical gap in the understanding of all surface-to-surface munitions effects within LSCO is paramount for tactical targeting and the success of military operations. Enhanced training and a paradigm shift towards a deeper, more nuanced comprehension of artillery effectsincluding both lethal and non-lethal outcomes are essential. Such a level of expertise necessitates the development of an advanced weaponeering course that goes beyond mere software use, aiming to bridge the gap between theoretical knowledge and the complex realities of modern combat. Such educational advancements should particularly focus on the 131A Field Artillery Technicians, who play a pivotal role as subject matter experts in artillery and targeting. By expanding their knowledge of effects, these technicians will be better equipped to advise commanders, ensuring that artillery is used effectively and efficiently. Tactical level targeting in LSCO will demand an expert understanding of artillery to leverage precision fires, minimize collateral damage and fully unleash artillery's potential to achieve tactical objectives. The proposed courses will not only enhance the effectiveness of current operations and training but ensure that the military remains adaptable and capable in the face of evolving global threats.

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