

## Combined Arms



## Military Operations on Urbanized Terrain (MOUT)

Marine Corps Warfighting Laboratory (MCWL)  
U.S. Marine Corps

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## Combined Arms

This X-File integrates lessons learned from MCWL  
Urban Warrior Experiments.

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from the Marine Corps Warfighting Laboratory Home Page found  
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Throughout this X-File, we use masculine nouns and  
pronouns for the sake of simplicity. Except where otherwise  
noted, these nouns and pronouns apply to either gender.

U.S. Marine Corps

UNITED STATES MARINE CORPS  
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9 November 1999

### FOREWORD

1. **PURPOSE:** This X-File on the use of combined arms is another in a series that generates lessons learned from the results of our experiments. Our goal is to provide a reference that can be quickly read and easily transported—in the cargo pocket of the utility uniform—so Marines are better prepared to fight and win.

2. **SCOPE.** This is an overview of the combined arms that are available to the Marine Air Ground Task Force (MAGTF). Our focus is on applying this core competency during MOUT. We give small unit leaders information on what is available and ways to effectively apply these capabilities in the urban battlespace.

3. **SUPERSESSION.** None.

4. **CHANGES.** Recommendations for improvements to this X-File are encouraged from commands and from individuals. You can reproduce and forward the attached User Suggestion Form to the above address.

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## Table of Contents

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X-Files	1
Urban Warrior (UW)	1
Figure 1 Where the X-Files Fit	1
X-Files	1
Tips on How We Use the Dragon	2
MOUT Doctrine	2
Tips on the Focus of this X-File	2
File	2
Figure 2 Framework of this X-File	3
Introduction	4
USMC Core Competencies	4
Combined Arms Doctrine	4
Combined Arms Definition	4
Doctrine for Combined Arms Tactics	5
Combined Arms Philosophy	5
Tips on Effective MOUT CSS Planning	6
Tips on Using the Warfighting Functions	7
MAGTF Organic Combined Arms	8
Tips on Focusing the Power of the MAGTF	8
Organic MAGTF Assets	8
Organic Combined Arms Capabilities	8
Tips on Organic Fire Support Planning	9
Tips on Artillery Employment	9
Tips on Mortar Employment	10
Naval Surface Fire Support (NSFS) and Naval Gunfire (NGF)	10
Tips on Antiarmor Weapons	10
Tips on Antiarmor Weapons Employment	10
Tips on Machine Gun Positions	11
Tips on Snipers as a Combined Arms Asset	11
Tips on Designated Marksmen (DM)	12
Tips on Task Organization	13
Tips on Effective Organization	13
Figure 3 MOUT Experimental Mechanized Formation	14
Tips on an Effective Mechanized Patrol Formation	14

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Tips on a Combined Arms Antiarmor Team (CAAT)	14
Close Air Support	16
Command and Control	16
Mechanized Operations	16
Combat Engineers	16
<b>MOUT Combined Arms Factors</b>	<b>17</b>
Tips on Battlespace Geometry Factors	17
Figure 4 Geometry of Dead Space	17
Figure 5 MOUT Distance Components	18
Figure 6 Noncontiguous MOUT Distance	18
Tips on Rules of Engagement (ROE)	18
Tips on Human Factors	19
Intelligence Requirements	20
Tips on MOUT Target Identification	20
Figure 7 Alphanumeric Target ID Grid with Footnotes	21
Tips on Frontages, Formations, and Zones of Action	21
Tips on MOUT Command and Control (C <sup>2</sup> )	22
Communications and Information Systems	22
Tips on the Intra Squad Radio (ISR)	23
Figure 8 ISR	23
Tips on Use of C <sup>2</sup> Enhancements	23
Figure 9 Palm Top EUT	23
Tips on Use of Electronic Navigation Aids	24
<b>Urban Close Air Support</b>	<b>25</b>
Close Air Support (CAS)	25
MAGTF CAS Enablers	25
Tips on Call for Fire at the Small Unit Level	25
Figure 10 Sample CDR Computer Screen	26
MAGTF Ordnance Capabilities	26
Targeting of Air Delivered Ordnance	26
ACE MOUT TTPs	27
Characteristics of the MOUT CAS Environment	27
Tips on Setting the Conditions for CAS	27
Tips on Accuracy vs. Radius of Effects	28
Fixed-Wing Aircraft Operations	29
Tips on Urban CAS Activities	30
Figure 11 Notional Urban CAS Activities	31
Tips on CAS Targeting	31

Tips on use of UAVs	32
<b>MCWL Urban CAS Experiments</b>	<b>33</b>
Yuma Range Urban Target Complex	33
Figure 12 Yodaville Urban Target Complex	33
Figure 13 Yodaville Multi-Story Building	33
Tactical Aircrew Combat Training System (TACTS)	34
Weapons Impact Scoring Set (WISS)	34
Weapons Analysis and Lethality Tool Set (WALTS)	34
Lessons Learned from the Aviation LTA	34
Figure 15 Example of Ground Laser Spot Movement	35
Air Ground Maneuver in Yodaville	36
Figure 16 Yodaville Technology	37
<b>Additional ACE Combined Arms Capabilities</b>	<b>38</b>
Assault Support Helicopters	38
Combat Roles	38
Tip on Joint Terminology	38
Employment of Air Defense	39
<b>Urban Mechanized Operations</b>	<b>40</b>
Mechanized Operations Definition	40
MAGTF Combat Vehicles	40
Tips on Employment of Armored Vehicles in MOUT	40
Armored Vehicle Fire Support Roles	41
Variety of Missions	41
Table 2 Sample Missions for Mechanized Operations	41
Special MOUT Considerations	42
LAV-25	42
Tips on Dismounted Infantry-LAV Relationship	42
LAV Swim Capability	43
Tips on Immediate Action Drills (IADs)	43
LAV MOUT Capabilities	43
Assault Amphibious Vehicle	44
Employment Considerations	44
AAV MOUT Capabilities	45
Tips on AAV Amphibious Roles in MOUT	46
<b>Tank/Infantry Operations</b>	<b>47</b>
Marine Tanks in MOUT	47

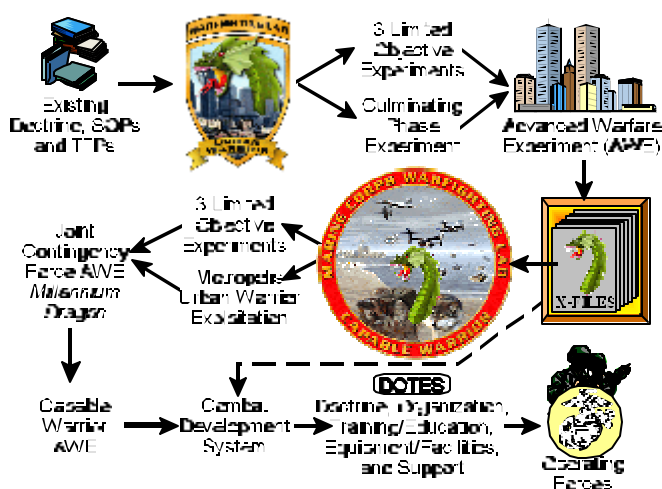
Tank Weapon Systems . . . . .	47
Track-width Mine Plows and Rollers . . . . .	48
Tank-Infantry Coordination . . . . .	48
Tank/Infantry Employment . . . . .	48
Marine Tank Unit Tasks . . . . .	48
Marine Infantry Tasks . . . . .	49
M1A1 Employment Considerations . . . . .	49
Tips on Target Indication Techniques for Tank Guns . . . . .	51
Figure 17 Tank Main Gun Method . . . . .	51
Combat Engineers in MOUT . . . . .	53
Overview of Combat Engineer Combined Arms Capabilities . . . . .	53
Engineer Organization . . . . .	53
Engineer Tasks in Offensive Maneuver . . . . .	54
Engineer Technical Reconnaissance . . . . .	54
Bridge Repair and Construction . . . . .	54
Obstacle Breaching . . . . .	54
Forced Entry into Buildings . . . . .	54
Helicopter Landing Zones . . . . .	54
Engineer Tasks in Defensive Maneuver . . . . .	54
Summary . . . . .	56
Listing of X-Files . . . . .	60

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## X-Files

**Urban Warrior (UW)** is a series of experiments designed to test, validate and refine tactics, techniques and procedures (TTPs)—and some enabling technologies—that can help us fight and win battles on urbanized terrain. What you read here is a compilation what we have learned about MOUT during the Urban Warrior experiments.

**X-Files.** The information in this booklet is part of the experiment files (X-Files) created by MCWL using post training analysis and feedback from Marines. Figure 1 summarizes where the X-Files fit on the pathway between MCWL and the Operating Forces.



**Figure 1** Where the X-Files Fit

The X-Files are not doctrine, nor are they standing operating procedures (SOPs). X-Files are evolving and will be refined during further experiments. For example, the information in this X-File will be exploited and refined during *Metropolis*, a subset of our next experiments named *Capable Warrior*.

When we have the necessary information and knowledge on these TTPs, we will insert them into the Marine Corps Combat Development System to be evaluated relative to doctrine, organization, training and education, equipment and facilities, and support (DOTES).

**Tips on How We Use the Dragon.** We use the *dragon* to mark paragraphs that give you the word on lessons learned by Marines and Sailors during our experiments. These tips may be entirely new information or they may recommend adjustments so that you can more effectively apply current doctrine, SOPs or TTPs.



**MOUT Doctrine.** Marine Corps Warfighting Publication (MCWP) 3-35.3 *Military Operations on Urbanized Terrain* provides doctrinal guidance and detailed information on TTPs. We assume that users of this X-File are familiar with this doctrine.

**Tips on the Focus of this X-File.** The focus of this X-File is to draw together *what* the MAGTF has available and *how* it can be applied in MOUT. This entails effective integration of all the capabilities of the MAGTF's Command Element (CE), Ground Combat Element (GCE), Aviation Combat Element (ACE), and Combat Service Support Element (CSSE) to win the battle in the shortest amount of time with the fewest casualties. We will discuss each of these capabilities in relation to our training and experience during the Urban Warrior experiments:

- Infantry
- Indirect Fires
- Antiarmor Weapons
- Snipers
- Close Air Support
- Command and Control
- Mechanized Operations
- Engineers

**Tips on Synthesis of this X-File.** The Warfighting Lab's Special Purpose MAGTF Experimental —SPMAGTF(X)—developed a program of instruction (POI) that included mechanized operations. This POI was the core of the combined arms training program given to the GCEs and CSSEs drawn from the operating forces and used in our experiments. The Aviation Combat Elements that participated in the experiments used TTPs drawn from the *ACE MOUT Manual* developed by Marine Aviation Weapons and Tactics Squadron One (MAWTS 1). As summarized in figure 2, this X-File draws from those sources and what we learned during Urban Warrior to synthesize tactical level information on MOUT combined arms. Because there were significant restrictions on actual aviation operations during our experiments, most of our close air support synthesis comes from wargaming, brainstorming, and a Limited Technical



Assessment conducted by the Lab at Yuma Range Urban Target Complex (commonly called “Yodaville”) which is adjacent to Marine Corps Air Station, Yuma, AZ.



Figure 2 Framework of this X-File

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## Introduction

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**USMC Core Competencies.** Every year, the leadership of the Marine Corps reports to Congress and the Nation that we are trained, organized and equipped around these six core competencies. As shown in the below list, *combined arms operations* is one of them.

- Expeditionary Readiness
- Combined Arms Operations ←
- Expeditionary Operations
- Seabased Operations
- Forcible Entry from the Sea
- Reserve Integration.

**Combined Arms Doctrine.** Marine Corps Doctrinal Publication 1 (MCDP 1) *Warfighting*, establishes the framework for this X-File with this explanation of combined arms:

*In order to maximize combat power, we must use all the available resources to best advantage. To do so, we must follow a doctrine of combined arms. Combined arms is the full integration of arms in such a way that to counteract one, the enemy must become more vulnerable to another. We pose the enemy not just with a problem, but with a dilemma—a no-win situation.*

*We accomplish combined arms through the tactics and techniques we use at the lower levels and through task organization at higher levels. In so doing, we take advantage of the complementary characteristics of different types of units and enhance our mobility and firepower. We use each arm for missions that no other arm can perform as well; for example, we assign aviation a task that cannot be performed equally well by artillery.*

**Combined Arms Definition.** Marine Corps Reference Publication (MCRP) 5-12C, *Marine Corps Supplement to the DOD Dictionary of Military and Associated Terms* defines Combined Arms as follows:

*The full integration of combat arms in such a way that to counteract one, the enemy must become more vulnerable to the other.*

**Doctrine for Combined Arms Tactics.** MCDP 1-3 *Tactics* states:

*Modern tactics is combined arms tactics. That is, it combines the effects of various arms—infantry, armor, artillery, and aviation—to achieve the greatest possible effect against the enemy.*

*The strengths of the arms complement and reinforce each other. At the same time, the weaknesses and vulnerabilities of each arm are protected or offset by the capabilities of the other.*

The MAGTF is a balanced combined arms team. Combined arms is standard practice and second nature for all Marines.

**Combined Arms Philosophy.** This is more than simply using multiple weapons systems against an enemy. It's employing organic weapons, supporting arms, and maneuver to present a dilemma to the enemy; i.e., to avoid one threat, he will expose himself to another. Applying combined arms demands tactical proficiency and knowing the effects and employment methods for many types of weapons and how they relate to maneuver warfare.

Combined arms also includes integrating the various elements of the MAGTF into effective fighting teams that combine the strengths of one element with another to eliminate weaknesses. For example, when you combine tanks and infantry to work together in an urban battle, you make a formidable team. Tanks operating alone can be vulnerable to close-in antitank fires such as the rocket-propelled grenade (RPG). Infantry operating alone has no powerful direct fire system. By operating together, the two elements create a team that helps eliminate the vulnerabilities of the other. The tanks provide *immediate* and powerful fire support while the infantry provides protection for the tanks against close threats.

**Combined Arms CSS.** MAGTF combined arms maneuver elements must get a smooth, continuous flow of materiel and services. We know

from our experience that supplies and equipment in Classes I (rations), III (POL), V (munitions), and IX (repair parts), are the most critical to successful combined arms operations in MOUT. Disabled combat vehicles must be repaired and returned to service quickly or they will be easily destroyed in the restricted MOUT maneuver space. Although tanks and other major combat vehicles may not consume large amounts of fuel during MOUT, they must be refueled without being cycled to a rear area. Thus, the CSSE must not only plan for rapid ammunition resupply, equipment refueling and repair, they have to be prepared to do so in very dangerous forward locations amid narrow streets and multi story buildings.

**Tips on Effective MOUT CSS Planning.** This is based on operational questions, such as the following:



- What are the composition, disposition, and capabilities of the expected enemy threat?
- Where and when will the expected contact occur?
- What are the expected personnel casualties and equipment losses?
- What impact will enemy special weapons capabilities (such as NBC) have?
- How many EPWs are expected and where?
- How will terrain and weather affect CSS operations in the battle?
- What are the support priorities (by element and type of support)?
- Which unit has priority for emergency resupply?
- What are the force protection requirements and capabilities associated with each plan and branch plan?

As in all operational areas, integrated planning and thorough briefings are important keys to effective MOUT CSS planning. These activities play a critical role in ensuring that the MAGTF can execute its CSS plans efficiently, on time, and with the fewest possible problems. They allow the commander, his subordinate leaders, and each CSS Marine to discover potential problem areas and to develop contingency plans to take care of unforeseen difficulties.

We recommend reviewing *X-File 3-35.12 Urban Sustainability* for more comprehensive information on MOUT CSS considerations.

**Tips on Using the Warfighting Functions.** We recommend using the Warfighting Functions (WFs) as a planning template to ensure all facets of the MAGTF's combined arms capabilities are integrated to achieve synergies. As stated in MCDP 1-2 *Campaigning: Effective action in any single warfighting function is rarely decisive in and of itself. We obtain maximum impact when we harmonize all warfighting functions to accomplish the desired strategic objective in the shortest time possible and with minimal casualties.* These six mutually supporting military activities are defined in MCRP 5-12C as:

- Command and Control.  
**S** The means by which a commander recognizes what needs to be done and sees to it that appropriate actions are taken.
  - Maneuver.  
**S** The movement of forces for the purpose of gaining an advantage over the enemy.
  - Fires.  
**S** Those means used to delay, disrupt, degrade, or destroy enemy capabilities, forces, or facilities as well as affect the enemy's will to fight.
  - Intelligence.  
**S** Knowledge about the enemy or the surrounding environment needed to support decision making.
  - Logistics.  
**S** All activities required to move and sustain military forces.
  - Force Protection.  
**S** Actions or efforts used to safeguard own centers of gravity while protecting, concealing, reducing, or eliminating friendly critical vulnerabilities.
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## MAGTF Organic Combined Arms

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**Tips on Focusing the Power of the MAGTF.** When we fully integrate weapons systems and maneuver into one cohesive effort, the awesome power of the MAGTF is released. For example, in order to avoid artillery fire and air strikes, the enemy must seek cover. This allows maneuver against him to gain a positional advantage. Applying this in an integrated way allows us to focus our assets in combinations to leave the enemy without any good options and instilling a sense of hopelessness in him.


**Organic MAGTF Assets.** All combat and combat support elements of the MAGTF can be part of the combined arms team. These include:


- Infantry  
**S** Mortars, heavy guns, antiarmor weapons and snipers
- Artillery
- Combat Engineers
- Reconnaissance
- Tanks
- Assault Amphibious Vehicles (AAVs)
- Light Armored Vehicles (LAVs)
- Aviation  
**S** Rotary- and fixed-wing Offensive Support  
**S** Rotary- and fixed-wing (MV-22) Assault Support  
**S** Electronic warfare aircraft (EA-6Bs from VMAQ)  
**S** Air Defense
- Command and Control Warfare (C<sup>2</sup>W) Assets  
**S** Radio Battalion  
**S** Psychological Operations (PSYOP) Augmentation  
-- when assigned
- Civil Affairs units

Although not an organic part of the MAGTF, naval surface fire support can be an important contributor to the combined arms effort.

**Organic Combined Arms Capabilities.** Combining MAGTF assets in various configurations produces combined arms capabilities. Use of the powerful combined arms capabilities of the MAGTF is limited only by


our understanding of *what* they are, *where* they reside in the MAGTF, and *how* to best integrate their effects to accomplish the mission.

 **Tips on Organic Fire Support Planning.** Even though traditional fire support effectiveness may be degraded by the proximity of buildings to targets, minimum range restrictions and the like, you can enhance its potential with a *fully integrated* approach. For example, plan mortar and artillery fires on top of, and immediately around objectives and even friendly defensive positions for close support. Plan to use MAGTF aviation on targets that you cannot hit with artillery and mortars. Include a plan for how the ACE targets can be marked or otherwise clearly identified for and by the aircrew. Match air targets with weapon accuracy and explosive power. For example, use cluster bombs and/or precision guided munitions to neutralize or destroy targets while controlling potential for fratricide, collateral damage, rubble or noncombatant casualties.

 **Tips on Artillery Employment.** These weapons may have limited effectiveness in cities with tall buildings. Their role may be limited to the tops of buildings, large open areas, or in a direct fire mode. However, in suburban areas or cities composed primarily of low-rise structures, artillery can be an effective weapon. Other employment considerations include:


- Restrictions on the types of rounds we use to:
  - conform to the ROE
  - control collateral damage
  - reduce rubble on friendly avenues of approach
  - avoid creating fires or conflagration in potentially highly flammable targets such as gas stations, refineries, etc.
    - > This danger also exists in slum or shanty town areas where construction is of highly flammable materials, and cooking and heating is done with open fires and/or bottled gas.
  - Use as direct-fire to destroy fortifications.
- S** Its limited urban mobility makes it a very vulnerable target.


**Tips on Mortar Employment.** In addition to the cautions about starting fires, these are key mortar employment considerations:

- 
- High rate of fire, short minimum range, and a high trajectory can reduce dead space sanctuaries.
  - Use VT fuzes to attack targets on tops of buildings.
  - Use to provide obscuration to hide ground movement.
- Use to provide limited illumination fires for night fighting.
  - Plan on buildings reducing the effectiveness of illumination rounds by creating shadows;
    - S** e.g., if illumination is behind the objective, the enemy troops would be in the shadows rather than in the light.
  - Rubble may adversely affect your ability to displace mortars.

**Naval Surface Fire Support (NSFS) and Naval Gunfire (NGF).**

- NSFS includes NGF, missiles and Electronic Warfare systems.
- NGF is severely limited in MOUT due to its flat trajectory.
- Missiles are not a choice for tactical fire support in MOUT.

 **Tips on Antiarmor Weapons.** These weapons have shaped charge warheads so they can penetrate and destroy heavily armored tanks. They are not very effective as an urban anti-personnel weapon because they produce relatively little spall. This category includes antitank guided missiles (ATGMs) such as the Tube launched, Optically tracked, Wire guided (*TOW*), the *Dragon* and the *Javelin*. It also includes unguided missiles such as the Light Antiarmor Weapon (*LAW*), the *AT4* and the antiarmor version of the Shoulder-launched, Multi purpose Assault Weapon (*SMAW* also: *Bunker Buster*).

 **Tips on Antiarmor Weapons Employment.** Antiarmor weapons are normally employed in a decentralized mode at the small unit level. They are best deployed along major thoroughfares and upper stories to attain long-range fields of fire. Make sure that these are dug in with overhead protection and that you have sufficient clearance for the backblast to the rear—at least a 20' by 20' room with an opening in the back. And, their minimum firing range of *65 meters* could limit firing opportunities in the confines of the urban environment. Some key employment considerations include:

- Engage enemy armor in predetermined locations that afford the most advantage to the shooter.

- Select weapon positions that provide maximum range fires.
- Fire TOWs, Dragons and Javelins from an open area.
- Fire from an enclosed area *only* if it is a sturdy ventilated structure of appropriate size.
- The AT4 has a minimum arming distance of *10 meters*, allowing it to be successful at the typically short MOUT engagement ranges.
- Backblast from antiarmor weapons will create an extensive dust and debris cloud in a room.
- Dust and debris will reduce or temporarily eliminate vision, and **S** backblast dust and debris can make it impossible for gunners to remain in the room because they can't breathe.
- Set up positions to be mutually supporting so the shooters can quickly move from position to position under cover and escape easily if necessary.
- Be aware of the potential for wire cuts and wire drag from rubble when employing the TOW and Dragon.
- This can cause misses and unguided flight.
- Standard TOW 2/2A missiles fly into/directly impact the target.
- TOW 2B Missiles fly *over* the target and fire an explosively formed penetrator down onto the top armor.
- It cannot be used against nonmetallic targets.
- Gunners must avoid firing directly over other friendly vehicles, disabled vehicles or large metal objects like water or oil tanks.

**Tips on Machine Gun Positions.** During the UW limited objective experiments, we occasionally saw deployment of machine guns to upper stories in buildings. Generally speaking, higher is not better for these positions. You get the maximum grazing fire and the largest beaten zone from basement or street level positions—assuming the absence of street level rubble. On the other hand, if you are using machine guns to cover an intersection, using higher story positions may be appropriate because your targets are vehicles, rather than a foot mobile enemy.



**Tips on Snipers as a Combined Arms Asset.** Although sometimes overlooked as part of the MAGTF's combined arms capability, snipers can deliver long-range precision fire at selected targets from concealed positions. Beyond their ability to create adverse psychological effects on the enemy, snipers also enable the infantry to cover a large area, without having to occupy the



terrain. They provide information to maneuver forces on enemy size, location, movement, etc. In *offensive* operations snipers are normally used to:

- Gain and maintain contact with the enemy.
- Disrupt enemy movement and observation.
- Deliver accurate fires in support of search elements.
- Support (by fire) infantry movement across streets.
- Call for, and control fire support.
- Enhance security and prevent surprise.
- Screen flanks.
- Provide counter sniper fire.

In *defensive* operations, the sniper is best employed to provide early warning of enemy approach, disrupt it, and if possible, cause the enemy to deploy prematurely. Snipers are best employed defensively to:

- Detect and destroy infiltrators.
- Protect units at the FEBA from surprise attacks.
- Protect patrols from ambush.
- Screen the flanks and rear of the defensive positions.
- Delay and inflict casualties on an advancing enemy.
- Harass the enemy and cause him to deploy prematurely.
- Direct supporting arms fire.
- Deny enemy access to certain areas or avenues of approach.

**Tips on Designated Marksmen (DM).** MCWL has developed a pilot program of training one member of each infantry fire team as a *designated marksman*. His purpose is to provide well-aimed shots in a direct support role. These Marines are taught many of the same skills as the Marine Sniper. For example, they are taught position selection, range estimation, final firing positions, elevated firing angles, effects of weather, surgical shooting, and advanced shooting skills out to 300 meters. They are not taught the classic sniper skills of stalking, camouflage or observation techniques.



During our experiments, platoon and squad leaders used the DM to:

- Take out enemy high value targets, such as machine guns, snipers, radio operators, etc.
- Provide overwatch of the squad or platoon during movement.
- Provide observation posts.
- Provide supporting fires during movement or maneuver.

These specially trained infantrymen are part of the existing rifle squad. They are not additional numbers on a unit's table of organization.

**Tips on Task Organization.** In most instances, the most effective means of operating in the urban battlespace is task organization into a *combined arms team*. This allows each arm of combat to supplement the other, as well as cover any deficiencies that may exist. For example, tanks combined with infantry can provide near instantaneous direct fire support, as well as breaching capability. The Warfighting Laboratory, working with elements of II MEF, experimented with various combinations of combined arms teams. Here is the one we found to be most effective. This formation will not fit *all* situations. Commanders and leaders must assess each situation and determine the best task organization from the assets available. For example, the smallest, most combat effective way to employ Tank, AAV, or LAV units is by platoon. However, in the urban environment, the close nature of terrain does not allow this optimum employment. So we task organized into smaller elements such as the section.

- A section of tanks is two (2) vehicles.
- A section of LAVs is two (2) vehicles.
- A section of AAVs is four (4) vehicles.

**Tips on Effective Organization.** The task organization we tested is built upon an infantry platoon, supported by a tank section, LAV section, and AAV section. We tested this force in both low- and mid-intensity situations, against an opposing force of equal strength, less the armor. These units are formed into *three maneuver elements, under the command of the infantry platoon commander*, who is advised by the senior supporting commanders or leaders. This advisory role is important because the tank, AAV or LAV commander will have more intimate knowledge of the capabilities and limitations of his equipment than the infantry leader. The three maneuver elements are:

- infantry squad, one tank and one AAV;
- infantry squad, and two LAVs;
- infantry squad, one tank, and one AAV.

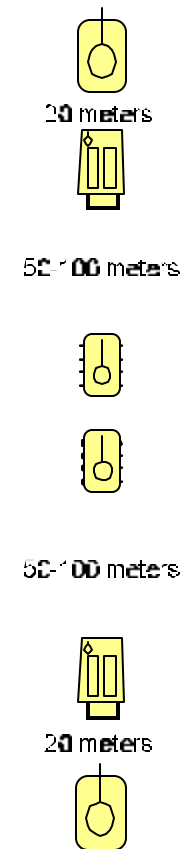
Although the tanks prefer to work in platoons, we found that using sections in MOUT allowed us to combine the strengths of the various components and negate some of the limitations. Further, nothing

precludes the infantry squad or platoon from being attached to the AAV, LAV or Tank platoon commander—based on METT-T factors.

**Tips on an Effective Mechanized Patrol Formation.** Broken into these three maneuver elements, our platoon patrolled through the city in the formation shown in figure 3. A tank in the lead, followed at approximately 20 meters by an AAV with infantry embarked. The AAV had one of the cargo hatches open with infantrymen scanning assigned sectors to the front, rear and flanks. The ramp of the AAV was open to the horizontal in order for troops to deploy immediately in the event of ambush. We found that *if the ramp was not open, a delay of up to 10 seconds occurred during the most critical point of an ambush*, the immediate action. Also, this configuration allowed use of the AAV in this mode without incurring the delay in resetting its ramp when the emergency “combat drop” was used. (Please note that the ramp of the AAV requires some strengthening in order to remain in the horizontal position.) The infantry platoon leader normally, but not always, traveled in the first element.

The second element in the formation was the infantry embarked aboard the LAVs. This unit moves approximately 50 to 100 meters behind the lead element, and is the rapid reaction force of the platoon. The LAV section was prepared to move quickly to the flanks of any contact and engage with organic weapons, as well as deploying embarked infantry.

**Tips on a Combined Arms Antiarmor Team (CAAT).** Although it is neither a doctrinal term nor a doctrinal organization, we found that each of the infantry battalion participants in our experiments organized a CAAT to be ready to deal with an armor threat. Therefore, here is information on how at least one of the battalions in the operating forces organizes this capability.



**Figure 3** MOUT Experimental Mechanized Formation

Threat dependent, commander's may choose to task organize elements from heavy machine gun assets and antiarmor assets into a mounted CAAT. When it is organized from assets drawn solely from the battalion—i.e., no tanks, AAVs or LAVs—it is almost wholly drawn from the Weapons Company. Depending on the threat, all or part of a rifle company's Fire Support Team (FST)—artillery forward observer (FO), 81mm FO and FAC—is part of the CAAT. Often, an 81mm mortar vehicle with one tube is included in the CAAT so that the 81mm mortar can be an *on call* marking tool for CAS. The vehicle mounted weapons included in a nominal CAAT platoon are:

- TOW, Dragon and/or Javelin ATGMs
- Mk-19 40mm grenade machine guns
- .50 caliber heavy machine guns

When used in the CAAT, the TOWs are invaluable not only for their range, but for their thermal sights.

The CAAT members are trained to be proficient in call-for-fire and close air support procedures. In this regard, their capabilities can be enhanced through the use of a Precision Intelligent Targeting System (PITS) and hand-held designators for precision guided weapons. The CAAT uses doctrinal movement techniques consistent with assigned mission and the threat situation. Internal overwatch is maintained for security. It is used tactically as a reconnaissance, screening, guard, ambush and delay force.

In the offense the CAAT can be sort of a combat reconnaissance patrol ahead of, or flanking, the main body in movement to contact. On contact with the enemy, they shoot and move in concert with the MAGTF scheme of maneuver. In the defense, the CAAT can be used far out in front to expand the defense in depth with tanks in a series of defensive delay lines to shoot and maneuver in a combined arms battle well in front of the main battle position. They will also be part of the counterattack force, usually in overwatch of tanks.

In either the offense or defense, the unit must have a plan to react to a decisively engaged CAAT. For example, the unit's plan could designate a reserve or tactical combat force to immediately exploit success in a decisive engagement. On the other hand, it should also have a branch plan to recover the CAAT if it should become necessary. Simply stated, the CAAT is not a stand-alone maneuver unit.

CAAT logistics is a serious challenge. The vehicles may cut up many tires and break oil pans or U-Joints on the urban streets (rubble, deep pot/shell holes, etc.). One approach we became aware of was to make space for extra tires (mounted on rims) in the vehicles. Cross training CAAT Marines in basic motor pool mechanic skills (as suggested in the *Urban Sustainability X-File*) was invaluable because of the difficulty in getting CSSE MT contact teams far forward during in the urban battlespace.

**Close Air Support.** Covered later in this X-File.

**Command and Control.** Outlined in the next section of this X-File.

**Mechanized Operations.** Covered later in this X-File.

**Combat Engineers.** Covered later in this X-File.

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## MOUT Combined Arms Factors

Urban combat has some unique characteristics that we must clearly understand to effectively plan and execute combined arms. Most of these factors are discussed in other *X-Files*, but we have consolidated some of them here to create a clear context for the rest of this X-File.

**Tips on Battlespace Geometry Factors.** Urban targets have hard, smooth, relatively flat surfaces. Rounds almost always hit these surfaces at an oblique angle—on a slant—rather than at the perpendicular. This greatly increases the potential for reduced effectiveness because munitions with impact fuzes either do not detonate or have low order detonations. These angular impacts also increase the potential for ricochets. Other important battlespace geometry factors include the following:

- Engagements are at close range,
  - S** inducing danger to Marines from backblast and fragmentation, and
  - S** causing dud ordnance from firing inside of minimum arming range.
- Engagement times are short—often ruling out deliberate, well-aimed shots (unless quickfire shooting skills have been developed and practiced).
- Canyons formed by tall buildings create dead space as shown in figure 4. This affects
  - S** depression and elevation limits for indirect fire weapons, and
  - S** angular flight path for air dropped ordnance.

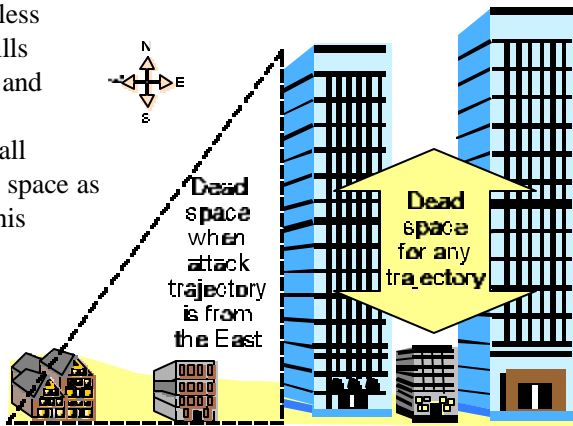


Figure 4 Geometry of Dead Space

- For artillery fired at low-angle, the dead space is about five times the height of the building.

- For artillery fired at high-angle and mortar fires, the dead space is about one-half the height of the building.
- Distance in urban combat often relates as much to *vertical* separation as it does to *horizontal* measurement.

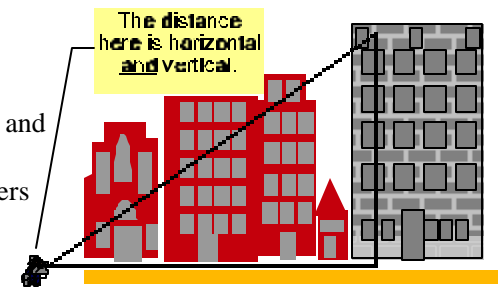


Figure 5 MOUT Distance Components

- Separation between forward and rear areas may be greatly compressed in terms of meters and miles but can be greatly extended in time by the need to move up and down stairs and ladders. Figure 5 illustrates the vertical component of distance in MOUT.
- Urban terrain can be *noncontiguous* because MOUT maneuver often bypasses isolated pockets rather than securing terrain in a continuous manner. This is illustrated in figure 6

- Buildings provide excellent cover and concealment to the enemy.
- Targets are obscured by smoke, dust and shadows from buildings.
- Targets are hard to identify from the air.
- Targets are hard to hit from the air.
- Concern for fratricide is a major factor.
- Limiting collateral damage and rubble is a high priority.

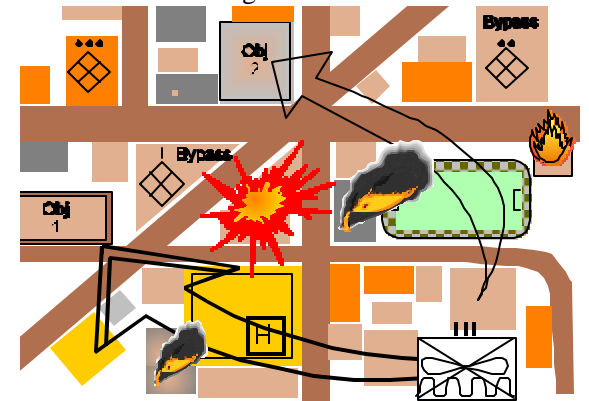


Figure 6 Noncontiguous MOUT Distance

**Tips on Rules of Engagement (ROE).** ROE are used to guide us in the sound selection, deployment, and employment of forces in a given situation. *Chairman, Joint Chiefs of Staff Instruction 3121* is the standing ROE (SROE) for U.S. Forces and is designed to be used in all operational contingencies including

peacetime, wartime, and humanitarian operations. It states the following:

*At all levels, the SROE are influenced by, and are consistent with, the Law of Armed Conflict (LOAC). These ROE, and the LOAC, are definitive within the commander's areas of responsibility and shall be strictly adhered to at all times notwithstanding noncompliance by opposing forces.*

*THESE RULES DO NOT LIMIT A COMMANDER'S INHERENT AUTHORITY AND OBLIGATION TO USE ALL NECESSARY MEANS AVAILABLE AND TO TAKE ALL APPROPRIATE ACTION IN SELF-DEFENSE OF THE COMMANDER'S UNIT AND OTHER US FORCES IN THE VICINITY.*

ROE never prevent a Marine from protecting himself or the lives of others. ROE must be thoroughly briefed, understood, and enforced.

**Tips on Human Factors.** Because urban fighting is done by small units that are in very close proximity to one another, shared situation awareness can be the difference between victory and defeat.



Other key human factors are:

- Casualties can be high so the unique challenges of urban casualty evacuation must be planned for.
- Ammunition usage is very high so rapid/constant resupply is critical.
- Close coordination of fires is required to reduce potential fratricide.
- Observation posts (OPs) with adequate fields of view are scarce.
- Precision targeting is very difficult.
- ROE can limit fire support options.
- **S** ROE never limit a Marine's right of self defense.
- Effective communications are very difficult to maintain.
- Expect extensive injuries from glass fragments embedded in skin and serious abrasions caused by concrete.
- Anticipate some crushing injuries from falling walls and debris.
- Anticipate eye injuries from flying glass.
- Anticipate fractures from tumbling down stairs or falling from upper stories of buildings.
- Plan for breathing problems caused by significant, persistent dust clouds from weapon firing and impacts.
- Educate Marines and Sailors on preventive measures against getting and spreading infectious diseases endemic to the area.

**Intelligence Requirements.** All MAGTF elements need information on the enemy. Some of the key components that drive MAGTF MOUT information requirements include:

- Urban cycle/tempo
  - S** rush hour,
  - S** normal work hours,
  - S** school hours (children in the streets)
  - S** meal hours, etc.
- Political and administrative centers
- Religious sites - and prayer times
- Electrical generation sites and power grids
- Gas distribution centers
- Fuel centers and gas/POL stations
- Food distribution centers
- Markets
- Transportation hubs
- Key road networks
- Water purification, pumping and distribution centers
- Underground systems (subways, sewers, etc.)
- Radio and television studios and transmitting towers
- Key terrain
  - S** offering observation and/or fires over large areas or key avenues
- Location of police and fire units
- Location of medical facilities and medical personnel
- Ethnic, religious, cultural, political and administrative boundaries.

**Tips on MOUT Target Identification.** We got our best results when we used major intersections, principal buildings, and other readily identifiable physical features as target reference points (TRPs) and control points. For target identification, we used an alphanumeric grid system that numbered buildings along the route of attack and within the area of interest. Figure 7 is one way that we did this for Urban Warrior training. This simplified target identification for all elements of the MAGTF. Also, we designated the near side of the street as the objective rather than causing the attacker to secure buildings on *both* sides of the street to take the objective.



Failure to do so however, will usually result in high friendly casualty rates as you are attacking into the enemy's strength.

**Tips on MOUT Command and Control (C<sup>2</sup>).** Today's MAGTF

commanders plan, coordinate and direct their forces using various portions of the electromagnetic (radio frequency /RF) spectrum. For example, they communicate via radios, data links, computers and fiber optics. They gather and disseminate information via radios, radar and other sensors, both active and passive. We have to consider the effects of the urban terrain on visual and electronic communication. Specifically, buildings and rubble severely limit lines of sight—making hand and arm signals impractical. And most tactical electronic communications depend on clean sight lines. Therefore, in order to maintain communications with higher and adjacent units, it may be necessary to send communications personnel to the tops of buildings or towers. Then use the Intra Squad Radio (ISR) to maintain links to them.

Other C<sup>2</sup> considerations are:

- Wire can be an adequate means of communication in urban defense; **S** but it can be easily interdicted (cut or tapped) by the enemy.
- Wireless communication is degraded by structures, **S** and a high concentration of power lines.
- Messengers are a good means of communication, **S** although they are very vulnerable in the urban terrain.

If you cannot communicate where you are, *move* until you can.

**Communications and Information Systems.** We need these to provide us with the ability to collect, process, analyze, and exchange information. For example, small units conducting independent operations must have the communications capabilities and maps to allow them to effectively call for fire. And, we know that urban CAS execution requires dependable and interoperable communications. Information systems must relay timely information, such as target activity after attack and additional targets, to facilitate real-time CAS decision making as well as future CAS planning.

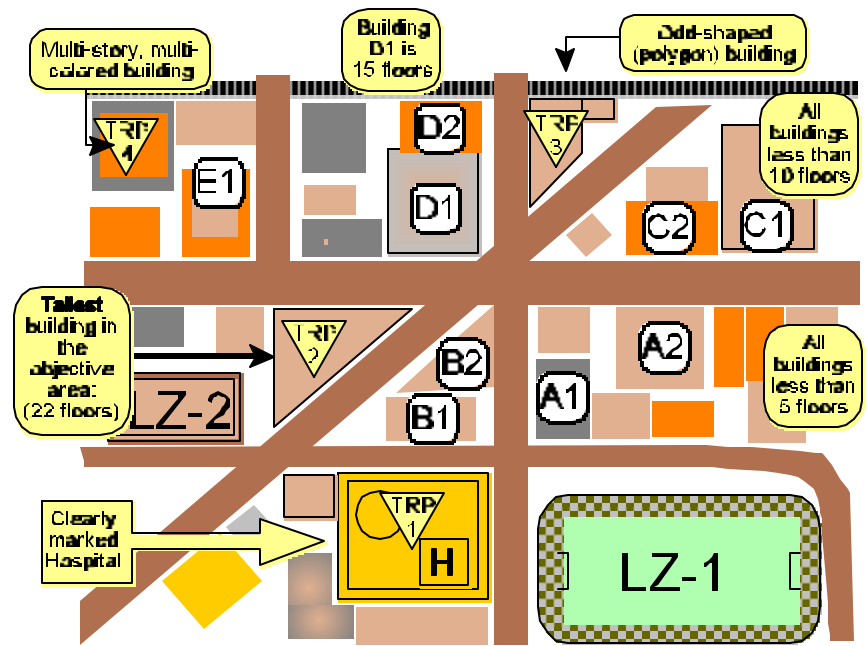


Figure 7 Alphanumeric Target ID Grid with Footnotes

**Tips on Frontages, Formations, and Zones of Action.** An urban attack is normally constrained within relatively narrow zones of action. The frontages depend on the enemy's strength, the size of the buildings, and the anticipated resistance. Because of training area limitations during Urban Warrior experiments, we generally conducted platoon sized attacks that were limited to a frontage of one block.

Even though frontages are limited, you must not fall into the trap of conducting only frontal attacks. The limited frontages and restrictive nature of the urban battlespace tend to drive unit commanders and leaders into linear thinking about the battle.  
*You must resist this and keep a maneuver approach.*

An attack to the enemy's flank is *always* better than an attack into the teeth of his defense. Platoon commanders and squad leaders must set bases of fire on the front of buildings and send squads or teams to penetrate from the flanks or rear. This is often difficult to do in a city.

**Tips on the Intra Squad Radio (ISR).** During Urban Warrior, we issued and used the hand-held ISR in various venues. Figure 8 depicts an early version of the ISR used in our experiments. At various times they were issued to platoon commanders, squad leaders and fire team leaders. At other times, they were issued to all members of a platoon to enhance their situation awareness and combat effectiveness. Although initially focused on the GCE, and its maneuver, we found the ISR to have great potential to integrate all modes of combined arms. Here is what we learned with the ISR:

- Marines need to be trained to exercise radio discipline.
- Marines need to routinely train on the ISR
  - S** or when under pressure they will revert to yelling, which often alerts the enemy to specific locations and intentions
- The ISR greatly enhanced maneuver,
  - S** particularly at the squad and fire team level.
- The ISR greatly enhanced situation awareness throughout a platoon
  - S** even though they were separated by walls or rubble.
- The ISR helped expedite CASEVAC and resupply.
- The ISR helped commanders and leaders maintain control over their personnel and track their location.
- The ISR functioned well in the urban environment
  - S** despite its limited range of about two miles.



**Figure 8**  
ISR

Also, we think the MAGTF should equip all FACs with ISRs. All our experiments showed the ISR is a key combined arms tactical enabler in MOUT.

- Issue of the ISR to the operating forces should begin when the final version is decided upon in early FY 2000.
- *X-File 3-35.9 Intra Squad Radio*, will accompany its issue.

**Tips on Use of C<sup>2</sup> Enhancements.** During many of our experiments, the Internet *Shared Net* and *Newsgroups* were used extensively by the MAGTF C<sup>2</sup> nodes. This enabled us to decrease dependence on voice communications. It also increased situation awareness (SA) among all of the MAGTF elements. We used technology



**Figure 9** Palm Top EUT

to provide position reports of units that had the end user terminal (EUT). Figure 9 shows an experimental version of the EUT used in our Advanced Warfighting Experiment. See *X-File 3-35.13 Tactical Instrumentation* for more information on this and the ISR. Technology improvement to our first EUT is in final prototype development.

**Tips on Use of Electronic Navigation Aids.** The urban canyon adversely affects the performance of some types of communications-electronic devices such as the GPS, the Position Location Reporting System (PLRS), and other line of sight (LOS) data-distribution systems. Use these systems on the tops of buildings, in open areas, and down streets where obstacles will not affect LOS readings. This entails map study to preplan navigation and communication way points in the urban canyon. Our Urban Warrior experience showed us that units who expected to do this “on the run” (i.e., without preplanning) were seldom effective.

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## Urban Close Air Support

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### Close Air Support (CAS). JP 1-02 defines CAS as follows:

*air action by fixed- and rotary-wing aircraft against hostile targets which are in close proximity to friendly forces and which require detailed integration of each air mission with the fire and movement of those forces.*

For purposes of this X-File on Combined Arms, our focus for the ACE is on CAS, which is within the Offensive Air Support (OAS) function of Marine Corps aviation. MCWP 3-23.1 *Close Air Support* addresses basic CAS doctrine and TTP. It focuses on the details of CAS employment and the role CAS plays in integrated MAGTF, joint and multinational operations. However, it does not contain information specific to MOUT. The definitive work on urban CAS is the *ACE MOUT Manual* produced by MAWTS 1.

Close air support is the unique organic combat power available to the MAGTF commander from his ACE.

**MAGTF CAS Enablers.** The two essential elements that enable MAGTF CAS are the:

- wide array of fixed wing and rotary wing aircraft in the ACE, and
- forward air controller (FAC), who may be ground based or airborne.
  - S** Typically, FACs are Marine Corps aviators who have trained with the MAGTF prior to deployment.

**Tips on Call for Fire at the Small Unit Level.** Although not fully qualified FACs, each infantry squad should have a member trained in urban call for fire procedures. This should include preparation of 9-line briefs for CAS requests. To help in this regard, the Lab has developed and fielded a training program called the Combat Decision Range (CDR). This is focused on computer based tactical decision making and training. Its scenarios are focused on rifle squad level missions in the urban environment. In addition to causing small unit leaders to maneuver and use supporting



arms, it also causes them to act within various ROE.

Figure 10 is a screen capture of one of the training exercises. Note the options—in the form of icons—presented along the left edge of the screen.

MCWL has provided a CDR Mobile Training Team (MTT) to all of the infantry regiments in the operating forces. Those who have had the CDR training report increased confidence, improved command and control, and enhanced situation awareness at the small unit level in the horizontally and vertically dispersed battlespace.



**Figure 10** Sample CDR Computer Screen

**MAGTF Ordnance Capabilities.** The wide array of ordnance available to the MAGTF through the ACE includes free fall unitary and cluster bombs, rockets, cannons, laser-guided bombs, and electro-optically guided missiles. The ACE also has specialized ordnance that can be guided by a global positioning system (GPS). These can be delivered effectively by MAGTF rotary- and/or fixed-wing aircraft. To improve responsiveness, the ACE can have CAS aircraft in an airborne orbit so that they can attack a target within minutes of a request—with preloaded ordnance. They can also have aircraft on strip alert—at forward sites or aboard amphibious shipping—whose ordnance load can be adjusted to meet unique circumstances. Often this upload or download of specific ordnance can be done in less than an hour. Also, all MAGTF aircraft operate in the same frequency range as the rest of the MAGTF and have secure communications capabilities should they be required.

**Targeting of Air Delivered Ordnance.** This is affected by the aircrew's ability to find, identify, and hit the target. MAGTF aircraft have sophisticated sensors to help aircrew do this. However, the aircrew may have to rely on the FAC or FAC(A) to mark and/or sufficiently describe the target to enable ordnance delivery. The FAC or FAC(A) also has to establish the proximity of friendlies and noncombatants, and inform the aircrew of requirements to limit collateral damage. The FAC or FAC(A) also coordinates the integration of other supporting arms; e.g., he

deconflicts aircraft with artillery and mortar fire. Most important, the FAC is the final clearance authority for the aircrew to release any ordnance.

CAS integration with other supporting fires in MOUT enables maneuver to achieve decisive action.

**ACE MOUT TTPs.** The *ACE MOUT Manual* provides the framework for planning and conducting MAGTF urban aviation operations. Much of the information in the following paragraphs is based on information extracted from that document as we applied it during Urban Warrior.

**Characteristics of the MOUT CAS Environment.** Effective urban CAS is hard to do for the same reasons that all urban combat is hard to do. It almost always involves fierce, face-to-face small unit action that makes it hard to identify who is friendly and who is the enemy. It also is marked by a very demanding targeting and weaponeering process; i.e.,

- find the target,
- match the right ordnance to the target,
  - S** considering both accuracy and weapons effects.
- mark the target so aircrew can identify the target from the air,
- hit the target and
- assess the results for maneuver and/or re-attack requirements.

Unless aircrew and terminal controllers have trained frequently to meet the unique challenges of MOUT, their ability to conduct effective CAS could be seriously degraded. Ideally, this training should include FACs, FAC(A)s and maneuver elements in a real/realistic urban environment.

**Tips on Setting the Conditions for CAS.** The essential condition for CAS is responsiveness. Unresponsive CAS threatens mission accomplishment and can cost lives. Once responsiveness is reasonably assured, the MAGTF should consider how the answers to each of the following questions affect the planned use of CAS in the urban battlespace.

- Do we have air superiority so CAS aircraft (a/c) can function freely?
- Is the weather suitable for CAS a/c to operate?
- Are CAS aircraft available?
- Is suppression of enemy air defenses (SEAD) required?

- S** Particularly for rapid firing anti-aircraft guns.
- Can the GCE supply SEAD for CAS? This is complicated because:
  - S** direct fire weapons may not have a clear field of fire or gun-target line due to vertical obstructions, and
  - S** indirect fire weapons may be prohibited by ROE or because of fratricide and collateral damage concerns.
- Can we mark/designate the target so CAS a/c can locate and hit the target?
  - S** E.g., smoke, electronic (laser, IR, etc.) or precise grid.

Marks of all types are very hard to see in urban terrain. FAC skill must include ability to “talk pilot’s eyes on to target.” This is an art that must be practiced frequently to be properly developed.

- Is the right ordnance and fuzing combination available?
- Is a precision guided munition required?
  - S** Such as laser-guided, electro-optical, or infrared (IR) guided munitions, and/or aircraft with special equipment or capabilities.

**Tips on Accuracy vs. Radius of Effects.** Generally speaking, we have to change our ideas about weapon system accuracies and the importance of their radius of effects in the urban environment. Specifically, we must have weapons that can be delivered with enough accuracy to “hit the target” in the vertically developed urban battlespace.



Acceptable accuracies, expressed as circular error probability (CEP) are different in the urban canyon because of the compressed, vertical nature of the battlespace. This is compounded by the difficulty of target identification within and among buildings. For example, a 10-meter CEP for a laser guided 1000 lb. bomb is acceptable in open terrain. However, this kind of error in a city could be disastrous to friendly troops locked in close quarters combat with an enemy who is across a city street. For example, optimized aircraft/weapon combinations with 3-5 meter CEPs may not be usable because of the target identification problems and restricted delivery paths created by buildings in the urban battlespace.

Even very accurate precision guided ordnance delivery can give us problems in CAS. A “bull’s eye” with a 1000 lb. bomb may pack too much punch to be acceptable to nearby friendly forces. Therefore, we must have reduced or scaleable weapons effects to control the potential for fratricide and minimize collateral damage. The down side of that is that smaller scale weapons have to be *very* accurate to be effective.

The optimum answer appears to be a collection of accurate weapons that allow us a spectrum of damage inducing effects. This can involve:

- a series of many weapons, each with a different effect, or
- a few weapons that have scalable effects ranging from
  - S** a high speed “slug” to
  - S** a high explosive bomb with huge over pressure and a dense, high speed fragmentation pattern.

**Fixed-Wing Aircraft Operations.** MAGTF fixed-wing aircraft can isolate, interdict, and reduce enemy strongpoints in the offense. In the defense, they attrit enemy forces as they approach, attack forces attempting to bypass, or canalize the enemy to take avenues of approach that are advantageous to the defender. Key F/W CAS considerations are:

- F/W aircraft often operate out of the enemy’s air defense threat.
- Typical F/W air strikes are delivered from extended slant ranges. This can cause accuracy errors that are unacceptable in MOUT.
- Higher altitudes flown by F/W aircraft can make target identification very difficult in MOUT.
  - S** Hard to gain situation awareness from F/W operating altitudes.
- Heavy ordnance capabilities can reduce or destroy vital enemy supplies and facilities.
- The shock, concussion, and psychological effects of heavy ordnance can reduce the efficiency and fighting spirit of enemy forces.
- Rubble and debris from F/W air attacks may increase the defender’s cover and create obstacles to the movement of friendly forces.
- Proximity of opposing forces to friendly forces increases the potential for fratricide.
  - S** This may require the use of precision guided munitions (PGMs) or the temporary disengagement of friendly forces in contact.
- Air delivered ordnance may be restricted by the ROE because of the presence of civilians or requirement to preserve key city facilities.

- Limited ground observation may require the use of forward air controllers (airborne) (FAC(A)).

**Rotary-Wing Aircraft.** Attack helicopters can easily gain and maintain situation awareness of the ground scheme of maneuver. They can rapidly maneuver within the built-up area to attack a variety of targets from slant ranges that are usually much shorter than F/W delivery ranges. Urban structures offer ideal cover for attack helicopters. The ability to deliver PGMs, rockets, and 20 mm cannon fire makes the attack helicopter a valuable asset in reducing strongpoints, breaking up enemy concentrations, and providing suppressive fires for attacking forces. Attack helicopters also provide a highly maneuverable antiarmor capability. Additionally, they:

- Provide suppression and/or destruction of enemy forces within buildings and strongpoints.
- Conduct counterattacks.
- Isolate the built-up area or objectives within the built-up area
- Conduct armed reconnaissance and patrols.
- Conduct rapid concentration of fires.

*The potential danger to rotary wing aircraft is very high in MOUT.*

For example, an unsophisticated enemy in Somalia was able to shoot down four tactically proven helicopters with RPGs and small arms.

**Tips on Urban CAS Activities.** CAS is almost always immediately needed by the GCE; however, certain activities must occur very rapidly before ordnance is delivered. Figure 11 summarizes some—but not all—of the activities that take place in a very short period of time in an urban close air support environment. In the urban battlespace, enemy and friendly forces are in very close proximity—and we may not always be able to pause the assault, protect our troops and use aviation to neutralize targets.



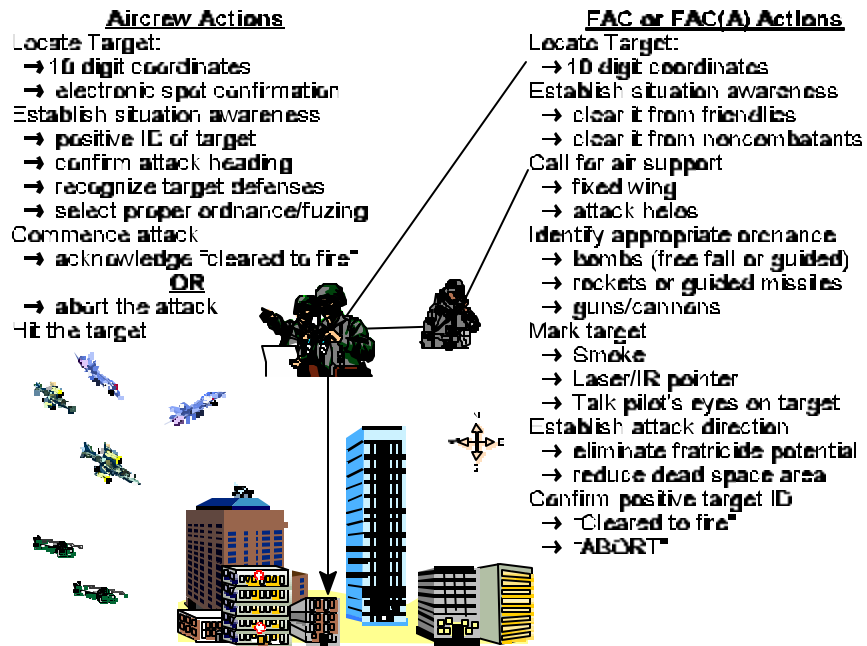


Figure 11 Notional Urban CAS Activities

**Tips on use of UAVs.** We know from our UW experience that loitering UAVs can be very useful. One of the most obvious things we found is that enemy activity was greatly reduced when they knew a UAV was overhead. Beyond that deterrent effect, when UAV video feeds are linked to fire support coordinators, they can maintain surveillance on danger areas and have near-perfect situation awareness. They can also assist in the fires process for small unit leaders. By inputting UAV information (video, sensors, etc.) into a common tactical database, all echelons of command have access to the necessary information to develop a common tactical picture. For example, in certain restricted situations we found that is possible for the fire support coordinator to actually see the same tactical picture as the unit requesting CAS/fires. On the firing/ weapon delivery end, as technology improves, the originator may not have to provide terminal control if the UAV has everybody's "eyes on target."

During our experiments, we found that squad leaders *can* call in CAS, but they *cannot* deconflict it with other MAGTF fires.

Especially in the defense, we are often locked into a fixed position. Therefore, because of the high potential for fratricide—either by direct hit or collateral weapons effects—we must have *precise* location and identification of CAS targets before they are engaged by our aircraft.

**Tips on CAS Targeting.** Because we need to *scale* our weapons—use measured firepower—to eliminate the threat while protecting against fratricide and unwanted/collateral damage, we found the following to be effective:

- Preplan potential targets using 10 digit coordinates;
  - S** number them,
  - S** share numbers with the GCE, CSSE and the ACE, and
  - S** preprogram them into available unmanned aerial vehicle (UAV) support.
- Mark friendly positions and strongpoints with thermal tape.
  - S** Easily seen by night vision equipment in USMC aviation.
- Preplan types of ordnance so MAGTF aircraft are properly loaded.

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## MCWL Urban CAS Experiments

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**Yuma Range Urban Target Complex.** This is a one-of-a-kind, 400 meter by 350 meter rectangle located in a Restricted Area that is 15 miles SE of Yuma, AZ. Commonly called “Yodaville” the complex consists of 167 structures made of unserviceable shipping containers of all types. For example, 8'x8'x20' Sea Vans are used for single story buildings—and ordnance shipping containers are banded together and stacked up to create multistory structures. It has streets and alleys. Its buildings have color variations that replicate such different construction materials as brick, concrete and lumber. Yodaville also contains vehicle targets (both civilian and military) and dummy personnel figures scattered throughout. Figure 12 is a panoramic picture of its current appearance.



**Figure 12** Yodaville Urban Target Complex

Figure 13 shows the way that many of the multistory structures are built. This group of vertically developed urban targets—some as high as five levels—can imitate discrete openings such as windows and doors. Such features make it functional for training of warfighting forces, planning and rehearsal of operational missions, test and evaluation of new systems, and development of new tactics and concepts of operation.



**Figure 13** Yodaville Multi-Story Building

**Tactical Aircrew Combat Training System (TACTS).** This system enables the following capabilities in Yodaville:

- Tracking of TACTS instrumented aircraft
- No drop bomb (weapon) scoring capability (NDBS)

- Real-time display and post mission replay of sorties.

When using the no-drop scoring system, it is possible to have ground forces in the target area for a tactical exercise.

**Weapons Impact Scoring Set (WISS).** This system enables extremely accurate—within three (3) feet—determination of ordnance impact.

**Weapons Analysis and Lethality Tool Set (WALTS).** This integrates realistic physics-based weapons effects and environments to allow us to judge weapons effects on various types of targets. For example, we can apply the characteristics of a reinforced steel and concrete building to some of the structures in Yodaville—and match these characteristics to a wide range of weapons effects. This gives us reliable expected results of target-weapon matches. These can be displayed on a 3D screen to assist us in training or operational planning and rehearsal.

**Lessons Learned from the Aviation LTA.** We have not yet solved the urban CAS problem. Nor have we solved the larger problem of fire support in the city. However, we continue to experiment and make progress. Here is a summary of information on the urban CAS issue gleaned from our UW experiments and the Lab’s Aviation Limited Technical Assessment—including experiments with an autonomous 120mm mortar—conducted in Yodaville in June 1999.

- An autonomous (remote controlled) 120 mm mortar shows promise but in no case could we achieve accuracies (3-meter CEP) acceptable for precision fires necessary in MOUT.
- Mortar (120mm) delivered near-infrared illumination munitions are effective in the Urban CAS environment.
- Laser designation—from airborne and ground platforms—in urban CAS is visible in sufficient time to enable target engagement for most rotary- and fixed-wing attack profiles.
- A laser designator “twitch” creates unique problems in the vertically developed urban environment.
  - S** It could cause the spot to move from one vertical target; e.g., a floor of a multistory building to another building—in front of, or behind—the desired target as shown in figure 14.

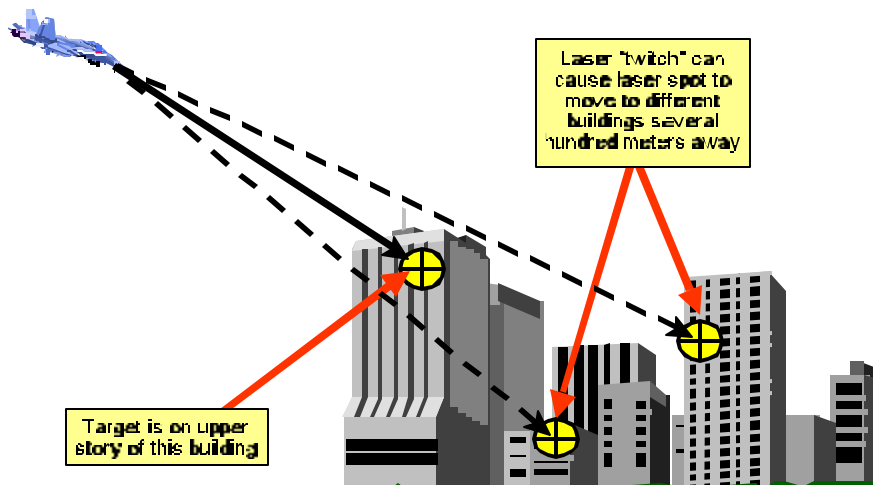


Figure 14 Example of Airborne Laser Spot Movement

S It could cause the spot to move beyond the vertical surface to another surface that is a significant distance from the target as illustrated in figure 15.

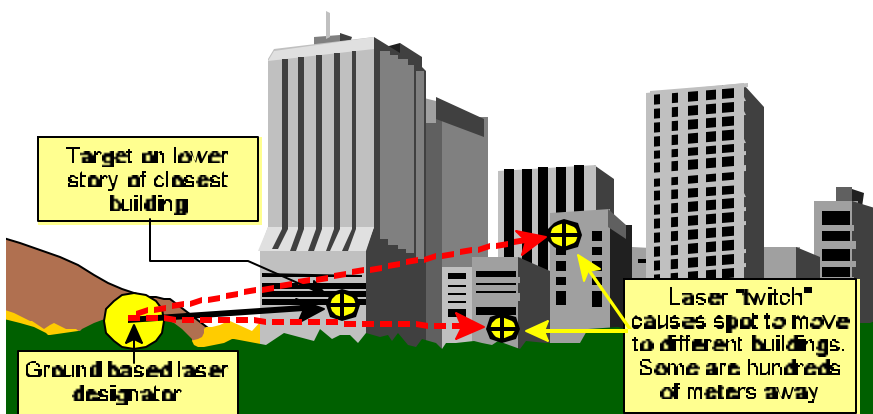


Figure 15 Example of Ground Laser Spot Movement

S It could also move the laser spot outside of a seeker field of view—rather than just a small distance on a horizontal plane.

- Aircrews are able to acquire laser designated targets through smoke and other battlefield obscurants.
- Although aircrews can see the laser spot in their heads-up display (HUD), they cannot *always* be sure that the spot they see is on the

target they want to hit rather than on some obscurant particles short of the target.

S If ROE require a positive visual target ID and/or the supported unit FAC cannot be certain that the laser spot is on the target, then aircrew cannot deliver ordnance.

- We have an automated capability to electronically pass the nine-line CAS mission brief from a remote sensor to fixed wing aircraft (i.e., a properly configured AV-8B).
- We have a man-portable device that can be used by the well-trained TACP/FAC in the urban battlespace to detect, identify and establish a position—with reasonable accuracy—for a given target.
- We can effectively employ air delivered TOW against structural targets in urban CAS.
- Urban strafe is *only* effective when the canyon created by the buildings allows sufficient target acquisition for a positive ID and acceptable delivery angles.

S Strafing is not a precision ordnance delivery.

**Air Ground Maneuver in Yodaville.** The ability to call and adjust urban CAS—while actually occupying nearby structures—is a unique feature of this training facility. However, ground force maneuver in Yodaville is limited because structures cannot currently be entered, nor can they safely provide platforms upon which to deliver infantry via helicopter. It is also relatively small in area, compared to the actual urban sprawl that the MAGTF can realistically expect to encounter. However, the value of GCE units maneuvering in Yodaville while coordinating no drop delivery of close air support may well outweigh these limitations to true maneuver.

We are currently working the environmental issue regarding ground maneuver. We know we need to make this a future Yodaville capability.

Figure 16 illustrates how key technology is combined at the Yodaville Yuma range.

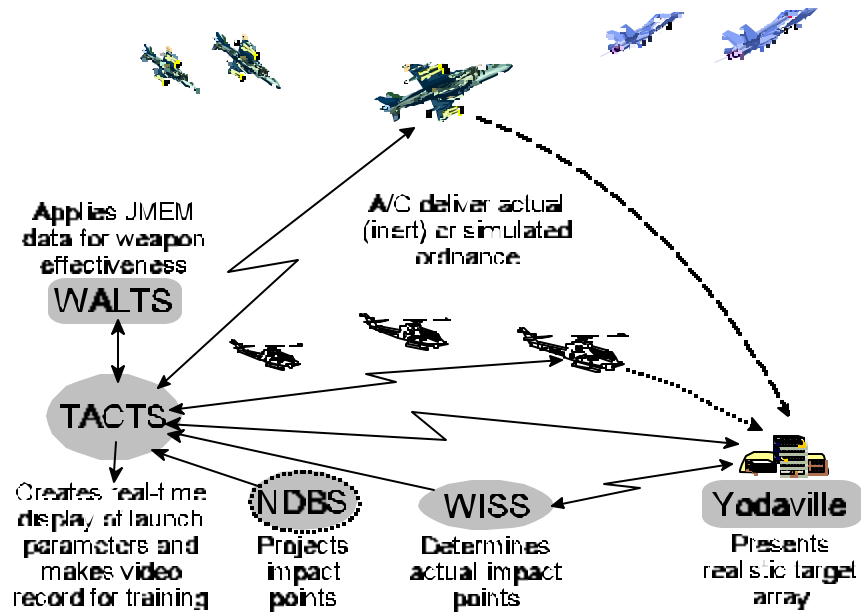


Figure 16 Yodaville Technology

## Additional ACE Combined Arms Capabilities

**Assault Support Helicopters.** Helicopter mobility is a significant advantage in the urban environment. In fact, movement of forces by helicopters may be the linchpin to the maneuver necessary to accomplish the mission. However, using helicopters this way is based on reducing the enemy antiair threat. Therefore, SEAD is normally necessary to decrease the effectiveness of enemy small arms fire, anti-aircraft fire and man portable guided missiles (manpads). In addition to helo borne assault, casualty evacuation is an essential role for MAGTF helos. This is because units engaged in house-to-house fighting normally suffer more casualties than units fighting in open terrain—and evacuation by helo is often the *only* way to get them out. At the same time, roads are likely to be crowded with resupply and evacuation vehicles and may also be blocked with craters, rubble or refugees. Helicopters provide the MAGTF the means to overcome these obstacles.

**Combat Roles.** Some of the roles that assault support helicopters may play in urban warfare are:

- Insertion and extraction of forces.
- Command, control and aerial retransmission.
- Casualty evacuation (CASEVAC) from the field to a medical facility
- CSS operations.
- Limited aerial reconnaissance.

**Tip on Joint Terminology.** CASEVAC is the joint term, vice the more familiar (to Marines) term, MEDEVAC.



- MEDEVAC in the joint arena refers to moving wounded, ill or injured personnel between medical facilities rather than from the battlefield to a care facility.

**Helicopter Borne Assault Techniques.** Marines can be put on the tops of buildings—when the buildings can support the weight of a helicopter. Marines can also rappel, fastrope or jump out of helicopters hovering just above the roof. Pre assault action must ensure that obstacles such as mines, electrical wires, telephone poles, or antennas are cleared.

For large-scale assaults, rooftop landings are not practical. Open spaces (parks, parking lots, sports arenas) within the built-up area may be used. Depending on mission, enemy, terrain and weather, troops and support available, time available (METT-T), helicopter borne forces may assault into an LZ in one wave or multiple waves.

**Employment of Air Defense.** Basic air defense doctrine does not change when units operate on urbanized terrain. We still apply the employment principles of mix, mass, mobility, and integration. These are some things to consider when developing a MOUT air defense plan:

- Our principal lines of communication, road and rail networks, and bridges must be protected from enemy air attacks.
- Good firing positions may be difficult to find and occupy for long-range air defense missile systems.
- Movement between positions is normally restricted.
- Radar masking and degraded communications reduce air defense warning time for all units.

Positioning of air defense weapons in built-up areas may be limited to more open areas without masking, such as parks, fields, and rail yards. Stinger teams provide protection for infantry battalions the same as in any operation. When employed within the built-up area, rooftops normally offer the best firing positions. Heavy machine guns emplaced on rooftops can also provide additional air defense.

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## Urban Mechanized Operations

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**Mechanized Operations Definition.** MCRP 5-12C defines these as:

*Tactical operations designed to maximize the ground mobility, protection, shock action, and firepower of combat vehicles to concentrate combat power rapidly against the enemy. Combat power is generated by the massed employment of tanks and by enhancing the mobility of the forces through the use of assault amphibious vehicles and other ground mobility means.*

**MAGTF Combat Vehicles.** MAGTF combat vehicles are M1A1 tanks, light armored vehicles (LAVs), and assault amphibious vehicles (AAVs). These are primarily mobility assets that function best in an unrestricted, mobile environment. These vehicles can play an important role *inside* the city by using their firepower in support of offensive and defensive operations. However, the LAVs and AAVs are vulnerable to armor-piercing rounds and the man packed antiarmor weapons that are so lethal in the canalized killing areas created by urban streets. *All* of these vehicles are vulnerable to top-attack munitions that are easily launched from upper stories of buildings.

**Tips on Employment of Armored Vehicles in MOUT.** Plan to take advantage of the long range of their weapons. Use them as a heavy security force to attrit the enemy before he makes it to your vital areas. Force him to deploy early, then bring the armor back to mutually supporting prepared positions tied into canalized "kill zones." In most defenses, they form the backbone of the counterattack force.



Ensure that a thorough plan and well understood procedures are in place before mechanized assets are introduced into the urban environment. This minimizes the potential for vehicle and personnel casualties during mech-infantry linkup.

**Armored Vehicle Fire Support Roles.** Some of the fire support roles for a combat vehicle are:

- Suppression/destruction of enemy forces in buildings and strongpoints.
- Reserve or counterattack suppression fires.
- Creating entry/exit points in buildings. For example:
  - S** 2<sup>nd</sup> LAR created entry points by ramming walls in *Just Cause* in Panama.
  - S** 1<sup>st</sup> Tank Battalion made the entry point into Adid’s compound in Somalia.
- Isolation of the built-up area or objectives within the built-up area.
- Antiarmor fires.
- Breaching obstacles in a direct fire mode.

**Variety of Missions.** Mechanized assets can perform a variety of missions. Table 2 gives you some examples:

Function	Asset
Command and Control	AAV-C7, LAV-C2, Tank (C-2 config.)
Fire Support Coordination	AAV-C7, LAV-C2, Tank (C-2 config.)
Personnel Carrier	AAV-P7
Direct Fire Support	Tank, LAV, AAV
Rapid Advance	Tank, AAV
Fringe Isolation	Tank, AAV, LAV
Fringe Security (Screen and Guard)	Tank, LAV
Reserve/Counterattack	Tank, AAV
Security, Reconnaissance, Patrolling	Tank, LAV, AAV
Artillery Prime Mover	AAV, LAV
Preloaded Mobile Resupply	AAV, LAV-L
Casualty Evacuation (CASEVAC)	AAV, LAV-L

**Table 2** Sample Missions for Mechanized Operations

Command and control configured tanks have additional HF and UHF radios (Forward Observer and Forward Air Control configuration) that augment the tank’s organic VHF radios.

**Special MOU Considerations.** SOPs and TTPs that are focused on MOU are the underpinning of successful mechanized operations. Above all, successful mechanized operations are ALWAYS directly dependent upon mech-infantry support and coordination.

- An unprotected tank in this high risk, chaotic environment is a tank under threat of imminent close in attack and antiarmor fires.
- Dismounted infantry must be directly tied into supporting mechanized assets.
- The armor on AAVs, and in particular LAVs, does not make you “bulletproof.” Driving these vehicles to the cusp of the heavy direct fire area will generally result in heavy casualties.

**LAV-25.** For purposes of this X-File, we focus on the LAV with the 25mm Bushmaster gun—called the LAV-25 (variant). The LAV-25’s mission is to conduct reconnaissance, security and limited offensive and defensive operations.



The LAV is not an armored personnel carrier. It offers little protection in the lethal environment of a built-up area. If the LAV is not buttoned up, vehicle commanders and drivers become a priority target for snipers in the vertical terrain. However, once buttoned up, the vehicle crew has severely restricted visibility. Because of the reduced visibility, LAVs are extremely vulnerable to antitank or heavy machine gun fire because the natural canalization of the urban canyon severely limits the vehicle’s ability to maneuver. The LAV is better suited to overcome minor obstacles than the HMMWV. Its mounted weapon system is also much more stable than those found on the Humvee.

**Tips on Dismounted Infantry-LAV Relationship.** The LAV has little inherent self-defense capability, especially in the close terrain of the urban environment. Accordingly, the following considerations apply:



- The LAV must be closely integrated with dismounted infantry in order to provide mutual protection and mutual support

- The supported unit commander must understand the risks and limitations involved in using LAVs in close terrain so that he can use this asset to its potential without unnecessary risk.

**LAV Swim Capability.** The existence of waterways, canals, and rivers in and around urban areas can provide avenues of ingress into designated objective areas. If used in conjunction with supporting fires, smoke, and/or deception operations, LAVs can capitalize on their swim capability and make use of waterways previously viewed as obstacles.

**Tips on Immediate Action Drills (IADs).** Immediate action drills



*must* be developed and rehearsed extensively, not only within the LAV community, but also extensively with the supported unit. Due to the risk and uncertainty in MOUT all parties—infantry and armor—must have a solid grasp of relationships and actions for a variety of situations and missions.

**LAV MOUT Capabilities.** Keeping in mind its vulnerability to antitank weapons and heavy machine gun fire, the LAV-25/infantry team can effectively employ the following capabilities during MOUT:

- Isolation
  - S Secure area by direct fire and observation.
  - S Block physical lines of communication.
  - S Cordon off designated areas.
  - S Over watch
- Raid
  - S Speed, shock and surprise.
  - S Can carry limited number of people for actions on the objective.
- Reaction Force
  - S Speed, firepower, shock, and surprise.
  - S Provide fire support from a secure position.
  - S Carry limited number of people for actions on the objective.
- Noncombatant Evacuation Operation (NEO)
  - S Speed and firepower (when necessary)
  - S Limited ability to carry small number of evacuees.
- Vehicle Recovery
  - S Limited towing capability
- CASEVAC
  - S Logistics variant (LAV-L) is best suited to this mission,
  - S Speed and limited space to treat injured personnel.

- Fire Support
  - S Direct fire with its 25mm chain gun
  - S Ability to call indirect fires
- Control of Civil Disturbance
  - S Shock effect against belligerents
  - S Used in tightly integrated manner with infantry riot line
  - S Vehicle is vulnerable to Molotov cocktail
- Patrolling
  - S Maneuverability
  - S Greater speed and firepower than HMMWV
  - S Few internal troops

In Somalia and Haiti we learned the benefit of keeping Marines and equipment up *above* the crowds in a permissive patrolling environment. In addition to the psychological impact of the height, it reduced the problems of locals trying to snatch equipment and weapons. On the other hand, close coordination between the LAV, AAV and tank, and *dismounted* infantry is the key to successful execution in the non-permissive/combat environment.

**Assault Amphibious Vehicle.** As stated in JP 1-02, this is a fully tracked, amphibious vehicle tasked to land the surface assault elements of the landing force and their equipment in a single lift from assault shipping during amphibious operations to inland objectives. It also conducts mechanized operations and related combat support in subsequent operations ashore. It provides limited protection during transportation and provides overwatch in the attack while the infantry dismount and take the fight to the enemy. Its weapons station includes a .50 caliber heavy machine gun and a 40mm grenade launcher machine gun (Mk-19).



**Employment Considerations.** Whenever the AAV is on the ground, it needs to be closely integrated with the dismounted infantry effort in order to provide mutual protection and mutual support.

- The supported unit commander must understand the risks and limitations involved in using AAVs in close terrain in order to use this asset to its potential.

**AAV MOUT Capabilities.** Possible and realistic mission profiles for the MOUT environment include these operations—many of which are similar to those discussed earlier for the LAV. Specific tasks associated with the AAV’s mission include:

- Transport assault elements.
- Transport selected equipment and supply.
- Provide lift for assault elements, equipment, and supplies.
- Participate in the planning and coordination of mechanized, linkup, riverine, and landing operations.
- Provide direct and indirect fire support with organic weapons systems.
- Provide support in the clearing of lanes through minefields and other obstacles.
- Isolation
  - S Secure an area by direct fire and observation
  - S Block physical lines of communication
  - S Overwatch
- Raid
  - S Speed, firepower, shock and surprise.
  - S Can carry at least a reinforced rifle squad for actions on the objective.
- Reaction Force
  - S Speed, firepower, shock, and surprise.
  - S Can carry at least a rifle squad for actions on the objective.
- NEO
  - S Speed and deep water amphibious capability.
  - S Can transport significant number of evacuees.
  - S Offers limited protection to embarked evacuees.
  - S Has limited defensive firepower.
- Vehicle Recovery
  - S Limited towing capability
- CASEVAC
  - S Best USMC armored platform for this mission.
  - S Has speed, security, and firepower.
  - S Offers safety and treatment of injured personnel
- Fire Support
  - S Direct fire with heavy machine gun and grenade launcher
  - S Significant organic radio communications assets for MAGTF
- Control of Civil Disturbance

- S LAV better suited to this role
- S Shock to belligerents
- S Close coordination with infantry riot line essential
- S Vulnerability to Molotov Cocktails
- Patrolling
  - S Maneuverability
  - S Greater speed and firepower than HMMWV
  - S Internal troops
  - S Mech-infantry coordination key
  - S LAV may be better suited to this mission
- Counterattack force
  - S Speed and firepower
  - S Delivery of reaction force to the scene
- Defensive strong point
  - S Integrated into the defense
  - S Provides fire from covered position

Coordination between the AAV and dismounted infantry is the key to success of these capabilities in the urban environment.

**Tips on AAV Amphibious Roles in MOUT.** The existence of waterways, canals, and rivers in and around urban areas can provide avenues of ingress into designated objective areas. If used in conjunction with supporting fires, smoke, and/or deception operations, AAVs can capitalize on their amphibious capability and make use of waterways previously viewed as obstacles.



Both the AAV and the M1A1 tank have the capability to rapidly generate a large amount of smoke to assist urban tactical maneuver. Both also have on-board smoke grenade launchers.

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## Tank/Infantry Operations

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**Marine Tanks in MOUT.** The powerful, high-velocity 120mm cannon mounted on the M1A1 tank provides direct-fire support. Although the infantry assumes the lead role during combat in urban areas, tanks and infantry work as a close team. Tanks move down streets with the infantry protecting them from antitank weapons (RPGs, AT-3s, etc.). In turn, the tanks support the infantry with fire. The primary role of the tank cannon during combat in urban areas is to provide direct fire against buildings and strongpoints that are identified as targets by the infantry.



**Tank Weapon Systems.** The M1A1 tank has significant firepower with highly accurate fire control systems that includes a 20 power optical sight. Its four killing systems are:

- 120mm main gun with multiple warheads available.
- 7.62mm coaxial machine gun w/ 10,000 round magazine  
**S** with tracer and armor piercing incendiary rounds.
- 7.62mm loader's machine gun w/ 200 round magazine
- .50 caliber machine gun w/100 round magazine  
**S** with 1000 more rounds on board

The tank can also mount an in-bore .50 caliber device used to shoot precision engagements to 2000 meters.

- This is a deadly anti-sniper weapon.  
**S** The in-bore device is normally a training device, but maneuver units can have it available to specially configure the tank's main gun when such a requirement is anticipated.

When planned for, the .50 caliber in-bore device can be very effective in this role and can effectively control collateral damage.

In addition to its 20 power optics, the tank's fire control systems include:

- Laser range finder.
- Thermal Imaging system,  
**S** can provide the infantry an enhanced surveillance capability during low light or reduced visibility conditions.

When deployed to Mogadishu, Marine tanks were very effective on night patrols because of their ability to see in the darkness.

**Track-width Mine Plows and Rollers.** Although not optimized for use in the urban environment, these capabilities can be used in the city when attached to the front of the tank. Plows make lanes through minefields and rollers detect minefields and proof lanes created by other means. The 3-ton plow lifts and pushes mines that are surface-laid or buried up to 6 inches deep to the side of the track-width lanes. The plow creates a 68-inch cleared path in front of each track. Mines lifted by the plow are left in the spoil on each side of the furrowed path and remain a hazard until removed or neutralized. Therefore, the plow can be used effectively in the urban streets to clear local barricades made of wire, rubble, etc. that have been laced with surface-laid mines.

Rollers are designed to detect minefields. A roller set is not a good primary system for minefield reduction because several mine detonations will destroy it. The 10-ton roller sweeps a 44-inch path in front of each track. Magnetically fused mines will not be defeated unless activated or crushed by the roller.

**Tank-Infantry Coordination.** Tanks never fight alone. In the restricted urban terrain, it is more advantageous for tanks to take a supporting role in the forward movement of the infantry. They provide close-in direct fire support against hard and soft targets that could slow the infantry's advance. Regardless of terrain, infantry and armor units fight as part of a combined arms team to maximize their respective capabilities and minimize their limitations. The infantry and tanks move together. The infantry may be dismounted, truck-mounted, or AAV-mounted, depending on METT-T factors.

**Tank/Infantry Employment.** When Marine tanks are employed in MOUT, tank units may have to be task organized down to sections—two tanks per section.

*Marine Tank Unit Tasks.* Tanks support the infantry in urban areas by:

- Providing shock effect and firepower.
- Isolating objectives with direct fire to prevent enemy withdrawal, reinforcement, or counterattack.

- Neutralizing or suppressing enemy positions with smoke, high explosive antitank (HEAT), and automatic weapons fire as infantry closes with and destroys the enemy.
- Assisting opposed entry of infantry into buildings when doorways are blocked by debris, obstacles, or enemy fire.
- Smashing through street barricades or reducing barricades by fires.
- Using fires to reduce enemy strong point in buildings.
- Obscuring enemy observation using onboard smoke generators.
- Holding cleared portions of the objective by covering avenues of approach.
- Attacking by fire any other targets designated by the maneuver element commander.
- Establishing roadblocks.
- Suppressing identified sniper positions.

*Marine Infantry Tasks.* Infantry supports tank in urban terrain by:

- Locating targets for engagement by the M1A1 tank.
- Suppressing and destroying antitank weapons with mortars, automatic weapons, and grenades.
- Assaulting positions and clearing buildings.
- Providing local security for M1A1s throughout the urban operation;
  - S** at a minimum, one infantry fire team must provide security for each tank.
- Ground guide tanks in close terrain using standard tracked vehicle hand and arm signals.

Speed and shock are weapons for tank/infantry employment. It may be best to immediately assault through a firing barricade or position from which the force is receiving fire.

**M1A1 Employment Considerations.** The following are some techniques and concerns that Marine infantry and/or tank leaders should consider when employing M1A1s in urban terrain:

- M1A1 main gun fire is an effective method for destroying targets in a building and creating a psychological effect that destroys the enemy's will to continue.
- The tank's main gun has danger zones that can cause death and serious injury to Marines due to:
  - S** backblast overpressure that can kill or incapacitate,

- S** an armor piercing discarding sabot (APDS) round that discards 3 or 4 petals after firing that can kill unprotected personnel
- S** the *Danger Zone* extends 1000m along gun line and 70m on either side of the barrel.
- M1A1 mounts machine guns that:
  - S** are very accurate in reduced visibility,
  - S** have a large magazine capacity, and
  - S** can be fired without endangering dismounted infantry.
- Streets and alleys constitute ready-made fire lanes and firing zones;
  - S** but they can greatly restrict and canalize tank routes making it vulnerable.
- In urban terrain, Marine tanks work best in platoons of four tanks or in sections of two M1A1s;
  - S** with one tank providing overwatch for the other.
- In extreme cases, M1A1s can work individually
  - S** but this is not recommended.
- At least one infantry fire team should remain with each tank to furnish local security.
  - S** HOWEVER, DISMOUNTED TROOPS CANNOT BE WITHIN THE DANGER ZONE (DESCRIBED ABOVE).
- A hastily rigged external TA-1 phone—we used a wiring harness purchased from commercial sources—can be an excellent means for communication between the infantry and the vehicle commander.
  - S** Otherwise, use hand and arm signals or SINCGARS radio.
- Tanks can create holes in the walls of buildings for the infantry.
  - S** Using caution to observe the firing fan restrictions.
- Tanks can use HEAT ammunition against barricades and tall structures such as steeples and chimneys likely to harbor enemy artillery observers;
  - S** dependent on the established ROE.
  - S** However, crews can fire on observed or known hostile enemy positions at all times.
- Tankers must be alert for bunkers in houses along the street.
- Tanks avoid stopping or moving slowly near non secure buildings.
- M1A1s should mount the fording kit exhaust plenum pipe attachment or heat shield deflector to allow infantry to safely approach the rear of the tank.
- Units should check all bridges and overpasses for mines and should determine their weight-carrying capacity.
- Tanks do not enter buildings with basements,

- Eliminates potential to fall into them.
- M1A1s should stay near buildings held by friendly troops.
- Crew members must watch for signals from infantry inside buildings on their flanks.

When possible, M1A1s should destroy enemy strongpoints with main gun fire. One technique is to fire SABOT ammunition to penetrate the reinforced wall of a building followed by high-explosive antitank (HEAT) rounds to kill or neutralize the enemy. M1A1s should fire first into the ground floor to drive the enemy into the basement, where infantry can attack them, or to higher floors, where Marine tank fire can destroy them.

**Tips on Target Indication Techniques for Tank Guns.** The tank should be directed into position by using some sort of mark or flag. Otherwise, the tank may accidentally move past the supporting infantry and expose itself to enemy fire. This type of coordination is very difficult and requires extensive training, because a simple signal may make the difference in the survival of that tank.



Orient the tank commander on target using a *reference point*. This method uses an easily recognizable point like a church tower and uses a clock system to talk the tank gunner onto the target building.

Once the tank gunner has identified the correct building, the supported unit will use a standard building identification method, explained earlier to talk the gunner onto the correct window. For example, “From the church tower, five o’clock, 200 meters, white two story building.”

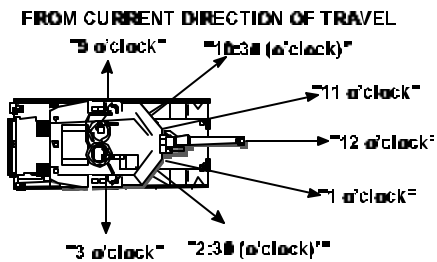


Figure 17 Tank Main Gun Method

Orient the tank commander using *Tank Main Gun* method. The infantry unit will talk the tank on target by using the turret to guide the gunner as shown in figure 17. Always use the 12 o’clock position as the direction of travel with the main gun over the main slope. For example: “RPG team at 2 o’clock.”

Use smoke, tracer fire, laser pointer, etc. to *mark a target* for a tank.

*Describe target.* This should be short, simple, and easy to understand. Once the commander has identified a target, he responds: “identified.”



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## Combat Engineers in MOUT

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**Overview of Combat Engineer Combined Arms Capabilities.** The nature of the urban battlespace requires extensive use of engineers in both the offense and defense. For offensive maneuver, they can help prepare the battlespace during shaping operations, they can provide immediate assault support by clearing obstacles—with heavy equipment or demolitions—and they are critical for mine clearance operations and elimination of improvised explosive devices and booby traps. For defensive maneuver, they essentially reverse the process.



In addition to adding significant combat support power to the MAGTF, combat engineers can repair and maintain the internal support facilities of the city in order to support and sustain further operations. Engineer assets available to the MAGTF are often concentrated in the CSSE. However, there are engineer skills and equipment available in the GCE and ACE. Also, naval construction forces (NCFs) can be attached to the MAGTF to support known or anticipated requirements.

**Engineer Organization.** The best way to support the MAGTF's needs in the compartmentalized, closed-in nature of the city is by task organizing combat engineer assets. That is, form teams to meet specific needs rather than attaching engineers piecemeal to each company or company team. For example, mass engineer assets at critical times and places—such as a breaching effort—and attach them to appropriately dispersed maneuver elements. Once the need to mass is satisfied, redirect the engineer assets to meet the next requirement. Most engineer manual labor tasks, however, will have to be completed by maneuver units, with reinforcing engineer heavy equipment support and technical supervision. Another task organization example is to attach two-man demolition teams to support a rifle platoon or squad when they are assigned to breach obstacles or blow booby traps. This gives small unit leaders key support to act decisively.

**Engineer Tasks in Offensive Maneuver.** As part of a combined arms offensive operation, properly organized and positioned engineers can enable decisive maneuver by performing all or many of these tasks:

- *Engineer Technical Reconnaissance.*
  - S Determine the level of effort required to penetrate outer and inner defenses.
  - S Determine the location and type of enemy obstacles and minefields, and make breaching recommendations
- *Bridge Repair and Construction.*
  - S If bridges along critical avenues of approach have been destroyed or damaged.
  - S As necessary to support MAGTF maneuver.
- *Obstacle Breaching.*
  - S Includes clearing of mines, obstacles, and booby traps.
  - S Use demolitions to destroy fortifications and strongpoints that cannot be reduced by maneuver unit's organic assets.
- *Forced Entry into Buildings.*
  - S When required to assist assault forces into buildings.
- *Use of Heavy Equipment.*
  - S Clear barricades and heavy rubble with earth moving equipment to assist forward movement.
  - S Reduce obstacles or strongpoints, restore vital services, and clear and maintain routes into a city.
- *Helicopter Landing Zones.*
  - S Enable maneuver options.
  - S For CASEVAC, resupply and reinforcement missions.

**Engineer Tasks in Defensive Maneuver.** With the advantage already with the defender, an urban area can be made nearly impregnable with proper preparation of the battlespace by skillful engineers. For example, streets and alleys that canalize movement can be turned into a deadly maze for attacking forces. Specific defensive engineer tasks include, but are not limited to the following:

- Assess and report on which buildings are suitable for strongpoints.
- Fortify key positions to repel attack and prevent the counterattack.
- Construct complex obstacle systems,
  - S to limit vertical and subterranean movement.
- Emplace barbed wire, tetrahedrons and improvised barriers such as overturned vehicles, rubble cribs, etc.

- Clear and mark routes to aid rapid movement of counterattack and exploitation forces.
  - Prepare armor defensive positions.
  - Prepare antiarmor weapon positions
  - **S** to reduce over pressure from back blast.
  - Maintain critical urban services such as power, water, etc.
  - Keep railroads, airfields, and ports operational as needed.
  - Fight as infantry when needed.
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## Summary

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Combined Arms, as one of the Marine Corps's six core competencies, is employing organic weapons, supporting arms, and task organized maneuver elements to present a dilemma to the enemy; i.e., to avoid one threat, he will expose himself to another. Applying combined arms demands tactical proficiency and knowing the effects and employment methods for many types of weapons and how they relate to maneuver warfare.

Combined arms also includes integrating the various elements of the MAGTF into effective fighting teams that combine the strengths of one element with another to eliminate weaknesses. When we fully integrate weapons systems, task organization and maneuver into one cohesive effort, the awesome power of the MAGTF is released. Use of the powerful combined arms capabilities of the MAGTF is limited only by our understanding of *what* they are, *where* they reside in the MAGTF, and *how* to best integrate their effects to accomplish the mission.

All combat and combat support elements of the MAGTF can be part of the combined arms team. These include:

- Infantry
- Artillery
- Combat Engineers
- Reconnaissance
- Tanks
- Assault Amphibious Vehicles (AAVs)
- Light Armored Vehicles (LAVs)
- Aviation
- Command and Control Warfare (C<sup>2</sup>W) Assets
- Psychological Operations (PSYOP) Augmentation
- Civil Affairs units

Although not an organic part of the MAGTF, naval surface fire support can be an important contributor to the combined arms effort.

Urban combat has some unique characteristics that we must clearly understand to effectively plan and execute combined arms. For example, urban battlespace geometry includes factors such as:

- Hard, smooth, relatively flat surfaces that greatly increase the potential for ricochets and less-than-optimum detonations.
- Close range engagements,
  - inducing danger from backblast and fragmentation, and
  - dud ordnance from shooting inside of minimum arming range.
- Short engagement times.
- Defilade space caused by canyons formed by tall buildings.
- Vertical and horizontal distance components.
- Compressed separation between forward and rear areas.

ROE are used to guide us in the sound selection, deployment, and employment of combined arms forces in a given situation.

- ROE do not prevent a Marine from protecting himself.
- ROE are based on mission, threat, law of war, and host nation restraints.
- ROE must be thoroughly briefed, understood, and enforced.

All our experiments showed the ISR is a key combined arms tactical enabler in MOUT.

The definitive work on urban CAS is the *ACE MOUT Manual* produced by MAWTS 1. The two essential elements that enable MAGTF CAS are the:

- wide array of fixed wing and rotary wing aircraft in the ACE, and
- forward air controller (FAC), who may be ground based or airborne.

Targeting of air delivered ordnance—both fixed- and rotary-wing— is affected first and foremost by the aircrew’s ability to find, identify, and hit the target. The FAC or FAC(A) has to mark the target, establish the proximity of friendlies and noncombatants, and inform the aircrew of requirements to limit collateral damage. He also coordinates other supporting arms; e.g., he deconflicts aircraft with artillery and mortar fire. Most important, the FAC is the final clearance authority for the aircrew to release any ordnance.

CAS integration with other supporting fires in MOUT enables maneuver to achieve decisive action.

Acceptable accuracies are different in the urban canyon because of the compressed, vertical nature of the battlespace. This is compounded by the difficulty of target identification in and among buildings. Even the most accurate precision guided ordnance may not be usable in light of target identification problems, restricted delivery paths and collateral damage considerations. The optimum answer appears to be a collection of very accurate weapons that allow us a spectrum of damage inducing effects to eliminate the threat while protecting against fratricide and unwanted/collateral damage.

UAV video feeds can maintain surveillance on danger areas and provide near-perfect situation awareness. For example, in certain restricted situations we found that is possible for the fire support coordinator to actually see the same tactical picture as the unit requesting CAS/fires.

MAGTF combat vehicles can play an important role in the urban battlespace by using their firepower in support of offensive and defensive operations. However, the LAVs and AAVs are vulnerable to armor-piercing rounds and the man packed antiarmor weapons that are so lethal in the canalized killing areas created by urban streets. *All* combat vehicles are vulnerable to top-attack munitions that are easily launched from upper stories of buildings.

Successful mechanized operations are ALWAYS directly dependent upon mech-infantry support and coordination.

The Tank, LAV and AAV must be closely integrated with dismounted infantry in order to provide mutual protection and mutual support in the urban canyon. In Somalia and Haiti we learned the benefit of keeping Marines and equipment up *above* the crowds in a permissive patrolling environment. In addition to the psychological impact of the height, it reduced the problems of locals trying to snatch equipment and weapons. On the other hand, close coordination between the LAV, AAV and tank, and *dismounted* infantry is the key to successful execution in the non-permissive or combat environment.

The M1A1 tank has significant firepower with highly accurate fire control systems. The primary role of the tank cannon during combat in urban areas is to provide direct fire against buildings and strongpoints. In the restricted urban terrain, it is more advantageous for tanks to take a

supporting role in the forward movement of the infantry. Tanks never fight alone. They provide close-in direct fire support against hard and soft targets that could slow the infantry's advance. Regardless of terrain, infantry and armor units fight as part of a combined arms team to maximize their respective capabilities and minimize their limitations. The infantry and tanks move together. The infantry may be dismounted, truck-mounted, or AAV-mounted, depending on METT-T factors.

When possible, M1A1s should destroy enemy strongpoints with main gun fire. One technique is to fire armor-piercing ammunition to penetrate the reinforced wall of a building followed by high-explosive antitank (HEAT) rounds to kill or neutralize the enemy. M1A1s should fire first into the ground floor to drive the enemy into the basement, where infantry can attack them, or to higher floors, where Marine armor fire can destroy them.

Both the AAV and the M1A1 tank have the capability to rapidly generate a large amount of smoke to assist urban tactical maneuver.

The nature of the urban battlespace requires extensive use of engineers in both the offense and defense. In addition to adding significant combat support power to the MAGTF, combat engineers can repair and maintain the internal support facilities of the city in order to support and sustain further operations. The best way to support the MAGTF is to mass engineer assets at critical times and attach them to maneuver elements. As part of a combined arms offensive operation, properly organized and positioned engineers can enable decisive maneuver.

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**Listing of X-Files**

<b>X-Files</b>		
<b>Title</b>	<b>X-File #</b>	<b>Publication Status</b>
Urban Attacks	3-35.1	Published
Combat Squad Leader	3-35.2	Published
Battle Captain	3-35.3	March 2000
Urban Defense	3-35.5	Published
Urban Patrolling	3-35.6	Published
Security Operations	3-35.7	Published
Combined Arms	3-35.8	Published
Intra Squad Radio	3-35-9	November 1999*
Directed Energy Weapons	3-35.10	In staff review
HA/DR Assessment	3-35.11	Published
Urban Sustainability	3-35.12	Published
Tactical Instrumentation	3-35.13	Published
HA/DR Operations	3-35.14	November 1999

\* Depending on a contract award.

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