Engineer Support to Engagement Area Development



By Major Kenneth J. Crawford

Most engineers are challenged when they prepare for combined arms defensive operations—it's never the same twice in a row. What we do to effectively integrate engineer expertise into engagement area planning depends on the military decision-making process (MDMP). We must thoroughly understand the impact engineers can have in tactical operations. This article describes how staff engineers can best support the planning phase of engagement area development during the MDMP.

Development Steps

Successful integration of engineer capabilities into the MDMP requires that we read, understand, and apply our knowledge of the supported unit's doctrine and tactical standing operating procedures (TACSOPs). Engineers who support division or brigade defensive operations that assign or direct engagement areas must understand how to effectively integrate their capabilities into engagement area development.

Doctrine provides a sound planning reference that must be applied to the current situation and surrounding terrain. Figure 1 shows a variation of the seven steps of engagement area development found in FM 71-1, *Tank and Mechanized Company Team,* and FM 7-20, *The Infantry Battalion.* The most significant difference is the switching of steps 4 and 5—positioning forces (direct-fire assets) before planning and integrating obstacles. This switch is logical because the maneuver commander is the "client" we support. In addition to pointing to a map and stating where he wants to kill the enemy (step 3), the maneuver commander must conduct mission analysis and understand the enemy's intent (steps 1 and 2) and know what he can see to kill throughout the depth of the battlefield.

1. **Identify all likely enemy avenues of approach.**
2. **Determine likely enemy schemes of maneuver.**
3. **Determine where to kill the enemy.**
4. **Position direct fire weapon systems.**
5. **Plan and integrate obstacles with direct fires.**
6. **Plan and integrate indirect fires with direct fire and obstacles.**
7. **Conduct rehearsals.**

Figure 1. Engagement area development steps.

Developing a defensive course of action (COA) takes each battlefield operating system into account and synthesizes a combined arms team designed to achieve a given mission against an attacking enemy. The focus of the defense is to destroy or defeat the enemy at predetermined sites where terrain favors the defending friendly forces—the engagement areas. Determining what will be critical events, or decision points (DPs), during defensive operations requires detailed planning, analysis, war gaming, and synchronization. DPs

trigger multiple actions during combat operations and must be synchronized by thorough staff planning and coordination. When executing defensive operations, commanders fight from a position that allows them to visualize the battlespace (the three-dimensional fight). Engineers are the best-suited personnel in the combined arms staff to facilitate terrain visualization and positioning of forces during the MDMP.

To support the maneuver commander's intent and the combined arms staff, engineers must apply our capabilities and knowledge to each step of engagement area development. Just as the engineer estimate provides a format to align planning efforts with the MDMP, the following process provides an effective tool for defensive planning.

1. Identify all likely enemy avenues of approach

Staff engineers work closely with the S2 to analyze the terrain as soon as the mission is received. This is the first step in the engineer battlefield assessment. The OCOKA (observation and fire, cover and concealment, obstacles, key terrain, and avenues of approach) analysis must include the impacts of weather and the advantages and disadvantages that terrain offers. Engineers identify maneuver elements (friendly and enemy) favored by the combination of terrain and weather and explain why. Terrain visualization enables engineers to identify potential sites that offer an advantage over the range of the enemy's maneuver and weapon systems. Use of TerraBase II software and the Division Terrain Teams can help identify areas where terrain facilitates enemy approaches into our engagement areas behind intervisibility lines or through restricted terrain. Products engineers can easily produce to help in this process are lines of sight, obliques, weapon range fans (to identify dead space), and perspective images. As these products are developed, engineers should analyze them to determine the time and distance that enemy forces maneuver through and to estimate how long we can engage him with fires. These products can be used throughout the MDMP as tools for COA development (positioning of forces), war gaming, and rehearsals.

Engineers should consider the following factors when analyzing the avenues of approach through assigned sectors:

- Compartmentalization of the terrain and possible engagement windows for direct-fire and wire-guided missile systems (time of flight vs. tracking vs. enemy's ability to accurately return fire).
- Locations where the combination of terrain and man-made obstacles can achieve the desired effect.
- Availability and use of the Division Terrain Team. Early identification and prioritization of products created using TerraBase II promotes efficient use of resources by eliminating "nice to have" products. Since the situation and the commander dictate what is important for each mission, an SOP for product requirements is not needed but can be used.

2. Determine likely enemy schemes of maneuver

Engineers focus directly on the enemy's mobility/survivability capabilities and limitations during the second step of the engineer battlefield assessment. Working with the S2, they develop an estimate of enemy mobility/survivability assets and the order of battle, using TRADOC Pamphlet 350-16, *Heavy OPFOR Tactical Handbook;* FM 100-60, *AR and Mechanized-Based OPFOR Organization Guide;* and FM 100-63, *Infantry-Based OPFOR Organization Guide*. This step is critical because obstacle groups in engagement areas are designed to defeat the enemy's ability to sequentially breach or bypass obstacles in depth. Determining how the enemy will employ breach assets along an avenue of approach is a "best guess" based on staff engineers' knowledge and experience. The success of massed direct and indirect fires hinges on our ability to accurately site and emplace obstacles and target specific enemy mobility assets. Additionally, this step helps us to identify, recommend, and prioritize high-value targets.

3. Determine where to kill the enemy

By accurately estimating the force size, formations, speed, and the most likely and most dangerous COA along specific avenues of approach, engineers can predict where the enemy will transition his formations. Although distances for these transitions vary depending on the tactical situation, the following sequence and distances are doctrinally correct for an enemy attack:

- Mechanized infantry brigades transition to individual mechanized infantry battalion columns at 12-15 kilometers.
- Mechanized infantry battalions transition to company columns at 4-6 kilometers.
- Companies transition to platoon columns at 2-3 kilometers.
- Platoons transition to attack formations at 600-1,000 meters from the main defense.

If the situation permits, we can use ground or air observers, ADAM/RAAM, or attack aviation (provided we have air parity and a synchronized suppression of enemy air defenses [SEAD] plan) to disrupt the enemy's command, control, and maneuver as he transitions from battalions/companies in column to battalions/companies on line. Companies begin to transition to platoons in column where we plan to engage with tank- and wire-guided missile systems. If the combined arms staff can identify where the terrain masks enemy maneuver, it can position systems (covert operations lazing teams [COLT], scouts, fire support teams, observer teams, etc.) to engage enemy vehicles on the high-value target list. Otherwise, these vehicles may be in dead space to direct-fire systems that occupy DPs.

4. Position direct-fire weapon systems

Terrain surrounding potential engagement areas is the most significant factor in positioning direct-fire weapon systems. Although the range capabilities of our weapon systems are

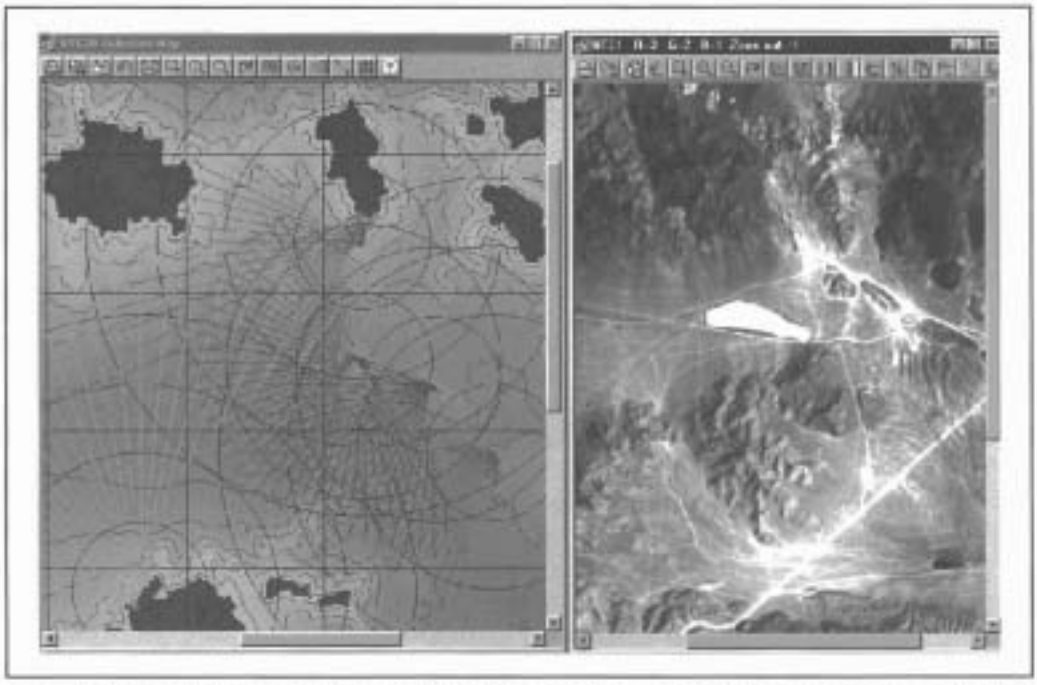


Figure 2. Direct-fire systems can be tentatively sited using a combination of terrain analysis and imagery. Above left depicts the center of mass for company team battle positions overlooking Drinkwater Lake at the NTC. To the right is a satellite image of the area.

considerable, the enemy has the advantage with wire-guided systems (the AT-5/8 = 4 kilometers and the AT-10/11 = 5 kilometers). Engineers must analyze the terrain to determine how to minimize the range of enemy systems. Use a reverse slope defense, intervisibility lines, defile, or integrate obstacles with restricted terrain to prevent him from maneuvering large formations.

The decision aids (tools) created in steps 1-3 are used to identify the best locations for the engagement area. For example, a weapon range fan shows that we can observe and engage a vehicle in an avenue of approach for 2.5 kilometers. The next step is to calculate how long it will take the enemy to move that distance at a given rate of march (2.5 kilometers/20 kilometers per hour = .13 hours or 7 minutes 30 seconds). At this range, the tracking time for our wire-guided missile systems (12 seconds at 211 meters per second) and 120-millimeter main gun (2 seconds at 1,517 meters per second) is an important factor. The maneuver S3 knows the distance where the probability of hit (P_h) and probability of kill (P_k) are highest. For planning purposes, determine these probabilities for each type of maneuver unit (mechanized and armor) based on the unit's Table XII gunnery and apply them as a constant.

Vegetation is another consideration. Neither the Digital Topographic Support System (DTSS) nor the TerraBase II program accurately shows how vegetation affects observation at any given position. We must analyze maps and conduct reconnaissance to confirm data the DTSS or TerraBase II provides.

Engineers may create additional products that support COA development and use them when completing the analysis and decision steps of the MDMP. The only limitations on product development are time, initiative, and experience. The needs of the supported element will dictate which products are most useful.

After the commander selects a COA, the staff provides the terrain products to subordinate units for their use during reconnaissance and when occupying positions or sectors. The terrain selected for the fight drives the frontages of each subordinate element. For example, when fighting in an open desert, the frontage of a defending platoon can be extended significantly further than when it is defending in rolling and forested terrain. Prepare for the possibility that terrain and vegetation may degrade the range of enemy and friendly weapon systems to meters rather than kilometers.

After tentatively identifying positions for weapon systems throughout the sector (Figure 2), the staff engineer can develop a survivability execution matrix for blade assets. After the COA decision brief, the commander's survivability guidance may include:

- General intent for engineer effort.
- Priority of support by unit, engagement area, and/or phase.
- Focus of digging assets, including the survivability level and priority for each system.
- Level of force protection for key command, control, and communications nodes.

If the COA calls for alternate, supplementary, or successive battle positions, use the data developed in the third step of the engineer battlefield assessment and identify what support engineers can provide. If the COA requires additional blade assets, identify the duration, benefits gained, and the potential impact or alternatives if the assets are not available. The TACSOPs must state that occupying maneuver units, not engineers, are responsible for positioning systems. Once maneuver elements identify these positions, they must mark and prioritize the positions to maximize the efficiency of

blade assets (Figure 3). However, as the terrain experts, engineers must coordinate with the supported unit before the blades arrive and recommend ways to improve blade effectiveness based on site conditions (rocky, water table, egress routes, etc).

5. Plan and integrate obstacles with direct fires

FM 90-7, *Combined Arms Obstacle Integration*, describes how engineers can be most efficient and effective during obstacle emplacement. This step comes after the direct-fire weapon systems are positioned. To effectively site, mark, emplace, and turn obstacles in sector, engineers must know what can or cannot be seen from the battle positions (Figure 4). When analyzing the combined effects of obstacles and direct fires, we must know the P_h, based on the percentage of vehicles entering the observed obstacle group and detonating a mine.

The enemy decides whether to breach or bypass an obstacle group. If he elects to breach, use the P_h for the obstacle effect (see Figure 5, page 44), combined with the P_h/P_k of our direct-fire weapon systems to determine the number of vehicles the enemy is likely to lose. For example, the direct-fire engagement trigger will be the lead motorized rifle battalion (MRB) encountering a fix effect obstacle group. The P_h for an MRB in battle formation is 50 percent (worst case). This equates to four vehicles through the depth of the obstacle group (nine tanks lead in an MRB attack formation). The enemy must react to the obstacle encounter, which triggers the overwatching elements' direct-fire engagement. A tank company team firing against a lead enemy battalion (approximately 42 combat vehicles) at a range of 2.5 kilometers may have a P_k of 90 percent. This would yield 29 enemy vehicles remaining at the end of the first volley (42 enemy vehicles -[14 friendly vehicles engaging X 90 percent P_k = 12.6] = 29.4 or 29 enemy vehicles remaining).



Figure 3. Maneuver company team commanders must site and mark positions before survivability assets arrive. Blade teams must understand the standard for the types of positions they are to prepare.

Few units have perfect fire control or distribution and kills for every round fired against a moving target. In this scenario, the combined effect of obstacles and direct fires is 25 enemy vehicles attempting to maintain command and control, maneuver, breach, and return fire. Specific fire-control plans destroy the enemy's primary breach assets. This may cause the enemy to fix friendly forces and wait for second echelon forces before continuing to move, attempting to bypass, withdrawing, or mechanically breaching through the obstacle group.

To clarify his intent and help develop the engagement area, the maneuver commander provides the following information to focus engineer countermobility efforts:

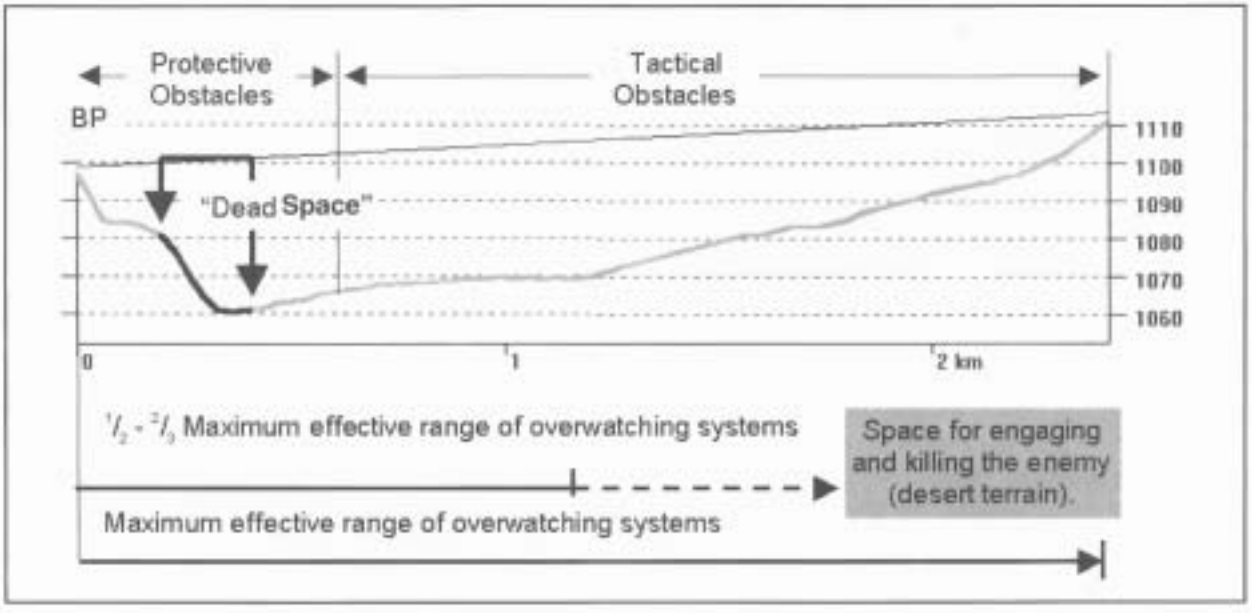


Figure 4. Example of a TerraBase II line-of-site view at Drinkwater Lake. It accurately depicts range, dead space, and elevation data from a given point on the ground.

Standard planning factors identify the resources (Class V mines) required to emplace obstacles along an avenue of approach as follows:

Obstacle Effect	Resource Factor (RF)	Probability of Hit (P_h) (percent)	Linear Density
Disrupt	0.5 X AA	40 - 50	0.4 - 0.5
Fix	1.0 X AA	50 - 60	0.5 - 0.6
Turn	1.2 X AA	75 - 85	0.9 - 1.1
Block	2.4 X AA	>85	>1.1

AA = Avenue of approach.
Linear density (LD): number of mines ÷ front length(m) = mines per meter of front.
Area density (AD): number of mines ÷ front X depth = mines per m^2.
To convert AD to LD: AD X depth(m) = LD.

Figure 5. Minefield probability planning based on effect

- Priority of obstacle effort by engagement area or phase.
- Intent for obstacle effects—disrupt, fix, turn, or block. (These are the results the maneuver commander wants to achieve through combined use of direct fires, obstacles, and indirect fires along specific avenues of approach.)
- Mobility requirements and obstacle restrictions (counterattack axis, main supply routes, withdrawal routes, reserve obstacles, etc.).
- Intent of employing scatterable mines or situational obstacles (by system—where, when, duration, and authority).
- Maneuver forces' support to obstacle effort (guard force requirements for reserve obstacles, marking, mine dump and Classes IV and V support, etc.).

Note: *Using engineers to mark obstacles, in addition to emplacing them, reduces the total amount of obstacle effort in sector.*

- Obstacle protection (counterreconnaissance, reseed plan, deception, enemy breach asset destruction).
- Obstacle command and control (execution authority, marking, lane closure, reporting, tracking, restrictions, and control measures—zones, belts, and groups).
- Obstacle deception.

Situational obstacles require a significant amount of staff synchronization. Step 2 identifies how the enemy is likely to attack and employ breaching assets according to the order of battle. The trigger for situational obstacles is one of three things: enemy action, friendly action, or a combination of both. By employing a scatterable mine system triggered by enemy action (for example, a company-sized or larger force approaching or passing through a DP), the distance from the targeted area of interest (TAI) to the DP can be calculated using the following equation:

$\underline{M^3 + E + A < T > C}$, where:

M^3 = the cumulation of the following applicable times. The cumulation must be less than the time it takes the enemy to reach the TAI.

- Movement of communications (time required for the observer to call the controlling HQ, plus the time for the HQ to receive approval from the authorizing commander, plus the time for the HQ to direct the emplacing element/unit to execute).
- *Move to TAI* (the time required to move/fire to/into the TAI [ground/air systems or time of flight for indirect munitions]).
- *Move from TAI* (the time required for the element/unit to move from the end point to a reload or secure hide position).

E = time required to dispense or fire the mission.

A = time required to arm/activate the munitions.

T = time required for the targeted enemy element to move from the first observed location in a named area of interest (NAI) to the TAI (or obstacle location). Contact there is initiated by either a mine strike or direct fires from an overwatching element.

C = time required to position a friendly maneuver element in an overwatching battle position. Friendly forces must establish a defensive posture in a battle position (or other advantageous position) before the enemy has the opportunity to engage. (Plan a minimum of a 4-kilometer range for enemy antitank weapon standoff and understand the risk when applying lesser distances.)

Maneuver commanders at company team, battalion, and brigade levels must ensure that obstacles, direct-fire weapon systems, and indirect fires are integrated. Ground

reconnaissance cannot be replaced with "eyeballing" a map or using decision aids developed for the COAs. Ground reconnaissance helps site obstacles and must occur as early as possible. To expedite obstacle emplacement after the COA is approved, staff engineers provide subordinate engineer units with information to help them begin parallel planning and direct coordination between engineers and supported maneuver units. When the MDMP is complete, execution matrices, time lines, Classes IV and V resourcing and allocation, and a survivability plan are developed and included in both the Engineer Annex and the subordinate engineer operations order.

6. Plan and integrate indirect fires with direct fire and obstacles

As staff engineers identify obstacle groups, fire support coordinators develop a fire plan to support the intended effects of engagement areas. They target fires on the enemy side of obstacles where the enemy is most likely to be (dead space), the point at which assets begin to canalize through a breach point, or at targets determined by the maneuver commanders and subordinate fire support teams. The point where obstacle groups tie, or anchor, into existing obstacles is critical. The anchor point is where the combined effects of the obstacles and fires force the enemy to commit to a breach or seek a bypass.

This is not the time to consider using ADAM/RAAM, because integrating ADAM/RAAM must be done early to be effective. The maximum planning range of scatterable munitions is 17.5 kilometers for M109 fires and 17.7 kilometers for M198 fires. If the point along an avenue of approach where the second echelon mechanized infantry brigade transitions from battalions in column to battalions on line can be targeted, or if the advanced guard main body can be separated from the second echelon battalions, we can identify the associated NAIs, DPs, and TAIs to support this mission. The key concern is whether it will take more than 15 minutes for a battery to fire the mission. When developing the COA, identify how many artillery batteries are available to support the mission and determine whether to use low- or high-angle fires. Since the maximum rate of fire is four rounds per minute per tube, the angle of fires directly impacts the length of time and number of rounds it will take to fire the mission. Generally, high-angle fire requires four times more rounds than low-angle fire for RAAM. Therefore, more time or tubes may be required to complete the mission.

The staff must weigh the advantages and disadvantages of the time it may take the fire support elements to complete the mission (for example, copperhead, interdiction, SEAD, or suppression) and make recommendations to the maneuver commander. He must decide whether to use artillery tubes to fire ADAM/RAAM missions based on the size and type of enemy element (target), the P_h for the avenue of approach (location), and the overwatching elements' ability to observe/engage the enemy as he negotiates the obstacle (effect).

7. Conduct rehearsals

Units conduct combined arms rehearsals to ensure that all elements are properly synchronized. Review CALL Newsletter No. 98-5, *Rehearsals,* and incorporate its concepts into TACSOPs. Specific engineer-related topics addressed in combined arms defense rehearsals follow:

- Priorities of engineer effort (obstacle group sequence of emplacement, who is marking, link up and execution of blade effort, Q36 radar and air defense artillery coverage).
- FASCAM triggers and execution ($M^3 + E + A < T > C$).
- Classes IV and V supply point and mine-dump operations. (These may be discussed during combat service support rehearsals but must be understood for the combined arms rehearsals.)
- Obstacle turnover, responsibility, and security.
- Lane closures.
- Counterattack mobility support.

At any given time during mission execution, engineers should be able to tell the maneuver commander where the engineer effort stands—the "glide path." Engineers must thoroughly understand and translate the impact that incomplete obstacle groups have on enemy maneuver so the commander can adjust his orders to achieve the same effects.

Summary

Engineer staff officers are key players in engagement area development. They produce quality and useful decision aids, integrate engineer capabilities into engagement area plans, understand the capabilities of supported units, and provide sound tactical recommendations to commanders based on a complete analysis of the mission, enemy, terrain, troops, and time available (METT-T). Engineers are especially important in terrain visualization. They know where to apply available tools to best support the commander's battlespace visualization during engagement area development.

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