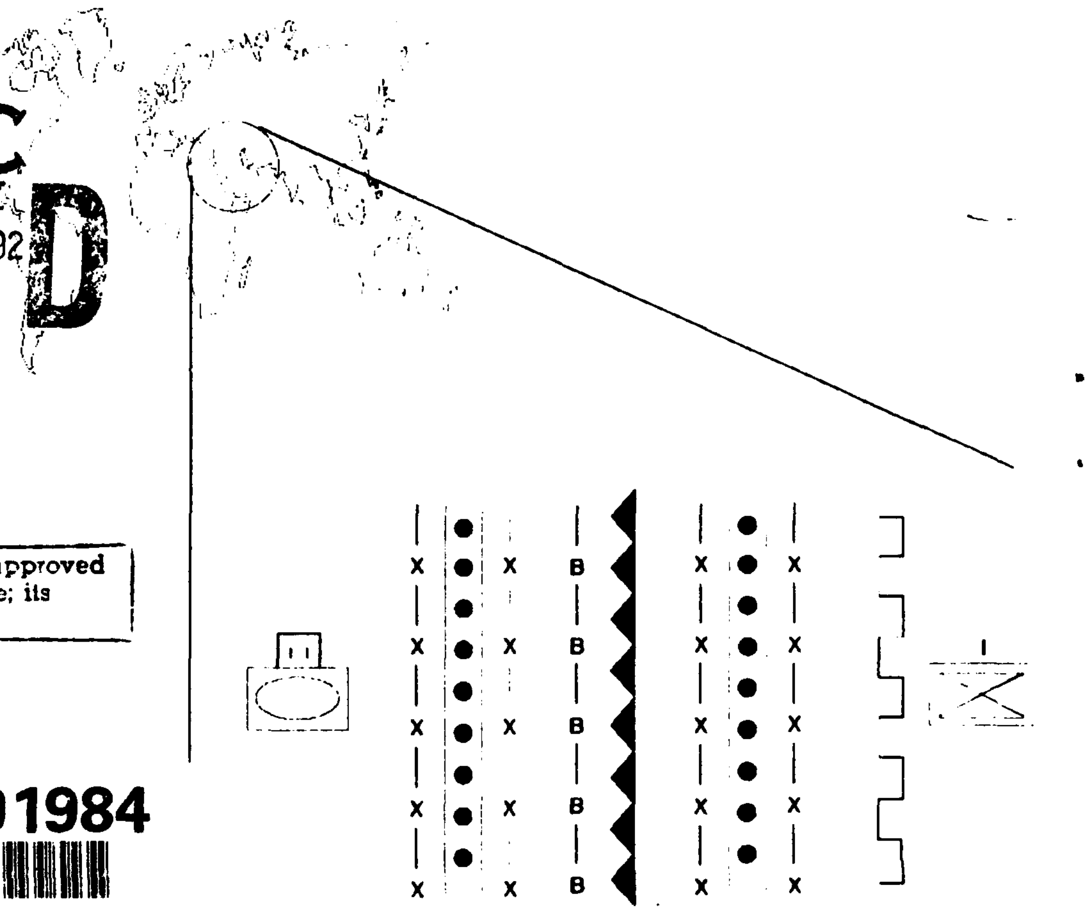
# Quick Reaction Analysis
# Combined Arms Deliberate Breach of a Complex Obstacle

## Desert Shield/Desert Storm









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The Quick Reaction Analysis (QRA) was performed jointly by the US Army Engineer School and TRADOC Analysis Command in support of operation Desert Storm. The analysis examined a combined arms deliberate breach of a complex obstacle. The QRA's initial purpose was to quantify direct- and indirect-fire attrition rates during the conduct of an opposed heavy force (armored) deliberate breach. Army leaders later used QRA insights to help determine fielding priorities for countermine and counterobstacle material in support of Desert Storm.

The QRA used the Janus(A) simulation to game a scenario developed to reflect realities in the Gulf. Janus(A) focuses on individual fighting system engagements and assessments.

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## Quick Reaction Analysis

1. **(U) Introduction.** The Quick Reaction Analysis (QRA) examined a combined arms deliberate breach of a complex obstacle. The analysis considered various breaching alternatives using a JANUS-A. The JANUS-A is a force-on-force, high-resolution, two-sided, interactive, stochastic (random), combat-simulated model. The JANUS-A model was used to game a combined arms deliberate breach opposed by a threat force. The JANUS-A postprocessor was used to determine resulting force effectiveness. An armored task force conducted the combined arms deliberate breach. The threat complex obstacle was composed of pressure- and magnetically fuzed minefields, wire, and a tank ditch. The threat force that overwatched the complex obstacle, with direct and indirect fire, was a dismounted infantry battalion augmented with antitank assets (BRDMs) and towed artillery.

a. *(U) Purpose.* The QRA's initial purpose was to quantify direct- and indirect-fire attrition rates during the conduct of a heavy force (armored) deliberate breach through a complex obstacle. However, as the analysis matured, senior Army leaders used QRA insights to help determine fielding priorities for Operation Desert Shield countermine and counterobstacle materiel.

b. *(U) Background.* The QRA genesis was a Commander, United States Army Materiel Command (AMC), request for an Operation Desert Shield countermine brief in early September 1990. A detailed countermine/counterobstacle briefing was given to Headquarters (HQ) AMC by project manager-mine, countermine, and demolitions (MCD)/United States Army Engineer School/United States Army Armor School/United States Army Foreign Science and Technology Center (PM-MCD/USAES/USAARMS/FSTC) on 12 September 1990 based on a projected Iraqi threat. The projected Iraqi threat was hypothesized to consist of a series of complex obstacles overwatched by direct and indirect fires along the Kuwait-Saudi Arabian border. The Army Materiel Systems Analysis Agency's (AMSAA) supporting analysis (for the AMC brief) only addressed inherent minefield lethality. The synergistic effects of direct and indirect overwatch fires, which account for the majority of the armored combat vehicle (ACV) kills in a breach operation, was not accounted for. Also, the AMSAA analysis did not include the impact of obstacles, such as tank ditches, berms and wire, that were anticipated and later observed in the Kuwaiti Theater of Operations (KTO).

(U) On 28 September 1990, the USAES Commandant requested TRADOC Analysis Command (TRAC) initiate the QRA to quantify the effects of Iraqi direct and indirect fires overwatching a complex obstacle. TRAC-White Sands Missile Range (WSMR), USAES and USAARMS coordinated the scenario, red and blue force structure and run matrices in late September to early October 1990 based on available intelligence. During a QRA in-process review (IPR) at Fort Leonard Wood on 25 October 1990, the Combined Arms Center (CAC) Commander directed further analysis based on a corps main effort. A corps main effort would yield an increased level of artillery support. On 29 October 1990 in the Army Operations Center (AOC), the Deputy Chief of Staff for Operations and Plans (DCSOPS) gave the Chief of Staff, US Army (CSA) a counterobstacle briefing, using the QRA emerging results as supporting analysis. A modified form of the CSA briefing was given to the Chairman, Joint Chiefs of Staff (JCS), and the Secretary of Defense (SECDEF) in late November 1990. The incoming TRAC Commander was briefed on the final QRA results on 20 December 1990. A general officer counterobstacle meeting (GOCM) was convened at the National Training Center (NTC) on 7 and 8 January 1991 to further address Operation Desert Shield mobility concerns and proposed solutions to shortfalls. The QRA was also used as the supporting analysis for the NTC (GOCM).

c. *(U) Doctrine.* Figure 1 outlines the doctrine associated with deliberate breaching operations.

(1) (U) FM 90-13-1, Combined Arms Breaching Operations. The doctrine for a combined arms deliberate breach of a complex obstacle is in place. FM 90-13-1 clearly outlines the tenets for a successful breach as intelligence, fundamentals, organization, mass and synchronization. A brief summary follows:

- (U) Intelligence. This tenet focuses on the intelligence preparation of the battlefield (IPB) and engineer battle assessment (EBA) process, obstacle intelligence (OBSTINTEL) as a priority intelligence requirement (PIR), and the combined arms nature of reconnaissance.
- (U) Breach. This tenet address the fundamentals of suppress, obscure, secure, and reduce (SOSR).
- (U) Organization. All breaches are organized into a support force, breach force, and assault force.

o (U) Mass and synchronization. These tenets talk to force allocation ratios of at least 3 attackers to 1 defender at the point of application, directing combat power against weakness, orchestrating direct and indirect fires, and bringing scarce engineer and breaching resources together at the proper place and time. Breach synchronization is a dynamic process that involves gathering intelligence, organizing a detailed reverse planning sequence that includes contingencies, imparting clear instructions to subunits, maintaining effective command and control, and rehearsing.

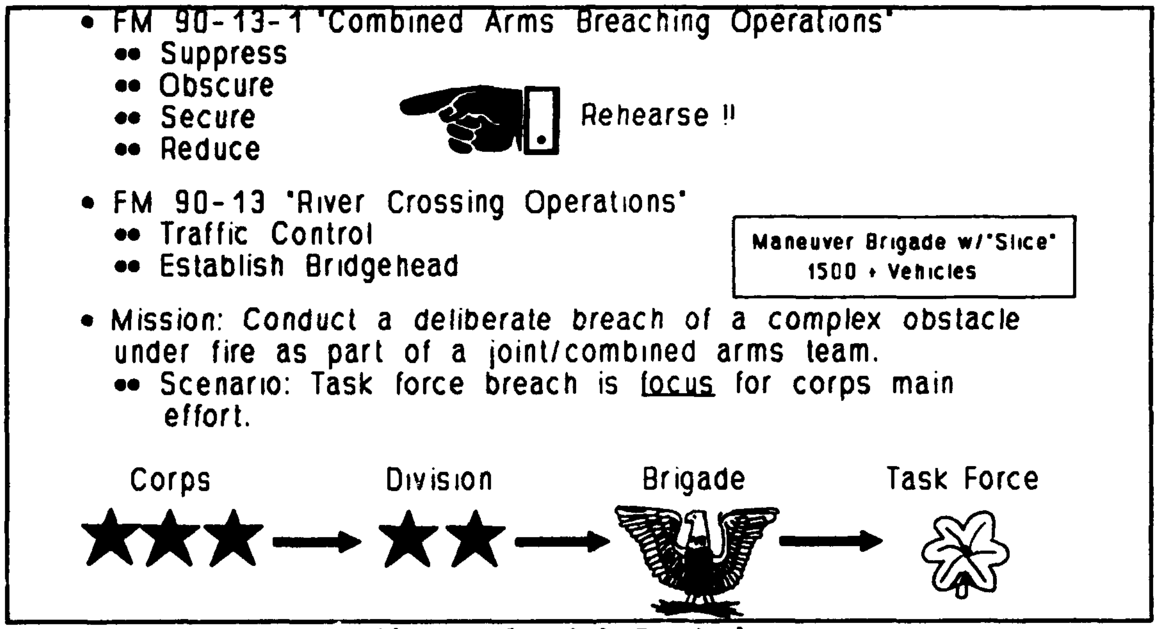



**Figure 1. (U) Doctrine**

(2) (U) FM 90-13, River Crossing Operations. A deliberate breach and a river crossing operation are very similar. Traffic control is critical to both operations. A three task force brigade, with divisional slice, is in excess of 1,500 vehicles. A four task force brigade is in excess of 1,700 vehicles. The brigade may *stretch out* as far as 85 kilometers. Strict command and control measures such as staging areas, regulating lines, holding areas, call-forward areas, traffic-control points, and guides and escorts to the breach lanes must be established to

ensure a smooth flow of vehicles from assembly areas through the breach lanes into the bridgehead. The brigade executive officer is the breaching area commander; the brigade engineer is the breaching force engineer. (**Note**: If a corps engineer battalion is in support, the breaching force engineer is the corps engineer battalion commander.) This should not be confused with breach force commander at brigade and task force level. Figure 2 shows the command and control measures for a deliberate breaching operation.

(U) As in river crossing operations, a bridgehead is established on the enemy side of the complex obstacle. For purposes of this analysis, the bridgehead on the enemy side of complex obstacle will be called a *breachhead*. The breachhead is established to secure against enemy counterattack until the exploitation and breakout force attacks out of the breachhead. The breachhead also facilitates the generation of additional breach lanes and widening of existing lanes through the complex obstacle unopposed by threat direct and unobserved indirect fires. Additional breach lanes and widened assault lanes are required for quick traversal of follow on forces through the complex obstacle.

(3) (U) General. A task force commander conducting a deliberate breach of a complex obstacle can expect direct and indirect assistance from brigade, division, corps, and echelons above corps (EAC). Although passage through a complex obstacle is not an objective, the corps commander's interest will focus on the task force(s) conducting a deliberate breach. Ensuring a successful breach requires each echelon of command to assume responsibilities follows:

(a) (U) EAC. Destroy enemy air defense capability and establish global air superiority if possible. At minimum, air superiority in the vicinity of the breach site is sufficient. Fix or destroy strategic reserves. Conduct deception operations as required.

(b) (U) Corps. Fix or destroy threat operational reserves. Target and destroy multiple rocket launchers (MRLs) and surface-to-surface missiles (SSMs) through the use of artillery, tactical air (battlefield air interdiction (BAI)) or attack helicopter assets. Conduct or support deception operations as required.

(c) (U) Division. Fix or destroy tactical (armored) reserves using artillery or attack helicopters. Control counterfire fight against tube artillery and MRLs within range of the breach site. Support deception operations as required.

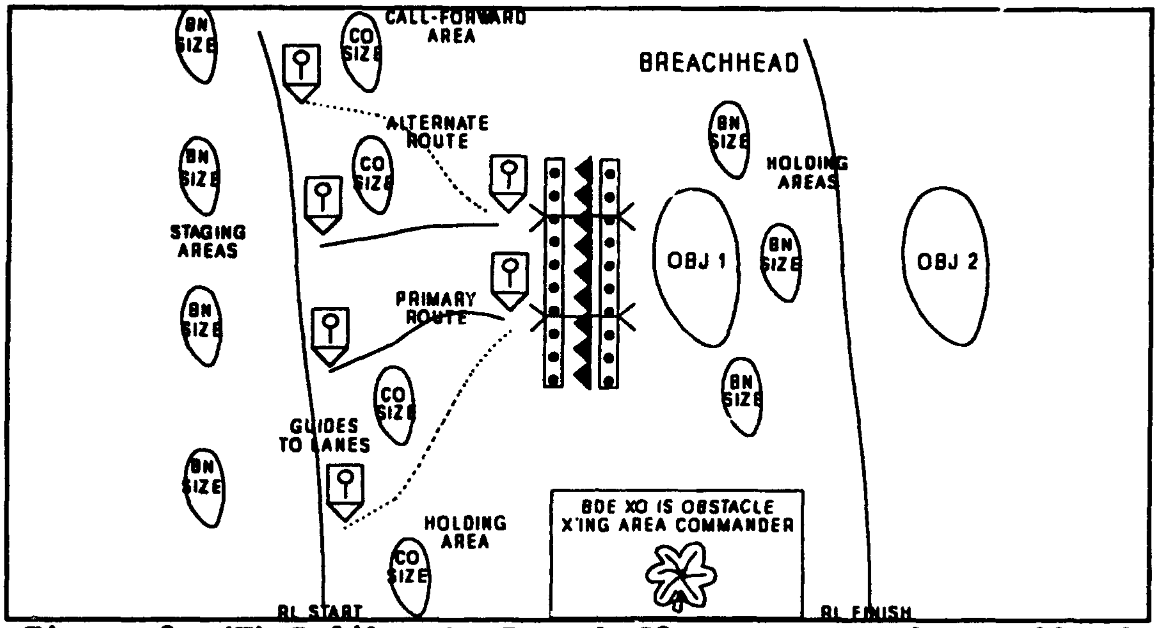



**Figure 2. (U) Deliberate Breach C2 Measures and Breachhead**

(d) (U) Brigade. Provide direct- and indirect-fire suppression and obscuration, as required, in the vicinity of the breach site. The brigade organizes into a breach force, support force, assault force and a reserve. The brigade's breach force is the task force described below. The brigade's breach force is normally commanded by an infantry or armor officer, but can be commanded by an engineer.

(e) (U) Task force. Conduct the deliberate breach. As shown in Figure 3, (page 7) the task force organizes into a support force, breach force, and assault force. The overall task organization is mission, enemy, terrain, troops, and time available (METT-T) driven, tactically tailored to accomplish the mission. Before initiating the deliberate breach, a thorough reconnaissance must be accomplished. Reconnaissance may locate a bypass or passage lanes through the complex obstacle as well as gain specific obstacle intelligence (OBSTINTEL). Therefore, the reconnaissance must be complete bringing all intelligence assets to bear. At the brigade and task force level, reconnaissance must be a combined arms task. A combat engineer squad or platoon must be included in the reconnaissance effort. When possible, an infiltration before the deliberate breach is preferred. Eliminating the enemy's listening posts (LP), observation posts (OP), or overwatch forces will speed breaching operations. The support force is responsible to suppress the enemy force overwatching the complex obstacle with direct and indirect fires.

(U) The fire support team (FIST), infantry and armor units make up the support force. Suppressive fires will include artillery and, if available, attack helicopters and close air support (CAS). Supporting artillery and mortars provide obscuring smoke. Smoke generators and smoke pots can be used if the prevailing winds and conditions are favorable. The breach sites and the enemy side of the complex obstacle are physically secured if possible. At a minimum, the far side of the complex obstacle will be secured with fires. If the far side of the complex obstacle cannot be secured, direct and indirect fires can make it difficult for the enemy to maneuver and slow down his reaction time. A slow threat reaction with a quick complex obstacle reduction provides a measure of security to the breaching task force.

(U) The breach force uses engineer and armor assets to reduce the complex obstacle and the infantry to provide close-in security in the vicinity of the breach lanes. The task force's breach force is normally commanded by an engineer officer. A minimum of two lanes is required for each task force. Two lanes facilitate passage of the task force through the complex obstacle and reduce risk by providing redundancy. The assault force passes through the two breach lanes and assaults the enemy overwatch positions. The breach and assault forces are both composed of infantry, armor, and engineer units.

d. *(U) Requirements.* Our maneuver forces may have to breach the Iraqi complex obstacles emplaced along the Kuwaiti-Saudi Arabian border if no bypass can be found. Thus, the Iraqi complex obstacles generate a potential breaching requirement. KTO obstacles fall into two categories, static or dynamic. Static obstacles are those obstacles positioned before the battle. Complex obstacles currently observed in the KTO fall into this category. Dynamic obstacles are those obstacles placed after the battle has started in response to maneuver. Scatterable mines that Iraqi forces might use to disrupt, fix, turn, or block our ground force maneuver will be considered dynamic obstacles. Also, nuclear, biological, chemical (NBC) contaminated areas can be created during the battle and are considered obstacles.

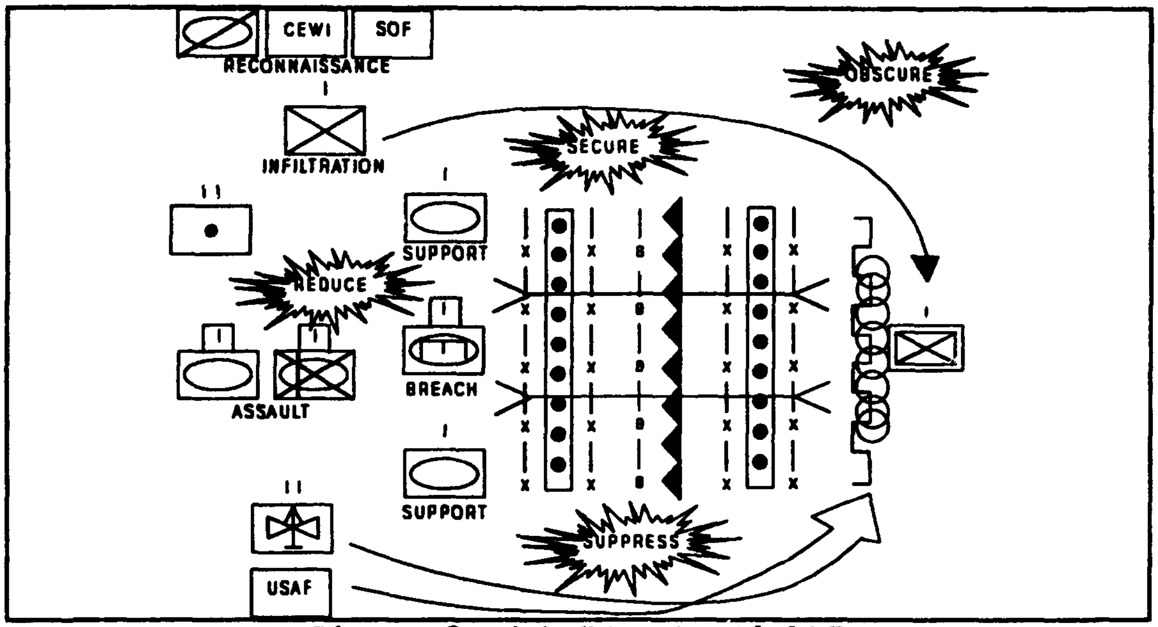



**Figure 3. (U) "How to Fight"**

(1) (U) Iraqi Static Obstacles. Figure 4 (page 8) shows a generic complex obstacle that can be observed in the KTO. The overwatch forces primarily are dismounted infantry and towed artillery that possess limited mobility. Armor is generally used as a mobile reserve that will react to defense penetrations, as appropriate. Tanks and armored antitank vehicles are also *salted* into the static defense. The entire depth of the complex obstacle can be covered by direct and indirect fire. The berm and wire, which may affect wire-guided antitank guided missiles (ATGMs), cause *dead space* that cannot be covered by direct fire. This dead space provides some cover and concealment that might be exploited during combined arms breaching operations.

(U) Given the linear minefield densities indicated above, the number of expected mines encountered in both breach lanes is calculated as follows. Each breach lane is 4 meters wide (the width of an M1A1 main battle tank is 3.6 meters). Multiplying breach lane width by each minefield's linear density will yield the expected number of mines encountered per breach lane. In each breach lane, 6 to 8 mines will be encountered in the first minefield and 3 to 4 mines will be encountered in the second minefield. The task force doctrinal requirement is to generate two lanes through the complex obstacle. Therefore, the total number of mines encountered by the breaching task force will be in the range of 18 to 24.

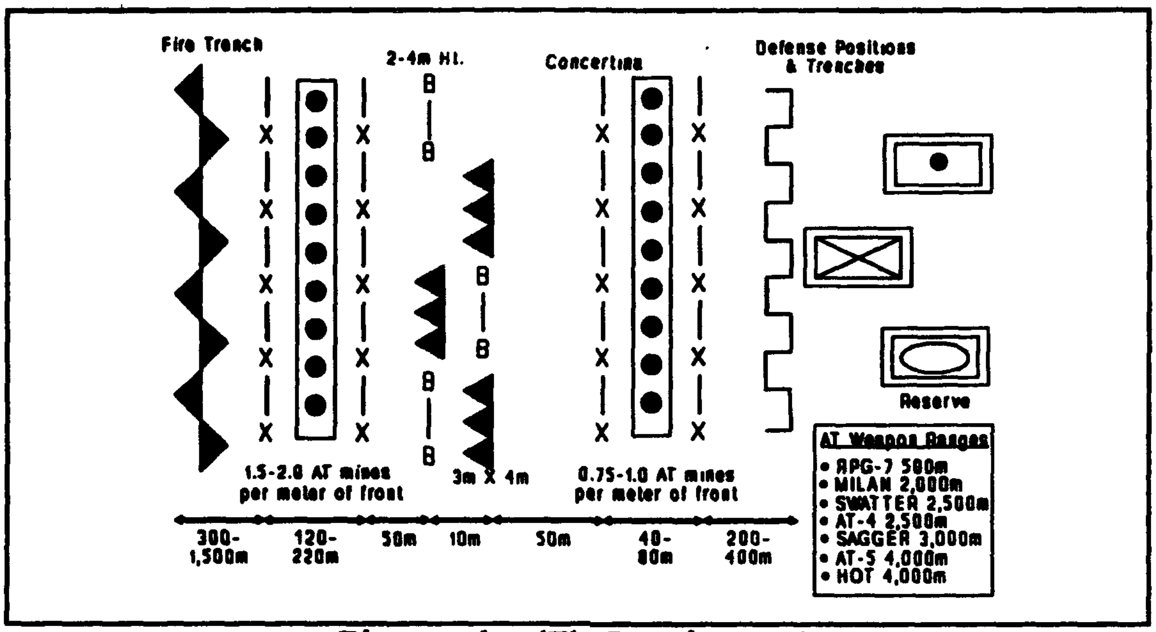



**Figure 4. (U) Requirement**

(2) (U) Iraqi Dynamic Obstacles. Dynamic obstacles can either be placed where maneuver forces will encounter the obstacle during movement or placed directly on top of the maneuver unit. Encountering an obstacle forces the maneuver unit to conduct either an in-stride or deliberate breach. A dynamic obstacle placed on top of a maneuver unit requires an extraction. An extraction is much more difficult than a breach and would require the maneuver commander to suspend his operation temporarily. Therefore, dynamic obstacles such as scatterable mines present a significant threat, especially if a unit is already breaching a complex obstacle. The Iraqi forces have the capability to deliver scatterable mines using ground dispensers, helicopters, and MRLs. The MRL presents the greatest threat due to the large minefield *footprint* and the number antitank mines delivered per battery and battalion volley. The MRL will be used to reinforce a static obstacle that is breached or about to be breached. Response time for a MRL scatterable mine mission is about 30 minutes for a specific location. As previously

mentioned, corps and division fires must eliminate the MRL threat to give the task force commander the best possibility of breaching success. Figure 5 summarizes the key points concerning Iraqi dynamic obstacles.

- Dynamic Emplacement-Experience vs. Encounter!
  - Extraction vs. Breach?
- Delivery capabilities:
  - Munitions availability confirmed for ground dispensers, helicopters and multiple rocket launchers (MRL).
- MRL systems:
  - 122mm
  - 262mm
  - Note: MRL "footprint" and mine data available upon request! "Footprint" and mine data are classified.

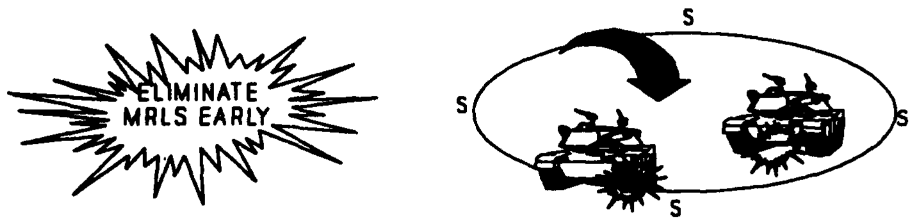



**Figure 5. (U) Scatterable Mines**

e. *(U) Capabilities.* Figure 6 (page 10) lists the US Army's capabilities to defeat obstacles. Be aware that no single item of breaching equipment is able to effectively defeat all Iraqi complex obstacles. Multiple equipment is required for all but a few specific complex obstacles. Also, mine plows and rollers are mounted on an M1 main battle tank. The agility and fighting capability of the tank is reduced when either a plow or a roller is used to breach a minefield.

(1) (U) Combat Engineer Vehicle (CEV). The M728 CEV can reduce tank ditches, berms, and wire with its blade. The CEV capability is limited since the engine and transmission rapidly overhead when additional stress is applied to the system. The CEV is not designed nor can it be used to reduce minefields. The CEV blade is mounted perpendicular to the direction of movement and cannot be articulated. The blade is designed for rubble and limited obstacle clearing and will not plow surface or buried mines aside while moving forward. In addition, the hydraulics which raise and lower the blade are not hardened to survive a

mine blast. CEV survivability is equivalent to a M60A1 main battle tank.

"THE GREATEST GAP BETWEEN THE GROUND FORCE MISSION AND CAPABILITY IS IN MAINTAINING THE ABILITY TO MANEUVER AGAINST MINES AND COMPLEX OBSTACLES." GEN. MOSHE LEVY, IDF C of S

- CEV
- MICLIC
- AVL-B/MF
- Fascines
- Tank-mounted, track-width mine plow
- Tank-mounted, track-width mine roller
- ACE
- IDA
- CEV mine rake
- Artillery
- USAF bombing
- Fuel air explosive
- VEMASID

**Figure 6. (U) US Capabilities**

(2) (U) Mine Clearing Line Charge (MICLIC). The MICLIC is a trailer-mounted, rocket-projected explosive line charge. It is usually towed by an armored vehicle such as a CEV, M113, M2, M60 tank, or ACE. The MICLIC trailer is not survivable. The MICLIC defeats single-pulse, pressure-fuzed mines which are surface laid or buried not deeper than 1 inch. A single-pulse, pressure-fuzed minefield up to a 100 meters deep can be reduced with a single firing. Lane width is 14 meters. Minefields more than a 100 meters deep require repetitive MICLIC firings. The MICLIC is also effective against wire obstacles.

(3) (U) Armored Vehicle Launched Bridge/MICLIC and Fascines (AVLB, AVL-MF). The AVLB is a standard tank chassis (with turret removed) modified to transport, launch, and retrieve the 18.3-meter span, military load class 60 bridge. The AVLB provides the capability to cross tank ditches. The AVL-MF mounts two MICLICs and a maxi fascine on an AVL chassis. The AVL-MF gives the force the ability to reduce a complex obstacle composed of a tank ditch, wire, and single pulse, pressure fuzed minefield less than 180 meters deep. AVLB survivability is equivalent to a M60 main battle tank.

(4) (U) Fascines. Fascines can provide the ability to reduce tank ditches without the use of an AVLB. The two types of fascines are maxi and mini. A maxi is for large gaps up to 3 meters deep by 4 meters wide. It is made up of 75 pipes bundled together. A maxi can be mounted on a CEV and AVLB chassis. A mini for smaller gaps up 0.6 meters deep by 0.8 meters wide. It is made up of 6 pipes bundled together. A mini can be launched by a M113. Combinations of maxis and minis can be used to defeat tank ditches of various depths and widths.

(5) (U) Tank-Mounted, Track-Width Mine Plow. This plow is an armor asset used to generate track width lanes through minefields and is mounted on a M1 or M60 tank. The mine plow is angled and in front of each tank track. As the tank moves forward, the mine plow casts surface and buried mines aside. The mine plow will clear all mines in front of each track up to a 12 inches deep, but leaves an uncleared center lane. A dogbone and chain between each plow defeats tilt-rod activated mines in the center lane, but will not effectively defeat magnetically fuzed mines. The mine plow reduces minefields at a rate of 5 to 10 kilometers per hour (kph).

(U) Breach speed is highly dependent on soil type and regularity of the terrain. For example, in sandy soil, breach speed is 10 to 16 kph. The mine plow is unable to consistently clear a breach lane through a minefield that all tactical vehicles can use. The width between the two cleared track lanes and the depth (which increases during use) of the plowed lanes do not allow all tactical vehicles to pass. Plowed breach lanes require continual maintenance to ensure unhindered passage of attack and follow-on forces. The tank main gun must be traversed to the side during plowing. A mine detonating under the plow may throw it into the air and damage the tube. Also, the tank cannot maneuver when it is plowing and must continue on a straight course through the minefield to avoid lifting the plow and missing mines.

(6) (U) Tank-Mounted, Track-Width Mine Roller. This mine roller is an armor asset used to detect minefields and proof breach lanes. The roller can be used to generate track width lanes through minefields. The mine roller will clear all mines in front of each track except for multiple impulse fuzed mines. The mine roller leaves an uncleared center lane. A dogbone and chain between each roller defeats tilt-rod activated mines in the center lane, but will not effectively defeat magnetically fuzed

mines. The mine roller reduces, detects, and proofs at 5 to 15 kph. The tank main gun must be traversed to the side during rolling. A mine detonating under the roller may throw pieces into the air and damage the tube. The mine roller, when mounted, cannot keep pace with the supported maneuver force. The mine roller weighs more than 10 tons and slows tank speed by a factor of 33 to 50 percent. When employed, the tank must travel in a relatively straight line, since tight turns may cause the rollers to deviate from the path of the tracks and miss mines.

(7) (U) Armored Combat Earthmover (ACE). The M9 ACE blade can be used to reduce tank ditches, berms, and wire obstacles but not minefields. The ACE's engine and transmission are designed for heavy earthwork. The blade is mounted perpendicular to the direction of movement. It is not V-shaped and is unable to plow mines while moving forward. The survivability of the ACE is equivalent to a M113.

(8) (U) Improved Dogbone Assembly (IDA). The IDA is a replacement for the current tank-mounted, track-width mine plow and mine-roller dogbone assembly. The IDA allows the dogbone and chain to defeat both tilt-rod and magnetically fuzed mines. For best effectiveness, the IDA reduces magnetically fuzed mines when the mine plow and roller is moving at approximately 1 to 3 kph.

(9) (U) CEV Mine Rake. This mine rake is used to generate full width lanes through a minefield. It is mounted on the CEV's rubble clearing blade and clears mines up to 12 inches deep at speeds up to 16 kph in dry, sandy soils. The mine rake's performance is highly dependent on soil type, weather conditions, and terrain. Nonhomogeneous soil, wet weather, or irregular terrain significantly reduces the effectiveness of the mine rake. It defeats all mines and wire in its path. The mine rake cannot effectively reduce tank ditches and berms. A degree of tank ditch and berm reduction is possible in dry, sandy soils. However, when the mine rake is used with a maxi fascine mounted on the CEV's back deck, the capability to defeat both minefields and wire and tank ditches in a desert environment is clearly possible.

(10) (U) Artillery. Using artillery to breach minefields and complex obstacles has been proposed. A recent AMSAA/Ballistic Research Laboratory (BRL) countermine analysis determined that only surface-laid, single-impulse, pressure-fuzed minefields could be effectively reduced by artillery fire;

blast being the primary defeat mechanism. Buried minefields would require an inordinate number of rounds to achieve any significant reduction level, since fragments are the primary defeat mechanisms in this case. Artillery will reduce wire obstacles, and tank ditches and berms if enough rounds are used. However, the large number of rounds required to reduce minefields and other obstacles creates numerous craters that will reduce both breach and passage speed.

(11) (U) Bombing. The use of bombing to reduce minefields and complex obstacles has been proposed. An operational test was conducted at the NTC to explore complex obstacle reduction. Results indicate that surface-laid, single-impulse, pressure-fuzed mines will be reduced due to bomb blast. Other mine types will not be reduced unless physically removed by bomb blast. The bomb craters and blast effects did not form a continuous clear breach lane through the complex obstacle; therefore a breach procedure is still required. Tank ditches and berms were not effectively reduced. Wire obstacles were defeated.

(12) (U) Fuel Air Explosives (FAE). FAE can be used to defeat single-impulse, pressure-fuzed minefields that are surface laid or buried up to 1 inch. Other mine types, tank ditches, berms, and wire are not reduced.

(13) (U) Vehicle Magnetic Signature Duplicator (VEMASID). VEMASID projects a magnetic signature which prematurely detonates magnetically fuzed mines. Pressure, blast-hardened, multiple-impulse and tilt-rod fuzed mines are not defeated by VEMASID. Currently, VEMASID has been type classified for the M109 Howitzer. VEMASID installation is under consideration for other ACVs.

f. *(U) Shortfalls.* A comparison of Iraqi complex obstacle and scatterable mine requirements versus US countermine and counterobstacle capabilities are shown in Figures 7, 8, and 9.

(1) (U) General. Figure 7 (page 14) shows a generic comparison of requirements versus capabilities for countermines (mines only), counterobstacles (obstacles other than mines), and system vulnerability (survivability of the system that carries the countermine and counterobstacle equipment into the breach lane). A green rating indicates the capability meets all the requirements. A yellow rating indicates the capability meets only a portion of the requirements. A red rating indicates the

capability does not meet any of the requirements. Note two key points. First, mine plows and mine rollers are mounted on main battle tanks. This reduces the mobility and, to some degree, the fighting ability of the M1A1 tank. Second, no single item of countermine and counterobstacle equipment can effectively reduce an Iraqi complex obstacle and survive threat direct and indirect fires. Complex obstacle reduction requires multiple breaching items, properly sequenced and orchestrated, for success.

MULTIPLE EQUIPMENT REQUIRED TO DEFEAT COMPLEX OBSTACLE

| Capabilities | Requirement Countermine | Counterobstacle | System Vulnerability |
|---|---|---|---|
| CEV | Red | Green | Amber |
| MICLIC | Amber | Red | Red |
| AVLB | Red | Amber | Amber |
| AVLMF | Amber | Amber | Amber |
| Fascines | Red | Amber | Amber |
| Plow | Amber | Red | Green |
| Roller | Amber | Red | Green |
| ACE | Red | Green | Amber |
| IDA | Amber | Red | Green |
| Rake | Green | Red | Amber |
| Arty | Amber | Amber | Green |
| Bombs | Amber | Amber | Green |
| FAE | Amber | Red | Green |
| VEMASID | Amber | Red | Green |

**Figure 7. (U) General Shortfalls**

(2) (U) Countermine. Figure 8 shows requirements versus capabilities for countermine. Simple-pressure, blast-hardened pressure, double-impulse, and magnetically fuzed mines were selected because they comprise the majority of the Iraqi mine inventory. Tilt-rod fuzed mines are only a small portion of the inventory. Determining which countermine capability to use requires high-quality OBSTINTEL. Reconnaissance assets must determine threat minefield composition (mine type and fuzing) and location and dimensions before breaching operations. The use of artillery or bombs to defeat mines potentially generates another mobility requirement. If delay or point impact fuzing is used, the resulting craters create another obstacle to be breached. Also, mine plows and rollers and the CEV mine rake performance are severely degraded when operating over uneven terrain such as artillery and bomb craters.

OBSTINTEL CRITICAL

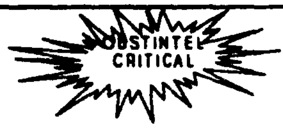
| Capabilities | Requirement: Simple Pressure | Blast-Hardened Pressure | Multiple Impulse | Magnetic / Seismic |
|---|---|---|---|---|
| MICLIC | Amber | Red | Red | Red |
| AVLMF | Amber | Red | Red | Red |
| Plow | Green | Green | Green | Red |
| Roller | Green | Green | Red | Red |
| IDA | Green | Green | Green/Red | Amber |
| Rake | Green | Green | Green | Green |
| Arty | Amber | Red | Red | Red |
| Bombs | Amber | Red | Red | Red |
| FAE | Amber | Red | Red | Red |
| VEMASID | Red | Red | Red | Green |

**Figure 8. (U) Countermine Shortfalls**

(3) (U) Counterobstacle. Figure 9 (page 16) shows the requirements versus capabilities for obstacles other than mines. The fire trench represents the most formidable obstacle threat observed in the KTO. Specific fire trench information is discussed below. OBSTINTEL is critical for success. An excellent example of OBSTINTEL value is fascine use. Depth and width of an tank ditch will drive the number of maxi and mini fascines required for a successful breach. If OBSTINTEL does not determine the actual depth and width of the tank ditch, sufficient fascines may not be available at the breach site and the force could be delayed at the tank ditch. This delay could prove fatal for the breaching task force.

(4) (U) Fire Trenches. The Iraqis have prepared fire trenches 3 by 4 by 100 meters in sets of 10. Each 1,000-meter fire-trench set is fed by a pipeline distribution network from a crude-oil well head. The Iraqis will fill the trenches and explosively fire the crude oil when tactically appropriate. Filling the entire fire-trench set will take 2 to 6 hours depending on distance from the well head. Figure 10 outlines fire-trench breach methodology. As with all obstacles, the best course of action is to bypass rather than breach, especially the fire trench. Reconnaissance plays a key role. Industry is the best source of data to determine the physical characteristics of

the well which ultimately feeds the fire trench. To breach a fire trench, use the following procedures:




| Capabilities | Requirement | | | |
|---|---|---|---|---|
| | Wire | Berm | Tank Ditch | Fire Trenches |
| CEV | Green | Green | Green | Red |
| AVLB | Green | Red | Green | Red |
| AVLMF | Green | Red | Green | Red |
| Fascines | Red | Red | Green | Red |
| Arty | Green | Amber | Amber | Red |
| Bombs | Green | Amber | Amber | Red |
| ACE | Green | Green | Green | Red |

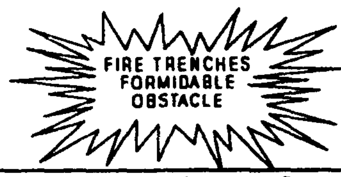



**Figure 9. (U) Counterobstacle Shortfalls**

- o (U) Sever the fire trench source by special operations forces (SOF), artillery, helicopters, or high-performance aircraft and missiles.

- o (U) Use the breaching procedures as for a tank ditch, if the ditch set is not filled with crude oil. If the ditch is filled but not fired, ignite the crude oil for tactical as well as combat safety reasons. Fired crude oil will burn out in about 24 hours. Wait 6 to 12 hours (cool-down period) before breaching operations.

- o (U) Use the AVLB for breaching procedures, if possible, because the burned crude oil will leave a 2 foot sludge at the bottom of the fire trench. If you use CEVs or ACEs to breach the fire trench, use clean aggregate to ensure a trafficable breach.

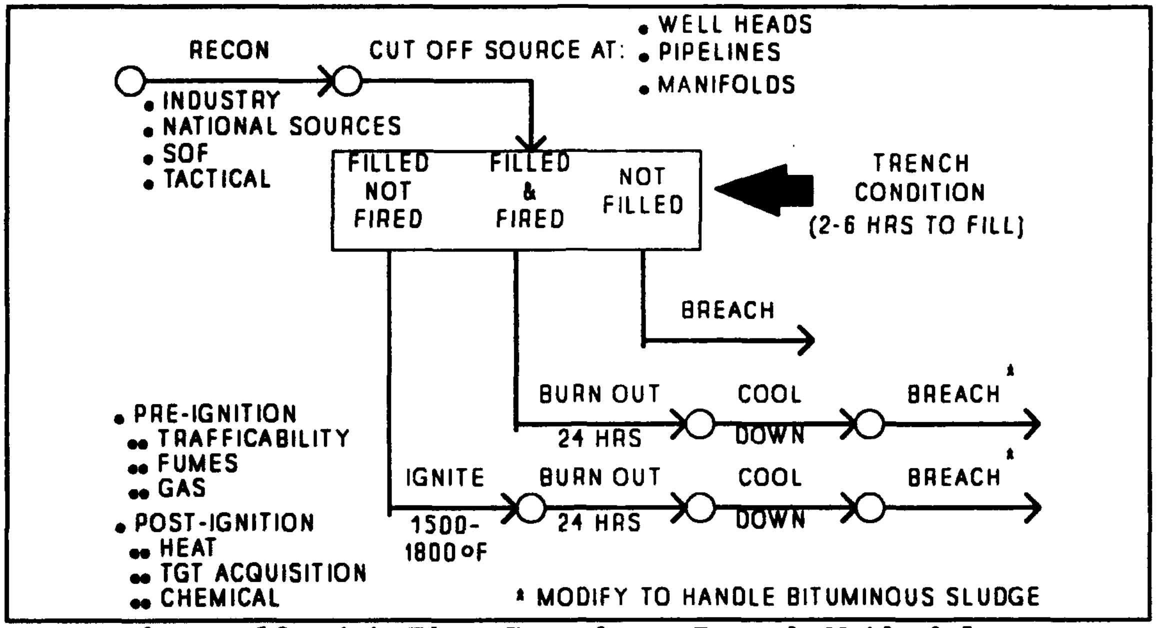



**Figure 10. (U) Fire Trenches: Breach Methodology**

**2. (U) Methodology.**

a. *(U) Essential Elements of Analysis (EEA).* The following EEA are the critical questions that guide the analysis and, when answered, provide insights to the issues and problems mentioned earlier. LTG Wishart added the third question during the 25 October 1990 QRA IPR.

- o (U) What is the effectiveness of battalion countermine sets (BCMS)? **Note:** A BCMS can equip 12 tanks with mine plows and 4 tanks with rollers.

- o (U) What is the effectiveness of an enhanced CEV (CEV mine rake)?

- o (U) What is the effectiveness of an increased level of artillery support?

b. *(U) Measures of Effectiveness (MOE).* The quantitative outcomes that help answer the EEA are MOE. The first four MOE listed below focus on those items a maneuver commander would be interested in. The last MOE is a common measure of force effectiveness used in the analytic community.

- o (U) Mission accomplishment. Secure the objective and number of lanes breached.
- o (U) Percentage of each type of breach and combat system surviving. Is another deliberate complex obstacle breach possible?
- o (U) Blue losses by type. Who killed the breach and combat systems; where and when did the systems die?
- o (U) Red losses by type. Who killed the red systems; where and when did the red systems die?
- o (U) Loss exchange ratio. Total red losses and total blue losses.

c. *(U) Scenario.* The scenario focuses on an armored task force (blue) conducting a combined arms, deliberate breach through a complex obstacle. The complex obstacle is overwatched by an infantry battalion (red) reinforced with an antitank company. The blue armored task force mission is to secure an objective occupied by a red dismounted infantry company on the far side of the complex obstacle. The task force attempts to generate two breach lanes through the complex obstacle. The task force commander directs the majority of available combat power at one red dismounted company sector, which overwatches the breach sites. The remainder of the threat battalion is fixed in place by task force and brigade fires. The scenario ends when the red dismounted company is destroyed. The scenario stage is set below. Each command echelon either directly or indirectly assists the blue armored task force commander during the conduct of the deliberate breach.

(1) (U) EAC. The enemy air defense, air force, and army aviation capabilities have been virtually destroyed in the KTO. Strategic reserves are combat ineffective. Air superiority in the vicinity of the corps penetration point is assured. Enemy air reconnaissance is severely limited.

(2) (U) Corps. As shown in Figure 11, the corps penetrates the enemy defenses in the mechanized infantry division sector. Deception operations are conducted in the armored cavalry regiment and air assault division sectors. The purpose of the deception operations is to confuse the threat as to the location of the corps main attack. The airborne division fixes enemy forces in place through the use of direct and indirect fires. BAI and corps aviation assets focus on the threat's operational reserves (an armored brigade). One armor brigade constitutes the corps reserve. An armor division (-) is the corps exploitation force.

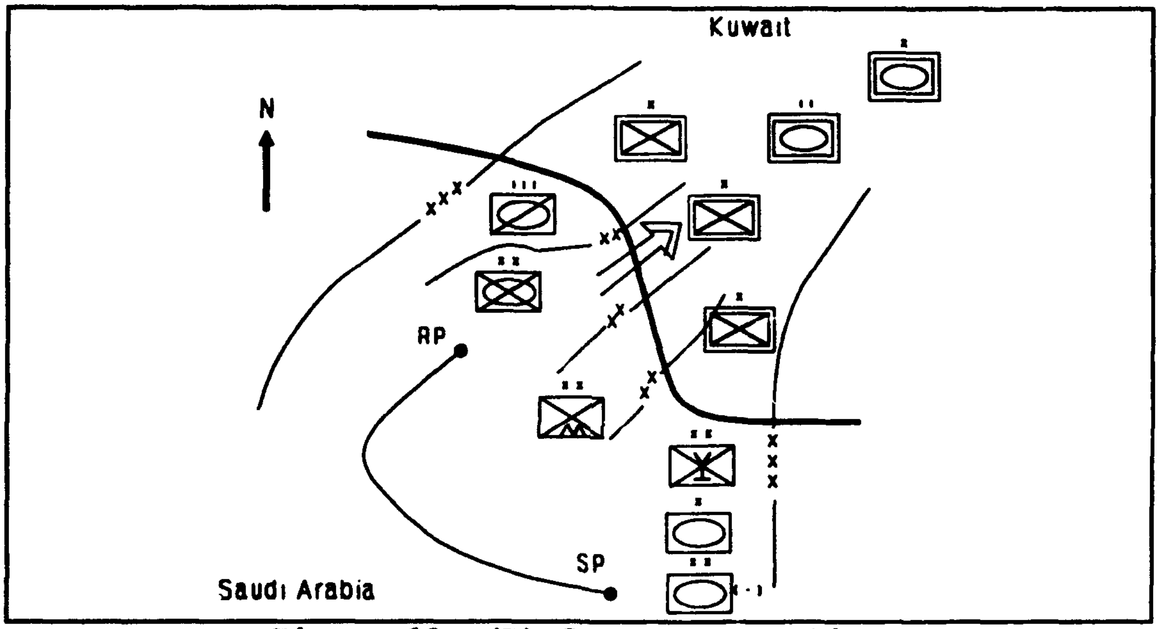



**Figure 11. (U) Corps Perspective**

(3) (U) Division. The division conducts an initial penetration of the Iraqi defense through the 1st brigade zone of attack (Figure 12, page 20). Division forces are initially *stacked* along the western portion of the division zone giving the impression that the main attack is in the 2nd brigade area. The 1st brigade maneuvers to the eastern portion of the division zone and conducts a deliberate breach of the enemy defense. The 2nd brigade fixes enemy forces to its front by fires, later shifting fires as required to support 1st brigade operations. After breaching the enemy defenses, 1st brigade clears Iraqi forces on the far side of the complex obstacle in the division sector and establishes the division breachhead.

(U) Division and supporting corps engineers generate additional breach lanes as well as widening existing breach lanes through the Iraqi complex obstacle along the entire 9-kilometer division front. Additional breach lanes and widening existing breach lanes is necessary to rapidly pass the remainder of the division and the corps exploitation forces that follows. The division cavalry squadron and 3rd brigade maneuver through the breach lanes into the division breachhead and breakout. The 3rd brigade is the division's exploitation force and the division cavalry squadron is the division's forward screening force. The 2nd brigade executes follow on missions, as required. Allocated CAS sorties and the Division's aviation assets are directed at threat tactical reserves (an armored battalion).

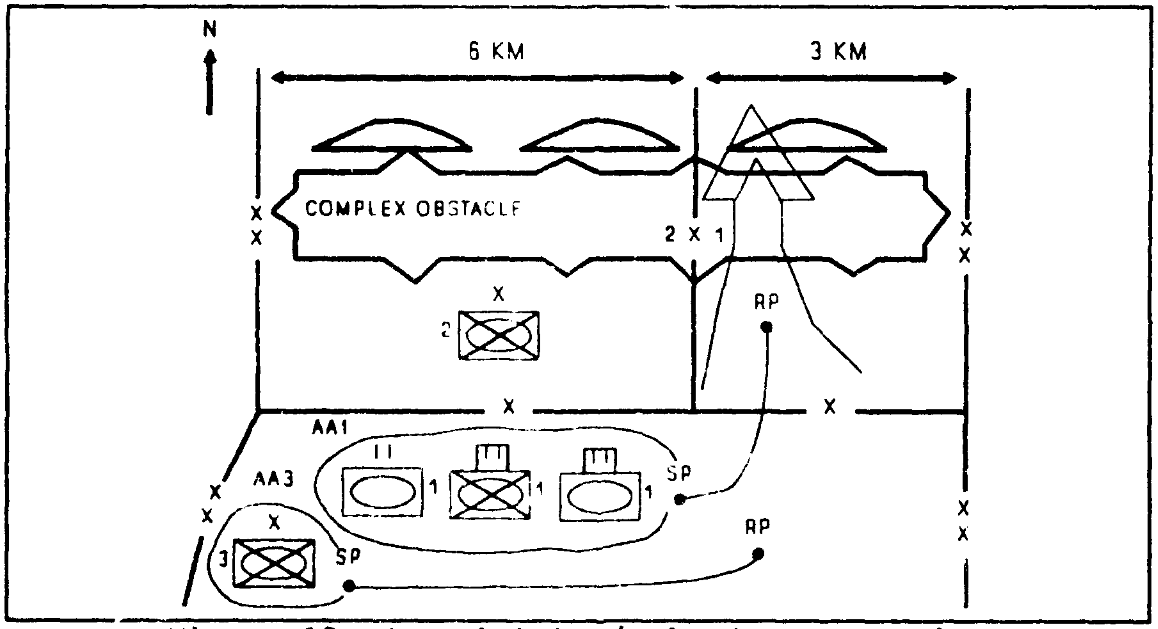



**Figure 12. (U) Division/Brigade Perspective**

(4) (U) Brigade. The 1st brigade breaches the Iraqi complex obstacle along a 3-kilometer front and establishes the division breachhead. An armored task force will conduct the deliberate breach and will be followed by a mechanized task force and an armored battalion. The initial armored task force will force a penetration, destroy the enemy company, hold the breach shoulders open, and eventually secure the eastern portion of the division breachhead. The mechanized task force will maneuver through the breach lanes, eliminate Iraqi forces to the west of the penetration point, and secure the western portion of the division

breachhead. The remaining armored battalion will maneuver through the breach lanes and establish a blocking position forward of the penetration point to secure the northern portion of breachhead.

(5) (U) Task Force. The armored task force will generate two lanes through the Iraqi complex obstacle (Figure 13, page 22). The Iraqi overwatch force will violently oppose the armored task force's efforts to breach the complex obstacle. The complex obstacle is overwatched by a Iraqi infantry battalion reinforced with an antitank (BRDM w/AT-5) company. The complex obstacle is composed of the following:

- (U) A pressure-fuzed minefield of enhanced density at 2 mines per meter of front (normal density is 1 mine per meter of front).
- (U) Concertina wire.
- (U) A 3- by 4-meter tank ditch.
- (U) A magnetically fuzed minefield of enhanced density at 1 mine per meter of front (normal density is 0.5 mine per meter of front).
- (U) A pressure-fuzed minefield at 1 mine per meter of front and more concertina wire.
- (U) Concertina wire.

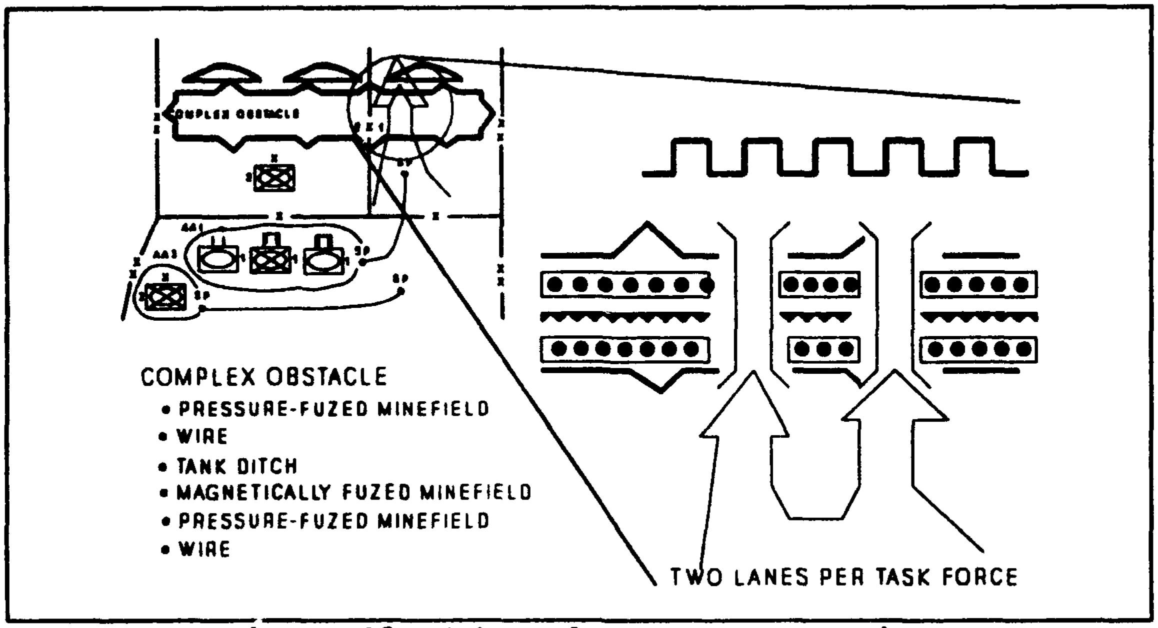



**Figure 13. (U) Task Force Perspective**

(6) (U) Force Structure. Figure 14 shows the preferred blue reinforced armored task force and red infantry battalion force structures. The red force structure is an estimate based on information available in late September and early October 1990. All MILAN, HOT, and BRDM command vehicles have forward-looking infrared (FLIR) target acquisition. The blue and red force structures were intended to be reasonable laydowns. An unreasonable red or blue force structure (a blue task force with excessive combat power) could skew the analysis. Current information indicates that distribution of MILANs and HOTs in red force structure were probably overstated. Unfortunately, the exact number of antitank systems in an Iraqi dismounted infantry battalion still remains unclear. As previously discussed, a limited number of threat tank platoons were positioned forward to support dismounted infantry battalions along the Kuwaiti-Saudi Arabian and the Iraqi-Saudi Arabian border.

| Blue | Red |
| --- | --- |
| 52 M1A1 (9 plows & 3 rollers) | 3 BRDM-FLIR (AT-5) |
| 14 M2 | 6 BRDM-DVO (AT-5) |
| 4 MICLIC | 18 MILAN gunners-FLIR |
| 6 ACE | 6 HOT gunners-FLIR |
| 2 CEV | 270 Riflemen (RPG16/18) |
| 6 AVLB | 18 152-mm Howitzer |
| 73 Riflemen (AT-4) | 36 122-mm Howitzer |
| 4 4.2" mortars | 6 120-mm mortars |
| 72 155-mm Howitzer | |
| 9 MLRS launchers | |

- Blue force structure is preferred alternative.
- Conservative examination
- Red force structure "best guess" at the time.

**Figure 14. (U) Blue and Red Force Structure**

(7) (U) Blue and Red Organization. Figure 15 (page 24) shows the blue and red force structure. The armored task force is organized into a support force, a breach force, and an assault force. The deliberate breach is orchestrated according to the breaching fundamentals SOSR. Figure 15 shows the Iraqi battalion *triangle* fortification from the Iran-Iraq war. Again, this was an estimate based on information available in late September and early October 1990. Iraqi deployments in the KTO indicate a two-up one-back deployment of dismounted infantry in trench systems. Therefore, the *triangle* fortification is not an unreasonable selection for analytic purposes. Each of the smaller *triangular* fortifications within the larger *triangle* fortification are occupied by a dismounted Iraqi infantry company. Nine BRDMs are positioned in the interior of the larger battalion *triangle* for antitank support.

(8) (U) Blue Mission. The blue armored task force objective is to destroy the red infantry company overwatching the complex obstacle where the two breach lanes are generated. The remainder of the Iraqi infantry battalion will be *fixed* in position by task force, brigade, and division direct and indirect fires.

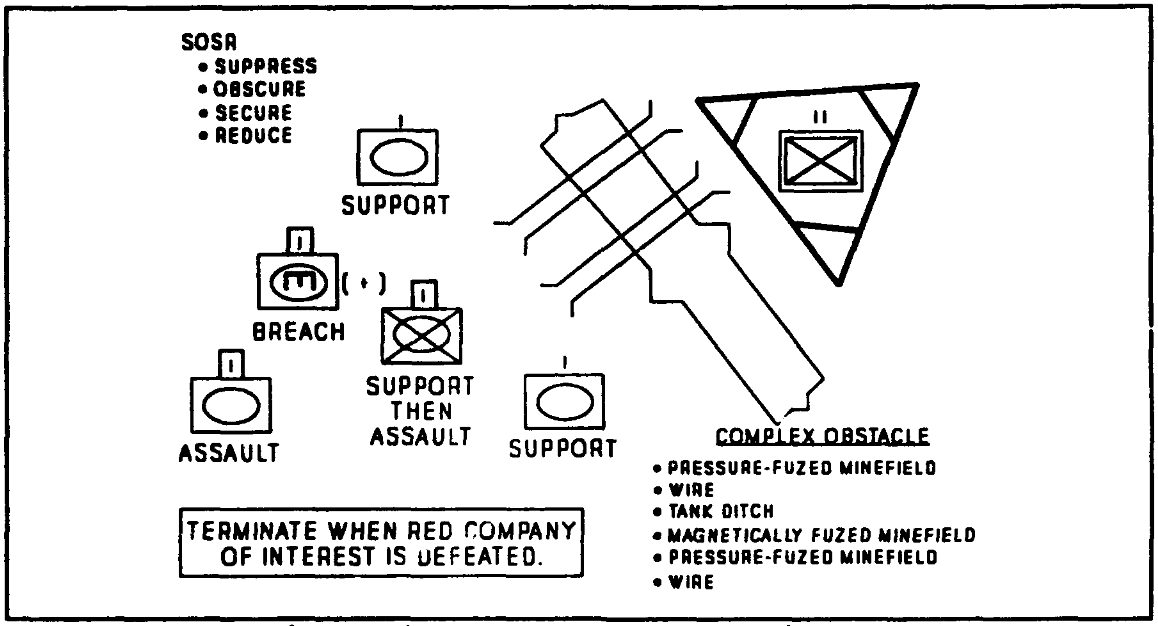



**Figure 15. (U) Task Force Mission**

d. *(U) Model.* The JANUS-A model was used to game the armored task force scenario described above. JANUS-A is designed for conflict up to a blue brigade versus a red division. The model focuses on individual fighting system engagements and assessments with an aggregation capability up to company-sized elements. JANUS-A provides the best representation of combat at the blue battalion and task force versus red brigade and regiment level and below without aggregation. The JANUS-A code is event-sequenced, runs in near real time, and uses a probabilistic solution technique. Its graphical environment provides a battlefield with a detailed treatment of conventional military systems and digitized terrain.

(U) Gamers, in a competitive simulated battle, make tactics and system employment decisions based on information gained from interactive graphics. JANUS-A's interactive graphics display a continuous presentation of a map and operations overlay display and provide on-call status reports. This man-in-the-loop model is used to evaluate the interaction of the principal maneuver elements under conventional or chemical conditions when new weapons systems or innovative tactics are introduced. The JANUS-A model is easily set up in comparison to its deterministic counterparts and rapidly provides analytical insights. JANUS-A output will be used to quantify the MOEs previously described.

e. *(U) Run Matrices.* With exceptions, various alternatives of armored task force scenarios were gamed. The dominant factor, which changes from alternative to alternative, is the composition of the breach force. Two sets of JANUS-A runs were gamed: a basic set and an artillery plus-up set. The basic set was derived from the original scenario used for the HQ AMC brief. The artillery plus-up set was based on the Combined Arms Center (CAC) Commander's guidance and United States Army Field Artillery School (USAFAS) expertise. Since JANUS-A is stochastic and interactive, a number of replications are required to smooth out the battle flow, reduce human variability, and provide a basis for statistical analysis. Each case consists of five replications.

(1) (U) Basic. The basic-run set consists of the seven cases shown in Figure 16. The composition of the breach force varies with each case. Armor and infantry force structure and deployment remain unchanged. Artillery support for all seven cases is three 155-millimeter (mm) artillery battalions and one MLRS battery. Engineer allocations at the brigade level and breach force organizations are at Appendix A.

- Engineer company
- Engineer battalion (-)
- Engineer company (+): add plows and rollers
- Engineer company (+): add plows and rollers minus ACEs
- Engineer company: two CEV mine rakes
- Engineer company (+): four CEV mine rakes
- Engineer company (+): add plows and rollers plus four CEV mine rakes

Arty Spt: 3-155 Bns, 1-MLRS Btry

**Figure 16. (U) Basic Run Set**

(2) (U) Artillery Plus-Up. Figure 17 (page 26) shows the artillery plus-up set of five cases. The first two cases change

only the composition of the breach force. The remaining three cases change the composition of the breach force and use of artillery, increase the size of the support force, and make the red antitank systems more survivable with overhead cover. Artillery support for all five cases is one 8-inch artillery battalion, six 155-mm artillery battalions, and two MLRS batteries. The level of artillery support was determined by USAFAS based on the corps-level scenario discussed earlier. Use of artillery assets may vary depending on the case. Engineer allocations at the brigade level and breach force organizations are at Appendix B.

- Engineer battalion (-)
- Engineer company (+): add plows and rollers
- Engineer battalion (-) (no ACE): HC vs WP smoke, an additional tank Bn for the support force, 30% red AT systems with overhead cover...Package 1
- Engineer battalion (-) (no ACE): same as above, but with an additional 15 min artillery preparation, MLRS fires only counterbattery...Package 2
- Engineer company (+): add plows and rollers and Package 2

Arty Spt: 1-8" Bn, 6-155 Bns, 2-MLRS Btry

**Figure 17. (U) Artillery Plus-Up Run Set**

### 3. (U) Combat Effectiveness.

a. *(U) Battle Flow.* Figure 18 shows battle-flow timing. The following battle narrative traces the flow of battle from the armored task force perspective. Since JANUS-A is a stochastic model, each replication will be different. This battle narrative is one replication selected from the reinforced company (tank plows and tank rollers augment an engineer company) case in the basic set. The deliberate breach is initiated at before-morning nautical twilight (BMNT). The thermal inversion present at BMNT will maximize the effectiveness of obscurants. Wind is blowing from northwest to southeast at 1 to 2 knots. Weather is clear.

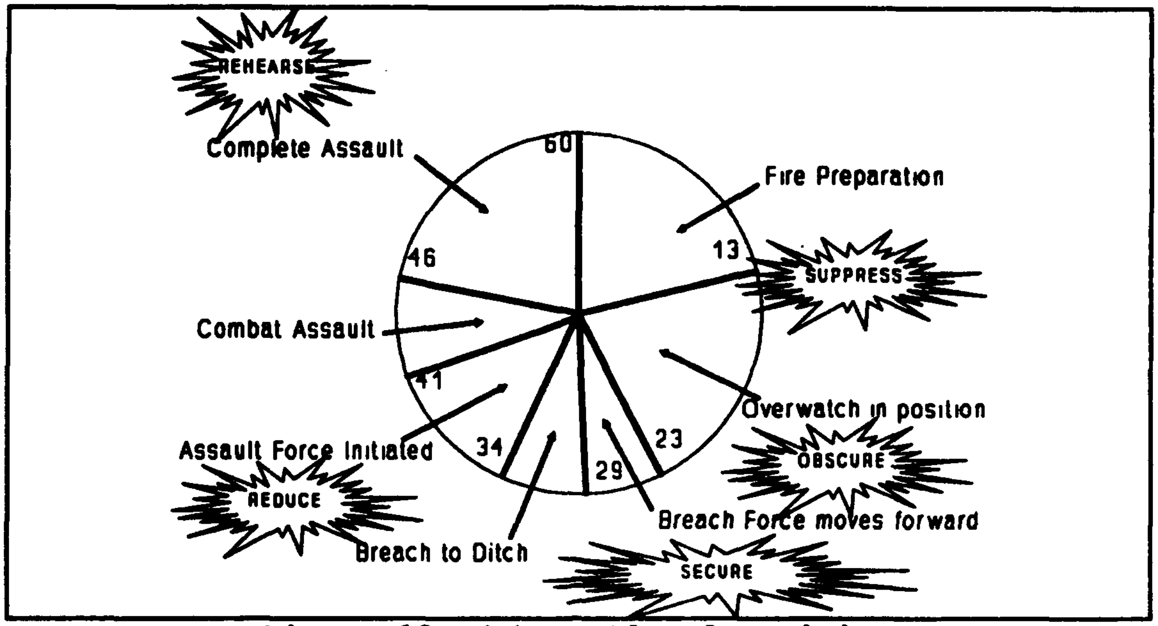



**Figure 18. (U) Battle Flow Timing**

(1) (U) 0 to 13 Minutes. Artillery and mortar fires start the suppression and obscuration of enemy forces in the objective area.

(2) (U) 13 to 23 Minutes. The support force maneuvers into assault by fire positions and suppresses the threat company of interest with direct fires. The remaining portion of the threat battalion is secured in position by support force direct fires and indirect fires. Indirect suppressive fires continue and smoke is built to reduce the threat's acquisition capabilities.

(3) (U) 23 to 29 Minutes. The breach force maneuvers forward to the leading edge of the complex obstacle and begins preparing two breach lanes for the task force. Direct fires continue to suppress and fix enemy forces in place. Indirect fires suppress and maintain obscuration levels in the objective area.

(4) (U) 29 to 34 Minutes. The two breach lanes from the leading edge of the complex obstacle up to the tank ditch are complete and secured. Direct and indirect fires continue to suppress and fix enemy forces in place. Artillery and mortar smoke on the objective area continues.

(5) (U) 34 to 41 Minutes. The assault force moves forward into the two partially completed breach lanes. The breach force continues to work from the tank ditch to far side of the complex obstacle. Suppressive, smoke and fixing fires are maintained.

(6) (U) 41 to 46 Minutes. The breach lanes are complete and secured. The assault force passes through the lanes and assaults the enemy position. Direct and indirect fires are shifted off of and beyond the objective to seal avenues of escape and approach, as appropriate.

(7) (U) 46 to 58 Minutes. Assault continues until threat overwatch company is destroyed. Task force reorganizes and prepares for a potential threat counterattack.

b. *(U) Basic.*

(1) (U) Gaming Results (Figure 19).

(a) (U) Mission accomplishment. Securing the objective is the most important MOE to the maneuver commander. A contributor to securing the objective is the number of breach lanes generated. Five replications are run for each case and two lanes are attempted for each replication. Therefore, a total of five opportunities to secure the objective and ten breach lanes are possible. Figure 19 shows the relative comparison between the cases. Note that an engineer company (2 CEVs, 4 MICLICs, 6 ACEs, and 6 AVLBs) is the current allocation for a maneuver brigade.

(U) Weighting the brigade's main effort (the armored task force) with the entire engineer company does not secure the objective nor yield any completed breach lanes. Increasing the density of CEVs, MICLICs, ACEs, and AVLBs by weighting the brigade main effort with an engineer battalion (-) results in only three secure objectives and three complete lanes. Introducing nine plows and three rollers into the breaching task force, to reinforce the engineer company, achieves desires results. The objective is secured all five times and nine breach lanes are completed. Removing six ACEs from the engineer company results in one less completed lane than in the reinforced engineer company with plows and rollers. Mounting the mine rake on the engineer company's two CEVs makes the force slightly more effective. However, augmenting the engineer company with two more CEV mine rakes, for a total of four CEV mine rakes, yields good results: five objectives secured and five completed lanes.

The *cadillac* run with nine plows, three rollers, and four CEV mine rakes augmenting an engineer company performs exactly as expected: 5 objectives secured and all 10 lanes completed.

(U) For mission accomplishment, plows and rollers yield the best payoff. The reinforced engineer company with plows and rollers versus the reinforced engineer company with plows and rollers minus the ACE illustrates this point. MICLIC, as a primary countermine resource, is deficient even in increased quantities. This deficiency is primarily seen in the following cases: engineer company, engineer battalion (-), and, to a lesser extent, the engineer company with two CEV mine rakes. The CEV mine rake contributes to mission accomplishment, and this contribution increases as more CEV mine rakes are made available. The engineer company with two CEV mine rakes and the engineer company with four CEV mine rakes highlight the point.

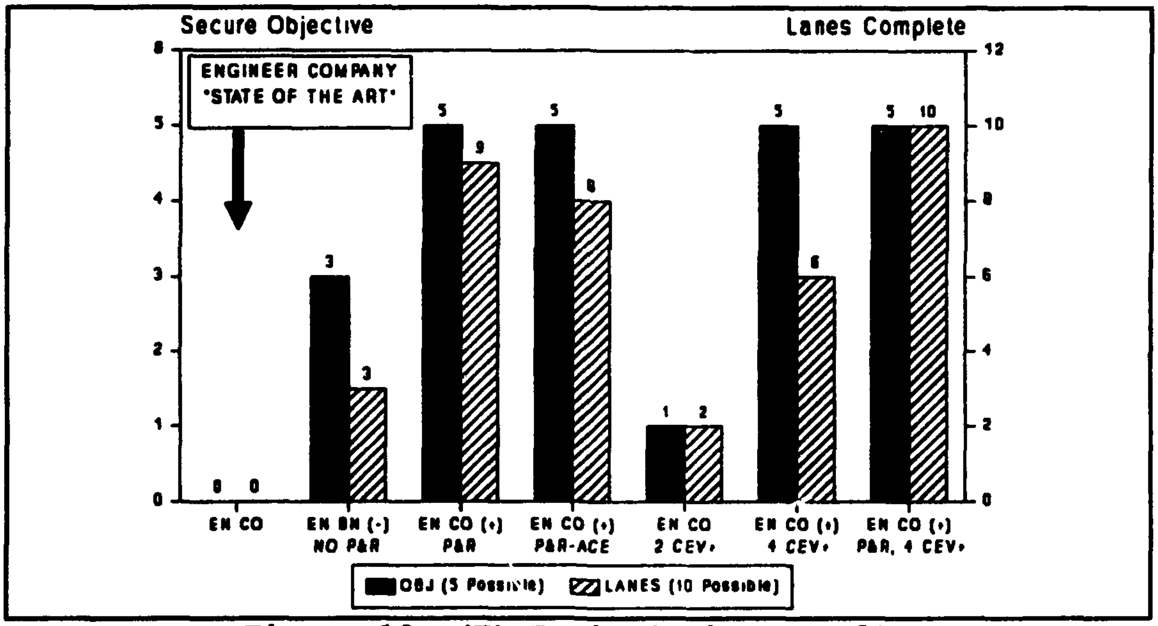



**Figure 19. (U) Basic Gaming Results**

(b) (U) Mines. Figure 20 (page 30) shows that mines killed few combat systems in the basic run set. This result is consistent with historical data and recent simulation output. The mine's greatest benefit is not direct mine losses, but the enhanced effectiveness of direct- and indirect-fire systems that overwatch the complex obstacle. A deliberate breach procedure, which minimizes direct mine loss (18 to 24 mine losses are possible), also slows the overall momentum of the attack. Because the momentum of the attack slows, the threat obtains an increased *window of opportunity* to acquire and subsequently engage blue systems. In the maximum mine loss case (the engineer company) mines represented only 5 percent of the total kills; the remaining 95 percent are direct- and indirect-fire losses. Specifically, lack of countermine resources forced the assault force to bull through the second minefield before assaulting the objective in the engineer company case. The remaining mine losses in all other cases resulted from either poorly cleared breach lanes, gaps in the breach lanes because of breacher loss, or magnetically fuzed mines not defeated by countermine resources.

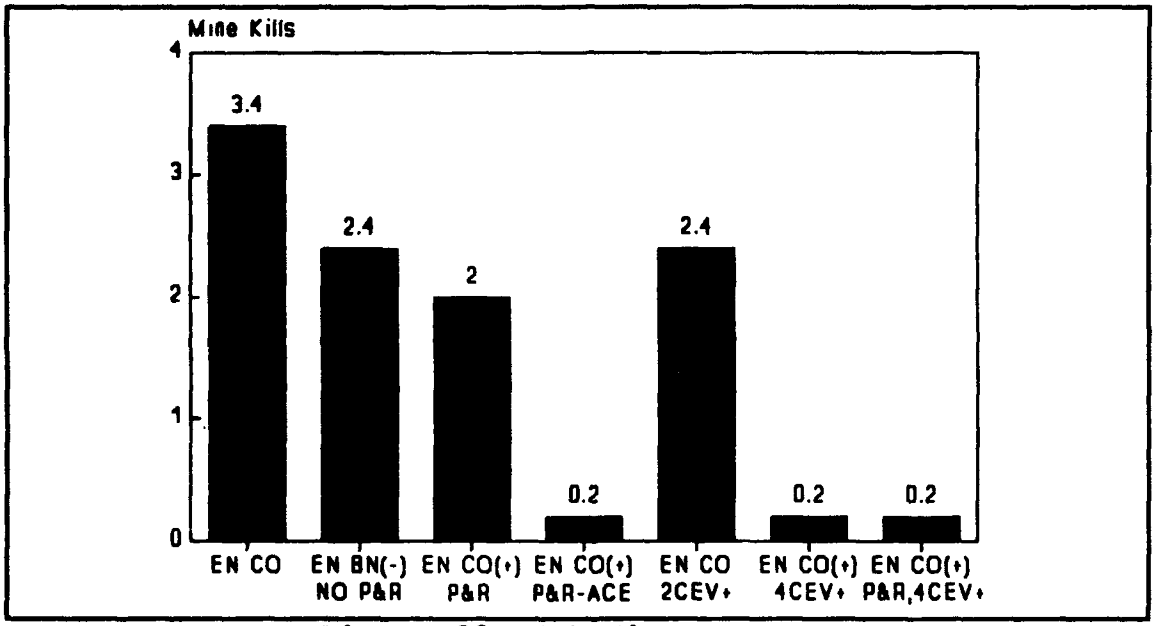
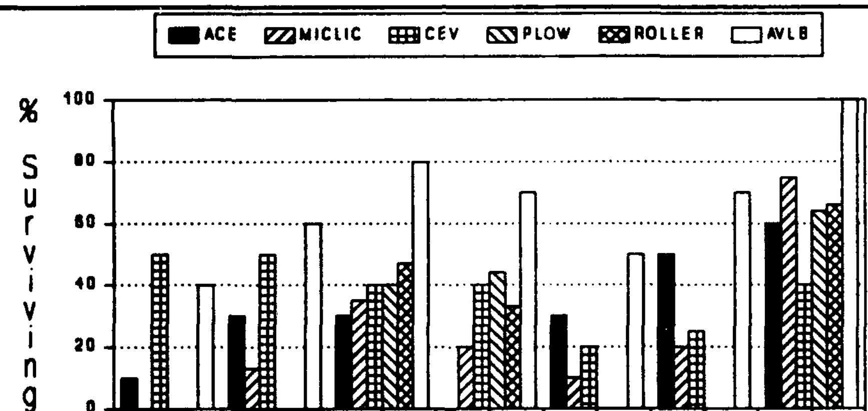



**Figure 20. (U) Mine Losses**

(c) (U) Survivability. Figure 21 shows breacher survivability results. Overall breacher survivability is poor. The deliberate breaching environment is very lethal. Breach force losses maneuvering forward to the leading edge of the complex obstacle are low. Once the breach force starts reducing the complex obstacle, breacher losses increase substantially. Over 80 percent of the breachers die to direct and indirect fires during the reduction phase. In all alternatives, the MILAN kills the most breachers.

(U) The trailer-mounted MICLIC is the most vulnerable vehicle. JANUS does not directly represent the trailer-mounted MICLIC. It allows the MICLIC to be mounted on a vehicle that simulates a trailer. For this analysis, the MICLIC is towed on either an ACE or M113, which are not highly survivable items of equipment, but more survivable than a trailer-mounted MICLIC. Therefore, MICLIC survivability is somewhat overstated. However, cases that depend on the MICLIC for countermine capability indicate low survivability rates. The MICLIC is easily destroyed by both direct and indirect fires.

(U) AVLB survivability appears relatively high, but the results shown in Figure 21 can be misleading. The AVLBs are not the primary breacher choice to defeat the tank ditch. The CEV and the ACE are the primary breachers used to defeat the tank ditch. The bulk of the AVLBs remain in the original assembly area that the breach force maneuvered from and are not a priority target. The AVLBs assigned to the breach force are only called forward from the assembly area when all the CEVs and ACEs are destroyed in the breach lanes.




| | EN CO | EN BN (-) | EN CO (+) | EN CO (+) | EN CO | EN CO (+) | EN CO (+) |
|---|---|---|---|---|---|---|---|
| ACE | 10 | 30 | 30 | | 30 | 50 | 60 |
| MICLIC | 0 | 13 | 35 | 20 | 10 | 20 | 75 |
| CEV | 50 | 50 | 40 | 40 | 20 | 25 | 40 |
| PLOW | | | 40 | 44 | | | 64 |
| ROLLER | | | 47 | 33 | | | 66 |
| AVLB | 40 | 60 | 80 | 70 | 50 | 70 | 100 |
| | | NO P&R | P&R | P&R-ACE | 2 CEV+ | 4 CEV+ | P&R, 4 CEV+ |

**Figure 21. (U) Basic Breacher Survivability**

(d) (U) Loss exchange ratios (LER). Figure 22 (page 32) shows LER. Losses include both ACVs and individual soldiers. Red losses drive the LER except for the reinforced engineer company with plows, rollers, and enhanced CEVs. In this instance, the breach speed and quantity of survivable breachers dramatically reduces blue losses.

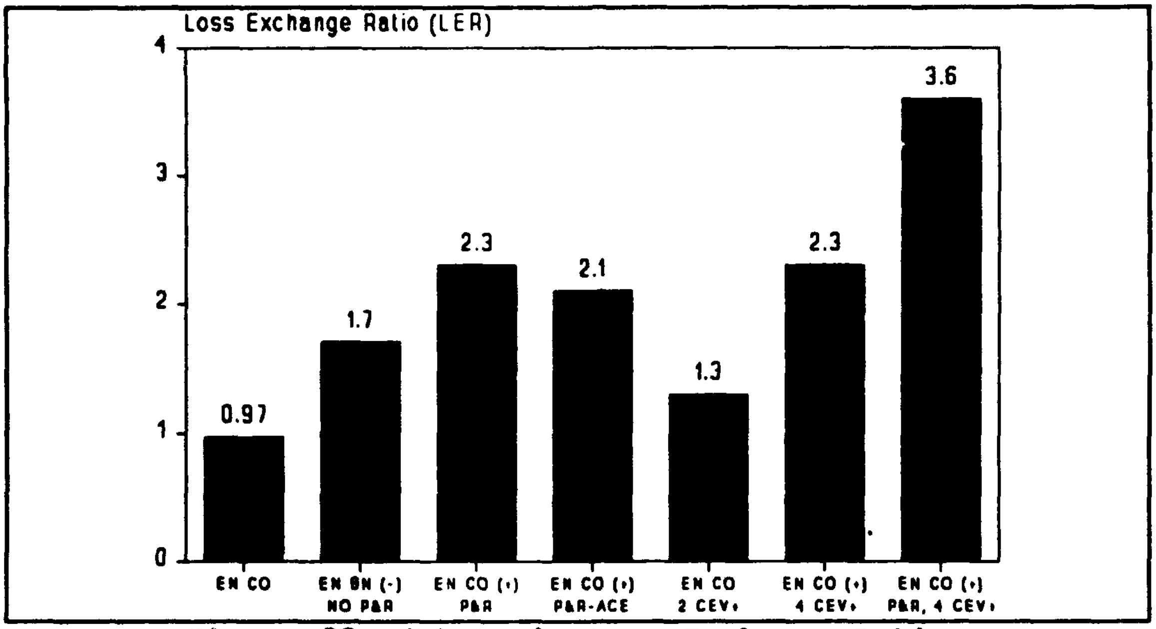



**Figure 22. (U) Basic Loss Exchange Ratios**

(2) (U) Analysis. JANUS-A offers an ideal command and control (C2) environment. The number of secured objectives and completed breach lanes shown in Figure 19 (page 29) are very close to an upper bound on performance. Given the deliberate breaching environment described above, an option that does not yield five secured objectives should not be used in the field because such an option leads to program failure. For instance, the engineer battalion (-) secures the objective three out of five replications and generates only three completed breach lanes. A maneuver commander that selects the engineer battalion (-) option *signs up* for failure to secure the objective twice and seven incomplete breach lanes under ideal C2 conditions. In a field environment where C2 is less than ideal, a maneuver commander can expect far more failures. A more prudent selection would be an option with five secured objectives.

(U) Figure 23 lists a summary ranking of the basic cases. Objectives secured, number of breach lanes generated, and ability to breach another complex obstacle are used as criteria to determine a relative ranking. Ability to breach another complex obstacle is based on breacher survivability and surviving combat power. Two clear winners emerge: the reinforced engineer company with plows, rollers, and enhanced CEVs and the reinforced engineer company with plows and rollers. Two cases are marginal performers: the reinforced engineer company with plows and rollers minus ACEs and the reinforced engineer company with four enhanced CEVs. The marginal cases would not be able to breach a second complex obstacle. The remaining cases are not viable combat options.

| RANKING | ALTERNATIVE | REMARKS |
|---|---|---|
| 1 | Company (+) P&R, 4 CEV+ | All 10 lanes, fastest, & fewest Blue losses. Most breachers left. |
| 2 | Company (+) P&R | 9 lanes complete, can breach again. |
| 3 | Company (+) P&R-ACE | 8 lanes complete. No 2nd Breach. |
| 4 | Company (+) 4 CEV+ | 6 lanes complete. CEV+ fast, 2nd breach? |
| 5 | Battalion (-) No P&R | 3 lanes complete. No 2nd breach, more vulnerable & very slow |
| 6 | Company 2 CEV+ | 2 lanes complete. No 2nd breach. |
| 7 | Company | No successful breach! |

**Figure 23. (U) Base Case Summary Ranking**

c. *(U) Artillery Plus-Up.*

(1) (U) Gaming Results.

(a) (U) Mission accomplishment. Figure 24 (page 34) shows the number of objectives secured and number of breach lanes generated. Two cases from the basic set are directly compared with the first two cases from the artillery plus-up set. An increased level of artillery support yields one more objective secured and two breach lanes in the engineer battalion (-) and one more breach lane in the reinforced engineer company with plows and rollers. Package one engineer battalion (-) case and package two engineer battalion (-) case show no tactical differences at the task force level as measured by the MOEs of secured objectives and breach lanes complete. However, large operational differences from a division and corps perspective exist (see Figure 27, page 37). Package one and package two engineer battalion (-) cases are without plows, rollers, or ACEs. A significant task force tactical difference is observed between package two engineer battalion (-) case and package two reinforced engineer company case with plows and rollers.

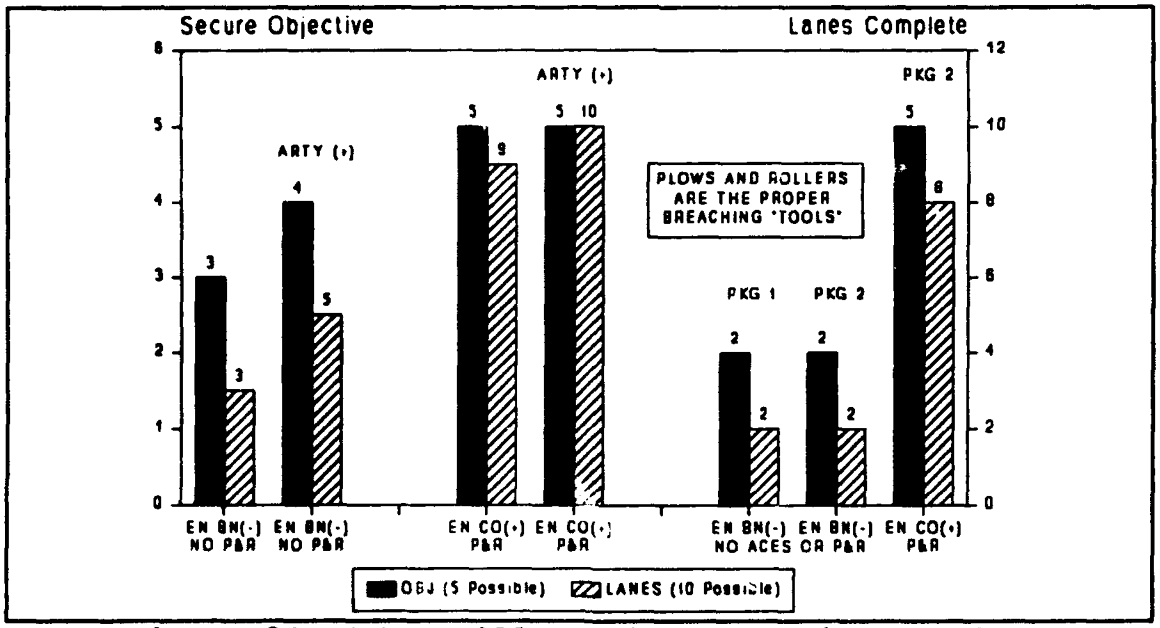


**Figure 24. (U) Artillery Plus-Up Gaming Results**

(b) (U) Mines. Figure 25 shows few combat systems killed by mines in the artillery plus up run set. (**Note**: Artillery was <u>not</u> used to reduce minefields in the artillery plus-up set.) The benefit of mines is not kills directly attributed to mines but the enhanced effectiveness of direct- and indirect-fire systems that overwatch a minefield or complex obstacle. As in the basic run set, the deliberate breach minimizes direct mine loss, but slows the overall momentum of the attack. When the attack momentum is reduced, the threat can take advantage of an increased *window of opportunity* to acquire and engage blue ACVs. Mine losses are the result of poorly cleared lanes, breacher loss, or magnetically fuzed mines.

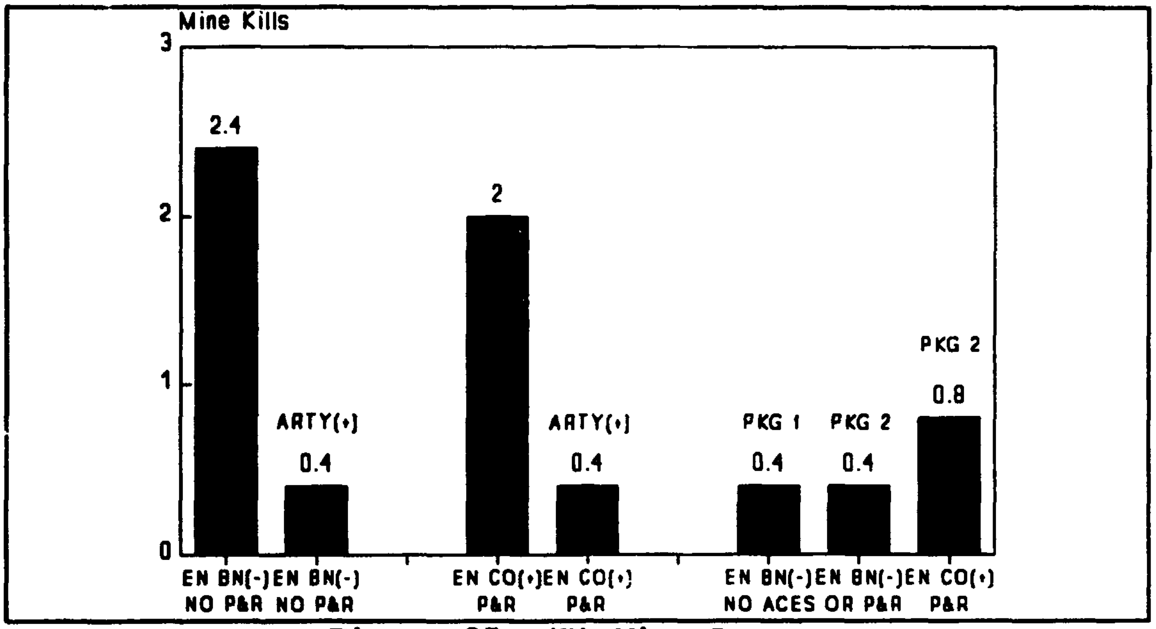
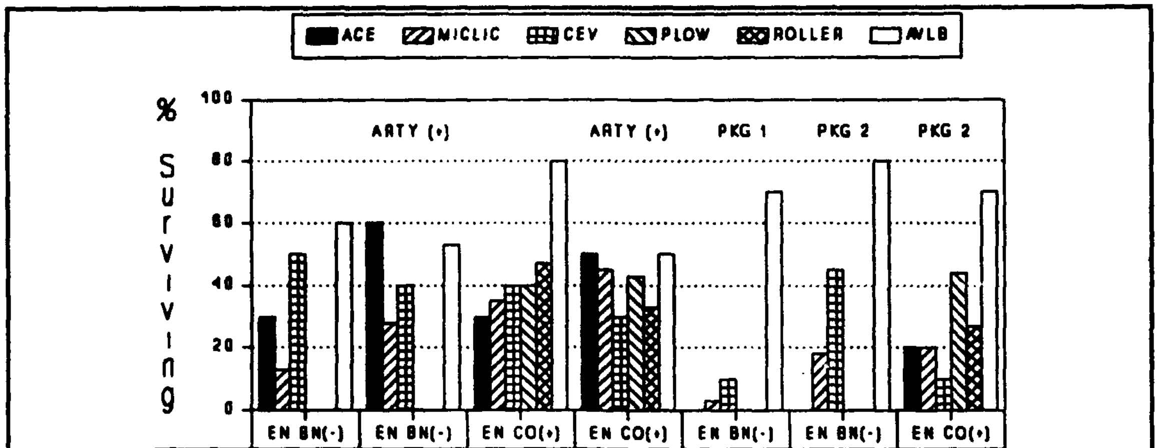



**Figure 25. (U) Mine Losses**

(c) (U) Survivability. Breacher survivability, shown in Figure 26 (page 36), remains poor. Threat direct-fire tank weapons become more dominant than in the basic run set. Overhead cover increases the antitank gunners' survivability to indirect fires. Even the increased level of artillery support does not completely neutralize the antitank gunners that have overhead cover. Consequently, the threat gains greater control of the breach lanes. The majority of breachers are destroyed in the breach lanes. Package one and package two engineer battalion (-) runs depend on MICLIC as the primary countermine resource. Since the MICLIC is vulnerable to direct and indirect fires, these runs indicate low system survivability levels. Package two reinforced engineer company with plows and rollers does better because of an increased survivability level provided by the tank.




| | EN BN(-) | EN BN(-) | EN CO(+) | EN CO(+) | EN BN(-) | EN BN(-) | EN CO(+) |
|---|---|---|---|---|---|---|---|
| ACE | 30 | 60 | 30 | 50 | | | 20 |
| MICLIC | 13 | 28 | 35 | 45 | 3 | 18 | 20 |
| CEV | 50 | 40 | 40 | 30 | 10 | 45 | 10 |
| PLOW | | | 40 | 43 | | | 44 |
| ROLLER | | | 47 | 33 | | | 27 |
| AVLB | 80 | 53 | 80 | 50 | 70 | 80 | 70 |
| | NO P&R | NO P&R | P&R | P&R | NO ACE OR P&R | | P&R |

**Figure 26. (U) Artillery Plus-Up Breacher Survivability**

(d) (U) LER. Figure 27 shows LER. Examining the engineer battalion (-) cases and the reinforced engineer company cases with artillery plus-up and without the artillery plus-up (basic set) yields no surprises. An increased level of artillery support increases the combat effectiveness of the blue armored task force. A *jump* in LER is observed between package one engineer battalion (-) and both package two engineer battalion (-) and package two reinforced engineer company with plows and rollers. Both package two cases allocate two MLRS batteries exclusively to counterbattery, no suppressive fires.

(U) Figure 24 (page 34) and Figure 27 must be considered when evaluating the package one and two package two runs. Counterbattery fires cause a large increase in red artillery losses and reduced blue artillery losses. Also, breacher losses for package two engineer battalion (-) case are high as a result of red antitank systems in overhead cover. Therefore, few blue forces arrive at the objective since most breach lanes fail. Virtually no close combat occurs. As a result, more blue maneuver systems survive. Therefore, the LER for package two engineer battalion (-) case inflates over package one engineer battalion (-) case. Package two reinforced engineer company with plows and rollers indicates the same responsiveness to blue MLRS counterbattery fires: increased red artillery losses and decreased blue artillery losses. However, tank-mounted plows and rollers reap the benefit survivable countermine assets yield. More breach lanes succeed. Since the breach lanes succeed, blue forces can maneuver forward to assault the objective, and close combat occurs in all five replications. The blue assault increases blue maneuver force losses so the LER is less than package two engineer battalion (-) run.

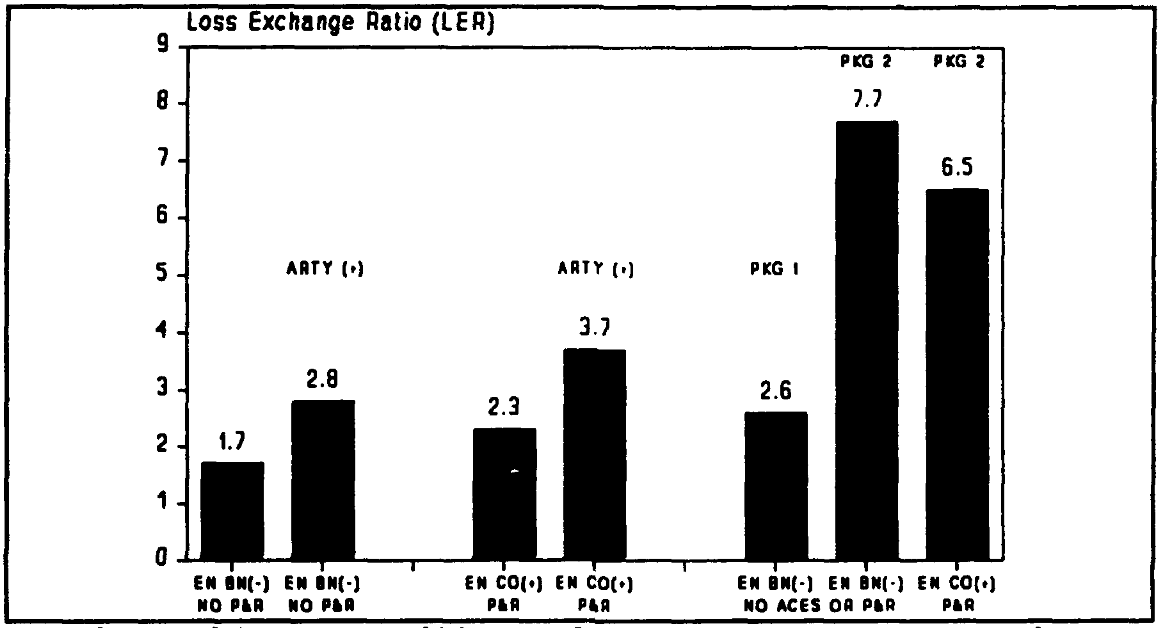



**Figure 27. (U) Artillery Plus-Up Loss Exchange Ratios**

(2) (U) Analysis. Any cases with less than five mission successes should be discarded based on the JANUS-A C2 failure selection argument discussed above. Note that package one and two engineer battalion (-) cases and the reinforced engineer company with plows and rollers case do not change the composition of the breach force. Therefore, a straight forward comparison is not always possible; too many variables change. The best that can be achieved are some inferences based on gaming observations. Package two engineer battalion (-) run and package two engineer company with plows and rollers can be directly compared. The only difference between these two package two runs is the breach force composition.

(U) The artillery plus-up set is divided into two sections for ranking: a set where the only difference is the composition of the breaching force and a set where the composition of the breaching force and other previously mentioned differences have been explored. Figure 28 shows the two summary rankings of the artillery plus-up cases.

| RANKING | ALTERNATIVE | REMARKS |
|---|---|---|
| 1 | Company (+) P&R | All 10 lanes, fastest, & most breachers left. |
| 2 | Battalion (-) No P&R | 5 lanes complete, no 2nd breach. |
| 1 | Company (+) P&R, PKG 2 | 8 lanes complete, 2nd breach? |
| 2 | Battalion (-) No P&R, PKG 2 | 2 lanes complete, no 2nd breach. |
| 3 | Battalion (-) No P&R, PKG 1 | 2 lanes complete, no 2nd breach. |

**Figure 28. (U) Artillery Plus-Up Summary Ranking**

o (U) The reinforced engineer company with plows and rollers is superior to the engineer battalion (-). The reinforced engineer company with plows and rollers secures the objective all five times, completes all 10 breach lanes successfully, and is able to execute a follow-on deliberate breach of a complex obstacle. In comparison, the engineer battalion (-) is a less desirable field option. The engineer battalion (-) secures the objective 80 percent of the time (under ideal C2 conditions), generates five successful lanes, and cannot execute another breach of a complex obstacle.

o (U) Package two engineer company with rollers and plows is preferred to package two engineer battalion (-) without plows, rollers, and ACEs. Package two engineer battalion (-) is not a desireable field option, since it can secure the objective only two out of five replications, yields only two successful breach lanes, and cannot breach a second complex obstacle. Package one engineer battalion (-) secures the objective only 40 percent of the time, generates two breach lanes, and is unable to breach successive complex obstacles. Package one engineer battalion (-) is also an extremely poor field option.

d. *(U) JANUS-A and National Training Center (NTC) Comparison.* JANUS-A offers an ideal C2 environment. JANUS-A results provide very close to an upper bound estimate on task force effectiveness. Results in the field will generally indicate lower performance levels primarily due to less than ideal C2. A recent active component rotation at the NTC clearly illustrates this point and probably represents a lower bound on task force performance (last day of the rotation, unfamiliarity with plows and rollers, incorrect implementation of doctrine, and C2 problems). Figure 29 (page 40) shows a rough comparison between an engineer company supporting a brigade in JANUS-A and at the NTC. In both cases, the task force conducting the main attack is weighted appropriately with an engineer company. Force effectiveness, as measured by LER, and physical breach time are radically different. Although the blue and red force compositions and environments are not exactly the same, an inference of lower field performance levels is valid. The following points are offered for consideration based on observed results at this NTC rotation:

o (U) A deliberate breach is a combined arms effort.

o (U) Combined, realistic, and comprehensive rehearsals by all members of the combined arms team are essential for success.

o (U) Time to collect intelligence and plan and rehearse may be the commander's most precious resource.

o (U) Accurate intelligence and good C2 are critical.

o (U) Redundancy of breaching systems is required.

o (U) Battalion countermine sets (tank-mounted, track-width mine plows and rollers) worked well.

o (U) Reliability and survivability of trailer-mounted MICLIC is questionable.

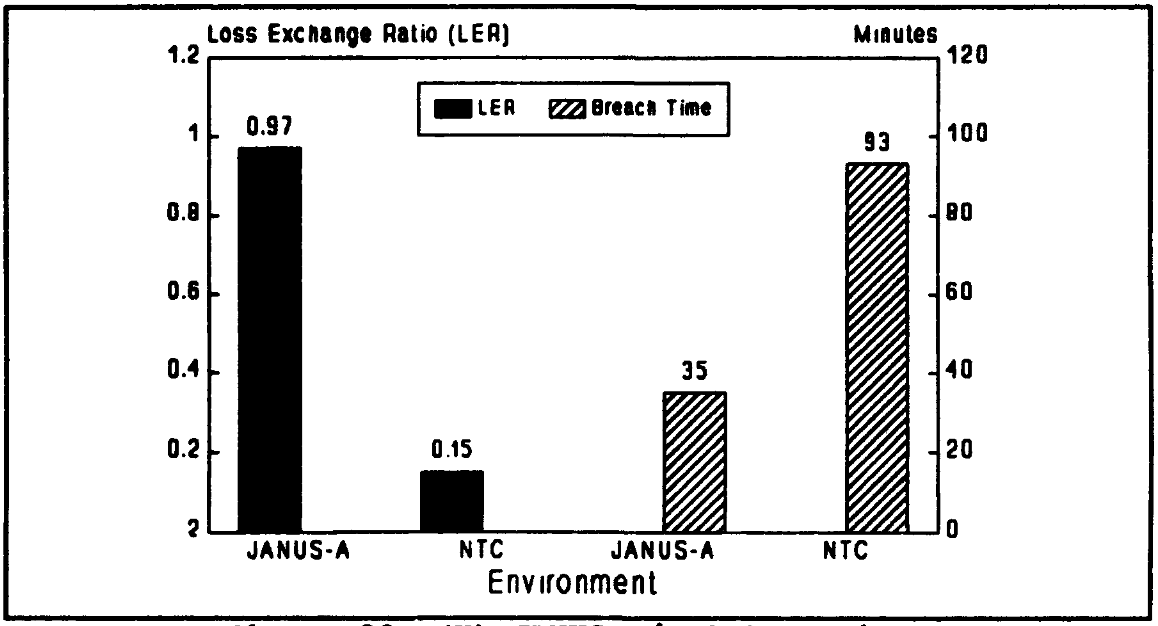



**Figure 29. (U) JANUS-A/NTC Comparison**

**4. (U) Findings.** The great strength of the QRA is the comparative analysis between different breach force compositions. The comparative analysis discussed above leads to the following findings:

a. *(U) Basic Runs.*

(1) (U) Plows and Rollers. Both are required for a successful breach. Those breach force combinations with plows and rollers yield greater combat effectiveness than those that depend on the MICLIC. The MICLIC is not an effective countermine solution. The analysis suggests MICLIC's role is redundancy for plow and roller losses or as a preparatory measure before using the plow and roller. A preparatory MICLIC firing would reduce the number of conventional mines in the breach lane and increase the survivability of the mounted plow and roller attachments.

(2) (U) CEV. The CEV with a full-width rake and a maxi fascine enhances breach capability. A greater breach speed than the plow and a countermine and counterobstacle capability makes the CEV with a full-width rake and maxi fascine appealing and, in sufficient quantities, can defeat some complex obstacles. The reinforced engineer company with four enhanced CEVs illustrates this point.

(3) (U) Breaching. Breaching success is directly proportional to breacher survivability, number of breachers, and the vulnerability of red long-range antitank systems. Breaching options that depend on the MICLIC as the primary countermine resource in comparison to those options which use plows and rollers support this finding. The less survivable these assets are, the greater the number of breaching resources that must be made available. FM 90-13-1 uses 50- percent breacher loss as a planning figure. The results noted above indicate that the breacher loss planning figure, for a deliberate breach of a complex obstacle, should be close to 100 percent.

(4) (U) Timing. Assault force timing is critical. The task force commander must commit his assault force so that the time between completion of the breach lanes and the assault on the objective is minimized. This may require the commitment of the assault force in breach lanes that are not yet complete. Assault force timing is primarily driven by the depth of the complex obstacle.

(5) (U) Tank-Ditch Breach. Given only four tank ditch reducing assets, a doctrinal two-lane breach is doubtful. The tank ditch proved to be the most challenging portion of the obstacle to defeat. The CEV, ACE, and AVLB survivability warrants a breach force planning figure in excess of 100 percent to ensure a successful breach of the tank ditch.

b. *(U) Artillery Plus-Up Runs.*

(1) (U) Plows and Rollers. The breach force will be unsuccessful without plows and rollers. They represent the best available countermine tools. Plows and rollers are able to maintain a greater breach momentum forward and are the most survivable items of countermine equipment. MICLIC is not the countermine solution. Redundancy or a preparatory use are legitimate MICLIC missions

(2) (U) Breaching. Over four additional artillery battalions increase force lethality and enhance task force survivability, but they cannot ensure a successful breach. An increased level of artillery support clearly increases combat effectiveness. The results of the counterbattery battle are good news for the division and corps. Although conditions for the task force have improved, it is still crucial that proper

equipment be provided or the deliberate breach of the complex obstacle will not be successful.

(3) (U) Smoke. No significant difference noted in outcome when hydrogen chloride (HC) smoke is substituted for white phosphorous (WP). When HC smoke is used, blue and red systems with FLIR acquired targets perform slightly better. The total number of smoke rounds required for obscuration remained virtually unchanged.

(4) (U) Outcome. An additional tank battalion in overwatch produces little change in combat outcome. The additional tank battalion provided additional suppression but killed few antitank weapons. The tank battalion obtained only 5 to 10 infantry kills. A better support force would be Bradley fighting vehicle (BFV) heavy. The main battle tank does not have a truly effective suppressive round (a highly explosive antipersonnel round) for dismounted infantry. The BFV's 25-mm chain gun represents the best suppressive weapon currently available for a dismounted infantry threat.

**5. (U) Conclusion.**

a. *(U) Doctrine, Training, Leader Development, Organization, and Materiel (DTLOM) Solutions.* The QRA focuses primarily on materiel solutions. However, insights in the doctrine, training, leader development, and organization solution areas are apparent.

(1) (U) Doctrine. Deliberate breaching doctrine is in place and it works. The JANUS-A implementation of the breaching fundamentals-SOSR-did not indicate any doctrinal deficiencies. FM 90-13-1 and FM 90-13 embody the doctrine required to succeed. A potential item of consideration is the 50-percent planning factor for breacher loss. For a deliberate breach, this analysis suggests that a 100-percent planning factor may be more appropriate.

(2) (U) Training. Rehearsal is critical to success. The TRAC-WSMR JANUS-A modelers required numerous practice runs to finally develop an *acceptable* deliberate breach. Trial runs in the modeling world are equivalent to rehearsals in the real world. The real world severely penalizes hesitation during the conduct of a deliberate breach. Any hesitation allows the threat additional time to acquire and destroy blue systems. The goal is

Operational Focus

- Doctrine: FM 90-13-1, FM 90-13
- Training: Rehearse, Mobile Training Teams (MTT)
- Leader Development: Rehearse, MTT
- Organization: METT-T, Engineer Restructure Initiative
- Materiel: Plow, Roller, IDA, CEV Rake and ACE

**Figure 30. (U) DTLOM Solutions**

a well-organized, rapidly executed breach operation. SOSR requires an integrated, synchronized combined arms effort. This effort will only be achieved through detailed rehearsals with all members of the combined arms team.

(3) (U) Leader Development. A detailed knowledge of doctrine, tactics, techniques, and procedures (TTP) is required. Applications of this detailed knowledge through combined arms rehearsals will maximize the probability of success. JANUS-A offers an ideal C2 environment. On the battlefield, leaders will experience a degraded C2 environment. Detailed rehearsals, with all participants, will improve the C2 environment despite internal and external disruptive influences.

(4) (U) Organization. The task organization must be tactically tailored for the situation. METT-T drives the task organization. The Engineer Restructure Initiative (ERI) will place an engineer battalion within each of the division's maneuver brigades and a regimental engineer headquarters at the division level. Since an engineer battalion is placed in each maneuver brigade, each armor or mechanized task force's *slice* is an engineer company. The current organization is an engineer battalion assigned to the division that usually allocates only an engineer company per maneuver brigade and a platoon per task

force. ERI gives the division more command and control over its organic engineers and other allocated engineers from corps. Also, ERI provides an increased density of engineer equipment (primarily for mobility) forward in the maneuver brigade sector. The task force conducting the deliberate breach of a complex obstacle will be weighted with combat power, as appropriate. The results of the basic and artillery plus-up sets indicate the task force must be weighted with a sufficient amount and type of breaching resources to succeed. METT-T and ERI will provide the appropriate density of mobility resources at the point of execution.

(5) (U) Materiel. The QRA indicates that plows and rollers are the current countermine solution. However, using the tank in a countermine role detracts from its primary mission of killing ACVs. Fielding the ACE in sufficient numbers will assist in the counterobstacle arena. The CEV mine rake offers a *quick-fix* solution to generate full-width breach lanes and when coupled with a maxi fascine, a countermine and counterobstacle solution. (The CEV mine rake is regional solution focused on the Mideast.) The CEV mine rake's effectiveness is highly dependent on soil type and weather conditions. The IDA adds the capability for plows and rollers to not only defeat tilt-rod fuzed mines in the center lane, but magnetically fuzed mines in the center lane as well.

b. *(U) Essential Elements of Analysis (EEA).* The EEA are the questions that focused the QRA. The answers to the QRA's EEA are summarized below:

(U) What is the effectiveness of BCMS? The BCMS are the best countermine resource. They make the maximum contribution to breaching task force effectiveness. Introducing the BCMS to augment an engineer company's countermine resources yields a 137-percent increase in task force effectiveness as measured by LER. All cases that used plows and rollers in the basic run set and the artillery plus-up run set secured the objective 100 percent of the time and completed the most breach lanes. The BCMS force effectiveness contribution can be traced to breacher survivability, quantity authorized, and breach speed.

(U) What is the effectiveness of an enhanced CEV? The CEV mine rake enhances task force effectiveness. It is an attractive countermine solution because it clears a full-width lane. When coupled with a maxi fascine mounted on the back deck, the mine rake offers both a countermine and counterobstacle breacher. Modifying the two existing CEVs in an engineer company with the mine rake and a maxi fascine yields a 34-percent increase in task force effectiveness as measured by LER. Equipping an engineer company with four enhanced CEVs realizes a 137-percent increase in task force effectiveness as measured by LER (five out of five secured objectives and six successful breach lanes). The mine rake's contributions to force effectiveness are due to a full-width mine clearing blade and, most importantly, an increase in breach speed. The negative aspect is that the mine rake only is effective in the sandy soils found in the Mideast. The CEV lacks the M1A1's survivability and the mine rake requires a greater drawbar pull to operate in nonhomogeneous soil conditions.

(U) What is the effectiveness of an increased level of artillery support? Comparing LERs shows a 61- to 65-percent increase in task force effectiveness was obtained by introducing an increased artillery support level. More artillery support improves the environment for the breaching task force but cannot guarantee a successful breach. The proper countermine and counterobstacle breaching tools must still be supplied to successfully execute a deliberate breach. The force effectiveness contribution as a result of an increased artillery support level is due primarily to increased destruction of red direct- and indirect-fire assets. Destroying these threat assets increases the survivability of the breaching task force since less red weapons systems are available to destroy blue targets.

**6. (U) Final Remarks.** USAES and TRAC-WSMR recognize that speed in the analytical world can result in errors, shortcomings, and/or outright *warts* that require appropriate caveats. However, the primary QRA analysts believe that the insights gained from examining a combined arms deliberate breach of a KTO complex obstacle are valid and appropriate for application in the field. Note that *trends and comparisons* are the analytical insights gained not the absolute values of numbers presented. Models and scenarios are only representations of reality and do not account for the *fog of war* or the human impact of armed conflict. The reader's suggestions, comments, and constructive criticism concerning the QRA are always welcome and certainly appreciated.

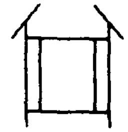
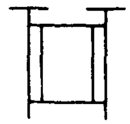
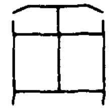
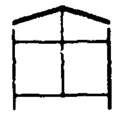
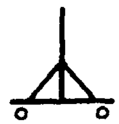
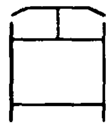
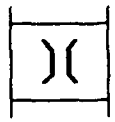
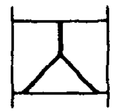
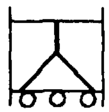
# Quick Reaction Analysis
# Combined Arms Deliberate Breach
# of a Complex Obstacle

## Breach Force-Breaching Columns
## and
## Brigade Level-Engineer Allocations

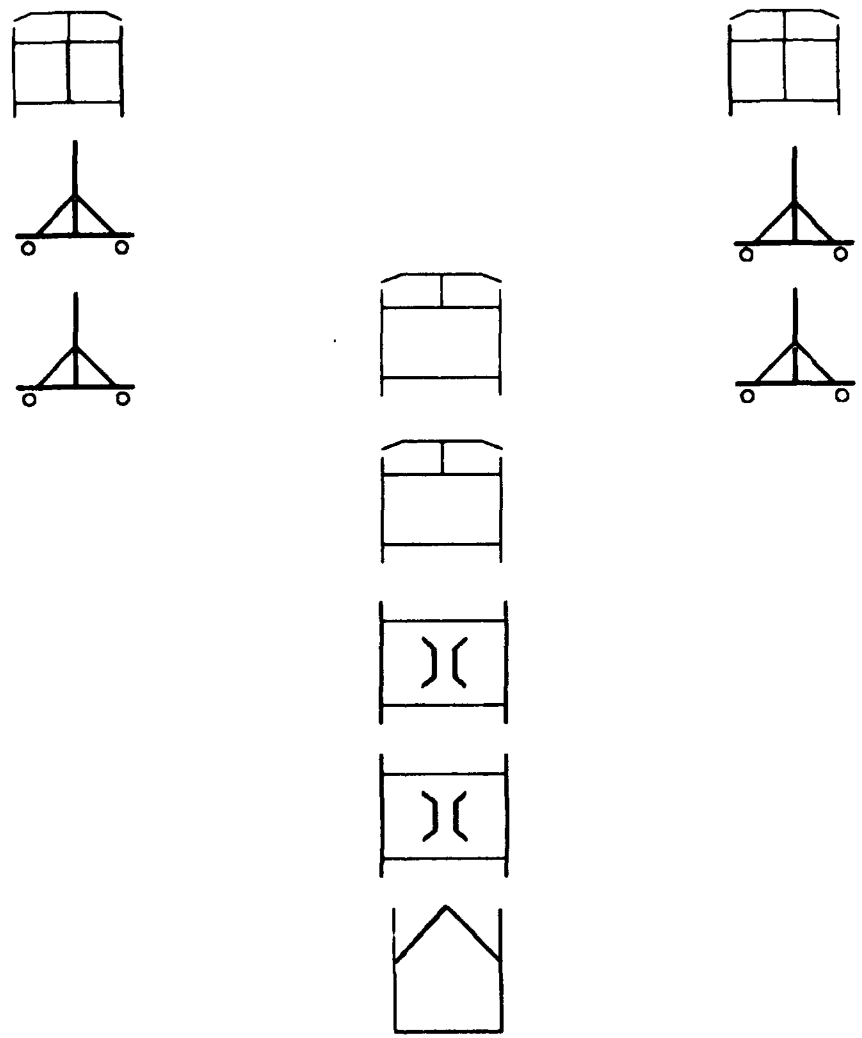
## Appendix A
## Basic Run Set

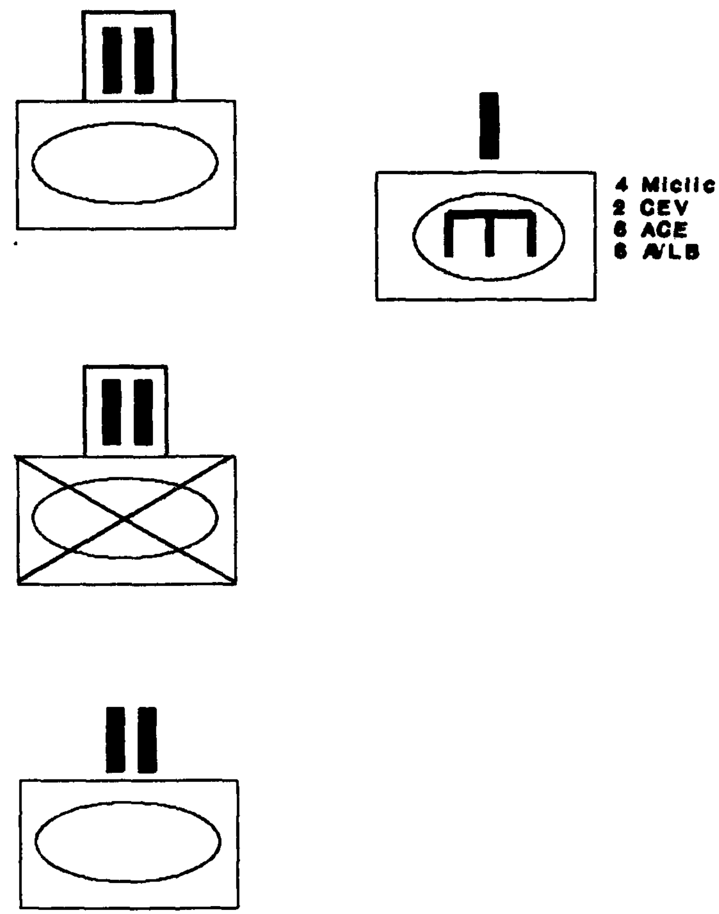
# Engineer Symbols

## Countermine/Counterobstacle Equipment

- Tank-Mounted, Track-Width Mine Plow 
- Tank-Mounted, Track-Width Mine Roller 
- Combat Engineer Vehicle (CEV) 
- CEV w/Full Width Mine Rake 
- Mine Clearing Line Charge (MICLIC) 
- Armored Combat Earthmover (ACE) 
- Armored Vehicle Launched Bridge (AVLB) 
- Armored Vehicle Launched MICLIC (AVLM) 
- AVLM w/Fascines (AVLMF) 

# Breaching Columns
# Engineer Company



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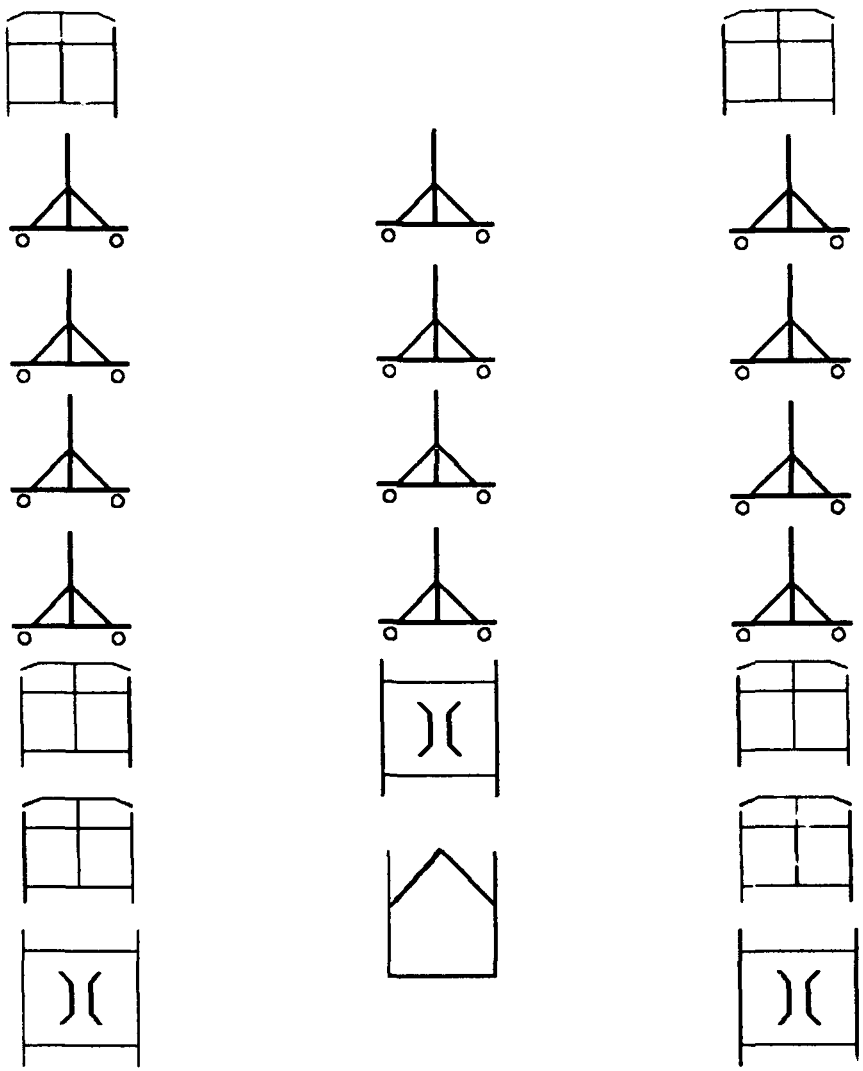
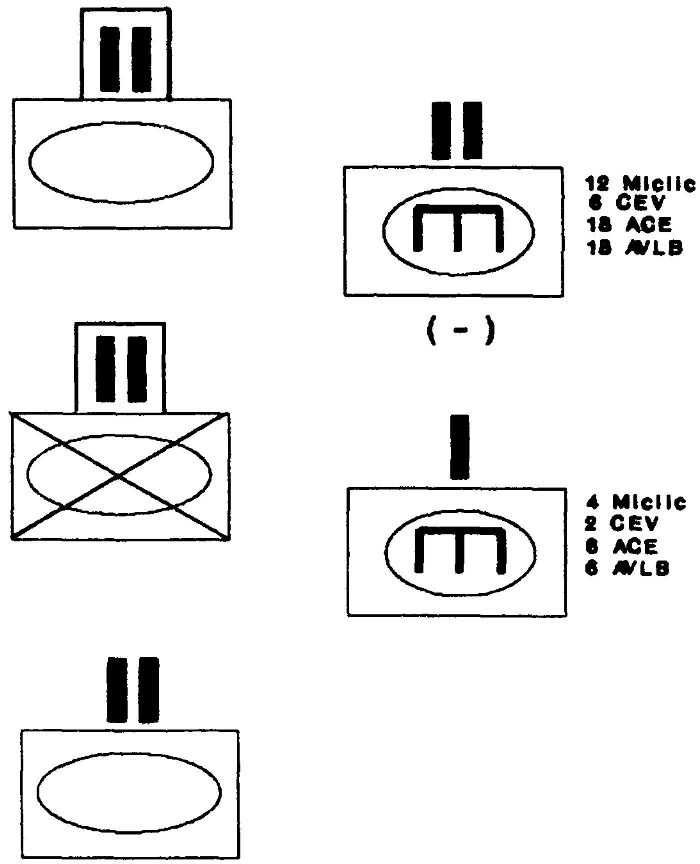
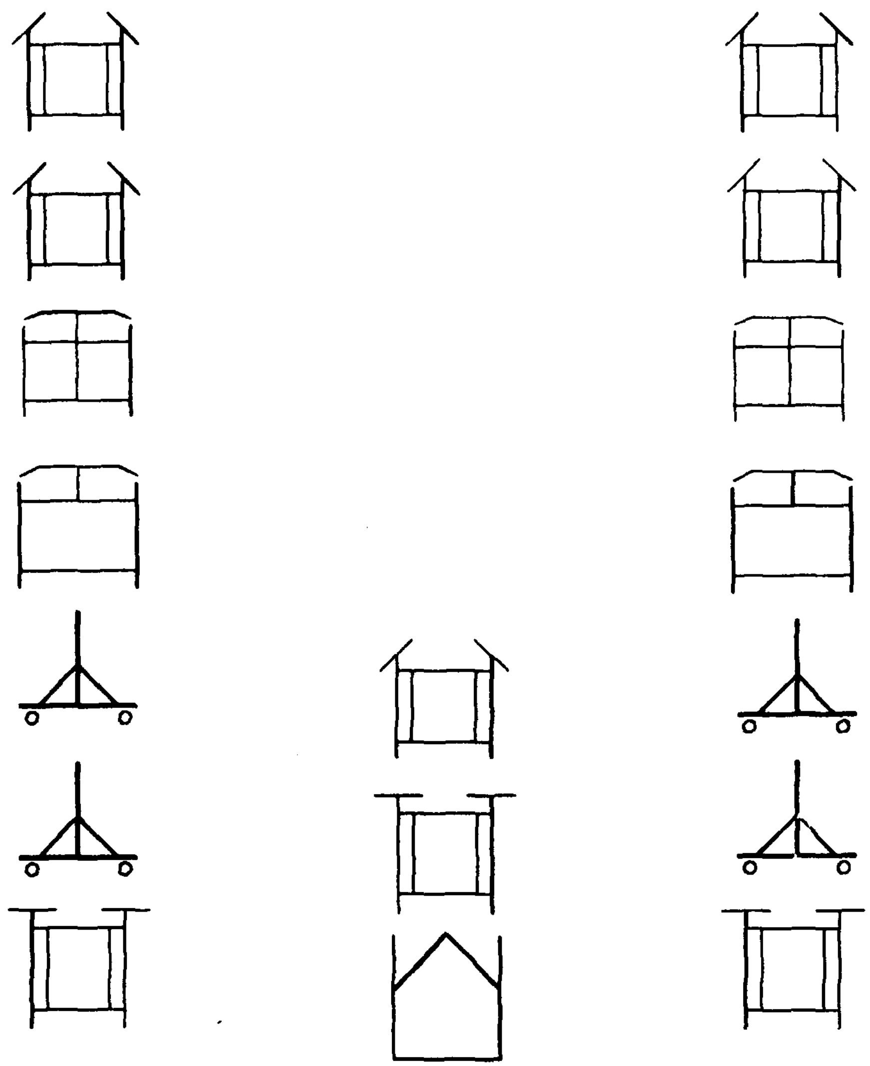
# Breaching Columns
# Engineer Battalion (-)

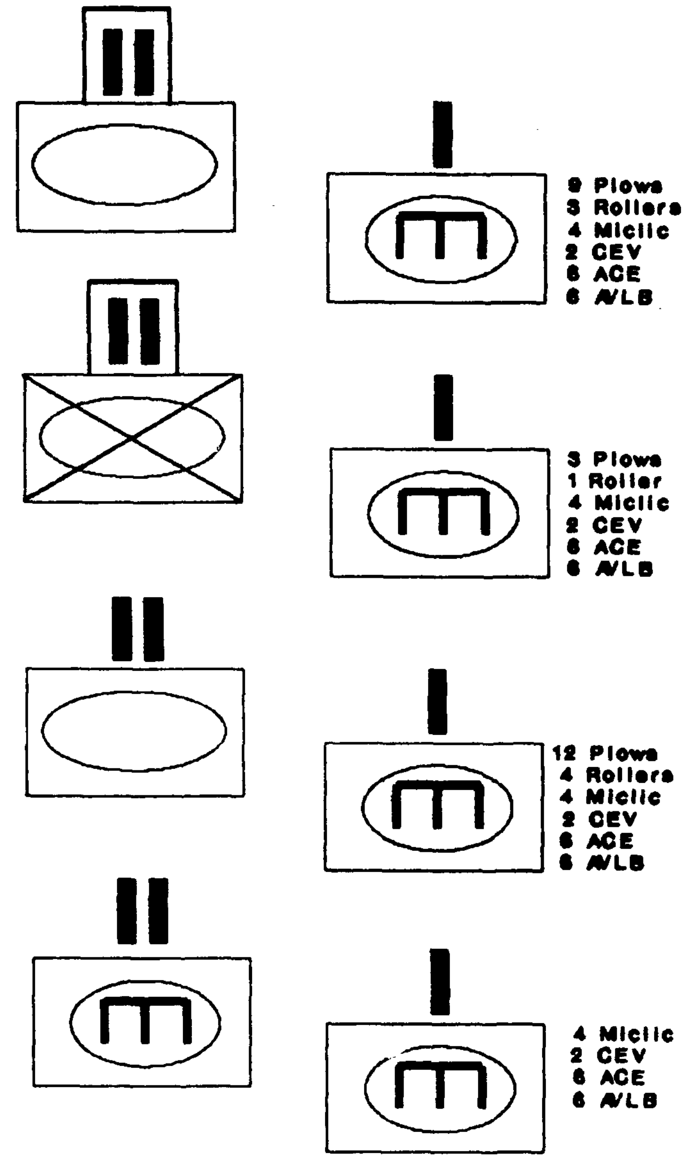





Arty Spt: 3-155 Bns, 1-MLRS Btry

# Breaching Columns
## Engineer Company (+): Add Plows and Rollers



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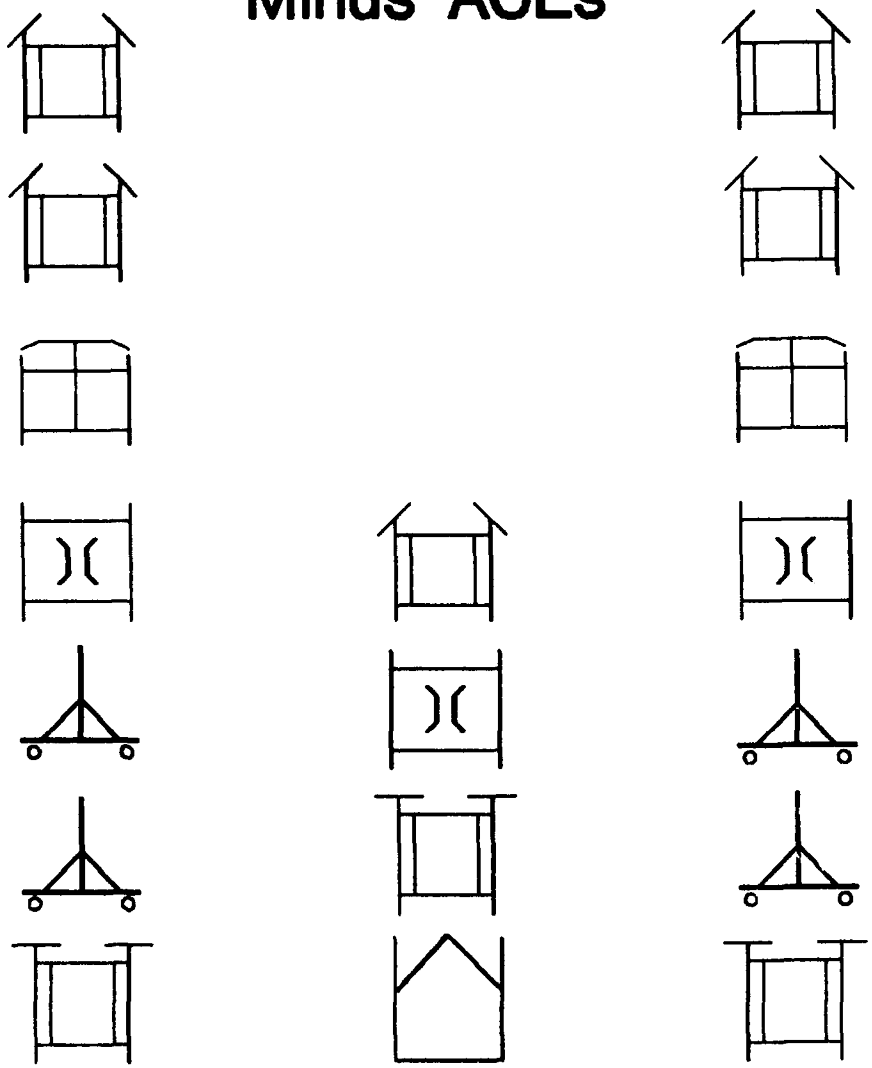
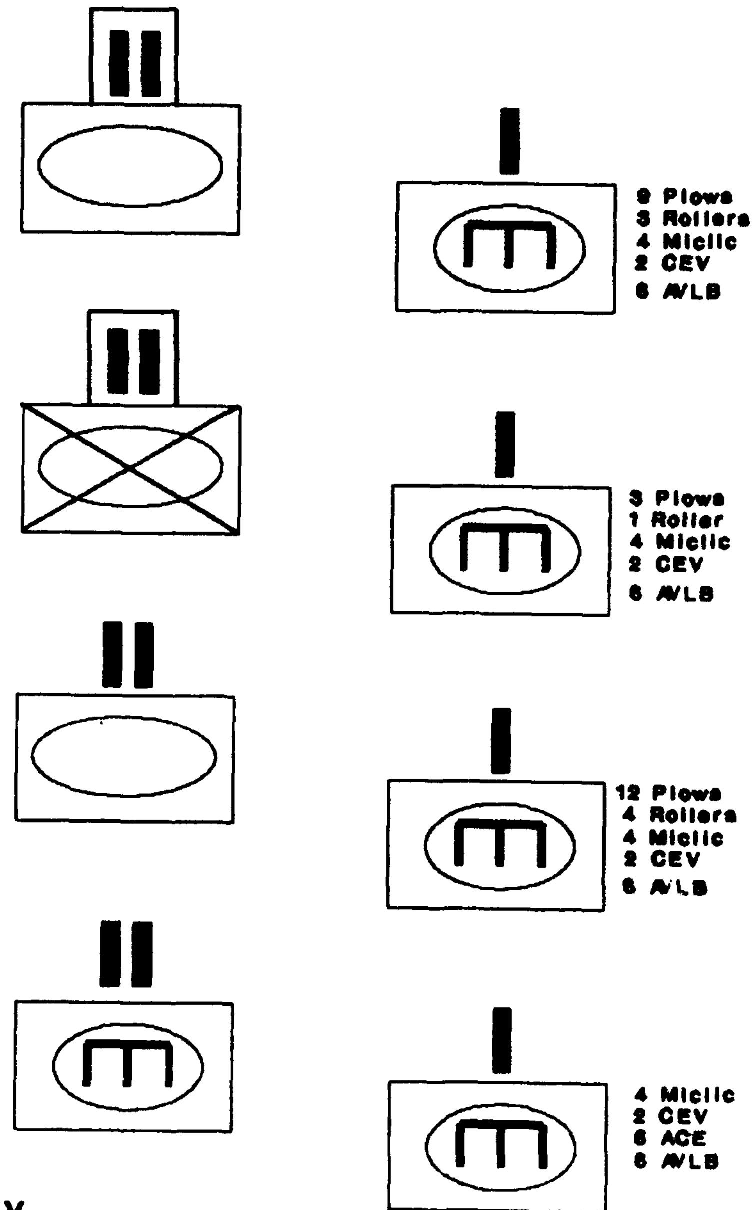
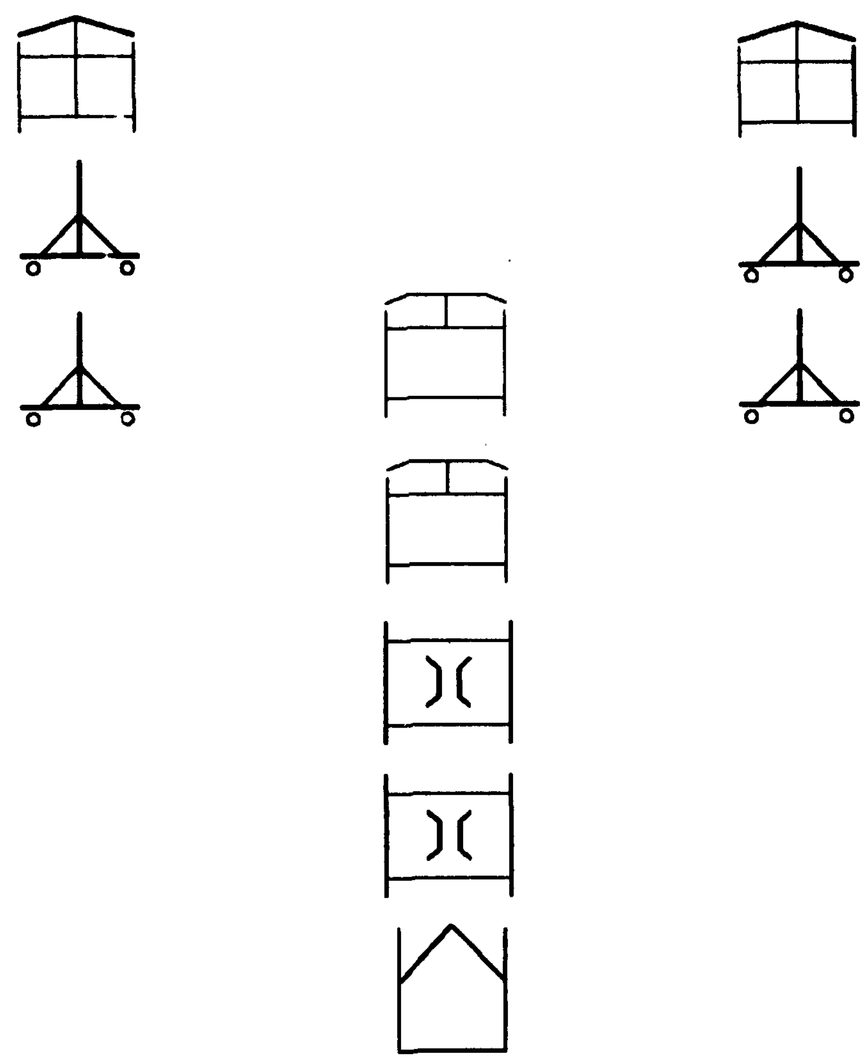
# Breaching Columns
# Engineer Company (+): Add Plows and Rollers
# Minus ACEs

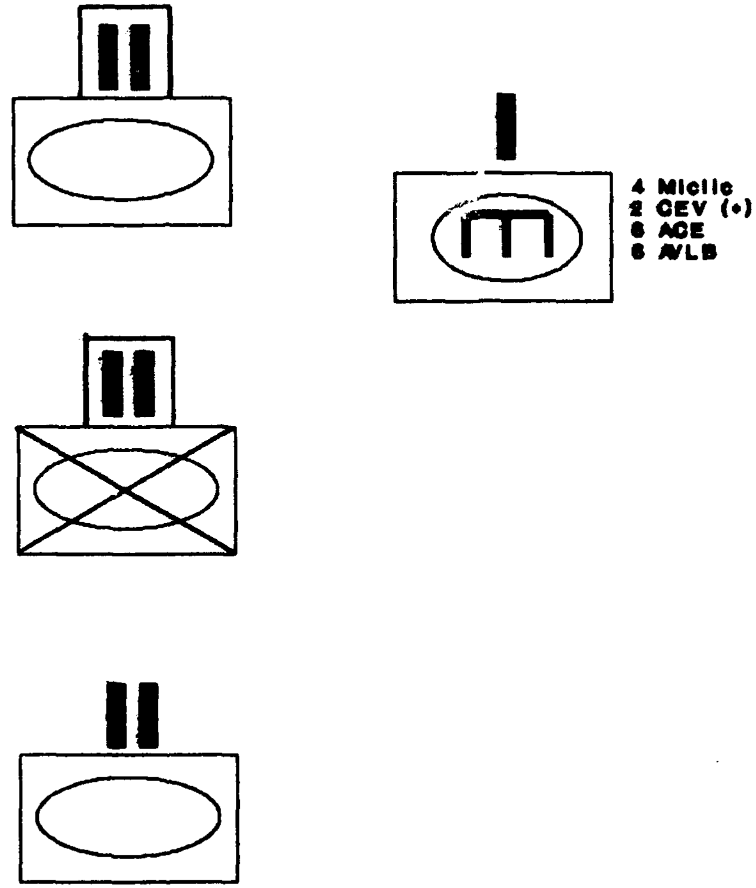





Arty Spt: 3-155 Bns, 1-MLRS Btry

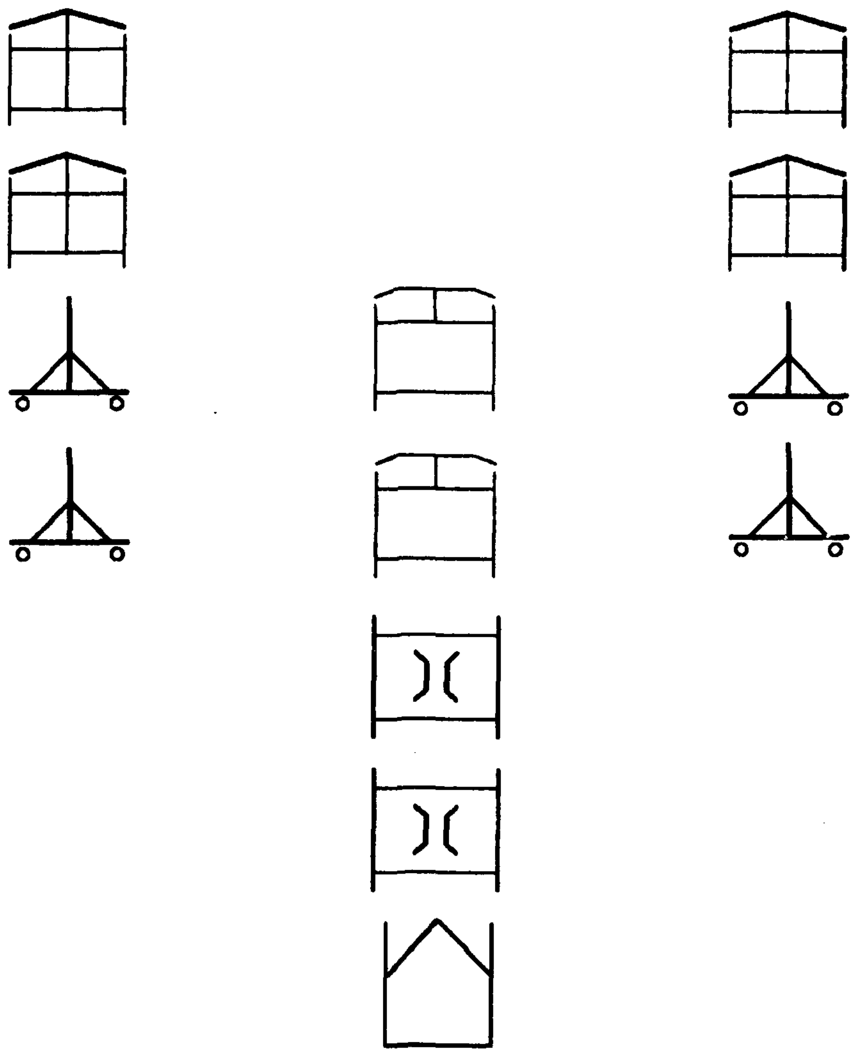
# Breaching Columns
## Engineer Company: Two CEV Mine Rakes

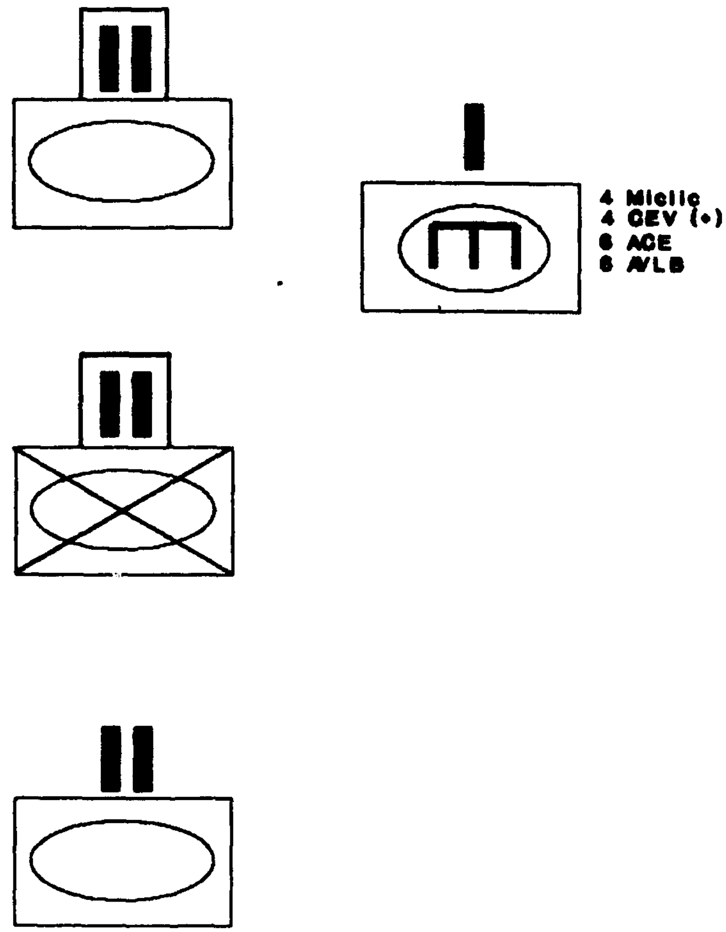





Arty Spt: 3-155 Bns, 1-MLRS Btry

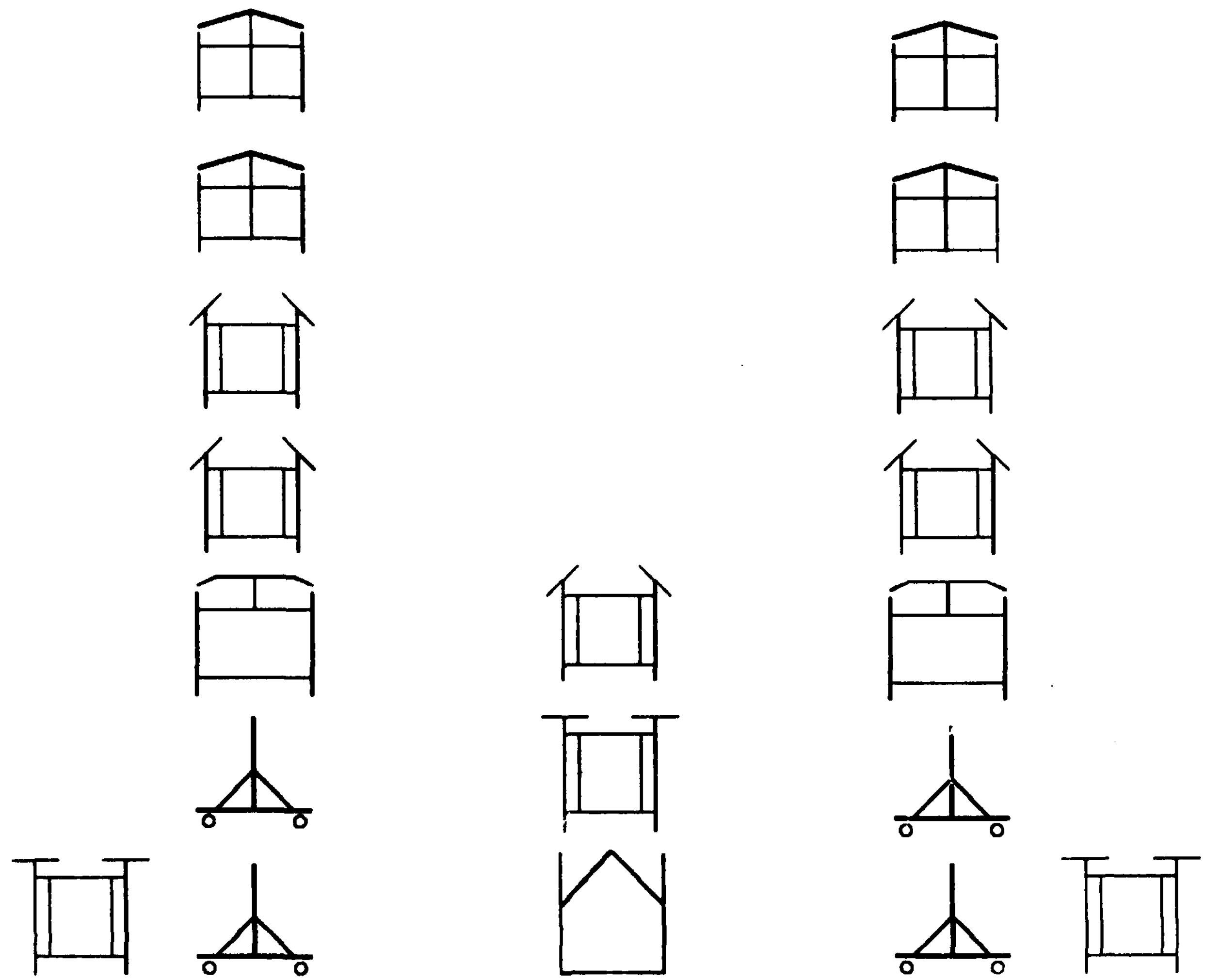
## Breaching Columns
## Engineer Company (+): Four CEV Mine Rakes

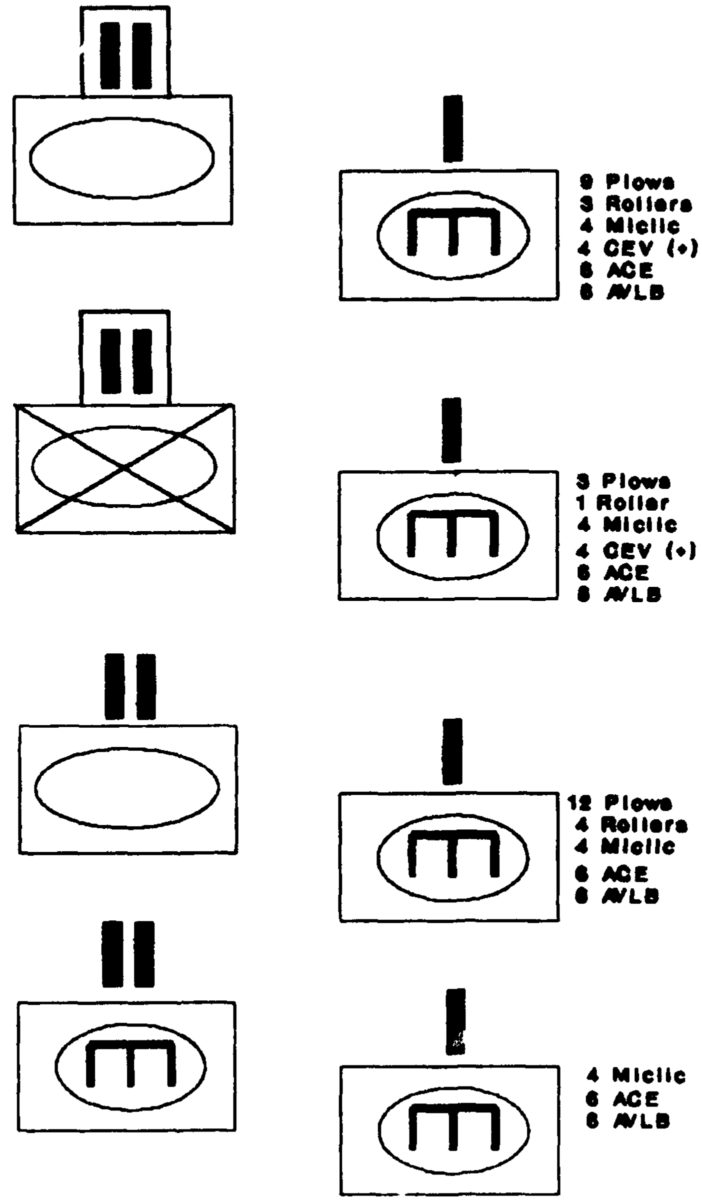





Arty Spt: 3-155 Bns, 1-MLRS Btry

# Breaching Columns
## Engineer Company (+): Add Plows and Rollers Plus Four CEV Mine Rakes






Arty Spt: 3-155 Bns, 1-MLRS Btry

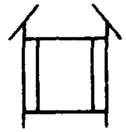
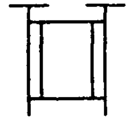
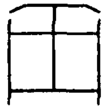
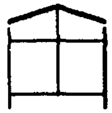
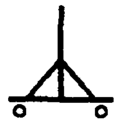
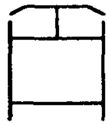
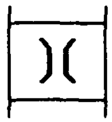
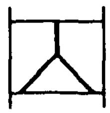
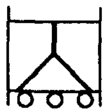
# Quick Reaction Analysis
# Combined Arms Deliberate Breach of a Complex Obstacle

## Breach Force-Breaching Columns
## and
## Brigade Level-Engineer Allocations

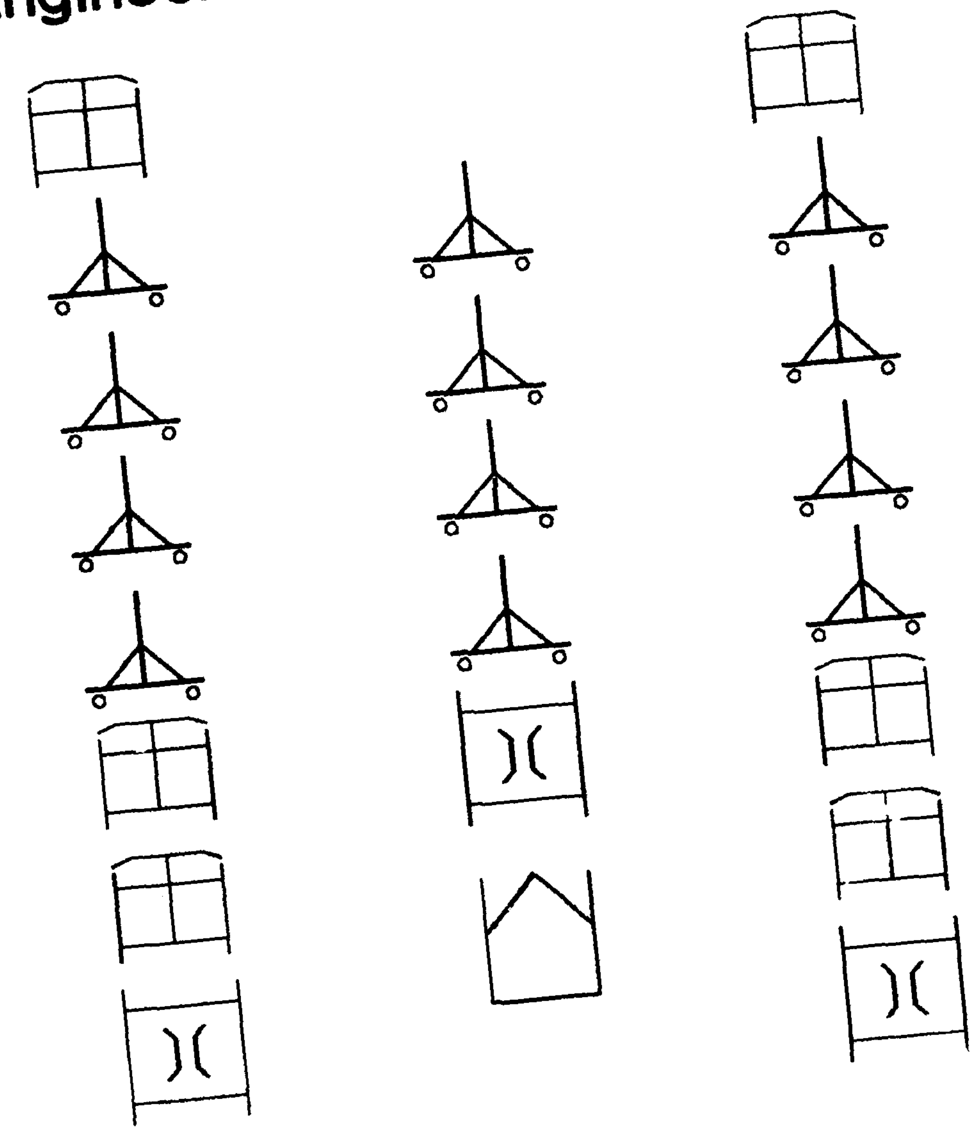
## Appendix B
## Artillery Plus-up Run Set

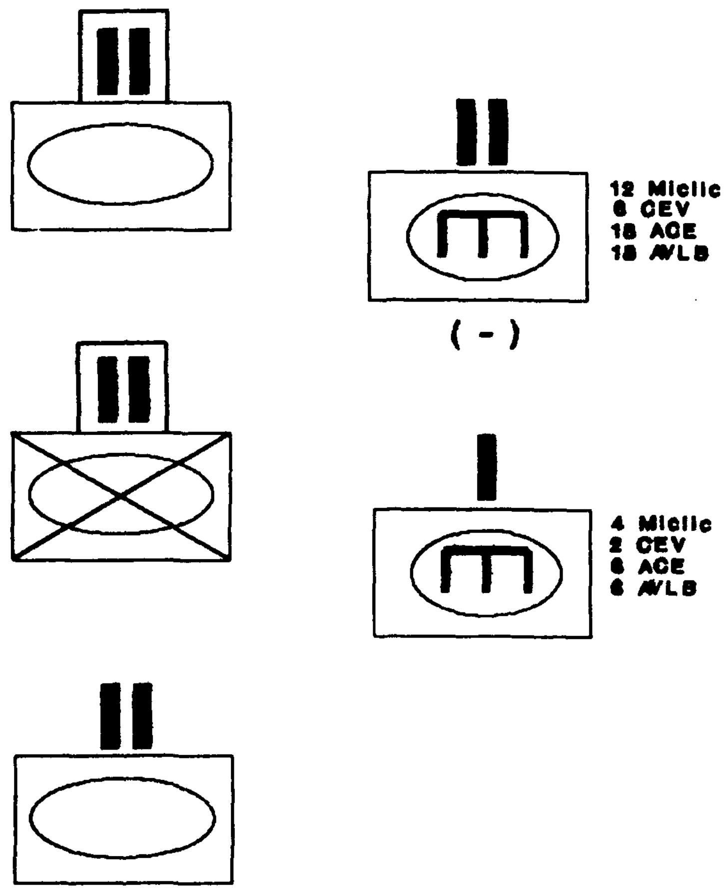
# Engineer Symbols

## Countermine/Counterobstacle Equipment

- Tank-Mounted, Track-Width Mine Plow 
- Tank-Mounted, Track-Width Mine Roller 
- Combat Engineer Vehicle (CEV) 
- CEV w/Full Width Mine Rake 
- Mine Clearing Line Charge (MICLIC) 
- Armored Combat Earthmover (ACE) 
- Armored Vehicle Launched Bridge (AVLB) 
- Armored Vehicle Launched MICLIC (AVLM) 
- AVLM w/Fascines (AVLMF) 

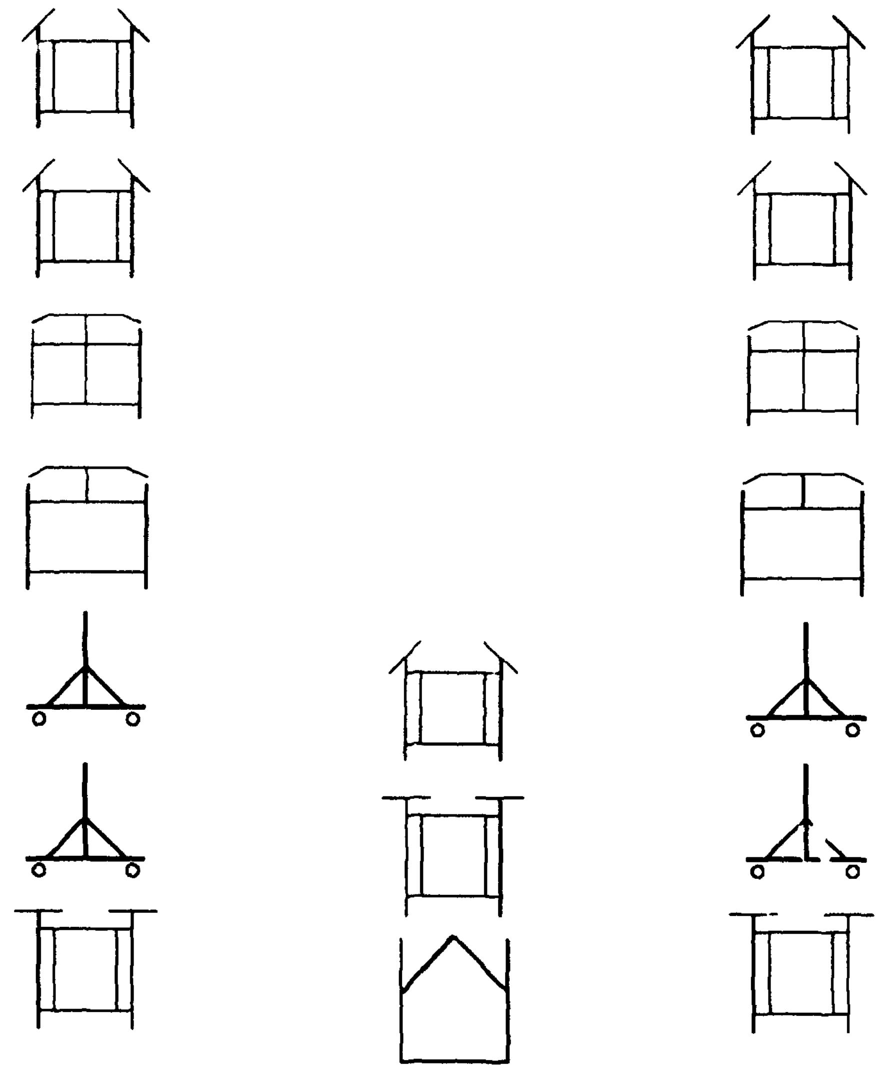
# Breaching Columns
## Engineer Battalion (-) & Arty+

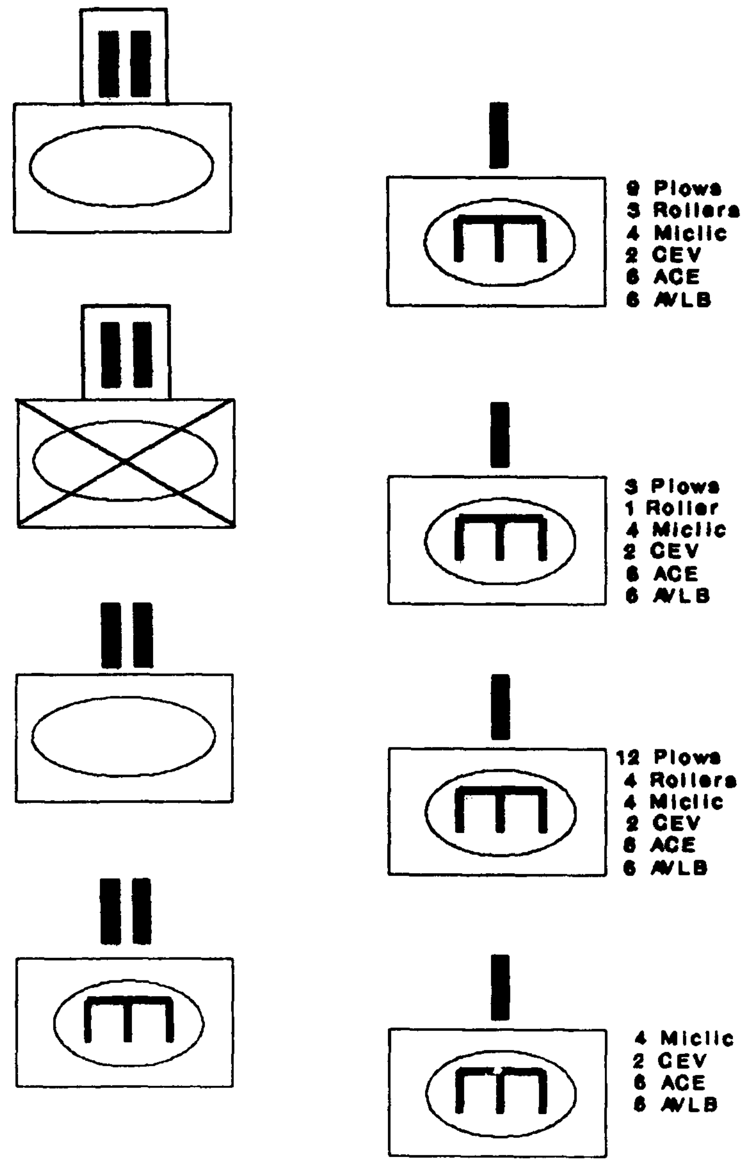





Arty Spt: 1-8" Bn,
6-155 Bns, &
2-MLRS Btry

# Breaching Columns
## Engineer Company (+): Add Plows & Rollers & Arty+



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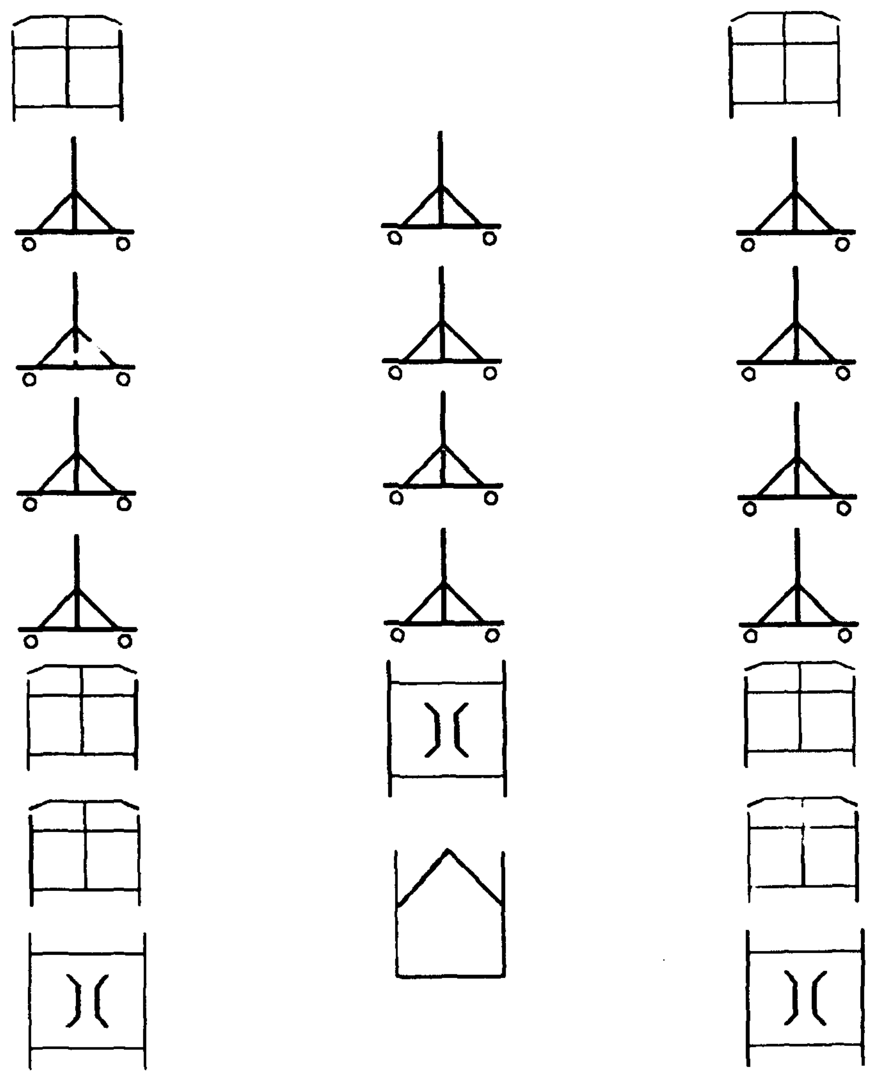
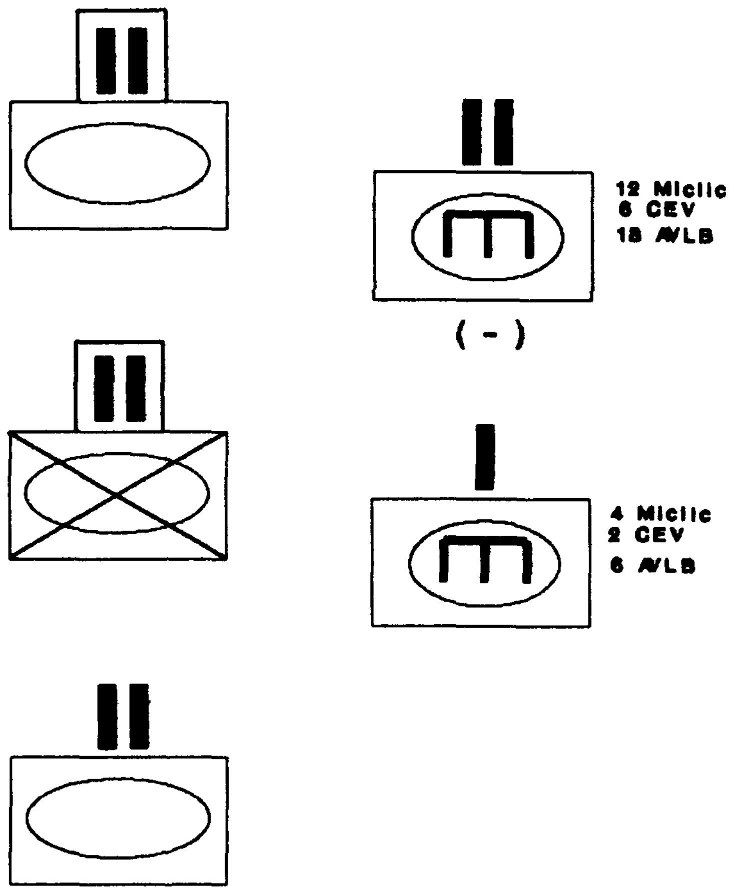
# Breaching Columns
## Engineer Battalion (-) & Arty+

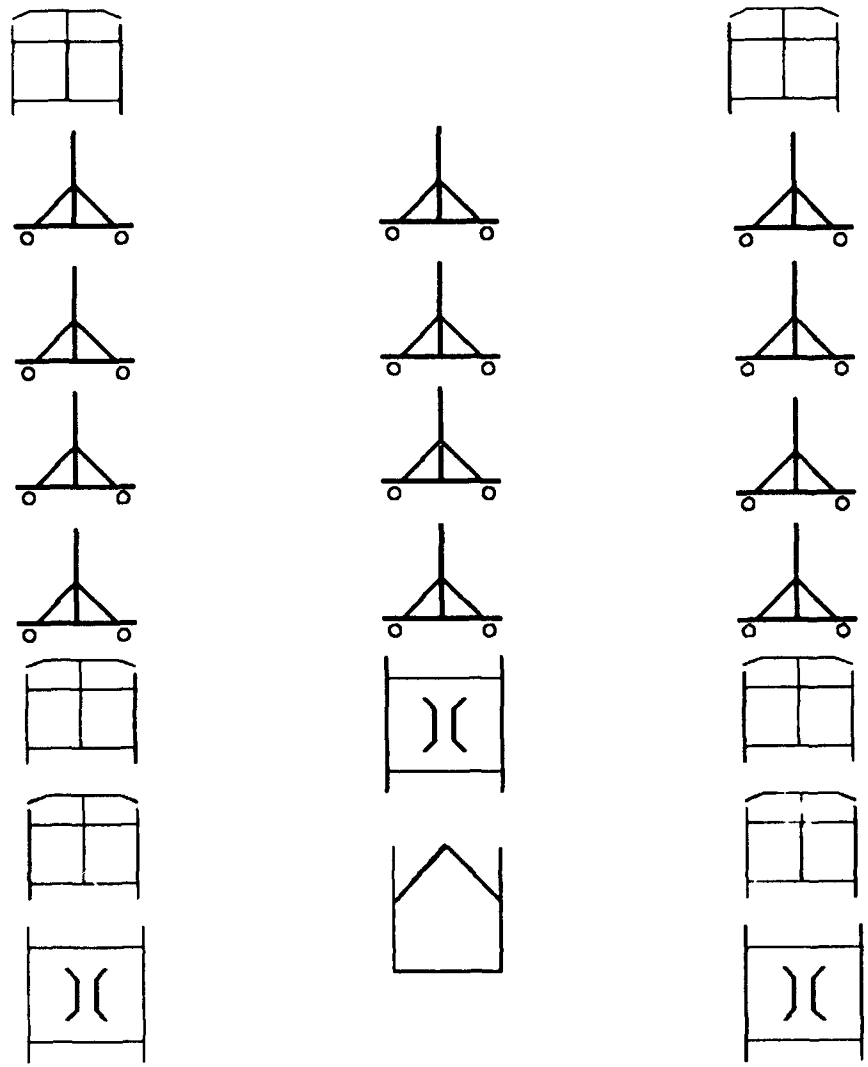


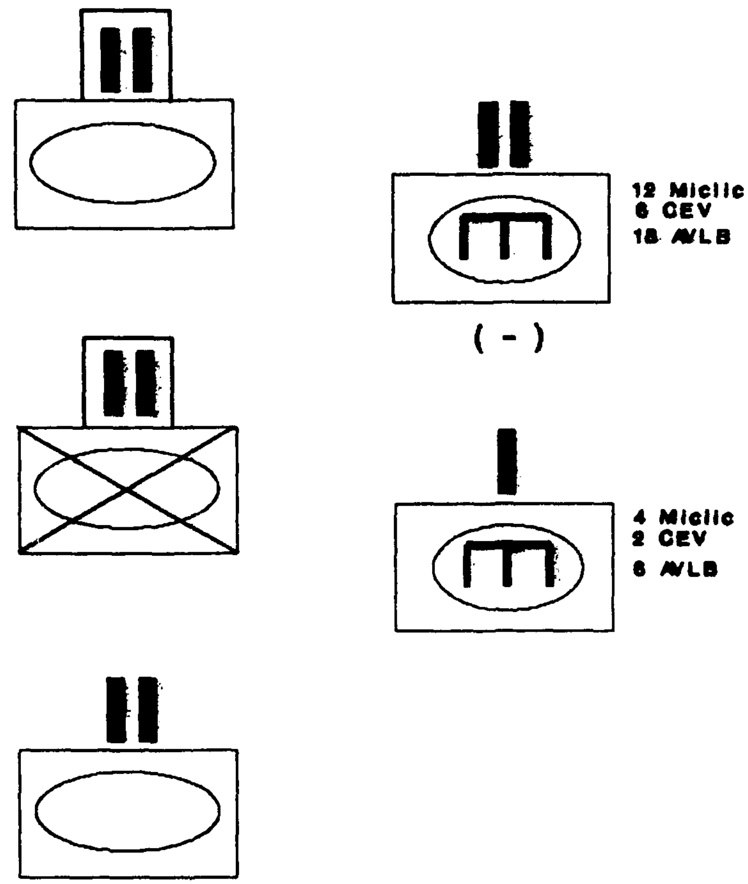



Arty Spt: 1-8" Bn,
6-155 Bns, &
2-MLRS Btry
HC vs. WP for Smoke

30% Overhead Cover for Red AT Weapons

# Breaching Columns
# Engineer Battalion (-) & Arty+






Arty Spt: 1-8" Bn,
6-155 Bns, &
2-MLRS Btry
HC vs. WP for Smoke
15 Mins more Prep
MLRS only Cntbtry

30% Overhead Cover for Red AT Weapons

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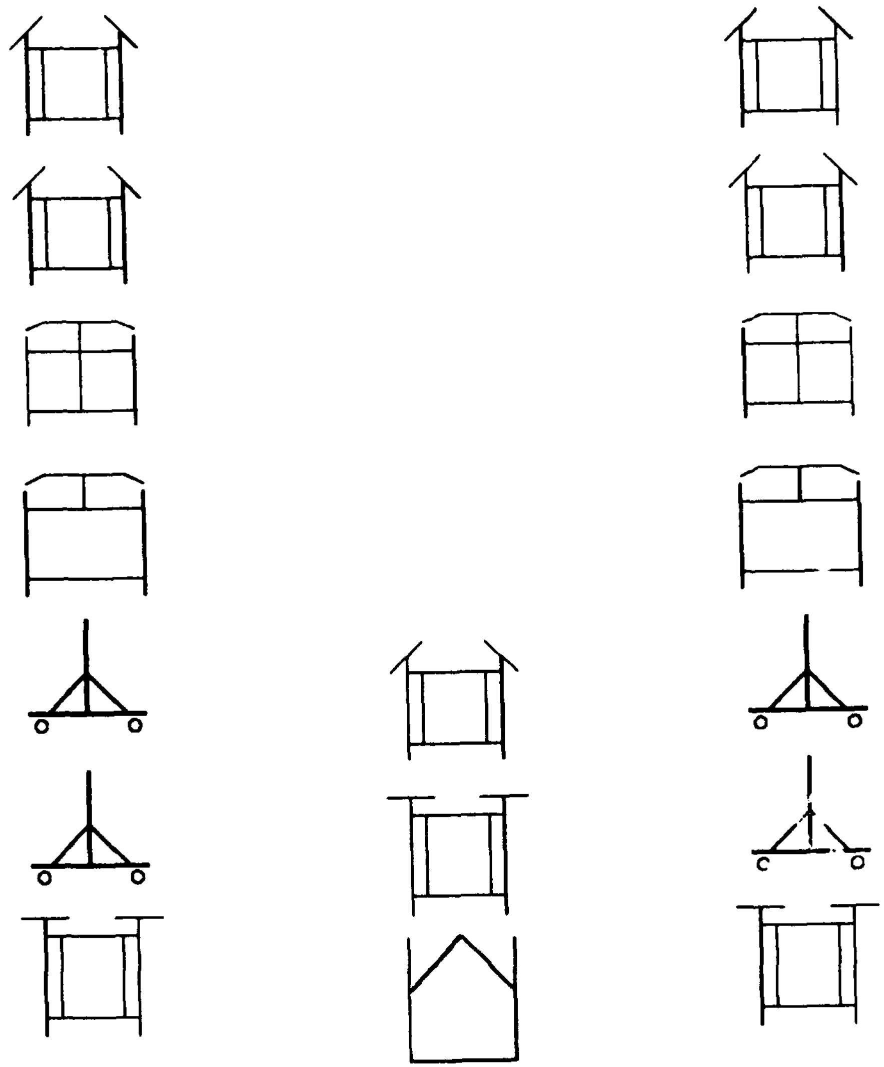

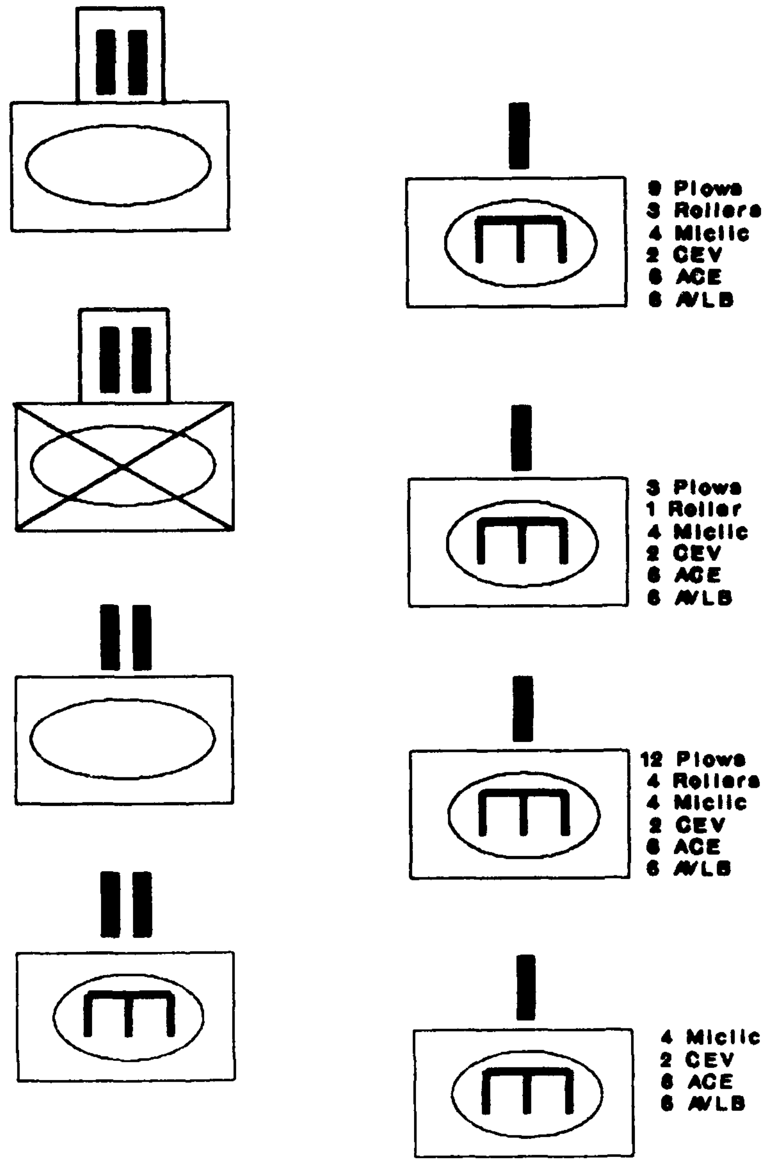


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